FINAL

STRATEGIC VALUE SOLUTIONS INC

Value Planning Report

Plan Formulation Project

South Utah & Juab County, UT

CENTRAL UTAH WATER CONSERVANCY DISTRICT

Workshop Dates: June 24-28, 2024
Report Date: October 29, 2024

Final

Value Engineering Study Report

for

Plan Formulation Project

South Utah & Juab County, UT

October 29, 2024

Prepared for:

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SECTION 1

STRATEGIC VALUE SOLUTIONS INC

EXECUTIVE SUMMARY

SECTION 1
EXECUTIVE SUMMARY

This report presents the results of a Value Planning (VP) Study conducted by Strategic Value Solutions, Inc. (SVS) on prospective value-based solutions for the Plan Formulation Project in South Utah and Juab County, UT for the Central Utah Water Conservancy District. The study reviewed a compilation of information on existing conditions and the Jacobs (Jacobs) analyses of this information. The VP Study included a 5-day (40-hour) value methodology workshop that was conducted with three multidisciplinary teams in Orem, UT, June 24-28, 2024.

Southern Utah County and eastern Juab County are expected to see significant population growth, with nearly 400,000 new residents in southern Utah County and 19,000 in Juab County by 2065, contributing to Utah's overall population doubling during this period. In response, the Central Utah Water Conservancy District, in partnership with Jacobs, has developed strategies for new water supplies, system configurations, capital construction costs, and phased implementation plans.

The plan includes an integrated ULS and SHC conveyance system for raw water delivery, a 100-MGD water treatment plant with phased capacity (50 MGD in Phase 1 and 50 MGD in Phase 2) to meet 2065 demands, and strategies to meet municipal and industrial water needs for the Goshen Mega Site and Benjamin and Lake Shore communities. It also aims to provide potable water for future finished water demands in Juab County and meet the District's resolution with Juab County Water Conservancy District. The purpose of the VP Study is to identify viable alternatives, design suggestions, and expert evaluation of this concept. The Value Alternatives and Design Suggestions provided in this report are conceptual and advisory in nature. The Value Team makes no project decisions and has performed no detailed engineering analysis beyond that shown within this report. The workshop was divided into three breakout teams: overall system integration, conveyance (raw and finished water), and water treatment plant. This was to provide more focus in each of these areas with dedicated experts to evaluate the District's proposed plan.

Workshop Results

Overall System Integration: This team focused on the integration of the new Plan Formulation Project concept with the existing water supply and infrastructure, covering high-level system planning for water treatment, storage, and distribution to meet the projected demands. It aimed to optimize system performance for both short-term needs and long-term goals, ensuring cost-effective, robust solutions. Key findings include the recommendation to use smaller, modular water treatment facilities instead of a single large plant, enhancing flexibility in anticipating population growth. The project also aimed to improve the Strawberry Highlight Canal (SHC) by enclosing it to capture an extra 8,000 acre-feet of water, thus increasing supply, protecting water quality, and reducing liability. Highlighted alternative concepts propose using existing wells to provide potable water more rapidly and efficiently, particularly in areas with immediate demand like Mona, thereby reducing the need for extensive pipelines and large treatment plants. These recommendations ensure a resilient and adaptable water supply system, crucial for sustaining community growth and meeting future demands.

Conveyance (Raw & Finished): This team addressed the conveyance of both raw and finished water, evaluating potential improvements to pipelines, pumping stations, and related infrastructure to optimize performance and reduce costs. The team identified several value improvement opportunities for the conveyance system, including the use of different pipeline materials and construction methods. Specific alternatives focused on facilitating construction, improving conveyance, and reducing losses. Alternatives included using early contractor involvement, reducing pipeline cover from 6 feet to 4 feet, and installing both finished and raw water pipelines in the same trench where feasible. Suggestions involved expedited geotechnical investigations in areas prone to landslides or seismic activity, coordination with other utility owners, and adding escalation clauses to construction contracts. Alternatives proposed using HDPE pipes instead of welded steel for certain sections, employing earthquake-resistant ductile iron pipes in select fault zones, and using select backfill instead of trench zone controlled low-strength material. Additional design suggestions included using portable/mobile energy dissipators, identifying contractor laydown and staging areas, and implementing truck tunnel crossings instead of trenchless crossings under I-15.

Water Treatment Plant: This team focused on the South Utah Valley Regional (SUVR) Water Treatment Plant (WTP) design and operation, proposing changes to improve efficiency, reduce costs, and enhance the plant's ability to meet future demand. The team proposed several alternatives to optimize the water treatment process, including modular design approaches and phased construction strategies. Emphasis was placed on accommodating future demand, improving constructability, and ensuring the plant can handle variable water quality and supply conditions. Alternatives included constructing a 20 MGD water treatment plant at Santaquin first, to serve Juab County, and an 80 MGD plant in South Utah Valley in the future. This phased approach allows for scalability and cost management. Other alternatives proposed using smaller, more manageable flocculation and sedimentation basins, and sending residuals and filter waste to the engineered lagoons to eliminate the need for additional backwash water clarification processes. The team also evaluated locating the ozone generation building on top of the contactors to save space and costs and bidding on the water treatment plant as two separate packages for civil works and construction to streamline the process. Design suggestions involved planning for future electrical demand and new substations, designing raw water storage ponds to avoid failure towards other plant components in seismic events, and including pre-oxidation in the raw water storage pond to address manganese issues before flocculation and sedimentation.

Conclusions

In conclusion, the Value Planning Study meticulously reviewed and proposed significant alternatives and design suggestions to enhance the raw and finished water conveyance systems and the water treatment plant (WTP) for the South Utah Valley Regional (SUVR) Water Treatment Project. The Value Team's comprehensive analysis focused on optimizing material selection, improving constructability, and mitigating identified risks, thereby delivering substantial cost savings and operational efficiencies. This study's holistic approach ensures that the project can adapt to varying demand scenarios and potential future uncertainties. By leveraging existing resources, such as groundwater from Strawberry Highline Canal wells, and exploring innovative solutions for immediate water needs in areas like Mona, the proposed strategies effectively address both short-term and long-term challenges.

Overall, the Value Planning Study's findings and recommendations help to create a solution for a resilient, efficient, and adaptable water supply system capable of meeting the evolving needs of the Central Utah Water Conservancy District and its customers.

SECTION 2

INTRODUCTION

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INTRODUCTION

Project Description Summary

Southern Utah County and eastern Juab County are projected to experience significant population growth over the next four decades. The Kem C. Gardner Policy Institute projects nearly 400,000 new residents in southern Utah County and 19,000 in Juab County by 2065. The entire state of Utah is expected to nearly double in population during this period.

Central Utah Water Conservancy District (District) has developed and discussed strategies for new water supplies, system configurations, capital construction costs, and phased implementation plans in partnership with Jacobs. The District aims to develop a reliable and resilient integrated raw water supply and finished water delivery system to meet future municipal, industrial, and agricultural demands.

Summary of Phases I through III: The Phase II report (Jacobs, 2021) recommended several key initiatives, including:

- Adding a new South Utah Valley Regional (SUVR) Water Treatment Plant (WTP)
- Implementing finished water conveyance pipelines and pumping facilities
- Meeting non-potable needs with the Spanish Fork-Santaquin (SFS) Pipeline and Strawberry Highline Canal (SHC)
- Reallocating and retiming delivery of Utah Lake Drainage Basin Water Delivery System (ULS) and Strawberry Valley Project (SVP) supplies

Eight portfolios were developed in Phase II to represent future conditions through 2065, with potable water demand ranging from 36 to 122 million gallons per day (MGD).

Phase III Findings:

- Evaluation of managed aquifer recharge (MAR) at the Salem Gravel Pit indicated challenges due to poor infiltration characteristics, specifically, clay lenses in the lower layers.
- Recommendations for further study if MAR development is pursued by the District.

Planning-Level Design Phase: This phase builds on previous project phases to further refine the regional water supply plan, with goals including:

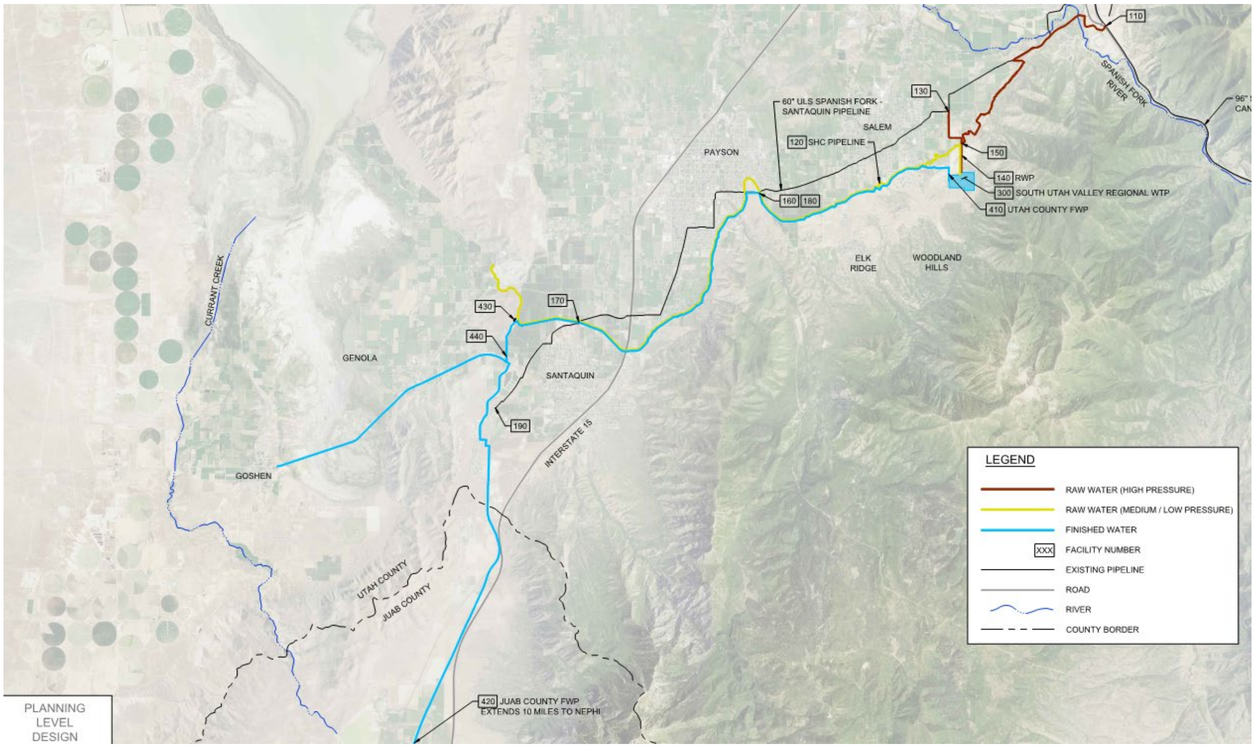
- Developing a refined system configuration and operational strategy
- Creating 5% design drawings for identified facilities
- Producing an AACE International Class 4 cost estimate

- Summarizing work performed in this report

Planning-Level Design System Configuration:

The preferred concept includes:

- An integrated ULS and SHC conveyance system for delivering raw water
- A 100-MGD WTP to meet 2065 demands, with phased treatment capacity (Phase 1 buildout of 50 MGD, Phase 2 buildout of 50 MGD)
- Meeting Municipal and Industrial (M&I) demands for the Goshen Mega Site and the Benjamin and Lake Shore communities with finished water
- Serving future Juab County finished water demands with potable water



The Value Team was provided a construction cost estimate indicating an anticipated cost of $1,427,500,000, based on mid-point construction prices, intended as a preliminary program budget value.

Project Goals

The project aims to identify strategies to supplement existing water supplies to meet future M&I growth in southern Utah County and Juab County, while continuing to address agricultural water needs in southern Utah County. It seeks to determine the optimum conveyance of raw water supplies to users by utilizing both new and existing facilities, including the Spanish Fork Canyon Pipeline, the ULS SFS Pipeline, and the SHC. Additionally, the project focuses on identifying the necessary water treatment and finished water infrastructure to meet future demands effectively.

Value Planning Methodology

This VP Study used the international standard Value Methodology established by SAVE International®, the Value Society. The Value Methodology (VM) uses a six-phase process executed in a workshop format with a multidisciplinary team. Value is expressed as the relationship between functions and resources where function is measured by the performance requirements of the customer and resources are measured in materials, labor, price, time, etc. required to accomplish that function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

With this process, the Value Team identifies the essential project functions and alternative ways to achieve those functions, and then selects the best alternatives to develop into workable solutions for value improvements.

Additional information about the VP Study processes used in the generation of the results presented is provided in Section 3 of this report.

District Objectives

As part of the kickoff to the workshop the District provided the Value Team with a clear objective for this effort. The District's objective to this workshop is:

"*To evaluate the District's plan and provide recommendations on how to deliver the correct water type (raw or potable), to the right location, and at the appropriate time in the most effective manner.*"

Value Planning Study Constraints

Constraints or limits on the VP Study are used to define the boundaries between project aspects that the project stakeholders will consider changing and those that cannot be changed. These constraints may result from a variety of political, technical, schedule, or environmental causes. Excessive constraints tend to inhibit the Value Team's ability to identify creative opportunities for value improvement. Inadequately defined constraints can result in the Value Team's effort being wasted in areas where there is no possibility of change. Constraints identified for this study were:

- Population and demand projections from the initial PFP phases should be adhered to.
- Detailed water right information will not be evaluated in this effort.
- The SHC Enclosure is a multi-purpose project that offers significant benefits, and any proposed alternative must offer equivalent benefits:
  - It provides a water supply from saved water and return flows made available to the District for contracting with customer agencies.
  - It benefits agricultural producers by offering pressurized, high-quality irrigation water.

  - It enhances public safety for municipal partners and reduces liability for the canal company.
- It is preferred that water diverted directly from the Spanish Fork River does not enter new facilities due to poor water quality.
- The District-owned Salem property will be the location of the primary regional WTP, negating the need to evaluate other sites for the primary plant.
- The concept should be evaluated without considering aquifer storage recharge (ASR) or additional raw water storage.
- Facility 510/520, the Diamond Fork Pump Station, should not be eliminated unless the impacts on water supply are mitigated.

Value Alternatives

Table 4-1, 5-1, and 6-1 located in Section 4 - Overall System Integration, Section 5 - Conveyance (Raw & Finished), and Section 6 - Water Treatment Plant, respectively, include a complete list of all the Value Alternatives developed. These tables show the number and title of each alternative as well as a summary of the cost savings. These savings include the capital or first cost savings as well as the present worth value of the savings associated with the long-term ownership and operating costs over the economic life of the project. The first cost savings and the present worth savings on operations and maintenance (O&M) sum to give the overall life cycle cost savings for each Value Alternative.

It should be noted that Value Studies are working sessions for the purpose of developing and recommending alternative approaches to the current plan. As such, the results presented are of a conceptual nature and are not intended as a final design. Detailed feasibility assessment and final design development of any of the alternatives or suggestions presented herein, should they be accepted, remain the responsibility of the District and Jacobs.

Some alternatives presented in this report are variations of a common concept and others are alternatives to a specific aspect of the plan. Thus, not necessarily all alternatives in this report can be implemented as selection of some may preclude or limit the use of others.

These potential savings do not reflect any costs for redesign, which must be considered. Moreover, the full benefit and impact of many of the alternatives goes beyond the cost savings to include improved project performance of required functions.

Optimum Combination of Alternatives

After completing the development of the Value Alternatives, the Conveyance and Water Treatment Plant Teams reviewed the composite list of alternatives to identify what they believed to be the Optimum Combination of alternatives. This combination represents the best value solution for each project in the opinion of the Value Team.

The review concluded that the maximum project benefits would be realized by combining the alternatives as detailed in Tables 5-1 and 5-2 located in Section 5 – Conveyance (Raw & Unfinished), and Table 6-3 in Section 6 - Water Treatment Plant.

This combination results in the following potential cost savings:

Conveyance (Raw Water)	
Capital Cost Savings	$24,612,000
Present Worth of O&M Cost Savings	$0
Life Cycle Cost Savings	$24,612,000
Conveyance (Finished Water)	
Capital Cost Savings	$116,458,000
Present Worth of O&M Cost Savings	$0
Life Cycle Cost Savings	$116,458,000
Water Treatment Plant	
Capital Cost Savings	$162,548,000
Present Worth of O&M Cost Savings	$67,692,000
Life Cycle Cost Savings	$94,856,000

The savings from some of the individual Value Alternatives have been adjusted to account for overlapping savings when combined with other Value Alternatives. The calculations for these savings can be found in the Cost Information Appendix to this report.

Design Suggestions

In addition to the Value Alternatives, the Value Team also identified 16 Design Suggestions. These are suggestions for changes or clarifications to the project documents that did not have an identifiable or quantifiable cost impact that could be determined within the scope of the workshop. The Design Suggestions from this study are included in Value Alternative Sections for each project.

Validation Issues

In the process of identifying recommendations for change, the Value Team evaluated all aspects of the plan. In general, an absence of recommendations pursuant to certain portions of the project investigated can serve as a validation of the plan for those portions of the project. If a portion of the project is investigated and no recommendation for change results from that investigation, then it can be assumed that the Value Team agrees with the plan as originally presented.

Through this process many of the current plan decisions proved to be appropriate to accomplish the required functions. Some of the more significant decisions that were validated through the scrutiny of the VP Study include:

- The enclosure and pressurization of the SHC should be pursued from both a safety and conservation objective.
- Construction of a WTP in response to the potable water needs of the communities both current and future.

Additional Benefits

A VP Study typically results in benefits beyond cost savings. These benefits are generated as a part of a Value Alternative, Design Suggestion, or from an observation made by the Value Team or one of the other participants during the workshop. Below are some of the benefits realized from this study, in addition to the cost savings discussed above.

- Many alternatives identified during the workshop enhanced the project's performance in fulfilling required functions. This involves optimizing processes, materials, and approaches to ensure the project meets its objectives more effectively.
- The scrutiny of the current plan by the Value Team validated many existing decisions. This process confirmed that certain aspects of the project were already optimal, thus reinforcing confidence in some parts of the current strategy.
- Engagement of contractors early through ECI or CMAR reduces the likelihood of claims or disputes and enhances collaboration among project stakeholders, leading to a smoother project implementation.
- The Value Team identified 16 design suggestions aimed at improving the project without directly impacting costs. These suggestions often involve changes or clarifications that enhance the project's functionality, safety, or ease of operations and maintenance.
- The creative phase of the workshop generated numerous ideas, promoting innovative solutions to some of the project challenges. This phase encouraged thinking beyond conventional methods to achieve better outcomes. Not all ideas can be developed or even further considered due to time but it gives the PDT and the District a springboard for new, innovative ideas on the project.

- The consideration of alternative pipeline materials and construction methods provided the project team with flexibility in decision-making as design and construction progresses. This approach allows for adjustments based on cost, availability, and other project-specific factors.

Project Risks

During the workshop the team identified several risks that could impact the project schedule, cost, and overall execution. Key risks include labor and contractor issues, such as insufficient local labor, a limited bidding pool, and the potential for unqualified contractors, which could delay the project and increase costs. Environmental and geological risks, such as inclement weather, landslides, and geological seismic events, also pose significant schedule threats. Additionally, material and equipment availability concerns, including delays in long-lead items, could further postpone project completion.

Regulatory and legal challenges, like authorization issues and delays in NEPA approval, could impose restrictions and affect the timeline. Land acquisition problems and environmental concerns, such as wetlands created by leaks and contamination, might necessitate mitigation measures and cause delays. Community and political factors, including community input, public acceptance, and political uncertainties, could lead to additional design costs and impact project continuity. Water quality and supply issues, such as changes in water quality and supply from Strawberry Reservoir, may affect delivery.

Finally, poor coordination between construction projects, Design Teams, and phases, along with financial factors like hyper escalation and inflation, could result in significant schedule and cost overruns. Managing these risks is crucial to the successful completion of the project. This effort can help to further validate risks already in the risk register as well as expand the risk register to be more comprehensive as the project moves forward. For a complete list of risks identified by the team see Appendix C.

Implementation Results

The final phase of the Value process consisted of implementation decisions and actions. An implementation meeting was conducted virtually with the District and Jacobs staff.

This meeting was conducted to discuss each Value Alternative and Design Suggestion, answer questions, and decide what changes to make to the project. During the meeting, some ideas were accepted, others partially accepted or modified and some were rejected. The decisions and the rationale for these decisions are documented in Appendix G – Response to Recommendations. These decisions are also summarized in Table 4-1, 5-1, and 6-1, Summary of Alternatives.

Accepted Savings

Estimated net savings from the Value Alternatives accepted by the District for implementation are:

Capital Cost Savings	$328,196,000

Additional Savings

Implementing additional items that are still open, undecided or require further study by the District and Jacobs could add additional savings up to:

Capital Cost Savings	$303,618,000
Present Worth of O&M Cost Savings	($67,692,000)
Life Cycle Cost Savings	$235,926,000

SECTION 3

STRATEGIC VALUE SOLUTIONS INC

SECTION 3
VALUE PLANNING PROCESS

This section describes the process used to conduct this VP Study and the significant findings of the Value Team. This VP Study used the international standard Value Methodology established by SAVE International, the Value Society. The standard establishes the specific 6-Phase, sequential process, and the objectives of each of those phases, but does not standardize the specific activities in each phase.

Value Methodology (VM) is the general term that describes the structure and process for executing the Value Workshop. This systematic process was used with a multidisciplinary team to improve the value of the project through the analysis of functions and the identification of targets of opportunity for value improvement.

The **VM Job Plan** provides the structure for the activities associated with the VP Study. These activities are further organized into three major stages:

1. Pre-Workshop preparation
2. VM Workshop
3. Post-Workshop documentation and implementation

Figure 3-2 at the end of this section shows a diagram of the VM Job Plan used for this VP Study.

Defining Value

Within the context of VM, Value is commonly represented by the following relationship:

$$Value \approx \frac{Acceptable\ Performance\ (Function)}{Minimum\ Resources}$$

In this expression, functions are measured by the acceptable performance requirements of the customer, such as mission objectives, risk reduction, and quality improvements. Resources are measured in materials, labor, price, time, etc. required to accomplish the specific function. VM focuses on improving Value by identifying the most resource efficient way to reliably accomplish a function that meets the performance expectations of the customer.

It can be seen from this relationship that Value is improved or increased by:

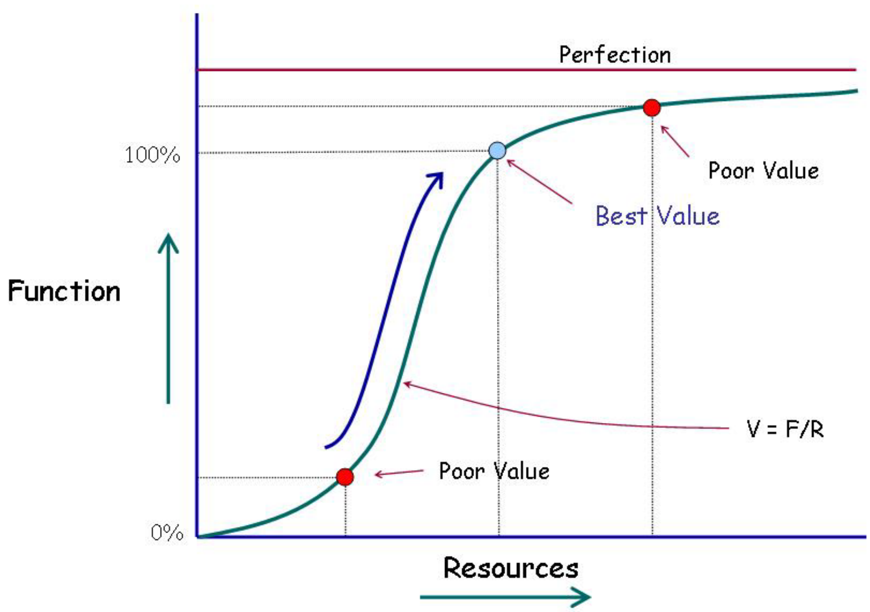
1. Increasing function without increasing resource consumption. Some increase in resources is acceptable as long as there is a greater increase in function performance.

2. Decreasing resources without decreasing function. Again, some decrease in function may be acceptable if the corresponding decrease in resources is significant enough.

Ideally, the Value Team looks for opportunities to increase function and concurrently decrease resource requirements. This will achieve the best value solution.

This value concept is illustrated in Figure 3-1, The Value Curve. This figure shows a hypothetical curve from plotting the value expression above. This curve will asymptotically approach perfection. The best value solution for a given project or project element will be found at the knee of the curve. At this point, the required function or functions have been achieved to 100% of the required level with a corresponding minimum resource commitment. To attempt to increase the function performance beyond this level will result in a resource consumption that has a higher worth than the marginal increase in function. This results in a poor value solution. Conversely, a poor value solution can also be the result of not achieving the function to 100% of the requirement. In this case, an incremental increase in resources delivers significant increase in function performance. The Value Methodology is used to identify the poor value decisions in a project and then develop alternative solutions to better align the project along this curve to achieve a best value solution.

Figure 3-1
The Value Curve™



This understanding of how Value is affected by changes in function or resources provides the foundation for all SVS Value Studies. The following paragraphs describe the process we used to understand the functional requirements and how we identified value improvement alternatives.

Pre-Workshop

Prior to the start of the workshop, the team was tasked with reviewing the most current documentation on the project development. This was done to familiarize them with the project plan and to prepare them for asking questions of the project stakeholders during the project presentations at the beginning of the workshop. Much of the background information for this study was generated by Jacobs.
Other pre-workshop activities included:

- Coordinating workshop logistics and communicating those to the various participants
- Providing guidance to the District and Jacobs on presentation content for the project introduction
- Scheduling workshop participants and assigning tasks to ensure the team is prepared for the workshop
- Gathering necessary background information on the project and making sure project documentation is distributed to the team members

Materials furnished to the Value Team by the District and Jacobs are listed in the Appendix.

Site Visit

Due to the extensiveness of the site, a site visit was conducted during the Pre-Workshop stage prior to the workshop. This site visit was attended by representatives from the Value Team, the District, Strawberry Highline Canal Company, and Jacobs.
The purpose of the site visit was to give the Value Team members a first-hand opportunity to see the physical features of the project site/existing facility/other that influenced the plan development.

From this site visit, the Value Team made the following observations:

Diamond Fork Pump Station and Water Quality:

- **Wetlands and Agricultural Impacts**: The Diamond Fork Pump Station site has wetlands and upstream agricultural impacts that may affect water quality. However, the turbidity at this site is significantly better than at the Spanish Fork River.
- **Rain Impact**: Water quality deteriorates when it rains, with turbid water turning red, grey, or black depending on the terrain it rains on (red rock, burned areas, etc.).

Canal and Pipeline Construction:

- **Canal Conditions**: The first reach of the canal is unsuitable for a pipe, and downstream areas will be tight for the SHC pipeline construction.

- **Sediment Removal**: Significant silt and sedimentation is removed from the SHC annually.

Infrastructure and Construction Challenges:

- **Topography and Elevation Differences**: The gravel pit is substantially lower than the plant site, with a significant topography difference not evident from contour scans.
- **Fault Line Proximity**: The plant site near the raw water storage has significant topography, and the fault line is just behind the Salem water tank.
- **Site Suitability**: Despite challenges, the WTP site is excellent, though the topography drives the layout and limits usable space, particularly on the east side.

Design and Operational Considerations:

- **Turbidity and Sediment Management**: There is very turbid water and tons of sediment dredged from the SHC.
- **Construction Phasing**: Phasing of the buildout is crucial to avoid poor water quality due to the water age if infrastructure is built too soon before housing is constructed.

Risk Mitigation and Planning:

- **Seismic Risk**: The fault line near the raw water storage poses a risk, necessitating careful consideration of the dam/embankment design, potential relocation, or modification of the raw water storage reservoir to reduce construction costs and seismic risks.
- **Operational and Water Quality Risks**: Issues like increased DBP formation due to long pipeline residence times, and turndown challenges in winter operations, require booster stations and proper equipment doubling to manage large and small flow ranges efficiently.

VM Workshop

The VM workshop was an intensive session during which the project plan was analyzed to optimize the balance between functional requirements and resource commitments (primarily capital and O&M costs).

The VM Job Plan used by SVS includes the execution of the following phases during the workshop:

1. Information Phase
2. Function Analysis Phase
3. Creative Phase
4. Evaluation Phase
5. Development Phase
6. Presentation Phase

Information Phase

At the beginning of the workshop, it was important to understand the background of the project from which the plan was developed. This background was provided in an oral overview by the District and Jacobs. The overview and subsequent project analysis provided information on the following topics:

- Rationale why this project is necessary
- Project objectives that have governed the proposed plan
- Rationale for the proposed plan configuration
- Explanation of plan features, criteria, and assumptions
- VP Study constraints
- Project cost

The District's presentation provided the Value Team with an overview of the goals, issues, and expectations for the project. The District and the Value Team also finalized the VP Study constraints. This was followed by Jacobs's more detailed presentation on the project plan and an explanation of the rationale behind key plan level decisions. Further, this gave Jacobs an opportunity to share their rationale for design decisions and direction for the project.

From these presentations, the Value Team noted the following key information:

Project Scope and Objectives:

- **Growth Planning**: The project aims to provide solutions for the growing areas of Southern Utah County and Juab County, planning for water needs through 2065.
- **Agricultural and Residential Needs**: The project must serve both agricultural and residential water needs, with a focus on long-term sustainability.

Water Conveyance and Treatment:

- **Water Conveyance**: Determining the best ways to convey water from nearby sources to the end users is critical.
- **Water Treatment**: Finding the best solutions for treating water to meet long-term needs, considering wide-ranging demand fluctuations and possible water shortages.

Pipeline and Material:

- **Pipeline Materials**: Steel pipe is used for high-pressure pipelines, while HDPE is used for low-pressure finished water pipelines.
- **Use of Gravity Flow**: Most pipelines will use gravity flow with minimal pumping required, enhancing efficiency.

Population Growth and Infrastructure:

- **Rapid Population Growth**: South of Salt Lake Valley is experiencing rapid population growth, which is necessitating robust water infrastructure planning.
- **Goshen Valley Mega Site**: There are plans for a large residential development (70,000+ homes) in the Goshen Valley Mega Site, which is not currently included in transportation models but is considered for water usage in the current plan.

System Flexibility and Seismic Considerations:

- **Flexible System Design**: The system must be designed to handle future adjustments easily, ensuring long-term adaptability.
- **Seismic Zone**: Some project features are in seismically active areas, requiring that the pipeline system includes seismic joints to ensure pipeline flexibility in an event. In addition, the water treatment plant site is adjacent to the Wasatch Fault.

Water Rights and Reuse:

- **Water Rights**: Water rights are a significant concern in Utah, with policies affecting groundwater appropriation. The largest water supply is from the Strawberry Reservoir.
- **Water Reuse**: With new Utah legislation there is a very limited chance for water reuse, but saline water is not a concern due to the presence of fresh water 30 feet under the Great Salt Lake.

Operational Challenges:

- **Seasonal Shuts and Adjustments**: The system needs to be shut off 7-9 times per year due to fires, taking up to 20 hours to restore. Floods also require system adjustments.

- **Water Treatment Plant (WTP)**: The planned South Valley WTP will include ozone treatment with GAC filters and large reservoirs, initially without UV but with plans for future needs.

Design and Construction Considerations:

- **ROW and Easements**: Right-of-way and easements are crucial for construction, with potential issues in property acquisition and access.
- **Utility Relocations**: Utility conflicts along new pipeline alignments could cause scheduling delays and increase costs.
- **Material Procurement**: Fluctuations in steel prices and availability could significantly impact project material costs.

Project Cost Analysis

The cost information used as a baseline for this study was derived from the Jacobs Technical Memorandum dated June 20, 2024. In addition to the baseline pricing provided by the Jacobs estimate, the cost estimating team also used proprietary and independently sourced pricing information from existing databases, suppliers, and live jobs to apply pricing values for new Value Suggestions presented by the Value Team.

The Value Team was provided with a construction cost estimate as part of the project documentation. This estimate indicated an anticipated construction cost of $1,427,500,000 based on prices escalated to the mid-point of construction.
The budget for construction is not official at this time, and the Jacobs Cost Estimate is intended to be used as a tool to set the first marker of potential Program Budget of $1.427 billion.

Following a review by the Value Team, adjustments are recommended that will provide more consistency throughout the unit pricing. Additional information on these adjustments is included in the Cost Information Appendix to this report. For purposes of this Value Study, the cost comparisons included in the Value Alternatives have been estimated to a construction contract (bid) level using the designer's/Value Team's adjusted estimate.

The Value Team's review of the estimate verified the reasonableness of the:

- Estimated quantities
- Estimated unit costs
- Estimated contingencies
- Mark-ups for overhead, profit, bonds, etc.
- Overall project cost

This was done to ensure that the Value Team had reliable data to use as the basis for cost comparisons of alternatives.

Review of the costs included comparison of unit prices to recently received prices for similar projects and to published unit price indices. Unit prices for unique project elements were compared to prices based on applicable crew compositions and production rates.
Vendor quotations were obtained for unique and/or major equipment and compared to those in the project cost estimate. Adjustments were made where appropriate to bring unit prices and quantities into conformance with the current design documents and presentation information provided to the value team.

A complete review of all the estimate's supporting backup data was not attempted due to time limitations and availability of information; however, limited reviews were made of some quantities for the larger cost items within the estimate.

Review of Unit Costs

After review of the unit costs in the project cost estimate, the Value Team recommends the following adjustments:

- Below the line percentages seem reasonable. Those include; taxes, sub contractor OH&P, General Conditions, Contractor Profit, Bonds and Insurance, Contingency. Verify local tax applied at 7% may be correct, however a few different searches yielded marginally different numbers.
- Rebar ranges from $0.90 to $1.20 for similar applications. In addition to this pricing seems on the lower side of expectation.
- Concrete 4500psi at $132/cy seems lighter than expected
- Mass excavation at regulating pond at $5.39-$5.81/cy seems very low.
- 60" ball valve at $917,970 is a very specific number. It may be quoted, however seems higher than expected
- 60" flow meter is priced at $302,287.58. This is a very specific number and may be quoted, however price seems higher than expected.
- 1-1/2" rigid conduit at $7.01/LF price seems light
- Unit costs appear low for structural excavation at $9.66/CY and structural backfill at $10.46/CY
- Dump Fees are $25/CYD appears high
- Dump Charges for Site Demolition Spoils, 12 YD tandem, priced per cubic yard $37.50/CYD appears high

Significant Cost Issues

The following items represent some of the more significant cost variations identified during the review.

- The biggest cost factor in these estimates comes from the values that were used for the carbon steel piping. Given their quantity, size, and overall impact on the project cost, it's crucial that these values are accurate and well-supported. Even though we're in the Pre-Concept stage, we can get reliable quotes from trusted suppliers. A 15% error in the material estimate for this much piping could result in a cost discrepancy of over $50 million. As the estimating team, we strongly recommend that the piping material values be the top priority to nail down at this budgeting stage.

To further analyze the project cost, the Value Team prepared a cost model for the project. This cost model was used by the Value Team for the following purposes:

- To identify parts of the project with the greatest costs
- To estimate the greatest differences between cost and worth
- To aid in focusing the efforts of the Value Team during the study.

The Value Team's cost model for this project is included in the Cost Information Appendix.

Economic Data for Life Cycle Cost Analysis

To express life cycle costs, the Value Alternatives have been presented based on discounted present worth cost. The economic criteria used by the team were as follows:

Year of Analysis: 2024

Analysis Period:.. 50-100 years

Gross Discount Rate: .... 7% per year

Inflation Rate: .... 4% per year

Net Discount Rate:... 3% per year

Function Analysis Phase

Function Analysis is the heart of the VM process and is the key activity that differentiates the VM process from other problem solving or improvement practices. During the Function Analysis Phase of the VM Job Plan, functions are identified that describe the expected outcomes of the project under study. Function Analysis also defines how those outcomes are expected to be accomplished by the plan. These functions are described using a two-word, active verb and measurable noun pairing.

This identification and naming convention of project functions enables a more precise understanding by limiting the description of a function to an *active verb* that operates on a *measurable noun* to communicate what work an item or activity performs. This naming convention also helps multidisciplinary teams to build a shared understanding of the functional requirements of the project.

Function Determination

Defining functional requirements for the project allowed the District to be sure that the project, with the current plan, would fulfill the needed purposes. The entire project was analyzed to determine what functions are being accomplished by the current plan. Required functions were retained. Some functions were not necessary to accomplish the mission of the project and thus became candidates for deletion.

During the Function Analysis Phase, the Value Team used various function analysis techniques to analyze the project. Each breakout team conducted this phase separately with the focus set on their scope. This analysis helped the team confirm its understanding of the overall project objectives and analyzed the functions of key project elements. The Value Team Leader led the Value Team through an in-depth discussion of the possible functions of each key project element to clearly and precisely identify the purposes of each.

FAST Diagram

Function analysis was enhanced by using a graphical mapping tool known as the *Function Analysis System Technique* (FAST), which allows Value Team members to understand how the functions of a project relate to each other. The resulting FAST

Diagram allowed quick visualization of the logical relationship between project functions and the project as a whole. The FAST diagram is in the Function Analysis section of the Appendix.

The FAST Diagram is structured such that moving to the right of any function answers the question, “How are we accomplishing this function?” Moving to the left of any function answers the question, “Why are we accomplishing this function?” Elements that are vertically connected occur “When” or as a consequence of the function it is connected to on the horizontal path.

The functions between the two dashed lines, called Scope Lines, represent the functional elements of the project which are within the scope of the VP Study. The first column of functions (basic functions) within the left Scope Line represents the functions that must occur in order for this project to successfully accomplish its mission. The remaining functions (secondary or support functions) represent how the current plan has chosen to accomplish those basic functions.

Creative Phase

This step in the VM process involved generating ideas using creativity techniques. The Value Team recorded all ideas regardless of their feasibility. In order to maximize the Value Team’s creativity, evaluation of the ideas was not allowed during the creative phase. The Value Team’s effort was directed toward a large quantity of ideas. These ideas were later screened in the Evaluation Phase of the workshop.

The creative ideas generated by the Value Team are included in the Appendix. The list also includes ratings for each idea based on the Evaluation Phase of the workshop. These lists should be carefully reviewed, as there may be other good ideas not developed by the Value Team because of time constraints. These should be further evaluated or modified to gain the maximum benefit for the project.

Evaluation Phase

In this phase of the workshop, the team selected the ideas with the most merit for further development.

After an initial vote, the Value Team Leader assessed how many ideas could be developed into Value Alternatives within the remaining duration of the workshop. From this assessment, all ideas with a certain number of votes were selected for development. However, prior to the final selection, the results were revisited collectively by the Value Team to ensure that those selected by the voting process truly represented the best ideas for development. This gave the Value Team the opportunity to down-rate some ideas and to up-rate other ideas based upon team discussion of the ideas.

The criteria used for selection were:

1. The inherent value, benefit, and technical appropriateness of the idea
2. The expected magnitude of the potential cost savings, both capital and life cycle
3. The potential for the District and Jacobs acceptance of the idea

Ideas were selected for development as Value Alternatives based on all three criteria.

Not all ideas were developed. This evaluation process is designed to identify those ideas with the greatest potential for value improvement that can be developed into Value Alternatives within the time constraints of the workshop and the production capacity of the Value Team. The remaining ideas were eliminated from further consideration by the Value Team; however, the ideas not developed should also be reviewed, as there may still be other good ideas not developed by the Value Team because of time constraints or other factors. These could be further evaluated or modified to gain the maximum benefit for the project.

To further ensure the Value Team is focused on developing the best ideas, a mid-point review meeting is conducted with the Value Team Leader, the District, and Jacobs representatives. This mid-point review allowed the District and Jacobs to identify any fatal flaws in the ideas that were not apparent to the Value Team but were apparent to the District and Jacobs project team because of their greater institutional knowledge of the project. These fatal flaws may be technical, operational, political, etc.

Development Phase

During the Development Phase of the workshop, each idea was expanded into a workable alternative to the original project concept. Development consisted of preparing a description of the Value Alternative, evaluating advantages and disadvantages, and making cost comparisons.

Each alternative is presented with a brief narrative to compare the original concept and the alternative concept. Sketches and brief calculations were also developed, if needed, to clarify and support the alternative. The Value Alternatives developed during the workshop are presented in Section 4,5, and 6.

The Value Team Leader and, to the extent possible, other Value Team members reviewed each alternative to improve completeness and accuracy.

Redesign costs are not included in the cost comparison of alternatives. The responsibility for determining these costs is between the District and Jacobs. Redesign costs, if any, should be addressed by Jacobs in their response to the District on the alternatives.

Presentation Phase

The last phase of this workshop was the presentation of Value Alternatives. The presentation was made by the Value Team on June 28, 2024, to representatives of the District's and Jacobs's project team. The Value Team described each Value Alternative and the rationale that went into the development. This was followed by answering the audience's questions.

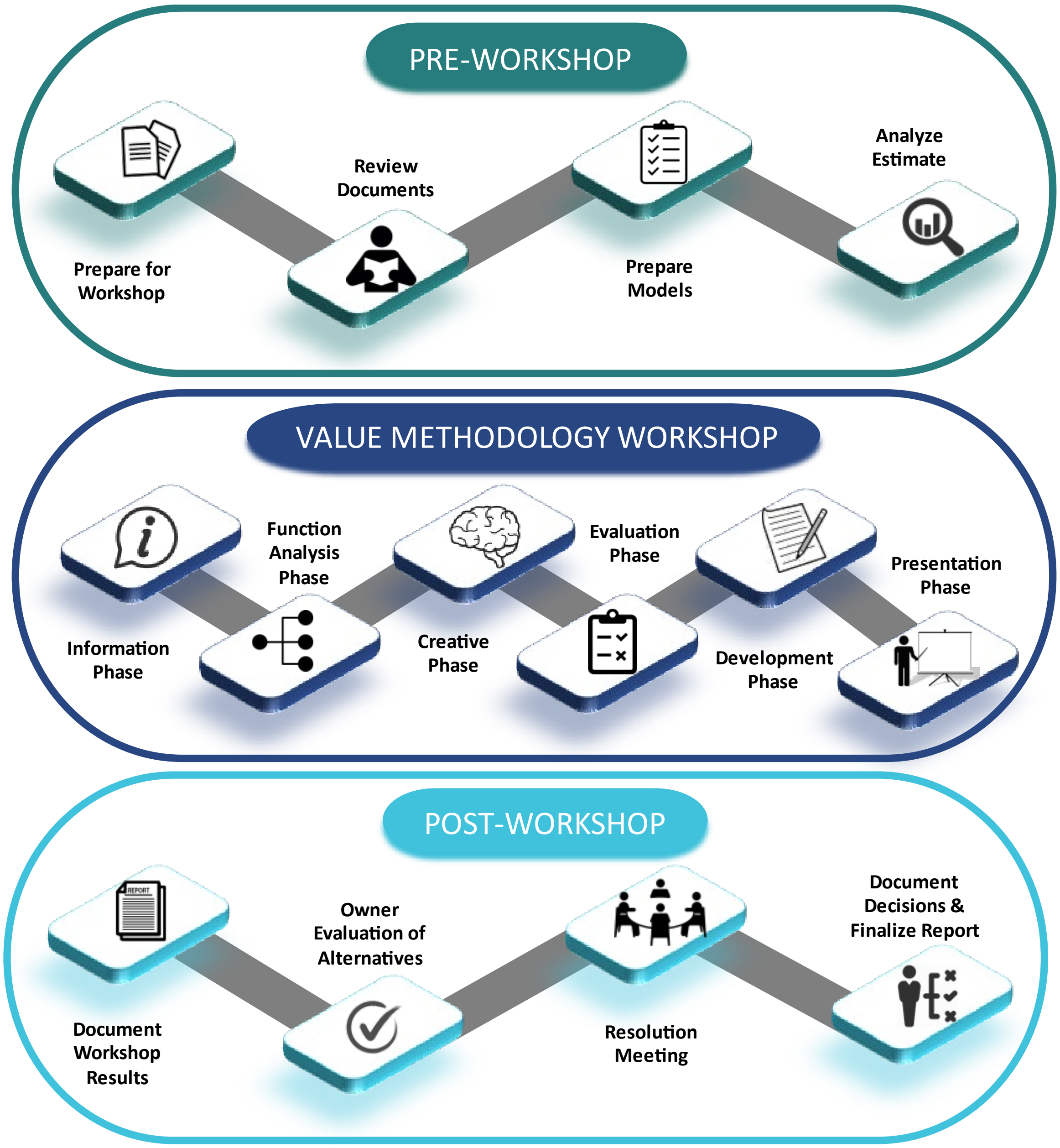
Post-Workshop

The Post-Workshop activities of this VP Study consisted of preparing the VP Study Reports and coordinating with the District and Jacobs to help them make decisions regarding the acceptance of the Value Alternatives.

Upon completion of the review, a meeting was held between the District, Jacobs, and the Value Team Leader for resolution of any outstanding questions and for making decisions regarding the appropriate implementation action for each Value Alternative and Design Suggestion. The results of that meeting are presented in Appendix F: Response to Recommendations.

This Final VP Study Report includes the Value Alternatives developed during the workshop and the subsequent implementation decisions.

Figure 3-2
The SVS Value Process ™



Alternatives

The following sections are the results of this VP Study and represent the value improvement opportunities that can be realized on this project. They are presented as individual alternatives for specific changes to the current plan.

Each alternative includes:

- A summary of the original concept
- A description of the alternative concept
- A brief narrative comparing the original plan and the recommended change
- Sketches, where appropriate, to further explain the alternative
- Calculations, where appropriate, to support the technical adequacy of the alternative
- A capital cost comparison
- And a life cycle cost analysis, if appropriate

Cost was the primary resource that was compared to the functions being accomplished in the project. To ensure that costs were compatible within the Value Alternatives proposed by the Value Team, the project cost estimate was used as the basis of cost.

Design Suggestions

In addition to the Value Alternatives, the Value Team generated several other ideas that have been termed Design Suggestions. These are presented to bring attention to areas of the plan which, in the opinion of the team, should be changed. In general, these ideas were designated as Design Suggestions rather than Value Alternatives for one of two reasons:

1. The value improvement opportunity is relatively small
2. The concept could not be adequately evaluated or developed within the constraints of the workshop resources

Design Suggestions typically are associated with issues such as:

- Improved operation
- Ease of maintenance
- Easier construction
- Reduced risk of construction claims
- Clarification of construction documents
- Or safer working conditions

SECTION 4

STRATEGIC VALUE SOLUTIONS INC

OVERALL SYSTEM INTEGRATION

SECTION 4
OVERALL SYSTEM INTEGRATION

Scope of Study

The focus of this breakout team was to look at the overall integration of the new Plan Formulation Project into the existing water supply and infrastructure. This team looked at the high-level system planning for the infrastructure needed for water treatment, storage, and distribution to meet quality and quantity requirements provided the projected demands. This included the new water source and overall integration into the existing infrastructure.

This section delves into the integration of individual project components to optimize the overall system performance from both a short-term need and long-term goal. The objective is to ensure a holistic approach to system integration, enhancing project value through cost-effective and functionally robust solutions. The section includes design suggestions that, while not fully developed as value alternatives, aim to improve operational efficiency, maintenance, construction feasibility, and safety. These suggestions underscore the importance of continuous evaluation and potential refinement of the project design to achieve the best possible outcomes. The integration efforts highlighted in this section are crucial for the successful implementation of the project, ensuring that all components work synergistically to meet the overarching goals of the Central Utah Water Conservancy District.

Key Findings

The VP team went through several key discussions during the workshop. One of the more significant discussions the team had was related to the location of a finished water treatment plant and which phase it should be constructed. The team agreed that the District should consider using smaller, modular water treatment facilities rather than a single, large regional water treated water treatment facility. The rationale for this decision was due to the variance that is likely to be seen in where population growth will occur and at what time in the future that happens. This flexible approach allows the District to better anticipate where population growth will occur. In addition, this type of approach should help to keep finished water rates competitive in the region maintaining the District as the primary provider.

During the function analysis phase, the team determined there to be two higher order functions of this project: first, to meet potable demands and second, to improve Strawberry Highlight Canal. The team had substantial discussion focused on water delivery and demands. The team had a paradigm shift during this phase in which it became clear that this project's main purpose was to provide potable water to South Utah and Juab County. What made this a paradigm shift for the team is that it was believed this project was only about the safety and longevity of the SHC. Through team conversation the team agreed that the improvements to SHC are a result of meeting another required function of this project which is to Increase Supply by capturing an extra ~8,000 acre-feet of water that would typically evaporate or seep out of the canal.

This is being accomplished through enclosing the SHC. Through the evaluation process, the team validated that this design approach is appropriate and helps to achieve three fundamental functions of the project which are Increase Supply, Protect Water Quality, and Reduce Liability.

Highlights

The proposed alternative concepts not only deliver substantial cost savings but also bring significant intangible benefits and risk mitigation. By enhancing operational flexibility and redundancy, these alternatives ensure a more resilient water supply system, which is crucial for sustaining community growth and meeting future demands. The elimination of single points of failure and the strategic use of groundwater sources increase reliability, while reducing potential water quality issues associated with long pipeline detention times. The team strongly investigated options for other potential water sources to augment or accelerate construction activities. Through this analysis the team discovered several opportunities to leverage existing wells owned by SHCC and Rocky Mountain.

One of the key recommendations that came out of this breakout team's evaluation of the project was an alternative proposing to use these existing wells. The alternative concept TW-21 proposes the utilization of groundwater from existing wells near the Strawberry Highline Canal (SHC) to provide potable water to the towns of Santaquin and Mona, instead of relying on a finished water pipeline from the South Utah Valley Regional Water Treatment Plant (SUVR WTP) in Salem. This approach focuses on converting existing irrigation wells to meet drinking water standards and using them to supply these towns with potable water more rapidly and efficiently. The alternative concept emphasizes the urgent need to supply finished water to areas with immediate demand, particularly Mona, where water scarcity has led to a moratorium on new construction permits. Groundwater is often of higher quality than surface water and requires less treatment. This alternative also aims to expedite water delivery, reduce the length of pipelines needed, and decrease reliance on extensive water treatment processes.

Another key recommendation in response to the urgent needs in Mona. The alternatives DW-06 and DW-12 focus on providing water to the town of Mona and Nephi by employing different strategies that involve developing new infrastructure and leveraging existing resources. Both alternatives aim to deliver water more efficiently and promptly, addressing immediate and future water needs in Mona and the surrounding areas. This alternative proposes constructing a new water treatment plant (WTP) at Mona. The plant will treat water from the Mona Reservoir, which will be supplied through a new water exchange agreement. This strategy eliminates the need for a lengthy finished water pipeline from South Utah County to Juab County, specifically serving the towns of Mona and Nephi directly. By treating water closer to the demand area, this alternative reduces potential water quality issues associated with long detention times in pipelines. It provides water to Mona sooner than the original concept, avoiding delays related to constructing the regional water treatment plant and the associated long pipelines.

TW-10, TW-17, and TW-21 emphasize the critical role of water treatment and distribution in ensuring the long-term sustainability of the water supply system. The proposed water treatment plants in Santaquin and Mona, coupled with a decision tree framework for program planning, provide a structured approach to addressing varying water demands and uncertainties. Utilizing groundwater from the Strawberry Highline Canal wells offers an immediate and high-quality water source, further enhancing the system's resiliency and reliability.

In conclusion, the team evaluated alternatives that address both immediate and long-term needs. Ultimately, these changes lay a robust foundation for a resilient and adaptable water distribution infrastructure that can effectively respond to evolving challenges and opportunities.

Organization of Alternatives

The alternatives presented on the following pages are organized by functional categories, and then numerically within each of those categories. The divisions used to organize the alternatives are as follows:

Deliver Water (DW)

Increase Supply (IS)

Treat Water (TW)

These designations have been used throughout the Value process to organize the ideas.

Table 4-1
Summary of Alternatives

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
DW - Deliver Water					
DW-02	Use the ULS to convey finished water from South Utah Valley Regional Water Treatment Plant to Santaquin and enlarge the Strawberry Highline Canal enclosure to accommodate the ULS water	$192,637,000	$0	$192,637,000	A
DW-06	Develop a third water treatment plant at Mona to eliminate some finished water pipeline	$154,972,000	$0	$154,972,000	R
DW-09	Move optional hydropower to the Spanish Fork pipeline in lieu of Pipeline 140	($6,479,000)	$0	($6,479,000)	F
DW-12	Extend the ULS to Mona and use three water treatment plants at Mona, Santaquin, and Salem supplied by ULS	$116,993,000	$0	$116,993,000	R
IS - Increase Supply					
IS-03	Limit irrigation use for residential (new construction)	Design Suggestion			F
IS-12	Identify additional canals in South Utah and Juab County to treat as M&I water	Design Suggestion			F
IS-13	Construct a pump station on the Spanish Fork Provo Reservoir canal to pump water to a water treatment plant for treatment	($7,081,000)	$0	($7,081,000)	F
TW - Treat Water					
TW-10	Construct a Santaquin Water Treatment Plant in Phase 1 and construct Salem Water Treatment Plant at a future date	$207,952,000	$0	$207,952,000	R

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
TW-17	Develop a decision tree framework for the program planning process and periodically re-evaluate actual and projected M&I assumptions and investments	Design Suggestion			A
TW-21	Use ground water from Strawberry Highline Canal wells near Santaquin to provide potable water for Santaquin and Mona	$131,550,000	$0	$131,550,000	A

A = Accepted R = Rejected

1. Some proposals presented in this report are variations of a common concept and others are proposals to a specific aspect of the design. Thus, not necessarily all proposals in this report can be implemented as selection of some may preclude or limit the use of others.

2. These potential savings do not reflect any costs for redesign, which must be considered. Moreover, the full benefit and impact of many of the proposals goes beyond the cost avoidance to include improved project performance of required functions.

*For the Final Report, preliminary decision rationale is inserted in Appendix E – Supplemental Information

DELIVER WATER

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	DW-02
Use the ULS to convey finished water from South Utah Valley Regional Water Treatment Plant to Santaquin and enlarge the Strawberry Highline Canal enclosure to accommodate the ULS water	
Challenges Standard or Criteria:	Yes ☒ No ☐
Changes the intended use of the ULS pipeline.	
Description of Original Concept:	
The original concept directs untreated water through the ULS pipeline with a new connection that will divert some ULS water into the South Utah Valley Regional WTP. The treated water is then piped through finished water pipeline from the WTP to the surrounding communities as far south as Nephi, UT. The agricultural demands are supplied through the Strawberry Highline Canal (SHC) with some existing turnouts on the ULS pipeline from the connection to the WTP to the city of Santaquin.	
Description of Alternative Concept:	
The alternative concept is to redirect all the treated water through the ULS pipeline converting it to a finished water pipeline. This eliminates the finished water pipeline distribution from the WTP to all southern communities. However, this still provides finished water access to these areas via the existing ULS. All agricultural use water is conveyed through the SHC which would need to be enlarged from the original concept.	
Rationale for Change:	
The main rationale for this concept is to accelerate the District's ability to deliver treated water to customers from the proposed South Utah Valley Regional (SUVR) WTP without the need for new infrastructure.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	$192,637,000
Function	Resources	O&M Savings:	$0
☐ Increased	☐ Increased	Life Cycle Cost Savings:	$192,637,000
☒ Maintained	☐ Maintained		
☐ Decreased	☒ Decreased		

Advantages/Disadvantages

Alternative No.: DW-02

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Increases separation of finished water and raw water pipelines • Uses existing connections to the cities from Salem to Santaquin • The ULS has been approved for extension Nephi • Allows for interconnection of the optional Santaquin WTP and the SUVR WTP • Replaces HDPE pipe with a concrete mortar lined pipe	• Any changes to flows in the ULS pipeline require reopening of the EIS and the DPR • Combines Strawberry High Line Canal Company and the District raw water into one pipe • Limits the use of the ULS pipeline to treated water • Increases the size and cost of the SHC enclosure • Eliminates redundancy provided with a second raw water line • City connections that were designed for raw water must be converted to finished water connections • Loss of high pressure in the ULS pipeline • Will have to repressure the ULS line after WTP

Discussion

Alternative No.: DW-02

Description of original concept affected by this change:

The original concept involves directing untreated water through the ULS pipeline, with a new connection diverting some of this water into the South Utah Valley Regional WTP. After treatment, the water is distributed through a finished water pipeline from the WTP to surrounding communities, reaching as far south as Nephi, UT. Agricultural demands are met via the SHC, utilizing some existing turnouts on the ULS pipeline from the WTP connection to the city of Santaquin.

Issue of concern to the team:

The Value Team was searching for ways to get finished water to southern communities as early as possible. This proposal could potentially expedite finished water deliveries after the SUVR WTP is operational. Much less new infrastructure for finished water pipeline would not need to be installed to make these deliveries.

Description of alternative concept:

The alternative concept involves redirecting flow from the ULS pipeline to the proposed SHC Pipeline. It also involved directing flow from the SUVR WTP to the ULS pipeline. To accomplish this, the ULS pipeline would need to be disconnected or valved between the "T" to Line 140 and finished water return connection to the ULS. Currently the ULS pipeline is designed to be extended to Santaquin. The finished water pipeline after Santaquin would remain.

Benefit of making the change:

The alternative concept increases separation of the finished water line and the raw water line. There are substantial cost savings to remove the addition of another pipeline on this project.

Additional explanation:

There are several concerns regarding the integration of the ULS, Strawberry High Line Canal Company (SHLCC), and finished water pipeline systems due to their differing pressure levels. Firstly, the SHC pipe would need to be upsized to handle the combined flows of ULS raw water and SHLCC raw water, and it would need to accommodate high pressure or require booster pump stations to maintain contracted pressures. Additionally, the turnouts on the ULS would need retrofitting for drinking water pressures, or new turnouts would be needed at FW locations, leading to the abandonment of new high-pressure raw water turnout facilities.

The locations of finished and raw water turnouts on the ULS are likely different, necessitating adjustments to the piping downstream of the turnouts to connect to the appropriate systems. The ULS, SHLCC, and FW pipelines have different endpoints, requiring additional piping in areas like Santaquin where these systems diverge.

Timing is also a major consideration as finished water cannot come online until the SHC pipe is fully installed and retrofitted with turnouts for ULS raw water deliveries. Temporary cross-connections between ULS and SHLCC would be needed to deliver raw water flows during the construction of the new SHC pipeline, but these facilities would eventually be abandoned, although some mechanical equipment might be reusable. Finally, the District has expressed concerns about water quality and obtaining regulatory approval to convert a raw water facility to a finished water facility. These issues would have to be further considered to determine if the cost savings and potential schedule advantages are worth it.

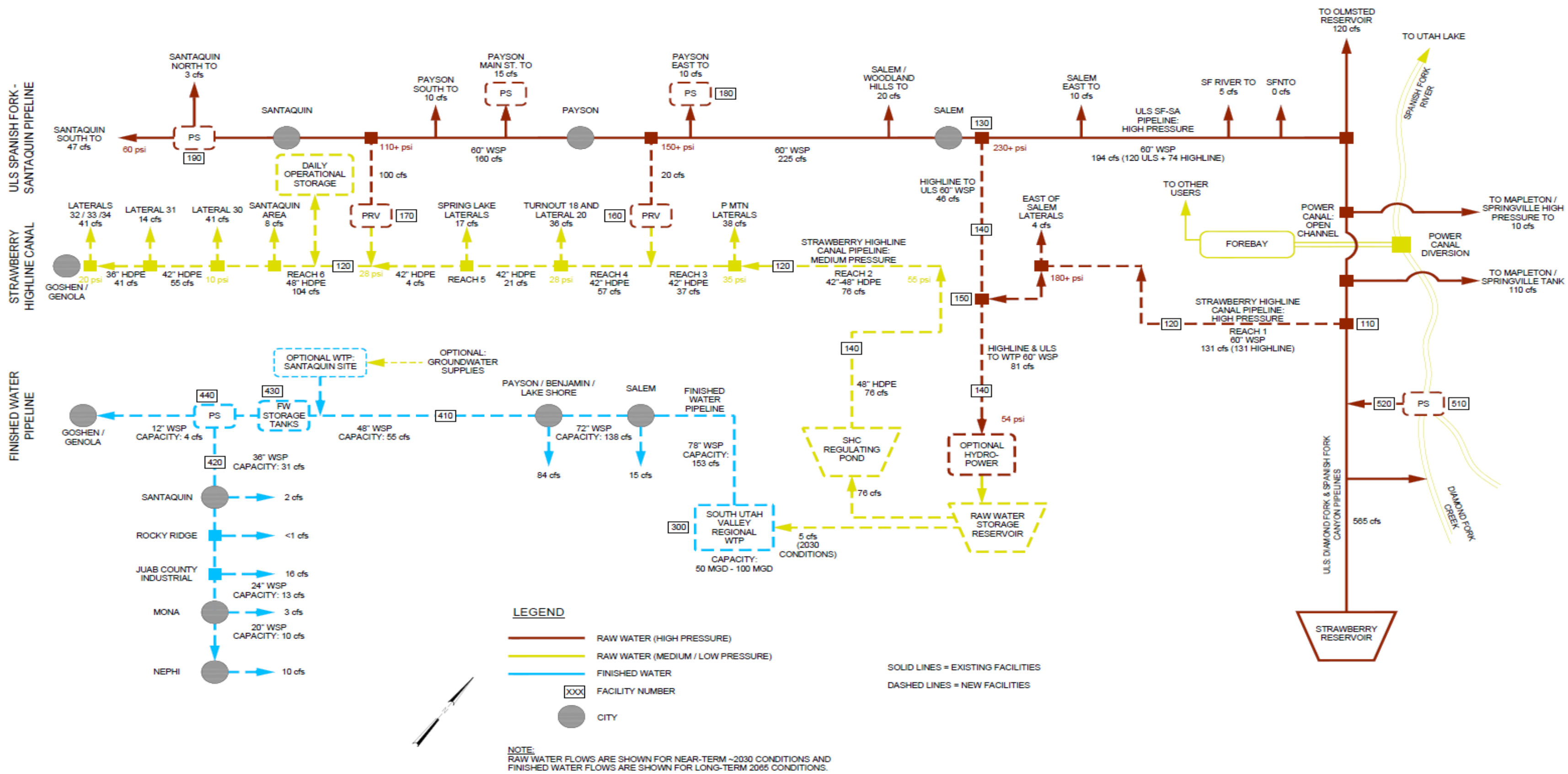
Key steps to implementing the idea:

The first step is to determine if the required effort to implement this alternative is worth the savings of not having all the new finished water pipeline. Present and discuss the alternative with ULS pipeline federal government stakeholders.

Sketch

Alternative No.: DW-02

☒ **ORIGINAL** ☐ **ALTERNATIVE**

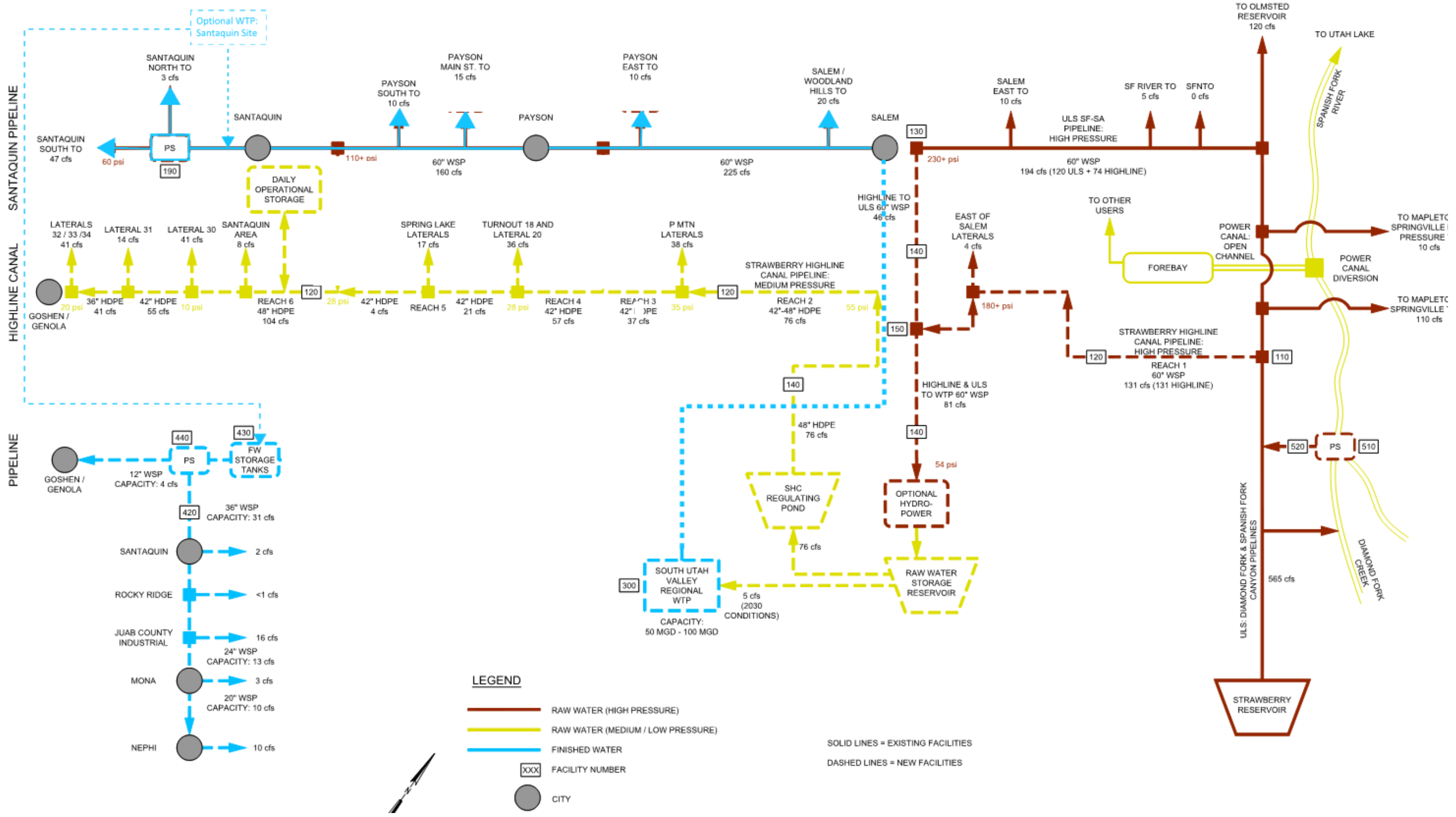


Original Flow Diagram

Sketch

Alternative No.: DW-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Finished Water Using the ULS Pipeline

Calculations

Alternative No.: DW-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Flows into ULS/SUVR WTP

Strawberry Highline Reach 1 = 131 CFS

ULS pipeline (after Spanish Fork River outflows) = 194 CFS

Strawberry + ULS = 131 + 194 = <u>325 CFS</u>

Total treatment capacity = <u>153 CFS</u>

Flows to Strawberry Highline = 325 CFS – 153 CFS = <u>172 CFS</u>

Calculations

Alternative No.: DW-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**

SHC upsizing:

Pipe Velocity and Flow Calculation				
*Flow = Velocity * Area (Q=VA)*				
Diameter (IN)	**Area (IN^2)**	**Area (SF)**	**Flow (CFS)**	**Velocity (FT/Sec)**
72	4072	28	350	12.4
72	4072	28	250	8.8
72	4072	28	150	5.3
60	2827	20	350	17.8
60	2827	20	250	12.7
60	2827	20	150	7.6
48	1810	13	350	27.9
48	1810	13	250	19.9
48	1810	13	150	11.9

Construction Cost Estimate

Alternative No.: DW-02

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
36 IN HDPE	LF	473.00	3,212	$1,519,276		
42 IN HDPE	LF	610.00	55,182	$33,661,020		
72 IN CMLS	LF	1,783.00			58,394	$104,116,502
Facility 410	LS	172,000,000	1	$172,000,000		
Total Markup	86.91%			$180,060,395		$90,487,652
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$387,241,000		$194,604,000
NET SAVINGS						$192,637,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	DW-06
Develop a third water treatment plant at Mona to eliminate some finished water pipeline	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to construct a pressurized finished water pipeline from South Utah County to Juab County, specifically to serve Mona and Nephi. This finished water will be served from a single regional WTP near the city of Salem (SUVR WTP).	
Description of Alternative Concept:	
The proposed concept is to withdraw water from Mona Reservoir and divert it to a new WTP in Mona to serve Mona and Nephi potable demands. A water exchange would be required with Mona Reservoir water rights holders to make this alternative feasible. The alternative concept is to exchange Mona Reservoir's raw water with raw and/or finished water to the Goshen area where timing will dictate whether the exchanged water is raw or finished.	
Rationale for Change:	
This alternative would take potable water deliveries off the critical path of the SHC WTP and finished water pipeline. Thus, provide water to Mona at an earlier date than is currently proposed with the SHC enclosure facility in the original concept. In addition, this also avoids the potential water quality issues associated with long detention times in a long-finished water pipeline with low velocities.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$154,972,000
O&M Savings:	$0
Life Cycle Cost Savings:	$154,972,000

Advantages/Disadvantages

Alternative No.: DW-06

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Provides water to Juab County, specifically Mona, earlier than original concept anticipates • Eliminates the need and cost for the finished water pipeline between Santaquin and Juab County communities from Salem WTP • Removes some finished pipeline construction and O&M responsibility from the District • Reduces the risk of water quality issues in the long pipeline • Eliminates the need for chlorination booster station • Increases storage and supply redundancy provided for the proposed Santaquin WTP if ULS pipeline was extended to Mona Reservoir • Reduces size of the SUVR WTP	• Requires a water right exchanges • Adds another WTP to the District's system • Adds finished water pipeline construction and O&M responsibility to local communities • Relies on adequate water supply being available in Mona Reservoir

Discussion

Alternative No.: DW-06

Description of original concept affected by this change:

The original concept is to construct a pressurized finished water pipeline from South Utah County to Juab County areas. The pipeline would be fed from the new SUVR WTP in Salem through a finished water pipeline that follows the SHC alignment then turns south before terminating at Nephi, roughly 25 miles of finished water pipeline.

