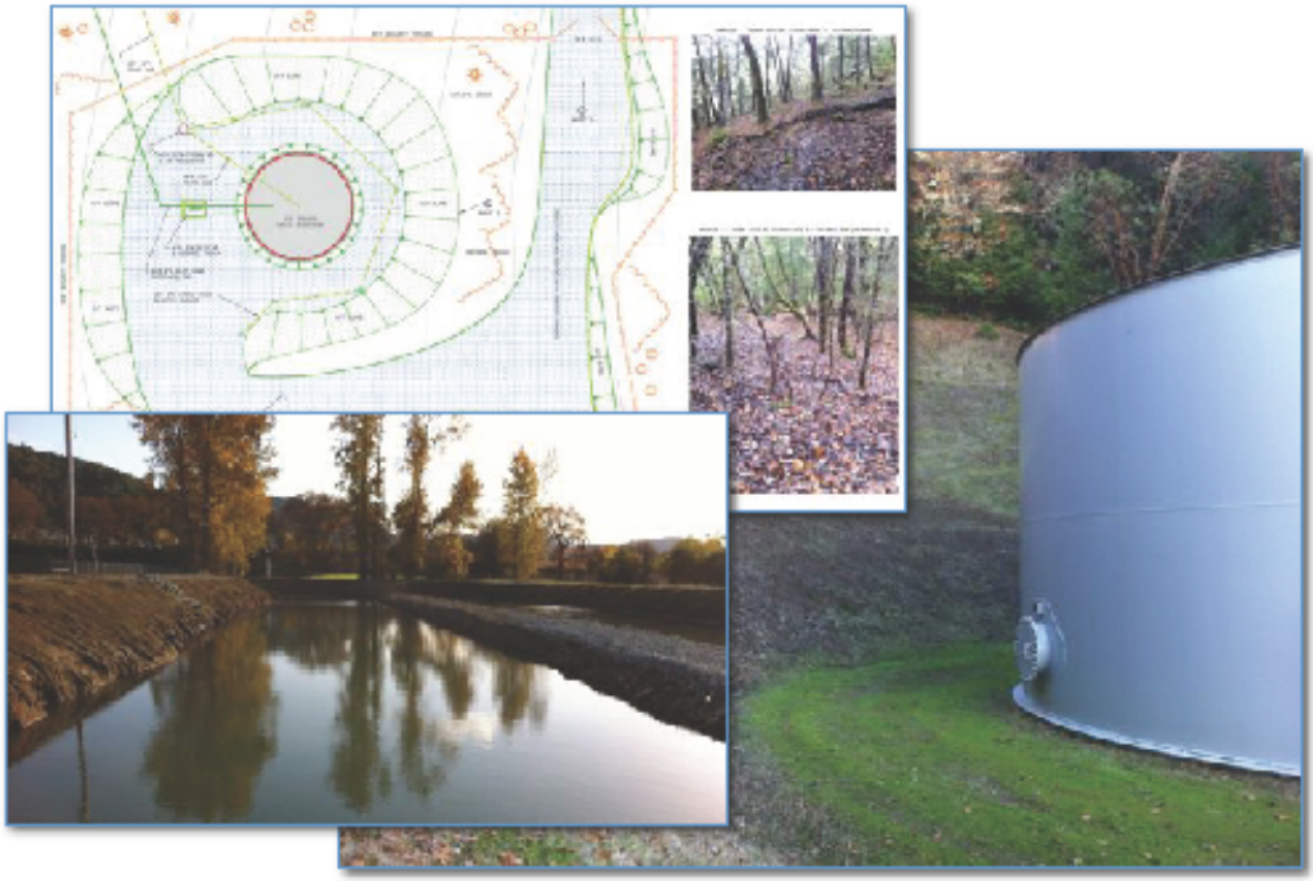
Tri City Water & Sanitary Authority

Back Acres Preliminary Engineering Report

September 2013



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Project No. 100.01

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Douglas County, Oregon

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ABBREVIATIONS

AAD = Average Annual Demand
ADD = Average Daily Demand
MMD = Maximum Monthly Demand
MDD = Maximum Daily Demand
PHD = Peak Hourly Demand

WMP = Water Master Plan (HBH, 2006)
WRS = Water Rate Study (2007)

Executive Summary

Tri City Water & Sanitary Authority (Tri City, Authority) has diligently pursued the improvement of its water system in order to ensure excellent service to its customers. This study affirms the Authority's commitment to the community and answers key questions concerning various aspects of the water system. These aspects include the current status of water system characteristics, updated projections for future water system needs, conservation measures, required capital projects, and other important needs.