Issue of concern to the team:

The current concept schedule for finished water delivery to Juab County would be later than desirable given that current demands exist in the Mona area. The original concept requires construction of a large regional WTP and long finished water pipeline with potential water quality issues associated with long detention times.

There are also potential water quality issues associated with long detention times in a long-finished water pipeline with low velocities requiring a chlorination booster station along the alignment. Treating water closer to the Mona and Nephi demands would reduce this risk.

Description of alternative concept:

The concept is to withdraw water from Mona Reservoir and divert it to a new WTP in Mona and serve Mona and Nephi M&I demand. A water rights exchange or a lease agreement would be required with Mona Reservoir water rights holders to make this alternative feasible.

There is an assumption that most of the water in Mona Reservoir currently serves agricultural demands in the Goshen area. It is also being projected to partially serve future residential development in the Goshen area with this agricultural water. Agricultural demand will transition to M&I demand in the future. The exchanged water from the ULS pipeline will eventually need to be treated.

Benefit of making the change:

This proposal provides finished water to Juab County, specifically Mona, earlier than the original concept anticipates. It eliminates the need and cost for the finished water pipeline between Santaquin and Juab County communities, thereby removing some finished pipeline construction and O&M responsibilities from the District. Additionally, it reduces the risk of water quality issues associated with long detention times before water is delivered to users, which could occur with the long pipeline proposed in the original concept.

Another benefit of this proposed concept is it takes the finished water supply to Juab County off the critical path of SHC enclosure and the Salem WTP. Water can be provided to Juab County sooner if the Salem WTP is delayed for any reason. This requires supplying water to Goshen by the time the Mona WTP goes online.

Additional explanation:

The District will need to initiate discussions with the water rights holders in the Mona Reservoir to propose using 13 CFS of water rights in Mona Reservoir. This would be in exchange for 13 CFS of raw water to be delivered from the ULS pipeline and or site, to the Goshen area near Santaquin. In the future, these 13 CFS of raw water will be converted to finished water for Goshen, provided by the future Santaquin WTP.

This alternative will also build a WTP with a 13 CFS (8.5 million MGD) capacity near Mona Reservoir. This capacity is intended to meet the municipal and industrial (M&I) demands of Mona and Nephi only. The source of water for the new WTP will be Mona Reservoir. It is estimated that a 21-inch pipeline would be required, and the new WTP would be located no more than 1-mile from the south end of Mona Reservoir. Additionally, a low head 10 MGD pump station is required to pump water from Mona Reservoir to the new Mona WTP.

This alternative does not provide capacity for the projected industrial demands in Juab County; however, this capacity could be added if necessary. The treated water from the new Mona WTP would be conveyed to Mona and Nephi through city-provided pipelines. If the plant size were increased to include industrial demands, the necessary pipeline infrastructure would need to be provided by local or industrial entities.

The Goshen agricultural demand is currently served by water rights in Mona Reservoir. The water to be diverted to the new Mona WTP would be replaced in the Goshen area by raw water from the ULS Pipeline or the site in Santaquin. A pipeline would be constructed from the ULS Pipeline or the site to the Goshen Area. It is suggested that the proposed finished water pipeline from the SHC enclosure project be constructed to supply the raw water for this Mona Reservoir exchange in the early years of operation. At some point in the future, when the M&I demand in Goshen replaces the agricultural demand, this pipeline would be transitioned to finished water service.

A water rights change of diversion would need to be implemented for this alternative. To provide a firm supply for the new Mona WTP, it is proposed that discussions be initiated with Rocky Mountain Power. A potential source of temporary water could be a lease with Rocky Mountain Power's Currant Creek Power Plant for a currently unused well at the Power Plant. This water could be provided under a lease arrangement until another water supply for Mona Reservoir can be secured. This alternative would eliminate the need for the proposed finished water pipeline from Santaquin to Juab County.

Consideration could be given to completing the ULS Pipeline all the way to Mona Reservoir and provide the water for the new Mona WTP via this pipeline.

This would be a 7.4-mile, 24-inch pipeline. This approach would eliminate the need to negotiate and implement water rights exchanges with Mona Reservoir water rights holders. There would be a need to secure approval to divert ULS pipeline water into Mona Reservoir. This would also provide storage of water for the Mona WTP. This option is further evaluated in DW-12.

This ULS pipeline could also be used to send water back to the proposed Santaquin WTP during peak demand periods to augment the supply from the Salem WTP for South Utah County demands. Additional District storage and supply redundancy could also be provided for the proposed Santaquin WTP.

Examples where this has been used:

The Tarrant Regional Water District in Fort Worth, Texas delivers raw water from several reservoirs southeast of the Dallas-Fort Worth area to several communities via reservoirs and pipelines. The communities are then responsible for taking the water at designated locations and treating the water for final use. The District does not provide treated water to end users.

Key steps to implementing the idea:

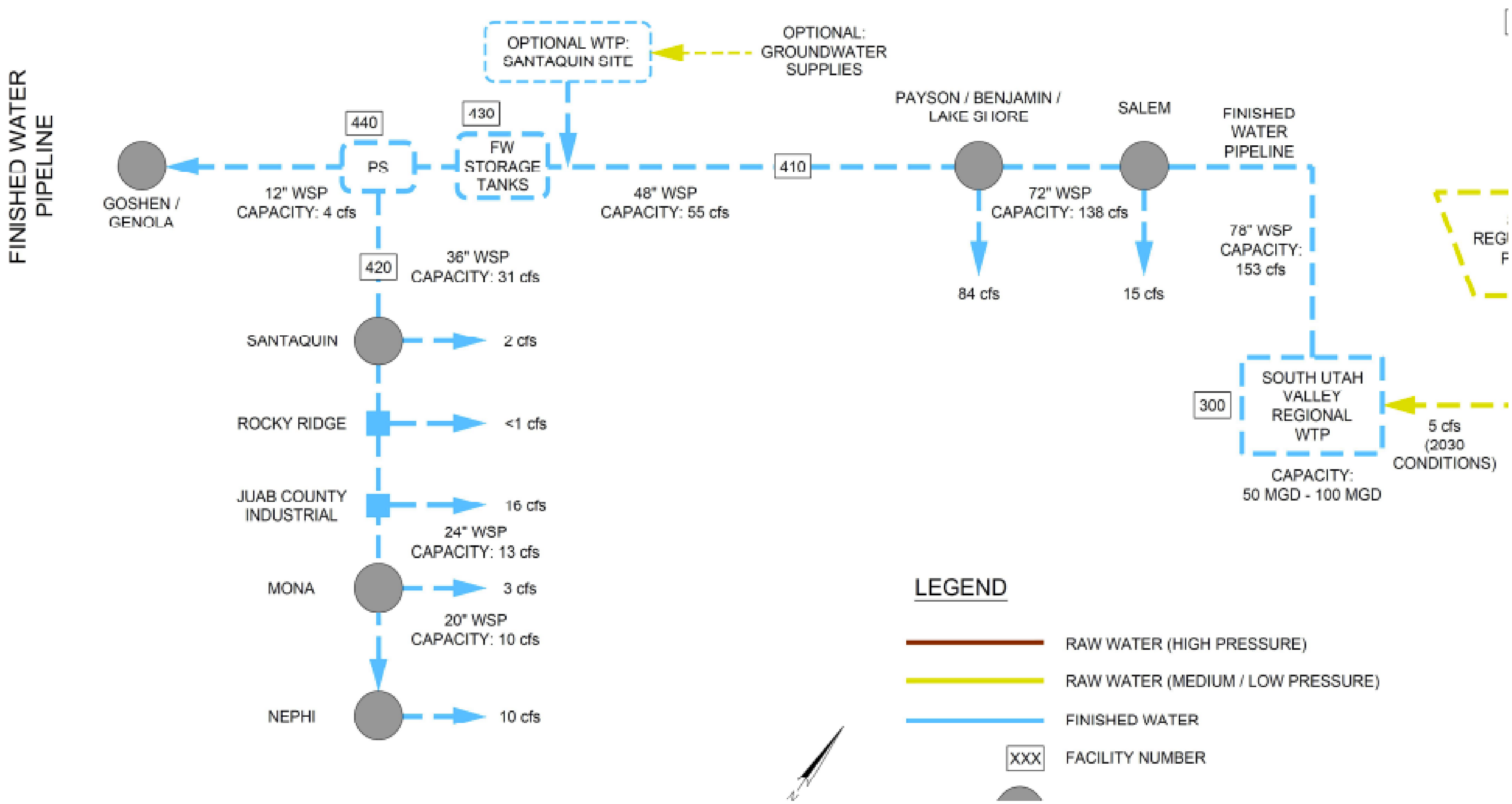
Initiate discussions with the water rights holders in the Mona Reservoir to propose the use of 13 CFS of water rights in exchange for 13 CFS of raw water to be delivered from the ULS pipeline to the Goshen area near Santaquin. In the future, this raw water will be converted to finished water for Goshen, provided by the future Santaquin WTP.
A water rights change of diversion would need to be implemented for this alternative if negotiations with water rights owners are successful.

Additionally, locate and acquire a site for the new Mona WTP and secure the right-of-way for a pipeline from Mona Reservoir to the new Mona WTP. Confirm the size of the new Mona WTP, considering potential industrial demands in Juab County. Initiate the design and construction of a finished water pipeline between Santaquin and Goshen. Start discussions with Rocky Mountain Power regarding the potential lease of well water from their Currant Creek Power Plant. Lastly, contact the Central Utah Office regarding the construction of the ULS Pipeline from Santaquin to Mona Reservoir.

Sketch

Alternative No.: DW-06

☒ **ORIGINAL** ☐ **ALTERNATIVE**

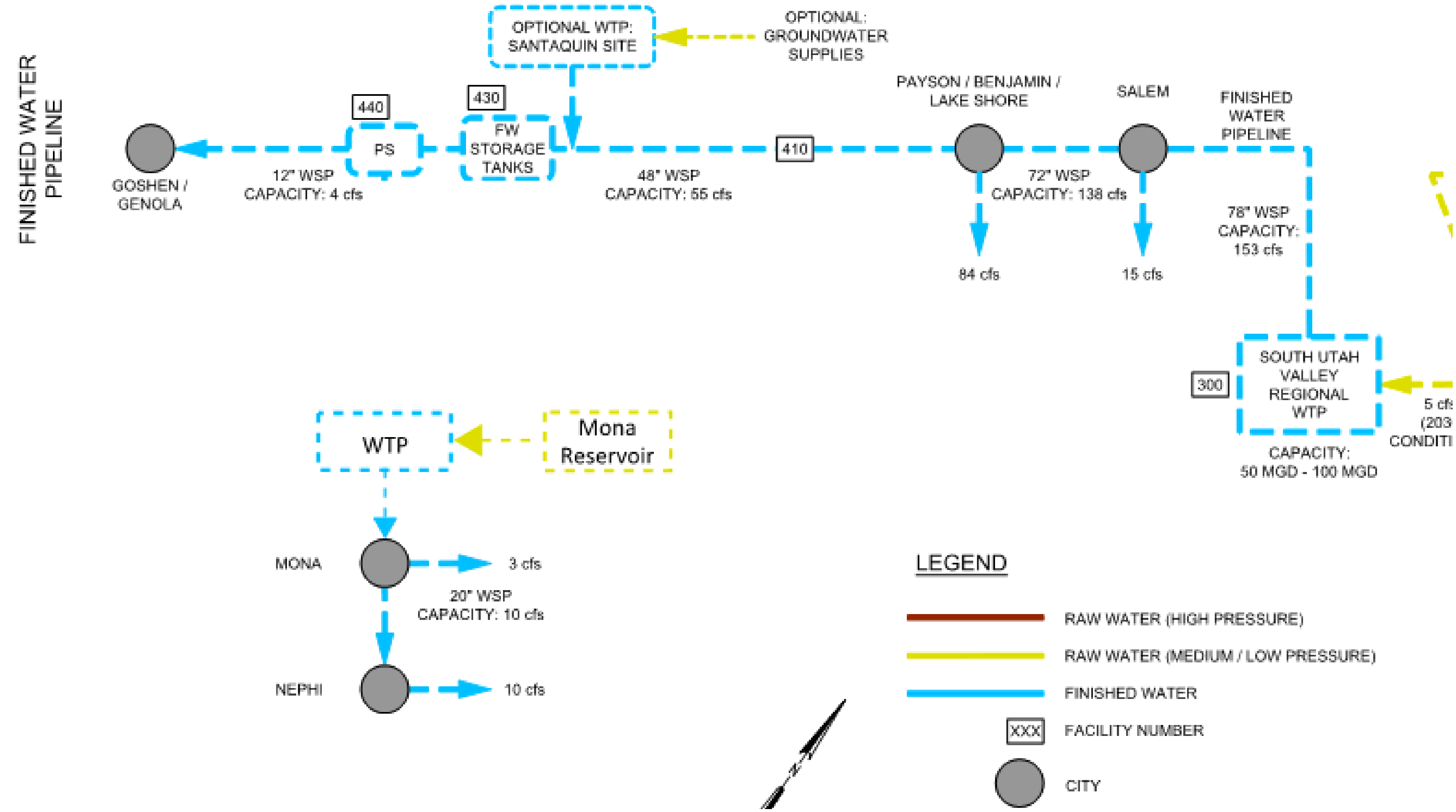


Finished Water Conveyance

Sketch

Alternative No.: DW-06

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Schematic with Mona WTP and Reservoir

Calculations

Alternative No.: DW-06

☒ **ORIGINAL** ☒ **ALTERNATIVE**

1. Purchase a 20 AC site for new WTP
2. Add cost of 1,000 LF paved access road to new WTP
3. Assumed 5,000 LF of new 21-inch pressurized pipeline, include ROW
4. Add cost of 8.45 MGD water treatment plant
5. Power supply to new WTP
6. Add cost of 3,000 LF of 15-inch HDPE from Currant Creek Power Plant to Mona Reservoir, include ROW
7. Add cost of 1-mile of 21-inch finished water pipeline to delivery point between Mona and Nephi
8. Add cost of 10 MGD pump station at WTP to finished water pipeline
9. Assumed 100,000 LF of finished water pipeline from Santaquin to Nephi would be eliminated from approximately STA 430 to Nephi
10. Show cost of new finished water pipeline between Santaquin and Goshen, this is not a new cost, but likely a cost advanced in the schedule
11. Show reduction in capacity of Santaquin WTP by 8.45 MGD (Due to time this was not captured in the cost evaluation, however, it would be a cost savings to this alternative)

Construction Cost Estimate

Alternative No.: DW-06

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Land acquisition	AC	160,000.00			20	$3,200,000
Paved access road	SF	8.50			18,000	$153,000
21 IN HDPE raw water pipe	LF	490.00			5,000	$2,450,000
8.45 MGD WTP	MGD	6,000,000			8.45	$50,700,000
New power supply (30% of WTP and PS)	LS	21,200,000			1	$21,200,000
15 IN WSP HDPE	LF	250.00			3,000	$750,000
10 MGD pump station	MGD	2,000,000.00			10	$20,000,000
Cost of Santaquin to Nephi pipeline	LS	181,364,000	1	$181,364,000		
Total Markup	86.91%			$157,630,243		$85,569,188
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$338,994,000		$184,022,000
NET SAVINGS						$154,972,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	DW-09
Move optional hydropower to the Spanish Fork pipeline in lieu of Pipeline 140	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to locate the optional hydropower generation at on the Highline and Utah Lake System (ULS) to WTP 60-inch WSP (Line 140 on the schematic) just upstream of the raw water storage reservoir. This would allow generation of water to be delivered to the SUVR WTP and to the enclosed SHC.	
Description of Alternative Concept:	
The alternative concept is to move the optional hydropower generation from Line 140 to the Spanish Fork Canyon Pipeline above the SHC high pressure take off.	
Rationale for Change:	
This change would allow the hydropower generation to occur on all water delivered through the Spanish Fork Canyon Pipeline as opposed to only the water delivered to the SUVR WTP and the enclosed SHC. In addition to increasing the flow available for generation it would increase the opportunity for generation. The excess power could be marketed to help offset project costs.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☒ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Cost Savings Summary

First Cost Savings:	($6,479,000)
O&M Savings:	$0
Life Cycle Cost Savings:	($6,479,000)

Advantages/Disadvantages

Alternative No.: DW-09

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Increases flows and opportunity for power generation • Options to market excess generation to offset project costs	• Reduces pressure in all water deliveries on the ULS • Optional hydropower generation is further away from SUVR WTP requiring wheeling agreements to take power to SUVR WTP • If the plant is generating power for market, it would have to be done under a lease of power privilege. This means the construction and operation of the plant might not be awarded to the District. As such, they would not benefit from the income.

Discussion

Alternative No.: DW-09

Description of original concept affected by this change:

The original concept is to locate the optional hydropower generation on the Highline and ULS to WTP 60-inch WSP (Line 140 on the schematic), just upstream of the raw water storage reservoir. This would allow for generation on water delivered to the SUVR WTP and the enclosed SHC.

Issue of concern to the team:

The Value Team is concerned that the location of the optional hydropower generation could be located on the alignment in area with higher flows to increase the opportunity for power generation.

Description of alternative concept:

The Value Team recommends the District consider moving the location of the optional hydropower generation from Line 140 to the Spanish Fork Canyon Pipeline above the SHC high pressure take off to allow additional generation.

Benefit of making the change:

This change would allow increased flow and opportunity for higher volume of power generation. Excess energy from the additional power generation could be marketed and sold to offset project costs.

Additional explanation:

As planned, the existing optional hydropower generation will only generate on the 81 CFS planned to be delivered to the SUVR WTP and the enclosed SHC. There is an additional 360 CFS planned for delivery on the ULS. Moving the pump station would increase the available flow to 441 CFS, a 544% increase. In addition to increasing the flow rate, this would also increase the opportunity for generation by allowing generation when raw water is delivered through the ULS to South Utah County, North Utah County, and via the Mapleton Springville Pipeline. An additional generation could be marketed to offset project costs.

Adding hydropower generation to the Spanish Fork Canyon Pipeline would impact the available head for water deliveries through the ULS. If the maximum head available for generation is limited to the 54 PSI provided by the District for delivery to the proposed raw storage reservoir, the Value Team can evaluate the ULS deliveries with a reduced 115 FT reduction head. The hydraulic grade line (HGL) for the ULS Spanish Fork-Santaquin Pipeline is provided in the design drawings and displayed in the sketches.

An additional line has been added for a reduced HGL by 115 for both the pigged and DPR scenarios. As long as the pipeline remains pigged, there will be sufficient head to meet the delivery needs. If HGL for the DPR is adjusted, it appears there will be minimal impacts to deliveries already requiring a pumping. Additionally, pressures from 2021 to present were reviewed at the connection between the Spanish Fork Provo Reservoir Canal Pipeline (SFPRCP) and the Olmsted Power Plant.

Typically pressure from the SFPRCP came in at 280 PSI and are cut through a plunger valve to 150 PSI. This is well within the limits of optional power generation. Finally, the elevation of the Mapleton tank is approximately 4,960 FT. There will still be enough head to push water into the Mapleton tank for delivery to the Mapleton Springville Pipeline.

Examples where this has been used:

The District has a history of power generation coupled with water deliveries. They operate two runs of the river power plants. The Jordanelle hydroelectric power plant generates power on water released from Jordanelle delivery. The Olmsted power plant generates power on the water delivered to the lower Provo River and Utah Lake.

Key steps to implementing the idea:

Firstly, evaluate impacts to the ULS deliveries due to the decreased pressure head and determine if customer can take delivery at the reduce head due to power generation.

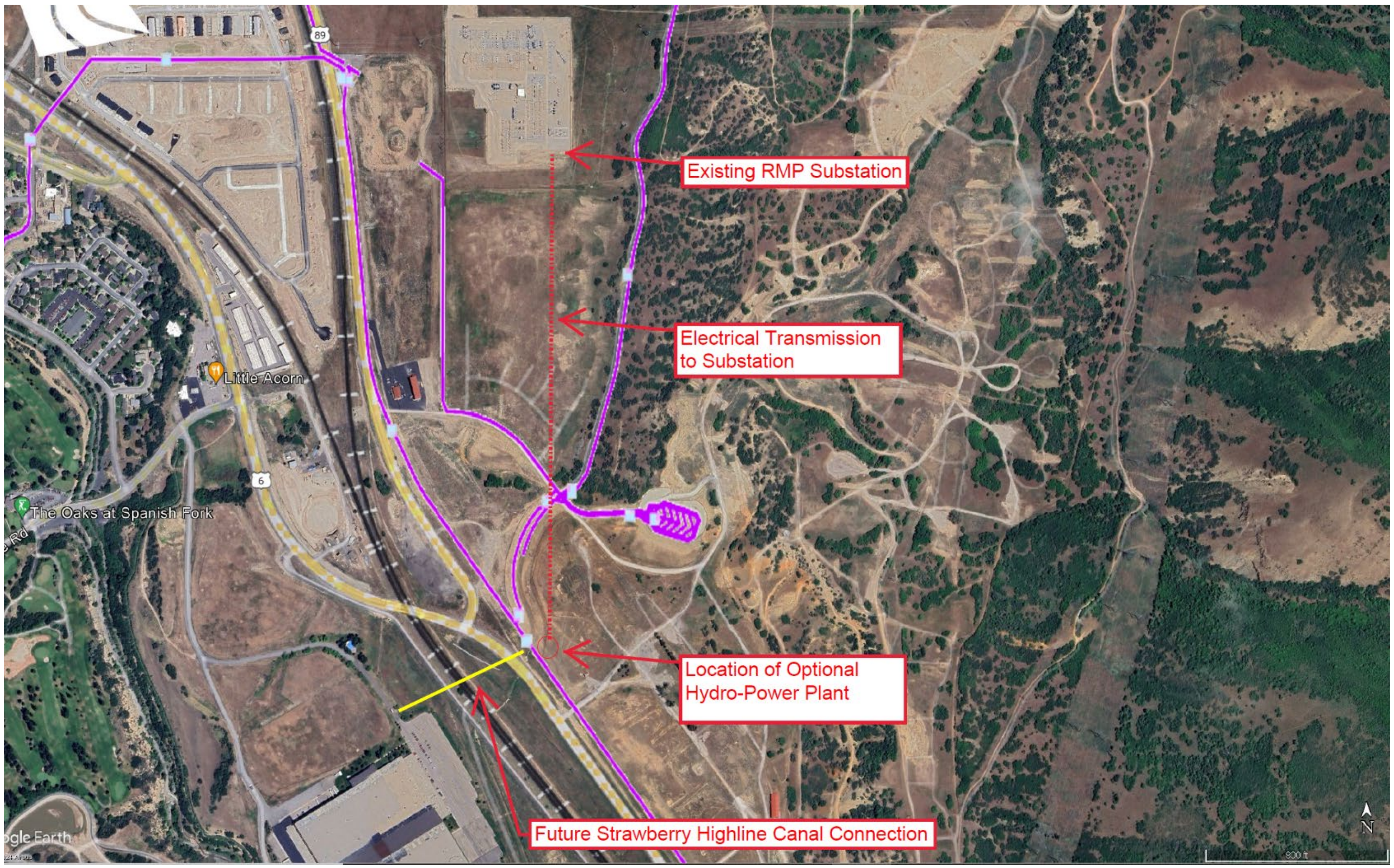
An Energy Market Feasibility Study is essential to assess the viability of integrating hydropower into the water delivery system. This study will involve developing an estimated flow pattern for water deliveries and the subsequent power generation pattern. It will also determine the amount of energy consumed by the District versus the amount available for distribution. Additionally, the study will evaluate the energy market to identify potential electrical customers for excess power generation, which could help fund the project. Another critical aspect is evaluating the costs and feasibility of electrical grid interconnection.

If the study deems the project feasible, several steps must follow. Firstly, a suitable site needs to be selected, potentially on existing easements or federal land (a concept sketch is attached). Transmission line routing and interconnections must be planned, noting there is an RMP substation approximately 0.75 miles from the proposed site. Collaboration with federal partners and considerations under the National Environmental Policy Act (NEPA) will be necessary. Additionally, contracts must be executed with energy utilities to handle power distribution and wheeling back to the SUVR WTP. Finally, the design and construction of the new hydropower facility will be undertaken.

Sketch

Alternative No.: DW-09

☐ **ORIGINAL** ☒ **ALTERNATIVE**

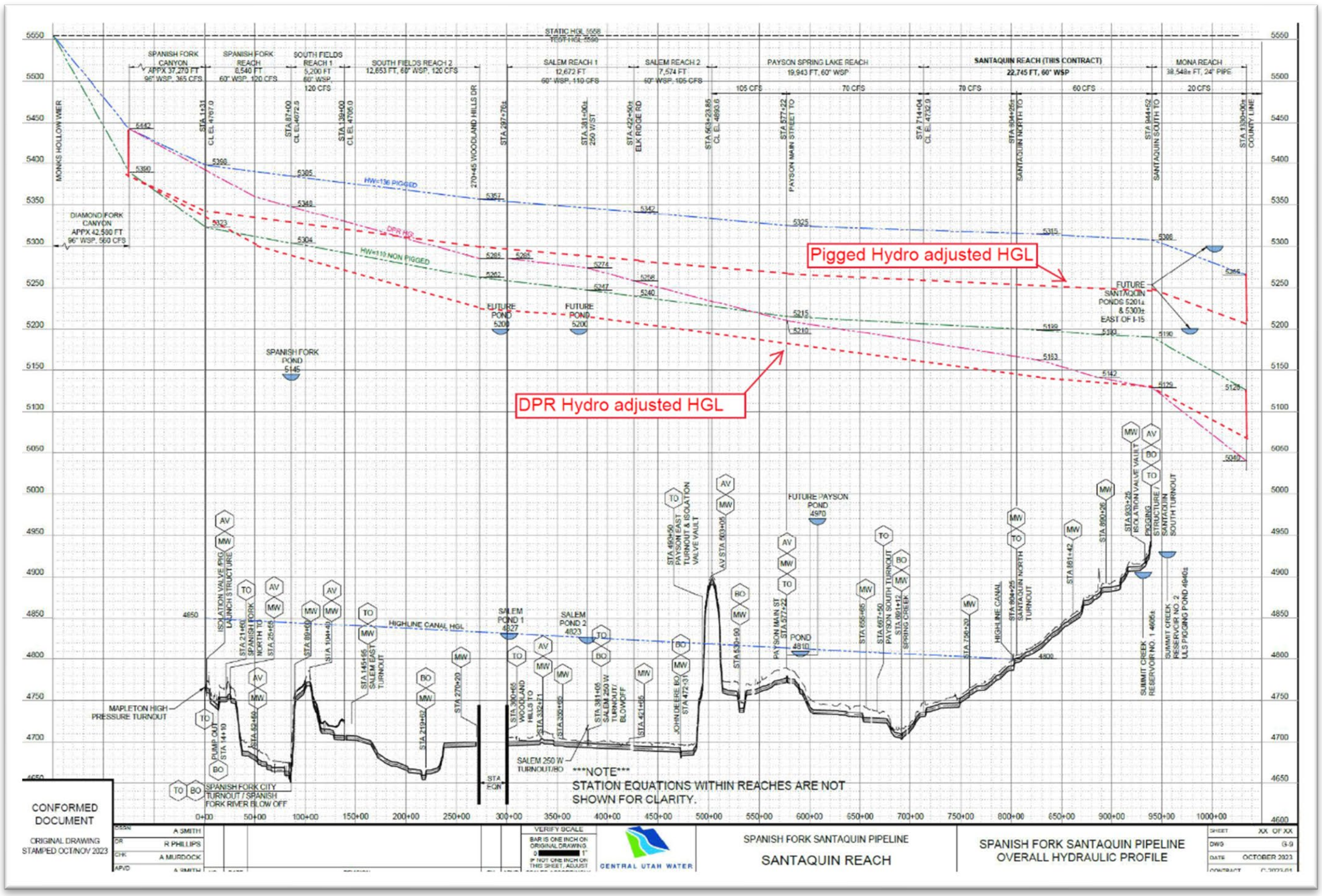


Vicinity Map – Optional Hydropower Location

Sketch

Alternative No.: DW-09

☐ **ORIGINAL** ☒ **ALTERNATIVE**

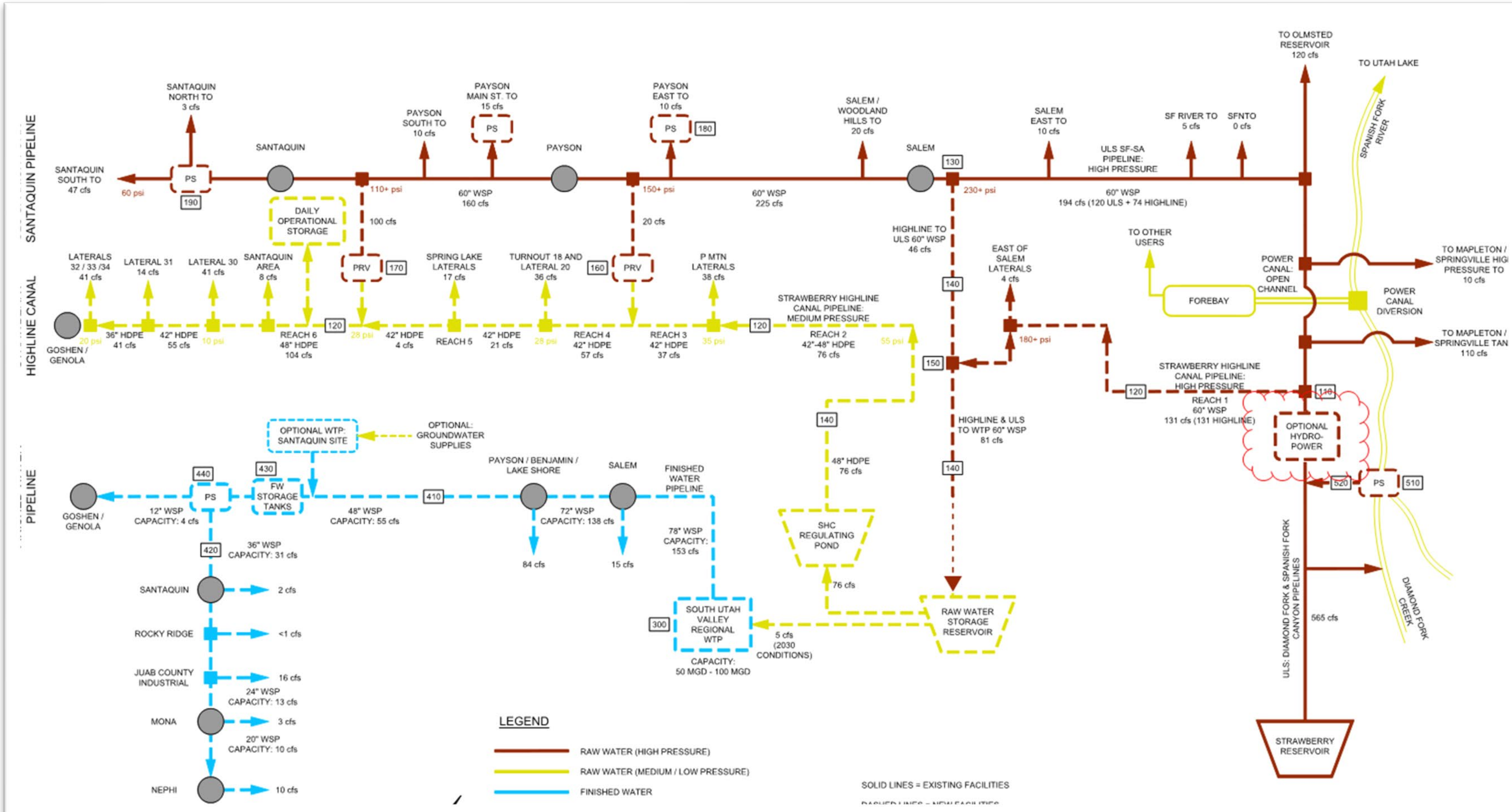


Adjusted Hydraulic Grade Line for ULS Santaquin Pipeline

Sketch

Alternative No.: DW-09

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Schematic View of Optional Hydropower Location Change

Calculations

Alternative No.: DW-09

☒ **ORIGINAL** ☒ **ALTERNATIVE**

The Value Team assumed the following components for the construction of a Hydropower facility:

Electrical Interconnection	EA	1
Concrete Building	SF	1,500
60 IN WSP Pipe Connection with Fittings	LF	100
SCADA	EA	1

Estimated OM&R Cost Benefit $340,000/year

Assumptions: Power Sales at $55/MWh; Higher flows are more efficient; OM&R cost based on last 5-year average from the Olmsted Power Plant. Generation at capacity 50% for original plan and 60% for alternate. Higher flows are slightly more efficient.										0.746 kW = 1hp 550 foot-lbs/sec = 1hp Power = Flow*Density*Efficiency				
	Net $ Per Year	Estimate OM&R Costs ($30/MWh)	Gross $ Per Year	Estimate Power Sales ($/MWh)	MWh	Capacity Factor	Run Time Per Year (hrs)	Days Running (days)	Power (MW)	Power (kW)	Head (ft)	Flow, Q (cfs)	Unit Weight of Water (lbs/ft^3)	Efficiency	Conversion (hp to kw) (0.746/550)
Original	$ 43,165	$51,798	$ 94,962	55	1727	0.5	8760	365	0.39	394	115	81	62.4	0.5	0.0014
Alternate	$339,338	$407,205	$746,543	55	13574	0.6	8784	366	2.58	2575	115	441	62.4	0.6	0.0014

To determine the future value of this income over the next 50 years:

$FV=PV\times(1+r)^n$

Where:

- PV is the present value ($43,000 and $340,000).
- *r* is the annual interest rate.
- H is the number of years (50 years).

At 5% Annual Interest Rate:

$FV = 340{,}00\times(1+0.05)^{50}$

$FV = 43{,}000\times(1+0.05)^{50}$

The future value of $43,000 over the next 50 years at a 5% annual interest rate: **$493,098**

The future value of $340,000 over the next 50 years at a 5% annual interest rate: **$3,898,915**

Construction Cost Estimate

Alternative No.: DW-09

			Original Concept		Alternative Concept	
			(Deletions)		(Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Electrical transmission line 12.7 kV	LF	90.00	1,000	$90,000	3,960	$356,400
Electrical interconnection	EA	2,500,000.00	1	$2,500,000	1	$2,500,000
Hydro generation 1.5 MW unit turbine and generator	EA	600,000.00			2	$1,200,000
Hydro generation 0.5 MW unit turbine and generator	EA	250,000.00			2	$500,000
Concrete building	SF	1,000.00			1,500	$1,500,000
60 IN WSP pipe connection with fittings	LF	2,000.00	100	$200,000	100	$200,000
SCADA	EA	120,000.00	1	$120,000	1	$120,000
Total Markup	86.91%			$2,529,190		$5,541,968
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$5,439,000		$11,918,000
NET SAVINGS						($6,479,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	DW-12
Extend the ULS to Mona and use three water treatment plants at Mona, Santaquin, and Salem supplied by ULS	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The current concept provides for a pressurized finished water pipeline to be constructed from South Utah County to Juab County, specifically Mona and Nephi.	
Description of Alternative Concept:	
The alternative concept is to extend the ULS Pipeline from its current end point to Mona Reservoir and then divert it to a new WTP in Mona.	
Rationale for Change:	
This alternative offers multiple benefits, including the ability to supply water to the Mona WTP independently of the SHC enclosure's completion to Santaquin. It mitigates the risk of potential water quality issues that arise from high detention times in long, low velocity finished water pipelines. Additionally, it ensures that Juab County receives water sooner if there are any delays with the Salem WTP. Furthermore, this alternative enhances operational redundancy and provides additional storage assets for the District.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$116,993,000
O&M Savings:	$0
Life Cycle Cost Savings:	$116,993,000

Advantages/Disadvantages

Alternative No.: DW-12

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Eliminates the need and cost for the finished water pipeline between Santaquin and Juab County communities from Salem WTP • Removes some finished pipeline construction and O&M responsibility from the District • Reduces the risk of water quality issues in the long pipeline proposed in the original concept • Additional storage (Mona Reservoir) and supply redundancy is provided for the proposed Santaquin WTP	• Adds another WTP to the District's system • Relies on adequate water supply being available in Mona Reservoir • Requires a supplemental Environmental Assessment/Environmental Impact Statement (EA/EIS) to extend the ULS Pipeline to Mona Reservoir, if the pipeline was in the ULS EIS, this would require a small amendment

Discussion

Alternative No.: DW-12

Description of original concept affected by this change:

The original concept is to construct a pressurized finished water pipeline to be constructed from South Utah County to Juab County areas, the pipeline would be fed from the new SUVR WTP (near the City of Salem) via a finished water pipeline that follows the SHC alignment then turns south at Santaquin and extends to Nephi.

Issue of concern to the team:

The original concept requires construction of a large regional WTP (Salem) and a long finished water pipeline with the potential for water quality issues associated with the long detention times. This also requires nearly all of the project to be constructed before finished water can be delivered to Mona or Nephi.

Description of alternative concept:

The alternative concept is to withdraw water from Mona Reservoir and divert it to a new WTP in Mona and serve Mona and Nephi M&I demand. The water for the new WTP would be provided by an extension of the ULS pipeline from its current end point in Santaquin to Mona Reservoir. This pipeline would be 7.7 miles long and 24 inches in diameter to provide a capacity of 20 CFS (13 MGD). The water for the pipeline would be provided by either current wells owned or accessible by the SHC near Santaquin or saved water resulting from the EHC Enclosure.

The proposal involves constructing the ULS Pipeline from its currently planned endpoint southwest of Santaquin to the Mona Reservoir in Juab County. This 20 CFS capacity would be supplied by the SHC wells or saved water from the canal enclosure, and the pipeline would include turnouts for potential users along the route. Additionally, a WTP with a capacity of 13 CFS (8.5 MGD) near the Mona Reservoir would be built to meet the municipal and industrial (M&I) demands of Mona and Nephi, with the source water being Mona Reservoir. It is estimated that a 21-inch pipeline would be required, and the new WTP would be located within a mile of the south end of Mona Reservoir, supplied by the ULS Pipeline with consumer water from the enclosure.

A low-head 10 MGD pump station is necessary to pump water from Mona Reservoir to the new WTP, with provisions for redundancy to allow water to be pulled directly from the reservoir. While this alternative does not currently account for the projected industrial demands of Juab County, capacity could be included with a reevaluation of the WTP, pump station, and pipeline capacities.

The treated water from the new Mona WTP would be conveyed to Mona and Nephi through city-provided pipelines, with infrastructure for industrial demands needing to be supplied by local or industrial entities if the plant size is increased.

This alternative would eliminate the need for the proposed finished water pipeline from Santaquin to Juab County. To secure a firm supply for the new Mona WTP, it is proposed to initiate discussions with Rocky Mountain Power for a potential lease of a currently unused well at the Currant Creek Power Plant, providing a temporary water source until a permanent supply for Mona Reservoir can be secured.

Benefit of making the change:

This proposal eliminates the requirement and resources for the finished water pipeline between Santaquin and Juab County communities, therefore removing some finished pipeline construction, operation, and maintenance responsibilities from the District. It also reduces the risk of water quality issues (decreasing water age) associated with long detention times before water is delivered to users, which could occur with the long pipeline proposed in the original concept. Additionally, it provides additional storage and operational redundancy for the proposed Santaquin WTP.

Additional explanation:

This approach would eliminate the need to negotiate and implement water rights exchanges with the Mona Reservoir water rights holders. It may still be advantageous to work out a lease arrangement with Rocky Mountain Power for augmentation water in Mona Reservoir. There would be a need to secure environmental approvals to divert ULS pipeline water into the Mona Reservoir. This would also provide storage of water for the Mona WTP. This ULS pipeline could also be used to send water back to the proposed Santaquin WTP during peak demand periods to augment the supply from the Salem WTP for South Utah County demands. Additionally, the District storage and supply redundancy could also be provided for the proposed Santaquin WTP.

Examples where this has been used:

The portion of this alternative that conveys raw water to the Mona Reservoir is consistent with the current ULS purpose and need, and the Central Utah Project is an example of this.

Key steps to implementing the idea:

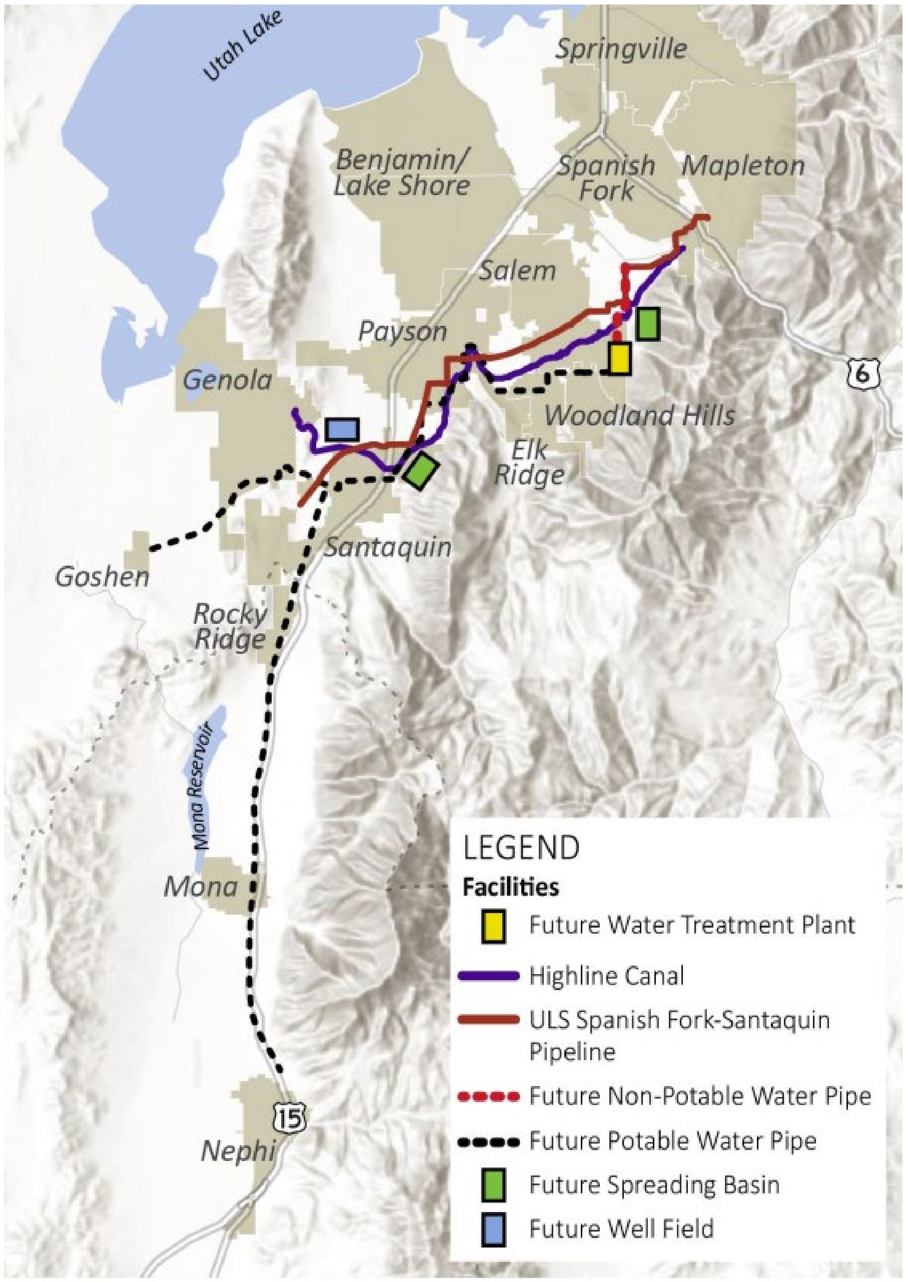
Identify 20 CFS of water to charge the Mona Reservoir from the ULS pipeline, utilizing sources such as the SHC wells in Santaquin and saved water in the SHC enclosure. Then locate and acquire a site for the new Mona WTP, requiring a minimum of 20 acres located within 1 mile of Mona Reservoir. In addition, secure the right-of-way for a pipeline from Mona Reservoir to the new Mona WTP, which will be approximately 5,000 linear feet.

Next, confirm the size of the new Mona WTP and its associated pump station and connecting piping, considering potential industrial demands in Juab County. It is suggested to initiate discussions with Rocky Mountain Power regarding the potential lease of well water from their Currant Creek Power Plant. Then, contact the Bureau of Reclamation regarding the construction of the ULS Pipeline from Santaquin to Mona Reservoir, noting that an Environmental Assessment (EA) or Environmental Impact Statement (EIS) will be required for the treatment component of this alternative.

Sketch

Alternative No.: DW-06

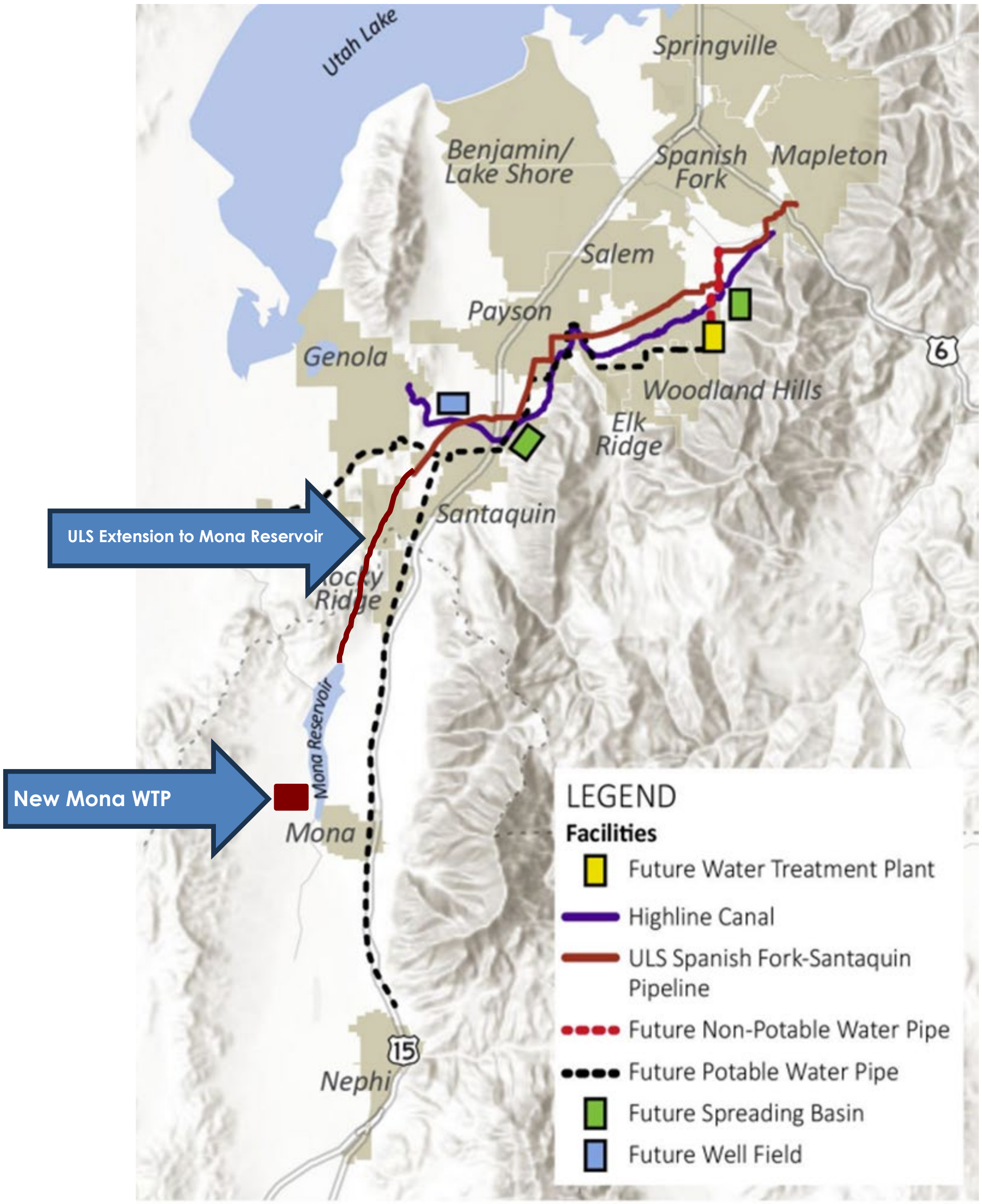
☒ **ORIGINAL** ☐ **ALTERNATIVE**



Original Plan for WTP

Alternative No.: DW-06

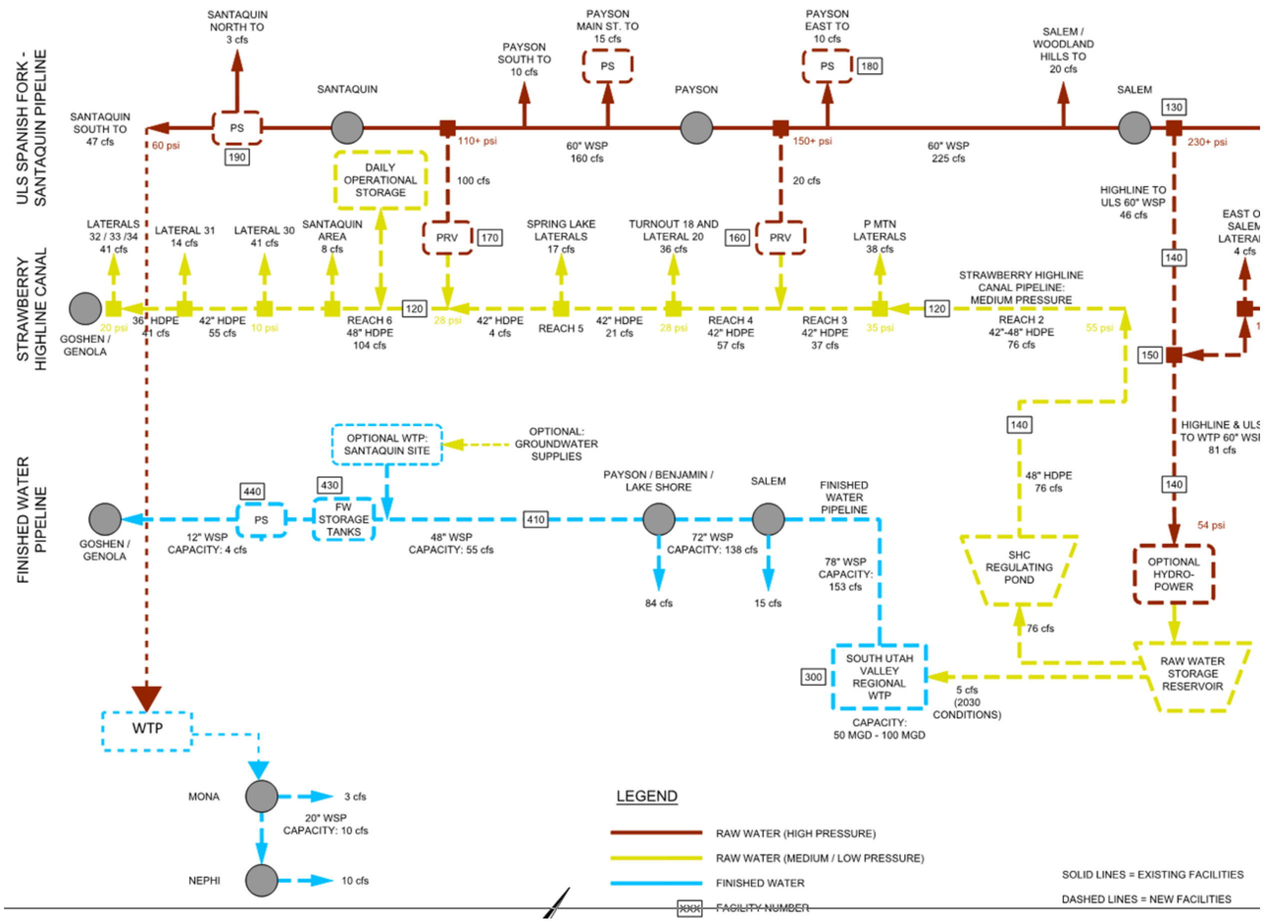
☐ **ORIGINAL** ☒ **ALTERNATIVE**



Construct New Mona WTP

Alternative No.: DW-06

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Schematic Layout of Water Flow

Calculations

Alternative No.: DW-12

☐ **ORIGINAL** ☐ **ALTERNATIVE**

1. Purchase a 20 AC site for new WTP
2. Add cost of 1,000 paved access road to new WTP
3. Add cost of 5,000 LF of 21-inch pressurized pipeline (HDPE), include ROW
4. Add cost of 8.45 MGD WTP
5. Power supply to new WTP
6. Add cost of 3,000 LF of 15 IN pipeline (HDPE) from Currant Creek Power Plant to Mona Reservoir, include ROW
7. Add cost of 1-mile of 21 IN finished water pipeline (WSP) to delivery point between Mona and Nephi
8. Add cost of 10 MGD pump station at WTP to finished water pipeline
9. Delete cost of finished water pipeline from Santaquin to Nephi

Construction Cost Estimate

Alternative No.: DW-12

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Purchase a 20 AC site for new WTP	AC	160,000.00			20	$3,200,000
Paved access road, new WTP	SF	8.50			18,000	$153,000
21 IN HDPE pressurized pipe	LF	490.00			5,000	$2,450,000
8.45 MGD WTP	MGD	6,000,000.00			8	$50,700,000
New power supply (30% of WTP and PS)	LS	21,200,000.00			1	$21,200,000
15 IN HDPE from Currant Creek Power Plant to Mona Reservoir	LF	250.00			3,000	$750,000
21 IN WSP FW pipe to delivery point between Mona and Nephi	LF	300.00			4,280	$1,284,000
10 MGD PS at WTP to FW pipeline	MGD	2,000,000.00			10	$20,000,000
24 IN WSP (extension of ULS)	LF	405.00			47,000	$19,035,000
FW Pipeline from Santaquin to Nephi	LS	181,364,000	1	$181,364,000		
Total Markup	86.91%			$157,630,243		$103,229,192
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$338,994,000		$222,001,000
NET SAVINGS						$116,993,000

INCREASE SUPPLY

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IS-03
Limit irrigation use for residential (new construction)	

Discussion

During the In-Brief, it was discussed whether there would be opportunities to decrease demand for the system by implementing landscaping/water restrictions on new development.

Upon further review it has been determined that the state of Utah already has ordinances in place that require this. Landscape ordinance requirements vary by location. Communities within a participating water district service area are advised to work with their water district to adopt landscape ordinances to become eligible for landscape incentives.

Partnering water districts include:

- Central Utah Water Conservancy District
- Jordan Valley Water Conservancy District
- Washington County Water Conservancy District
- Weber Basin Water Conservancy District

From the State Department of Natural Resources website:

At a minimum, the following water-efficient landscape ordinances for new construction are required:

- No lawn on parking strips.
- In the new development, no lawn in areas less than 8 feet in width.
- No more than 50% of front and side yard landscaped area in new residential developments is lawn. Lawn limitations do not apply to small residential lots with less than 250 square feet of landscaped area.
- In new commercial, industrial, institutional, and multi-family development common-area landscapes, lawn areas shall not exceed 20% of the total landscaped area outside of active recreation areas.

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IS-12
Identify additional canals in South Utah and Juab County to treat as M&I water	

Discussion

The proposal to pipe the SHC gave rise to this Design Suggestion. A benefit to the District for piping the SHC is capturing the water lost through evaporation and infiltration. Table 8-1 in the Plan Formulation Phase II Final Report suggests looking into the Salem Canal, East Bench Canal, and South Field Canal as potential features for water savings. There may be other canals and laterals that could be piped in southern Utah County as well as Juab County that could provide additional savings in water. The SHC has laterals not currently planned for enclosure namely Lateral 20, Lateral 30 and sub laterals, Lateral 31, Lateral 32, Lateral 33, and Lateral 34. These laterals should be considered for enclosure.

Tech Memo #2, Table 1-4, gives the approximate total of water that could be saved by piping Reaches 1 through 6 of the SHC. This total is derived from subtracting the total water delivered from the total required to meet the demand. It is unclear if this total includes losses in each lateral and turnout or if it is strictly the losses from the main SHC. If it includes the SHC and all the laterals, then not only would the SHC need to be piped, but all the accompanying laterals would also need to be piped to realize the total saved water. If the saved water implied in Table 1-4 is strictly confined to the SHC, then additional water could be saved by piping the laterals.

An initial investigation on lateral lengths is given in the table below. For this initial review, no consideration was given to size or flow. Conceivably, some of these laterals or portions of them may not warrant enclosure due to smaller size and smaller return of saved flow.

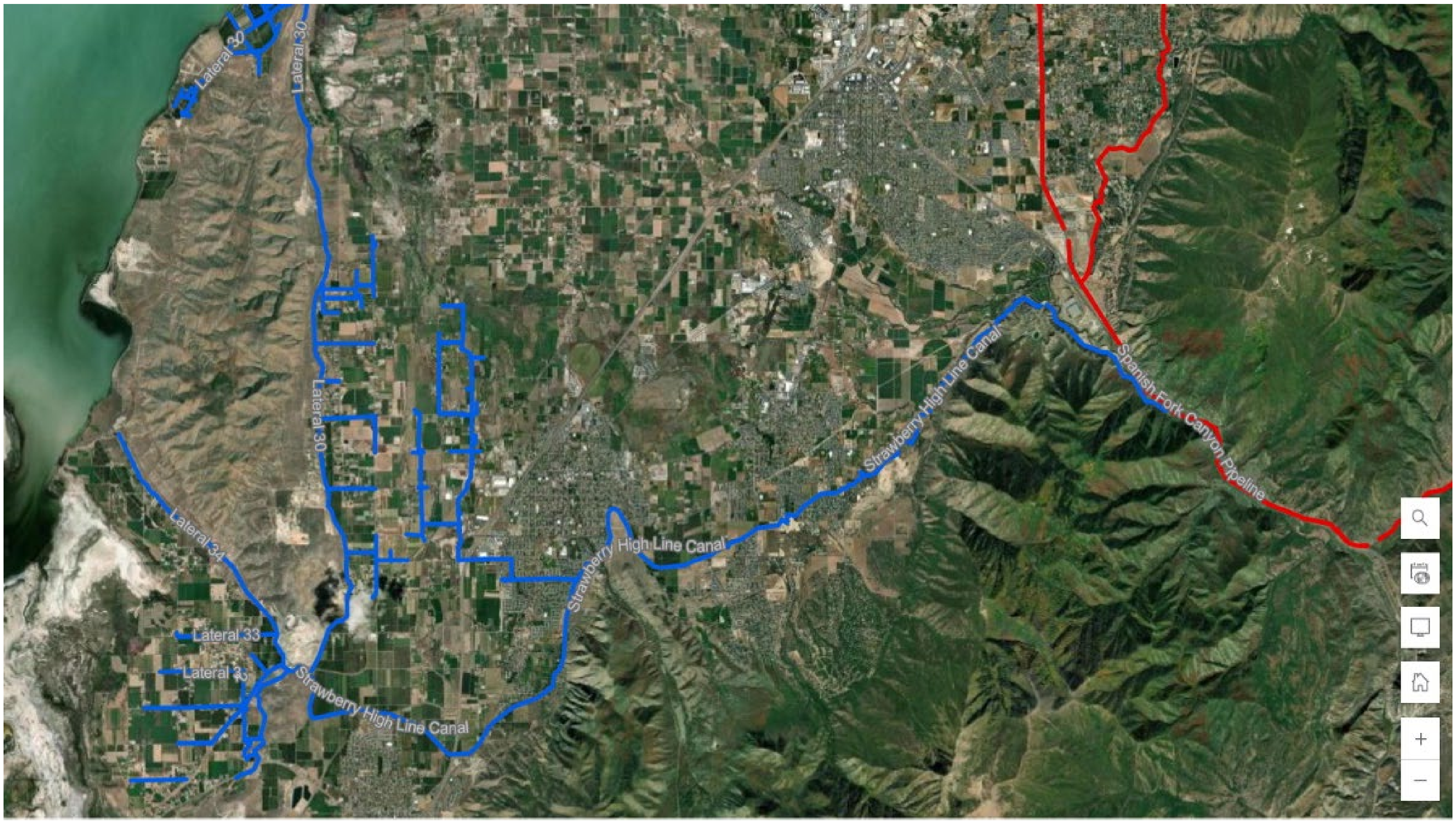
Table 1: SHC lateral lengths given in miles:

SHC Lateral	Length (Miles)
Lateral 20	12.79
Lateral 30	26.91
Lateral 31	3.55
Lateral 32	5.39
Lateral 33	1.54
Lateral 34	3.81

Sketch

Alternative No.: IS-12

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Strawberry Highline Canal and Laterals Shown in Blue

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IS-13
Construct a pump station on the Spanish Fork Provo Reservoir canal to pump water to a water treatment plant for treatment	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The proposed SUVR WTP is conceived to be supplied from only the ULS pipeline and SHC, which both source water from the Strawberry Reservoir.	
Description of Alternative Concept:	
The alternative concept provides a pump station for redundant supply of Jordanelle Reservoir water to the proposed SUVR WTP. This can be accomplished by pumping water from the Olmsted Reservoir at the Hydropower Plant to the proposed WTP. Water in this reservoir originates from the Jordanelle Reservoir and is mixed with water from the Strawberry Reservoir. This M&I system water serves commitments to the Don A. Christiansen WTP, Salt Lake City, North Utah County, and the Provo River.	
Rationale for Change:	
This proposal enhances the redundancy and resiliency of the ULS water supply for the SUVR WTP and water needs, ensuring a more reliable system. It increases operational flexibility allowing the District to transfer water between Jordanelle and Strawberry Reservoir sources and eliminates the risk of reliance on a single source thus creating system wide reliability. Additionally, adding a connection to the Spanish Fork River as an alternate source for the pump station further strengthens the system's robustness.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	($7,081,000)
Function	Resources		
☒ Increased	☒ Increased	O&M Savings:	$0
☐ Maintained	☐ Maintained		
☐ Decreased	☐ Decreased	Life Cycle Cost Savings:	($7,081,000)

Advantages/Disadvantages

Alternative No.: IS-13

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Provides redundancy/resiliency for the ULS water serving the SUVR WTP and raw water needs • Increases operational flexibility for M&I water • Allows the District to account for water transfers internally between Jordanelle and Strawberry Reservoirs • Eliminates the risk of ULS being reliant on one source • Consideration could be given to adding a connection to the Spanish Fork River as an alternate source for the pump station	• Complicates operations of the Spanish Fork Santaquin Pipeline • Requires revisiting the EIS and DPR for the ULS system • Requires the current water optimization project be successful • Additional land acquisition is necessary

Alternative No.: IS-13

Description of original concept affected by this change:

The original design concept for the Plan Formulation Project provides water from the Strawberry Reservoir to Juab and South Utah county. There are some groundwater sources proposed for a future optional Santaquin WTP.

Issue of concern to the team:

The Value Team sees issues in the long term resiliency and reliability of the project being contingent on one source. If there is a disruption to that source, water will not be available to customers.

Description of alternative concept:

The pump station alternative concept provides a redundant supply of Jordanelle Reservoir water to the proposed SUVR WTP. This can be accomplished by pumping water from the Olmsted Reservoir at the Hydropower Plant to the proposed WTP. Water in this reservoir originates from the Jordanelle Reservoir and is mixed with water from the Strawberry Reservoir. This M&I system water serves commitments to the Don A. Christiansen WTP, Salt Lake City, North Utah County, and the Provo River.

Water from the Olmsted Reservoir could be conveyed to the proposed SUVR WTP through the Spanish Fork Reservoir Canal Pipeline by reversing the incoming flow from the Olmsted plant back to a proposed pump station near the Mapleton Springville Regulating Tank. A valve will stop flow from the pipeline to the Mapleton tank when flow is reversed. This project would be completed in conjunction with the SUVR WTP. New land will likely be needed, and construction on pipeline will be required to facilitate connection.

Benefit of making the change:

This proposal provides redundancy and resiliency for the ULS water serving the SUVR WTP and raw water needs. It increases operational flexibility for M&I water and allows the District to transfer water between Jordanelle and Strawberry Reservoirs, thereby eliminating the risk of ULS being reliant on a single source. Additionally, consideration could be given to adding a connection to the Spanish Fork River as an alternate source for the pump station.

Additional explanation:

Siting the booster station near the intersection of the Spanish Fork Santaquin Pipeline and the Spanish Fork River was considered since it would allow pumping directly out of the Spanish River. This option was not pursued due to water quality concerns in the river. Nevertheless, this option could provide additional resiliency and flexibility.

Since this option feeds the SUVR WTP, it must align with the design and construction schedule for that project.

Examples where this has been used:

The District has a set of transfer pumps above the Don A. Christiansen Regional (DACR) WTP to allow water to be moved into the Salt Lake Aqueduct (SLA). A similar facility allows water to be delivered from the SLA to the DACR WTP.

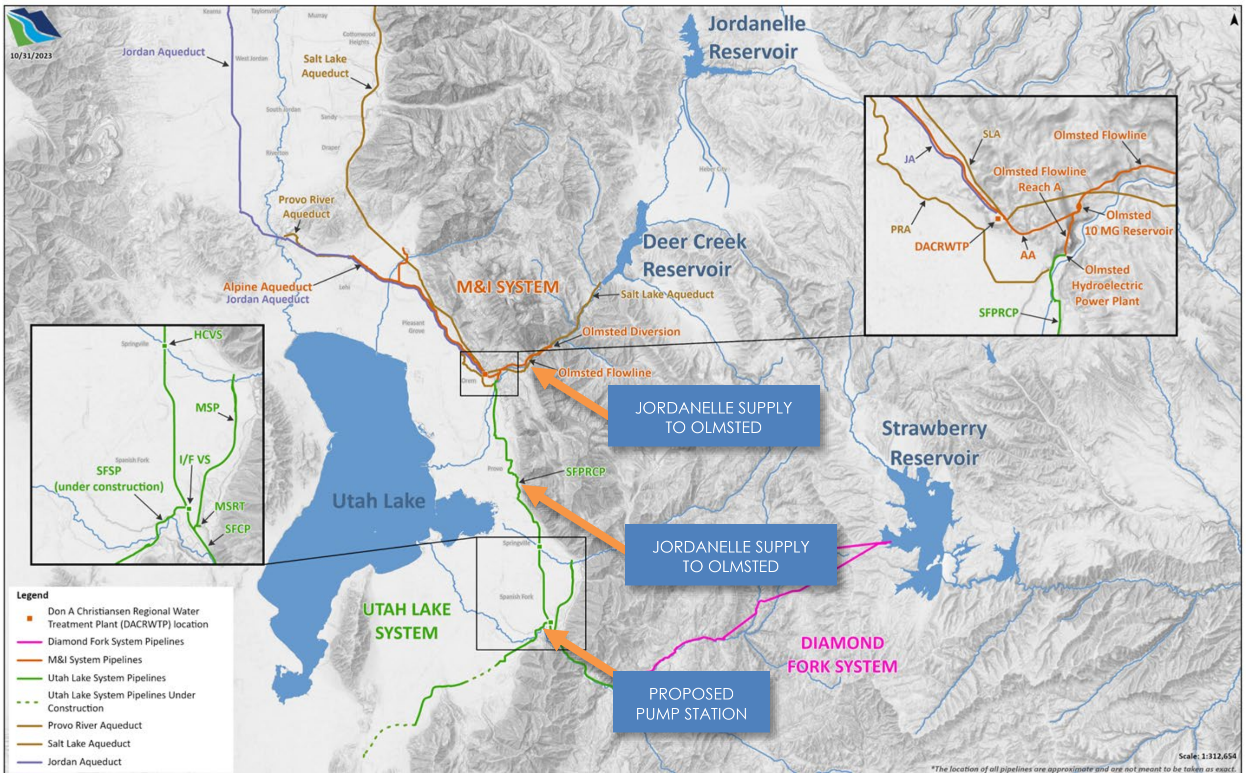
Key steps to implementing the idea:

To implement, it is necessary to evaluate the impact on the ULS Environmental Impact Statement and identify any required revisions. A hydraulic analysis of the Spanish Fork Santaquin Pipeline should be completed to ensure sufficient head is available to deliver water from Olmsted to the Mapleton Springville regulating tank, and to confirm the availability of land for the pump station at this location. Additionally, refining the preliminary cost estimate and determining the design schedule of the SUVR WTP is essential to align the pump station with that schedule.

Sketch

Alternative No.: IS-13

☐ **ORIGINAL** ☒ **ALTERNATIVE**

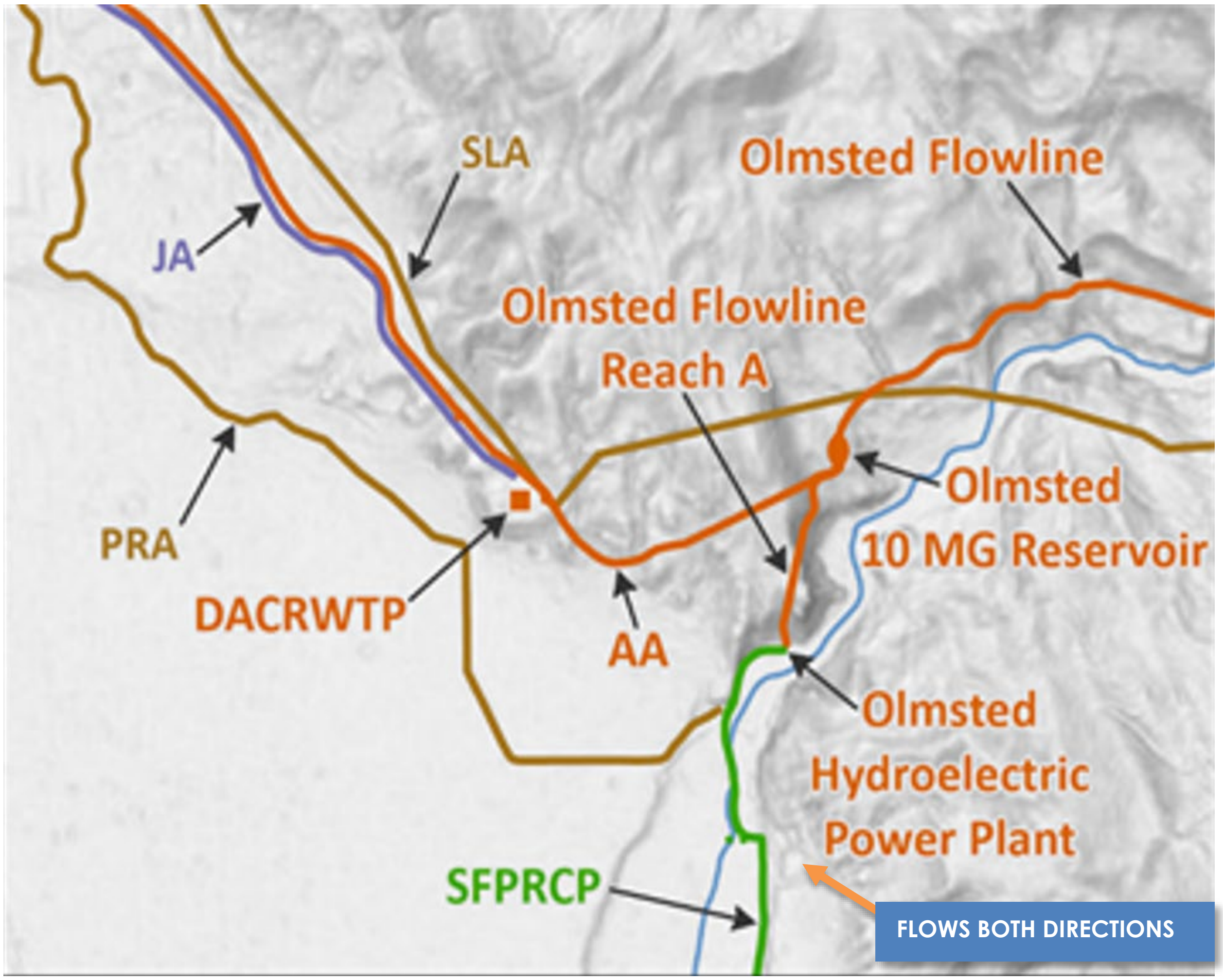


Olmsted Supply Reservoir and Proposed Pump Station

Sketch

Alternative No.: IS-13

☐ **ORIGINAL** ☒ **ALTERNATIVE**

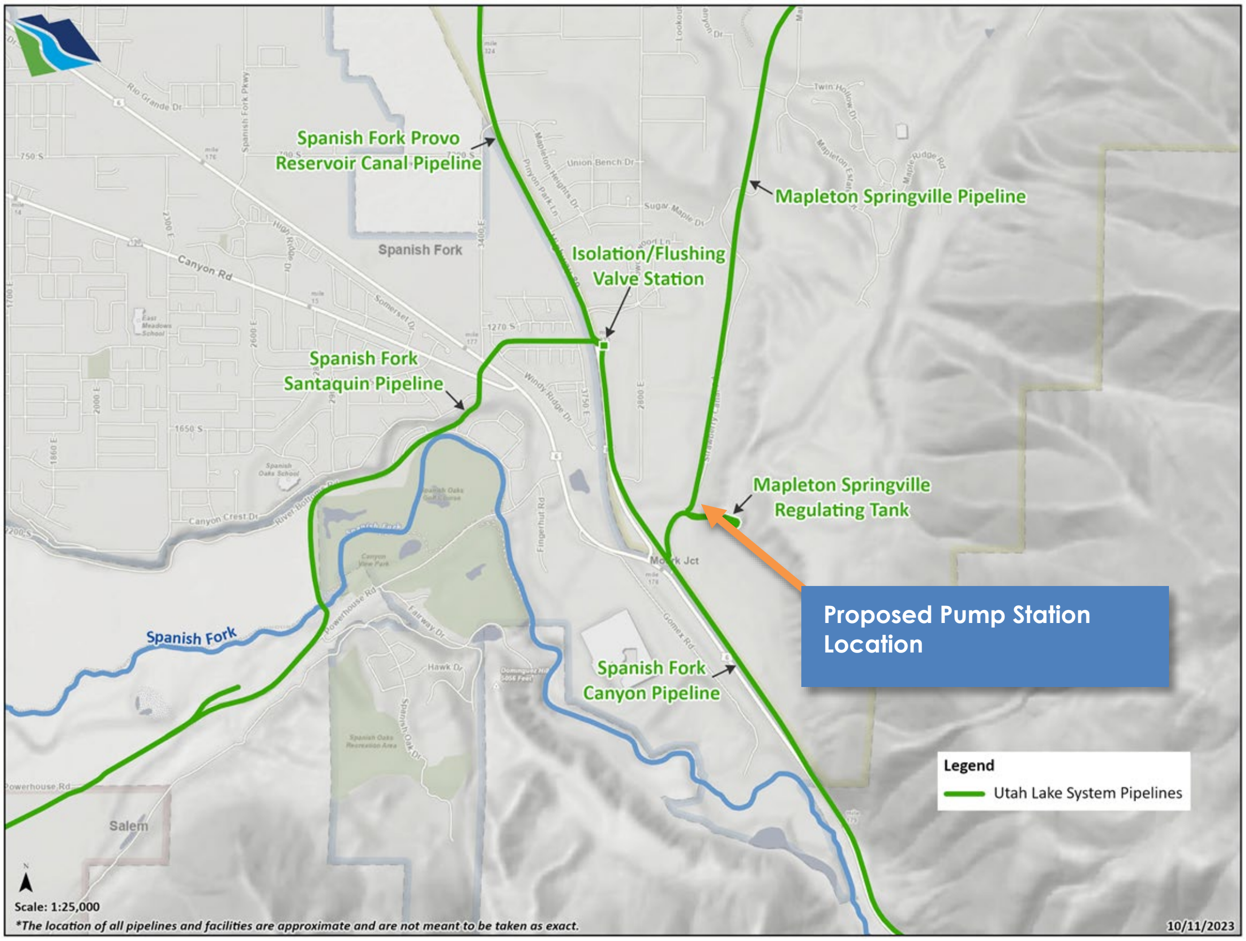


SFPRCP to Flow South to Proposed Pump Station

Sketch

Alternative No.: IS-13

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Proposed Pump Station Location

Calculations

Alternative No.: IS-13

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Pipe Calculations

Flow

Q = 10 MGD (15.47 CFS)

V_{ave} = 6 FPS

Pipe Size

A_{flow} = (Q/V)

A_{flow} = 15.47 CFS / 9 FPS

A_{flow} = 1.289 SF (185.62 IN^2)

D_{min} = 2 x $(185.62 / 3.14)^{1/2}$

D_{min} = 22 IN

D = 30 IN (+20% buffer)

Alternative No.: IS-13

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Pump Calculations

Pressure

Assumed feed pressure: 150 PSI

Assumed discharge pressure required: 250 PSI

Elevation loss: 0 PSI (immediately adjacent to connecting pipeline)

Minor loss: 0.20 PSI/FT = 20 PSI

Total pressure required: 250 - 150 + 20 = 120 PSI

Flow

Q = 10 MGD = 6,944.4 GPM

Pumps = 3

Flow/pumps = 3,500 (n+1)

HP = Q x P / (1,714 x Efficiency)

HP = (3,500 x 120) / (1,714 x 0.8) = 350 HP

Construction Cost Estimate

Alternative No.: IS-13

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
3,500 GPM vertical turbine pumps at 100 PSI (350 HP)	EA	600,000.00			3	$1,800,000
CIP pump station building (20' x 10')	SF	1,000.00			200	$200,000
CIP electrical building (10' x 7')	SF	1,500.00			70	$105,000
60 IN motor operated flow control valve	EA	400,000.00			1	$400,000
Electrical and instrumentation (35%)	LS	2,702,500.00			0.3	$810,750
Limited booster pump site grading	LS	5,000.00			1	$5,000
Chain link fence with 16 FT gate (50' x 50' site)	LF	50.00			200	$10,000
Site piping	LS	25,000.00			1	$25,000
Connection to existing 60 CMLS pipeline	EA	7,500.00			1	$7,500
5,000 Gallon hydropneumatics tank	EA	30,000.00			1	$30,000
30 IN CMLS discharge pipe (10 MGD)	LF	1,200.00			100	$120,000
400 kW Generator	LS	275,000.00			1	$275,000
Total Markup	86.91%					3,292,510
TOTALS	Breakdown of Markup can be found in the Cost Appendix					$7,081,000
NET SAVINGS						($7,081,000)

TREAT WATER

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	TW-10
Construct a Santaquin Water Treatment Plant in Phase 1 and construct Salem Water Treatment Plant at a future date	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to reserve the option to build a water treatment plant at a site in Santaquin and proceed with the SUVR WTP in Salem.	
Description of Alternative Concept:	
Build a 10 MGD Santaquin WTP in Phase 1 and provide source water connections from both the SHC and the Spanish Fork-Santaquin Pipeline.	
Rationale for Change:	
The expedited implementation of a 10-MGD WTP at a site in Santaquin (ultimate capacity: 20 MGD), together with source water connections from both the SCH and ULS offers significant benefits, in a potentially shorter timeframe, than the Phase 1, 50 MGD Regional WTP and Finished Water Pipeline which is assumed to be online June 2032.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☒ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Cost Savings Summary

First Cost Savings:	$207,952,000
O&M Savings:	$0
Life Cycle Cost Savings:	$207,952,000

Advantages/Disadvantages

Alternative No.: TW-10

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Offsets the cost of 20 MGD of water treatment at the Salem WTP • Potentially accelerates deliveries to Juab County • Reduces overall detention times in the finished water pipeline from Santaquin to Nephi [420] — eliminating the [410] reach • Provides source water redundancy	• Requires expensive land acquisition • Alters single regional plant policy • Potentially reduces economies of scale

Discussion

Alternative No.: TW-10

Description of original concept affected by this change:

The original concept does not include a WTP in Santaquin. It does, however, identify a future option to build a WTP at a site in Santaquin.

Issue of concern to the team:

- Site acquisition search should focus on large parcel (approximately 40 acres) suitable for future expansions.
- Ultimate capacity at the Santaquin WTP should be periodically re-evaluated based on actual demands and future events.
- Supplying water to Mona as soon as possible.

Description of alternative concept:

This alternative recommends building a 10 MGD WTP, at a site in Santaquin, during Phase 1 of the program. It also includes a second connection to the ULS pipeline, in addition to the enclosed SHC connection, which would require initial exchange flows from either the SHC or another source.

Benefit of making the change:

This change offers the potential for accelerating treated water deliveries to Mona and Nephi, as well as serving treated water demands on the western side of South Utah County. Further, the addition of a second supply of source water for the treatment plant increases the flexibility and reliability of the treated water system.

The addition of a second supply source from ULS eliminates single points of failure, thereby preventing supply interruptions. It also addresses the proximity to expected rapid growth and increased demands, bringing treatment services closer to water customers. This addition enhances redundancy and increases resiliency in the water supply system.

Additional explanation:

The early availability of a WTPat Santaquin should strengthen the District's competitiveness in securing contractual commitments for water treatment services from its raw water customers. Inevitably, some customers will consider building their own water treatment facilities, and large developments may also prefer to take raw water only and treat it themselves. Connection to WTP and supplying water to Mona will require water exchange.

Examples where this has been used:

This alternative is intended to be consistent with the current planning for water treatment facilities, applied to the option indicated in the Proposed System Configuration (TM2, Figure 5-1). The assumption was made that the operating costs would be comparable regardless of the location of the treatment plant.

Key steps to implementing the idea:

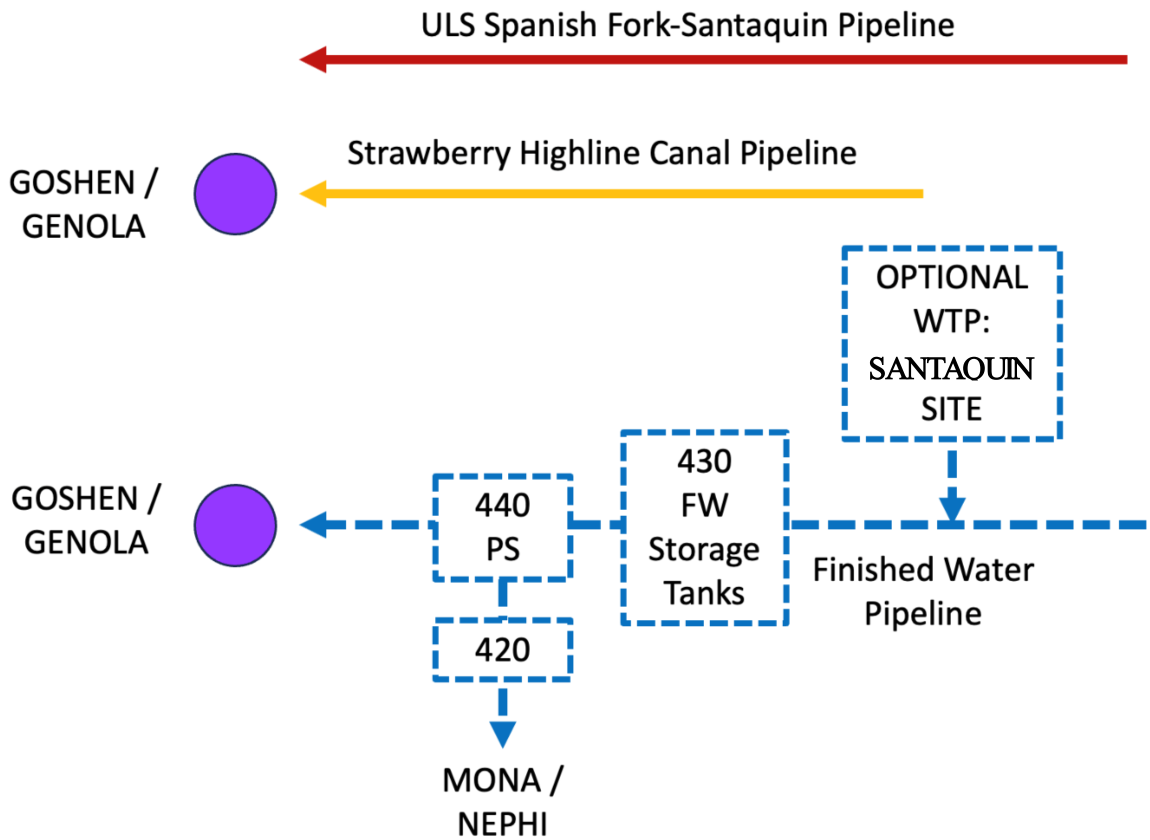
This planning-level alternative is highly conceptual and has not been subjected to an engineering review or evaluation. A preliminary engineering feasibility study should precede the implementation decision:

- Land acquisition
- Providing water for exchange (wells, piping site, etc.,)

Sketch

Alternative No.: TW-10

☒ **ORIGINAL** ☐ **ALTERNATIVE**

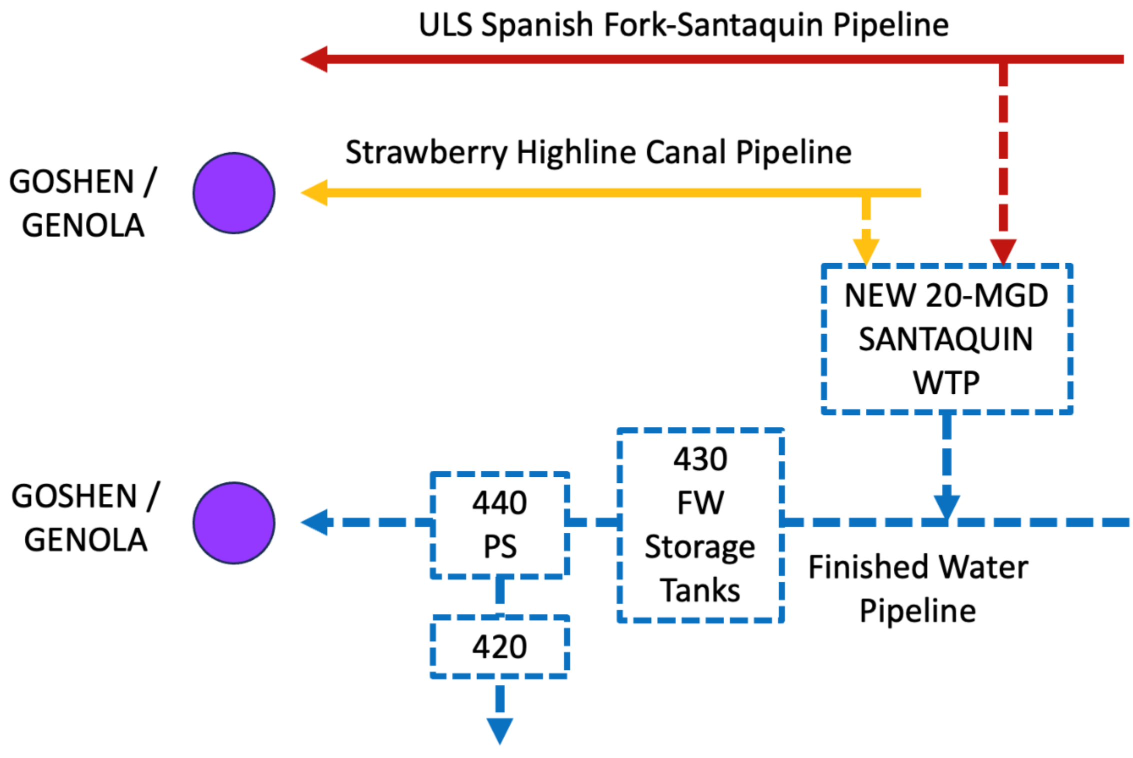


Project Flow Schematic Detail

Sketch

Alternative No.: TW-10

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Project Flow Schematic Detail

Construction Cost Estimate

Alternative No.: TW-10

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Land Acquisition	AC	160,000.00			40	$6,400,000
Water Treatment Plant Off-setting Treatment at Salem WTP	GAL	6.00	20,000,000	$120,000,000		
48" Pipeline from SHC to WTP	FT	1,172.00			1,000	$1,172,000
48" Pipeline from ULS to WTP	FT	1,172.00			1,000	$1,172,000
Total Markup	86.91%			$104,296,493		$7,599,738
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$224,296,000		$16,344,000
NET SAVINGS						$207,952,000

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	TW-17
Develop a decision tree framework for the program planning process and periodically re-evaluate actual and projected M&I assumptions and investments	
Discussion	

Given the wide range of projected 2065 treated water demands (34 MGD to 99 MGD), presented in TM3 (Table 1-1), the Value Team recommends the development of a detailed decision-tree framework that identifies potential/plausible future events and/or conditions that could impact the program's overall direction or future investments. Large-scale, uncertain impacts on treated water demands (e.g., clarification of Goshen needs, and rate of demand growth in both South Utah County and Juab County) should have explicit triggers identified for re-evaluation of assumptions and future options.

Following the initial development of the decision framework, annual reporting and reviews can include updating the status of decision tree events and incorporating newly identified contingencies.

Because there are competing methods for satisfying M&I demands, including city-level and parcel-level treatment options. The District should not expect it can secure 100% of the market for water treatment services, even though this has historically been the practice in the area. There remains the possibility that unused treatment capacity at the regional level will never be utilized. Securing contracts for treated water supply from District customers will diminish that uncertainty and offer an early indicator of the District's market share for water treatment services accessible to the District.

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	TW-21
Use ground water from Strawberry Highline Canal wells near Santaquin to provide potable water for Santaquin and Mona	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to provide finished water to Santaquin and Mona from either the SUVR WTP located in Salem or a water treatment facility in Santaquin. Surface water (ULS or SHC) is required as an input for either of these WTPs.	
Description of Alternative Concept:	
The alternative concept is to forego constructing a finished water pipeline from the SUVR WTP to Santaquin and instead complete a finished water pipeline from the well field to either Santaquin, Mona, or both.	
Rationale for Change:	
The Value Team discussed the location of the greatest need for finished water and concluded that Mona needed it first. This was based on information the Value Team received from the District about the general need of water in Mona and the moratorium on new and future construction permits. This alternative emphasizes supplying finished water to the point of greatest demand as soon as possible.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$131,550,000
O&M Savings:	$0
Life Cycle Cost Savings:	$131,550,000

Advantages/Disadvantages

Alternative No.: TW-21

Advantages of Alternative Concept	**Disadvantages of Alternative Concept**
• Supplies finished water to Mona and Santaquin in the shortest amount of time • Water quality for well water is better than surface water and as such requires less treatment • Reduces detention time in the pipelines for treatment chemicals • Reduces required demand for treated water from water treatment plants • Adds redundancy to the future finished water system • Future Santaquin WTP would not be necessary	• Additional environmental work for new well location(s) • Existing wells are for irrigation so conversion to M&I would be required • Wells would need to be re-established to drinking water standards or drilled new • Water quality issues occur when if combining treated water surface water and ground water • Adequate ground water supply may not be available to meet all future demands

Discussion

Alternative No.: TW-21

Description of original concept affected by this change:

The original concept involves constructing the SUVR WTP and accompanying finished water pipelines from Salem to Mona by the year 2032. This includes Phase 1 of the SUVR WTP, finished water pipeline from Salem to Santaquin, and finished water pipeline from Santaquin to Mona along with a pump station in Santaquin to pump water to Mona. The original concept also includes a potential water treatment site in Santaquin.

Issue of concern to the team:

The issue of concern to the Value Team was that the area of immediate need is not getting water until the year 2032, at the earliest. The Value Team placed an emphasis on timing of water deliveries to Mona. There was an emphasis on the general acceptance that the quality of ground water may be better than surface water. Given that there are already restrictions in Mona on construction and the District's resolution to provide Juab County with water, it seems like any opportunity to expedite water deliveries to this area would be high priority.

Description of alternative concept:

The Strawberry High Line Canal Company operates two wells (11 CFS total) adjacent to the canal and north of Santaquin. There are two privately owned wells that pump water into the SHC and pull the water out downstream (9 CFS). See figures below for the approximate locations of these wells (three are shown and one well location is unknown). The total groundwater flow for irrigation purposes added to the canal from these four wells is 20 CFS.

The three wells with known locations have diameters of 16 inches according to the website for the Utah Division of Water Rights. New or rehabilitated wells of at least this diameter would be required for drinking water.

The concept would be for the District to purchase the water rights for these four wells and replace the flow in the canal with project water, other water sources, ULS CUP temporary agricultural water, saved water from piping the SHC, or combinations of these to make the water users whole. The location of the wells would be located near the existing wells. However, depending on the aquifer and water rights there could be opportunity to relocate these newly drilled wells further south to shorten the finished water pipeline to Mona and Nephi.

Since these current wells are for irrigation purposes only, each would need to be re-drilled to current state of Utah drinking water standards or otherwise rehabilitated to meet Utah drinking water standards. Once drilled or otherwise rehabilitated, these wells could be connected to the current water system of Santaquin along with a culinary water line from Santaquin to Mona. Alternatively, a small number of drinking water wells could be drilled at other locations to better serve areas of demand.

The pumping station located in Santaquin would remain as a means of boosting the water up and over the hill to Mona. The pipeline alignment from Santaquin to Mona with a future connection to Goshen shown in the planning documents would remain the same.

As a matter of system redundancy, the finished water line from the SUVR WTP to Santaquin could be built at a time when design, construction, and cost make the most sense for the District.

Benefit of making the change:

Purchasing the water rights and converting the irrigation wells to culinary, along with constructing necessary piping, will supply Mona with finished water at the earliest time possible. The idea being to place emphasis on where demand is located.

The consensus of the Value Team was that ground water is often better quality than surface water. Using the water from the four wells would reduce necessary and expensive water treatment as the water would most likely only require minimal treatment such as chlorination per typical public culinary wells in the valley.

The pipeline from SUVR WTP to the well sites is approximately 10 miles long. The current rate of construction on the ULS is 3-4 miles per project. Projecting this rate on to the finished water pipeline, there would be three construction phases to get the pipe to Santaquin. The distance from Santaquin to Mona is approximately 8 miles. Building the pipeline from Santaquin to Mona first to connect to the wells will move completion dates sooner.

The distance from the SUVR WTP site to Mona is approximately 18 miles and requires chlorine residual in the system at each point of use. Chlorination sites would be required along the pipeline to maintain this residual. Simplifying the system by using well water and reducing the pipeline distance effectively reduces the amount of treatment chemicals necessary.

No WTP is necessary in Santaquin or Mona if well water is used. There is also a reduction in the total amount of treated water from SUVR WTP (13 MGD reduction).

Additional explanation:

On a side note, if one or two of these wells were designated strictly for Mona, no new pumping stations would be required. The total dynamic head would change but the well pumps might be used to supply sufficient pressure for the Mona water system.

The location of each well could likely change though drinking water rules would need to be followed. The water right location could be moved closer to Mona, further reducing the amount of pipe necessary to connect to Mona. This is a moot point if having a redundant finished water pipeline from SUVR WTP to Mona is desired at full build-out. Additional wells in the area may also be required to meet demands in Mona and Santaquin. There may also be wells closer to Mona that could be used to supply water.

Examples where this has been used:

Culinary water wells are used across the valley as an acceptable source of water and in many cases the main source of water.

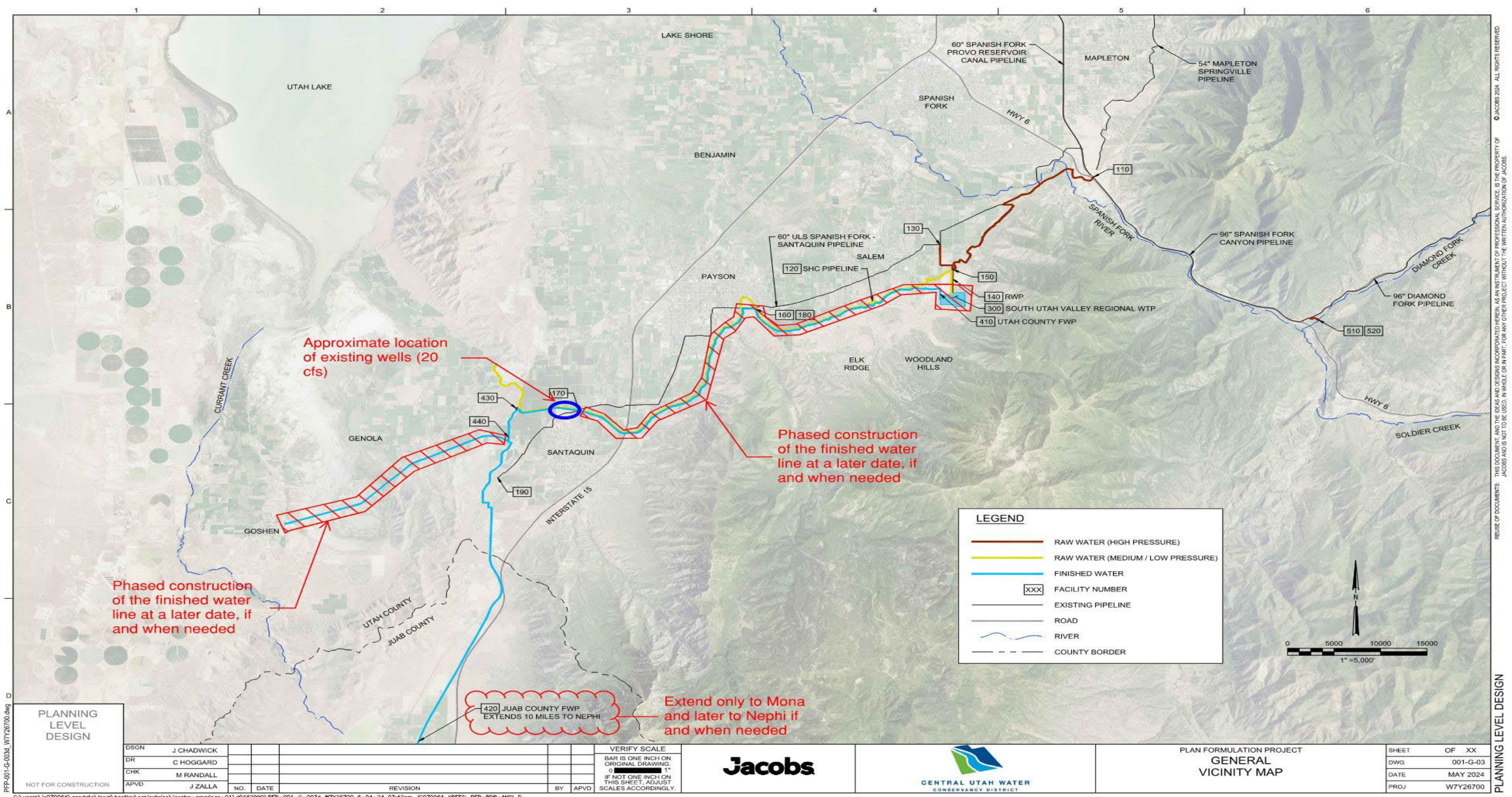
Key steps to implementing the idea:

Secure water rights by obtaining rights from Strawberry High Line Canal Company and private landowners. Additionally, it will be necessary to change the point of use for the acquired well water rights. Finding replacement water is crucial, which can be achieved either through saved water from piping the SHC or through other water exchanges to supply users. The consideration of ULS temporary agricultural contracts may help meet this demand. To ensure adequate water supply, existing wells will need rehabilitation or new wells drilled to meet Utah drinking water standards. Lastly, the construction of a pipeline from Santaquin to Mona, as already planned, will be undertaken, potentially involving the acquisition of any necessary rights-of-way and land.

Sketch

Alternative No.: DW-09

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Site Map with Well Location and Phasing Construction

Construction Cost Estimate

Alternative No.: TW-21

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Drill new culinary wells (16 IN diameter, 400 FT deep)	EA	400,000.00			4	$1,600,000
Well house building, CMU, steel roof (20' x 20')	EA	200,000.00			4	$800,000
Well chlorination	EA	5,000.00			4	$20,000
13 MGD reduction to SUVR WTP	MGD	6,000,000.00	13	$78,000,000		
Backup generator (400 kW)	EA	300,000.00			4	$1,200,000
Driveway and laydown yard (100' x 100')	EA	100,000.00			4	$400,000
Building electrical and pump electrical connection	EA	100,000.00			4	$400,000
Small 10' x 10' electrical building, CMU, steel roof	EA	50,000.00			4	$200,000
5,000 gallon surge tanks and hookup	EA	30,000.00			4	$120,000
Misc. pipe fittings, connection, valves, etc.	LS	15,000.00			4	$60,000
Abandon existing wells (grout closed)	EA	5,000.00			4	$20,000
500 HP, 5 CFS pump	EA	700,000.00			4	$2,800,000
Total Markup	86.91%			$67,792,720		$6,622,827
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$145,793,000		$14,243,000
NET SAVINGS						$131,550,000

SECTION 5

STRATEGIC VALUE SOLUTIONS INC

CONVEYANCE (RAW & FINISHED)

SECTION 5
CONVEYANCE (RAW & FINISHED)

Scope of the Study

This Value Team focused on all aspects of the raw and finished water conveyance within the plan. This included all pipelines, channels, turnouts, valves, and other associated infrastructure components of the conveyance system excluding the water treatment plant. The Value Team reviewed the original concept and made recommendations regarding pipeline materials, sizes, alignments, constructability, backfill material types, sequences of construction, and risk mitigation strategies.

The Value Team spent considerable time focused on developing mitigation strategies for the more than 40 risks identified during the workshop. These risks represented a variety of concerns that could impact the project's cost, schedule, or performance. They included a wide range of concerns such as seismic activity, NEPA approvals, pipeline corrosion, water quality, project funding, and even the District's taxing authority. The Value Team identified potential strategies to either reduce the probability these risks would occur or to lessen the impact to the cost and schedule if they do occur.

Key Findings

The table in this section includes a complete list of all the Value Alternatives and Design Suggestions developed. In the opinion of the Value Team, based on the understanding of the project requirements, all of these are viable alternatives to the original design and should be given full consideration for incorporation into the project.

Some of the more significant Value Alternatives include:

RL-02 Use HDPE pipe in lieu of welded steel pipe for Reach 1

The original concept is to use a 60-inch diameter welded steel pipe (WSP) that is mortar lined and tape wrapped with mortar protective coating as the raw water supply pipeline in the SHC Reach 1. The total length of this pipeline reach is 27,260 feet. The alternative concept is to use heavy duty DR-11 HDPE pipe in lieu of the welded steel pipe that is presently shown in the design drawings. The main rationale for this change is that the HDPE will allow the Reach 1 raw water pipeline to be constructed in a shorter period and for less cost. The use of HDPE pipe also eliminates the corrosion issue that must be mitigated when welded steel pipe is used. This alternative will save $27,198,000 in first cost.

RL-03 Use HDPE pipes in lieu of welded steel pipes for finished water pipeline that is less than or equal to 60 inches

The original concept is to use WSP for all finished water pipelines. The alternative concept is to use HDPE pipes for all finished water pipes that have a diameter less than or equal to 60 inches.

It is standard practice for numerous water districts across the country to use HDPE piping for finished water pipelines with diameters less than or equal to 60 inches. The installation of HDPE pipes can be completed more quickly than WSP which reduces the project schedule, and HDPE does not require cathodic protection. This alternative will save $72,151,000 in first cost.

RL-28 Use select backfill in lieu of trench zone controlled low strength material

The original concept is to use controlled low strength material (CLSM) for pipe backfill. The alternative concept is to use select backfill in lieu of the CLSM for pipe backfill. While the CLSM has advantages regarding speed of placement and forgiveness in placement, there is a great deal of this material required for the project. The availability of the large volume of CLSM material for the project is unknown. This alternative will save $34,729,000 in first cost.

Highlights

During the workshop, the conveyance Value Team generated 102 ideas for potential changes to the current design. Based on the Value Team members' professional judgment and input from the District and PDT representatives, 11 of these ideas were selected for developing into Value Alternatives with a cost avoidance and 11 Design Suggestions that improve operation, ease maintenance, improve constructability, or reduce risk.

The key functions prioritized by the Value Team for this project were to facilitate construction, improve conveyance, and reduce losses. To facilitate construction, the Value Team recommended using early contractor involvement (ECI), reducing the amount of cover over the finished water pipeline, installing both finished and raw water pipelines in the same trench were allowable, improving the contractor pre-qualification process, allowing precast box construction for turnout structures, expediting construction of the finished water pipeline from Mona to Nephi by eight years, using a portable/mobile energy dissipator, identifying contractor laydown and staging areas, using the truck tunnel crossing under I-15, and adding bid alternatives for the pipeline material.

To improve conveyance, the Value Team recommended expediting geotechnical investigation in areas with potential landslide or seismic activity, accounting for the construction labor site access delays within the productivity factor within the cost estimate, coordinating with other large utility owners, adding escalation clauses to the construction contractor to account for unexpected price increases during construction, increasing cloud seeding operations, and assigning a program manager to oversee all design and construction activities.

To reduce losses, the Value Team recommended using HDPE pipe for Reach 1 (raw water pipeline) and all finished water pipeline that is less than or equal to 60 inches in diameter, using earthquake resistant ductile iron pipe at select fault zones, using 8-inch-thick concrete walls and slabs for turnouts along Strawberry Highline Canal, using select backfill in lieu of trenched zone controlled low strength material, and using butterfly valves in lieu of isolation ball valves.

Organization of Alternatives

The alternatives presented on the following pages are organized by functional categories, and then numerically within each of those categories. The divisions used to organize the alternatives are as follows:

Facilitate Construction (FC)

Improve Conveyance (IC)

Reduce Losses (RL)

These designations have been used throughout the Value process to organize the ideas.

Table 5-1
Summary of Alternatives

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
FC - Facilitate Construction					
FC-02	Use early contractor involvement in lieu of design-bid-build	Design Suggestion			F
FC-03	Reduce the amount of cover over the finished water pipeline from 6 feet to 4 feet	$5,370,000	$0	$5,370,000	F
FC-11	Install both the finished water and raw water in the same trench where alignments allow	Design Suggestion			F
FC-14	Through the pre-qualification process, require the contractor to demonstrate the ability to meet production rates	Design Suggestion			F
FC-16	Allow precast box construction in lieu of cast-in-place construction for turnout structures	Design Suggestion			F
FC-18	Construct the finished water pipeline from Mona to Nephi 8 years earlier	$12,133,000	$0	$12,133,000	F
FC-23	Use a portable/mobile energy dissipator that can be reused at the end of each winter season	No Cost Developed			F
FC-25	Identify contractor laydown and staging areas throughout the construction corridor	Design Suggestion			F
FC-31	Use truck tunnel crossing in lieu of trenchless crossing of I-15	$1,304,000	$0	$1,304,000	F
FC-33	Bid alternative pipeline materials	$99,350,000	$0	$99,350,000	F

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
IC - Improve Conveyance					
IC-05	Expedite geotechnical investigation in areas with potential landslide or seismic activity	Design Suggestion			F
IC-13	Account for the construction labor site access delays within the productivity factor within the cost estimate	Design Suggestion			F
IC-15	Coordinate with other large utility owners	Design Suggestion			F
IC-19	Add escalation clauses to the construction contract to account for unexpected price increases during construction	Design Suggestion			F
IC-23	Increase the cloud seeding operations to increase falling rain or snow	Design Suggestion			F
IC-25	Assign a program manager to oversee all design and construction activities	Design Suggestion			F
RL - Reduce Losses					
RL-02	Use HDPE pipe in lieu of welded steel pipe for Reach 1	$27,198,000	$0	$27,198,000	R
RL-03	Use HDPE pipes in lieu of welded steel pipes for finished water pipeline that is less than or equal to 60 inches	$72,151,000	$0	$72,151,000	F
RL-11	Use earthquake resistant ductile iron pipe at select fault zones	($15,609,000)	$0	($15,609,000)	F
RL-25	Use 8-inch thick concrete walls and slabs for turnouts along Strawberry Highline Canal	$624,000	$0	$624,000	F

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
RL-28	Use select backfill in lieu of trench zone controlled low strength material	$34,729,000	$0	$34,729,000	F
RL-33	Replace the isolation ball valves with butterfly valves	$3,090,000	$0	$3,090,000	F

A = Accepted R = Rejected

Table 5-2
Optimum Combination of Alternatives

After completing the development of the Value Proposals, the Value Team reviewed the composite list of proposals to identify what was assumed to be the recommended combination of proposals. This combination represents the best value solution for the project in the opinion of the Value Team. The review concluded that the optimum project benefits would be realized by combining proposals in the following two tables.

Raw Water Conveyance				
Alt. No.	**Description**	**First Cost Savings**	**Present Worth O&M Savings**	**Life Cycle Cost Savings**
FC - Facilitate Construction				
FC-23	Use a portable/mobile energy dissipator that can be reused at the end of each winter season	No Cost Developed		
FC-33	Bid alternative pipeline materials	Accounted for in RL-02		
RL - Reduce Losses				
RL-02	Use HDPE pipe in lieu of welded steel pipe for Reach 1	$27,198,000	$0	$27,198,000
RL-11	Use earthquake resistant ductile iron pipe at select fault zones	($13,300,000)	$0	($13,300,000)
RL-25	Use 8-inch thick concrete walls and slabs for turnouts along Strawberry Highline Canal	$624,000	$0	$624,000
RL-28	Use select backfill in lieu of trench zone controlled low strength material	$7,000,000	$0	$7,000,000
RL-33	Replace the isolation ball valves with butterfly valves	$3,090,000	$0	$3,090,000
Raw Water Combination Total Cost Savings:		$24,612,000	$0	$24,612,000

*If necessary, the savings from some of the individual Value Proposals may have been adjusted to account for overlapping savings when combined with other Value Proposals.

Table 5-3
Optimum Combination of Alternatives

Finished Water Conveyance				
Alt. No.	**Description**	**First Cost Savings**	**Present Worth O&M Savings**	**Life Cycle Cost Savings**
FC - Facilitate Construction				
FC-03	Reduce the amount of cover over the finished water pipeline from 6 feet to 4 feet	$5,370,000	$0	$5,370,000
FC-18	Construct the finished water pipeline from Mona to Nephi 8 years earlier	$12,133,000	$0	$12,133,000
FC-31	Use truck tunnel crossing in lieu of trenchless crossing of I-15	$1,304,000	$0	$1,304,000
FC-33	Bid alternative pipeline materials	Accounted for in RL-03		
RL - Reduce Losses				
RL-03	Use HDPE pipes in lieu of welded steel pipes for finished water pipeline that is less than or equal to 60 inches	$72,151,000	$0	$72,151,000
RL-11	Use earthquake resistant ductile iron pipe at select fault zones	($2,300,000)	$0	($2,300,000)
RL-28	Use select backfill in lieu of trench zone controlled low strength material	$27,800,000	$0	$27,800,000
Finished Water Combination Total Cost Savings:		$116,458,000	$0	$116,458,000

*If necessary, the savings from some of the individual Value Proposals may have been adjusted to account for overlapping savings when combined with other Value Proposals.

FACILITATE CONSTRUCTION

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-02
Use early contractor involvement in lieu of design-bid-build	
Discussion	

The Early Contractor Involvement (ECI) method of construction contracting, whereby the general contractor is engaged early in the project, is suggested by the Value Team as a possible alternative to the standard design-bid-build contracting strategy.

At the time the contractor becomes involved with the project, the actual cost is not known; however, a target price has generally been established. The design generally has not been completed when the contractor becomes involved. As part of the ECI method, a best value process will be used to select the contractor. In addition to price, the contractors will be rated on their technical capabilities, experience on similar past projects, resumes of key personnel, etc. The ECI method reduces contractor risk, similar to a cost reimbursable contract.

Although the ECI method is relatively new compared to the design-bid-build method, it has been used successfully on large projects. There is less likelihood of claims or disputes arising between the owner and contractor if the contractor has construction experts embedded with the design and management team at an early stage.

The ECI method was used effectively after Hurricane Katrina made landfall in the New Orleans area in 2005. A few specific projects to benefit from ECI contract method were the large levee projects, LPV-145, LPV-146, and LPV-148.

Another alternative to design-bid-build contracting is to use the construction manager at risk (CMAR) project delivery method.

Under a typical CMAR delivery method, the owner or client hires a construction firm or construction manager early in the design and planning process to later oversee the project's construction. The construction manager advises the design firm during the project's design and planning phases and often acts as the general contractor during the construction phase to select, schedule, and sequence subcontractors to complete the required construction work.

The method is known as construction manager "at risk" because the recipient or subrecipient and construction manager negotiate a guaranteed maximum price (GMP) during the design phase. The construction manager will be responsible for any costs that exceed that amount.

While CMAR can be a complex process and the specifics of the delivery method will vary by jurisdiction, if done properly, then it can yield time and cost efficiencies by obtaining construction manager input during the design phase and beginning aspects of a construction project before the full design is complete.

The Value Team assumes this project could benefit from implementing either one of the above alternative project delivery methods, due to the early stage of this project, the large project size, and complexity of the project.

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-03
Reduce the amount of cover over the finished water pipeline from 6 feet to 4 feet	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept, per the preliminary design drawings, indicates there should be 6 feet of cover over the top of all finished water pipelines.	
Description of Alternative Concept:	
The alternative concept is to reduce the amount of excavation and backfill by 2 feet to a total of 4 feet of excavation and backfill.	
Rationale for Change:	
The Value Team assumes that the 6 feet of cover shown in the plans is conservative and that reducing the cover to 4 feet is feasible. The average depth of frost in the winter in Central Utah is between 30 inches and 40 inches, so 4 feet of cover is still conservative as it pertains to protecting the pipe from freezing. The 4 feet of cover also provides adequate protection from vehicle loading. Less excavation and backfill will save schedule time as well.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$5,370,000
O&M Savings:	$0
Life Cycle Cost Savings:	$5,370,000

Advantages/Disadvantages

Alternative No.: FC-03

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Potential schedule savings due to less excavation and backfill required • Provides additional protection for the pipe by using controlled low-strength material (CLSM) to encapsulate the finished water pipelines	• Potential conflicts with utilities that are installed at shallower depths

Discussion

Alternative No.: FC-03

Description of original concept affected by this change:

The original concept in the preliminary design drawings indicates there should be 6 feet of cover over the top of all finished water pipelines.

Issue of concern to the team:

The Value Team assumes the 6 feet of cover shown in the plans is conservative and not necessary to protect the finished water pipeline.

Description of alternative concept:

The alternative concept is to reduce the amount of excavation and backfill by 2 feet to a total of 4 feet of excavation and backfill.

Benefit of making the change:

This alternative reduces excavation and backfill and will save schedule time and cost.

Additional explanation:

The Value Team assumes reducing the cover from 6 feet to 4 feet will not violate any applicable standards or specifications.

Examples where this has been used:

Numerous projects require less than 6 feet of cover over pipelines, including the raw water pipelines for this project. The preliminary plans indicate that the raw water pipeline has 4 feet of cover. The Idaho Transportation Department (ITD) plans and specifications require 4 feet of cover over water pipelines.

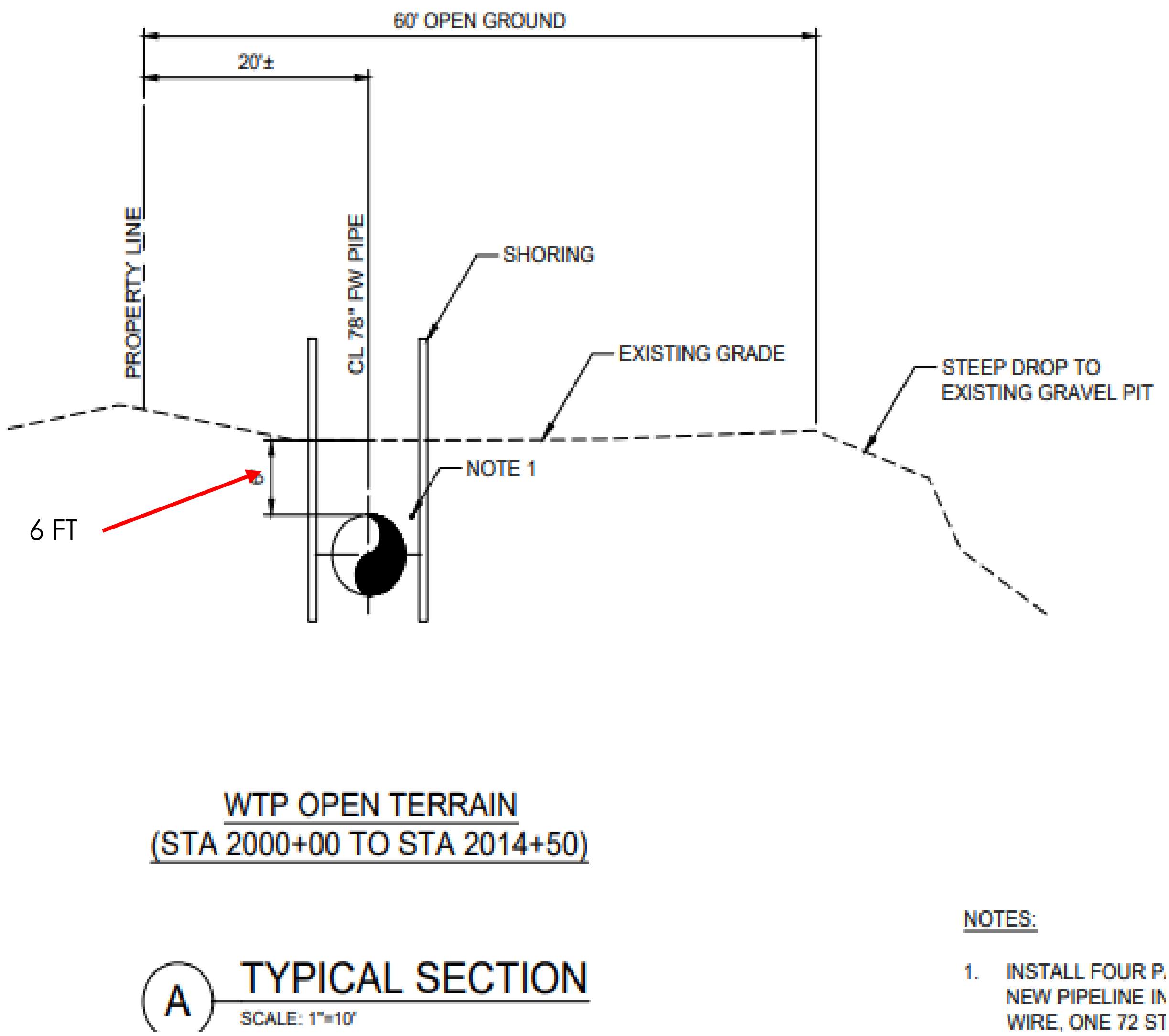
Key steps to implementing the idea:

The Value Team suggests the Design Team confirm that 4 feet of cover over the finished water pipelines is acceptable. If acceptable, then the plans and specifications need to be revised accordingly to show this change.

Sketch

Alternative No.: FC-03

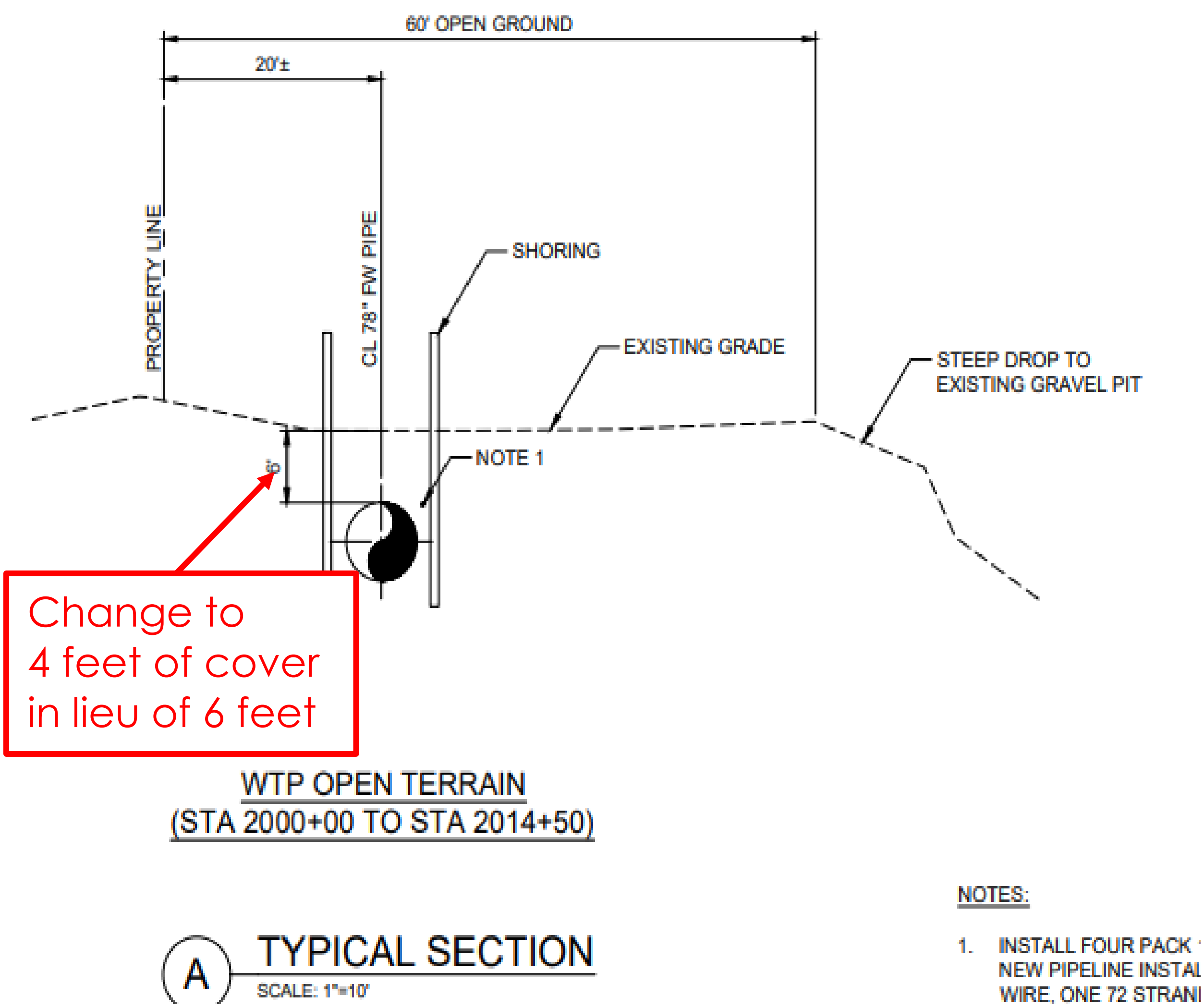
☒ **ORIGINAL** ☐ **ALTERNATIVE**



Typical Cross-Section for Finished Water Pipeline with 6 Feet of Cover

Alternative No.: FC-03

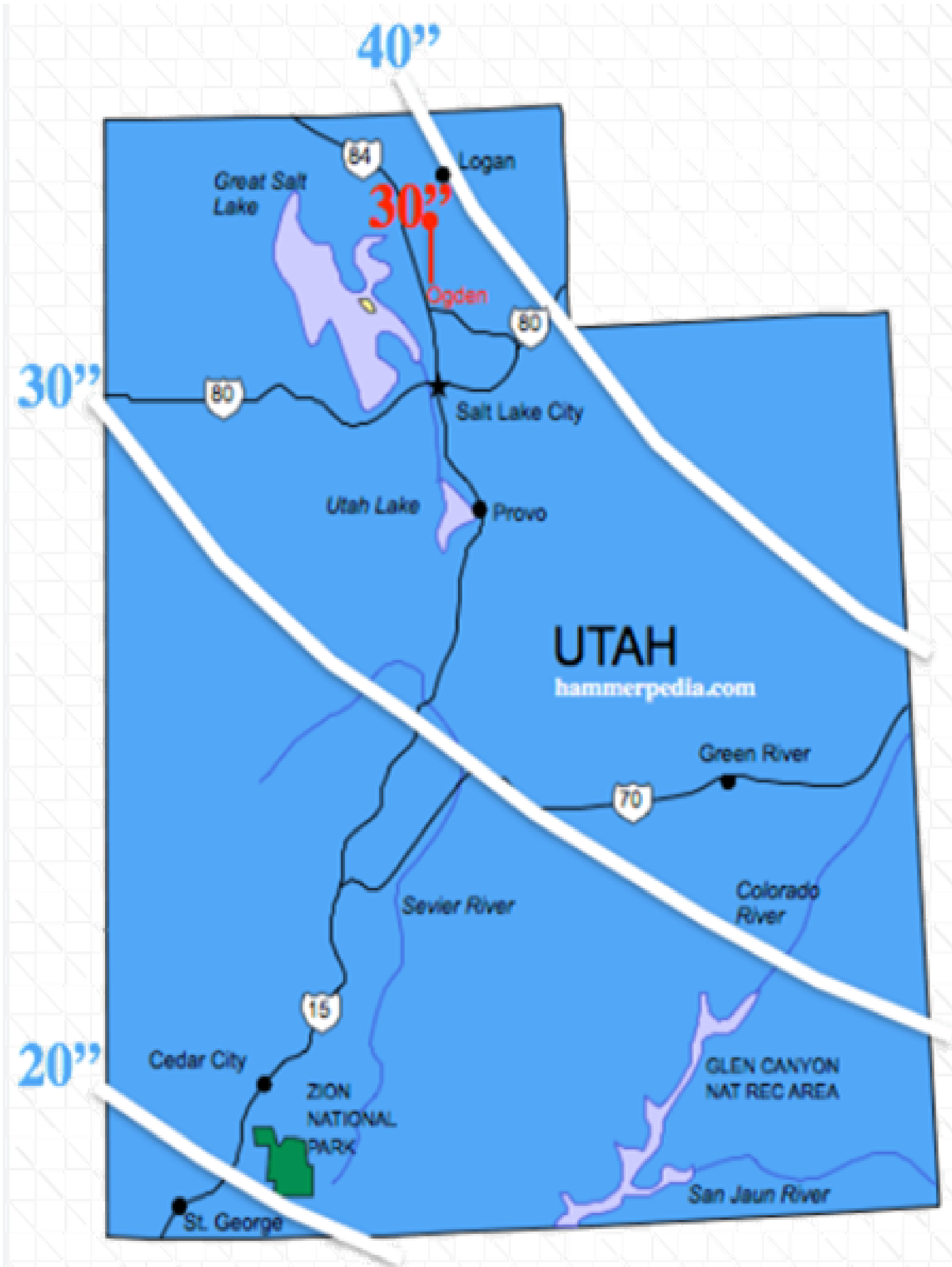
☐ **ORIGINAL** ☒ **ALTERNATIVE**



Proposed Typical Cross-Section for Finished Water Pipeline with 4 Feet of Cover

Alternative No.: FC-03

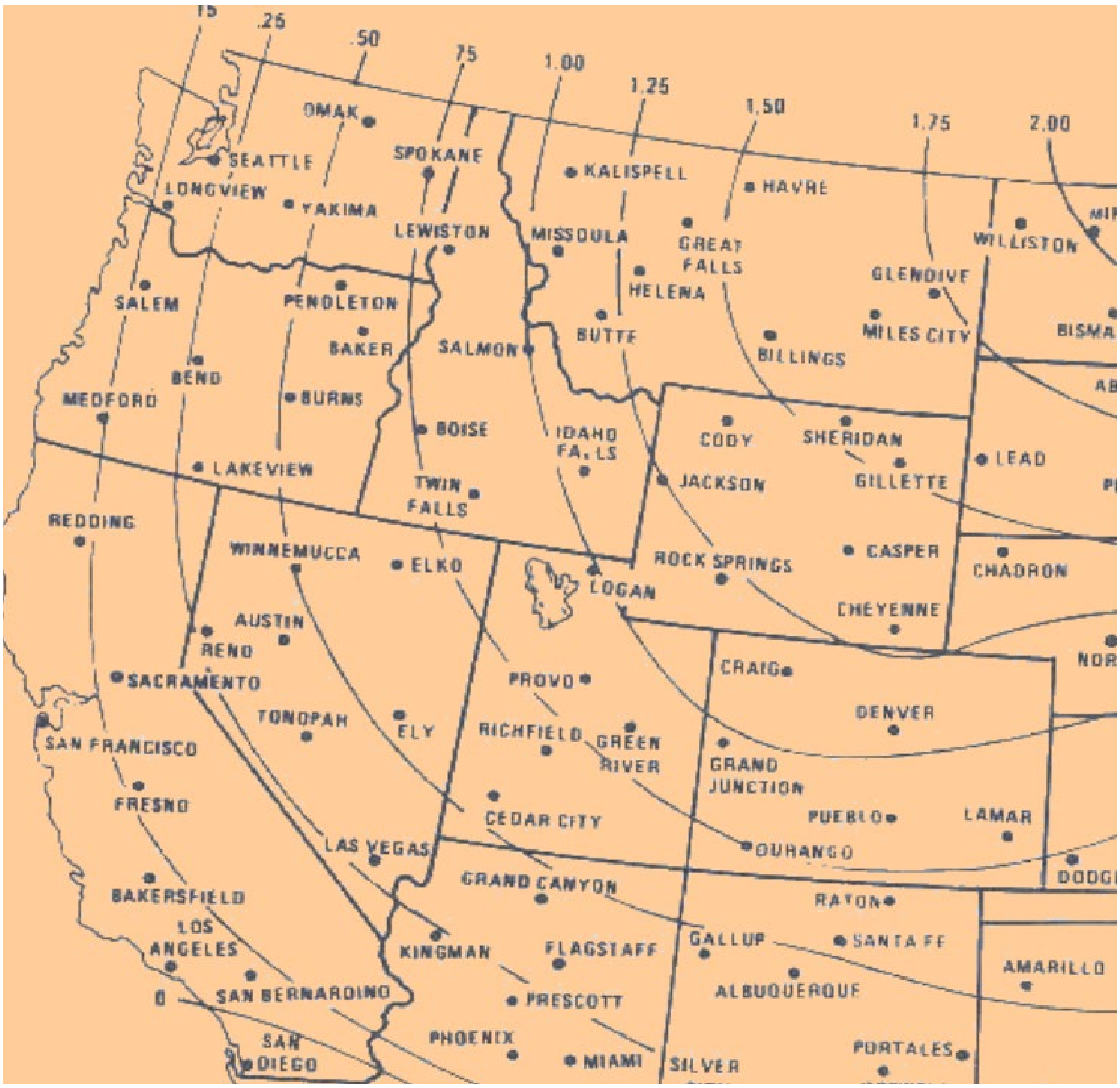
☐ **ORIGINAL** ☒ **ALTERNATIVE**



Frost Depth Map – Approximately 30-40 Inches

Alternative No.: FC-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**



NOAA Frost Depth Penetration Map for Western U.S. (In Meters)

Calculations

Alternative No.: FC-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Finished water pipeline excavation and backfill deduction calculation:

(L = length, W = width, D = depth)

78 IN diameter pipe: 7,200 FT L x 8.5 FT W x 2 FT D = 122,400 CF / 27 CY/CF = 4,533 CY

72 IN diameter pipe: 21,150 FT L x 8.0 FT W x 2 FT D = 338,400 CF / 27 CY/CF = 12,533 CY

48 IN diameter pipe: 38,700 FT L x 6.0 FT W x 2 FT D = 464,400 CF / 27 CY/CF = 17,200 CY

36 IN diameter pipe: 27,800 FT L x 5.0 FT W x 2 FT D = 278,000 CF / 27 CY/CF = 10,296 CY

24 IN diameter pipe: 38,300 FT L x 4.0 FT W x 2 FT D = 306,400 CF / 27 CY/CF = 11,348 CY

20 IN diameter pipe: 28,300 FT L x 3.67 FT W x 2 FT D = 207,722 CF / 27 CY/CF = 7,693 CY

12 IN diameter pipe: 27,920 FT L x 3.0 FT W x 2 FT D = 167,520 CF / 27 CY/CF = 6,204 CY

Construction Cost Estimate

Alternative No.: FC-03

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
78 IN diameter pipe - delete 2 FT of excavation	CY	8.51	4,533	$38,576		
72 IN diameter pipe - delete 2 FT of excavation	CY	8.51	12,533	$106,656		
48 IN diameter pipe - delete 2 FT of excavation	CY	8.51	17,200	$146,372		
36 IN diameter pipe - delete 2 FT of excavation	CY	8.51	10,296	$87,619		
24 IN diameter pipe - delete 2 FT of excavation	CY	8.51	11,348	$96,571		
20 IN diameter pipe - delete 2 FT of excavation	CY	8.51	7,693	$65,467		
12 IN diameter pipe - delete 2 FT of excavation	CY	8.51	6,204	$52,796		
78 IN diameter pipe - delete 2 FT of backfill	CY	34.00	2,267	$77,078		
72 IN diameter pipe - delete 2 FT of backfill	CY	34.00	12,533	$426,122		
48 IN diameter pipe - delete 2 FT of backfill	CY	34.00	17,200	$584,800		
36 IN diameter pipe - delete 2 FT of backfill	CY	34.00	10,296	$350,064		
24 IN diameter pipe - delete 2 FT of backfill	CY	34.00	11,348	$385,832		
20 IN diameter pipe - delete 2 FT of backfill	CY	34.00	7,693	$261,562		
12 IN diameter pipe - delete 2 FT of backfill	CY	34.00	6,204	$210,936		
Total Markup	85.50%			$2,480,007		
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$5,370,000		
NET SAVINGS						$5,370,000

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-11
Install both the finished water and raw water in the same trench where alignments allow	
Discussion	

The current design shows 12 feet between the centerline of the Strawberry Highline Canal (SHC) enclosure pipe and the finished water pipe. The pipes are also constructed in separate trenches. By reducing the distance between the pipes to 3 feet, it would allow common trench construction.

The following are key advantages of common trench construction:

- Effectively uses more of the existing channel thus reducing excavation quantities
- Potential time savings
- Reduction in backfill
- If HDPE is used for the finished water, then installation time is greatly reduced because of the welded joint construction for both pipelines

The following is a disadvantage of common trench construction:

- Steel pipe joints that require welding will be slightly more difficult to install between the pipes due to the 3-foot working space. Sections could be welded outside of the trench to save time. If HDPE is used, then this disadvantage is mitigated.

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-14
Through the pre-qualification process, require the contractor to demonstrate the ability to meet production rates	
Discussion	
The envisioned project has a lengthy overall schedule. Inside this long-term schedule are project elements that must be completed before other elements can be started or before they can be brought online. It is recommended that part of the pre-qualification process include a demonstration by the contractor that the expected production rates can be met. This demonstration would be based on evidence of previous projects of similar size and complexity, and records of adequate labor and equipment. Schedules from previous projects that confirm the production rates would be beneficial as well. Based on this pre-qualification information, the District can be assured that the project schedule can be met. The information may also indicate that the project schedule may be accelerated. Any acceleration in the overall project will result in economic savings simply due to reduced escalation. The acceleration could potentially allow expedited starts on other portions of the project that could result in additional project savings due to reduced escalation.	

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-16
Allow precast box construction in lieu of cast-in-place construction for turnout structures	
Discussion	
Unlike the smaller turnout structures, the large turnout structures do not lend themselves to precast construction; however, the smaller ones do, especially if they can match common sizes manufactured by Old Castle Infrastructure or similar suppliers. The precast structures will be much faster to install in the field than the cast-in-place structures. The Value Team suggests the design drawings allow the contractor to provide precast structures in lieu of cast-in-place for the smaller turnout structures.	

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-18
Construct the finished water pipeline from Mona to Nephi 8 years earlier	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to provide finished water to Nephi 8 years later than Mona.	
Description of Alternative Concept:	
The alternative concept is to construct the finished water pipeline between Mona and Nephi 8 years earlier.	
Rationale for Change:	
The rational for change is that it provides finished water to Nephi sooner and at the same time as Mona receives water.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$12,133,000
O&M Savings:	$0
Life Cycle Cost Savings:	$12,133,000

Advantages/Disadvantages

Alternative No.: FC-18

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Provides water to Nephi 8 years earlier • Coincides with the completion of the South Utah Valley Regional (SUVR) Water Treatment Plant (WTP) • Improves public relations with Nephi • Avoids separate design/ construction contracts • Reduces escalation of costs caused by inflation of materials	• Requires capital expenditure of $50,432,000 sooner

Discussion

Alternative No.: FC-18

Description of original concept affected by this change:

The original concept is to provide the finished water pipeline from Mona to Nephi in 2040.

Issue of concern to the team:

The Value Team assumes the demand for water would be so great that it would necessitate moving the schedule forward to 2032, coinciding with the completion of the SUVR WTP.

Description of alternative concept:

The alternative concept is to construct the finished water pipeline between Mona and Nephi 8 years earlier.

Benefit of making the change:

The primary benefit of making this change is that it provides water to Nephi 8 years earlier. In addition, it coincides with the completion of the SUVR WTP, increases public relations with Nephi, avoids a separate design/construction contract with related administrative costs, and reduces escalation of costs caused by inflation of materials and labor.

Key steps to implementing the idea:

The main step would be to include the 28,327 feet of 20-inch WSP from Mona to Nephi with the Santaquin to Mona for design and construction project. In addition, the District needs to investigate the financial impact on the District funding the project moving forward.

Sketch

Alternative No.: FC-18

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Project No.	Facility No.	Facility	Construction		Estimated Cost to Construction Midpoint Cost	
			Estimated Timeframe	Estimated Midpoint	Construction	Capital
1	110	96-inch Turnout	October 2026 to September 2027	April 30, 2027	$195,467,000	$242,379,000
	120	SHC Reach 1				
	130	ULS Turnout to SUVR WTP				
	140	Raw Water Pipe to SUVR WTP				
	150	ULS/SHC Intertie				
2	120	SHC Reaches 2 through 6	October 2027 to May 2029	July 31, 2028	$110,631,000	$137,182,000
3	160	Payson Pressure-Reducing Valve	October 2026 to September 2027	April 30, 2027	$4,224,000	$5,238,000
	170	Santaquin Pressure-Reducing Valve				
4	180/190	Payson Pump Station/Santaquin Pump Station	N/A	N/A	N/A	N/A
5	300	Raw Water Reservoirs	June 2028 to June 2032	June 30, 2030	$150,122,000	$186,151,000
		SUVR WTP (Phase 1)			$367,255,000	$455,396,000
		Finished Water Reservoirs (Phase 1)			$92,530,000	$114,737,000
6		SUVR WTP (Phase 2)	June 2052 to June 2055	December 31, 2053	$518,571,000	$643,028,000
		Finished Water Reservoirs (Phase 2)			$164,146,000	$203,541,000
7	410	Utah County Finished Water Pipeline (SUVR WTP to Juab County Finished Water Pump Station)	January 2029 to June 2032	September 30, 2030	$214,346,000	$265,789,000
8		Utah County Finished Water Pipeline (Juab County Finished Water Pump Station to Goshen)	June 2033 to June 2035	June 30, 2034	$33,573,000	$41,631,000
9	420	Juab County Finished Water Pipeline (Finished Water Pump Station to Mona)	June 2029 to June 2032	December 31, 2030	$119,398,000	$148,054,000
10		Juab County Finished Water Pipeline (Mona to Nephi)	June 2038 to June 2040	June 30, 2039	$50,432,000	$62,536,000
11	430	Juab County Finished Water Tanks Phase 1	June 2031 to June 2032	December 31, 2031	$73,559,000	$91,213,000
12		Juab County Finished Water Tanks Phase 2	N/A	N/A	N/A	N/A
13	440	Juab County Finished Water Pump Station	June 2030 to June 2032	Jun 30, 2031	$21,098,000	$26,162,000
14	510	Diamond Fork Pump Station	June 2047 to June 2049	Jun 30, 2048	$43,772,000	$54,277,000
	520	Diamond Fork Pipeline				

Construction Timeframe

Sketch

Alternative No.: FC-18

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Project No.	Facility No.	Facility	Construction		Estimated Cost to Construction Midpoint Cost	
			Estimated Timeframe	Estimated Midpoint	Construction	Capital
1	110	96-inch Turnout	October 2026 to September 2027	April 30, 2027	$195,467,000	$242,379,000
	120	SHC Reach 1				
	130	ULS Turnout to SUVR WTP				
	140	Raw Water Pipe to SUVR WTP				
	150	ULS/SHC Intertie				
2	120	SHC Reaches 2 through 6	October 2027 to May 2029	July 31, 2028	$110,631,000	$137,182,000
3	160	Payson Pressure-Reducing Valve	October 2026 to September 2027	April 30, 2027	$4,224,000	$5,238,000
	170	Santaquin Pressure-Reducing Valve				
4	180/190	Payson Pump Station/Santaquin Pump Station	N/A	N/A	N/A	N/A
5	300	Raw Water Reservoirs	June 2028 to June 2032	June 30, 2030	$150,122,000	$186,151,000
		SUVR WTP (Phase 1)			$367,255,000	$455,396,000
		Finished Water Reservoirs (Phase 1)			$92,530,000	$114,737,000
6		SUVR WTP (Phase 2)	June 2052 to June 2055	December 31, 2053	$518,571,000	$643,028,000
		Finished Water Reservoirs (Phase 2)			$164,146,000	$203,541,000
7	410	Utah County Finished Water Pipeline (SUVR WTP to Juab County Finished Water Pump Station)	January 2029 to June 2032	September 30, 2030	$214,346,000	$265,789,000
8		Utah County Finished Water Pipeline (Juab County Finished Water Pump Station to Goshen)	June 2033 to June 2035	June 30, 2034	$33,573,000	$41,631,000
9	420	Juab County Finished Water Pipeline (Finished Water Pump Station to Mona)	June 2029 to June 2032	December 31, 2030	$119,398,000	$148,054,000
10		Juab County Finished Water Pipeline (Mona to Nephi)	June 2038 to June 2032	June 30, 2039	$50,432,000	$62,536,000
11	430	Juab County Finished Water Tanks Phase 1	June 2031 to June 2032	December 31, 2031	$73,559,000	$91,213,000
12		Juab County Finished Water Tanks Phase 2	N/A	N/A	N/A	N/A
13	440	Juab County Finished Water Pump Station	June 2030 to June 2032	Jun 30, 2031	$21,098,000	$26,162,000
14	510	Diamond Fork Pump Station	June 2047 to June 2049	Jun 30, 2048	$43,772,000	$54,277,000
	520	Diamond Fork Pipeline				

Revised Construction Schedule

Construction Cost Estimate

Alternative No.: FC-18

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Juab County finished water (Mona to Nephi) 2040	LS	50,432,000.00	1	$50,432,000		
Juab County finished water (Mona to Nephi) 2032	LS	38,298,643.60			1	$38,298,644
*Markup included above						
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$50,543,000		$38,299,000
NET SAVINGS						$12,133,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-23
Use a portable/mobile energy dissipator that can be reused at the end of each winter season	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept does not show the energy dissipator in the plans.	
Description of Alternative Concept:	
The alternative concept is to provide a portable energy dissipator that can be reused at the end of each winter construction season no matter where the contractor ends.	
Rationale for Change:	
The existing gravity flow channel will require energy dissipation from the new SHC enclosure pipeline into the gravity channel to ensure agricultural demands are met between winter construction periods.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	No Cost Developed
Function	Resources	O&M Savings:	
☒ Increased	☐ Increased	Life Cycle Cost Savings:	
☐ Maintained	☒ Maintained		
☐ Decreased	☐ Decreased		

Advantages/Disadvantages

Alternative No.: FC-23

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces risk of not being able to provide agricultural water at the end of a construction season • Portable energy dissipator provides security that the winter construction can end at any location on the alignment • Can easily be reused and attached to the HDPE pipe at any location • The HDPE joints are welded to provide a restrained pipeline, which allows for the energy dissipator to be attached without thrust concerns	• None apparent

Discussion

Alternative No.: FC-23

Description of original concept affected by this change:

The original concept does not show the energy dissipator in the plans.

Issue of concern to the team:

The existing gravity flow channel will require energy dissipation from the new SHC enclosure pipeline into the gravity channel to ensure agricultural demands are met between winter construction periods. In addition, if the construction does not proceed as scheduled, then having a portable energy dissipator is important.

Description of alternative concept:

The alternative concept is to provide a portable energy dissipator that can be reused at the end of each winter season. The unit would also include a flanged adapter connection that could easily be fused onto the HDPE pipe. Additionally, a covered spillway chute with concrete barricades perpendicular to the flow will be needed. The energy dissipator forces water to hit itself before coming out of the pipe, hence the need for side portals/chute and no opening in the back.

Benefit of making the change:

The existing gravity flow channel will require energy dissipation from the new SHC enclosure pipeline into the gravity channel to ensure agricultural demands are met between winter construction periods. By providing a portable unit, if the construction does not proceed as scheduled, then having a portable energy dissipator allows the contractor to end at any location along the alignment.

Examples where this has been used:

An example where this has been used is the Newton Dam energy dissipator (Newton Dam, Utah).

Key steps to implementing the idea:

The main step to implementation would be to include a portable energy dissipator for HDPE in the next phase of design.

Sketch

Alternative No.: FC-23

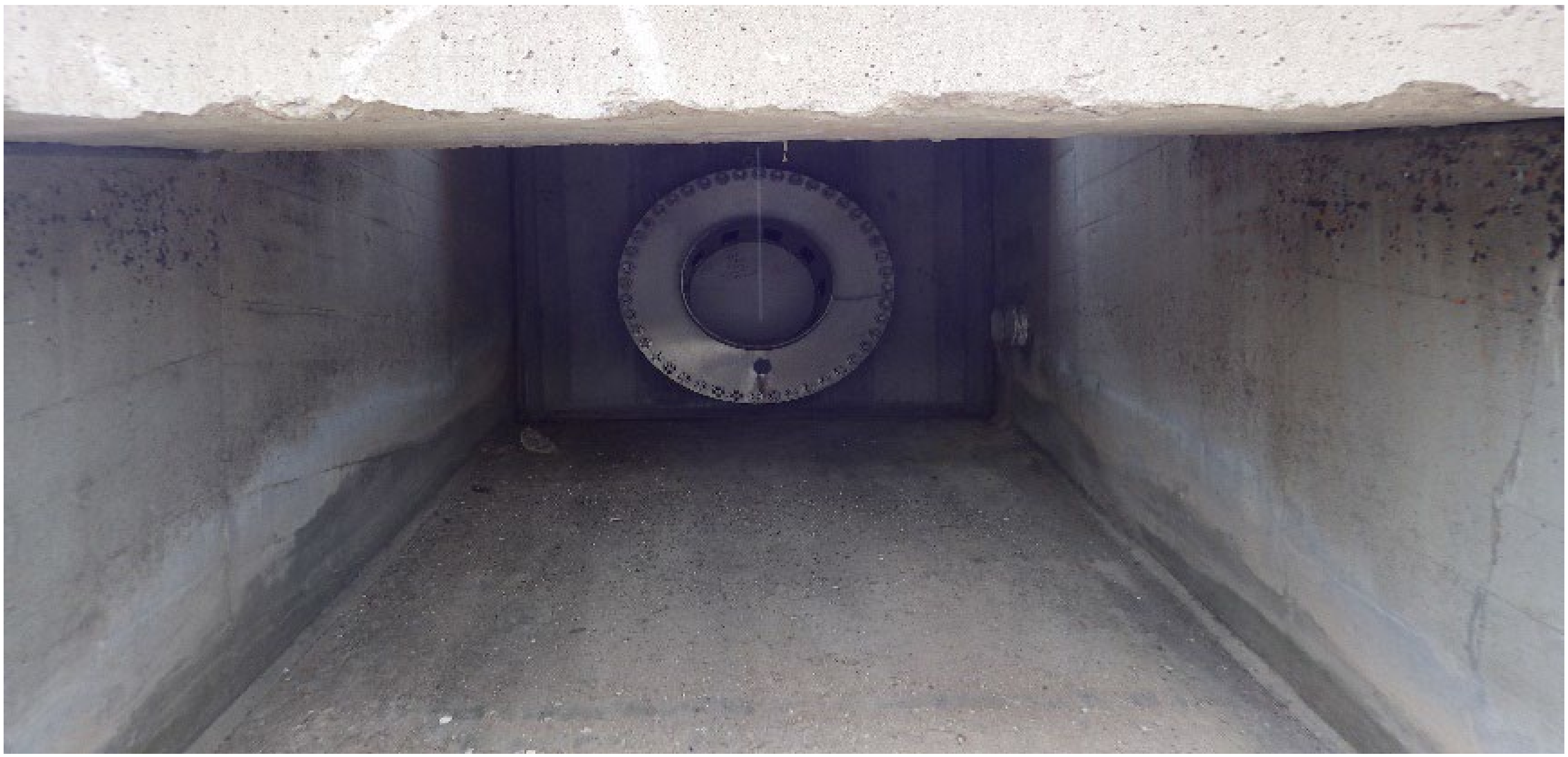
☐ **ORIGINAL** ☒ **ALTERNATIVE**

Energy Dissipator Arriving On-Site

Sketch

Alternative No.: FC-23

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Energy Dissipator Enclosure/Runout

Alternative No.: FC-23

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Full Dam Flow

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-25
Identify contractor laydown and staging areas throughout the construction corridor	
Discussion	

The Value Team assumes it is important for the Design Team to identify contractor laydown areas and staging areas and incorporate this information into the plans and specifications as part of the final RFP documents. Since this project covers a large area (approximately 30 miles in length) from Spanish Fork in the north to Nephi in the south, it will be important for the contractor to have multiple staging areas available prior to starting work to minimize haul distances and facilitate construction logistics.

The Value Team has also identified several other elements that should be developed or advanced by the Design Team to facilitate construction, including the following:

- Contractor access points should be identified in the plans prior to construction. Potential contractor access points are located within several local municipalities. The Value Team suggests that the Design Team coordinate with local jurisdictions to make them aware of the project and that access points will be necessary during construction. In addition to existing roads, further temporary easements may be required to facilitate construction access.
- Confirm local bridges will be used for construction haul routes can accommodate H-20 loading. If not, then alternative routes need to be found.
- As part of the project plans, the Value Team suggests the Design Team create traffic control plans. Haul route plans may be developed as well with caution as these plans may be considered as part of the contractors' means and methods.
- The Value Team suggests that the required existing utility relocations be expedited for the entire project corridor prior to the planned start of construction.
- Likewise, the Value Team suggests the Design Team coordinate with the Union Pacific Railroad to address issues that may arise from pipelines that cross underneath, within, or adjacent to their railroad right-of-way.

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-31
Use truck tunnel crossing in lieu of trenchless crossing of I-15	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to provide a trenchless crossing of I-15.	
Description of Alternative Concept:	
The alternative concept is to use the existing truck tunnel crossing to cross under I-15.	
Rationale for Change:	
The rationale for this change is that it uses an existing truck tunnel for the pipeline to cross under I-15 in lieu of a trenchless bore and jack crossing.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$1,304,000
O&M Savings:	$0
Life Cycle Cost Savings:	$1,304,000

Advantages/Disadvantages

Alternative No.: FC-31

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Simplifies Utah Department of Transportation (UDOT) permit and approval process • Utilizes existing truck tunnel for I-15 crossing • Allows 48-inch finished water pipe to be installed with the existing canal crossing of I-15 • Reduces risk of a trenchless crossing • Reduces construction schedule	• Need to investigate tunnel footing depth to allow the 48-inch HDPE SHC pipeline installation

Alternative No.: FC-31

Description of original concept affected by this change:

The original concept is to provide a trenchless crossing of I-15, using a 60-inch steel casing with a 48-inch welded steel finished water carrier pipe. In addition, the 48-inch HDPE SHC pipeline was designed to cross under the freeway within the existing channel culvert.

Issue of concern to the team:

The Value Team assumes there is an opportunity to take advantage of the existing truck tunnel beneath the I-15 for the 48-inch HDPE SHC pipeline. This eliminates the risk of a trenchless bore and jack crossing of I-15.

Description of alternative concept:

The alternative concept is to take advantage of the existing truck tunnel crossing for the 48-inch HDPE SHC pipeline and to use the existing channel culvert crossing for the 48-inch welded steel finished pipeline.

Benefit of making the change:

The primary benefit of making this change is that it eliminates the risk of a trenchless crossing of I-15. In addition, it simplifies the UDOT permit and approval process, takes advantage of the existing truck tunnel crossing, allows the 48-inch finished water pipe to be installed within the existing canal crossing, and reduces construction time.

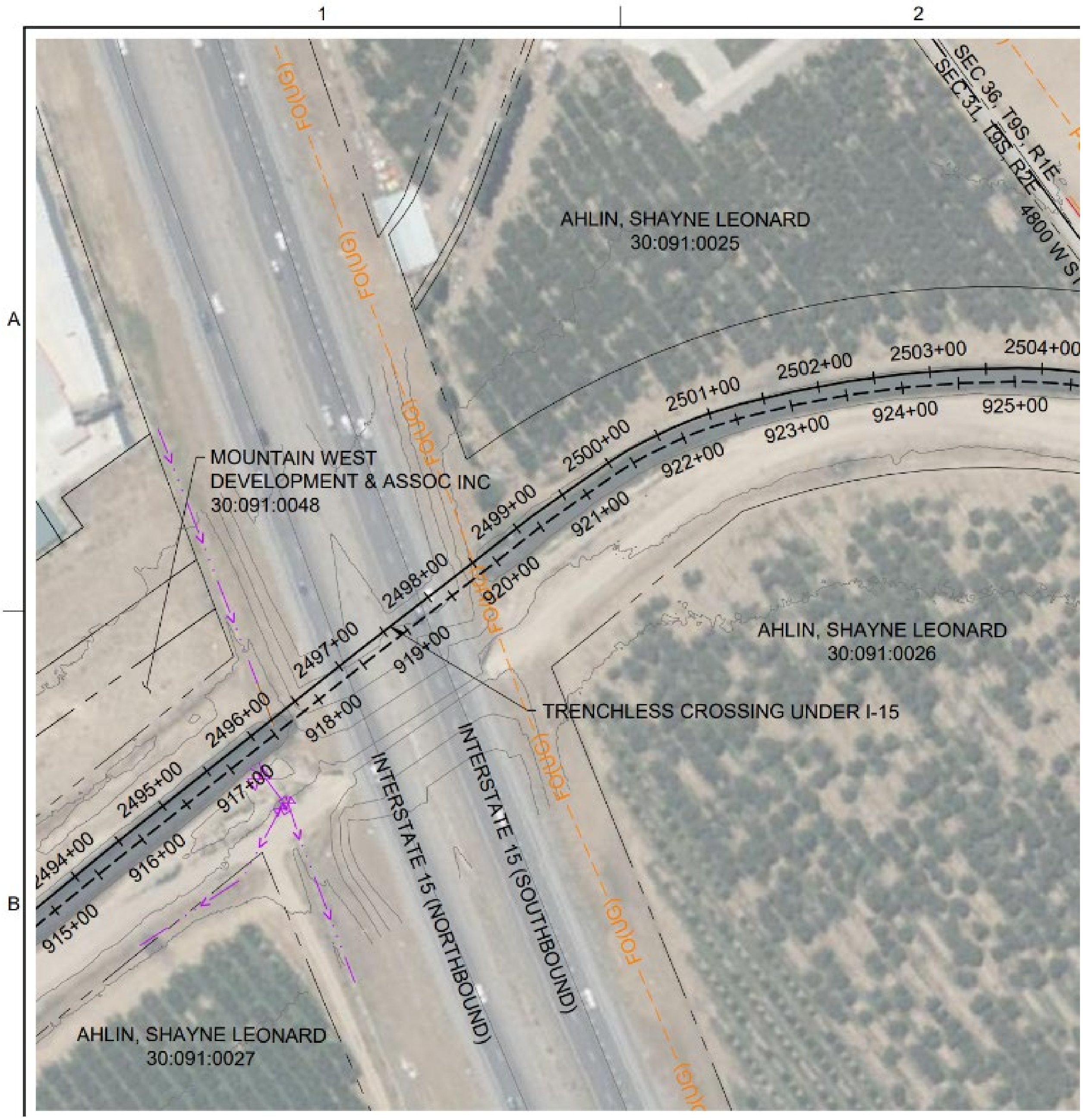
Key steps to implementing the idea:

The first step to implementing this idea would be to investigate the footing design of the existing truck tunnel to allow for a 60-inch-deep excavation for the 48-inch HDPE SHC pipeline. Even if structural drawings are available for the truck tunnel, the Value Team recommends a pothole along each tunnel wall to determine the type and dimensional information on the footings. Once the alternative concept is deemed feasible, then schedule a meeting with UDOT to discuss the permitting process. UDOT typically requires a casing for pressure pipeline crossings; however, since this is within the truck tunnel this requirement should be waived. In addition, butt-fused welding of the HDPE joints provides a fully restrained system as well as a leak proof pipeline. Also, the HDPE pipe will be backfilled with CLSM level with the existing roadway through the tunnel.

Sketch

Alternative No.: FC-31

☒ **ORIGINAL** ☐ **ALTERNATIVE**



Trenchless Crossing Under I-15

Sketch

Alternative No.: FC-31

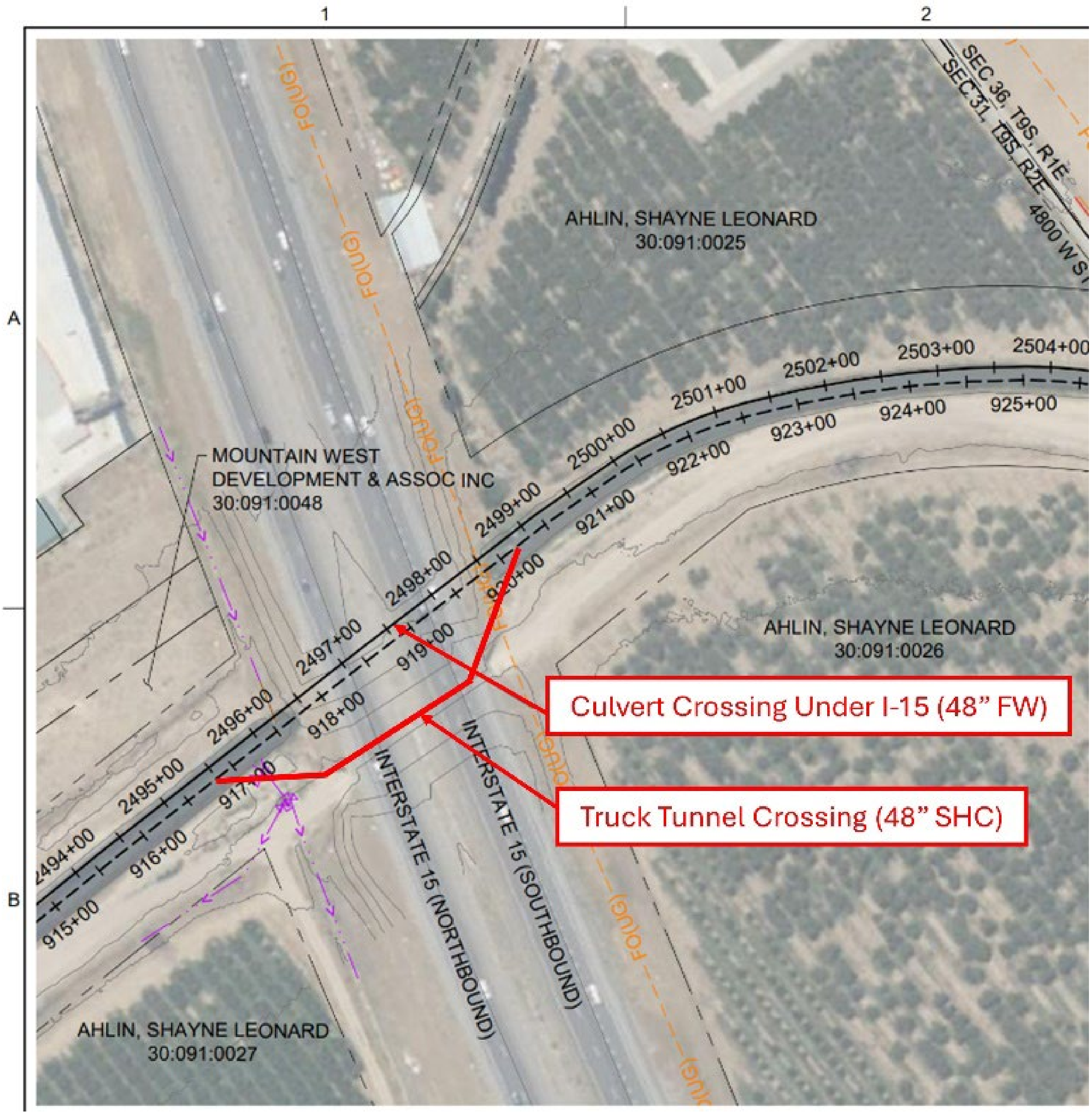
☐ **ORIGINAL** ☒ **ALTERNATIVE**

Existing Truck Tunnel Under I-15

Sketch

Alternative No.: FC-31

☐ **ORIGINAL** ☒ **ALTERNATIVE**



SHC Pipeline Alignment Utilizing the Truck Tunnel

Calculations

Alternative No.: FC-31

☒ **ORIGINAL** ☐ **ALTERNATIVE**

325 FT trenchless crossing using 60 IN casing and 48 IN steel.

Alternative No.: FC-31

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Assumed trench at the same length as trenchless crossing (525 FT). Note that the ULS freeway crossing tunnel is 265 FT. Actual distance within the truck tunnel is approximately 175 FT.

Excavation:

6 FT x 6 FT = 36 SF x 525 FT = 18,900 CF / 27 CY/CF = 700 CY

CLSM:

$A = \pi r^2$ = 3.14 (2.25 FT)^2 = 3.14 x 5 SF = 16 SF x 325 FT = 5,200 CF / 27 CY/CF = 192 CY

700 CY – 192 CY = 508 CY

Construction Cost Estimate

Alternative No.: FC-31

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Trenchless crossing of I-15	LF	1,593.68	525	$836,682		
Excavation	CY	25.00	700	$17,500		
CLSM	CY	300.00			508	$152,400
Total Markup	85.80%			$732,888		$130,759
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$1,587,000		$283,000
NET SAVINGS						$1,304,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	FC-33
Bid alternative pipeline materials	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to use welded steel pipe everywhere except for Reaches 2 through 6 of SHC which uses HDPE.	
Description of Alternative Concept:	
The alternative concept is to bid alternative pipe materials anytime welded steel pipe is being proposed.	
Rationale for Change:	
This alternative gives the District the opportunity to decide between welded steel pipe and the alternative pipe material based on cost savings.	

Value Improvement | **Cost Savings Summary**

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources		
☐ Increased	☐ Increased	First Cost Savings:	$99,350,000
☒ Maintained	☐ Maintained	O&M Savings:	$0
☐ Decreased	☒ Decreased	Life Cycle Cost Savings:	$99,350,000

Advantages/Disadvantages

Alternative No.: FC-33

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Gives owner flexibility with both cost and schedule when awarding the project based on alternative pipeline material bids • Adds pricing competitiveness across material types • Risk mitigation to protect against supply chain disruptions or price volatility in any single material market	• None apparent

Discussion

Alternative No.: FC-33

Description of original concept affected by this change:

The original concept shows welded steel pipe as the primary pipe material on the conveyance pipeline portion of the project.

Issue of concern to the team:

The Value Team believes there are other pipeline materials that could serve the same function while significantly reducing the resources needed for material and construction installation.

Description of alternative concept:

The alternative concept is to bid alternative pipe materials when advertising the project. The District can award the base bid while allowing for alternatives to be added and/or removed from the construction contract. The example given in the cost estimate specifically shows an alternative for HDPE pipe. It was assumed that anything larger than 60 inches would stay welded steel pipe, though Steinaker Service Canal near Vernal, Utah recently completed an installation of a 78-inch HDPE pipeline. It was also assumed that anything above 200 PSI would remain welded steel pipe.

Benefit of making the change:

One of the major benefits of bidding alternative pipe materials is the competition among different pipe materials, which can drive costs down across the board for pipe materials. Another great benefit is the flexibility and options with both cost and schedule that it gives to the District when awarding the project.

Examples where this has been used:

The District did this for the most recent central water project (CWP) well drilling for both well screen type and gravel pack type.

Key steps to implementing the idea:

- Identify alternative pipeline materials at various sizes (i.e., HDPE, DI, PVC).
- Update the bid form to include bid alternative pipeline materials.

Sketch

Alternative No.: FC-33

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Welded Steel Pipeline Installation

Sketch

Alternative No.: FC-33

☐ **ORIGINAL** ☒ **ALTERNATIVE**

HDPE Pipeline Installation

Construction Cost Estimate

Alternative No.: FC-33

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
60 IN welded steel pipe	LF	1,487.00	27,260	$40,535,620		
48 IN welded steel pipe	LF	1,172.00	38,700	$45,356,400		
36 IN welded steel pipe	LF	741.00	27,800	$20,599,800		
24 IN welded steel pipe	LF	588.00	38,300	$22,520,400		
20 IN welded steel pipe	LF	376.00	28,300	$10,640,800		
12 IN welded steel pipe	LF	303.00	27,920	$8,459,760		
60 IN HDPE	LF	950.00			27,260	$25,897,000
48 IN HDPE	LF	748.77			38,700	$28,977,561
36 IN HDPE	LF	473.28			27,800	$13,157,246
24 IN HDPE	LF	375.70			38,300	$14,389,437
20 IN HDPE	LF	240.33			28,300	$6,801,430
12 IN HDPE	LF	194.09			27,920	$5,418,909
Total Markup	85.80%			$127,080,765		$81,202,478
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$275,194,000		$175,844,000
NET SAVINGS						$99,350,000

IMPROVE CONVEYANCE

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-05
Expedite geotechnical investigation in areas with potential landslide or seismic activity	
Discussion	

The geotechnical and seismic investigations for the project should be expedited to characterize the subsurface conditions in areas of potential landslide and seismic activity.

The Value Team was made aware of an active slide area around Phase 1. The slide was identified during the design of the irrigation pipeline that runs along Powerhouse Road. The current alignment of Phase 1 SHC enclosure runs near the toe of the slide.

The geotechnical investigation should focus on this pipeline alignment to locate the interface of the slide and characterize its depth and potential movement. Continuous sampling should be conducted through the slide interface to determine the effective cohesion angle or angle of repose of the slide face. Depending on the results, the revetments can be designed to protect the pipeline from a future slide. These revetments might include sheetpile, grade beam, or drilled shaft slope protection.

If the slide is significantly deep, then the best option may be to move the pipe alignment away from the slide across the river, similar to the Utah Lake System (ULS) pipeline.

The expedited geotechnical investigation should be conducted on the remainder of the pipeline alignment as well. The investigation and testing should be used to determine the suitability of the excavated material for pipeline backfill to limit haul off.

The geotechnical and seismic investigations will also identify any areas of perched water that will require construction dewatering activities. This water should be tested when encountered and the results provided to the bidders in order for them to assign appropriate construction dewatering costs.

Sketch

Alternative No.: IC-05

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Approximate Known Slide Area

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-13
Account for the construction labor site access delays within the productivity factor within the cost estimate	
Discussion	

This Design Suggestion is related to the accountability that must be taken into consideration when dealing with site access delay and how they may impact productivity factors.

The conveyance site will occur over a large span of area in both difficult weather conditions, as well as difficult access points. Craft labor may account for some of that access time as being 'work time'.

The following consequences should be considered:

1. The productivity tables will be less efficient than otherwise would be considered for the installation of a similar material type in normal accessible conditions.
2. The labor rate for a day's work may be impacted as overtime could be triggered on a daily basis resulting in a higher cost per unit of productivity than originally anticipated.

Should union craft labor or non-union labor be used, site accessibility may be factored into the cost estimating process.

With a full analysis of expected labor hours, as well as schedule and access, the estimator will be in a confident position to then apply a factor to the labor productivity or general expected overtime wages to account for these items.

These should either be fully accounted for and expressed within the estimate figures, or if excluded, then they should be expressed in the basis of estimate what the potential outlay to the owner may be during the span of the project. Projects of this size and scope can see significant cost impact for unaccounted labor due to accessibility concerns and potential overtime outlay.

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-15
Coordinate with other large utility owners	
Discussion	

Large projects of this size have a limited number of contractors who can construct such a project. There are currently several large utility type projects throughout the state of Utah. It is anticipated that there will be several large new utility projects in the foreseeable future that will overlap with the Plan Formulation Project. With a limited contracting pool, if these large utility projects are bid at the same time, then it could further limit the contracting pool as contractors may not want to bid two large projects at the same time to limit their exposure to risk. The District currently meets with the other three large water districts in Utah (Weber Basin, Jordan Valley, and Washington County) on a regular basis to coordinate on a variety of different topics. The Value Team suggests adding to the coordination agenda a discussion of upcoming projects and try to strategically place when these projects are anticipated to bid to ensure as many qualified contractors bid the project as possible. Furthermore, it could prove even more beneficial if this same type of coordination is done with other large utilities throughout the state (i.e., water treatment plants and large municipalities).

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-19
Add escalation clauses to the construction contract to account for unexpected price increases during construction	
Discussion	

This Design Suggestion is to account for and include escalation clauses to the construction contract due to unexpected price increases (or decreases) during construction.

The Bureau of Labor Statistics, the Bureau of Economic Analysis, and the Federal Acquisition Regulation all produce historical and projected escalation percentages. The construction contract should be baselined with an expected escalation percentage. The escalation percentage should then be reviewed annually to ensure that purchasing costs are meeting escalation projects defined in the construction contract. Should actual escalation exceed contractually defined escalation by a reasonable margin, this would trigger a claim by the contractor against the owner. Conversely, should escalation targets be lower than expected, this could trigger a credit to the owner.

Both the owner and the contractor should come together with mutually beneficial language to protect interests and share risk among both parties to allow for a successful delivery of the project.

From the owner's perspective, the preconstruction cost estimate should consider an escalation factor to account for project costs. Escalation is typically computed to the mid-point of the expected construction schedule.

When the owner is willing to share the risk of escalation with the contractor, the contractor should be able to reduce the amount of risk contingency reserve within their bid prices. This should reduce the total construction cost if escalation remains at estimated levels.

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-23
Increase the cloud seeding operations to increase falling rain or snow	
Discussion	

Although cloud seeding is not a part of this project, the use of cloud seeding has been gaining traction in the upper Colorado Basin and Great Basin area as this region of the country experiences persistent drought conditions.

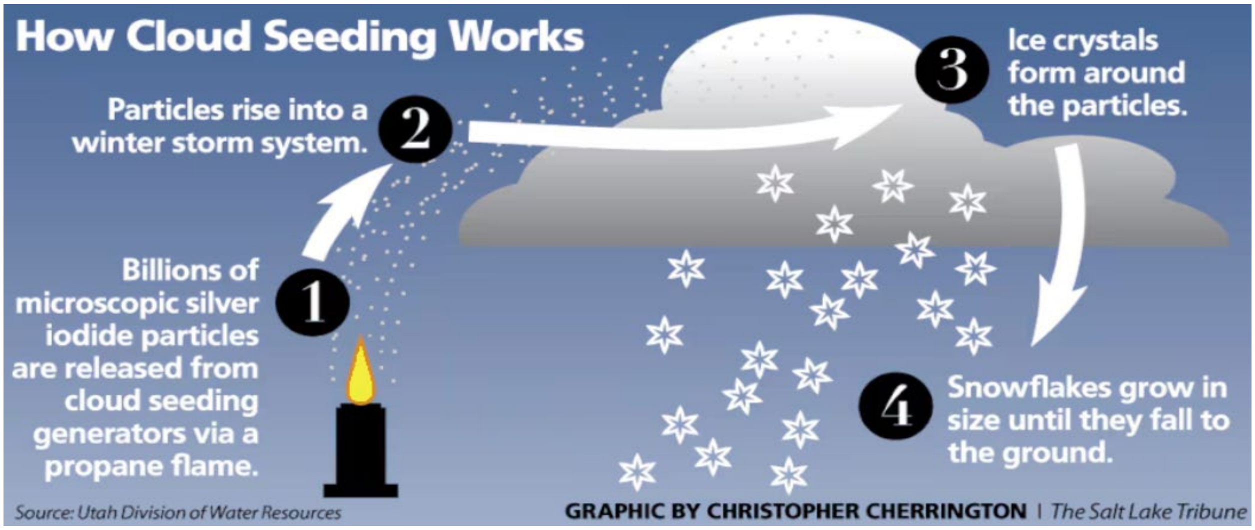
The Value Team assumes cloud seeding deserves consideration as part of the overall strategy to capture additional water to be used for agricultural and M&I purposes. The Value Team understands the District contributes resources to the overall Utah cloud seeding program and suggests they continue to support this program. The program is relatively inexpensive with funding being provided by state agencies such as the Utah Division of Water Resources, private entities such as ski resorts, and the federal government.

Utah has become a major source of cloud seeding efforts with funds also being contributed by the lower Colorado Basin states of Nevada, Arizona, and California.

Statistics from 2018 indicated that Utah increased its snowfall by 12%, or 186,000 acre-feet, due to cloud seeding.

Alternative No.: IC-23

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Schematic Showing Cloud Seeding Process

Sketch

Alternative No.: IC-23

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Typical Cloud Seeding Propane Generator that is used to Introduce Silver Iodide Particles into Approaching Storms to Increase Snowfall at High Altitudes

Alternative No.: IC-23

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Aircraft Flying into Clouds Carrying Flares Filled with Silver Iodide for Introduction into Clouds

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	IC-25
Assign a program manager to oversee all design and construction activities	
Discussion	

The Plan Formulation Project is a large multi-operational project that includes three main project elements with distinct design and construction requirements. While the three elements will be separated and developed independently, each element has significant interaction with the others.

It is recommended the District engage a program manager that will oversee all design and construction activities. This allows each program element to remain informed of the other elements and to ensure the connections and overlaps are coordinated.

The program manager would function as a single point of contact and interact between the District, Jacobs, and contractors. The program manager would be responsible for monitoring and managing the project schedule and budget to ensure the project runs economically and on schedule. Having this oversight will allow project issues to be identified early and addressed before they evolve into major problems. The program manager would also monitor the resources associated with the project and add or subtract resources as necessary to deliver the project within scope, on budget, and on schedule.

The decision will need to be made whether the program manager is a District employee or a third-party consultant. The advantages of an in-house District employee include:

- Good understanding of District requirements and constraints
- May be more accepted by the designer since the program manager is not a competitor
- Established relationship with District personnel
- Can make decisions on behalf of the District or at least has a direct connection to the District decision makers

Disadvantages of having the in-house program manager include:

- Requires a full-time person that might impact District staffing and operations
- May not have experience from other locations or regions that would benefit the project

Advantages for a third-party consultant include:

- Can be dedicated to the project without impact to District staffing and operations
- Potentially has a broader depth of experience with the various project elements from other locations or regions that would benefit the project
- Access to additional staff and resources without impacting District staffing and operations

Disadvantages of a third-party program manager include:

- May be viewed as a competitor to the design which may result in a less than favorable relationship
- Will not be able to make decisions for the District

REDUCE LOSSES

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-02
Use HDPE pipe in lieu of welded steel pipe for Reach 1	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to use a 60-inch diameter welded steel pipe (WSP) that is mortar lined and tape wrapped with mortar protective coating as the raw water supply pipeline in the SHC Reach 1. The total length of this pipeline reach is 27,260 feet.	
Description of Alternative Concept:	
The alternative concept is to use heavy duty DR-11 HDPE pipe in lieu of the welded steel pipe that is presently shown in the design drawings. (Note that "DR" refers to the dimension ratio, which is the pipe average outside diameter divided by the minimum wall thickness.)	
Rationale for Change:	
The main rationale for this change is that the HDPE will allow the Reach 1 raw water pipeline to be constructed in a shorter period and for less cost. The use of HDPE pipe also eliminates the corrosion issue that must be mitigated when welded steel pipe is used.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$27,198,000
O&M Savings:	$0
Life Cycle Cost Savings:	$27,198,000

Advantages/Disadvantages

Alternative No.: RL-02

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces construction duration • HDPE fusion process does not require highly skilled craft workers, unlike WSP installation and welded joint testing, which requires certified welders • HDPE pipe and fusion equipment is readily available • Eliminates corrosion concerns • Increases flexibility and sustainability to endure landslide or seismic events	• Large diameter HDPE pipe has not been used to date by the District for water supply projects • Large size of fusion machine will require additional planning and staging for its use

Discussion

Alternative No.: RL-02

Description of original concept affected by this change:

The original concept is to use 60-inch diameter WSP that is mortar lined and mortar coated as the raw water supply pipeline in the SHC Reach 1. The total length of this pipeline reach is 27,260 feet.

Issue of concern to the team:

The current preliminary schedule indicates that the SHC Reach 1 construction window is approximately1-year, from October 2026 to September 2027. The total length of 60-inch diameter pipe in Reach 1 is 27,260 feet. The Value Team assumes this schedule may be difficult to meet using WSP. The HDPE option has the potential to be installed faster than welded steel pipe.

Description of alternative concept:

The alternative concept is to use heavy duty DR-11 HDPE pipe in lieu of the WSP that is presently shown in the design drawings.

Benefit of making the change:

There are several benefits of making this proposed change. The Value Team assumes the schedule savings will be very important. Other benefits include potential cost savings and elimination of welding which requires highly skilled certified welders, as well as more flexibility to withstand seismic events.

Additional explanation:

As presented by the Design Team during the In-Brief presentation, the HDPE pipe has only been used within the raw water pipeline where pressures are low, and welded steel pipe is preferred where pressures are high. For the Reach 1 HDPE alternative, the Value Team has proposed using HDPE pipe with a DR-11. The DR-11 pipe is rated for 200 PSI. Further refinement of the pipeline design may allow the use of pipes with higher DR ratios and thinner wall thickness as listed below if pressures are lower than the 200 PSI that has been assumed:

DR 13.5 – 160 PSI

DR-15.5 – 140 PSI

DR-17.0 – 125 PSI

Examples where this has been used:

Steinaker Service Canal – Steinaker Reservoir north of Vernal, Utah.

HDPE pipe has also been used extensively for water supply systems within the United States and throughout the world.

Key steps to implementing the idea:

- Confirm and refine pipeline pressure anticipated within all sections of Reach 1 of the raw water line.
- Confirm that pipeline pressure is less than or equal to 200 PSI.
- Contact HDPE Suppliers to confirm availability and lead time for HDPE pipe delivery.
- Confirm with HDPE supplier the space requirement for fusion machine.
- If this alternative is accepted, then revise design drawings and specifications.

Sketch

Alternative No.: RL-02

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Typical WSP for Water Transmission

Sketch

Alternative No.: RL-02

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Typical WSP – Mortar Coated and Mortar Lined

Sketch

Alternative No.: RL-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Large Diameter HDPE Pipe with Fusion Machine

Sketch

Alternative No.: RL-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Large Diameter HDPE Pipe Installation Example

Calculations

Alternative No.: RL-02

☐ **ORIGINAL** ☒ **ALTERNATIVE**

The original concept calls for the use of WSP raw water pipeline in Reach 1.

The length of WSP to be replaced with HDPE from the TM7 Cost Estimate is 27,260 FT.

Construction Cost Estimate

Alternative No.: RL-02

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Furnish and install 60 IN WSP	LF	1,487.00	27,260	$40,535,620		
Furnish 60 IN and install diameter HDPE pipe	LF	950.00			27,260	$25,897,000
Total Markup	85.50%			$34,779,562		$22,219,626
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$75,315,000		$48,117,000
NET SAVINGS						$27,198,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-03
Use HDPE pipes in lieu of welded steel pipes for finished water pipeline that is less than or equal to 60 inches	
Challenges Standard or Criteria:	Yes ☒ No ☐
The District standard for finished water pipelines is WSP.	
Description of Original Concept:	
The original concept is to use WSP for all finished water pipelines.	
Description of Alternative Concept:	
The alternative concept is to use HDPE pipes for all finished water pipes that have a diameter less than or equal to 60 inches.	
Rationale for Change:	
It is standard practice for numerous water districts across the country to use HDPE piping for finished water pipelines with diameters less than or equal to 60 inches. The installation of HDPE pipes can be completed more quickly than WSP which reduces the project schedule, and HDPE does not require cathodic protection.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	$72,151,000
Function	Resources		
☐ Increased	☐ Increased	O&M Savings:	$0
☒ Maintained	☐ Maintained		
☐ Decreased	☒ Decreased	Life Cycle Cost Savings:	$72,151,000

Advantages/Disadvantages

Alternative No.: RL-03

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces construction time for the pipeline • HDPE fusing of joints is significantly faster than welded joints on steel pipe • HDPE fused joints require significantly less quality control than welded joints • HDPE is rated for the pressures in the finished water pipeline • Requires less skilled labor (welders, etc.) to construct • Eliminates cathodic protection system • Increases flexibility and resiliency of pipes where ground movement is of concern • Eliminates need for controlled low strength material (CLSM)	• HDPE pipe is not typically used by the District for finished water pipelines

Discussion

Alternative No.: RL-03

Description of original concept affected by this change:

The original concept is to construct the entire finished water pipeline using WSP.

Issue of concern to the team:

The Value Team was concerned about the time required for WSP construction and the number of skilled laborers, in particular welders, that is required to complete the construction.

Description of alternative concept:

The alternative concept is to construct the finished water pipeline using HDPE pipes. The bid documents would provide a bid alternative of HDPE to the WSP.

Benefit of making the change:

The benefit of making this change to HDPE is that it reduces the construction time, reduces the quantity of skilled laborers required, eliminates the cathodic protection system and CLSM, and increases resiliency in areas where ground movement is a concern due to its flexibility. Also, HDPE is used by other water districts for finished water pipelines.

Examples where this has been used:

Numerous water districts around the country use HDPE for finished water systems.
The Steinaker Service Canal enclosure in 2023 near Vernal, UT used 78-inch HDPE.

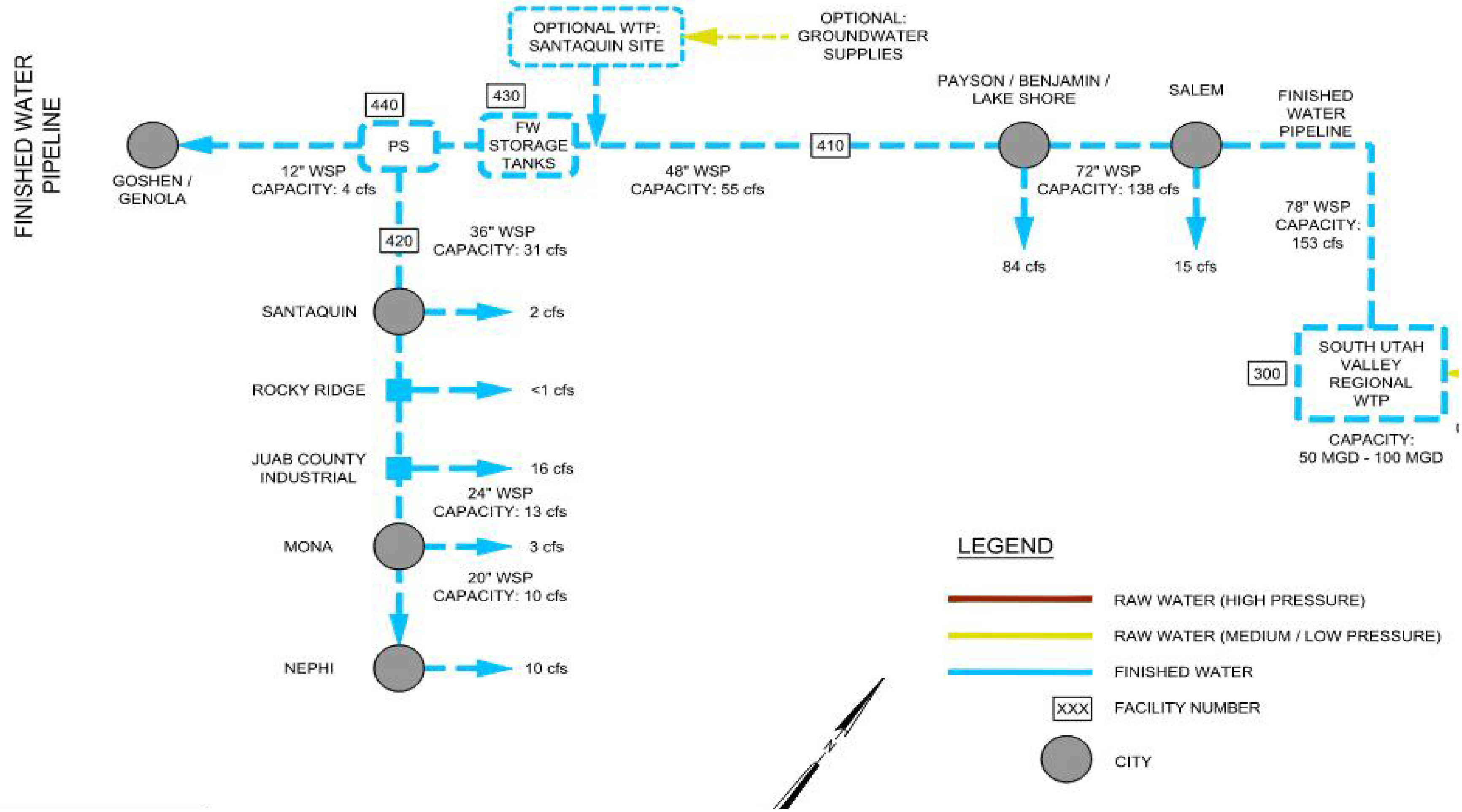
Key steps to implementing the idea:

At this stage of the design, the implementation of this alternative concept would be to allow the use of HDPE and provide a bid alternative to the WSP. The District then makes the final decision on welded steel pipe versus HDPE based on cost savings. Connection details have not been developed yet. These would need to be developed in subsequent phases of the project.

Sketch

Alternative No.: RL-03

☒ **ORIGINAL** ☐ **ALTERNATIVE**

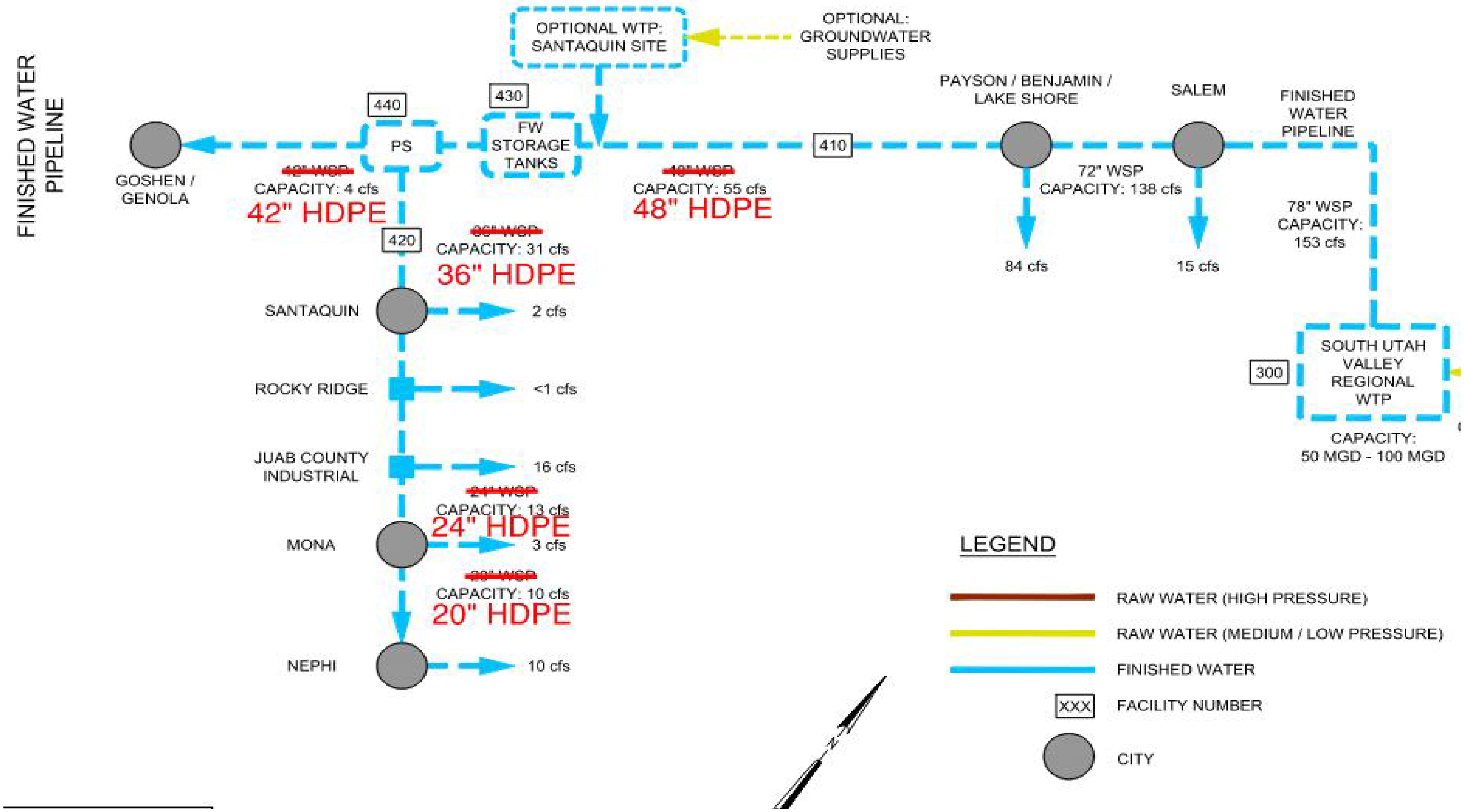


Schematic Showing Welded Steel Pipe Lengths for Finished Water Pipe System

Sketch

Alternative No.: RL-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Schematic Showing Alternative HDPE Pipe

Alternative No.: RL-03

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Original concept welded pipe lengths taken from the project estimate:

Finished Water Steel Pipe Lengths

78 IN	7,200.00	LF
72 IN	21,150.00	LF
48 IN	38,700.00	LF
36 IN	27,800.00	LF
24 IN	38,300.00	LF
20 IN	28,300.00	LF
12 IN	27,920.00	LF

Raw Water Steel Pipe Lengths

60 IN	27,260.00	LF	Phase 1
60 IN	7,610.00	LF	ULS to WTP

Construction Cost Estimate

Alternative No.: RL-03

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
48 IN WSP	LF	1,172.00	38,700	$45,356,400		
36 IN WSP	LF	741.00	27,800	$20,599,800		
24 IN WSP	LF	588.00	38,300	$22,520,400		
20 IN WSP	LF	376.00	28,300	$10,640,800		
12 IN WSP	LF	303.00	27,920	$8,459,760		
48 IN HDPE pipe	LF	748.77			38,700	$28,977,399
36 IN HDPE pipe	LF	473.28			27,800	$13,157,184
24 IN HDPE pipe	LF	375.70			38,300	$14,389,310
20 IN HDPE pipe	LF	240.33			28,300	$6,801,339
12 IN HDPE pipe	LF	194.09			27,920	$5,418,993
Total Markup	85.80%			$92,301,203		$58,982,545
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$199,878,000		$127,727,000
NET SAVINGS						$72,151,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-11
Use earthquake resistant ductile iron pipe at select fault zones	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to construct Reach 1 of the SHC raw water pipeline with WSP and Reach 2 through 6 with HDPE pipe. The concept for the finished water pipeline calls for the material to be welded steel pipe.	
Description of Alternative Concept:	
The alternative concept is to use earthquake resistant ductile iron pipe (ERDIP) in lieu of welded steel pipe or HDPE pipe only in areas where faults or landslide risks have been identified.	
Rationale for Change:	
There are several known, mapped quaternary faults located along the alignment of the raw water pipeline as well as the finished water pipeline. The purpose of this proposed change is to mitigate the potential for pipe damage and service disruption due to seismic events, including landslides.	

Value Improvement		Cost Savings Summary	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	($15,609,000)
Function	Resources	O&M Savings:	$0
☒ Increased	☒ Increased	Life Cycle Cost Savings:	($15,609,000)
☐ Maintained	☐ Maintained		
☐ Decreased	☐ Decreased		

Advantages/Disadvantages

Alternative No.: RL-11

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Increases flexibility of pipes • Increases movement resistance • Less dependent on geotechnical investigation as the accurate depth of fault slip planes is less critical • Joints work like a chain, so that each one can move without the whole system failing • Successfully used in areas of high seismic activity, including California and Japan • Pipe sizes are available up to 104 inches in diameter	• Limited number of manufacturers in United States • May need to be procured from a foreign source • Potential for long manufacturing and delivery time • The type of pipe has not presently been used by projects within the District's jurisdiction • Contractor training required to install this specialty pipe

Discussion

Alternative No.: RL-11

Description of original concept affected by this change:

The original concept is to construct Reach 1 of the SHC raw water pipeline with WSP and Reach 2 through 6 with HDPE pipe. The concept for the finished water pipeline is to be constructed with only WSP.

Issue of concern to the team:

There are several known, mapped quaternary faults located along the alignment of the raw water pipeline as well as the finished water pipeline. The presence of these mapped faults poses a risk to the integrity and operation of the water supply pipelines.

Description of alternative concept:

The alternative concept is to use ERDIP in lieu of WSP or HDPE pipe only in areas where faults or landslide risks have been identified.

Benefit of making the change:

The purpose of this proposed change is to mitigate the potential for pipe damage and service disruption due to seismic events, including landslides. The ERDIP works as a flexible system that can withstand major ground displacements caused by earthquakes and landslides.

Additional explanation:

ERDIP has been used successfully in earthquake prone areas throughout California and other parts of the world. Although this pipe system is expensive compared to conventional steel or HDPE pipe, the increased cost can be mitigated by only using the ERDIP in select areas where faults are known to exist.

If the alternative concept to use ERDIP in fault zones does not move forward, then the Value Team recommends considering HDPE pipe for use at known fault locations. Although not as flexible as the ERDIP system, HDPE pipe is considerably more flexible than WSP.

Examples where this has been used:

The Santa Clara Valley Water District in San Jose, California, has used ERDIP for water supply projects within its jurisdiction. ERDIP has been used extensively in Japan in earthquake prone areas.

Key steps to implementing the idea:

- Expedite and complete a geotechnical and seismic report for this project.
- Focus on the known faults and landslide location(s) or potential landslide location(s) and consider using ERDIP in these areas only.
- Meet with ERDIP manufacturers to discuss the use and delivery lead time of ERDIP.
- If this alternative concept moves forward, then the Design Team will update drawings and specifications as necessary.

Sketch

Alternative No.: RL-11

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Typical Large Diameter Welded Steel Pipe

Sketch

Alternative No.: RL-11

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Demonstration of Earthquake Resistant Ductile Iron Pile (ERDIP) Hoisted with Crane (Kubota)

Sketch

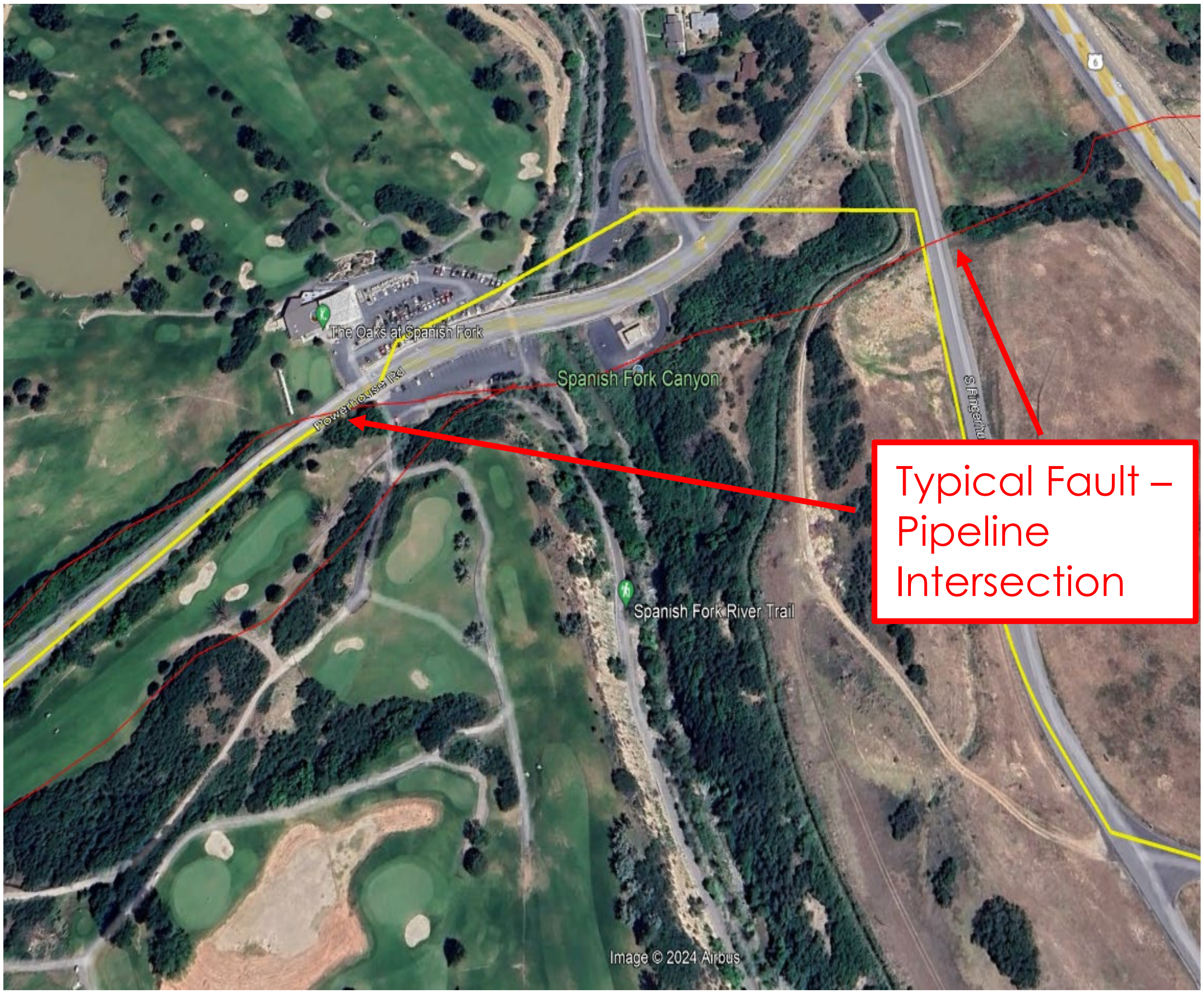
Alternative No.: RL-11

☐ **ORIGINAL** ☒ **ALTERNATIVE**

ERDIP Installation in Earthquake Prone Santa Clara Valley, California

Alternative No.: RL-11

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Typical Fault – Pipeline Intersection

Alternative No.: RL-11

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Approximate location of faults:

60 IN diameter raw water ERCIP:

134+00 – 136+00	= 200 FT
144+00 – 146+00	= 200 FT
170+00 – 172+00	= 200 FT
200+00 – 203+00	= 300 FT
228+00 – 230+00	= 200 FT
268+00 – 280+00	= 1,200 FT
302+00 – 304+00	= 200 FT
Total 60 IN	**= 2,500 FT**

42 IN diameter raw water ERCIP:

660+00 – 662+00	= 200 FT
706+00 – 708+00	= 200 FT
758+00 – 760+00	= 200 FT
900+00 – 902+00	= 200 FT
Total 42 IN	**= 800 FT**

72 IN diameter finished water ERCIP:

2,286+00 – 2,288+00 = 200 FT

48 IN diameter finished water ERCIP:

2,336+00 – 2,338+00	= 200 FT
2,478+00 – 2,480+00	= 200 FT
Total 48 IN	**= 400 FT**

Construction Cost Estimate

Alternative No.: RL-11

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Furnish and install 60 IN WSP (raw water)	LF	1,168.00	2,500	$2,920,000		
Furnish and install 42 IN WSP (raw water)	LF	685.22	800	$548,176		
Furnish and install 78 IN WSP (finished water)	LF	1,487.00	200	$297,400		
Furnish and install 48 IN WSP (finished water)	LF	775.13	400	$310,052		
Furnish and install 60 IN ERDIP (raw water)	LF	3,576.00			2,500	$8,940,000
Furnish and install 42 IN ERDIP (raw water)	LF	2,097.00			800	$1,677,600
Furnish and install 78 IN ERDIP (finished water)	LF	4,553.00			200	$910,600
Furnish and install 48 IN ERDIP (finished water)	LF	2,372.00			400	$948,800
Total Markup	85.50%			$3,495,889		$10,705,266
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$7,573,000		$23,182,000
NET SAVINGS						($15,609,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-25
Use 8-inch thick concrete walls and slabs for turnouts along Strawberry Highline Canal	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept shows 12-inch thick concrete walls and slabs for turnouts along SHC.	
Description of Alternative Concept:	
The alternative concept proposes using 8-inch thick concrete walls and slabs for turnouts.	
Rationale for Change:	
This will optimize cast-in-place turnout boxes along SHC.	

Value Improvement	**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$	First Cost Savings:	$624,000
Function: ☐ Increased ☒ Maintained ☐ Decreased	O&M Savings:	$0
Resources: ☐ Increased ☐ Maintained ☒ Decreased	Life Cycle Cost Savings:	$624,000

Advantages/Disadvantages

Alternative No.: RL-25

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Requires less concrete • Increases curing speed, which could speed up the construction process • Reduces excavation and/or increased internal space	• May need to adjust design for deeper structures

Discussion

Alternative No.: RL-25

Description of original concept affected by this change:

The original concept shows 12-inch thick concrete walls, slabs, and roof decks for each of the turnouts along the SHC.

Issue of concern to the team:

Considering the turnouts are all within the SHC easement and that it is likely a pedestrian trail will be constructed on top of the canal pipeline, the Value Team suggests only using 8-inch concrete for the turnouts.

Description of alternative concept:

The alternative concept is to use 8-inch thick concrete walls, slabs, and roof decks for each of the turnouts along the SHC.

Benefit of making the change:

The major benefits of using 8-inch thick concrete include:

1. Material cost savings: less concrete will be required, reducing material costs.
2. Reduced excavation: less excavation may be needed for the thinner structures, saving time and costs.
3. Faster curing time: thinner concrete sections generally cure faster, which could speed up the construction process.
4. More internal space: thinner walls provide slightly more internal space for equipment and maintenance access.

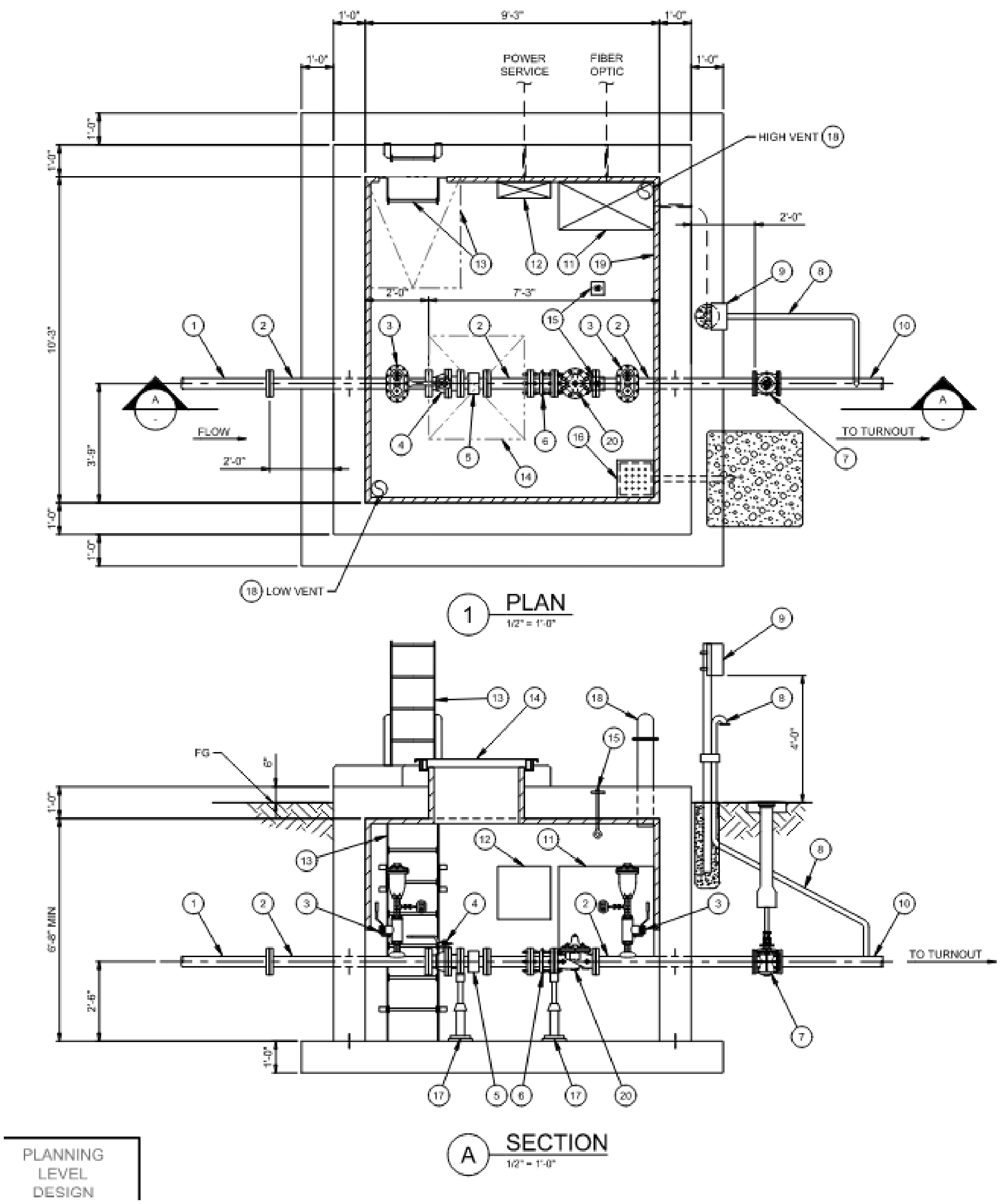
Examples where this has been used:

Vaults of this depth are routinely less than 12 inches thick.

Sketch

Alternative No.: RL-25

☒ **ORIGINAL** ☐ **ALTERNATIVE**

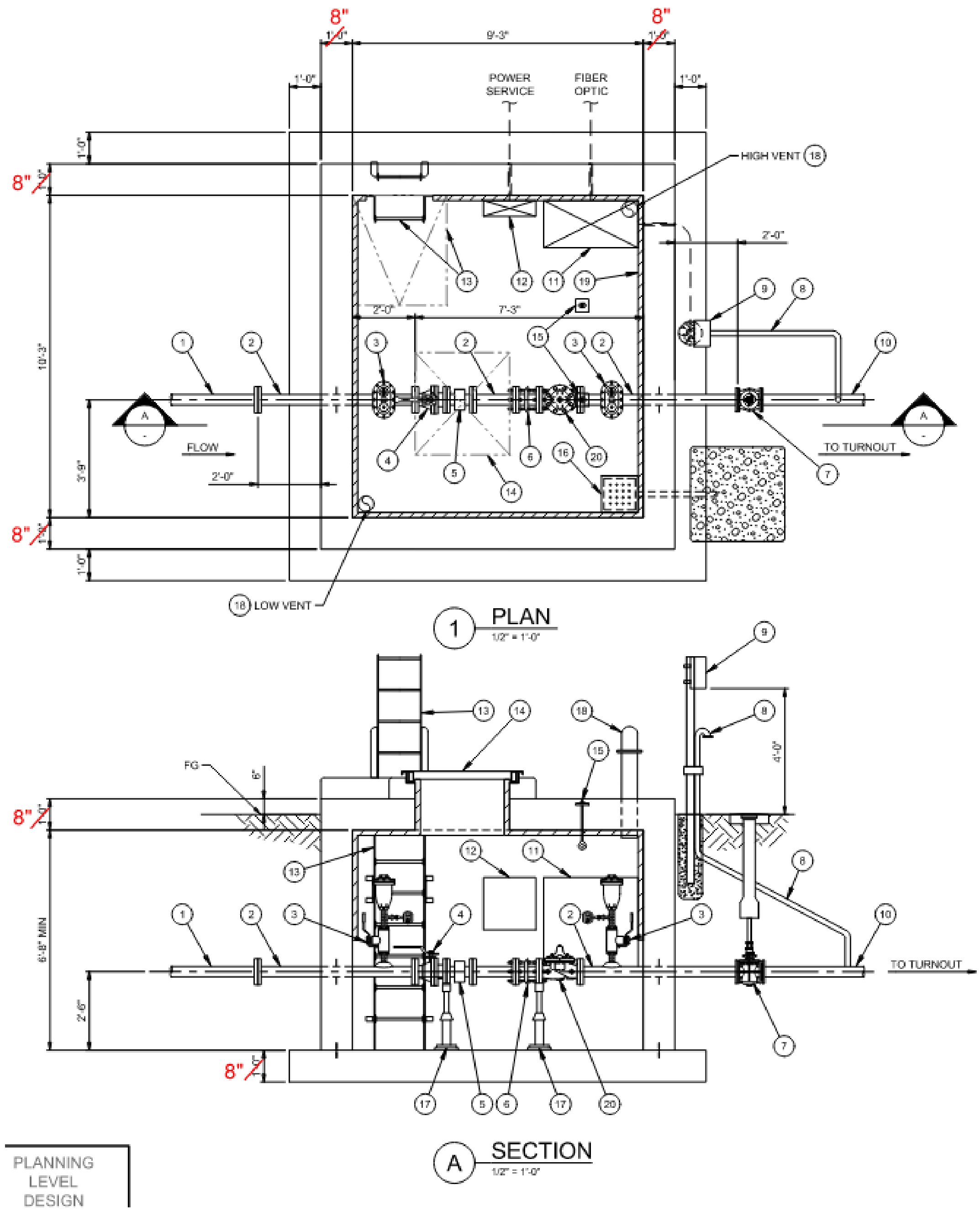


12-Inch Thick Walls, Slabs, and Roof Deck

Sketch

Alternative No.: RL-25

☐ **ORIGINAL** ☒ **ALTERNATIVE**



8-Inch Thick Walls, Slabs, and Roof Deck

Construction Cost Estimate

Alternative No.: RL-25

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Total	Alternative Concept (Additions) Qty	Total
12 IN thick wall/slab SHC turnout	CY	700.00	1,440	$1,008,000		
8 IN thick wall/slab SHC turnout	CY	700.00			960	$672,000
Total Markup	85.80%			$864,864		$576,576
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$1,873,000		$1,249,000
NET SAVINGS						$624,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-28
Use select backfill in lieu of trench zone controlled low strength material	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to use controlled low strength material (CLSM) for pipe backfill.	
Description of Alternative Concept:	
The alternative concept is to use select backfill in lieu of the CLSM for pipe backfill.	
Rationale for Change:	
While the CLSM has advantages regarding speed of placement and forgiveness in placement, there is a great deal of this material required for the project. The availability of the large volume of CLSM material for the project is unknown.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$34,729,000
O&M Savings:	$0
Life Cycle Cost Savings:	$34,729,000

Advantages/Disadvantages

Alternative No.: RL-28

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Select backfill material is readily available from the District landfills • Eliminates the need for potential batch plant • Uses the same backfill as the HDPE pipelines • Minimizes haul-off of excavated material and native pipeline is suitable for backfill	• Select backfill will take longer to construct • District has a strong preference for CLSM • May be most practical for pipe diameters 48 inches or less • Care must be taken in placement to not compromise the cathodic protection of the steel pipe

Discussion

Alternative No.: RL-28

Description of original concept affected by this change:

The original concept is to use CLSM for the backfill of the WSP.

Issue of concern to the team:

The large quantity of the CLSM required for the project may not be available with other pipeline projects being constructed in the region. The haul distances from existing batch plants may preclude its use without the construction of temporary batch plants.

Description of alternative concept:

The alternative concept is to use conventional select backfill for the WSP.

Benefit of making the change:

The large quantity of CLSM required and the long haul distances to some of the pipelines may preclude the use of CLSM.

Additional explanation:

It is understood by the Value Team that the District has a strong preference for CLSM backfill for welded steel pipelines. The advantages of CLSM include faster placement, no compaction requirements, no specialized equipment, etc.

The large quantity of CLSM backfill required for the project may not be available when needed due to other construction in the region and without the construction of temporary batch plants for the project. Construction of batch plants will drive up the cost of the material.

Long haul distances from existing batch plants may preclude the use of the material due to placement time requirements. The placement time limitations may be overcome with the construction of temporary batch plants closer to the pipeline location.

Conventional backfill is currently specified for the HDPE pipelines and would be a logical extension for the welded steel pipe. Placement of conventional backfill materials requires care near the pipe in order to protect the pipes cathodic protection.

The use of excavated material during pipeline construction should be evaluated for use as pipe backfill. The use of the excavated material would reduce the haul-off quantities and cost and would reduce the construction duration.

The use of conventional backfill could also be limited to pipe diameters of 48 inches or less due to concerns of compaction and movement of the larger pipe diameters.

Examples where this has been used:

Conventional/select backfill is routinely used for pipelines across the United States.

Key steps to implementing the idea:

Determine if CLSM is a practical choice:

- Identify batch plant locations.
- Determine haul time to the pipeline sites, and determine if CLSM placement times can be met.
- Identify other large project pipeline projects in the region that will compete for the CLSM supply during the construction period.
- Determine if temporary batch plants will be required to produce the CLSM.

Determine if conventional/select backfill is a practical choice:

- Determine labor and equipment requirements to make select fill material at quarries.
- Determine haul distances to pipeline sites.
- Determine backfill placement time and effort to develop difference in cost to placing CLSM.

Determine if on-site soil can be used for pipe backfill:

- Based on the forthcoming geotechnical investigation, determine the suitability of the excavated pipeline material for backfill.
- Determine the backfill time, labor, and equipment required for using the on-site soil for backfill.
- Determine the reduction on haul-off of excavated material.

Based on the three analyses, determine the most efficient and economical backfill option for the pipelines.

Sketch

Alternative No.: RL-28

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Photo of CLSM Backfill

Sketch

Alternative No.: RL-28

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Conventional Pipeline Backfill

Calculations

Alternative No.: RL-28

☒ **ORIGINAL** ☐ **ALTERNATIVE**

Based on the cost estimate, the CLSM quantity is 148,350 CY.

SVS

Construction Cost Estimate

Alternative No.: RL-28

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
CLSM pipe encasement	CY	160.00	148,350	$23,736,000		
Select backfill	CY	34.00			148,350	$5,043,900
Total Markup	85.80%			$20,365,488		$4,327,666
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$44,101,000		$9,372,000
NET SAVINGS						$34,729,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	RL-33
Replace the isolation ball valves with butterfly valves	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to use ball valves as isolation valves at each of the turnouts along the SHC.	
Description of Alternative Concept:	
Th alternative concept is to use double offset butterfly valves for isolation valves at each of the turnouts along the SHC for Reaches 2 through 6.	
Rationale for Change:	
A butterfly valve is a great option for Reaches 2 through 6 as these reaches are much lower pressures.	

Value Improvement	**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$	First Cost Savings:	$3,090,000
Function: ☐ Increased ☒ Maintained ☐ Decreased	O&M Savings:	$0
Resources: ☐ Increased ☐ Maintained ☒ Decreased	Life Cycle Cost Savings:	$3,090,000

Advantages/Disadvantages

Alternative No.: RL-33

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Shortens lead time • Deceases the size of the turnout structures • Easier to manage and install because they weigh less	• May not provide as tight a seal over time, however, irrigation turnouts may not need to be watertight • Potential for more maintenance as the seat and seal is easier to be damaged from large particles in the water

Alternative No.: RL-33

Description of original concept affected by this change:

The original concept is to use ball valves for isolation valves at each of the turnouts along the SHC.

Issue of concern to the team:

A double offset butterfly valve can serve the same function as a ball valve while substantially reducing the necessary resources. The Value Team acknowledges a ball valve is a great option, especially if the water quality in the open canal were to stay the same after piping the canal. However, piping the canal and ensuring no Spanish Fork River water will enter the canal pipeline greatly improves the water quality. With the water quality being significantly improved, a double offset butterfly valve can provide the same isolation function, especially at the lower pressures found in Reaches 2 through 6.

Description of alternative concept:

The alternative concept replaces the isolation ball valves with double offset butterfly valves for 6-inch and larger turnouts along Reaches 2 through 6. Double offset butterfly valves are not made in anything smaller than 6 inches. Reaches 2 through 6 range in pressures from 20 PSI to 55 PSI, which a butterfly valve should easily be able to handle. Furthermore, because water quality in the canal will be improved with this project, the risk of debris in the water damaging the seat of the butterfly valve is significantly reduced.

Benefit of making the change:

There are several benefits with using a butterfly valve rather than a ball valve. First, butterfly valves are much more space efficient, which can potentially lead to the ability to decrease the size of the turnout boxes. Second, butterfly valves are easier to manage and install, especially in larger sizes because they are lightweight in comparison to ball valves. Third, butterfly valves are more cost effective, especially in larger sizes.

Examples where this has been used:

The District used a 66-inch double offset butterfly valve at the Vat Diversion.

Keys steps to Implementing the Idea:

- Develop specification for double offset butterfly valves.
- Consider space savings and potentially reduce the overall size of turnout structures.
- Consider bidding double offset butterfly valves as bid alternative.

Sketch

Alternative No.: RL-33

☒ **ORIGINAL** ☐ **Alternative**

24-Inch Ball Valve

Alternative No.: RL-33

☐ **ORIGINAL** ☒ **Alternative**

20-Inch Double Offset Butterfly Valve

Construction Cost Estimate

Alternative No.: RL-33

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Ball valves, 30 IN	EA	250,000.00	4	$1,000,000		
Butterfly valves, 30 IN	EA	37,000.00			4	$148,000
Ball valves, 24 IN	EA	40,000.00	3	$120,000		
Butterfly valves, 24 IN	EA	30,000.00			3	$90,000
Ball valves, 20 IN	EA	150,000.00	4	$600,000		
Butterfly valves, 20 IN	EA	17,000.00			4	$68,000
Ball valves, 12 IN	EA	25,000.00	2	$50,000		
Butterfly valves, 12 IN	EA	6,000.00			2	$12,000
Ball valves, 8 IN	EA	20,000.00	10	$200,000		
Butterfly valves, 8 IN	EA	4,000.00			10	$40,000
Ball valves, 6 IN	EA	12,000.00	6	$72,000		
Butterfly valves, 6 IN	EA	3,500.00			6	$21,000
Total Markup	85.80%			$1,752,036		$325,182
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$3,794,000		$704,000
NET SAVINGS						$3,090,000

SECTION 6

STRATEGIC VALUE SOLUTIONS INC

WATER TREATMENT PLANT

Section 6
Water Treatment Plant

Scope of Study

This section of the report contains the recommendations which were developed for the Water Treatment Plant (WTP) scope of the project, which was reviewed by a dedicated breakout team of SMEs during the Value Planning Study. The scope under review by this breakout team includes the entire WTP as described in Jacobs' Technical Memo 5. Specifically, the scope reviewed by the team consisted of the entire South Utah Valley Regional (SUVR) WTP located in Salem, UT, which will be located on existing District-owned property. All process elements, from the raw water storage ponds to the finished water reservoirs were included in the scope of review. Although the team did explore opportunities to build initial treatment capacity at the Santaquin site as proposed by the original design, the team did not consider other locations for the WTP as this was studied by the Overall System Integration breakout team.

Key Findings

The WTP breakout team reviewed the design from three separate perspectives. First, the team stepped through each treatment process beginning with the raw water storage ponds, to the flocculation and sedimentation basins, to the ozone contactors, to the filters, and ultimately to the finished water storage reservoirs. The backwash process was also reviewed from the backwash equalization and clarification processes to the solid lagoons and spreading basins. Each process was reviewed individually for process design, water quality, and plant layout improvements. Overall, the Value Team found the original process design to be robust and functional, with only minor process improvements and optimizations identified.

Next, the team reviewed the process's ability to accommodate turndown. One of the most significant challenges that the WTP presents from a process design perspective is that there is both seasonal demand coupled with an unknown demand for the final buildout of the facility (i.e., 2065 demand). Figure 7-1 below summarizes the variability in demand and range of final buildout capacities:

Demands Used in Planning Level Design

	2030 High	2065 Low	2065 High
Peak Summer Month Finished Water Demands on District	16 mgd	34 mgd	99 mgd
Winter Month Finished Water Demands on District	3 mgd	17 mgd	41 mgd

Figure 6-1 – Demands Used for Planning Level Design of WTP (Jacobs, May 25, 2024)

The Value Team reviewed each treatment process to identify potential process pitfalls and/or inefficiencies associated with the potential turndown from the 50 MGD capacity that would be constructed in Stage 1, as compared to a potential 3 MGD maximum demand during the winter at initial operation of the facility. Several Value Alternatives were developed which would increase process efficiency during periods of low flow.

Finally, the Value Team reviewed the overall design capacity and phasing for the WTP. The team considered features included in the Phase 1 design to accommodate the full buildout of 100 MGD, and identify options to defer features which support the full buildout capacity until additional confidence in the 2065 finished water demand can be obtained. The team also considered potential benefits of prioritizing the construction of the Santaquin WTP.

Key Issues and Challenges:

The following items reflect the Value Team's observations on key project issues and challenges. Many of these items are addressed through Value Alternatives, Design Suggestions, and/or Design Comments; however, these items should also continue to be monitored as the design progresses:

- The 2065 demand for finished water ranges between 34 and 99 MGD. These figures are based on assumptions and approximations with limited commitment required from the municipalities. This presents a significant unknown on the size of the WTP which needs to be constructed to meet the demand, which could result in the WTP being constructed with a capacity that exceeds the demand.
- Based on the Value Team's understanding, the communities with the largest initial need for finished water are the furthest downstream.
- The winter demand immediately following construction of the WTP is estimated to be less than 3 MGD. These low flows to the communities which are the furthest away could result in a need to construct a chlorine booster station.
- The project site is adjacent to the Wasatch Fault, which drives additional seismic requirements for the design. In particular, the earthen raw water storage pond may be required to meet the state's dam safety requirements.
- The compatibility of the new water source with the existing water and distribution system is unknown. Proper diligence is required to prevent corrosion, maintain water quality, and to ensure satisfactory taste.

Highlights

Over the course of the Value Planning workshop, the WTP breakout team identified 12 Value Alternatives on ways to improve value on the project. In addition, the team identified two design suggestions and 10 design comments for the design team and stakeholders to review as the project advances. Key recommendations from the team include:

AT-01 Construct a 20 MGD water treatment plant at Santaquin first to serve the downstream (Juab) demand and construct an 80 MGD South Utah Valley water treatment plant in the future

This concept explores the possibility of locating the initial WTP at Santaquin rather than the Salem site to provide a finished water source that is located closer to the points of initial highest demand. The Value Team proposed providing a 20 MGD plant at Santaquin, and then constructing up to an 80 MGD plant at the Salem site to meet the final build out. This concept provides approximately $305,860,000 in first cost savings and also provides the District with an opportunity to provide operations feedback on the proposed treatment process before constructing the larger facility at Salem.

MC-07 Bid the Water Treatment Plant as two packages - one for civil works and one for water treatment plant construction

This concept explores the option of separating the construction effort of the WTP into two separate contracts – one for civil works and one for construction of the WTP facilities. This concept would allow earthwork to begin while the treatment plant design is finalized. This concept has a potential for $16 million cost savings and could result in the WTP being online up to 1 year earlier than planned.

PW-19 Send all residuals and filter waste to engineered lagoons to eliminate the backwash water clarification process and filter to waste equalization and pumping

This recommendation challenges the need for a dedicated backwash equalization and clarification process, and instead sends the unequalized BWW and FTW water to the solids lagoons for equalization, clarification, and dewatering. This concept simplifies the waste handling process operations and also reduces the footprint required on the project site. This concept has a potential for $56 million in cost savings.

Study Context:

It should be noted that many concepts were proposed by the Value Team which challenge the final 100 MGD capacity of the WTP. For the sake of comparison, all of the costs for the Value Alternatives maintain the full buildout of a 100 MGD final capacity. For this reason, many of the alternatives listed in Table 7-1 show a significant O&M cost as project scope was deferred to Phase 2. Construction activities deferred to Phase 2 are expected to be constructed in 2055, which adds significant escalation to any scope deferred. The Value Team notes that by deferring any project scope to Phase 2, this enables the District to increase the confidence level of the final plant capacity, which may allow these deferred items to be reduced in size (if the final capacity is less than 100 MGD) or eliminated entirely (if the final capacity does not exceed 50 MGD).

Organization of Alternatives

The alternatives presented on the following pages are organized by functional categories, and then numerically within each of those categories. The divisions used to organize the alternatives are as follows:

Accommodate Turndown (AT)

Miscellaneous/Constructability (MC)

Purify Water (PW)

Satisfy Stakeholders (SS)

These designations have been used throughout the Value process to organize the ideas.

Table 6-1
Summary of Alternatives

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
AT - Accommodate Turndown					
AT-01	Construct a 20 MGD water treatment plant at Santaquin first to serve the downstream (Juab County) demand and construct an 80 MGD South Utah Valley Regional Water Treatment Plant in the future	$305,860,000	($1,356,477,950)	($1,050,618,000)	R
MC - Miscellaneous/Constructability					
MC-03	Locate the ozone generation building on top of the contactors	($1,953,000)	$0	($1,953,000)	F
MC-07	Bid the South Utah Valley Regional Water Treatment Plant as two packages - one for civil works and one for water treatment plant construction	$16,046,000	$0	$16,046,000	F
MC-09	Relocate the public through-road around the South Utah Valley Regional Water Treatment Plant site	Design Suggestion			A
PW - Purify Water					
PW-03	Size the raw water storage pond for 50 MG for Phase 1 and only build one pond	$72,058,000	($90,073,000)	($18,015,000)	F
PW-05	Use cast-in-place concrete tanks for raw water storage in lieu of earthen ponds	A: $13,633,000 B: $87,877,000	A: ($167,049,000) B: ($92,805,000)	A: ($153,416,000) B: ($4,928,000)	F

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
PW-07	Include pre-oxidation in the raw water storage pond to address manganese before flocculation and sedimentation	A: ($3,177,000) B: ($1,958,000)	$0	A: ($3,177,000) B: ($1,958,000)	F
PW-09	Use two 25 MGD floc/sed basins in lieu of four	$2,461,000	$0	$2,461,000	F
PW-15	Use the finished water reservoir for chlorination in lieu of chlorine contact basin	$21,674,000	$21,674,000	$43,348,000	F
PW-16	Reduce the depth of the filter media from 72 inches to 48 inches and shorten the hydraulic profile by 6 feet	$9,366,000	$0	$9,366,000	F
PW-19	Send all residuals and filter waste to engineered lagoons to eliminate the backwash water clarification process and filter to waste equalization and pumping	$56,184,000	$707,000	$56,891,000	F
PW-20	Send reclaimed water to the Strawberry Highline Canal regulating pond in the summer to reduce pumping costs in lieu of raw water storage pond	Design Suggestion			F
SS - Satisfy Stakeholders					
SS-01	Determine the current water quality in the finished water distribution systems based on actual sampling (ongoing monthly)	($1,185,000)	$0	($1,185,000)	F

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings	Decision
SS-07	Raise the finish grade elevation around the main process area to reduce the height of the exposed structures (from EL 5,070 to EL 5,090) and bury the finished water reservoir (EL 5,060 for finished grade versus EL 5,050 current)	($10,145,000)	$0	($10,145,000)	F

A = Accepted R = Rejected

Table 6-2
Optimum Combination of Alternatives

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings
MC - Miscellaneous/Constructability				
MC-03	Locate the ozone generation building on top of the contactors	($1,953,000)	$0	($1,953,000)
MC-07	Bid the South Utah Valley Regional Water Treatment Plant as two packages - one for civil works and one for water treatment plant construction	$16,046,000	$0	$16,046,000
MC-09	Relocate the public through-road around the South Utah Valley Regional Water Treatment Plant site	Design Suggestion		
PW - Purify Water				
PW-03	Size the raw water storage pond for 50 MG for Phase 1 and only build one pond	$72,058,000	($90,073,000)	($18,015,000)
PW-07	Include pre-oxidation in the raw water storage pond to address manganese before flocculation and sedimentation	B: ($1,958,000)	$0	B: ($1,958,000)
PW-09	Use two 25 MGD floc/sed basins in lieu of four	$2,461,000	$0	$2,461,000
PW-15	Use the finished water reservoir for chlorination in lieu of chlorine contact basin	$21,674,000	$21,674,000	$43,348,000
PW-16	Reduce the depth of the filter media from 72 inches to 48 inches and shorten the hydraulic profile by 6 feet	$9,366,000	$0	$9,366,000
PW-19	Send all residuals and filter waste to engineered lagoons to eliminate the backwash water clarification process and filter to waste equalization and pumping	$56,184,000	$707,000	$58,891,000

Alt. No.	Description	First Cost Savings	Present Worth O&M Savings	Life Cycle Cost Savings
PW-20	Send reclaimed water to the Strawberry Highline Canal regulating pond in the summer to reduce pumping costs in lieu of raw water storage pond	Design Suggestion		
SS - Satisfy Stakeholders				
SS-01	Determine the current water quality in the finished water distribution systems based on actual sampling (ongoing monthly)	($1,185,000)	$0	($1,185,000)
SS-07	Raise the finish grade elevation around the main process area to reduce the height of the exposed structures (from EL 5,070 to EL 5,090) and bury the finished water reservoir (EL 5,060 for finished grade versus EL 5,050 current)	($10,145,000)	$0	($10,145,000)
	TOTAL:	**$162,548,000**	**($67,692,000)**	**$94,856,000**

Table 6-3
Design Comments

Throughout the duration of the Value Study, the Value Team identified several Design Comments. Design Comments address concepts identified by the Value Team or focus areas provided to the Value Team to improve the project. Although these concepts are not substantial enough to be developed into Value Alternatives, they were discussed throughout the Creative Phase of the workshop to assist in the generation of creative ideas for value improvement on the project.

ALT NO.	Description
AT - Accommodate Turndown	
AT-02	For the ozone process, use two dedicated side stream injection systems for each contactor in lieu of one duty and one standby
AT-04	Install a chlorine booster station halfway down the finished water pipeline
AT-05	Provide a chlorine addition point leaving the finished water reservoir
MC - Miscellaneous/Constructability	
MC-01	Begin planning for electrical demand and new substation with utility
MC-05	Ensure the Water Treatment Plant design goes from the raw water storage pond to the finished water reservoir, residual ponds, and spreading basins
MC-06	Exclude the Strawberry Highline Canal regulating pond from the Water Treatment Plant design scope
PW - Purify Water	
PW-08	Eliminate the pressure relieving station upstream of the rapid mix
PW-11	Evaluate pre-ozone benefits before floc/sed for pre-ozone only or pre-/intermediate ozone
PW-17	Combine the process water and utility water pumps to a 2+1 configuration and include a hydropneumatics tank
PW-18	Evaluate getting fire protection water from the city of Salem in lieu of using process water to avoid fire rated pumps

ACCOMODATE TURNDOWN

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	AT-01
Construct a 20 MGD water treatment plant at Santaquin first to serve the downstream (Juab County) demand and construct an 80 MGD South Utah Valley Regional Water Treatment Plant in the future	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to build an initial 50 MGD SUVR WTP with a potential to expand the plant capacity to 100 MGD in a future phase. The original concept includes an optional WTP located in Santaquin.	
Description of Alternative Concept:	
The alternative concept is to build a 20 MGD WTP in Santaquin to meet immediate demands by 2030 and another 80 MGD WTP can be built in Salem when needed by 2065 to meet further demands.	
Rationale for Change:	
The Value Team understands that the greatest need for water in the system is currently focused on Juab County. The most urgent finished water demands are in the southern communities that would have long residence times from a Salem WTP. The raw water pipelines have surplus capacity to feed a Santaquin WTP, and a finished water pipeline can supply northern demands from the south. Delaying the construction of the Salem location will provide time to better understand finished water demand requirements without constructing a long pipeline from Salem to Juab County.	

Value Improvement	**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$	First Cost Savings:	$305,860,000
Function: ☒ Increased ☐ Maintained ☐ Decreased	O&M Savings:	($1,356,477,950)
Resources: ☒ Increased ☐ Maintained ☐ Decreased	Life Cycle Cost Savings:	($1,050,618,000)

Advantages/Disadvantages

Alternative No.: AT-01

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Provides a WTP closer to the communities with the highest demand • Avoids long water age in the pipelines due to low demand • Provides the District with hands-on operational experience through the 20 MGD plant prior to designing and building a similar 80 MGD facility • Increases resiliency offered by two facilities in case of an emergency of a single plant • Delays construction of the Salem WTP and finished water pipeline until more accurate demand projections are available	• If demand changes from what is anticipated, additional pumping may be required to serve upgradient communities

Discussion

Alternative No.: AT-01

Description of original concept affected by this change:

The original concept is to build an initial 50 MGD SUVR WTP with a potential to expand the plant capacity to 100 MGD in a future phase. The original concept includes an optional WTP located in Santaquin.

Issue of concern to the team:

The Value Team is concerned that the construction of a 50 MGD facility in Salem will be oversized in the short-term (but will meet needs by 2065), and the Salem location is far away from the communities with the most urgent demand. The greatest growth rate in the region is currently focused on Juab County, where building is limited by available water supply. Initially, residence time in the pipeline to Nephi can be 7 days at 2 MGD. While not prohibitive, this long time is significant in terms of disinfection byproduct production and maintaining a chlorine residual.

Description of alternative concept:

The alternative concept is to build a 20 MGD WTP in Santaquin to meet immediate demands by 2030 and another 80 MGD WTP can be built in Salem when needed by 2065 to meet further demands. The treatment facility will include the same unit processes as in the plan for the original concept but will be scaled to a smaller size. The originally planned raw water pipelines have surplus capacity to provide raw water to the 20 MGD Santaquin WTP.

Benefit of making the change:

This change provides water sooner where it is urgently needed and avoids long water age in the pipeline until the water is needed. In addition, operation of a 20 MGD facility, with the same process layout, provides the District with hands-on operational experience prior to designing and building a similar 80 MGD facility. This alternative also postpones the Salem WTP and finished water pipeline, so more accurate demand projections will be available when they are required. Finally, this change provides redundancy with having two facilities in case of an emergency instead of one site (once both are constructed).

Additional Explanation:

Although this alternative proposes providing an 80 MGD facility at Salem, it is possible to pursue a phased approach similar to the original concept which could have two phases of 40 MGD buildouts. As stated in other alternatives, deferring the construction of the 80 MGD facility at Salem allows for the future demands to be refined. If the plant size can be less than 80 MGD, significant savings is possible.

Examples where this has been used:

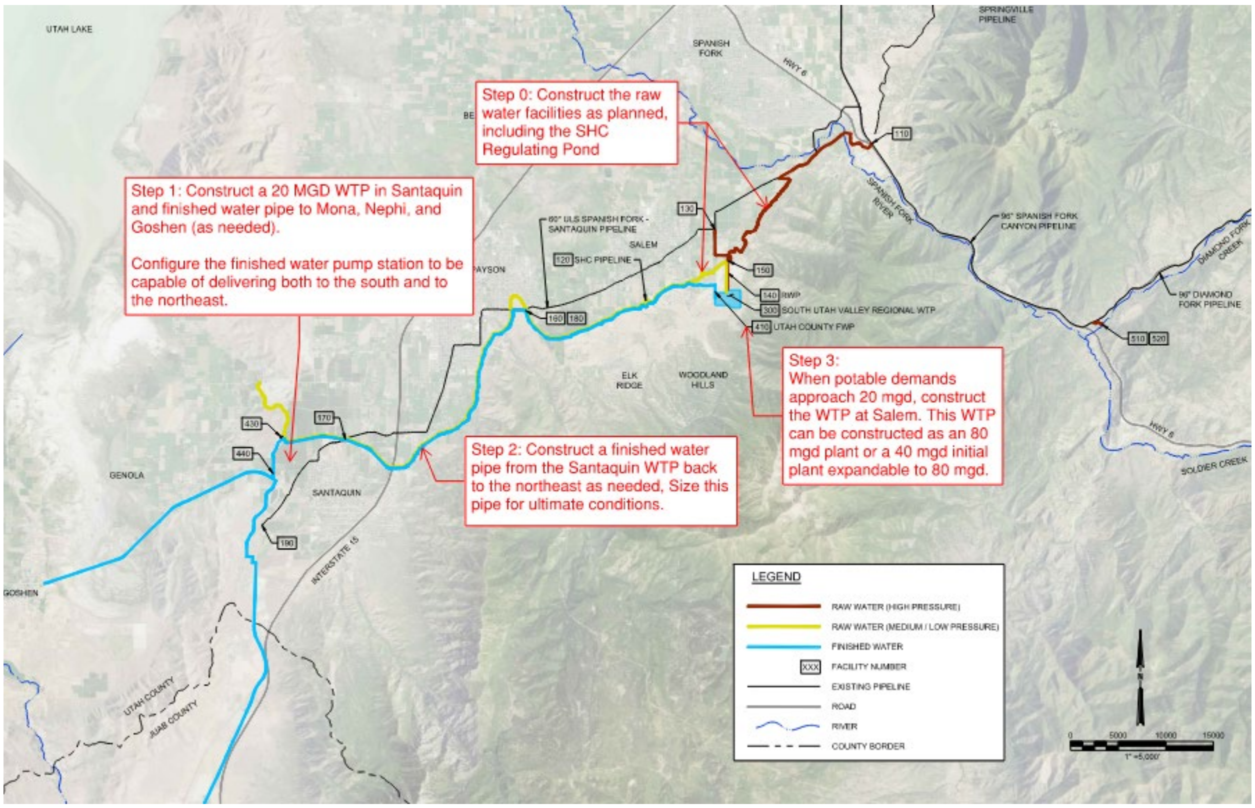
There are several local examples of water agencies that have multiple treatment plants treating the same water for different areas. Weber Basin Water Conservancy District has three plants treating water from the same aqueduct for different communities.
The South Ogden and Bountiful plants are approximately 10 and 20 miles away from the main plant and district headquarters in Layton.

Key steps to implementing the idea:

1. Confirm demands to ensure that upstream communities' needs will be met without the Salem WTP in the short-term.
2. Prepare a conceptual design of a 20 MGD facility in Santaquin and 80 MGD facility in Salem.
3. Anticipate the addition of a second operational team to service the new 80 MGD facility.

Alternative No.: AT-01

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Proposed Sequence of Alternative Implementation

Alternative No.: AT-01

☐ **ORIGINAL** ☒ **ALTERNATIVE**

20 MGD facility cost:

- Assumed approximately 50% of the cost of the 50 MGD facility to accommodate losses in economies of scale for larger facilities
- Land costs are not included and would need to be added

80 MGD facility cost:

- Assumed 100% of the cost of the 100 MGD cost for the O&M Building and Maintenance and Storage Building
- Assume all other components are 90% of the 100 MGD cost

Calculations

Alternative No.: AT-01

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Schedule:

Assume 20 MGD at Santaquin is constructed by 2032 to match the original schedule of the Salem WTP.

Assume 80 MGD at Salem is constructed in a single phase in 2049.

The original online date for Phase 2 (100 MGD) at Salem is June 2055.

LCCA:

For LCCA,

Calculate O&M Costs:

For 10 MGD Plant:

From data provided by CUWCD, O&M Costs for a 10 MGD plant are $260/AF.

10 MGD = 3.65 billion gallons per year.

The plant has seasonal demand, so assume 50% of the capacity is the average production in a year.

3,650,000,000 gallons per year * 50% production / 325,851 gallons per acre FT = 5,600 AC FT

5,600 AC FT per year * $260/AF = $1.4 million / year O&M

For 100 MGD Plant:

From data provided by CUWCD, O&M Costs for a 100 MGD plant are $115/AF.

100 MGD = 36.5 billion gallons per year.

The plant has seasonal demand, so assume 50% of the capacity is the average production in a year.

36,500,000,000 GAL per year x 50% production / 325,851 GAL per AC FT = 56,000 AC FT

56,000 AC FT per year x $115/AF = $6.4 million / year O&M

Calculations

Alternative No.: AT-01

☐ **ORIGINAL** ☒ **ALTERNATIVE**

O&M for Original 50 MGD Plant – Phase 1

Use 100 MGD calculation for annual cost:

Assume 50% reduction for 50 MGD.

Total = $6.4 million / year x 50% = $3.2 million

This is the cost to operate the original plant between 2032 and 2055.

Present worth of 32 years of annual cash flows at $3.2 million: $65,244,050.

O&M for Original 100 MGD Plant – Phase 2

$6.4 million / year

This is the cost to operate the original plant between 2055 and 2082 (assume 50-year period of study).

Present worth of 28 years of annual cash flows at $6.4 million: $120,090,000.

Alternative - O&M for 20 MGD Plant at Santaquin:

Use 10 MGD calculation for annual cost:

$1.4 million / year / 10 MGD x 20 MGD = $2.8 million / year

This is the cost to operate the original plant between 2032 and 2082.

Present worth of 50 years of annual cash flows at $2.8 million: $72,043,000

Alternative - O&M for 80 MGD Plant

Use 100 MGD calculation for annual cost:

$6.4 million / year / 100 MGD x 80 MGD = $5.12 million / year

This is the cost to operate the original plant between 2049 and 2082.

Present worth of 33 years of annual cash flows at $5.12 million: $127,482,000.

Construction Cost Estimate

Alternative No.: AT-01

			Original Concept		Alternative Concept	
20MGD Plant at Santaquin (50% of 50 MGD)			(Deletions)		(Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
010 Administration Building	LS	13,933,871.00	1.00	$13,933,871	0.50	$6,966,936
012 Maintenance and Storage Building	LS	17,290,000.00	1.00	$17,290,000	0.50	$8,645,000
014 Chemical Facility	LS	30,715,000.00	1.00	$30,715,000	0.50	$15,357,500
020 Raw Water Storage Ponds - See Table 1-2	LS	121,425,748.00	1.00	$121,425,748	0.50	$60,712,874
025 Rapid Mix	LS	11,169,000.00	1.00	$11,169,000	0.50	$5,584,500
030 Flocculation and Sedimentation	LS	67,575,000.00	1.00	$67,575,000	0.50	$33,787,500
040/045 Ozone Contactors and Generation Building	LS	28,236,000.00	1.00	$28,236,000	0.50	$14,118,000
050 Filtration	LS	59,948,000.00	1.00	$59,948,000	0.50	$29,974,000
060 Chlorine Contact Basin	LS	17,479,000.00	1.00	$17,479,000	0.50	$8,739,500
070 Finished Water Storage - See Table 1-2	LS	74,843,079.00	1.00	$74,843,079	0.50	$37,421,540
080 Backwash Supply Tank	LS	3,236,000.00	1.00	$3,236,000	0.50	$1,618,000
084 Backwash Waste Equalization	LS	11,268,000.00	1.00	$11,268,000	0.50	$5,634,000
086 Backwash Waste Clarification	LS	17,931,000.00	1.00	$17,931,000	0.50	$8,965,500
090 Solids Lagoons	LS	12,657,000.00	1.00	$12,657,000	0.50	$6,328,500
092 Emergency Overflow Pond	LS	5,616,000.00	1.00	$5,616,000	0.50	$2,808,000
Note: Use Phase 1 (50 MGD) costs for unit costs. The original concept is completely avoided, and the alternative (20 MGD at Santaquin) assumes 50% of the cost of Phase 1 to build 20 MGD.						
Total Markup	24.00%			$118,397,448		$59,198,724
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$611,720,000		$305,860,000
NET SAVINGS						$305,860,000

Construction Cost Estimate

Alternative No.: AT-01

Salem 100 MGD Phase 2 Avoidance			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
030 Flocculation and Sedimentation	LS	67,575,000.00	1	$67,575,000		
070 Finished Water Storage	LS	59,156,024.00	1	$59,156,024		
050 Filtration	LS	46,148,000.00	1	$46,148,000		
040/045 Ozone Contactors and Generation Building	LS	22,765,000.00	1	$22,765,000		
014 Chemical Facility	LS	12,307,000.00	1	$12,307,000		
060 Chlorine Contact Basin	LS	17,479,000.00	1	$17,479,000		
090 Solids Lagoons	LS	12,657,000.00	1	$12,657,000		
086 Backwash Waste Clarification	LS	3,980,000.00	1	$3,980,000		
025 Rapid Mix	LS	3,976,000.00	1	$3,976,000		
Construct 80 MGD Plant at Salem						
010 Administration Building	LS	13,933,871.00			1.00	$13,933,871
012 Maintenance and Storage Building	LS	17,290,000.00			0.90	$15,561,000
014 Chemical Facility	LS	43,022,000.00			0.90	$38,719,800
020 Raw Water Storage Ponds - See Table 1-2	LS	121,425,748.00			0.90	$109,283,173
025 Rapid Mix	LS	15,145,000.00			0.90	$13,630,500
030 Flocculation and Sedimentation	LS	135,150,000.00			0.90	$121,635,000
040/045 Ozone Contactors and Generation Building	LS	51,001,000.00			0.90	$45,900,900
050 Filtration	LS	106,096,000.00			0.90	$95,486,400
060 Chlorine Contact Basin	LS	34,958,000.00			0.90	$31,462,200
070 Finished Water Storage - See Table 1-2	LS	133,999,103.00			0.90	$120,599,193
080 Backwash Supply Tank	LS	3,236,000.00			0.90	$2,912,400
084 Backwash Waste Equalization	LS	11,268,000.00			0.90	$10,141,200
086 Backwash Waste Clarification	LS	21,911,000.00			0.90	$19,719,900
090 Solids Lagoons	LS	25,314,000.00			0.90	$22,782,600
092 Emergency Overflow Pond	LS	5,616,000.00			0.90	$5,054,400
Note: Include as a LCC future cost rather than a first cost						
Total Markup	219.00%			$538,834,223		$1,460,341,356
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$784,877,000		$2,127,164,000
NET SAVINGS						($1,342,287,000)

Life Cycle Cost Analysis

Alternative No.: AT-01

LIFE CYCLE PERIOD 50 YEARS ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST	ORIGINAL CONCEPT	ALTERNATIVE CONCEPT
	$611,720,000	$305,860,000
Capital Cost Savings		$305,860,000

ANNUAL EXPENDITURE	%	PRESENT WORTH FACTOR	ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPITAL COST	ANNUAL COST	PRESENT WORTH
O&M of 50 MGD - Salem Phase 1		See calcs		3,200,000	65,244,050			
O&M of 100 MGD - Salem Phase 2		See calcs		6,400,000	120,090,000			
O&M of 20 MGD - Santaquin		See calcs					2,800,000	72,043,000
O&M of 80 MGD - Salem		See calcs					5,120,000	127,482,000
Generalized O&M (% of Capital Cost)								
		SUB-TOTAL			$185,334,050			$199,525,000

SINGLE EXPENDITURE (REPLACEMENT)	YR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Construct 80 MGD Plant		1.0000		(1,342,287,000)		0
Salvage Value at End of Economic Life						
		SUB-TOTAL		($1,342,287,000)		$0
		TOTAL PRESENT WORTH		($1,156,952,950)		$199,525,000
				PRESENT WORTH SAVINGS ON O&M		($1,356,477,950)
				LIFE CYCLE COST SAVINGS		($1,050,618,000)

MISCELLANEOUS/CONSTRUCTABILITY

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	MC-03
Locate the ozone generation building on top of the contactors	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to construct two separate ozone contactors adjacent to the filters, with a separate ozone generation facility as a stand-alone facility. It is assumed that the ozone sample stations are outside and the side stream injection equipment is located in the Generation Building.	
Description of Alternative Concept:	
The alternative concept is to construct the two ozone contactors in a single structure with a gallery between them to house sampling and side stream systems, and to locate the ozone generation building above it.	
Rationale for Change:	
Constructing the two contactors with a gallery between them creates convenient access to sampling and side stream. Constructing the ozone generation on top of the contactors reduces the overall ozone footprint and eliminates the concrete associated with the ozone generation building foundation.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☒ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Cost Savings Summary

First Cost Savings:	($1,953,000)
O&M Savings:	$0
Life Cycle Cost Savings:	($1,953,000)

Advantages/Disadvantages

Alternative No.: MC-03

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces overall footprint requirements for ozone by half, which provides additional flexibility to layout facilities on the main plant site • Eliminates the foundation for the ozone generation because the contactors serve as its foundation • Gallery space between the contactor provides interior space for effective ozone sampling and convenient access and space for side stream systems • Side stream systems are located at the point of ozone injection, reducing the time in the mixed-phase high ozone concentration side stream which is important for bromate control	• Ozone building mechanical layout must be coordinated around the contactors below, requiring coordination of access hatches and floor drains • If finish grade remains at current elevations (EL 5,070), at 16 feet below the top of the contactor (EL 5,086), the generation room may be inconveniently located

Alternative No.: MC-03

Description of original concept affected by this change:

The original concept is to construct two separate ozone contactors adjacent to the filters, with a separate ozone generation facility as a stand-alone facility. The ozone generation facility is at grade (EL 5,070), approximately 8 feet above the bottom of the contactor and approximately 16 feet below the top of the contactor.

The Value Team assumes that the ozone generation building houses two initial (duty and standby) skids, two future (duty and standby) side stream skids that are remote from the injection into the settled water pipe, and that the ozone sampling is located on the exterior of the contactor.

Issue of concern to the team:

The ozone generation room is congested for the amount of equipment shown and additional space may be required. A single duty injection skid for 2 MGD to 50 MGD and the range of ozone doses may create turndown challenges. The side stream is remote from its injection point into the settled water. The contact time of the super-saturated ozone concentration in the side stream risks an increase in bromate formation. Exterior ozone sample stations may not be operator friendly and will be subject to freezing during winter conditions.

Although the site area is sufficiently large to accommodate the plant facilities, its' topography creates challenges that reduce the amount of usable space. Configurations that use large footprints will be more challenging to fit on-site and will limit site layout options.

Description of alternative concept:

The alternative concept is to reduce the overall ozone footprint to 50% of the original concept by constructing the two ozone contactors in a single structure with a gallery between them and locating the ozone generation building above it.

The gallery between the contactors will house sampling and side stream injection systems. The side stream injection skids are located immediately adjacent to the main pipes they feed, therefore the generator building will have more space to accommodate ozone generators, ozone cooling, ozone destruct, HVAC, and electrical.

Benefit of making the change:

This alternative configuration provides:

- More space for the ozone generation building while simultaneously reducing the overall footprint by 50%, reducing the footprint creates more flexibility in overall site layout
- Convenient operator access to ozone sampling
- Improved bromate control by minimizing contact time of the side stream injection
- Improved access to equipment in the Ozone Building
- Additional space for an increased number of smaller injection systems that could be required to improve efficient ozone operations under turndown conditions

Additional explanation:

This concept places the finished grade around the main plant facilities at the top of the hydraulic structures instead of 16 feet below them. If the original site grading is preserved, the ozone generation building can still be positioned over the contactors if the provisions are included to remove the generators from an upper floor.

Examples where this has been used:

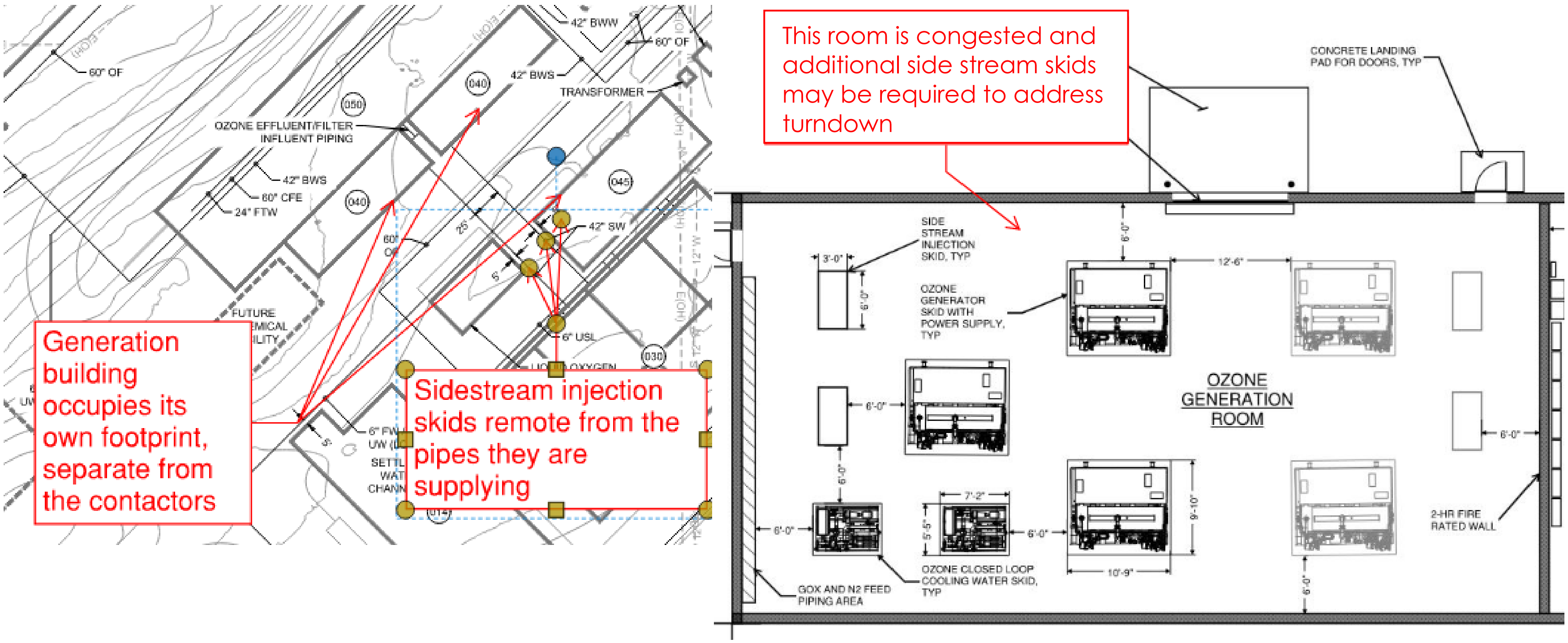
Ozone generation buildings have been located over ozone contractors at many locations both in Utah and across the US. Locally, this has been done at the Don A Christiansen Regional WTP and the Duchesne Valley WTP.

Key steps to implementing the idea:

This can be implemented as part of the normal course of design. Particular attention is required to coordinate contactor deck openings, structural supports, and floor drains with the gallery and contactors below.

Alternative No.: MC-03

☒ **ORIGINAL** ☐ **ALTERNATIVE**

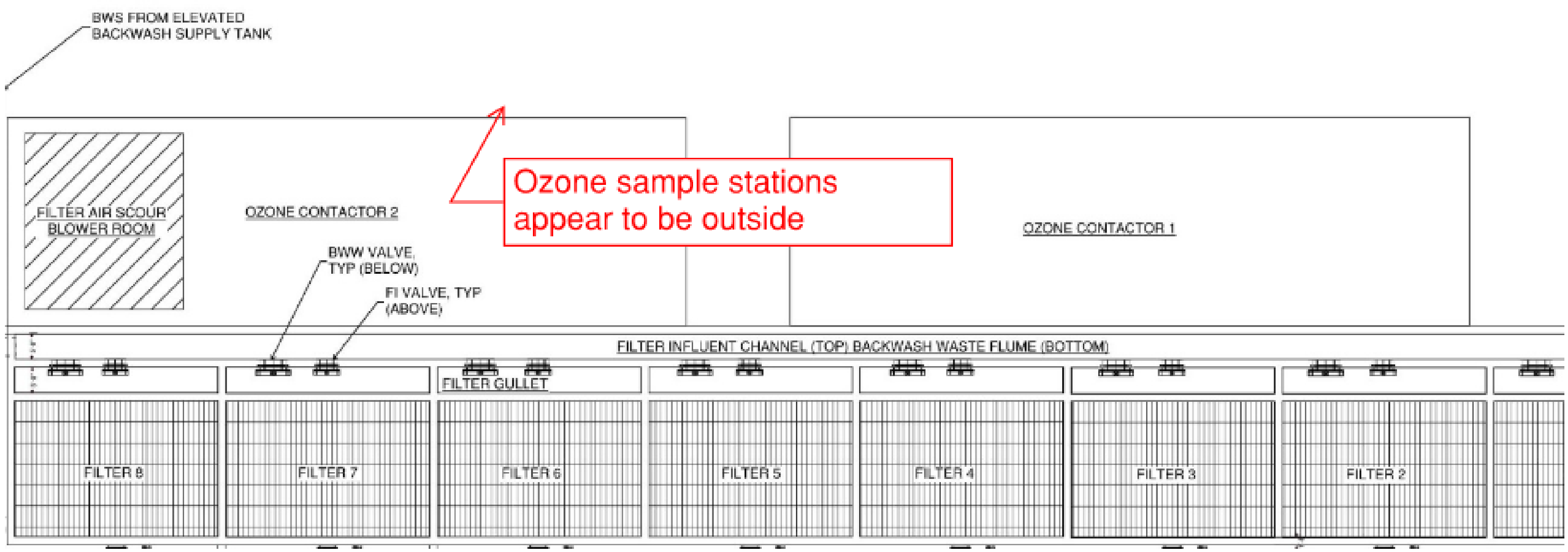


Separate Footprints for the Ozone Contactors and Generation Building

Sketch

Alternative No.: MC-03

☒ **ORIGINAL** ☐ **ALTERNATIVE**

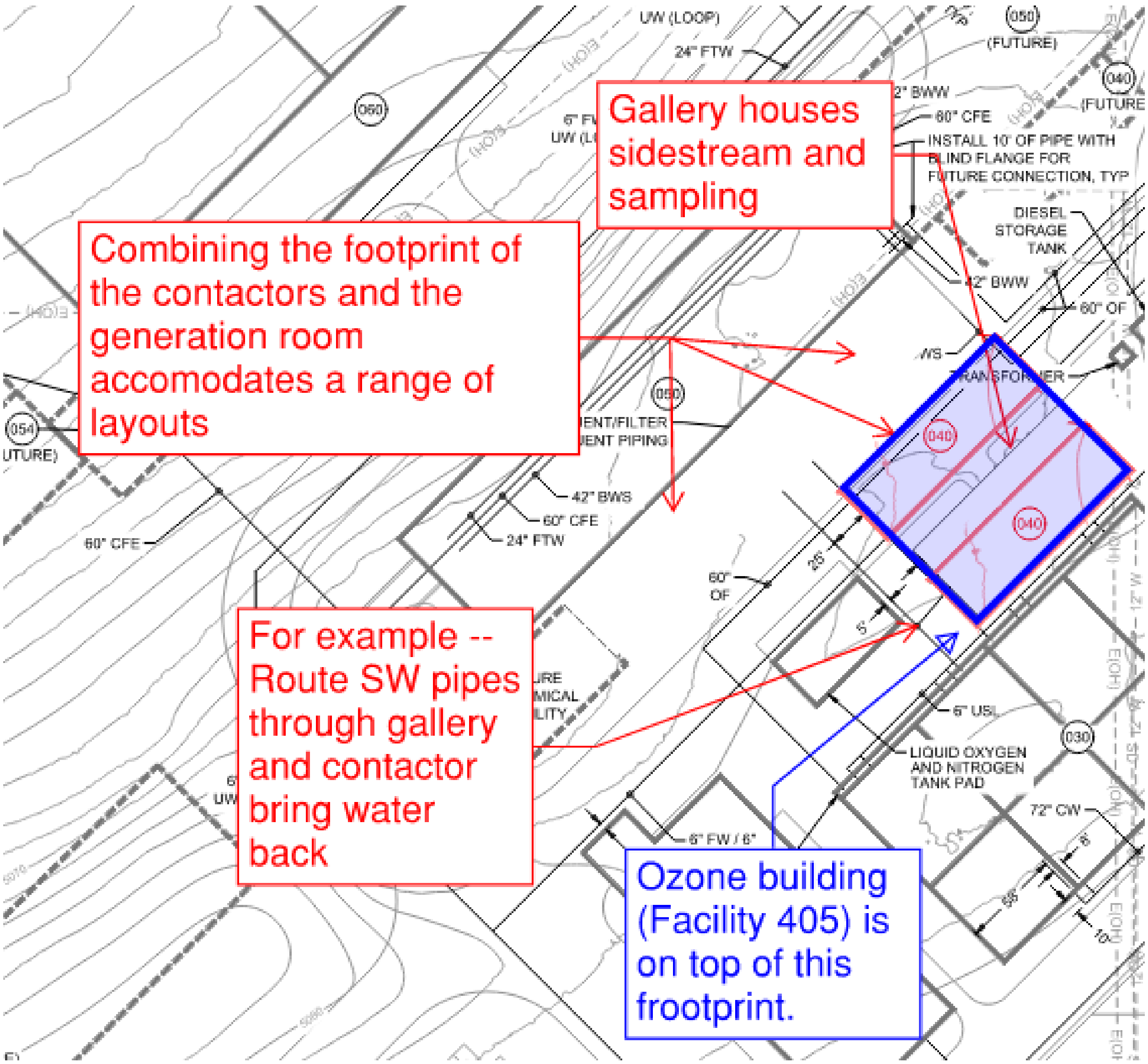


Ozone Stations Outside

Sketch

Alternative No.: MC-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Relocation of the Ozone Generation Building

Calculations

Alternative No.: MC-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**

For the cost estimate, the main cost savings are in the foundation of the ozone generation building, which is no longer needed. There is an additional cost for the gallery - bottom slab, end walls, and deck slab.

Foundation for the existing ozone generation room that is no longer required

[(45 FT + 4 FT footing extensions) x (142 FT + 4 FT footing extension) x (2 FT footing depth)] / 27 CY/CF = 530 CY concrete

The gallery concrete bottom slab, top slab and end walls

Existing contactors scale to 115 FT x 35 FT. Utah Valley WTP gallery is 40 FT wide at 120 MGD ultimate. There is a 100 MGD ultimate capacity, so assume 35 FT is sufficient for the gallery width. Assume 24 FT tall walls, 1 FT thick floor slab, and 1.5 FT thick elevated deck slab, 2 FT thick walls.

Gallery floor slab:

[(115 FT + 4 FT footing extensions) x (35 FT) x (2 FT footing depth)] / 27 CY/CF = **300 CY**

Gallery deck slab:

[(115 FT S) x (35 FT) x (2 FT slab depth)] / 27 CY/CF = **300 CY**

Gallery end walls:

[(35 FT) x (24 FT tall) x (1.5 FT wall thickness) x 2 walls] / 27 CY/CF = **93 CY**

Construction Cost Estimate

Alternative No.: MC-03

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Ozone generation building concrete foundation	CY	1,399.00	530	$741,470		
Ozone contactor gallery concrete foundation	CY	1,399.00			300	$419,700
Ozone contactor gallery end walls	CY	2,477.00			93	$230,361
Ozone contactor gallery roof slab	CY	3,513.00			300	$1,053,900
Remove need for ozone generation building						
**Piping, electrical, roof, misc. metal remains						
Total Markup	102.91%			$763,022		$1,753,490
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$1,504,000		$3,457,000
NET SAVINGS						($1,953,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	MC-07
Bid the South Utah Valley Regional Water Treatment Plant as two packages - one for civil works and one for water treatment plant construction	
Challenges Standard or Criteria:	Yes ☒ No ☐
Challenges standard of having one contract.	

Description of Original Concept:

The original concept is to construct a 100 MGD drinking WTP in two phases at the Salem City site. Phase 1 will provide 50 MGD of initial capacity and is anticipated to be awarded as a single contract for both site work (of the full buildout) and construction of the WTP facilities. The construction of Phase 1 includes several facilities that are sized for the full buildout and will not require expansion in Phase 2 (notably two 50 MG raw water storage ponds).

Description of Alternative Concept:

The alternative concept is to break out the civil site work, which includes the two 50 MG raw water storage ponds, into one bidding package and bid it early while the WTP design is being finalized. The WTP package would then be solicited later.

Rationale for Change:

The Value Team believes that it makes the most sense to separate these packages since the types of work are different. The civil site work package is large and complex, and will require a contractor with experience building dams, not just simple site work grading.

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	$16,046,000
Function	Resources	O&M Savings:	$0
☒ Increased	☐ Increased	Life Cycle Cost Savings:	$16,046,000
☐ Maintained	☐ Maintained		
☐ Decreased	☒ Decreased		

Advantages/Disadvantages

Alternative No.: MC-07

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Increases ability to acquire experienced contractors for each type of work • Allows project site work to start early • Increases bidding competition	• Two contracts to administer • Can delay WTP bid date if civil site work is not completed on time • Limits flexibility of late stage design changes affecting civil scope

Discussion

Alternative No.: MC-07

Description of original concept affected by this change:

The original concept is to construct a 100 MGD drinking WTP in two phases at the Salem City site. Phase 1 will provide 50 MGD of initial capacity and is anticipated to be awarded as a single contract for both site work (of the full buildout) and construction of the WTP facilities. The construction of Phase 1 includes several facilities that are sized for the full buildout and will not require expansion in Phase 2 (notably two 50 MG raw water storage ponds).

Issue of concern to the team:

This project requires complex site work (over 1 million cubic yards of earthwork) and includes specialized requirements to construct two earthen dams in a seismic zone. By bidding all this work in one package, it could limit the pool of qualified contractors who can perform this work or reduce the number of bidders due to contractors teaming together to perform the work. Additionally, bundling both the civil site construction and WTP facility construction into a single contract requires design of the WTP to be completed before site work can begin.

Description of alternative concept:

The alternative concept is to split the Phase 1 construction package into two bidding packages. The first bidding package would be for the civil site work including the construction of the two 50 MG raw water ponds. A second bid package would be solicited for the construction of the WTP.

Benefit of making the change:

This change allows the civil package to be ready to bid up to a year earlier than the full treatment plant design package. Also, due to the quantity of excavation and embankment work required to grade the site and construct two 50 MG raw water ponds, it makes sense that a standalone package for the civil site work might bring better pricing and more competition. If there are delays caused by some unforeseen issue, delay impacts would be less as well. If site work starts in June 2027, then the final completion of the overall Phase 1 could be completed in June 2031 instead of June 2032.

Additional explanation:

The bidding of the site work package separately means that the final design elevations for the WTP building locations and elevations need to be locked in. It could be problematic if grades change after the site work package is awarded.

Depending on cut and fill diagrams, the contractor should be given a date in their contract when they are required to have the WTP site work completed.

Note: There might be an option to have the entity working the gravel pit come into the area to start performing some rough grading in trade for the material.

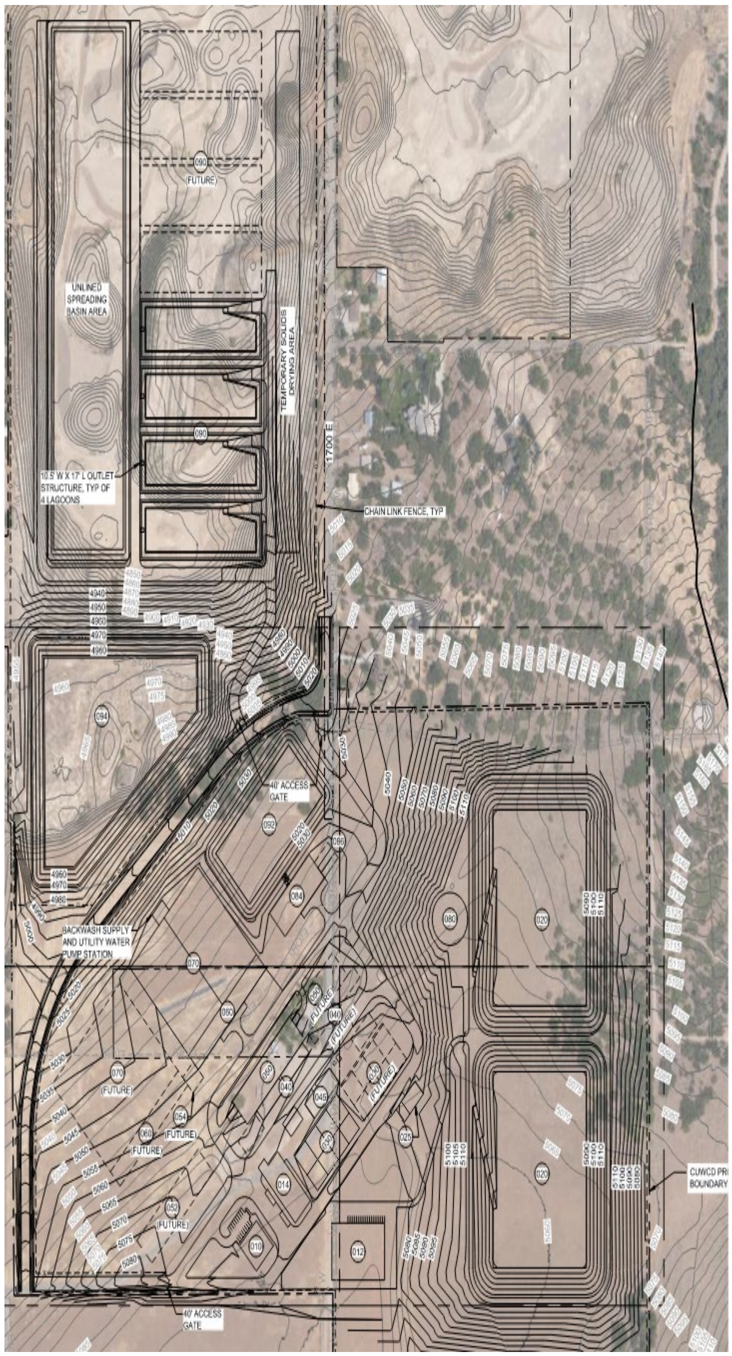
Key steps to implementing the idea:

Hire a designer to design and develop project documents for the site work including the construction of the two 50 MG raw water storage ponds. Advertise and bid on these as a standalone package while WTP plans are being finalized. Include statements in the contract about coordinating with the WTP contractor when they are selected.

Sketch

Alternative No.: MC-07

☒ **ORIGINAL** ☐ **ALTERNATIVE**

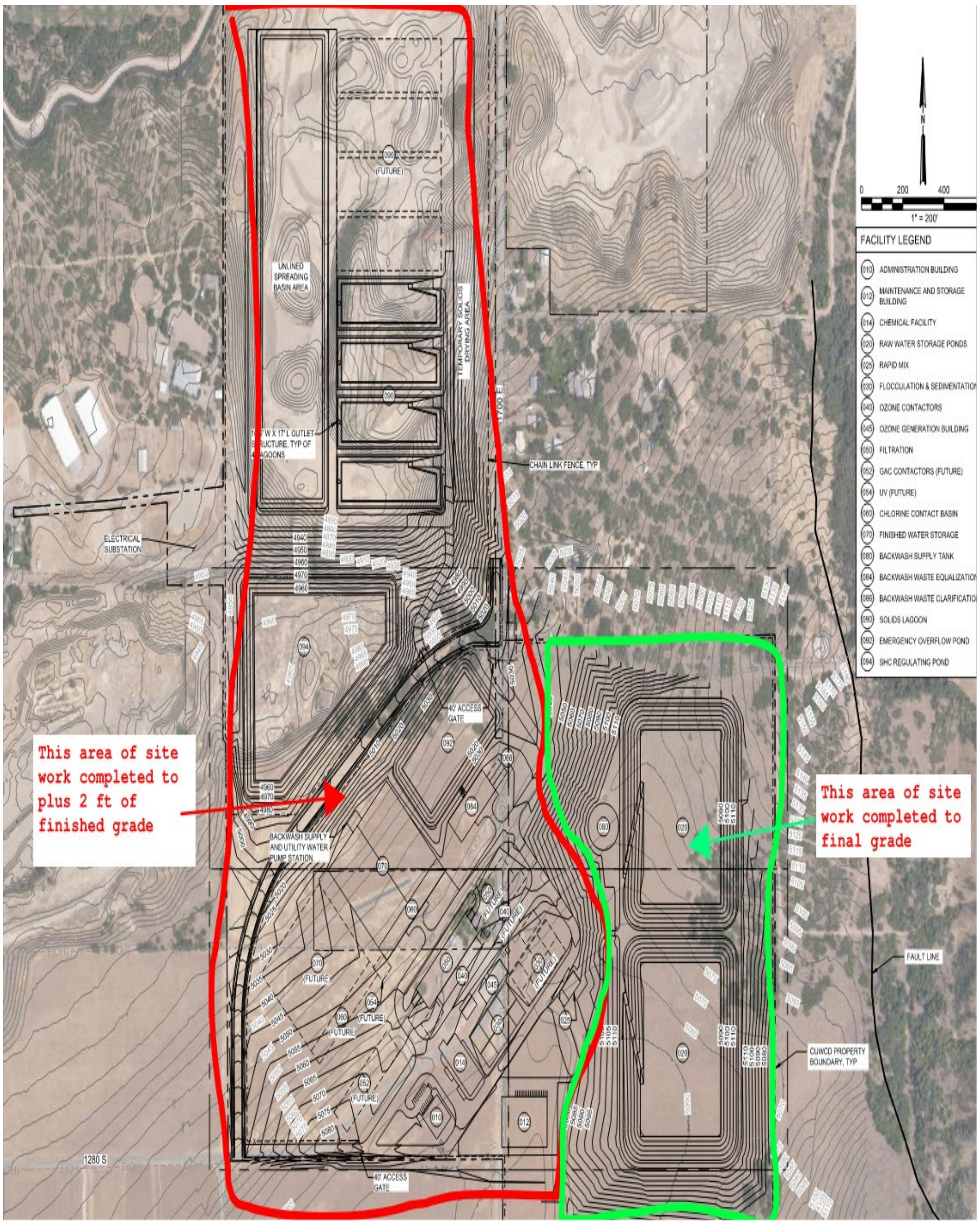


Original Site Plan of Phase 1 and 2

Sketch

Alternative No.: MC-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Site Plan of the Two Contracts

Calculations

Alternative No.: MC-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Assume a 12 MO earlier start for civil site work package which could provide an overall earlier completion date.

Construction Cost Estimate

Alternative No.: MC-07

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Construction of Phase 1 - mid-point of construction in June 2030	LS	493,322,827.00	1	$493,322,827		
Construction of Phase 1 - mid-point of construction in June 2029	LS	477,276,645.65			1	$477,276,646
Total Markup:	0%					
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$493,323,000		$477,277,000
NET SAVINGS						$16,046,000

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	MC-09
Relocate the public through-road around the South Utah Valley Regional Water Treatment Plant site	

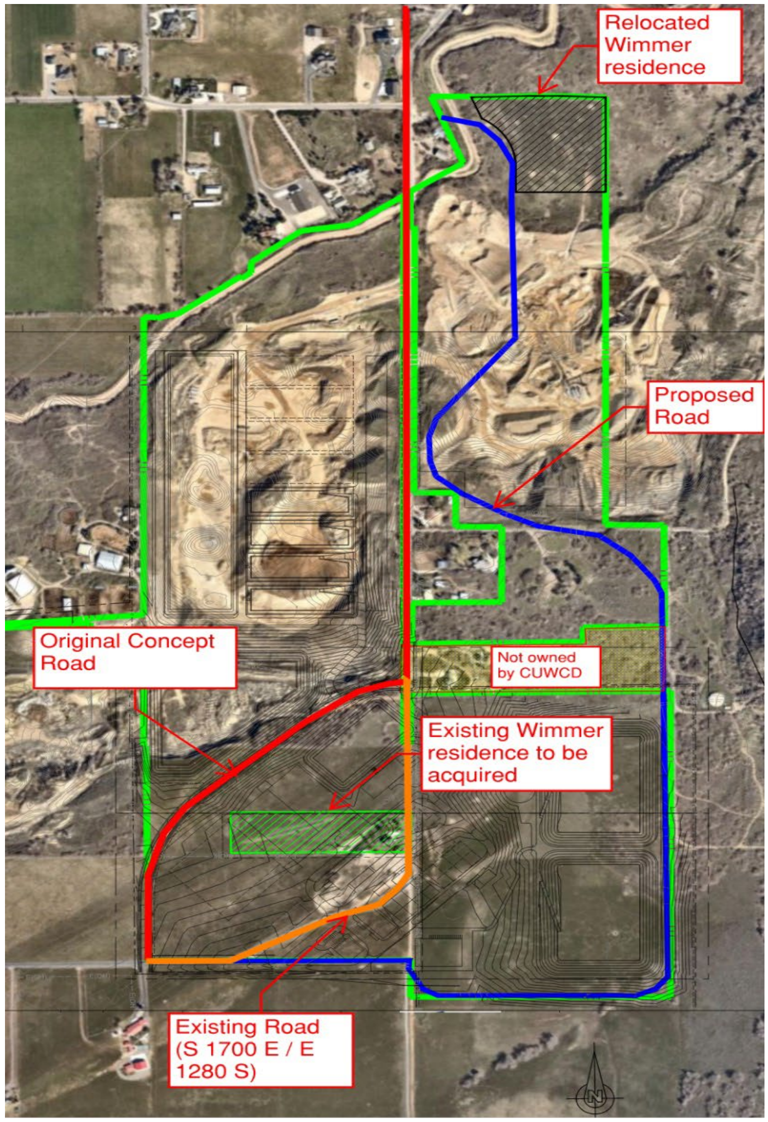
Discussion

The existing public roads S 1700 E and E 1280 S are planned to be relocated as a part of the construction of the SUVR WTP as indicated in the figure below in orange.
To accommodate the layout of the plant, the road alignment is proposed to be relocated slightly northward and will route between the finished water tanks and the SHC regulating pond, indicated in red. The proposed road alignment was intended to fit within District's existing property boundaries; however, the alignment will result in public traffic passing through the WTP site. This alignment may require additional screening (i.e., fencing, landscaping, etc.) to reduce the visual impact to the community and may also create a safety concern with vehicles passing through an operational WTP site.

To avoid traffic passing through the site, the Value Team recommends rerouting the public road along the southern and eastern boundary of the WTP site
(the District's preferred concept shown in blue below). This concept requires the purchasing of privately-owned property along the central-eastern portion of the site; however, by purchasing this property, this may also allow for the raw water storage ponds to be shifted further northward to reduce the amount of earthwork required for construction. This concept will also enable connectivity to the future relocated Wimmer residence.

The Value Team notes that the gravel pit to the northeast of the project site is currently outside of the project scope. This concept would add additional scope to the project as the road is routed through the existing gravel pit operation.
The Value Team also notes that connectivity to the existing homes on S 1700 E will need to be maintained unless these properties are also acquired by the District.

The Value Team also recommends meeting with both the District and Salem City to discuss possible options for the new route. Ask to determine how a new road impacts Salem City's road master plan or if any developers approached Salem City with plans showing proposed roads in the area.



Proposed Road Route Shown in Blue

PURIFY WATER

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-03
Size the raw water storage pond for 50 MG for Phase 1 and only build one pond	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to construct a 100 MGD drinking WTP in two phases at the Salem City site. Phase 1 construction will include several facilities that are sized for the full buildout and will not require expansion in Phase 2, which includes two 50 MG raw water storage ponds.	
Description of Alternative Concept:	
The alternative concept is to construct only one of the 50 MG raw water storage ponds in Phase 1 and construct the second 50 MG raw water storage pond with Phase 2.	
Rationale for Change:	
The current project study shows that the future demand for treated water can range from 36 MGD to 100 MGD in 2064. Therefore, the demand implies the need for only one raw water storage pond to be built now and wait until Phase 2 is ready to construct the second raw water pond at which time the demand for treated water will be updated and more defined.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$72,058,000
O&M Savings:	($90,073,000)
Life Cycle Cost Savings:	($18,015,000)

Advantages/Disadvantages

Alternative No.: PW-03

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces near term maintenance cost • Reduces risk of major damage downstream and off-site of property if dam fails or leaks due to seismic activity • Allows the Phase 2 pond to be sized to match the final plant capacity	• Construction of the second raw water storage pond during Phase 2 will be more costly due to escalation and more complex due to tying into an existing pond • The future location of the second raw water storage pond needs to be maintained to control weeds and fire risk

Discussion

Alternative No.: PW-03

Description of original concept affected by this change:

The original concept is to construct two 50 MG raw water storage ponds during Phase 1 of construction of the WTP. Both ponds are being constructed during Phase 1 based on the assumption that it is easier to construct these ponds concurrently versus constructing them separately at different times. The volume of material that needs to be excavated during Phase 1 and embanked across the complete site also gives reason to complete construction of both ponds at the same time.

Issue of concern to the team:

The Value Team is concerned that there is a significant amount of money being spent to construct a storage pond in Phase 1 that may not be required in the future if the demand stays at the low end of the projections. Demand is difficult to predict this early in planning, and the Value Team is concerned that the demand may change and result in differing needs in the future.

Description of alternative concept:

The alternative concept is to eliminate the construction of the second raw water storage pond during Phase 1. The Value Team suggests deferring this construction to Phase 2 of the WTP buildout. The berm/dam between the two ponds is anticipated to be fully constructed during Phase 1 to simplify future construction of the second raw water storage pond.

Benefit of making the change:

This provides substantial cost savings to Phase 1 of the project through the elimination of scope. In addition, regular maintenance costs will be reduced and there is less risk to the District with the threat of failure in only one storage pond instead of two.

Key steps to implementing the idea:

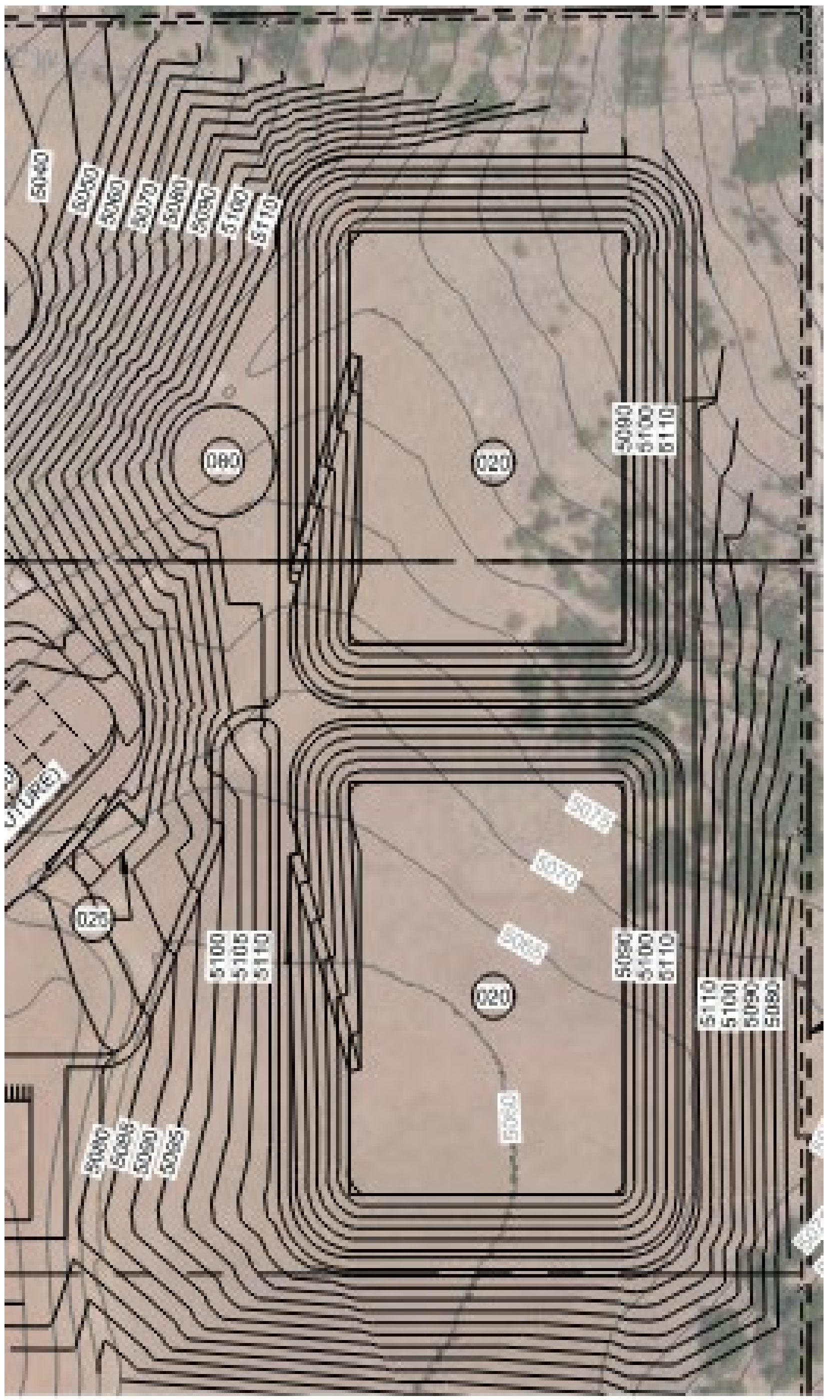
The final design criteria for the ponds need to be determined early. Some questions that need to be answered before construction:

- What are the requirements for construction?
- Does excavation of the berms need to be bedrock, is a clay core required, or just chimney drains and silty clays?
- Is enough storage provided to manage rain/run-off events, etc.?

Sketch

Alternative No.: PW-03

☒ **ORIGINAL** ☐ **ALTERNATIVE**



Layout of Two Raw Water Storage Ponds

Sketch

Alternative No.: PW-03

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Construct Only One Raw Water Storage Pond

Calculations

Alternative No.: PW-03

☒ **ORIGINAL** ☒ **ALTERNATIVE**

For both concepts, assume that a 20% premium would need to be applied to the baseline cost to capture construction of a dam rather than a berm.

Assume that constructing only 1 raw water storage pond in Phase 1 would cost 60% of the original cost, as the complete dam segment between the first and second pond would need to be constructed to simplify future construction of the second pond.

Assume that all excess cut not used for the construction of the second pond can be used or stored on site and will not require haul off.

The Value Team acknowledges that constructing a 50 MG pond in Phase 2 will cost more in the future due to the time value of money. However, the Value Team also feels that it is highly likely that a 50 MG pond may not be required based on current projections, and that a smaller capacity pond could be provided. Alternatively, the pond could be eliminated entirely if no expansion beyond 50 MGD is required. For the sake of comparison, the 50 MGD second raw water storage pond has been assumed to be constructed in 2053 to match the 100 MGD full buildout.

Construction Cost Estimate

Alternative No.: PW-03

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Raw Water Reservoirs	LS	$150,122,000	1.0	$150,122,000	0.6	$90,073,200
Dam Premium -- 20% of Original Raw Water Resv Total	LS	$150,122,000	0.2	$30,024,400		
Dam Premium -- 20% of Alternative Raw Water Resv Total	LS	90,073,200.00			0	$18,014,640
**Using Escalated Construction Costs from						
Table 1-3, Project 5, Facility 300						
**Table 1-3 costs include all markup and escalation to mid-point of construction						
(0% markup added to this cost estimate)						
**Cost Savings determined to be 40%						
**Intermediate berm and site work would still need to be performed with reduced scope						
Total Markup						
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$180,146,000		$108,088,000
NET SAVINGS						$72,058,000

Life Cycle Cost Analysis

Alternative No.: PW-03

LIFE CYCLE PERIOD 40 YEARS   ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST			ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
					$180,146,000			$108,088,000
Capital Cost Savings								$72,058,000
ANNUAL EXPENDITURE	**%**	**PRESENT WORTH FACTOR**	**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPITAL COST	ANNUAL COST	PRESENT WORTH
Generalized O&M (% of Capital Cost)								
		SUB-TOTAL			$0			$0

SINGLE EXPENDITURE (REPLACEMENT)	YEAR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Construct Pond in 2065	23	0.5067			148,139,377	75,061,000
Add premium for dam construction (20%)	23	0.5067			29,627,875	15,012,000
Salvage Value at End of Economic Life						
		SUB-TOTAL		$0		$90,073,000
		TOTAL PRESENT WORTH		$0		$90,073,000
			PRESENT WORTH SAVINGS ON O&M			($90,073,000)
			LIFE CYCLE COST SAVINGS			($18,015,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-05
Use cast-in-place concrete tanks for raw water storage in lieu of earthen ponds	
Challenges Standard or Criteria:	Yes ☒ No ☐
Both options challenge the standard that the pond has an open surface and is not to be contained. Option B challenges the District's requirement to provide 1-day of raw water storage.	
Description of Original Concept:	
The original concept is to construct a 100 MGD drinking WTP in two phases at the Salem City site. Phase 1 construction will include several facilities that are sized for the full buildout and will not require expansion in Phase 2, which includes two 50 MG raw water storage ponds.	
Description of Alternative Concept:	
The alternative concept is to replace the two raw water storage ponds with two cast-in-place concrete tanks for the raw water storage.	
Rationale for Change:	
Due to the state dam safety requirements that are expected to apply to the raw water storage ponds, utilizing concrete tanks will be less expective than constructing the earthen storage ponds.	

Value Improvement	**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$	First Cost Savings:	A: $13,633,000 B: $87,877,000
Function: ☒ Increased ☐ Maintained ☐ Decreased	O&M Savings:	A: ($167,049,000) B: ($92,805,000)
Resources: ☒ Increased ☐ Maintained ☐ Decreased	Life Cycle Cost Savings:	A: ($153,416,000) B: ($4,928,000)

Advantages/Disadvantages

Alternative No.: PW-05

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces amount of site work required on-site • Eliminates need to meet State Dam Safety requirements • Reduces water loss due to evaporation • Risk profile would change for tanks versus earthen dams	• If additional raw water storage is needed later, it would make sense that additional storage to be cast-in-place concrete tanks as well • Could promote algae growth in tank • More difficult to clean out sediment

Discussion

Alternative No.: PW-05

Description of original concept affected by this change:

The original concept is to construct two 50 MG raw water storage ponds during the Phase 1 construction of the WTP. Both ponds are being constructed during Phase 1 based on the assumption that it is easier to construct these ponds concurrently versus constructing them separately at different times. This is also happening during Phase 1 based on the volume of material that needs to be excavated and embanked across the complete site.

Issue of concern to the team:

The Value Team believes that the original design of the earthen raw water storage ponds will be subject to the state's dam safety requirements, which is expected to increase the cost and complexity of construction. Additionally, the Value Team is concerned that the Phase 1 buildout of 100 MG of raw water storage may not be necessary if the demand stays on the low end of the projections as per Figure 1-3 in the Plan Formulation Phase II Final Report.

Description of alternative concept:

The alternative concept is to use cast-in-place concrete tanks for the raw water storage rather than the earthen ponds. The tanks are proposed to be similar to the tanks proposed for the finished water storage reservoirs.

This concept is presented with two options:

Option A builds upon alternative PW-03 and recommends constructing two 25 MG tanks in Phase 1 to meet the District's requirements of providing 1-day of raw water storage on site.

Option B challenges the requirement to provide 1-day of raw water storage on site and instead provides ½-day of storage by using two 12.5 MG tanks. This concept matches the tank configuration provided for the finished water storage reservoirs.

Benefit of making the change:

This change provides a substantial cost savings to Phase 1 by reducing the project scope. This concept reduces long-term risk to the District by eliminating two high risk dams. Also, maintenance costs will also be reduced, going from two ponds to two concrete structures.

Additional explanation:

The raw water ponds will be classified as high risk dams requiring specialized construction requirements and a long-term monitoring program to check for leaks. Additional design checks are necessary to ensure design capacity can manage additional flows from runoff from storm events, etc. The use of concrete structures for storage eliminates some of this need. Design can be modeled similar to the finished water tanks to provide cost savings due to scale and repeatability. Enclosed tanks will make it more costly to clean and remove solids from the floor.

Examples where this has been used:

The District currently has a raw water tank on the Olmsted Pipeline reach.

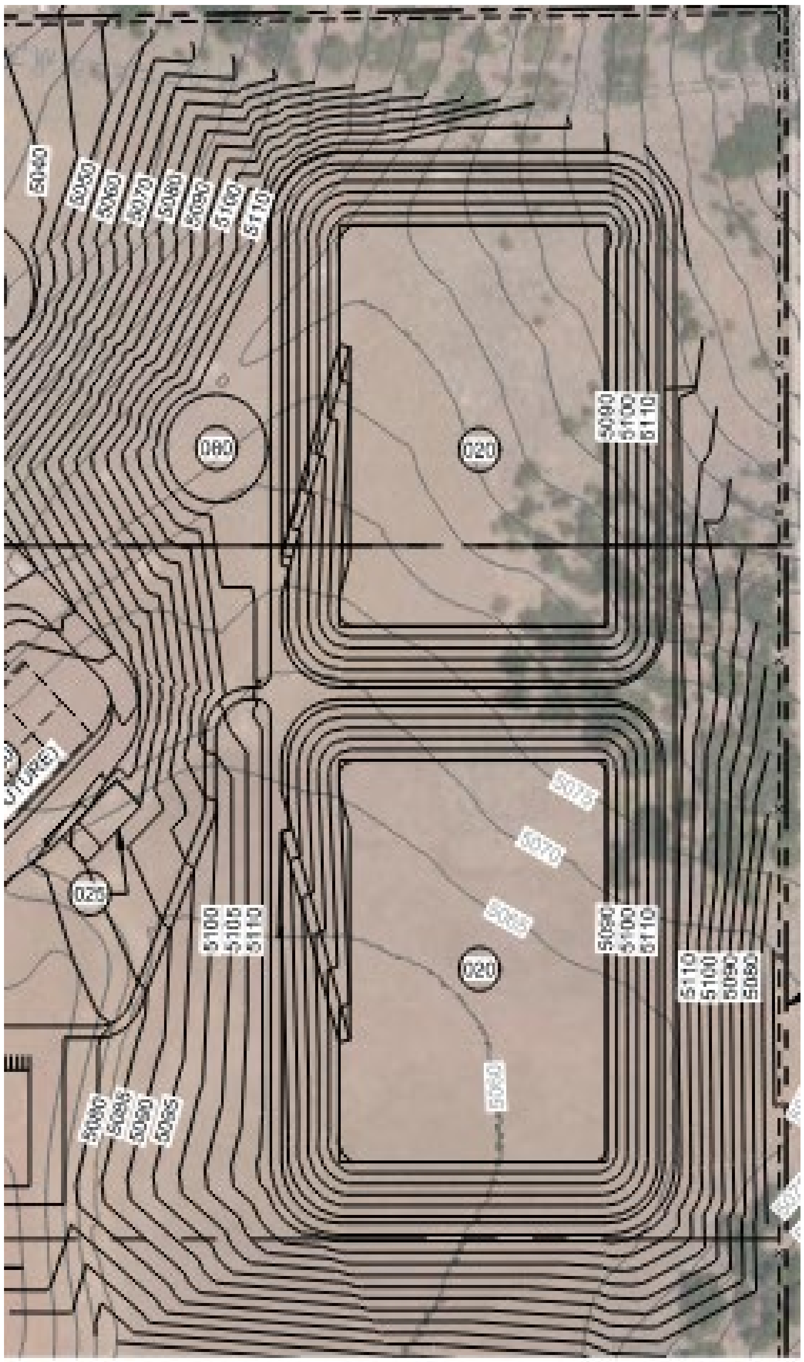
Key steps to implementing the idea:

To implement this idea, the design criteria for the concrete cast-in-place tanks will need to be established. Also, a design will need to be developed for both the raw water and finish water tanks to be the exact same size and dimensions, such that contractor can use the same exact forming system for both sets of tanks.

Sketch

Alternative No.: PW-05

☒ **ORIGINAL** ☐ **ALTERNATIVE**

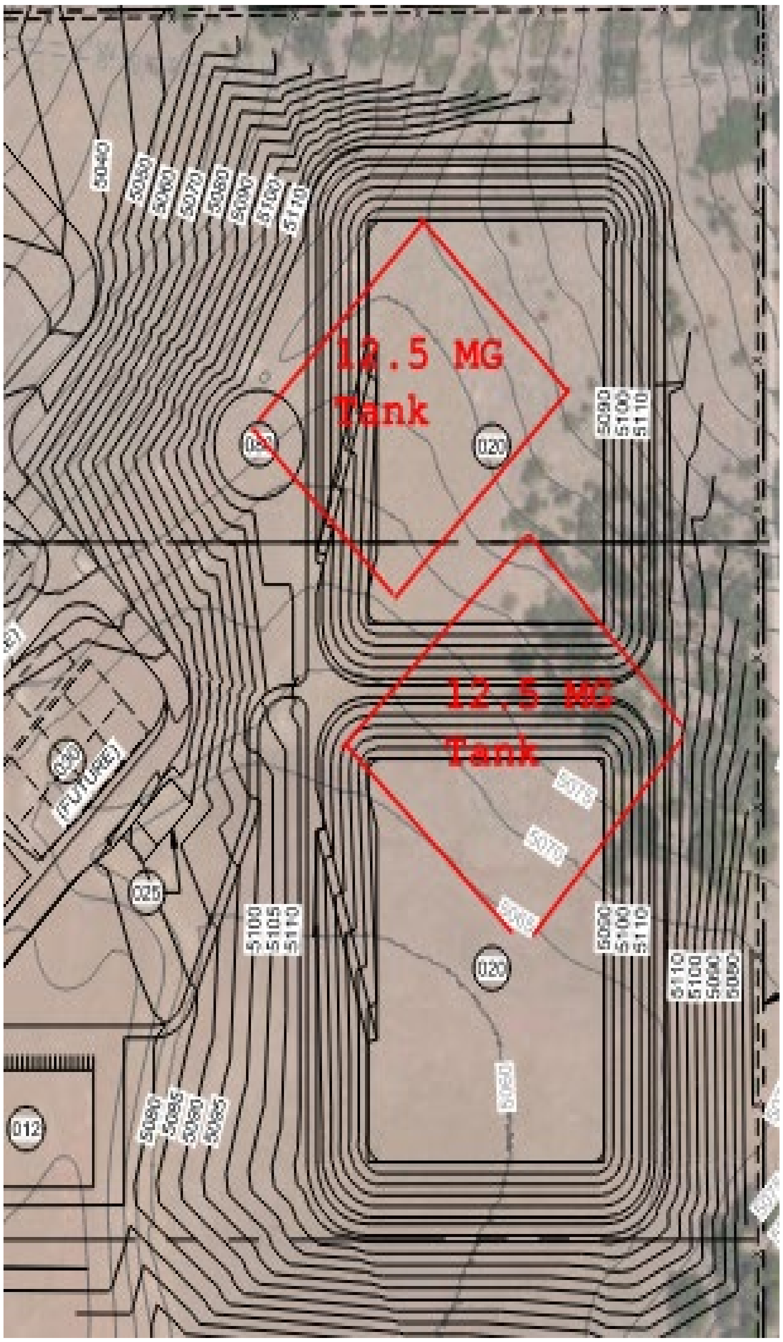


Layout of Two Raw Water Storage Ponds

Sketch

Alternative No.: PW-05

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Construct Two 12.5 MG Cast-In-Place Concrete Tanks (Option B)

Alternative No.: PW-05

☒ **ORIGINAL** ☒ **ALTERNATIVE**

The pricing used for the two options is based on the unit pricing for the finished water storage reservoirs provided by the design team.

For the cost estimates listed in Option A and Option B, it is assumed that the 100 MG earthen storage ponds are eliminated and that they are replaced with two 25 MG and 12.5 MG tanks respectively. Costs to double the storage volume using concrete tanks are included in the life cycle costs to reflect the Phase 2 full buildout in support of a 100 MGD plant. Similar to PW-03, it is noted that the tank capacities in Phase 2 may be reduced or completely eliminated, which would increase the cost savings provided by these two concepts.

Construction Cost Estimate

Alternative No.: PW-05

Option A – Two 25 MG Tanks:

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Raw water reservoirs	LS	$150,567,928	1	$150,567,928		
Dam construction premium -- 20%	LS	150,567,928.00	0.20	$30,113,586		
Cast-in-place concrete raw water tanks (2 x 25 MG, assume 1.8x)	LS	167,049,000.00			1	$167,049,000
**No dam premium included for concrete tanks						
**Markups and escalation are included in unit costs for raw water reservoir and finished						
Water Reservoir						
**Finished water reservoir cost is comparable to cost of new cast-in-place raw water tanks						
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$180,682,000		$167,049,000
NET SAVINGS						$13,633,000

Life Cycle Cost Analysis

Alternative No.: PW-05

LIFE CYCLE PERIOD 50 YEARS ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST	ORIGINAL CONCEPT	ALTERNATIVE CONCEPT
	$180,682,000	$167,049,000
Capital Cost Savings		$13,633,000

ANNUAL EXPENDITURE	%	PRESENT WORTH FACTOR	ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPITAL COST	ANNUAL COST	PRESENT WORTH
Generalized O&M (% of Capital Cost)								
SUB-TOTAL					$0			$0

SINGLE EXPENDITURE (REPLACEMENT)	YEAR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Construct 2 additional 2x 25 MG Tanks in 2053	23	0.5067		0	329,685,653	167,049,000
Salvage Value at End of Economic Life						
SUB-TOTAL				$0		$167,049,000
TOTAL PRESENT WORTH				$0		$167,049,000

PRESENT WORTH SAVINGS ON O&M	($167,049,000)
LIFE CYCLE COST SAVINGS	($153,416,000)

Construction Cost Estimate

Alternative No.: PW-05

Option B – two 12.5 MG Tanks:

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Raw Water Reservoirs	LS	$150,567,928	1	$150,567,928		
Dam Construction Premium -- 20%	LS	150,567,928.00	0.20	$30,113,586		
Cast-in-place Concrete raw water tanks	LS	92,805,000.00			1	$92,805,000
**No Dam Premium Included for Concrete Tanks						
**Markups and Escalation are included in Unit Costs for Raw Water						
Reservoir						
**Finished Water Reservoir Cost is comparable						
to cost of new Cast-In-Place Raw Water Tanks						
**Markups and Escalation are included in Unit Costs for Finished						
Water Reservoir						
Total Markup						
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$180,682,000		$92,805,000
NET SAVINGS						$87,877,000

Life Cycle Cost Analysis

Alternative No.: PW-05

LIFE CYCLE PERIOD 50 YEARS ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST			ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
					$180,682,000			$92,805,000
Capital Cost Savings								$87,877,000
ANNUAL EXPENDITURE	**%**	**PRESENT WORTH FACTOR**	**ORIGINAL CONCEPT**			**ALTERNATIVE CONCEPT**		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPITAL COST	ANNUAL COST	PRESENT WORTH
Generalized O&M (% of Capital Cost)								
SUB-TOTAL					$0			$0

SINGLE EXPENDITURE (REPLACEMENT)	YEAR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Construct additional 2x 12.5 MG Tanks in 2053	23	0.5067		0	183,158,696	92,805,000
Salvage Value at End of Economic Life						
SUB-TOTAL				$0		$92,805,000
TOTAL PRESENT WORTH				$0		$92,805,000
PRESENT WORTH SAVINGS ON O&M						($92,805,000)
LIFE CYCLE COST SAVINGS						($4,928,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-07
Include pre-oxidation in the raw water storage pond to address manganese before flocculation and sedimentation	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to pilot test manganese removal using a pre-oxidant such as chlorine. The use of caustic soda to promote biological manganese removal in the filters is also noted in the conceptual design report.	
Description of Alternative Concept:	
The alternative concept is the use of either pre-ozone or chlorine dioxide after the raw water storage ponds to oxidize reduced manganese, promoting its primary removal in flocculation/sedimentation.	
Rationale for Change:	
Manganese removal has historically been an aesthetic issue but health impacts at lower than the current secondary maximum contaminant level (SMCL) are proposed in some areas. Chlorine oxidation of manganese is kinetically slow – but can be effective on filter media when MnO_2 precipitates and catalyzes the reaction. However, with the use of biologically active filtration without chlorine across the filters as proposed, catalytic activity will not occur. Intermediate ozone can oxidize manganese but may produce colloidal-sized particles that are difficult to filter, and overdosing can cause generation of permanganate (leading to colored water). The District would get the most advantage out of oxidizing manganese prior to floc/sed, where particulate manganese can be removed. There are two oxidants that may be feasible to prevent these issues: pre-ozone or chlorine dioxide.	

Value Improvement	**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$	First Cost Savings:	A: ($3,177,000) B: ($1,958,000)
Function: ☒ Increased ☐ Maintained ☐ Decreased	O&M Savings:	$0
Resources: ☒ Increased ☐ Maintained ☐ Decreased	Life Cycle Cost Savings:	A: ($3,177,000) B: ($1,958,000)

Advantages/Disadvantages

Alternative No.: PW-07

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Oxidation of reduced manganese prior to floc/sed more effectively than with chlorine, enabling precipitation and removal in floc/sed • Avoids colloidal manganese created by intermediate ozone, which can be hard to remove by the filters • Pre-ozonation offers a low-cost option using chemical facilities from the intermediate ozone and a pipeline contactor • Chlorine dioxide offers oxidation potential for manganese that could be added at the rapid mix • Manganese at concentrations above 15-20 µg/L can cause aesthetic concerns to customers; improves water aesthetics	• Addition of another chemical (chlorine dioxide) • Disinfection by-products created from chlorine dioxide (chlorite)

Alternative No.: PW-07

Description of original concept affected by this change:

The original concept is to use chlorine pre-oxidation or biological manganese removal in the filters.

Issue of concern to the team:

The Value Team is concerned that manganese concentrations are high in the source waters and present a challenge to the original concept for the water treatment process. In addition to the current secondary maximum contaminant level (SMCL) of 50 µg/L, some states have proposed a health-based limit of 20 µg/L. The District should have a robust method for removing manganese, as limits may be lowered in the future and concentrations above 20 µg/L can cause customer complaints.

Elevated manganese concentrations in the WTP source water can become an operational challenge, with the potential to result in discolored water served to customers.

Table 2-1. Strawberry Water Quality Summary

Water Quality Parameter	Number of Samples	Minimum	5th Percentile	50th Percentile	95th Percentile	Maximum
Manganese (µg/L)	20	0	0	125	367	453

Table 2-2. Diamond Fork Water Quality Summary

Water Quality Parameter	Number of Samples	Minimum	5th Percentile	50th Percentile	95th Percentile	Maximum
Manganese (µg/L)	177	0	0	18	220	1,400

Chlorine pre-oxidation is kinetically slow unless MnO_2 surfaces are provided or precipitated such as on a filter. Chlorine is not planned across the filters, as the filters will be run as biologically active. With an application point at the rapid mix, little manganese oxidation would occur before the floc/sed process.

While biological manganese oxidation in biofilters may be feasible, concerns have been raised about acclimation times for microbial manganese oxidizers. Few examples of surface water facilities using biological manganese oxidation are known (WRF Guidance for the Treatment of Manganese, 2013). The District may prefer a more certain approach such as the use of pre-ozone or chlorine dioxide.

Description of alternative concept:

The alternative concept is to apply pre-ozone (Option A) or chlorine dioxide (Option B) after the raw water storage pond, prior to floc/sed. The purpose of this approach is to oxidize dissolved manganese present in the source water, allowing most of the manganese to be removed during flocculation and sedimentation.

While not explored in detail due to the focus on the WTP, the District could also seek to decrease manganese concentrations in water from Strawberry Reservoir through source water control. Examples include hypolimnetic aeration to prevent release of manganese from bottom sediments and installation of a multi-level intake.

Benefit of making the change:

Use of a targeted pre-oxidant like ozone or chlorine dioxide can oxidize the dissolved manganese, causing particle formation that can be removed in the floc/sed process. Chlorine as planned will not be effective.

Additional explanation:

Evaluate if additional reaction time could be provided by moving the rapid mix closer to the flocculation basins (note this ties in with Alternative PW-09).

Examples where this has been used:

Application of oxidants, including chlorine dioxide and ozone, prior to floc/sed was evaluated in a Fort Collins study (WRF Guidance Manual for the Treatment of Manganese, 2013; Gregory and Carlson, 2003). The study showed ClO_2 oxidation within 300 seconds (the plant contact time) and ozone oxidation within 60 seconds. Ozone, if slightly overdosed, resulted in pink water, highlighting the need for careful optimum dose targeting.

Pre-ozonation using a pipeline contactor has been used locally at Weber Basin's Davis North WTP for more than 20 years with success. Other plants also using pre-ozone include DAC and Little Cottonwood. Commonly in Utah, WTPs use chlorine above the filters in addition to pre-ozone. Another example is Green River Filtration Facility (Tacoma, WA), which uses a raw water transmission line for a 150 MGD WTP with pre-ozone.

Chlorine dioxide pre-oxidation has been used successfully at Jordan Valley (Utah), Sweetwater Authority (California), Corpus Christi (Texas), and recently evaluated for manganese at Laredo (Texas).

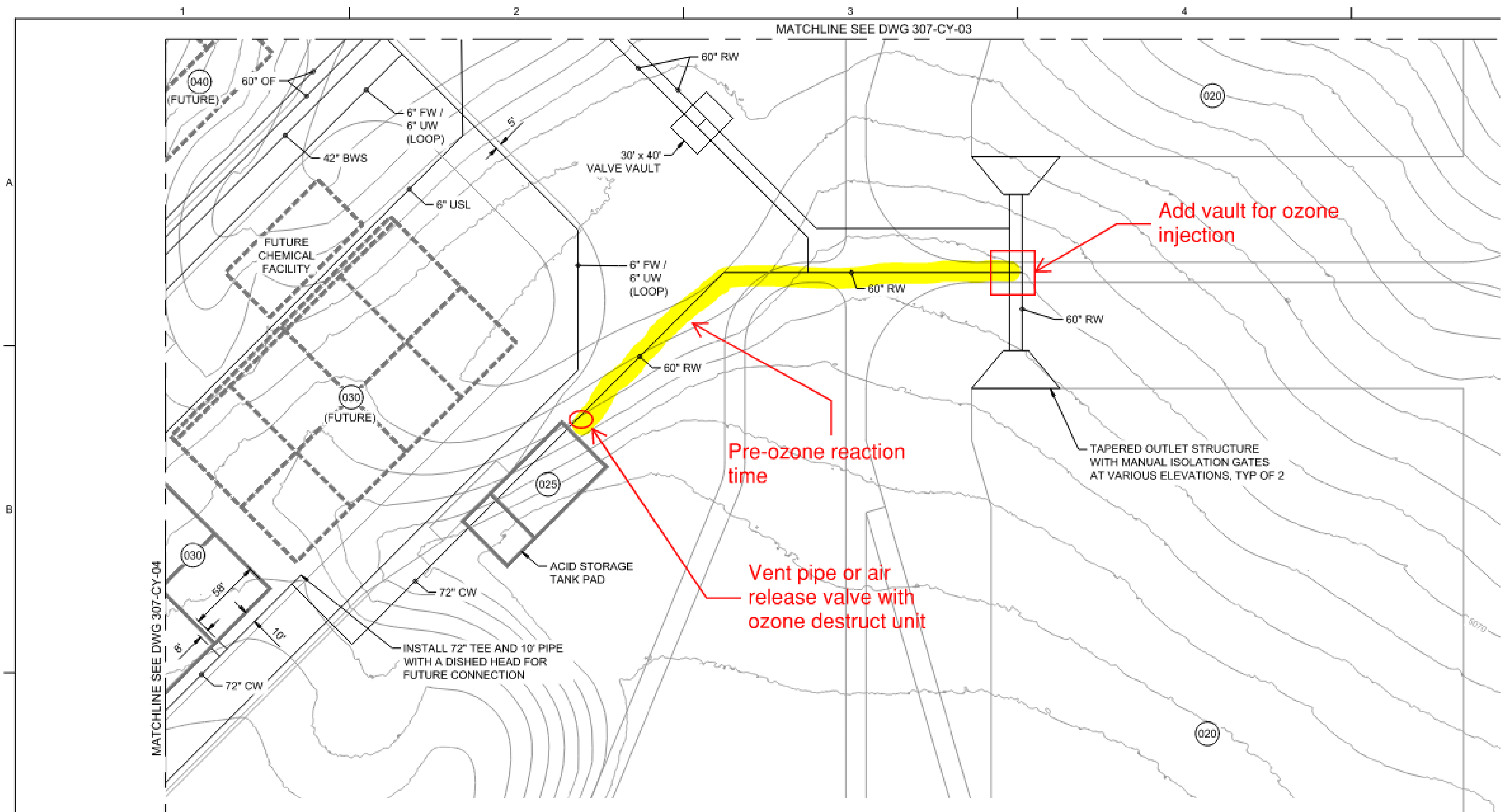
Key steps to implementing the idea:

1. Collection of data on the seasonality of manganese concentrations in the source water.
2. Evaluation and implementation of options for decreasing manganese concentrations in the source water reservoir.
3. Pilot testing of the two alternate oxidants, pre-ozone and chlorine dioxide.
4. Selection of the treatment approach and incorporation into design.

Sketch

Alternative No.: PW-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**



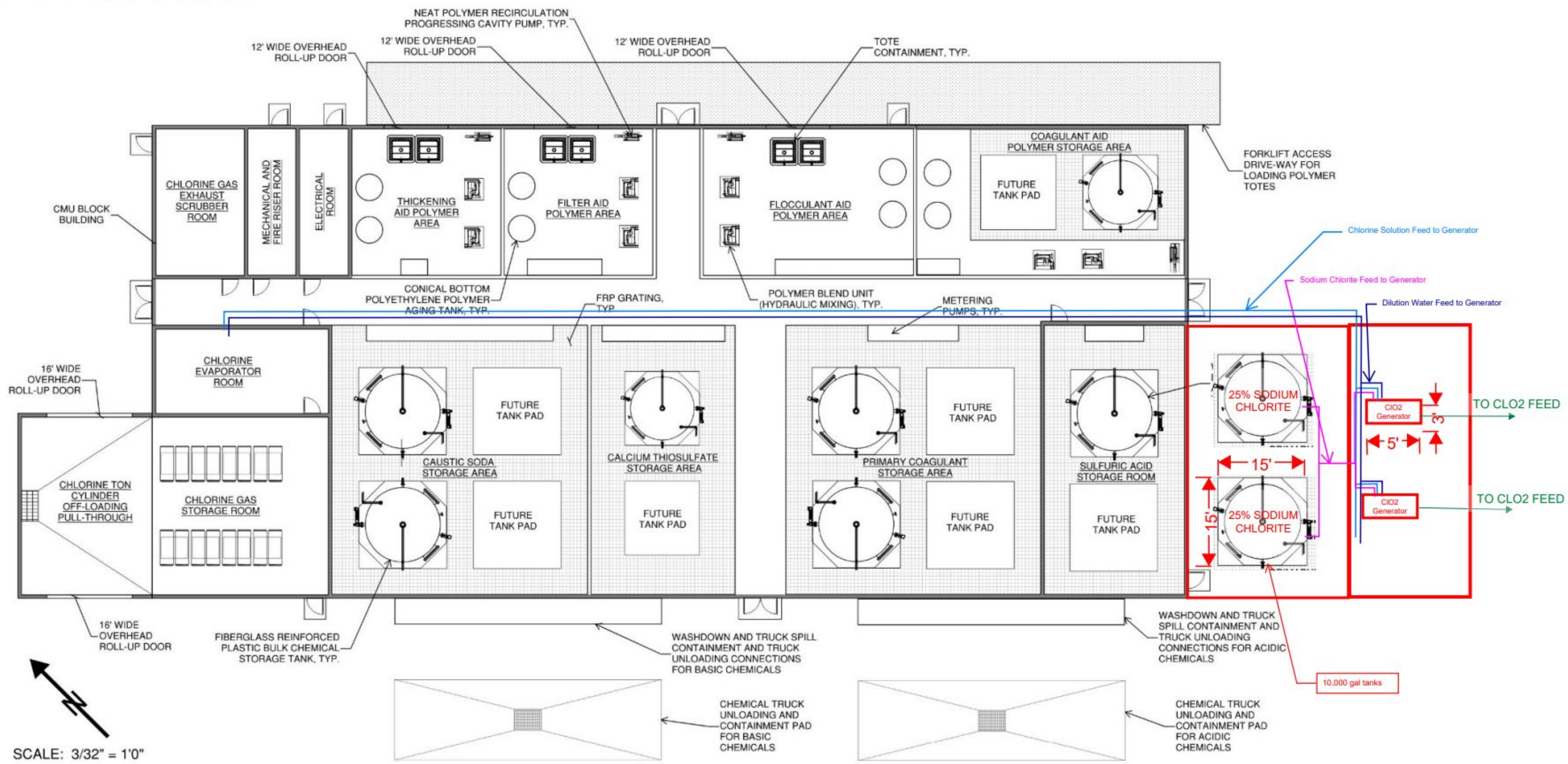
Alternative Pre-Ozone Injection and Reaction Time

Alternative No.: PW-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**

NOT TO SCALE

Figure A-5. Preliminary Chemical Facility Layout



Alternative Chemical Facility Layout – Addition of Chlorine Dioxide

Calculations

Alternative No.: PW-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Pre-ozone (A):

Approximate distance from isolation gate at the raw water reservoir outlet to the rapid mix = 350 FT

Pipe diameter = 60 IN = 5 FT

Volume in pipe for this reach: $V = \pi r^2 l = \pi \times (2.5\ FT)^2 \times 350\ FT$ = 6,869 CF = 51,378 GAL

Flow rate: 100 MGD = 69,400 GPM

Reaction time in pipe for 100 MGD from one basin:
t = V/Q = 51,378 GAL / 69,400 GPM = 0.74 min

Move the rapid mix downstream closer to the flocculation basins for additional reaction time.

Components for cost estimate:

- Vault
- Injection with a standard flash mix nozzle, quantity 2
- 6 IN SST pipe from the ozone building to the vault (estimated at 1,200 FT)
- Air release valve
- Ozone destruct unit
- Ozone dose assumption (to be confirmed): 0.5 MG/L (however, dose added here decreases the demand for intermediate ozone so no additional cost is expected)

Alternative No.: PW-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Chlorine Dioxide (B):

Assumptions:

- 1.4 MG/L chlorine dioxide dose
- 30 days of sodium chlorite storage
- Duty/standby configuration for generators and precursor chemicals
- msmilliiiautods.pdf (evoqua.com)
- Chlorine gas existing
- This system assumes a batch chlorine dioxide tank is not needed. Typically, ClO_2 batch tanks with pumps are used when the receiving point backpressure is >10 PSI; it is assumed this will not be the case. Direct feed is recommended.
- No double containment piping for chlorine dioxide.

Sodium chlorite volume required:

- 50 MGD flow rate:
  - ClO^2 required (LBS/day, PPD): 50 MGD x 1.4 MG/L x 8.34 = 584 PPD
  - Volume required for 30 days of storage: 584 PDD x 0.56 GAL/LB ClO^2 x 30 days = 9,808 GAL
  - Tanks required for 30 days of storage: 1
- 100 MGD flow rate:
  - ClO^2 required (pounds per day): 100 MGD x 1.4 MG/L x 8.34 = 1,168 PPD
  - Volume required for 30 days of storage: 1,168 PDD x 0.56 GAL/LB ClO^2 x 30 days = 19,616 GAL
  - Tanks required for 30 days of storage: 2

Calculations

Alternative No.: PW-07

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Chlorine gas required:

- 50 MGD flow rate:
  - LBS of chlorine gas required (PPD): 584 PPD ClO^2 x 0.5 LB Cl^2 gas / LB ClO^2 = 292 PPD
- 100 MGD flow rate:
  - Pounds of chlorine gas required (PPD): 1,168 PPD ClO^2 x 0.5 LB Cl^2 gas / LB ClO^2 = 584 PPD

Components for cost estimate:

- Chlorine dioxide generator, quantity 2
- Sodium chlorite storage tanks, 10,000 GAL each, quantity 2
- Dilution water piping, 1 IN, 200 FT
- Sodium chlorite piping, 3/8 IN, 60 FT
- Chlorine solution piping, 3/8 IN, 200 FT
- Chlorine dioxide piping, 1.5 IN, 800 FT
- Ball valves, quantity 11

Construction Cost Estimate

Alternative No.: PW-07

Option A: Pre-Ozone

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Vault	EA	55,000.00			1	$55,000
Injection with standard flash mix nozzle	EA	5,000.00			2	$10,000
6 IN Stainless steel pipe from ozone building to vault	FT	650.00			1,200	$780,000
Air release valve	EA	4,000.00			1	$4,000
Ozone destruct unit	EA	316,827.28			1	$316,827
Side stream with de-gasification	EA	400,000.00			1	$400,000
Total Markup	102.91%					$1,611,341
TOTALS	Breakdown of Markup can be found in the Cost Appendix					$3,177,000
NET SAVINGS						($3,177,000)

Construction Cost Estimate

Alternative No.: PW-07

Option B: Chlorine Dioxide

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Chlorine dioxide generator	EA	255,000.00			2	$510,000
Sodium chlorite storage tanks (10,000 GAL)	GAL	190,000.00			2	$380,000
PVC piping (1 IN): dilution water	FT	14.00			200	$2,800
PVC piping (3/8 IN): sodium chlorite	FT	14.00			60	$840
PVC piping (3/8 IN): chlorine solution	FT	14.00			200	$2,800
PVC piping (3/8 IN): chlorine dioxide solution	FT	14.00			800	$11,200
Ball valves (3/8 and 1 IN)	EA	5,225.00			11	$57,475
Total Markup	102.91%					$993,168
TOTALS	Breakdown of Markup can be found in the Cost Appendix					$1,958,000
NET SAVINGS						($1,958,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-09
Use two 25 MGD floc/sed basins in lieu of four	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to use four floc/sed basins for the 50 MGD plant.	
Description of Alternative Concept:	
The alternative concept is to reduce the number of floc/sed basins to two.	
Rationale for Change:	
Of all the processes, the floc/sed basins have the largest turndown capabilities and the least complexity of the other treatment processes. Reducing the number of basins reduces the number of hydraulic walls, flocculators, and valves without compromising process performance or turndown.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☐ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$2,461,000
O&M Savings:	$0
Life Cycle Cost Savings:	$2,461,000

Advantages/Disadvantages

Alternative No.: PW-09

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces the amount of equipment and concrete • Preserves turndown capabilities • Simplifies flow split	• Reduces capacity if a floc/sed basin goes down

Discussion

Alternative No.: PW-09

Description of original concept affected by this change:

The original concept is to use four floc/sed basins for the 50 MGD plant. Each basin is sized for 12.5 MGD.

Issue of concern to the team:

There are a lot of units for a process that has high turndown capabilities. It requires a four-way flow split that is accomplished with four additional flow control valve and flow meter combinations.

Description of alternative concept:

The alternative concept is to reduce the number of basins to two (sized for 25 MGD), which also simplifies flow split by accommodating a hydraulic flow split that relies on symmetry. The flocculators for the 12.5 MGD basins can be upsized to cover a larger area. It is likely that the same number of larger flocculators can cover the larger floc basin area. Floc/sed geometry for the larger basins can be adjusted to optimize around flocculation. The plate settler layout can be adjusted to meet basin widths optimized for flocculation.

Benefit of making the change:

This change reduces the number of flow meters, inlet valves, flocculators, and hydraulic walls. It may also reduce the number of sludge collectors.

Examples where this has been used:

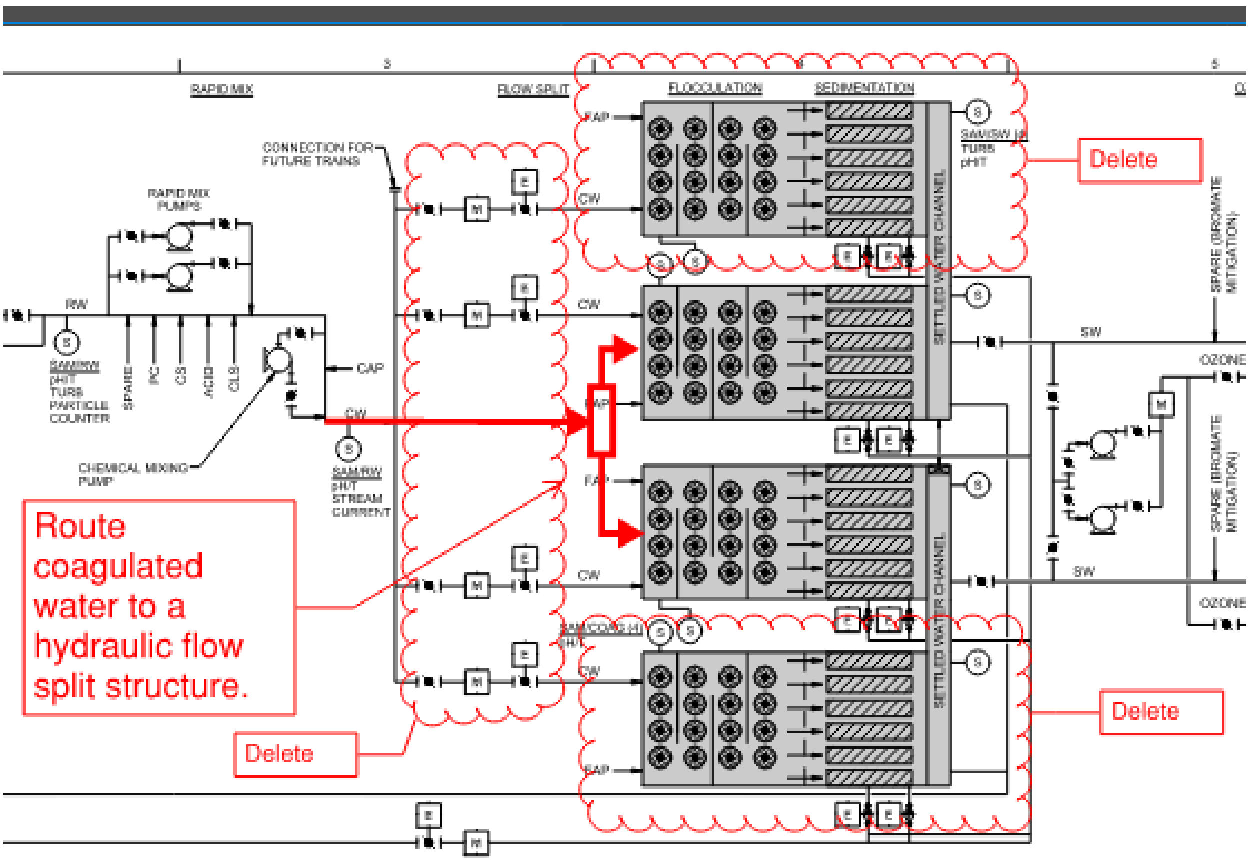
The District's Ashley Valley WTP and Duchesne Valley WTP both have two floc/sed basins sized for 50% each.

The Point of the Mountain WTP is a 75 MGD basin with three 25 MGD floc/sed trains with plate settlers. The Value Team believes a 25 MGD is a reasonable size for a WTP.

Sketch

Alternative No.: PW-09

☒ **ORIGINAL** ☒ **ALTERNATIVE**

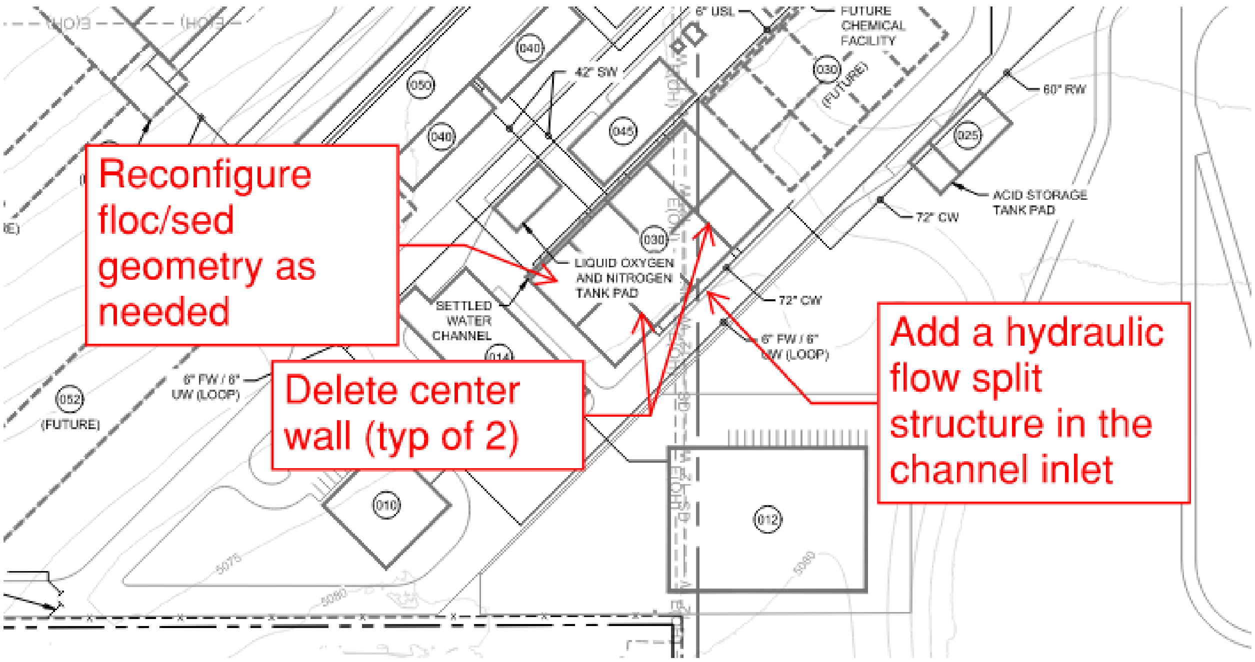


Configuration Reduces the Number of Floc/Sed Basins from Four to Two

Sketch

Alternative No.: PW-09

☒ **ORIGINAL** ☒ **ALTERNATIVE**



Reduces the Amount of Equipment but Requires the Same Footprint

Calculations

Alternative No.: PW-09

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Calculations to support the cost estimate.

- This eliminates 4 flow meters and flow control valves
  (assumed at 24 IN each, 6 FPS)
- Assume that the larger flocculators to accommodate a larger cell area are approximately the same cost, so eliminating 2 basins eliminates half of the flocculators.
- Assume that we have the same amount of hose-less collectors despite half of the basins. It is likely that fewer hose-less collectors will be required, but that would depend on how wide the originals were and how many we would need to cover the new basin.
- Eliminate 2 concrete longitudinal hydraulic walls:
  - Scaling from the drawings: 120 FT length
  - From the Hydraulic profile: 20 FT high
  - Assume 2 FT width
  - CY = (2 FT x 120 FT x 20 FT x 2 walls) / 27 CF/CY = 360 CY
- Eliminate drains and backfill valves (1 EA per basin) – assume 12 IN

Construction Cost Estimate

Alternative No.: PW-09

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
24 IN flow meters	EA	53,500.00	4	$214,000		
24 IN flow control valves	EA	49,050.00	4	$196,200		
Flocculators	EA	5,600.00	32	$179,200		
Vertical concrete hydraulic wall	CY	1,676.00	360	$603,360		
12 IN manual drain and backfill valves (submerged)	EA	5,000.00	4	$20,000		
Total Markup	102.91%			$1,248,011		
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$2,461,000		
NET SAVINGS						$2,461,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-15
Use the finished water reservoir for chlorination in lieu of chlorine contact basin	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to include a dedicated chlorine contact basin (CCB) for achieving disinfection contact time (CT), followed by two finished water reservoirs.	
Description of Alternative Concept:	
The alternative concept is to eliminate the CCB and rely on the baffled finished water reservoirs for CT.	
Rationale for Change:	
The District's standard is to use baffled finished water reservoirs in the three WTPs. Calculations show that the finished water tanks provide sufficient CT throughout the year. Cost savings and footprint can be saved by eliminating the CCB.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	$21,674,000
Function	Resources	O&M Savings:	$21,674,000
☒ Increased	☐ Increased	Life Cycle Cost Savings:	$43,348,000
☐ Maintained	☐ Maintained		
☐ Decreased	☒ Decreased		

Advantages/Disadvantages

Alternative No.: PW-15

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Eliminates an unnecessary CCB • Simplifies the construction of the WTP • Creates additional footprint available for future facilities	• Additional conservatism is offered for achieving CT with the CCB

Discussion

Alternative No.: PW-15

Description of original concept affected by this change:

The original concept is to include a dedicated CCB for achieving disinfection CT, followed by two 12.5 MG finished water reservoirs.

Issue of concern to the team:

The use of even one baffled finished water reservoir offers sufficient CT even under the most challenging conditions (I.e., winter, maximum flow, half-full). Since two finished water reservoirs are planned, more than sufficient CT is available.

Description of alternative concept:

The alternative concept is to eliminate the CCB and rely on the baffled finished water reservoirs for CT.

Benefit of making the change:

This change eliminates of the CCB and frees up available space on the site, eliminates infrastructure that requires maintenance, and offers cost savings.

Additional explanation:

The location for the addition of the chlorine solution, caustic, and acid were kept the same (upstream of the finished water reservoirs) to provide mixing and stabilization of the finished water before the point of entry to the distribution system. The Value Team considered the decreased disinfection strength at a higher finished water pH (from adding caustic before final disinfection) but noted that sufficient CT was achieved at a pH of 9 in the calculations.

Examples where this has been used:

The use of baffled finished water reservoirs without dedicated CCBs are common, including at the District's three WTPs.

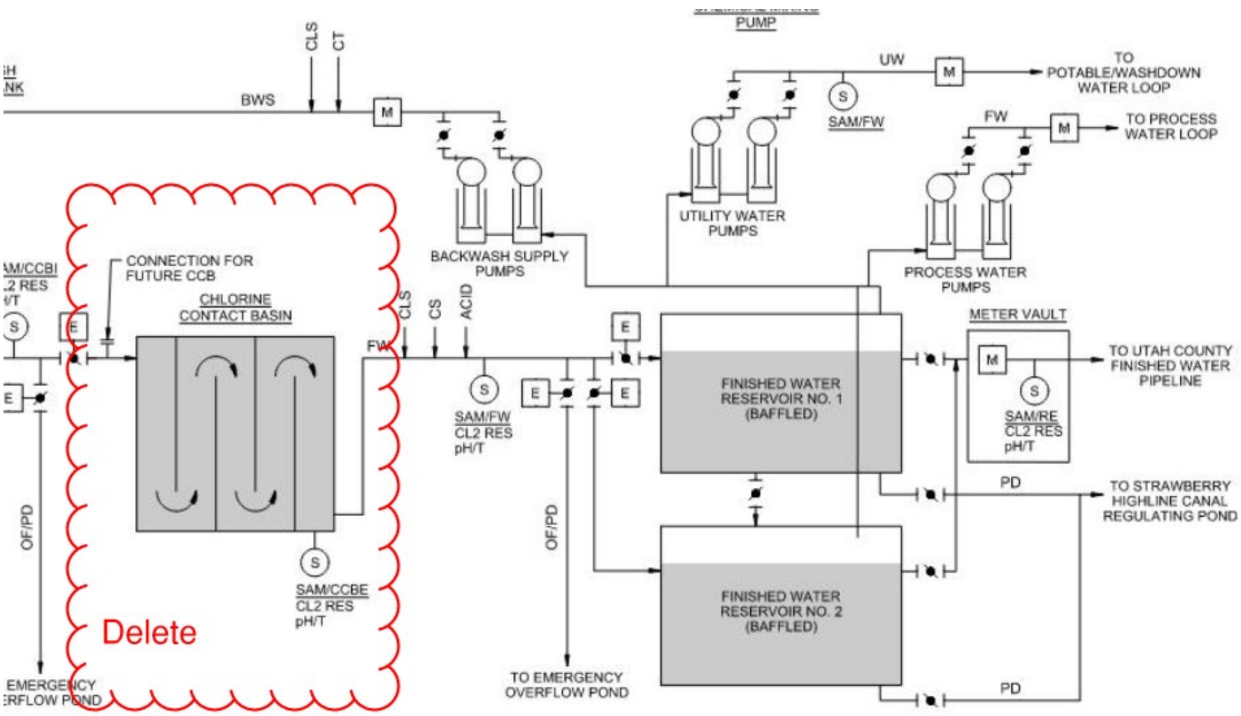
Key steps to implementing the idea:

1. Consider the additional degree of conservatism desired by the District.
2. Proceed with design with baffled finished water reservoirs and elimination of the CCB.

Sketch

Alternative No.: PW-15

☐ **ORIGINAL** ☒ **ALTERNATIVE**



Removal of CCB with Reliance on Finished Water Reservoirs for CT

Calculations

Alternative No.: PW-15

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Cross-check of CT calculations:

Virus												
Scenario	Residual Chlorine	Max. pH	Min. Temp	Max. Flow	Max. Volume	Theoretical Detention Time	Baffle Factor	Time	Min CT Provided	CT 4-log[1]	Log Inactivation Achieved	Log Inactivation Design Req'd
	C, mg/L		Cel	MGD	MG	min		min	min-mg/L	min-mg/L		
Winter, Two Unbaffled Reservoirs Online/Full	1	9	1.5	54.3	25	663	0.1	66.3	66.3	11.1	**24**	**2**
Winter, One Unbaffled Reservoir Online/Full	1	9	1.5	54.3	12.5	331	0.1	33.1	33.1	11.1	**12**	**2**
Winter, One Baffled Reservoir Online/Half Full	1	9	1.5	54.3	6.25	166	0.7	116.0	116.0	11.1	**42**	**2**
Winter, One Baffled Reservoir Online/Full	1	9	1.5	54.3	12.5	331	0.7	232.0	232.0	11.1	**84**	**2**

Giardia												
Scenario	Residual Chlorine	Max. pH	Min. Temp	Max. Flow	Max. Volume	Theoretical Detention Time	Baffle Factor	Time	Min CT Provided	CT 3-log[2]	Log Inactivation Achieved	Log Inactivation Design Req'd
	C, mg/L		Cel	MGD	MG	min		min	min-mg/L	min-mg/L		
Winter, Two Unbaffled Reservoirs Online/Full	1	9	1.5	54.3	25	663	0.1	66.3	66.3	409.2	**0.49**	**0.5**
Winter, One Unbaffled Reservoir Online/Full	1	9	1.5	54.3	12.5	331	0.1	33.1	33.1	409.2	**0.24**	**0.5**
Winter, One Baffled Reservoir Online/Half Full	1	9	1.5	54.3	6.25	166	0.7	116.0	116.0	409.2	**0.85**	**0.5**
Winter, One Baffled Reservoir Online/Full	1	9	1.5	54.3	12.5	331	0.7	232.0	232.0	409.2	**1.70**	**0.5**

[1] EPA Disinfection Guidance Manual Table B-2, interpolated for T = 1.5C

[2] EPA Disinfection Guidance Manual Table B-1, interpolated for T = 1.5C

One baffled finished water reservoir can be used to provide sufficient Giardia and virus CT, and the reservoir could be half full and still meet CT.

Construction Cost Estimate

Alternative No.: PW-15

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Chlorine contact basin	EA	17,479,000.00	1	$17,479,000		
Total Markup:	24.00%			$4,194,960		
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$21,674,000		
NET SAVINGS						$21,674,000

Life Cycle Cost Analysis

Alternative No.: PW-15

LIFE CYCLE PERIOD 50 YEARS ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST	ORIGINAL CONCEPT	ALTERNATIVE CONCEPT
	$21,674,000	$0
Capital Cost Savings		$21,674,000

ANNUAL EXPENDITURE	%	PRESENT WORTH FACTOR	ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPITAL COST	ANNUAL COST	PRESENT WORTH
Generalized O&M (% of Capital Cost)								
		SUB-TOTAL			$0			$0

SINGLE EXPENDITURE (REPLACEMENT)	YEAR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Construct CCB #2	23	0.5067	42,775,514	21,674,000		0
Salvage Value at End of Economic Life						
		SUB-TOTAL		$21,674,000		$0
		TOTAL PRESENT WORTH		$21,674,000		$0

PRESENT WORTH SAVINGS ON O&M $21,674,000

LIFE CYCLE COST SAVINGS $43,348,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-16
Reduce the depth of the filter media from 72 inches to 48 inches and shorten the hydraulic profile by 6 feet	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept provides a 72-inch-deep filter using very deep granular activated carbon (GAC) media. This filter provides an abundance of head for filtration.	
Description of Alternative Concept:	
The alternative concept is to reduce the media depth and head for filtration, while still preserving more than other high-rate filters in Utah treating similar water.	
Rationale for Change:	
This strategy reduces the amount of excavation, concrete, and media to construct the filters. Furthermore, the resulting shorter hydraulic profile will create more flexibility in locating the plant facilities on the site.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☐ Increased	☐ Increased
☒ Maintained	☐ Maintained
☐ Decreased	☒ Decreased

Cost Savings Summary

First Cost Savings:	$9,366,000
O&M Savings:	$0
Life Cycle Cost Savings:	$9,366,000

Advantages/Disadvantages

Alternative No.: PW-16

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Reduces excavation • Reduces concrete • Reduces the constraints that limit layout options due to the shorter hydraulic drop across the plant site • Preserves sufficient media depth and head for solids accumulation for effective bio and traditional filtration • If the finished water reservoir is left at the same hydraulic grade, then future GAC could be incorporated by gravity	• The filter media may not be fully optimized for biological filtration for manganese removal

Alternative No.: PW-16

Description of original concept affected by this change:

The original concept provides a 72-inch-deep filter using very deep granular activated carbon (GAC) media and provides abundance of head for filtration.

Issue of concern to the team:

The Value Team is concerned that the media configuration is very robust and more than required by this project. The cost consequences of such a conservative design are significant in additional media, concrete, and excavation.

Description of alternative concept:

The alternative concept is to install 48 inches of anthracite instead of 72 inches while still preserving appropriate L/d ratios (> 1,500, ensuring high quality water) and empty bed contact time (EBCT, > 6 min, ensuring sufficient biological filtration). It reduces the available head for filtration from 22 feet down to 16 feet (which will be the most head available for filtration and UV in Utah).

Benefit of making the change:

With these changes, the filters are 6 feet shallower, reducing concrete and excavation requirements. GAC quantities drop to 67% of the original quantity. These changes still create a robust filter process that will produce high quality water, which accommodates biological filtration, which preserves the ability for future high-rate filtration, and that results in long, efficient filter runs.

The shorter overall hydraulic grade further benefits the project in one of two ways:

1. The shorter hydraulic drop from the raw water ponds to the finished water reservoir creates additional flexibility for locating the facilities on-site.
2. The finished water reservoir could remain at the current hydraulic grade, and an additional 6 feet can be used in the future to treat water through GAC contactors for PFAS by gravity. This eliminates a future intermediate pump station.

Additional explanation:

There is a risk in making this change that biological removal through the filters may be less effective at the lower EBCT. However, manganese is best removed by pretreatment rather than relying on biological manganese removal, and there are provisions for manganese removal in the original project. Furthermore, Alternative PW-07 includes pretreatment improvements to improve manganese removal.

Examples where this has been used:

The alternative configuration provides a robust media with more head for filtration than every other filter in Utah. GAC media is commonly used with these parameters across the US.

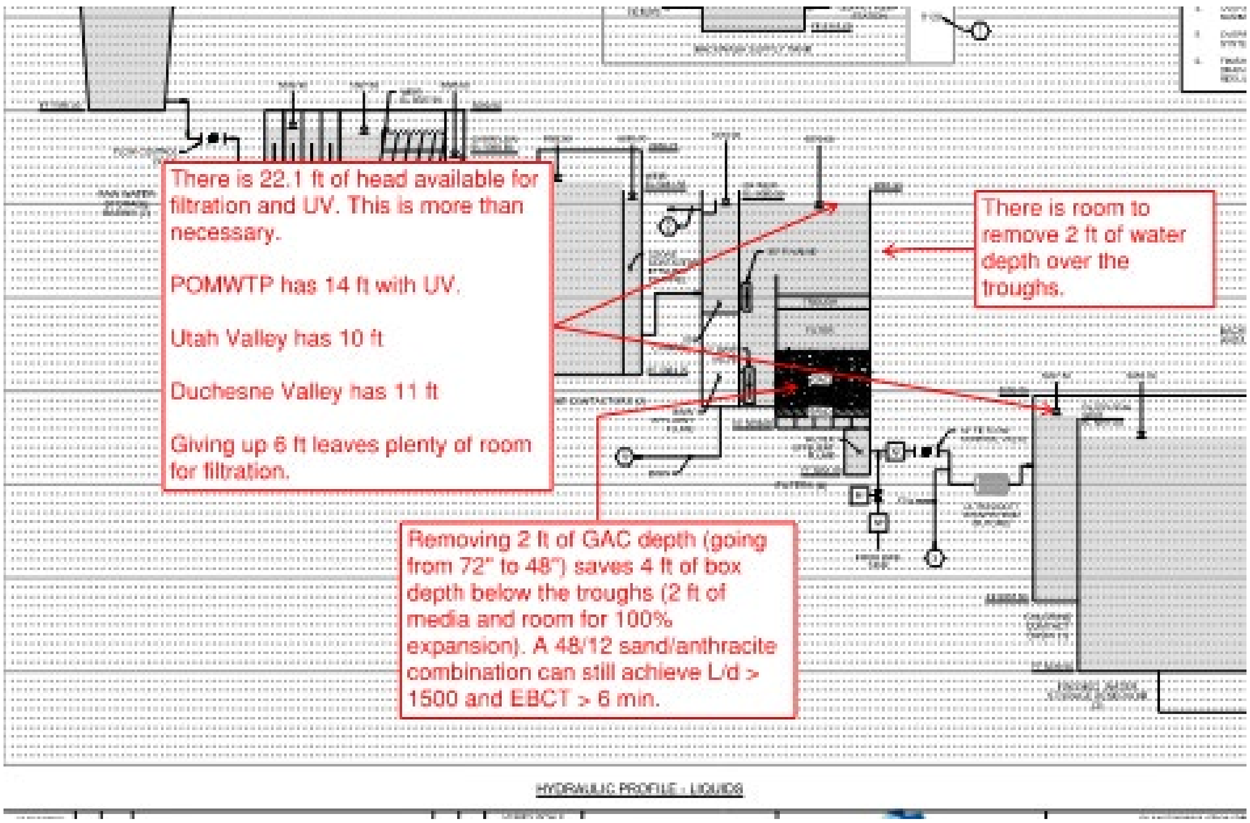
Key steps to implementing the idea:

This alternative can be easily incorporated into the normal design process as envisioned. Piloting the different media configuration over an extended period that covers seasonal variability will be important.

Sketch

Alternative No.: PW-16

☒ **ORIGINAL** ☒ **ALTERNATIVE**



Proposed Depth of Filter Box

Alternative No.: PW-16

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Reducing the GAC media depth:

Original depth = 72 IN - call this a **unit of 1.0**

Alternative depth = 48 IN - call this a **unit of 0.67**

Reducing wall costs:

This alternative suggests taking 6 FT out of all vertical walls in the filter building

Assume average wall thickness of 1.33 FT (some are 1 FT some are 1.5 FT)

- There are 17 short walls immediately around the filters:
  - 40 FT long x 6 FT tall x 1.33 FT x 17 walls / 27 CY/CF = **209 CY**
- There are 2 long walls immediately around the filters:
  - 250 FT long x 6 FT tall x 1.33 FT x 2 walls / 27 CY/CF = **154 CY**
- There are 2 exterior long walls around the filter and galleries
  - 300 FT long x 6 FT tall x 1.33 FT x 2 walls / 27 CY/CF = **185 CY**
- There are 2 exterior short walls around the filter and galleries
  - 80 FT long x 6 FT tall x 1.33 FT x 2 walls / 27 CY/CF = **49 CY**
- Total = **600 CY**

Reducing Excavation:

This alternative suggests taking 6 FT out of all excavation for overall footprint of 80 FT x 300 FT

- 80 FT x 300 FT x 6 FT / 27 CY/CF = **5,300 CY**

Construction Cost Estimate

Alternative No.: PW-16

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
GAC Media	EA	10,780,000.00	1	$10,780,000	0.67	$7,222,600
Reduced wall concrete	CY	1,676.00	600	$1,005,600		
Reduced excavation	CY	10.00	5,300	$53,000		
Total Markup	102.91%			$12,182,713		$7,432,540
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$24,021,000		$14,655,000
NET SAVINGS						$9,366,000

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-19
Send all residuals and filter waste to engineered lagoons to eliminate the backwash water clarification process and filter to waste equalization and pumping	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to equalize filter backwash water (BWW), clarify it, and pump the decant to the raw water (RW) pipeline for delivery to the RW storage basins. It separately equalizes filter-to-waste (FTW) water and pumps it to the RW pipeline. The equalization basins, pumps, and BWW clarifiers are located on the main plant site.	
Description of Alternative Concept:	
The alternative concept is to send un-equalized BWW and FTW water to the solids lagoons for equalization, clarification, and dewatering. A new integrated return pump station will return clarified BWW decant, thickened sludge decant, and dewatering decant into the RW pipeline for return to the RW storage basins.	
Rationale for Change:	
This change simplifies residual handling by transitioning solids handling processes (equalization and clarification) from the original dedicated facilities to the original sludge lagoons that are already included in the project. This reduces the number of facilities that must be operated and reduces chemical costs.	

Value Improvement		**Cost Savings Summary**	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	$56,184,000
Function	Resources		
☒ Increased	☐ Increased	O&M Savings:	$707,000
☐ Maintained	☐ Maintained		
☐ Decreased	☒ Decreased	Life Cycle Cost Savings:	$56,891,000

Advantages/Disadvantages

Alternative No.: PW-19

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Simplifies operations • Eliminates the original BWW equalization basin and its associated FTW equalization • Eliminates FTW equalization basin • Reduces chemical feed for residuals handling • Requires minor modifications to accomplish these purposes and does not substantially increase in size because sizing is dictated by dry time for the solids • Provides the ability to reclaim the water associated with sedimentation basin sludge • Eliminates the spreading basins	• The alternative reclaimed pump station whose pumps will return water to the RW pond via the RW pipeline will have a higher static discharge lift (approximately 246 feet) compared to the original 67 feet for the original reclaim pumps from the BWW Clarifier • There are more facilities (the alternative Reclaimed pump station) that are located off the main site and down the hill

Discussion

Alternative No.: PW-19

Description of original concept affected by this change:

The original concept is to employ a residuals handling strategy that is a common strategy which handles the sedimentation basin sludge (un-thickened sludge) differently from the more dilute BWW and from the very clean FTW water.

For the sedimentation basin sludge, the original system employs four, concrete lined solids lagoons. These four basins are sized with enough area to dry the solids using solar evaporation and decant to unlined spreading basin. The four basins are configured long and thin with an appropriate length to width ratio that allows solids to enter them, or solids stirred up by inlet flows, to settle out before the water exits at the opposite end.

For the BWW, the original system employs a BWW equalization basin that accommodates four backwashes; three BWW pumps (two duty, one standby); two BWW clarifiers (one duty, one standby) that use both coagulant and polymer; and a recycle pump station (two duty, two standby). These facilities work together to equalize BWW, clarify it, pump the decant back to the RW pipeline for delivery to the RW storage basins, and send un-thickened sludge to the solids lagoons.

The equalization basins and associated pumps, the clarifiers, and the reclaim pumps are located up on the main plant site. At this higher elevation, the reclaim pumps only have an approximate 67-foot static lift to get to the RW storage basin.

This is one of several typical strategies for processing residuals at a water treatment plant and matches that which was originally operated at the Don A. Christiansen Regional WTP. This strategy is particularly beneficial where there is insufficient land to properly configure an engineered lagoon system to both clarify and equalize effectively without batch operations, or to provide sufficient dry time for a basin before it must be put back in service.

Issue of concern to the team:

The Value Team noted that the District property includes sufficient land on the north side and the original sludge lagoons are already properly configured with four, concrete-lined basins with a length to width ratio of approximately 4:1. This configuration can be coupled with a subdivided reclaim pump station to accomplish equalization of both BWW and FTW, and clarification of FWW. By taking advantage of the land and the solids lagoons already in the original project, the equalization and BWW clarification processes can be eliminated. This reduces the number of processes that must be constructed, operated, and reduces chemical costs because engineered lagoons typically are required to chemical feed for proper operations.

Description of alternative concept:

The alternative concept is to maintain sedimentation basin solids processing at the Solids Lagoons. For BWW, eliminate the BWW equalization basins, pumps, and BWW clarifiers, and instead route the 42-inch BWW to the solids lagoons with an inlet and isolation valve to each of the four lagoons and adjacent to the existing ULS inlets. For FTW, eliminate the equalization basin and pumps (these are part of the BWW Equalization facility), route the 24-inch FTW parallel to the BWW to the solids lagoons until there is enough elevation drop to provide an air gap connection to the BWW line. From that point, the FTW and BWW share the BWW pipe to flow to the solids lagoons.

Construct a reclaim pump station with the following features:

- A submersible pump station with 3 independent pumps/wet wells:
  - The reclaim wet well and pump station is connected to the solids lagoon that is receiving BWW/FTW and returns water to the RW storage pond via the RW Pipeline
    - Assume 5 MGD (5% of 100 MGD) at 246-foot head.
  - The settled water wet well and pump station is connected to the solids lagoon that is receiving un-thickened sedimentation basin sludge. Its pump transfers water to the reclaim wet well
    - Assume 125 GPM at 15 feet
  - The decant water wet well and pump station is connected to the solids lagoon that is drying
- Provide pipe connections from each solids lagoon to each wet well.
  - Reclaim wet well: 18-inch
  - Settled and decant wet well: 6-inch
- Provide 18-inch pipe from the reclaim pump station to the FW pipe

Benefit of making the change:

This proposed change simplifies residual handling by transitioning solids handling processes (equalization and clarification) from the original dedicated facilities to the original sludge lagoons that are already included in the project. This reduces the number of facilities that must be operated and reduces chemical costs. It allows for reclaiming water from the sedimentation basin solids and eliminates the spreading basins.

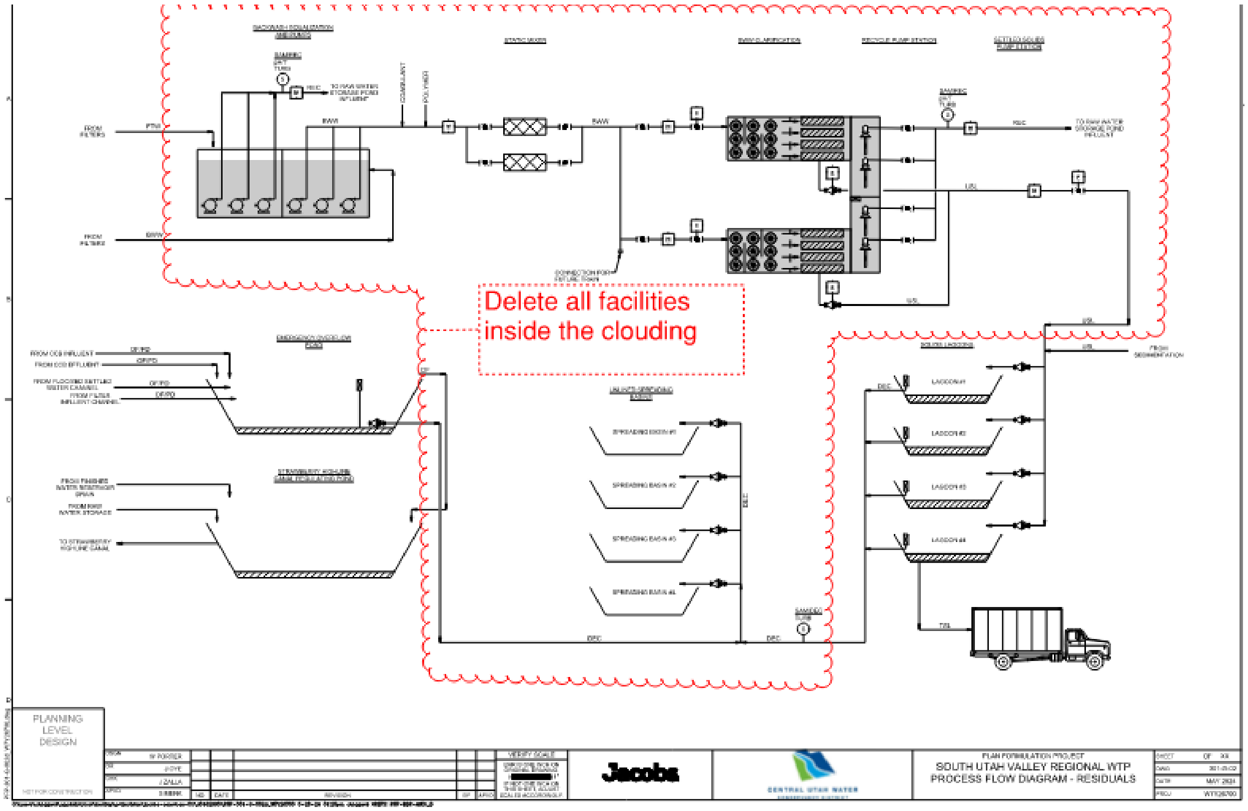
Examples where this has been used:

This exact process has been implemented at the District's Duchesne Valley WTP, and very similar processes have been implemented at Point of the Mountain WTP (Metropolitan Water District of Salt Lake and Sandy) and Weber South WTP (Weber Basin Water Conservancy District).

Sketch

Alternative No.: PW-19

☐ **ORIGINAL** ☒ **ALTERNATIVE**

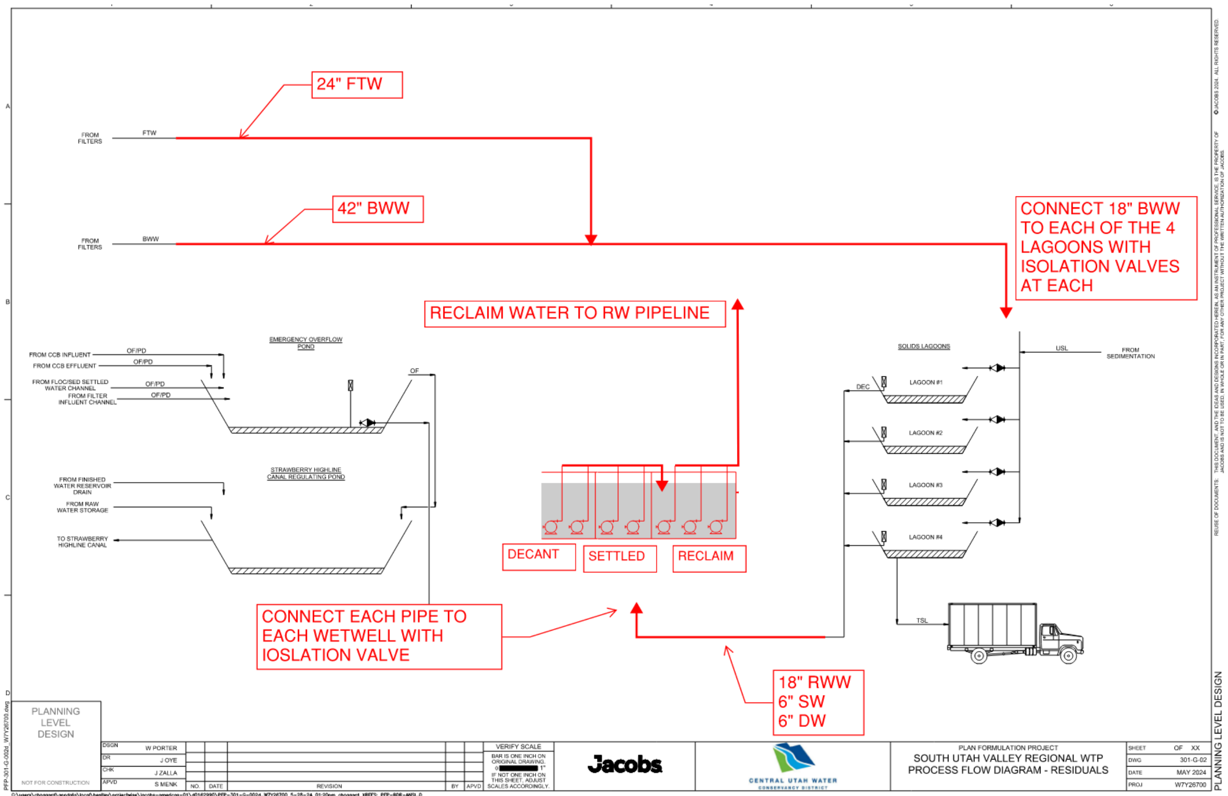


Facilities to Delete from the Original Residuals PFD

Sketch

Alternative No.: PW-19

☐ **ORIGINAL** ☒ **ALTERNATIVE**

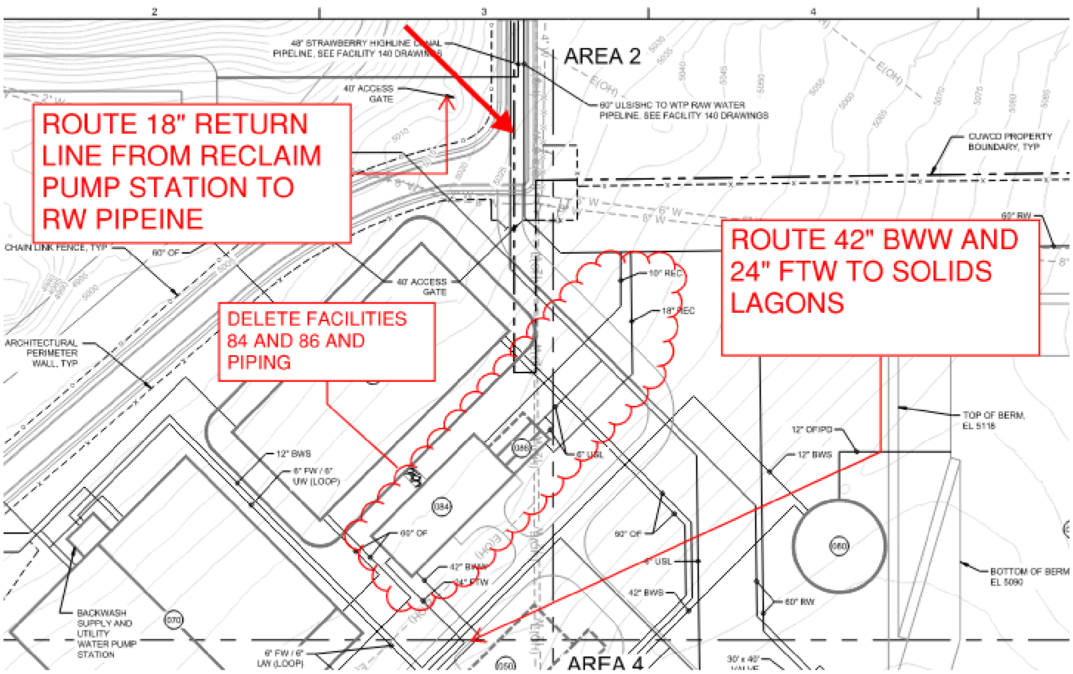


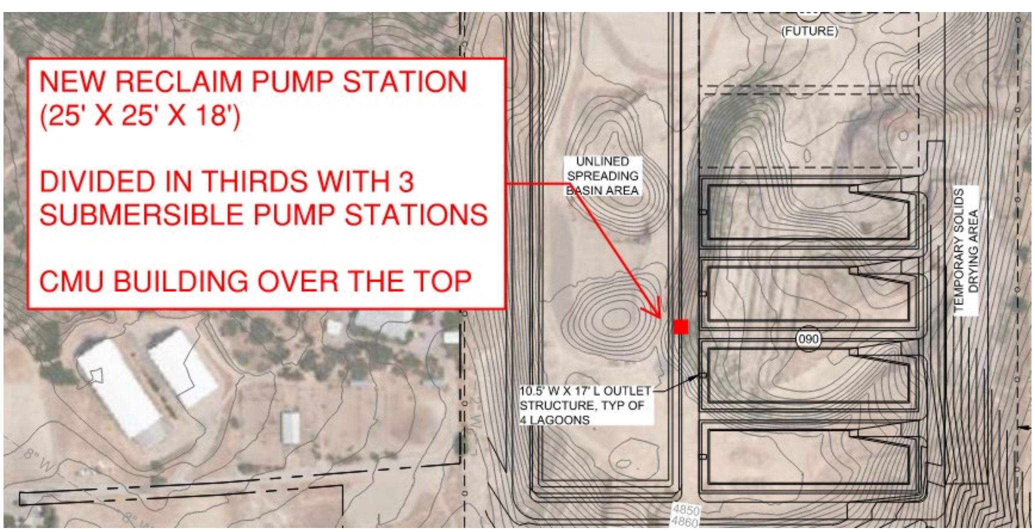
Facilities Required for the Alternative Configuration

Sketch

Alternative No.: PW-19

☐ **ORIGINAL** ☒ **ALTERNATIVE**





Modifications Required for Alternative Configuration

Alternative No.: PW-19

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Check the original drying bed area based on drying criteria.

- Assumptions:
  - 200 LB/MG solids production
  - Average annual water production for the 50 MGD plant condition: 20 MGD
  - Drying bed loading rate: 8 LB/SF/YR
- Calculations:
  - Total annual production:
    - 20 MGD x 200 LB/MG x 365 days = 1,460,000 LB/YR
  - Total area required:
    - 1,460,000 LB/YR / 8 LB/SF/YR = 182,500 SF
  - Total area provided in original project:
    - 4 basins x 186 FT x 446 FT = 331,824 SF
    - This is twice as much as required given the assumptions
- Conclusions: The original area provided is sufficient for drying for either the original configuration or the alternative configuration

Compare discharge head of original recycle pump station to alternative reclaim pump station.

- Assumptions:
  - RW pond elevation: 5,116 FT
  - BWW clarification wet well elevation: 5,049 FT
  - Alternative reclaim pump station wet well elevation: 4,870 FT
- Original static lift = 5,116 FT – 5,049 FT = 67 FT
- Alternative static lift = 5,116 FT – 4,870 FT = 246 FT

Alternative No.: PW-19

☐ **ORIGINAL** ☒ **ALTERNATIVE**

Estimate horsepower for reclaim pumps.

- Reclaim pump assumptions:
  - 2 duty, 1 standby
  - FLOW = 5% of future 100 MGD plant – 5 MGD
  - Static lift = 246 FT
  - 65% efficiency
- Horsepower per pump
  - HP = [(5 MGD/2) x 694 GPM/MGD x 246 FT] / [3,956 x 0.65] = 165 HP (this will require 200 HP motor)

Estimate horsepower for settled and decant pumps.

- Use Duchesne Valley WTP PIP:
  - 125 GPM at 13 FT – 5 HP

PW-19 LCCA:

Calculate O&M Costs:

From data provided by the District, O&M Costs for a 100 MGD plant are $115/AF.

100 MGD = 36.5 billion gallons per year.

The plant has seasonal demand, so assume 50% of the capacity is the average production in a year.

36,500,000,000 GAL per year x 50% production / 325,851 GAL per AC FT = 56,000 AC FT

56,000 AC FT per year x $115/AF = $6.4 million / year O&M

For Phase 1 WTP, we construct a 50 MG plant so use 50% of this number or $3.2 million/year.

Eliminate BWW Clarification Process:

Assume 5% total O&M is eliminated. $3.2 million / year x 5% = $161,000.

Account for increased pumping usage:

There are four pumps for the recycled water pump station.
Assume 50 HP with 3 duty 1 standby.

The proposed concept uses (3) 200 HP pumps with 2 duty 1 standby.

The delta in head differential with the alternative concept (pumping from the new reclaim pump station wet well) is 246 FT.

Calculate Energy Usage:

Assume energy cost is $0.17/kWh.

Original = 3 pumps x 50 HP = 150 HP total = 112 kW

Proposed = 2 pumps x 200 HP = 400 HP total = 298 kW

For original, 112 kW x $0.17/kWh x 24 hours x 365 days = $166,790/year

For alternative, 298 kW x $0.17/kWh x 24 hours x 365 days = $443,781/year

Assume pumps run 24/7 at 50 MGD only, so reduce by 50%:

Original = $166,790 x 50% = $83,395/year

Alternative = $433,781 x 50% =$216,890/year

Construction Cost Estimate

Alternative No.: PW-19

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
BWW equalization and pumps	LS	11,268,000.00	1	$11,268,000		
BWW clarification Phase 1	LS	17,931,000.00	1	$17,931,000		
BWW clarification Phase 2	LS	3,980,000.00	1	$3,980,000		
Recycle pump station	LS	2,500,000.00	1	$2,500,000		
Alternatives Reclaim Pump Station						
25' x 25' x 18' concrete hydraulic wet well	LS	291,400.00			1	$291,400
Reclaim pumps (200 HP submersible)	EA	725,000.00			3	$2,175,000
Settled and decant pumps (5 HP submersible)	EA	220,000.00			4	$880,000
25' x 25' x 15' CMU building	LS	573,200.00			1	$573,200
Additional 42 IN BWW piping	LF	2,200.00			1,500	$3,300,000
Additional 18 IN RWW piping	LF	1,340.00			500	$670,000
Additional 6 IN SW and DW piping	LF	100.00			1,000	$100,000
Total Markup	102.91%			$36,716,083		$8,221,834
TOTALS	Breakdown of Markup can be found in the Cost Appendix			$72,395,000		$16,211,000
NET SAVINGS						$56,184,000

Life Cycle Cost Analysis

Alternative No.: PW-19

LIFE CYCLE PERIOD 50 YEARS ANNUAL PERCENTAGE RATE 3.000%

CAPITAL COST	ORIGINAL CONCEPT	ALTERNATIVE CONCEPT
	$72,395,000	$16,211,000
Capital Cost Savings		$56,184,000

ANNUAL EXPENDITURE	%	PRESENT WORTH FACTOR	ORIGINAL CONCEPT			ALTERNATIVE CONCEPT		
			CAPITAL COST	ANNUAL COST	PRESENT WORTH	CAPIT AL COST	ANNUAL COST	PRESENT WORTH
Facility O&M - Savings from eliminating BWW clarification process		25.7298		161,000	4,142,000			
Pumping Costs		25.7298		83,395	2,146,000		216,890	5,581,000
Generalized O&M (% of Capital Cost)								
SUB-TOTAL			$6,288,000			$5,581,000		

SINGLE EXPENDITURE (REPLACEMENT)	YEAR	PRESENT WORTH FACTOR	ORIGINAL CONCEPT		ALTERNATIVE CONCEPT	
			ESTIMATE	PRESENT WORTH	ESTIMATE	PRESENT WORTH
Salvage Value at End of Economic Life						
SUB-TOTAL			$0		$0	
TOTAL PRESENT WORTH			$6,288,000		$5,581,000	

PRESENT WORTH SAVINGS ON O&M	$707,000
LIFE CYCLE COST SAVINGS	$56,891,000

Design Suggestion

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	PW-20
Send reclaimed water to the Strawberry Highline Canal regulating pond in the summer to reduce pumping costs in lieu of raw water storage pond	
Discussion	
The current plan has an allowance for finish water storage to be drained to the SHC regulating pond. The Value Team recommends providing an allowance for the reclaimed water to drain to the SHC regulating pond as well. This will cause additional redundancies and this water can be used to help meet the Highline Canal raw water demands while cutting operation costs of the WTP since this water will not need to be pumped.	

SATISFY STAKEHOLDERS

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	SS-01
Determine the current water quality in the finished water distribution systems based on actual sampling (ongoing monthly)	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept is to produce a water quality that is "non-corrosive and stable", defined as Langelier Saturation Index (LSI) of 0 to 0.6 and a Calcium Carbonate Precipitation Potential (CCPP) of 4 to 10 MG/L.	
Description of Alternative Concept:	
The alternative concept is to determine water quality compatibility with finished water recipients, by evaluating distribution materials and premise plumbing in those communities; evaluating water quality in the distribution systems of those communities; conducting pipe loop studies with harvested materials to understand corrosion and metals release potential from existing pipes; and assessing changes in aesthetics from the original supplies to the new supplies.	
Rationale for Change:	
Additional consideration is needed to evaluate potential unintended consequences of switching from groundwater supplies in downstream communities to the new source water supply. Corrosion potential or metals release may occur due to this water quality change, and customers may notice a difference. Advance testing and planning can avoid challenges when the new water supply comes online.	

Value Improvement

$$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$$

Function	Resources
☒ Increased	☒ Increased
☐ Maintained	☐ Maintained
☐ Decreased	☐ Decreased

Cost Savings Summary

First Cost Savings:	($1,185,000)
O&M Savings:	$0
Life Cycle Cost Savings:	($1,185,000)

Advantages/Disadvantages

Alternative No.: SS-01

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Minimizes corrosion related impact from new water supply integration through the evaluation of specific distribution system and premise plumbing conditions in finished water recipients' systems • Establishes baseline observed in the distribution system • Allows for evaluation of changes in water quality through determination of finished water recipients' water quality • Identifies blending strategies to minimize customer complaints related to water aesthetics	• Requires stakeholder input and cooperation • Increases resources for sampling and pipe loop studies

Discussion

Alternative No.: SS-01

Description of original concept affected by this change:

The original concept includes use of caustic soda to achieve positive LSI and CCPP for corrosion control. This approach will remain in place, but additional evaluation is recommended to evaluate whether the new supply should be blended or if additional corrosion control options should be considered.

Issue of concern to the team:

The Value Team is concerned because switching from a groundwater source to a surface water source has proven to be challenging in some communities due to changes in water quality and impacts on pipe tuberculation. An example of this is the Tucson red water release, which caused significant customer impacts (e.g., galvanized pipe degradation, red water release) and ultimately led to the new water treatment plant being permanently taken offline.

Description of alternative concept:

The alternative concept is to evaluate the distribution system and premise plumbing materials into which the new water will flow. Recommended additional work includes the following components:

- Determination of distribution system and premise plumbing materials in finished water recipients' systems – leveraging information collected in the Lead and Copper Rule recent evaluations.
- Evaluation of current water quality served to and present in the finished water distribution systems (i.e., conducting ongoing monthly sampling). More extensive analysis is needed than what is reported in the communities' Consumer Confidence Reports (CCRs).
- Based on the first two components, conduct pipe loop studies using harvested pipe materials to understand potential metals release and corrosion impacts when the water source is switched, or blends are introduced.
- During WTP pilot testing, assess aesthetics of the new supply compared to existing finished water recipients' supplies.
- Engage customers to provide opinions on the water quality change, and acceptable blends if 100% surface water is not acceptable.

Benefit of making the change:

The addition of this water quality and plumbing material evaluation will identify challenges that may be present in advance of introducing the new water supply into the pipelines.

Finished water recipients can then be more proactive in replacing problematic materials or identifying blends that work for the conditions and customers' aesthetic requirements. The Value Team has been involved in projects after problems arise (when water is already being served) and recommends proactive evaluation to avoid stranded assets or negative outcomes.

Additional explanation:

The Value Team understands that the distribution systems of finished water recipients are thought to be primarily ductile iron and PVC. However, a thorough analysis of both the distribution system and premise plumbing should be conducted to understand the extent of materials that need to be considered for balancing corrosion control.

More stringent Lead and Copper Rule regulations are proposed, which may be more challenging to meet in the future even for systems with only lead solder rather than lead pipe. Changes in water quality can induce the release of lead from solders, pipes, and household appurtenances. Process changes will trigger evaluation of water quality parameters (WQP) like those recommended in this alternative. Proactive testing and planning can help the District and finished water recipients avoid similar challenges experienced by other agencies.

Examples where this has been used:

Pipe loop tests like those suggested have been used in many communities. Examples include evaluation of the introduction of new water sources:

- Carlsbad Desalination Plant, conducted for Poseidon, Carlsbad, California
- West Basin Desalination Pilot Plant, conducted for West Basin Municipal Water District, Carson, California
- Metropolitan Water District of Southern California Pure Water Demonstration Facility, Carson, California

Water acceptability evaluations have been performed in communities to build back confidence after agencies have had negative aesthetic impacts when a new water source was introduced, including:

- City of Lomita, California
- Tucson Water, Arizona

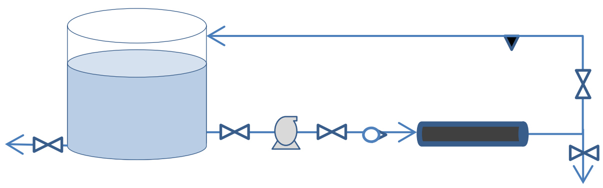
Key steps to implementing the idea:

1. Work with potential finished water recipients to inventory distribution system and premise plumbing materials. Talk with operations staff about field observations during pipe replacements – how much tuberculation is observed.
2. Ask finished water recipients to share water quality data. If sufficient information is not available, ask them to conduct ongoing monthly sampling in the groundwater supplied and in the distribution system to provide a baseline. Alternately, the District could offer to conduct the sampling and analyses.
3. Develop a plan for pipe loop testing conducted during WTP pilot testing using water generated from the pilot and water from the finished water recipients.
4. During WTP pilot testing, assess aesthetics of the new supply compared to existing finished water recipients' supplies. Involve customers from finished water recipients to assess acceptability and potential needs for blending groundwater and surface water.

Sketch

Alternative No.: SS-01

☐ **ORIGINAL** ☒ **PROPOSED**



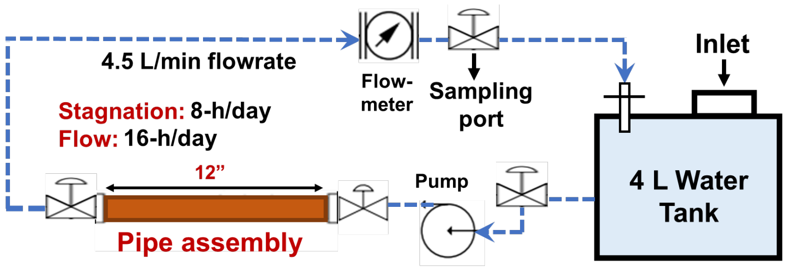
Cast Iron Pipe Loops

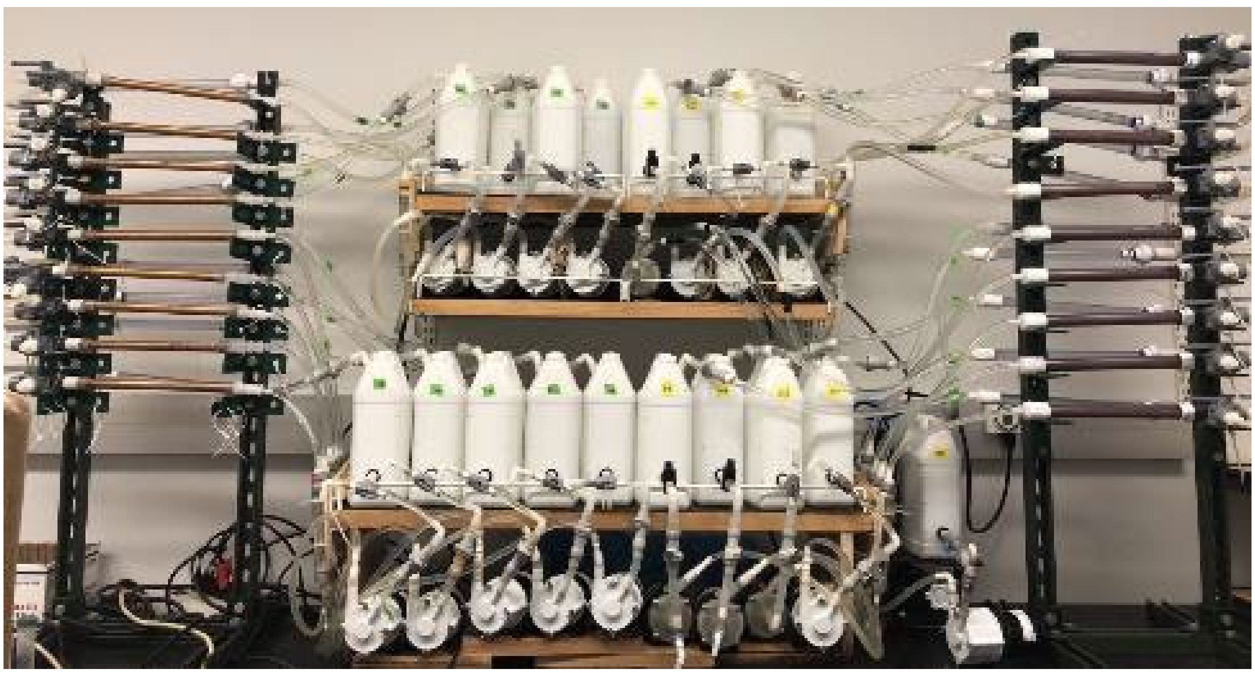
Example Pipe Tuberculation

Sketch

Alternative No.: SS-01

☐ **ORIGINAL** ☒ **PROPOSED**





Copper Pipe with Lead Solder Pipe Loops and Brass in Pipe Loops

Sketch

Alternative No.: SS-01

☐ **ORIGINAL** ☒ **PROPOSED**

Customer Acceptability Taste Testing of New Water Supply and Determination of Blend Preference

Lomita, CA residents rejected their new well and demand it be turned off. Blends of the well water and imported water were developed and customers were invited to taste test them and tell the difference. Over 97% of participants found the appearance of the blended water acceptable and nearly 67% preferred some form of blended water to 100% MWD imported water.

Calculations

Alternative No.: SS-01

☐ **ORIGINAL** ☒ **PROPOSED**

Task	**Approximate cost**
Coordinate with agencies to inventory distribution system and premise plumbing materials • Assume 8 recipient agencies • $200/HR x 60 HR x 8 agencies = $96,000	$96,000
Monthly sampling of water quality parameters in source waters and distribution systems • Assume 10 sites in 8 recipient agencies monthly • Assume at least: o Chloride at $30/sample o Sulfate at $30/sample o Alkalinity at $25/sample o Field pH – no cost o Total dissolved solids at $30/sample o Iron at $10/sample o Manganese at $10/sample o Lead at $10/sample o Copper at $10/sample	$148,800 per year

Task	Approximate cost

Pipe loop construction and testing (8 MO), assuming testing of galvanized customer service lines (4 loops), copper pipe with lead solder (8 loops), and brass (8 loops)
• Pipe harvesting and loop construction, $150,000
• Weekly water exchanges and shipments,
  o Iron pipe: $200/HR x 16 HR x 35 weeks = $112,000
  o Lead solder and brass: $200/HR x 24 HR x 35 weeks = $168,000
• Field equipment and consumables, $10,000
• Laboratory samples (water and solid phase): $80,000
• Test plan and reporting, $60,000
• Project management: $50,000
	$700,000

Customer acceptability panels for 8 recipient agencies • Assume 8 recipient agencies • Cost of 150 HR at $200/HR for coordination, preparation of blends, and leading the workshop for each agency	$240,000

Construction Cost Estimate

Alternative No.: SS-01

Item	Unit of Meas	Unit Cost	Original Concept (Deletions) Qty	Original Concept (Deletions) Total	Alternative Concept (Additions) Qty	Alternative Concept (Additions) Total
Coordinate on inventories	HRS	200.00			480	$96,000
Monthly sampling	EA	155.00			960	$148,800
Pipe loop construction and operation	EA	700,000.00			1	$700,000
Consumer acceptability panels	HRS	200.00			1,200	$240,000
TOTALS						$1,185,000
NET SAVINGS						($1,185,000)

Value Alternative

Project: Plan Formulation Project
Location: South Utah & Juab County, UT

	Alternative No:
Title:	SS-07
Raise the finish grade elevation around the main process area to reduce the height of the exposed structures (from EL 5,070 to EL 5,090) and bury the finished water reservoir (EL 5,060 for finished grade versus EL 5,050 current)	
Challenges Standard or Criteria:	Yes ☐ No ☒
None apparent	
Description of Original Concept:	
The original concept positions the finished grade of the project site towards the bottom of the concrete hydraulic structures. All of the hydraulic structures have buildings on top of them, which are therefore elevated above finished grade and require stair or elevator access from finished grade.	
Description of Alternative Concept:	
The alternative concept positions finished grade at the top of the hydraulic structures, which is at the elevation of the entrance to the buildings.	
Rationale for Change:	
The objective of this alternative configuration is to create a more operator-friendly facility with easier access and reduce the visual impact to the community by creating the appearance of shorter facilities.	

Value Improvement		Cost Savings Summary	
$\text{Value} \approx \frac{\text{Function}}{\text{Resources}}$		First Cost Savings:	($10,145,000)
Function	Resources	O&M Savings:	$0
☒ Increased	☒ Increased	Life Cycle Cost Savings:	($10,145,000)
☐ Maintained	☐ Maintained		
☐ Decreased	☐ Decreased		

Advantages/Disadvantages

Alternative No.: SS-07

Advantages of Alternative Concept	Disadvantages of Alternative Concept
• Eases access for operations and maintenance • Reduces visual impact on the community with shorter structures • Reduces construction costs for the CMU buildings because the subcontractor can stage scaffolding on the ground and the structure is less exposed to wind • Improves aesthetics and potentially dam design and construction because the RW reservoir embankment/dam is shorter • The higher grade will not interfere with District's desire to relocate the public roadway around the northeast side of the dam (refer to MC-09)	• Requires additional backfill • There may be an additional elevation drop to get from the main plant to the solids lagoons • There may be increased below grade galleries to access certain equipment – for instance gravity-fed sample stations • Drive access into the filter gallery may require retaining walls

Discussion

Alternative No.: SS-07

Description of original concept affected by this change:

The original concept positions the finished grade of the project site towards the bottom of the concrete hydraulic structures. All the hydraulic structures have buildings on top of them, which are consequently elevated above finished grade which requires stair or elevator access from finished grade.

Issue of concern to the team:

The Value Team is concerned about the significant amount of stairs required to get to the operating deck and buildings over the hydraulic structures. Equipment access to operating decks for all the main plant processes requires special attention during design. The tall buildings will also have a significant visual impact to the surrounding communities.

Description of alternative concept:

This alternative grading concept elevates the finished grade around the main plant processes. This plan accommodates relocating the public roadway northeast of the original dam, and the finished water reservoirs are fully buried in the alternative configuration rather than partially exposed.

Benefit of making the change:

The benefits of making this proposed change include:

- Eases access for operations and maintenance.
- Reduces visual impact on the community by having shorter structures.
- Reduces cost to construct CMU buildings from the ground.
- The western embankment of the RW Reservoir is shorter. This will improve aesthetics and potentially ease the dam design and construction.
- Raising the finished grade relative to the plant facilities may allow the plant to slide closer to the RW Reservoir to minimize backfill. This will also allow the FW Reservoir to slide southwest and be positioned such that its north-western edge is no longer on fill, simplifying structural design.
- By targeting a higher finished grade around the facilities, swapping the initial facilities (floc/sed, ozone, and filters) for the future facilities could shift the initial construction to higher existing ground elevations further saving backfill costs.

Examples where this has been used:

The District's Ashley Valley and Don A. Christiansen Regional WTPs have finished grade generally at the top of the hydraulic structures.

The finish grade at the District's Duchesne Valley WTP is close to the base of the process facilities similar to the original design concept. There are significant stairs for operator access. One of the buildings has an elevator for personnel and equipment access (the only elevator at a District WTP), and tall structures create significant visual impacts.

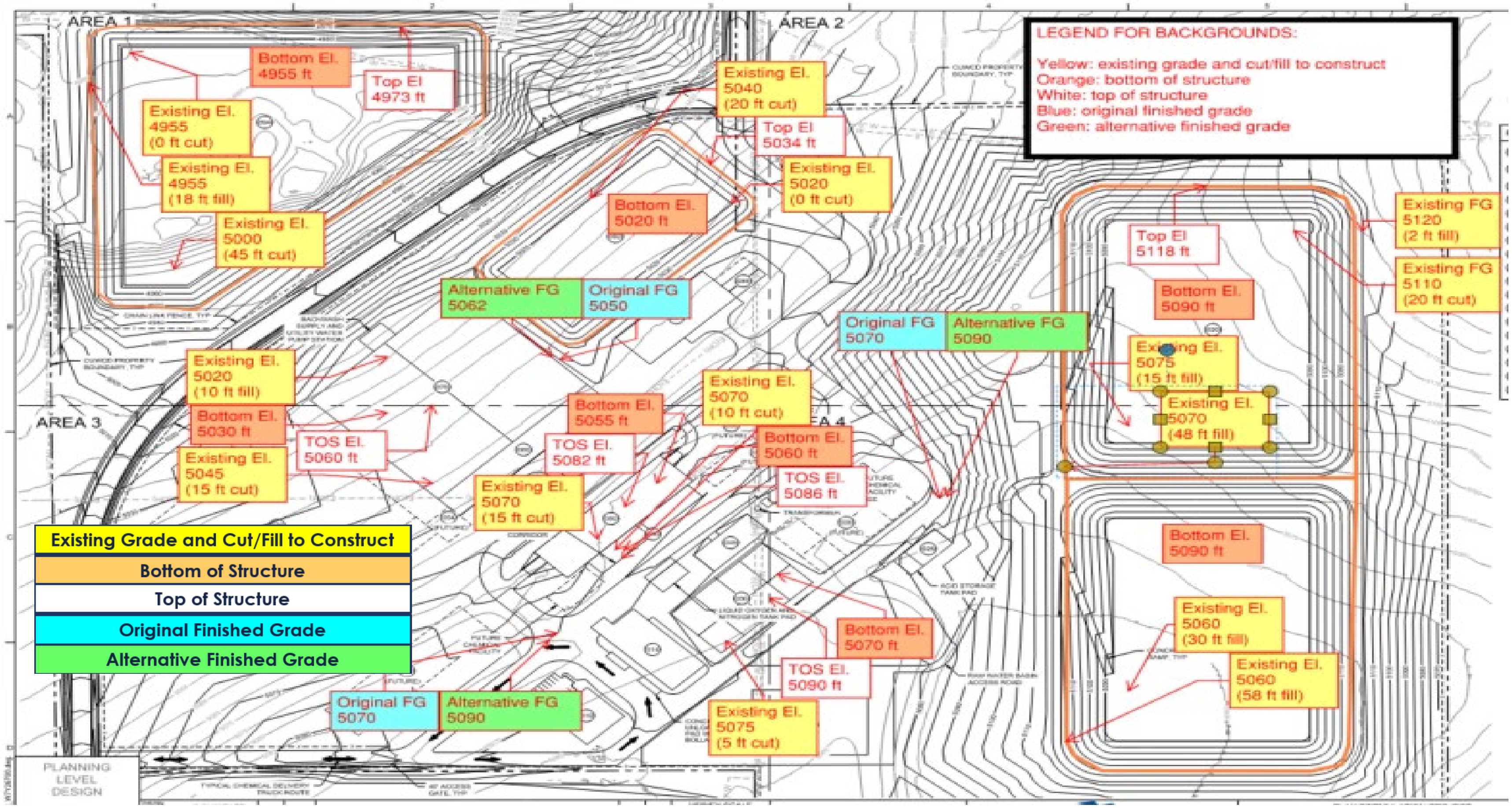
Key steps to implementing the idea:

This can be implemented during the normal course of project design. 3D civil and architectural modeling with advanced visualization techniques will facilitate both planning, community outreach, and design.

Sketch

Alternative No.: SS-07

☒ **ORIGINAL** ☒ **ALTERNATIVE**



Raising Finished Grade 12 to 20 Feet Around the Structures will Improve O&M Access and Aesthetics

Sketch

Alternative No.: SS-07

☒ **ORIGINAL** ☐ **ALTERNATIVE**

External Stairs and Stairs Up Steep Slopes Complicate O&M Access at the Duchesne Valley WTP The Alternative Grading Plan Eliminates these Issues.

Calculations

Alternative No.: SS-07

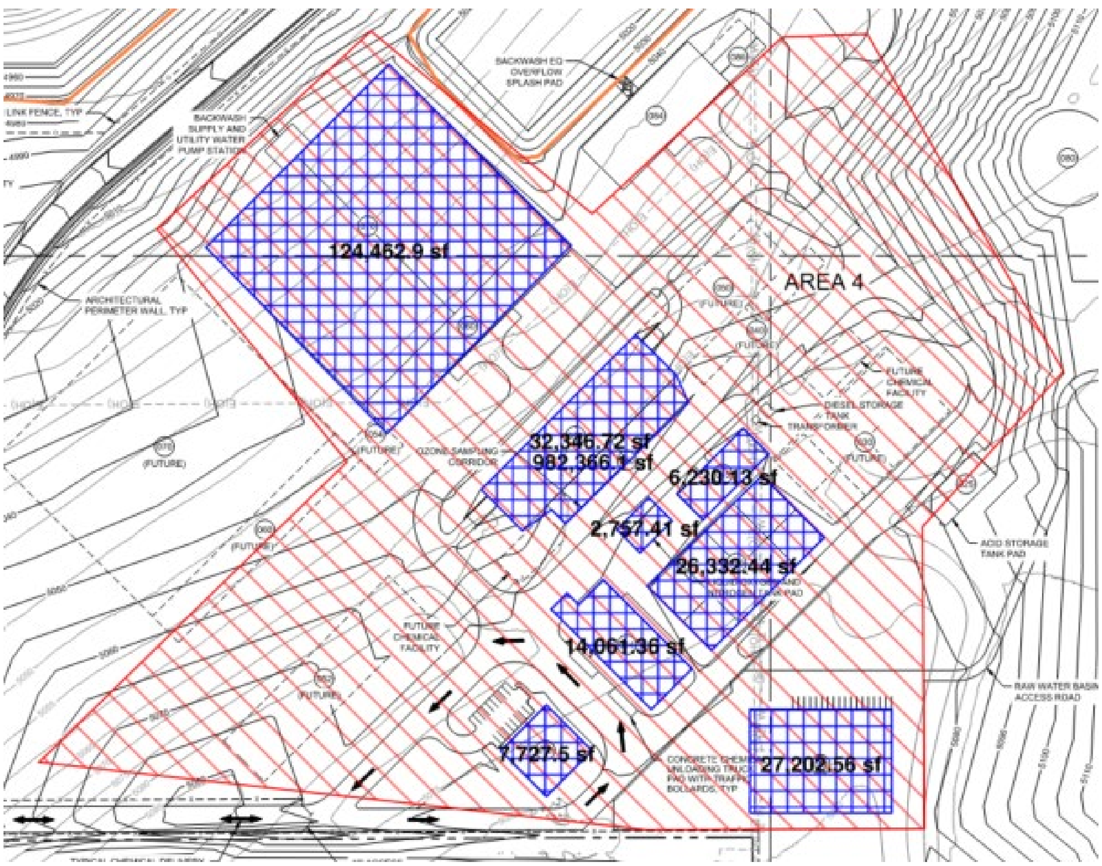
☐ **ORIGINAL** ☒ **ALTERNATIVE**

Estimate additional backfill for the higher finished grade.

Assume that the average additional fill is 20 FT around the structures and includes the area shown minus the area of the buildings. For the FW Reservoir, add 2 FT of cover over the structure. See figure below. Red hatching is total area, blue hatching is building area.

Volume = 20 FT x [982,400 FT– 32,350 FT – 6,230 FT – 2,760 FT – 26,300 FT – 14,100 FT - 7,700 FT – 27,200 FT – 124,500 FT] + 2 FT x 124,500 FT = 15,074,200 CF / 27 CY/CF = 558,304 CY.

Say 500,000 CY.



Construction Cost Estimate

Alternative No.: SS-07

			Original Concept (Deletions)		Alternative Concept (Additions)	
Item	**Unit of Meas**	**Unit Cost**	**Qty**	**Total**	**Qty**	**Total**
Cut and fill around structures to adjust grade	CY	10.00			500,000	$5,000,000
Total Markup	102.91%					$5,145,335
TOTALS	Breakdown of Markup can be found in the Cost Appendix					$10,145,000
NET SAVINGS						($10,145,000)

SECTION 7

STRATEGIC VALUE SOLUTIONS INC

PROJECT COST ANALYSIS

SECTION 7
PROJECT COST ANALYSIS

Review of the costs included comparison of unit prices to recently received prices for similar projects and to published unit price indices. Unit prices for unique project elements were compared to prices based on applicable crew compositions and production rates. Vendor quotations were obtained for unique and/or major equipment and compared to those in the project cost estimate. Adjustments were suggested where appropriate to bring unit prices into conformance with the current design documents and presentation information provided to the Value Team.

A complete review of all the estimate's supporting backup data was not attempted due to time limitations and availability of information; however, limited reviews were made of some quantities for the larger cost items within the estimate.

Review of Unit Costs

As a part of this workshop, the Value Team reviewed the cost estimate that was provided as a second opinion on the accuracy of the construction cost estimate to verify the estimated construction costs. This review ensured the Value Team had reliable data to use as the basis for cost comparisons of Value Alternatives. Any discrepancies between the Value Team's revised estimate and designer's original cost estimate were not reconciled between the Value Team's cost estimator and designer's cost estimator during the workshop. This high-level review identified the following issues for further consideration:

- Below the line percentages seem reasonable. Those include taxes, sub-contractor OH&P, General Conditions, Contractor Profit, Bonds and Insurance, and Contingency. Verify local tax applied at 7% may be correct, however a few different searches yielded marginally different numbers.
- Some inconsistency in similar items: Concrete, rebar, excavation, backfill, and piping. Application may be similar yet prices were different. The Value Team suggests further review to ensure like applications have consistent pricing throughout the estimate.
- Rebar ranges from $0.90 to $1.20 for similar applications. In addition to this pricing, the range seems on the lower side of expectation and this needs to be confirmed.
- Concrete 4,500 PSI at $132/CY seems lighter than expected. This needs to be confirmed, or source supplier quotation.
- Pumping at $15/CY seems lighter than expected. Please confirm
- Electrical I&C is understood not to be developed. An allowance at this stage is reasonable. The Value Team does not have visibility on appropriateness due to lack of information available currently.

- Mass excavation at regulating pond at $5.39-$5.81/CY seems very low. Consider a review and confirm.
- 60-inch ball valve at $917,970 is a very specific number. It may be quoted, however seems higher than expected and needs to be confirmed.
- 60-inch flow meter is priced at $302,287.58. This is a very specific number and may be quoted, however the price seems higher than expected and should be confirmed.
- 1-1/2-inch rigid conduit at $7.01/LF. This price seems light and should be confirmed.
- Confirm that structural excavation at $9.66/CY and structural backfill at $10.46/CY are up to date. Unit costs appear low.
- Confirm that the 60-inch carbon steel pipe price of $1,486/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value.
- Confirm that the 72-inch carbon steel pipe price of $1,088/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value. Also, an explanation as to why it is cheaper than the 60-inch pipe. This seems to be either an error or suggests that the 60-inch application is being done at a significantly more difficult access point than the 72-inch.
- Confirm that the 48-inch carbon steel pipe price of $714/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value.
- Confirm that the 78-inch carbon steel pipe price of $1,168/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value. Also, an explanation as to why it is cheaper than the 60-inch pipe.
- Confirm that the 36-inch carbon steel pipe price of $554/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value.
- Confirm that the 24-inch carbon steel pipe price of $308/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value.
- Confirm that the 20-inch carbon steel pipe price of $267/LF is quoted. It may be within range, however due to its large project cost impact and quantity, it would be prudent to ensure that it is based on a quoted value.
- In addition to the ball valve at the 60-inch level. All ball valves should be quoted values. They are high in cost, and potentially very high in lead time and could impact project schedule. Worth understanding fully their pricing and lead times.
- Is the regulating pond receiving a finish, aka a concrete liner. If yes where is that captured in the estimate? If not, is that because it is not a requirement of the project?

- It would be prudent to get a steel tank quote. Currently carried at $8,000,000 in the estimate. Value may be quoted, would just like to confirm.
- Chlorine boosting facility at $2,000,000 is based on a replica estimate. May be appropriate, however does it match previous estimate in relative size and scope? Also, has that project that the replica estimate developed further or bid? May have real pricing for a facility of this nature worth cross referencing and needs to be confirmed.
- Dump fees are $25/CY. This appears high and needs to be confirmed.
- Dump charges for site demolition spoils, 12 YD tandem, priced per CY. $37.50/CY. This appears high and needs to be confirmed.
- Haul spoils, 10-20 miles is $15/CY. This seems high based on an hourly rate for a Triaxle of $75 and needs to be confirmed.
- In general, would it be possible to provide more Element Summary unit costs, NOT LS. Example: Asphalt demolition and asphalt paving is summarized as LS - should be SY. Structural excavation is summarized as LS - should be CY, site electrical is summarized as LS - should be LF, etc.
- Backfill canal - earthworks sitework cut/fill - shows structural excavation. Should this say excavation and pile? Next item has structural backfill but no compaction and needs to be clarified.
- Excavation and backfill are the same quantities in certain locations.
- There is no detail to what is included in the traffic control costs

Significant Cost Issues

The following represents the most significant potential cost variation identified during the review:

- The single most significant impact of cost on these estimates is triggered by the values input on the carbon steel piping throughout. Due to their quantity, size, and cost impact of the overall project, it is imperative that they are quoted values with reasonable back up. Even though this project is in the pre-concept stage, the values of these piping systems are readily attainable through trusted suppliers. Even a 15% material value error in the estimate with this amount of quantity could generate an error in the program north of $50,000,000. The estimating team would recommend that the piping material values be the most important value to reasonably tie down at this budgeting stage.

The Value Team was provided cost information for the project which included the following key information:

Tech Memo 7 (Jacobs) program costs	$1,770,100,000
Budget for construction:	Not available at this time
Estimated construction cost:	$1,427,500,000
Estimate prepared by:	Jacobs
Estimate date:	June 20, 2024
Date for cost data:	June 2024
Construction start:	Review table after Mark-Up Calculations
Construction duration:	Review table after Mark-Up Calculations
Mid-Point of construction:	Review table after Mark-Up Calculations

The table below shows the mark-ups used in the current construction cost estimate and the mark-ups recommended by the Value Team. These recommended mark-ups were used in the cost comparisons of Value Alternatives. Where the recommended mark-ups differ from the current construction cost estimate, an explanation is provided.

Mark-Up	Current	Recommended	Rationale for Change
Taxes	7%	6.35% - 7.25%	7% may be the reasonable coverage for project wide. However, Utah and Juab County appear to spread from 6.35% to 7.25%.
Subcontractor Overhead and Profit	10%	10%	Reasonable allowance at this stage. Projects of this size can range from 8%-12%.
General Conditions and Contractor Overhead	12%	12%	Reasonable at this stage.
Contractor Profit	10%	10%	Reasonable at this stage. Projects of this size could range from 8%-12%.
Mobilization and Demobilization bonds and insurance	3%	3%	Bonds and Insurance typically occupy 2% of these costs leaving 1% for mobilization and demobilization, which is reasonable.
Total Mark-up		42%	**Construction Cost**
Construction Contingency (Conveyance)	25%	25%	Conveyance is more repetitive behavior, therefore reasonable to be less that Treatment Plant at this stage.
Construction Contingency (Plants)	30%	30%	Reasonable allowance for Class 4/5 estimating.
Construction Contingency (Water Planning/Integration)		30%	
Total Mark-up		67% - 72%	**Project Cost**
Escalation to Mid-Point June 2029 (3.5% per annum)	17.5%	17.5%	3.5% per annum is reasonable considering project time horizon.
Total Mark-up		84.5% - 89.5%	**Project Cost**

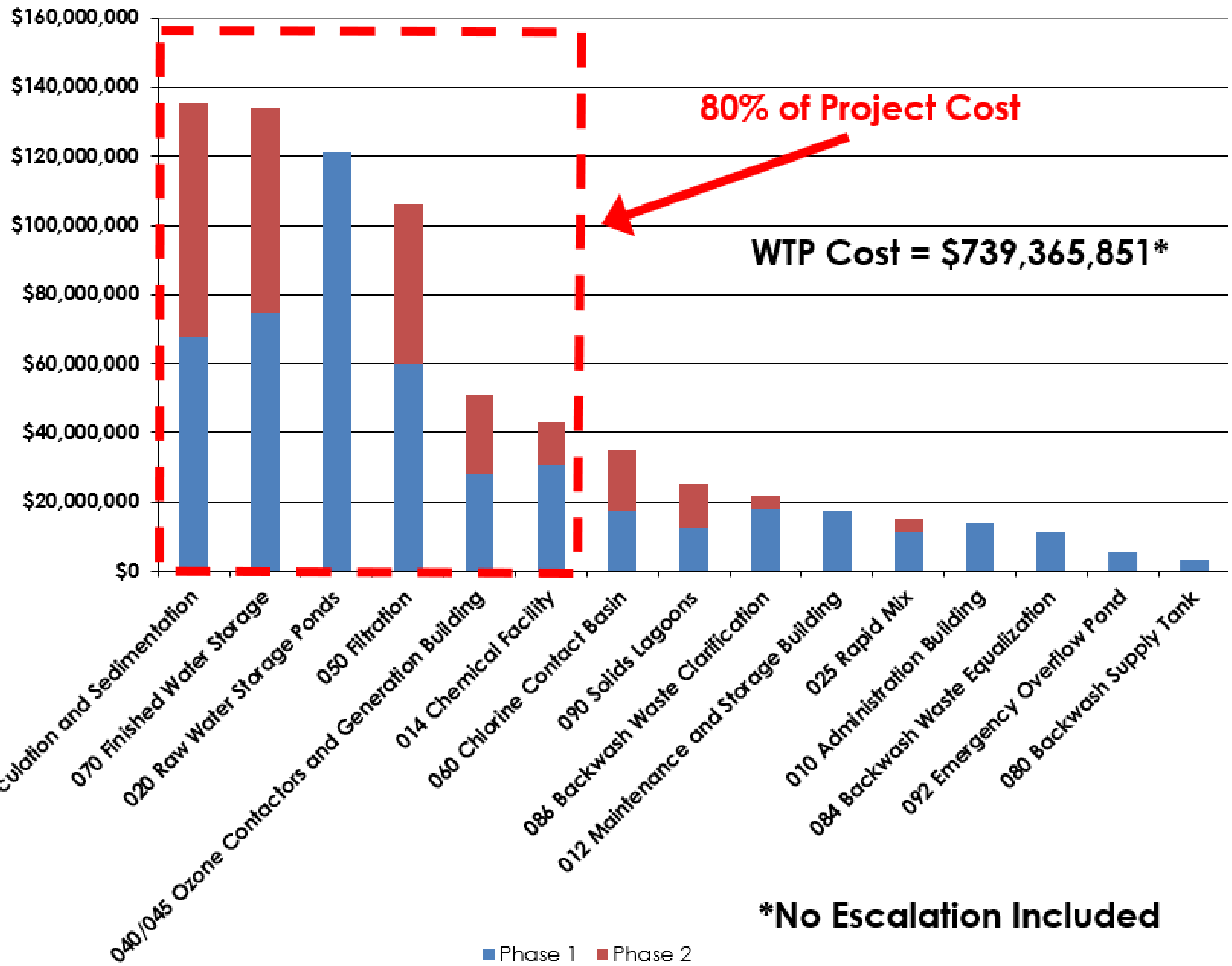
Calculation of Mark-Up

The following mark-up was applied as a line item on each of the Value Alternative cost estimates.

Conveyance Program

Direct Cost Markups (Markups to Library Cost)	
Cost Book Adjustment - Material	0.00%
Sales Tax	7.00%
Productivity - Labor & Equipment	0.00%
Overtime - Labor	0.00%
Direct Cost Markups (Results in Direct Cost)	**7.00%**
Subcontractor Markups (Markups to Direct Cost)	
Sub - Job Office Overhead (General Conditions)	10.00%
Sub - Home Office Overhead	
Sub - Profit	
Total Subcontractor Markups (Results in Cost to Prime)	**10.00%**
Prime Contractor Markups (Markups to Cost to Prime)	
Design Contingency	25.00%
Escalation to Mid-Point of Construction (June 2029)	17.50%
Prime - Job Office Overhead (General Conditions)	12.00%
Prime - Home Office Overhead	0.00%
Prime - Profit	10.00%
Insurance	3.00%
Bond	0.00%
Total Prime Contractor Markups (Results in Contract Cost)	**67.50%**
Owner Markups (Markups to Contract Cost)	
Engineering/Design	NIC
Construction Contingency	NIC
Supervision, Inspection & Overhead (SIOH)	NIC
Total Project Markup (Results in Project Cost)	
Total Markup	**84.50%**

Cost Model – Water Treatment Plant



Project No.	Facility No.	Facility	Construction		Estimated Cost to Construction Midpoint Cost	
			Estimated Timeframe	Estimated Midpoint	Construction	Capital
1	110	96-inch Turnout	October 2026 to September 2027	April 30, 2027	$195,467,000	$242,379,000
	120	SHC Reach 1				
	130	ULS Turnout to SUVR WTP				
	140	Raw Water Pipe to SUVR WTP				
	150	ULS/SHC Intertie				
2	120	SHC Reaches 2 through 6	October 2027 to May 2029	July 31, 2028	$110,631,000	$137,182,000
3	160	Payson Pressure-Reducing Valve	October 2026 to September 2027	April 30, 2027	$4,224,000	$5,238,000
	170	Santaquin Pressure-Reducing Valve				
4	180/190	Payson Pump Station/Santaquin Pump Station	N/A	N/A	N/A	N/A
5	300	Raw Water Reservoirs	June 2028 to June 2032	June 30, 2030	$150,122,000	$186,151,000
		SUVR WTP (Phase 1)			$367,255,000	$455,396,000
		Finished Water Reservoirs (Phase 1)			$92,530,000	$114,737,000
6		SUVR WTP (Phase 2)	June 2052 to June 2055	December 31, 2053	$518,571,000	$643,028,000
		Finished Water Reservoirs (Phase 2)			$164,146,000	$203,541,000
7	410	Utah County Finished Water Pipeline (SUVR WTP to Juab County Finished Water Pump Station)	January 2029 to June 2032	September 30, 2030	$214,346,000	$265,789,000
8		Utah County Finished Water Pipeline (Juab County Finished Water Pump Station to Goshen)	June 2033 to June 2035	June 30, 2034	$33,573,000	$41,631,000
9	420	Juab County Finished Water Pipeline (Finished Water Pump Station to Mona)	June 2029 to June 2032	December 31, 2030	$119,398,000	$148,054,000
10		Juab County Finished Water Pipeline (Mona to Nephi)	June 2038 to June 2040	June 30, 2039	$50,432,000	$62,536,000
11	430	Juab County Finished Water Tanks Phase 1	June 2031 to June 2032	December 31, 2031	$73,559,000	$91,213,000
12		Juab County Finished Water Tanks Phase 2	N/A	N/A	N/A	N/A
13	440	Juab County Finished Water Pump Station	June 2030 to June 2032	Jun 30, 2031	$21,098,000	$26,162,000
14	510	Diamond Fork Pump Station	June 2047 to June 2049	Jun 30, 2048	$43,772,000	$54,277,000
	520	Diamond Fork Pipeline				

APPENDICES

A – AGENDA

Orientation/Site Visit Agenda

Plan Formulation Project, South Utah & Juab County, UT
Workshop Location: South Utah County Office
4801 S Highway 89 Mapleton, UT 84664
Site Visit Dates: May 29 – 30, 2024

***All times are in Mountain Time Zone**

Wednesday (May 29, 2024)

8:00 – 8:30 Arrive at South Utah County Office/Meet and Greet

8:30 – 9:00 Introductions

9:00 – 9:30 Explanation of the Value Planning Process

- Review Agendas for both Orientation Meeting and Value Planning Workshop
- Discuss Workshop Breakout Team Configuration
- Including District's and Designer's roles and responsibilities in the process

9:30 – 10:30 Central Utah Water Conservancy District Presentation

- Goals and Objectives for the Project
- Overview of Project Schedule
- Overview of Project Budget and Funding
- Key Agreements or Decisions
- Key Risks (both threats and opportunities) associated with the Project
- Goals and Objectives for the Value Study
- Constraints on the Value Study
- Action Items for specific attention in the Value Study

10:30 – 10:45 Coffee Break

10:45 – 12:00 Project Designer Presentation

- Provide an overview of the project planning effort and schematic design
- Explain the basis for the design
- Explain the rationale for the design choices that have been made
- Identify key assumptions that have been made

Wednesday Cont.

- Summarize critical performance requirements
- Identify any project criteria or other factors which may be contributing to any higher-than-expected costs or significant challenges
- Additional action Items for specific attention in the Value Study
- Additional risks (both threats and opportunities) associated with the Project

12:00 – 1:00 Lunch Break

1:00 – 4:30 Conduct the Site Visit

4:30 Adjourn the Meeting at the Project Site

Thursday (May 30, 2024)

8:15 – 8:30 Arrive at South Utah County Office

8:30 – 9:00 Coordinate Site Visit/Review Agenda

9:00 – 12:00 Conduct the Site Visit

12:00 – 1:00 Lunch Break

1:00 – 2:00 Orientation Wrap-Up & Next Steps

- Additional Questions & Answers
- Logistics for Value Planning Workshop

STRATEGIC VALUE SOLUTIONS INC

Value Planning Workshop Agenda

Plan Formulation Project, South Utah & Juab County, UT
Workshop Location: 1426 E 750 N, #400, Orem, UT 84097
Workshop Dates: June 24-28, 2024

Monday June 24 — Who Should Attend

		Who Should Attend
8:00 – 8:30	Arrive and Setup	**ALL**
8:30 – 9:00	Kick-Off and Introductions Jared Robinson, SVS & Derek Bruton, CUWCD	CUWCD/VP Team/Jacobs
9:00 – 12:00	CUWCD Opening Comments Review of District Concerns and Goals Objectives and Constraints on the Value Study Jacobs Presentation/Q&A *Recap Presentations from Orientation Meeting*	CUWCD/VP Team/Jacobs
12:00 – 1:00	Lunch Break	
1:00 – 3:00	Team Review and Project Analysis Review Program Risks	CUWCD/VP Team/Jacobs
3:00 – 5:00	Function Analysis	VP Team

Tuesday June 25 — Who Should Attend

		Who Should Attend
8:00 – 11:00	Function Analysis (Cont.)	VP Team
11:00 – 12:00	Creative Idea Generation	VP Team
12:00 – 1:00	Lunch Break	
1:00 – 5:00	Creative Idea Generation (Cont.)	VP Team

Wednesday June 26 — Who Should Attend

8:00 – 9:30	Creative Idea Generation (Cont.)	VP Team
9:30 – 12:00	Evaluation of Ideas	VP Team
12:00 – 1:00	Lunch Break	
1:00 – 5:30	Value Alternative Development	VP Team
2:00 – 3:00	Mid-Point Review of Ideas Selected for Development A review of the list of ideas selected for development with the objective of providing an opportunity to brief Jacobs and the District.	CUWCD/SVS/Jacobs

Thursday June 27 — Who Should Attend

8:00 – 12:00	Value Alternative Development (Cont.)	VP Team
12:00 – 1:00	Lunch Break	
1:00 – 6:00	Value Alternative Development (Cont.)	VP Team

Friday June 28 — Who Should Attend

9:00 – 12:00	Value Alternative Development (Cont.)	VP Team
12:00 – 1:00	Lunch Break	
1:00 – 2:00	Prepare for Value Team Presentation	VP Team
2:00 – 4:00	Value Team Presentation	CUWCD/ VP Team/Jacobs

B – PARTICIPANTS

STRATEGIC VALUE SOLUTIONS INC

Plan Formulation Project
South Utah & Juab County, UT
May 29-30, 2024 – June 24-28, 2024

Name:	Organization:	Role on this Project	Phone:	Email:	Site Visit Day 1	Site Visit Day 2	Day 1 (In-Brief)	Day 2	Day 3 (Mid-Point)	Day 4	Day 5 (Out-Brief)
Value Team											
Tyler Clark	Strategic Value Solutions, Inc.	CVS Team Leader	816-795-0700	Tyler.Clark@svs-inc.com	X	X	X	X	X	X	X
Jared Robinson	Strategic Value Solutions, Inc.	CVS Team Leader	816-795-0700	Jared.Robsinon@svs-inc.com	X	X	X	X	X	X	X
Kyle Schafersman	Strategic Value Solutions, Inc.	CVS Team Leader	816-795-0700	Kyle.Schafersman@svs-inc.com	X	X	X	X	X	X	X
Mikayla Collins	Strategic Value Solutions, Inc.	Workshop Assistant	816-795-0700	Mikayla.Collins@SVS-inc.com	X	X	X	X	X	X	X
Sam Silva	Strategic Value Solutions, Inc.	Workshop Assistant	816-795-0700	Samantha.Silva@SVS-inc.com			X	X	X	X	X
Jessica Godfrey	Strategic Value Solutions, Inc.	Workshop Assistant	816-795-0700	Jessica.Godfrey@SVS-inc.com			X	X	X	X	X
John Robinson	Strategic Value Solutions, Inc.	CVS Team Leader	816-795-0700	John.Robinson@SVS-inc.com	X*		X	X	X	X	X
Mike Worlton	Black & Veatch	Water Planning	623-312-0728	WorltonMA@bv.com	X	X	X	X	X	X	X
Tom Jacobs	JTOM Consulting	Water Planning		Tom@JTOMConsulting.com	X*	X*	X	X	X	X	X
Todd Bednar	Black & Veatch	Cost Estimator	919-462-7479	Bednart@bv.com			X	X	X	X	
Wes James	Department of the Interior (CUPCA)	DOI Representative		Wsjames@usbr.gov				X	X	X	X
Will Garner	CUWCD	Operations Engineer		Will@cuwcd.gov	X	X	X	X	X	X	X

Plan Formulation Project
South Utah & Juab County, UT
May 29-30, 2024 – June 24-28, 2024

Name:	Organization:	Role on this Project	Phone:	Email:	Site Visit Day 1	Site Visit Day 2	Day 1 (In-Brief)	Day 2	Day 3 (Mid-Point)	Day 4	Day 5 (Out-Brief)
Don Baker	Water Resources Solutions	Open Channel/ Agricultural		Dbaker@wrs-rc.com	X	X	X	X	X	X	X
Mike Fleury	Carollo Engineers	Pipeline Expert		MFleury@carollo.com			X	X	X	X	X
Marty Larson	Highline	General Manager	801-319-3740	Mlarson@shlcco.com	X		X		X		X
Andrew Chalabardo	Leland Saylor & Associates	Cost Estimator	415-602-6863	Achalabardo@LelandSaylor.com			X	X	X	X	X
Bruce Weinberger	5RMK, inc.	Construction Expert	208-386-0108	BJWeinberger2020@gmail.com	X	X	X	X	X	X	X
Shaun Hilton	CUWCD	Project Manager	385-329-0679	Shaun@cuwcd.gov	X	X	X	X	X	X	X
Nicole Blute	Hazen and Sawyer	Water Treatment	310 266-6212	Nblute@hazenandsawyer.com	X	X	X*	X	X	X	X
Alan Domonoske	Carollo Engineers	Water Treatment	801-330-6753	ADomonoske@carollo.com	X	X	X	X	X	X	X
Clark Prothero	Raba Kistner Infrastructure, Inc.	Constructability		Clark.prothero@gmail.com	X	X	X	X	X	X	X
Michael French	Legis Consultancy	Cost Estimator	210-557-4894	Michael.french@constinnovation.com	X*	X*					
John Messina	Legis Consultancy	Cost Estimator	504-247-3658	johnmessina@cox.net			X	X	X	X	X
John Chadwick	Jacobs		801-623-6047	John.Chadwick@jacobs.com	X	X	X		X		X
Joseph Zalla	Jacobs	Project Manager	801-448-3780	Joseph.Zalla@jacobs.com	X	X	X		X		X

Plan Formulation Project
South Utah & Juab County, UT
May 29-30, 2024 – June 24-28, 2024

Name:	Organization:	Role on this Project	Phone:	Email:	Site Visit Day 1	Site Visit Day 2	Day 1 (In-Brief)	Day 2	Day 3 (Mid-Point)	Day 4	Day 5 (Out-Brief)
Roger Pearson	CUWCD			Rogerp@cuwcd.gov	X		X		X*		X
Derek Bruton	CUWCD	Project Manager	385-482-2562	Derek@cuwcd.gov	X	X	X	X	X	X	X
Sarah Sutherland	CUWCD	Environmental Programs Manager	801-226-7100	Sarah@cuwcd.gov	X		X		X		X
Michael Whimpey	CUWCD	General Manager			X		X		X*		
Gerard Yates	CUWCD				X		X				X
Bruce Ward	CUWCD	Chief Engineer			X		X		X		X
Rachel Musil	CUWCD	Water Supply Manager			X		X		X*		X
Paul Brown	Paul Redvers Brown, Inc.	Water Systems Planner		brownpr@paulredversbrown.com	X*	X*	X	X	X	X	X
Brendan Hedel	Jacobs	Water Planning Engineer			X*		X		X		X
Will Porter	Jacobs					X					
Bob Harding	Jacobs	Consultant	661-933-8992	Bob.Harding@jacobs.com	X	X	X		X		X
Jeremy Fowler	BOR		801-360-5415	Jsfowler@usbr.gov			X	X	X	X	X
Chris Elisa	CUWCD	NEPA	801-960-5373	ChrisE@cuwcd.gov	X		X		X		X

Plan Formulation Project
South Utah & Juab County, UT
May 29-30, 2024 – June 24-28, 2024

Name:	Organization:	Role on this Project	Phone:	Email:	Site Visit Day 1	Site Visit Day 2	Day 1 (In-Brief)	Day 2	Day 3 (Mid-Point)	Day 4	Day 5 (Out-Brief)
Devin McKrola	CUWCD		801-830-0901	Devin@cuwcd.gov			X		X		X
Paul Christensen	DOI-CUPCA		801-376-0193	Pchristensen@USBR.gov			X				X
Mike Raw	CUWCD			Miker@cuwcd.gov			X		X		X
Jared Hansen	CUWCD			jhansen@cuwcd.gov					X*		
Russ Franklin	CUWCD		685-230-5832	Russ@cuwcd.gov							X
Kirk Beech	CUWCD	Lands	801-361-3946	Kirk@cuwcd.gov							X
Brad Perkins	CUWCD	Engineering	801-361-5307	Brad@cuwcd.gov							X
Cort Lambson	CUWCD		801-376-9180	Cort@cuwcd.gov							X
Paul Pierpoint	CUWCD		801-376-8378	Paul@cuwcd.gov							X

* Attended via teleconference

C – RISK IDENTIFICATION

Risks Identified During Workshop:

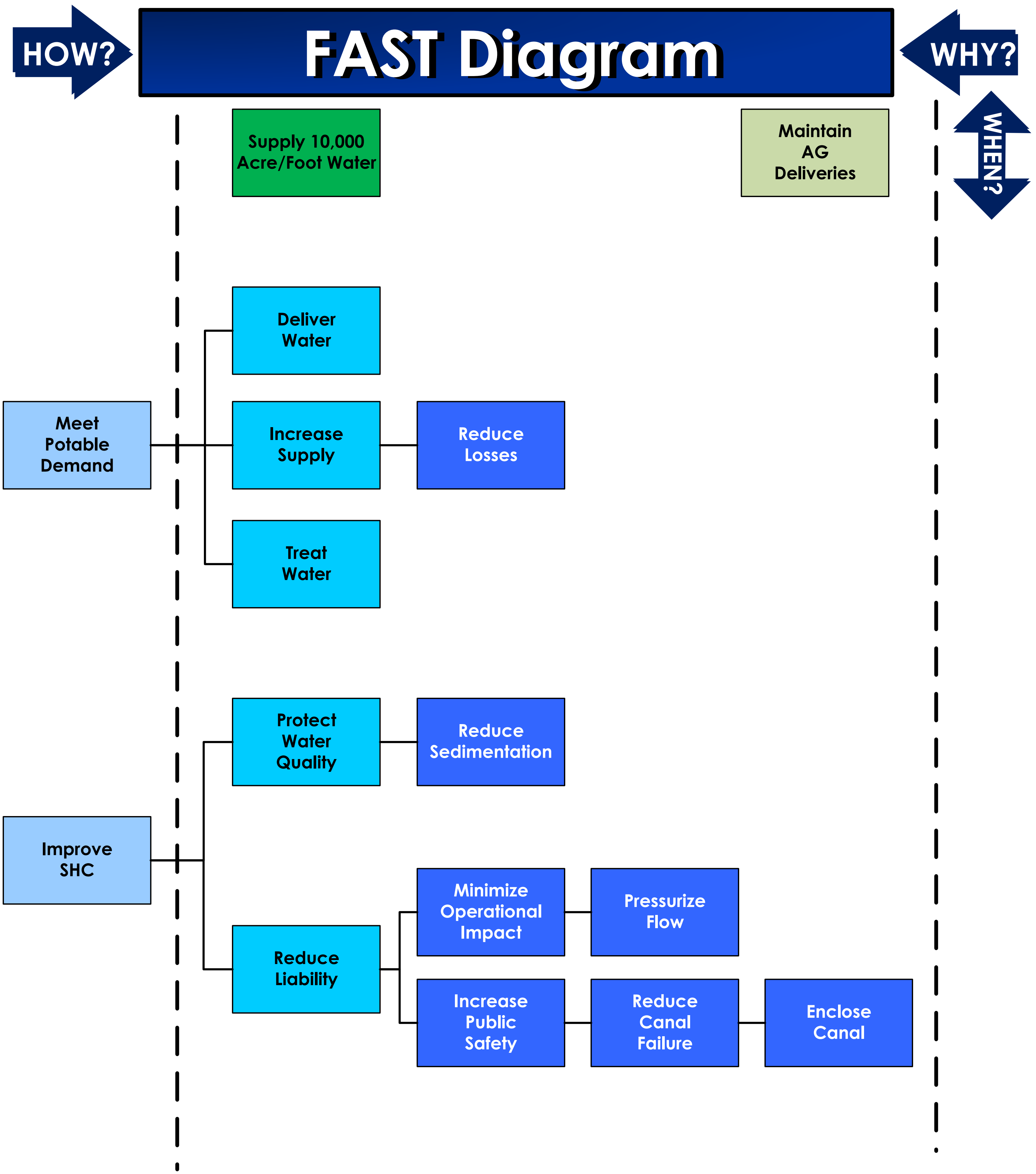
- Due to the sheer size and scale of the project, If there is insufficient local labor, then there is a risk to the project schedule.
- If there is a limited bidding pool, then there is potential for higher costs.
- If there is an unqualified contractor, then there a risk of poor project execution.
- If there is inclement weather leading to landslides, then there could be delays in schedule.
- If there are geological seismic events, then there could be delay in schedule.
- If material availability is limited, then there could be delays in the schedule.
- If there are delays in long-lead items, then there will be delays in schedule.
- This project may not be authorized to be a 207 project, this could impact certain restrictions such as the Buy America Act, impact water supply, increase District's responsibility.
- If the demand changes from what is projected (up or down, timing and quantities), then there will be impacts to cost and schedule.
- If the legislature removes the District's taxing authority, then budget will be impacted.
- If the construction of one pipeline occurs adjacently to a second one, then damage to either pipeline is possible.
- If you cannot get land acquisition, then delay in schedule.
- If the construction of the canal closure is not completed in time or inability to operate the canal, then it could impact the crops.
- Disruptions in construction could lead to disruptions in water delivery.
- If the NEPA approval process takes longer than expected, then the schedule will be delayed.
- If the canal integrity fails, then there are environmental impacts (i.e. landslides, safety, etc.).
- If there are utility conflicts in the corridor, then the schedule will be delayed.
- If there is another construction project ongoing at the same time, then there could be conflicts (schedule, availability of contractors, materials, etc.).
- If conditions of the water quality change, then the treatment requirements change.
- If the legislation for water quality changes, then the treatment requirements change.
- If there is a fire, then schedule could be impacted.
- If there is a need to coordinate with other federal agencies and railroads, then schedule could be impacted.

- If there are leaks in the current system that have created wetlands, then would require additional mitigation for wetlands.
- If canal is enclosed, then this reduces groundwater recharge.
- If there are archeological or historical preservations issues that occur, then this could impact the schedule.
- If canal is enclosed, then stormwater is not captured.
- If there are any areas where water comes into the canal, then there may be concentrated environmental concerns (water quality).
- If there is contaminated water, then additional dewatering pumps/remediation drain construction is required.
- If there is hyper escalation or inflation beyond expectations, then additional mitigation will need to be in place for the contractors and owners.
- Blending the water may cause unexpected corrosion of pipes.
- If corrosion is found, then cities will rely on the District to solve.
- If there are pressure changes, then unexpected corrosion could occur.
- If community input and public acceptance is taken into consideration, then additional architectural (aesthetic) design or cost could be incurred.
- If political uncertainties occur, then schedule and/or project could be impacted.
- If you get an unqualified contractor or low bidder, then project quality is impacted.
- If land acquisition does not go as planned, then there could be major project cost and schedule impacts.
- If the demand for water is lacking, then the water treatment plant will not function properly.
- If there are environmental protests, then this could impact the schedule.
- If there are any interruptions in the Strawberry Reservoir, then the water delivery for this project will be severely impacted.
- If the supply for the Strawberry Reservoir is limited by the Colorado River or Great Salt Lake agencies, then the water delivery could be impacted.
- If the coordination between different construction projects, design teams, and phases does not go as planned, then this could impact schedule and cost.

D – FUNCTION ANALYSIS

OVERALL SYSTEM INTEGRATION

FAST Diagram

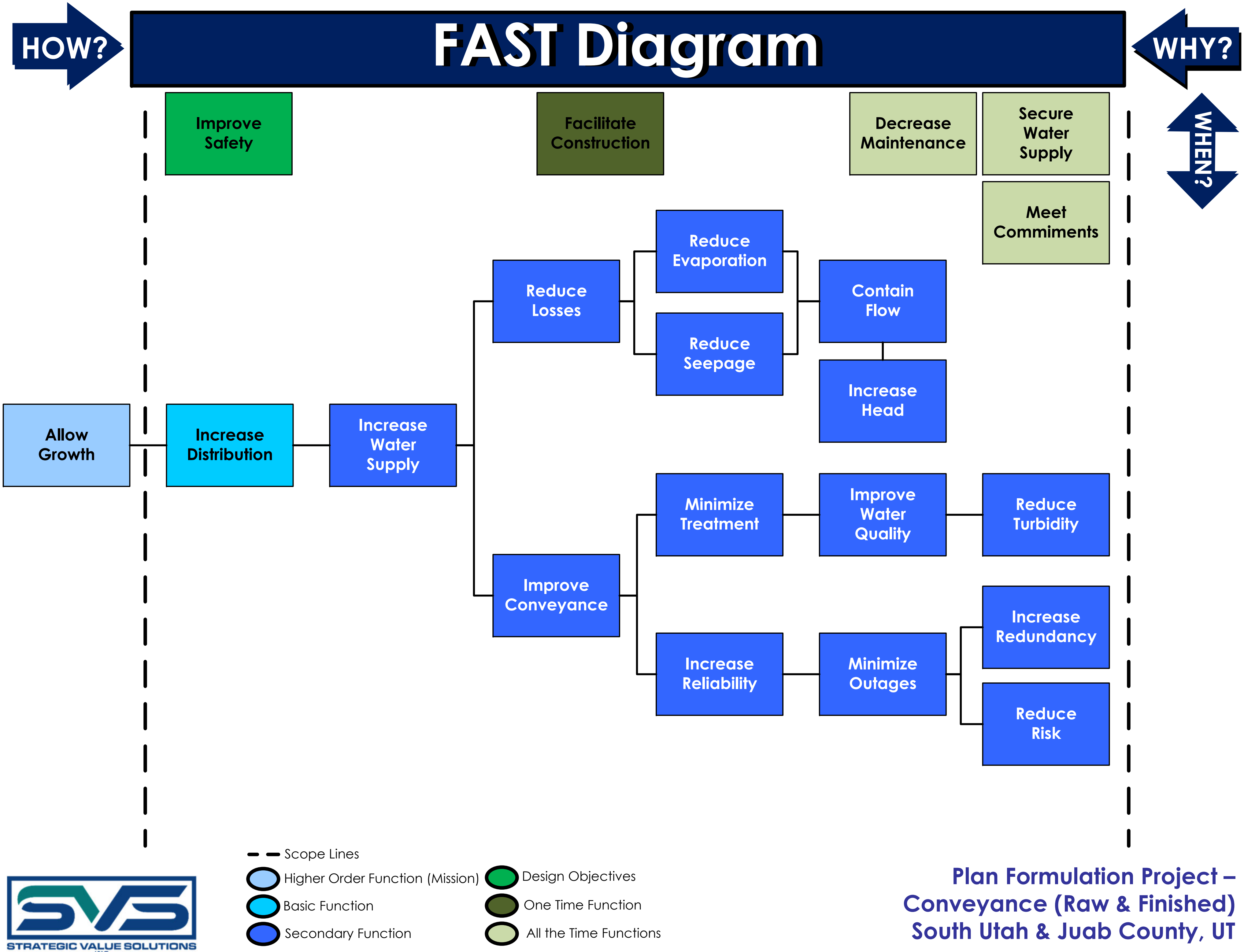


Scope Lines
Higher Order Function (Mission)
Basic Function
Secondary Function
Design Objectives
All the Time Functions

STRATEGIC VALUE SOLUTIONS INC

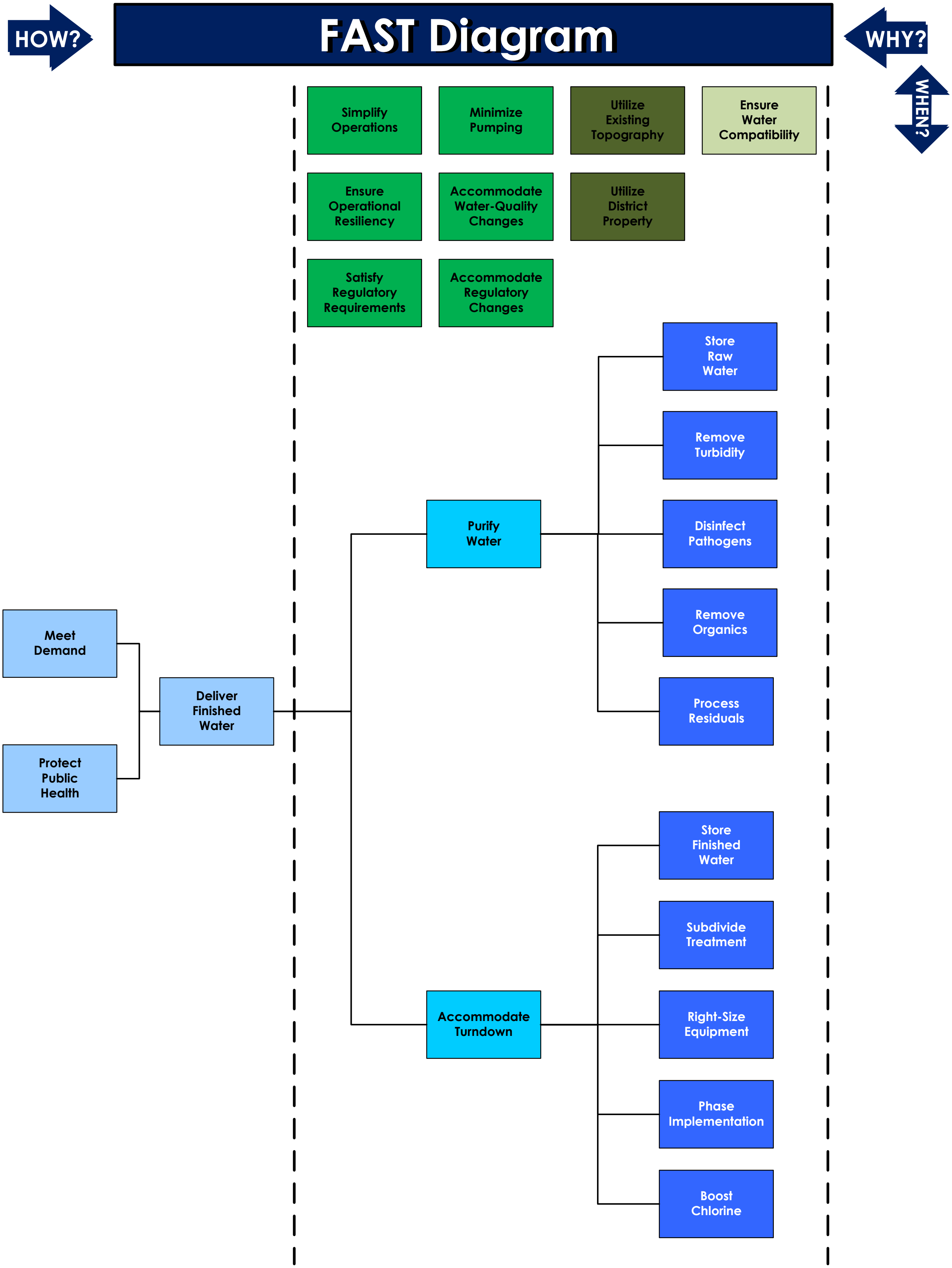
Plan Formulation Project – Overall Systems Integration South Utah & Juab County, UT

CONVEYANCE (RAW & FINISHED)



Plan Formulation Project – Conveyance (Raw & Finished)
South Utah & Juab County, UT

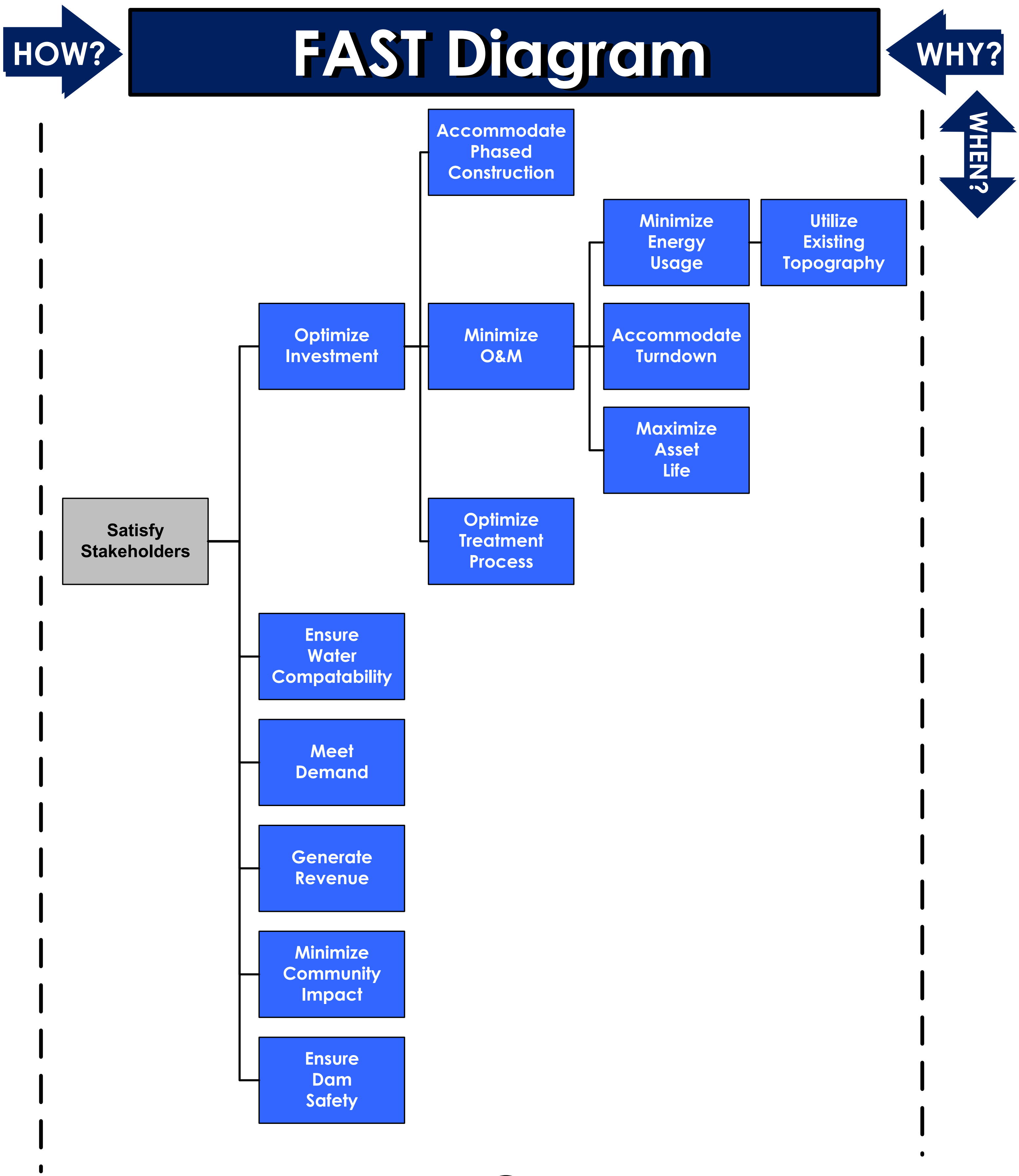
WATER TREATMENT PLANT



STRATEGIC VALUE SOLUTIONS INC

- Scope Lines
- Higher Order Function (Mission)
- Basic Function
- Secondary Function
- Design Objectives
- One Time Function
- All the Time Functions

Plan Formulation Project
Water Treatment Plant
South Utah & Juab County, UT



- Scope Lines
- Higher Order Function (Mission)
- Basic Function
- Secondary Function
- Design Objectives
- One Time Function
- All the Time Functions

STRATEGIC VALUE SOLUTIONS INC

Plan Formulation Project
Water Treatment Plant
South Utah & Juab County, UT

E – CREATIVE IDEA LISTING

OVERALL SYSTEM INTEGRATION

Creative Idea Listing

Alt. No.	Description	Votes
DW - Deliver Water		
DW-01	Ensure pipeline (140) at 130 to the Water Treatment Plant can take all the flow from the ULS and Strawberry Highline Canal water to the Water Treatment Plant	0
DW-02	Use the ULS to convey finished water from South Utah Valley Regional Water Treatment Plant to Santaquin and enlarge the Strawberry Highline Canal enclosure to accommodate the ULS water	3
DW-03	Run the finished water pipeline to I-15 and follow I-15 Row	0
DW-04	Add a connection from the ULS and/or Strawberry Highline Canal at the optional Santaquin water treatment plant	2
DW-05	Build Juab County finished water pipeline only	0
DW-06	Develop a third water treatment plant at Mona to eliminate some finished water pipeline	6
DW-07	Extend ULS to Goshen and exchange water rights for Mona Reservoir water	1
DW-08	Extend ULS to Mona Reservoir and use as storage	1
DW-09	Move optional hydropower to the Spanish Fork pipeline in lieu of Pipeline 140	4
DW-10	Implement the hydropower closer to the water treatment plant to offset power costs	2
DW-11	Do not use Strawberry Highline Canal and send all ULS and Strawberry Highline Canal deliveries through ULS	2
DW-12	Extend the ULS to Mona and use three water treatment plants at Mona, Santaquin, and Salem supplied by ULS	3
IS - Increase Supply		
IS-01	Develop a tiered system for the 10,000 acres per foot to Juab County	0
IS-02	Develop a potable reuse system at community level	0
IS-03	Limit irrigation use for residential (new construction)	DS
IS-04	Perform an excess supply study at Strawberry Reservoir	0
IS-05	Prevent losses at Monks Hollow	0
IS-06	Take effluent and treat and then inject	0

Alt. No.	Description	Votes
IS-07	Take effluent and discharge to infiltration basin	0
IS-08	Investigate water supply gain from pressurizing Strawberry Highline Canal	2
IS-09	Pressurize the Strawberry Highline Canal and convert irrigation to sprinklers and downsize the canal enclosure	0
IS-10	Investigate a water supply south of Mona or Nephi to serve immediate needs through a lease or exchange	0
IS-11	Use Schofield Lake as a water supply for potable water in Juab County	0
IS-12	Identify additional canals in South Utah and Juab County to treat as M&I water	DS
IS-13	Construct a pump station on the Spanish Fork Provo Reservoir canal to pump water to a water treatment plant for treatment	6
TW - Treat Water		
TW-01	Provide only raw water and let communities treat their own water supply	2
TW-02	Provide chlorination tablets to all homes	0
TW-03	Construct a smaller treatment plant in Santaquin in lieu of a larger plant in Salem	1
TW-04	Design a modular plant in Santaquin for future expansion as demand increases	0
TW-05	Along the canal develop aquifer recharge sites and recovery sites	0
TW-06	Use DAC Water Treatment Plant to distribute finished water	0
TW-07	Use Provo Water Treatment Plant to distribute finished water	0
TW-08	Build a water treatment plant to treat Utah Lake water in lieu of Salem Water Treatment Plant	0
TW-09	Use aquifer recharge and recovery at the turnouts along the pipeline	0
TW-10	Construct a Santaquin Water Treatment Plant in Phase 1 and construct Salem Water Treatment Plant at a future date	4
TW-11	Have the District subsidize the development of water treatment in local communities	0
TW-12	Construct a water treatment plant where the ULS and Strawberry Highline Canal intersect	0

Alt. No.	Description	Votes
TW-13	Construct a water treatment plant on the west side on Santaquin City along the Strawberry Highline Canal alignment	0
TW-14	Use a modular water treatment plant at Salem to allow for future demands and expansion as needed	0
TW-15	Use two smaller water treatment plants at Santaquin and Salem in lieu of a single 50 MGD plant	2
TW-16	Negotiate a deal for Mona Lake water to supply potable demands temporarily until canal is enclosed	1
TW-17	Develop a decision tree framework for the program planning process and periodically re-evaluate actual and projected M&I assumptions and investments	DS
TW-18	Consider using ULS water down to Juab County until canal enclosure is complete	0
TW-19	Use rocky mountain power water wells for temporary potable water	0
TW-20	Use Provo river water as a water supply for Juab County	0
TW-21	Use ground water from Strawberry Highline Canal wells near Santaquin to provide potable water for Santaquin and Mona	3

DS – Indicates the Idea was selected to be written as a Design Suggestion and is included in the Design Suggestion Section of this report

RR – Indicates the Idea received enough votes by the Value Team to be developed. However, during the Development Phase the team found that the Idea was not feasible. Therefore, it has been designated RR indicating that it was Reviewed and Rejected by the Value Team.

CONVEYANCE (RAW & FINISHED)

Creative Idea Listing

Alt. No.	Description	Votes
FC - Facilitate Construction		
FC-01	Use Construction Manager at Risk in lieu of Design-Bid-Build procurement	1
FC-02	Use early contractor involvement in lieu of design-bid-build	DS
FC-03	Reduce the amount of cover over the finished water pipeline from 6 feet to 4 feet	4
FC-04	Have District prepurchase long lead items and store them at the manufacturing facility until they are provided to the contractor	1
FC-05	Have District prepurchase and provide the valves to the contractor	1
FC-06	Construct the Phase 1 reach 1 including the regular pond in the summer in lieu of during the winter	0
FC-07	Align the pipeline within the ROW to accommodate future expansion of additional pipelines	0
FC-08	Fast track the Strawberry Highline Enclosure (SHE) including the regulating pond	1
FC-09	Construct the Strawberry Highline Enclosure (SHE) regulating pong now in lieu of waiting for full design to be complete	0
FC-10	Use the existing quarry as storage for pumped water going into the treatment plant	0
FC-11	Install both the finished water and raw water in the same trench where alignments allow	DS
FC-12	Procure turnout easements as soon as possible	0
FC-13	Initiate construction with irrigators regarding turn outs	0
FC-14	Through the pre-qualification process, require the contractor to demonstrate the ability to meet production rates	DS
FC-15	Weld every other joint outside of the trench in lieu of welding in place	0
FC-16	Allow precast box construction in lieu of cast-in-place construction for turnout structures	DS
FC-17	Award all raw water pipeline construction in a single contract	0
FC-18	Construct the finished water pipeline from Mona to Nephi 8 years earlier	3

Alt. No.	Description	Votes
FC-19	Pay contractor incentives for early completion and use liquidated damages for delays	1
FC-20	Implement significant liquidated damages for delays of raw water pipeline completion	0
FC-21	Use incentives for early completion	0
FC-22	Provide a temporary batch plant for the controlled low strength material (CLSM) at the gravel pit near the treatment plant	2
FC-23	Use a portable/mobile energy dissipator that can be reused at the end of each winter season	3
FC-24	Construct the turnouts in advance of enclosure pipeline	0
FC-25	Identify contractor laydown and staging areas throughout the construction corridor	DS
FC-26	Identify contractor access points throughout the corridor	0
FC-27	Confirm local bridges can accommodate H2O loading	0
FC-28	Create traffic control and haul route plan	2
FC-29	Expedite utility relocation for the entire corridor prior to design completion	0
FC-30	Expedite coordination with the railroad as soon as possible	0
FC-31	Use truck tunnel crossing in lieu of trenchless crossing of I-15	4
FC-32	Conduct a pre-construction survey/video to determine baseline conditions	0
FC-33	Bid alternative pipeline materials	4
FC-34	Use "Cleveland Trencher" type of equipment for smaller diameter pipeline installation in lieu of trench boxes	0
FC-35	Host early industry day to attract bidding attention	0
IC - Improve Conveyance		
IC-01	Locate and investigate known landslide locations and determine appropriate remediation	1
IC-02	Have the Design Team identify multiple sources for long-lead items and the capability to deliver these products	1
IC-03	Ensure this project meets the requirements established to be a 207 project	0
IC-04	Identify any materials that will not meet the Buy America Act and begin the waiver process as soon as possible	0

Alt. No.	Description	Votes
IC-05	Expedite geotechnical investigation in areas with potential landslide or seismic activity	DS
IC-06	The District should use lobbyist to ensure the legislators understand the importance of the taxing authority of the District	0
IC-07	Evaluate the effectiveness of using bonding to fund portions of the project	0
IC-08	Hire a Public Relations (PR) firm to support and promote this project to the public	0
IC-09	Update the population projections to the most recent data available to validate design demands	1
IC-10	Identify land and easement requirements for construction and begin acquisition as soon as possible	0
IC-11	Incorporate the NEPA process into the design process and do them both at the same time	0
IC-12	Identify the environmental impacts and consequences of removing the seepage from the canal	0
IC-13	Account for the construction labor site access delays within the productivity factor within the cost estimate	DS
IC-14	Expedite survey and coordination of existing utility conflicts and relocations	1
IC-15	Coordinate with other large utility owners	DS
IC-16	Investigate stormwater runoff as another source of water for mitigation	0
IC-17	Investigate stormwater as another source of water that can be captured and traded	0
IC-18	During geotechnical investigation sample ground water for contaminants to ensure proper dewatering plan can be implemented	0
IC-19	Add escalation clauses to the construction contract to account for unexpected price increases during construction	DS
IC-20	Pilot study the service laterals to customers to ensure the blending of waters does not cause negative impacts	1
IC-21	Ensure appropriate pressures are designed to be compatible with customers distribution systems	0

Alt. No.	Description	Votes
IC-22	Ensure accommodations for inline disinfection are included in the finished water pipeline	0
IC-23	Increase the cloud seeding operations to increase falling rain or snow	DS
IC-24	Ensure the Strawberry Reservoir intake structure is deep enough to operate in a low water condition	0
IC-25	Assign a program manager to oversee all design and construction activities	DS
IC-26	Collect and reuse agricultural water runoff in other non-potable uses	0
IC-27	Upgrade the agriculture irrigation systems to more efficient to minimize agricultural runoff	0
IC-28	Provide a loan program to agricultural users to upgrade irrigation systems to decrease their demand and increase the water supply	3
IC-29	Use a grant program to upgrade irrigation systems to decrease demand and increase water supply	0
IC-30	Include the regulating pond as part of the enclosure pipeline project as opposed to including it with the water treatment plant project	0
RL - Reduce Losses		
RL-01	Use PVC in lieu of welded steel for finished water pipelines less than or equal to 24 inches	2
RL-02	Use HDPE pipe in lieu of welded steel pipe for Reach 1	4
RL-03	Use HDPE pipes in lieu of welded steel pipes for finished water pipeline that is less than or equal to 60 inches	3
RL-04	Use high-density polyethylene (HDPE) in lieu of welded steel for finished water pipeline less than 72 inches	0
RL-05	Tunnel the pipeline through the mountain/hill in lieu of adding a pump station to go over the top	2
RL-06	Construct a pre-sedimentation basin at the beginning of a lined canal in lieu of the raw water pipeline	0
RL-07	Construct a pre-sedimentation basin at the beginning of the raw water canal and enclose it using a reinforced concrete box (RCB)	0
RL-08	Use the new regulating pond as a sedimentation basin	0

Alt. No.	Description	Votes
RL-09	Use the new regulating pond as a sedimentation basin to allow use of the Spanish Fork River water	0
RL-10	Use the new regulating pond as a sedimentation basin in the event of high turbidity	0
RL-11	Use earthquake resistant duct iron pipe (ERDIP) at select fault zones	3
RL-12	Use high-density polyethylene (HDPE) pipe at select fault zones for Reach 1	1
RL-13	Use high-density polyethylene (HDPE) pipe at select fault zones for finished water	0
RL-14	Use steel pipe designed for fault zones where needed	0
RL-15	Use Darcy-Weisbach formula calculation in lieu of Hazon-Williams to determine head loss	0
RL-16	Use reinforced concrete pipe (RCP) where applicable for low pressure applications	0
RL-17	Use concrete trapezoidal canal lining with fiber reinforced polymer (FRP) cover	0
RL-18	Construct storm water diversion on the uphill side of the canal and line the canal	0
RL-19	Install drainage culverts perpendicular at existing drainage courses to manage stormwater within the right of way	1
RL-20	Install grouted rip rap uphill of raw water pipeline in drainage courses for stormwater control	0
RL-21	Use riprap uphill of raw water pipeline in drainage courses for stormwater control	0
RL-22	Use a native seed mix to cover all disturbed areas within the canal alignment	0
RL-23	Use an aggregate base course (ABC) for the pipeline inspection access road	0
RL-24	Investigate the feasibility of the enclose pipeline and finished water pipeline being accommodated within the concrete or culvert road crossings	0
RL-25	Use 8-inch thick concrete walls and slabs for turnouts along Strawberry Highline Canal	4

Alt. No.	Description	Votes
RL-26	Use fiber reinforced polymer (FRP) cover for turnout covers in lieu of concrete	0
RL-27	Use 6-inch thick turnout covers in lieu of 12-inch thick covers	1
RL-28	Use select backfill in lieu of trench zone controlled low strength material (CLSM)	3
RL-29	Use aggregate backfill for pipe zone in lieu of controlled low strength material (CLSM)	1
RL-30	use conventional pipe zone bedding for the finished water pipeline in lieu of controlled low strength material (CLSM)	0
RL-31	Use conventional pipe zone bedding for pipelines less than or equal to 48 inches in diameter in lieu of controlled low strength material (CLSM)	2
RL-32	Construct a large storage reservoir on the water treatment plant site and move the water treatment plant to the quarry site	0
RL-33	Replace the isolation ball valves with butterfly valves	3
RL-34	Coordinate a third-party fiber optic cable run within the pipeline right-of-way	0
RL-35	Install a separate ductbank to sell to other utilities	0
RL-36	use steel walled above ground storage tanks in lieu of concrete tanks in south Utah County	0
RL-37	Use pre-tensioned water storage tanks in south Utah County in lieu of concrete tanks	1

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RR – Indicates the Idea received enough votes by the Value Team to be developed. However, during the Development Phase the team found that the Idea was not feasible. Therefore, it has been designated RR indicating that it was Reviewed and Rejected by the Value Team.

WATER TREATMENT PLANT

Creative Idea Listing

Alt No.	Description	Votes
AT - Accommodate Turndown		
AT-01	Construct a 20 MGD water treatment plant at Santaquin first to serve the downstream (Juab County) demand and construct an 80 MGD South Utah Valley Regional Water Treatment Plant in the future	3
AT-02	For the ozone process, use two dedicated side stream injection systems for each contactor in lieu of one duty and one standby	DC
AT-03	Construct 10 filters in lieu of 8 to improve turndown	0
AT-04	Install a chlorine booster station halfway down the finished water pipeline	DC
AT-05	Provide a chlorine addition point leaving the finished water reservoir	DC
AT-06	Construct the Southern Utah Valley Water Treatment Plant in three 33 MGD phases in lieu of two 50 MGD phases	0
MC - Miscellaneous/Constructability		
MC-01	Begin planning for electrical demand and new substation with utility	DC
MC-02	Design the raw water storage pond to not fail towards the rest of the Water Treatment Plant in a seismic event	0
MC-03	Locate the ozone generation building on top of the contactors	2
MC-04	Use the DAC water treatment plant for finished water (excess capacity of 40 MGD)	0
MC-05	Ensure the Water Treatment Plant design goes from the raw water storage pond to the finished water reservoir, residual ponds, and spreading basins	DC
MC-06	Exclude the Strawberry Highline Canal regulating pond from the Water Treatment Plant design scope	DC
MC-07	Bid the South Utah Valley Regional Water Treatment Plant as two packages - one for civil works and one for water treatment plant construction	2
MC-08	Negotiate with the existing gravel pit owner to perform mass excavation to +/-5 feet at 30% design	1
MC-09	Relocate the road around the site in lieu of through	DS

Alt No.	Description	Votes
PW - Purify Water		
PW-01	Add a softening process to the Water Treatment Plant to reduce the hardness of the water and eliminate home softeners	0
PW-02	Reduce the Phase 1 Water Treatment Plant size to 20 MGD in lieu of 50 MGD and size the raw water storage pond for 20 MG	1
PW-03	Size the raw water storage pond for 50 MG for Phase 1 and only build one pond	3
PW-04	Size the raw water storage pond for half-day demand of 25 MG for Phase 1	0
PW-05	Use cast-in-place concrete tanks for raw water storage in lieu of earthen ponds	2
PW-06	Shift the raw water storage pond to the north to reduce earthwork (requires purchasing more property)	0
PW-07	Include pre-oxidation in the raw water storage pond to address manganese before flocculation and sedimentation	2
PW-08	Eliminate the pressure relieving station upstream of the rapid mix	DC
PW-09	Use two 25 MGD floc/sed basins in lieu of four	3
PW-10	Use a lower plate settler loading rate to better handle high solid conditions (i.e., wildfire impact) (0.3 at 95% current; 0.25 at 95% recommended)	0
PW-11	Evaluate pre-ozone benefits before floc/sed for pre-ozone only or pre-/intermediate ozone	DC
PW-12	Use one horizontal liquid oxygen in lieu of two vertical tanks	0
PW-13	Design the filters to operate at 8 GPM/SF (or higher)	0
PW-14	Reduce the height of the media in the filters from 72 inches to 48 inches to reduce media cost, filter box depth by 4 feet (confirm total organic carbon and manganese removal)	1
PW-15	Use the finished water reservoir for chlorination in lieu of chlorine contact basin	2
PW-16	Reduce the depth of the filter media from 72 inches to 48 inches and shorten the hydraulic profile by 6 feet	2
PW-17	Combine the process water and utility water pumps to a 2+1 configuration and include a hydropneumatics tank	DC
PW-18	Evaluate getting fire protection water from the city of Salem in lieu of using process water to avoid fire rated pumps	DC

Alt No.	Description	Votes
PW-19	Send all residuals and filter waste to engineered lagoons to eliminate the backwash water clarification process and filter to waste equalization and pumping	3
PW-20	Send reclaimed water to the Strawberry Highline Canal regulating pond in the summer to reduce pumping costs in lieu of raw water storage pond	DS
PW-21	Locate the floc basins outside and keep sed basins inside to reduce cost	0
PW-22	Increase the area for storing 1-ton chlorine cylinders	0
PW-23	Add a second chlorine contact basin and size both for 50% to improve redundancy and maintainability	0
PW-24	Install a bypass around the chlorine contact basin	0
PW-25	Use a polymer liner for the raw water storage pond in lieu of concrete lining	1
PW-26	Install the concrete liner for one of the raw water storage ponds in Phase 2 rather than Phase 1	0
PW-27	Add chlorine dioxide to the treatment process to control manganese	1
PW-28	Evaluate lithium concentrations in the source water	0
PW-29	Eliminate carbon dioxide from the process	0
SS - Satisfy Stakeholders		
SS-01	Determine the current water quality in the finished water distribution systems based on actual sampling (ongoing monthly)	2
SS-02	Determine the distribution system and premise plumbing materials for finished water recipients	0
SS-03	Conduct pipe loop studies using harvested materials to understand corrosion potential	0
SS-04	Assess aesthetics with current and new supply and potential blends (perform during piloting)	1
SS-05	Begin discussions with communities on need for potable water (demand, preferences, etc.)	1
SS-06	Use trees and shrubs to help screen the Water Treatment Plant	0

Alt No.	Description	Votes
SS-07	Raise the finish grade elevation around the main process area to reduce the height of the exposed structures (from EL 5,070 to EL 5,090) and bury the finished water reservoir (EL 5,060 for finished grade versus EL 5,050 current)	3
SS-08	Align architectural standards with the surrounding community aesthetic	1

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DC – Indicates the idea was selected as a Design Comment.

F – MATERIALS PROVIDED

Materials Provided

Document	Prepared by	Date
Phase 1 WTP Cost Estimate	Jacobs	6/26/24
Phase 2 WTP Cost Estimate	Jacobs	
Planning Level Design (PLD) Report	Jacobs	June 2024
Planning Level Design (PLD) Drawings	Jacobs	May 2024
Utah Quaternary Faults kml file		
Environmental Impact Statement Diamond Fork System	CUWCD US Department of the Interior	July 1999
Final Environmental Assessment Diamond Fork System Update	CUWCD US Department of the Interior	February 2022
Environmental Impact Statement Utah Lake Drainage Basin Water Delivery System	CUWCD US Department of the Interior	September 2004
Strawberry Highline Canal Enclosure Hydraulic Analysis	Jacobs	September 8, 2020
Juab County and South Utah County Water Supply & Infrastructure Plan Formulation Project Technical Report (Juab County and South Utah County Appendices)	Hansen Allen & Luce, Inc Jacobs	April 2020 April 2012
Remaining Safe Yield Report	Hansen Allen & Luce, Inc	February 2020
Plan Formulation Phase I Portfolios Alternatives Summary	Jacobs	December 22, 2020
Juab County & South Utah County Water Supple and Infrastructure Plan Formulation Project Phase 1 Results	Jacobs Hansen Allen & Luce, Inc CUWCD	
Juab County and Southern Utah County Water Supply and Infrastructure Plan Formulation Project Plan Formulation - Phase II Final Report	Jacobs	September 27, 2021
Salem Gravel Pit Managed Aquifer Recharge Feasibility Investigation	Jacobs	February 7, 2023
Plan Formulation Project Phase 3 Spanish Fork & Diamond Fork Exchange Water Supply Modeling Findings	CUWCD	May 12, 2022
Objectives & Constraints for Value Planning Workshop	CUWCD	June 24, 2024
Value Planning Kickoff Meeting – Design Team Presentation	Jacobs	May 29, 2024

Document	Prepared by	Date
Site for Future Water Treatment Facility	CUWCD	June 27, 2024
Strawberry Reservoir Contract Summary	CUWCD	October 25, 2023

G – RESPONSE TO RECOMMENDATIONS

CENTRAL UTAH WATER
CONSERVANCY DISTRICT

Shelley Brennan *Chair of the Board*
G. Wayne Andersen *Vice Chair of the Board*
Gene Shawcroft *General Manager / CEO*

To: Joseph Zalla, PE, Jacobs Engineering

Jared Robinson, PE, Strategic Value Solutions

Subject: Value Planning Responses: CUWCD Plan Formulation Project

From: Derek Bruton, PE, CUWCD

Roger Pearson, PE, CUWCD

Date: October 9, 2024

After reviewing the draft Value Planning (VP) Report prepared by Strategic Value Solutions for the CUWCD Plan Formulation Project (PFP), we are making the following decision responses to the suggested alternatives referenced in the report.

Many of the alternatives merit further analysis during the preliminary and final design phases for the conveyance, treatment, and appurtenant facilities. These value alternative proposals will be provided to the relevant design teams for early evaluation and integration in the engineering design process.

Comments reference the alternative numbers used in the report:

DW-02	Repurpose reach of ULS for Finished Water Conveyance	Accept

A version of this concept was briefly explored during an earlier phase of the PFP, but not fully developed as the initial infrastructure portfolio. The VP process revaluated this option and highlighted potential cost savings of a significant magnitude of to be had by:

- Repurposing an existing 10 mile reach of Utah Lake System (ULS) Spanish Fork-Santaquin Pipeline between Salem and Santaquin
- Upsizing the planned enclosure of the Strawberry High Line Canal (SHLC) to convey raw water under Central Utah Project (CUP) Bonneville Unit (BU) ULS and Strawberry Valley Project (SVP) contracts
- Eliminating the need for an additional 10 mile segment of new large diameter pipeline for finished water

The District has worked with Jacobs Engineering to refine the initial cost estimates in the VP report and have confirmed that even with additional costs (replumbing existing raw water turnouts, additional turnout requirements on SHLC enclosure, building of new finished water turnouts, and

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the associated piping) which were not fully accounted for in the VP report this alternative has significant merit.

The District has committed to evaluating this as the preferred alternative through our environmental analysis under NEPA and envisions a refined version of this concept to ultimately be constructed.

DW-06	Addn. Mona Water Treatment Plant	Reject
DW-12	Extend ULS to Mona and use Three Treatment Plants	Reject
TW-10	1st Phase Santaquin WTP, 2nd Phase WTP in Salem	Reject
AT-01	Construct addn. treatment plant in Santaquin first	Reject

These four alternatives explore various ways to meet demands from multiple, smaller surface water treatment plants. The District has elected to focus on a single regional treatment plant for long-term efficiencies. These efficiencies include optimal staffing requirements, economies of scale, beneficial topographic siting of Salem property for gravity delivery, and taking advantage of acceptance of DW-02 minimizing the construction of additional finished water transmission pipelines. Additionally, the acceptance of alternative TW-21 allows for the possibility of a second water source in either the Santaquin or Juab County areas.

TW-17 (DS)	Develop Decision Tree for Program Implementation	Accept

The District program management team will develop a decision tree in conjunction with the facility design teams allowing for flexibility of future phasing triggers.

TW-21	Use ground water from SHLCC Wells near Santaquin for potable water	Accept

The District water supply team is involved in ongoing discussions with Strawberry High Line Canal Company (SHLCC) and other regional aquifer stakeholders on rights and usage of local groundwater, evaluating opportunities for the District to have additional water sources in the region.

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RL-02	Use HDPE for SHLC Reach 1	Reject

The District has determined that welded steel pipe (WSP) is preferred for reach 1 due to:

- Consistency of operational, maintenance, and reparability requirements with broader ULS system made of WSP
- Upsizing of the SHLC Reaches 2-5 to 72" due to acceptance of DW-02 are anticipated to also require WSP due to diameter

MC-09	Relocate public road around SUVRWTP Site	Accept

This road will be relocated to avoid bisecting the WTP property as part of broader site planning and development.

Alt. No.	Short Description	Decision	Decision Reasoning*
\Decisions¿A±Accepted?R_Rejected?F±Further.Study.in..Subsequent.Phases			
Overall.System.Integration			
DW-02	Repurpose reach of ULS for Finished Water Conveyance	A	See above. Preferred alternative being moved through environmental analysis
DW-06	Addn. Mona Water Treatment Plant	R	See above. The District has elected to focus on a single regional treatment plant for long-term efficiencies
DW-09	Hydropower to Spanish Fork Pipeline	F	Program team will evaluate in conjunction with Diamond Fork Hydropower discussions
DW-12	Extend ULS to Mona and use Three Treatment Plants	R	See above. District has elected to focus on a single regional treatment plant for long-term efficiencies
IS-03 (DS)	Limit irrigation use for new residential	F	Program team will coordinate as part of District conservation efforts
IS-12 (DS)	Identify addn. canals for M&I Source	F	Program team will coordinate as part of District water supply planning

Alt. No.	Short Description	Decision	Decision Reasoning*
\Decisions¿A±Accepted?R_Rejected?F±Further.Study.in..Subsequent.Phases			
IS-13	Pump Station on SFPR Pipe to pump water from Olmsted Flowline to SUVWTP	F	Program team will coordinate as part of District systems planning
TW-10	1st Phase Santaquin WTP, 2nd Phase WTP in Salem	R	See above. The District has elected to focus on a single regional treatment plant for long-term efficiencies
TW-17 (DS)	Develop Decision Tree for Program Implementation	A	See above. Program team will coordinate development
TW-21	Use ground water from SHLCC Wells near Santaquin for potable water	A	See above. Program team will coordinate as part of District water supply planning
Conveyance.(Raw.™.Finished)			
FC-02 (DS)	Use early contractor instead of design-bid-build	F	Will pass to conveyance team during design phase.
FC-03	Reduce pipe cover from 6 feet to 4 feet	F	Will pass to conveyance team during design phase.
FC-11 (DS)	Install raw and finished water pipelines in common trench	F	Acceptance of DW-02 would eliminate majority of simultaneous construction of raw and finished water transmission lines. Will be evaluated by conveyance team during design phase for any parallel pipes.
FC-14 (DS)	Prequalify contractors to ensure production rates	F	Will pass to conveyance team during design phase.
FC-16 (DS)	Allow precast construction in lieu of cast-in-place for turnouts	F	Will pass to conveyance team during design phase.
FC-18	Construct FW pipeline from Mona to Nephi Earlier	F	Will pass to conveyance team during design phase.
FC-23	Reusable Portable energy dissipater for each irrigation season	F	Will pass to conveyance team during design phase.
FC-25 (DS)	Identify laydown and staging areas throughout construction corridor	F	Will pass to conveyance team during design phase.
FC-31	Use existing vehicle tunnel instead of boring under I-15	F	Will pass to conveyance team during design phase.

Alt. No.	Short Description	Decision	Decision Reasoning*
\Decisions¿A±Accepted?R_Rejected?F±Further.Study.in..Subsequent.Phases			
FC-33	Bid alternative pipe materials	F	Will pass to conveyance team during design phase.
IC-05 (DS)	Expedite geotechnical investigation in geohazard areas	F	Will pass to conveyance team during design phase.
IC-13 (DS)	Account for construction site access delays within cost estimate	F	Will pass to conveyance team during design phase.
IC-15 (DS)	Coordinate with other large utility owners	F	Will pass to conveyance team during design phase.
IC-19 (DS)	Add escalation clause to contract to account for unexpected price increases	F	Will pass to conveyance team during design phase.
IC-23 (DS)	Increase cloud seeing operations	F	Will pass to conveyance team during design phase.
IC-25 (DS)	Assign program manager	F	Will pass to conveyance team during design phase.
RL-02	Use HDPE for SHLC Reach 1	R	See above. The District anticipates using WSP in Reach 1
RL-03	Use HDPE for 60" and smaller finished water pipes	F	Acceptance of DW-02 would eliminate the main trunk of new pipeline for finished water. Will pass to conveyance team to evaluate smaller diameter finished water branch lines.
RL-11	Use earthquake resistant pipe at fault zones	F	Will pass to conveyance team during design phase.
RL-25	Use 8" concrete slabs for structures	F	Will pass to conveyance team during design phase.
RL-28	Use select backfill in lieu of CLSM	F	Will pass to conveyance team during design phase.
RL-33	Replace isolation ball valves with butterfly valves	F	Will pass to conveyance team during design phase.
Water.Treatment.Plant			
AT-01	Construct addn. treatment plant in Santaquin first	R	See above. District has elected to focus on a single regional treatment plant for long-term efficiencies
MC-03	Locate ozone generation on top of contactors	F	Will pass to WTP team during design phase.

Alt. No.	Short Description	Decision	Decision Reasoning*
\Decisions¿A±Accepted⁚R_Rejected⁚F±Further.Study.in..Subsequent.Phases			
MC-07	Bid SUVRWTP as two packages	F	Will pass to WTP team during design phase.
MC-09	Relocate public road around SUVRWTP Site	A	See above. Program team will coordinate in conjunction with site planning
PW-03	Phase raw water storage ponds	F	Will pass to WTP team during design phase.
PW-05	Use concrete tanks for raw water storage	F	Will pass to WTP team during design phase.
PW-07	Include pre-oxidation in raw water storage ponds	F	Will pass to WTP team during design phase.
PW-09	Use two floc/sed basins instead of four	F	Will pass to WTP team during design phase.
PW-15	Use finished water reservoir for chlorination in lieu of chlorine contact basins	F	Will pass to WTP team during design phase.
PW-16	Reduce filter media depth	F	Will pass to WTP team during design phase.
PW-19	Send all residuals and filter waste to engineered lagoons	F	Will pass to WTP team during design phase.
PW-20	Send reclaimed water to SHLC regulating pond to reduce pumping costs	F	Will pass to WTP team during design phase.
SS-01	Determine the current water quality in finished water distribution systems with ongoing sampling.	F	Will pass to WTP team during design phase.
SS-07	Raise finish grade elevation to reduce height of exposed structures	F	Will pass to WTP team during design phase.