The need for this study became apparent over time, as the Authority has worked to prioritize improvements, address perceived system deficiencies, and accommodate potential growth. An important potential driver of water system demand could include development of the industrial park on the west side of Interstate 5. Development groups have asked the Authority to provide estimates of the level of utility service (water and wastewater) that can currently be provided, as well as those improvements required to accommodate a significant utility consumer. The answers to these questions requires a detailed analysis of current water system characteristics, and a comprehensive understanding of the current status of the water system. This analysis also forms the basis for answering other questions concerning the water system, including a new high-level pressure zone inline water storage tank (Back Acres), and conservation measures that could practically be implemented in the water system. This analysis provides a practical milestone-based framework that will guide the efforts of the Authority in the coming years, including the level of service that could be provided to the industrial park should a developer become seriously engaged. The required demand characteristics will trigger important improvements. Although each specific type of development has its own marginal demand characteristics that must be considered during the development phase, the current study will provide the necessary tools to support the development discussion.

This study was funded in part (50% matching) through a grant awarded by the Oregon Water Resources Department (Grant Agreement No. 0056 13). In addition to the objectives above, a requirement of the grant funding includes statutory tasks that must be considered in the study. This discussion is developed in Appendix A.

Study Objectives

The primary objective of the this study is to provide a preliminary engineering analysis for an inline water storage tank within the high-level pressure zone of Tri City's water system. Additional objectives of the study are summarized in the bulleted list below including the sections of relevant work.

- Compile necessary data, including the validation of the Water Master Plan data (Section 4.1). Ensure that water requirements are adequate to meet water system needs (Section 4.2).
- Identify potential alternatives to improve current deficiencies in the water system (Section 7).
- Evaluate each alternative for the Back Acres inline water storage tank, including preliminary engineering cost estimates for each (Section 7).
- Provide recommendations for the most feasible and cost effective alternative to meet water system needs (Section 7).
- Provide recommendations for water conservation and efficiency measures (Appendix A).

In addition to the objectives above, grant funding requirements call for specific statutory tasks to be considered in the study. These tasks are regarded in more detail in Appendix A.

ES1 Historic Water System Characteristics

The foundation of this study was created through a comprehensive analysis of the current status of the water system. This was accomplished through the review of a significant body of previous work, and analysis of recent water system data. The last three years of water system records were analyzed in detail and compared to the Water Master Plan (WMP) (2006, HBH), water rate study (2007), and other previous work. The primary goal of this analysis is to understand current water system characteristics as a means to ensure that excellent service can continue, and that future needs can be met. Reflection of this analysis upon the overall future needs of the community provides perspective on improvement needs as the community grows. Planning for future capital projects, conservation, and system efficiency projects are provided.

Figure ES1 provides a graphical representation of the Average Daily Demand (ADD) of water for the analysis period of 2001 – 2012. The blue bars represent actual historic water system data, while the red bars represent projections developed in the WMP. It is important to note that the blue bars for recent water system demand (2010 – 2012) are much less than the projected values developed in the WMP. The key value from this analysis shows that timeframes for expensive infrastructure improvements called for in the WMP can be deferred well into the future. Complex relationships drive water system demand, though the differences between projected and actual demand are the direct result of actions taken by the Authority. These direct actions include the reduction of water system losses through distribution system repairs, and the implementation of a new water rate structure in 2007. The new water rate structure encouraged conservation. In addition, the current population is significantly less than the projection developed in the WMP. The WMP projected a 2010 population of 4,592, while the 2010 census proved an actual population of 3,931.

Figure ES1 – Historical Average Daily Demand (2001 – 2012)

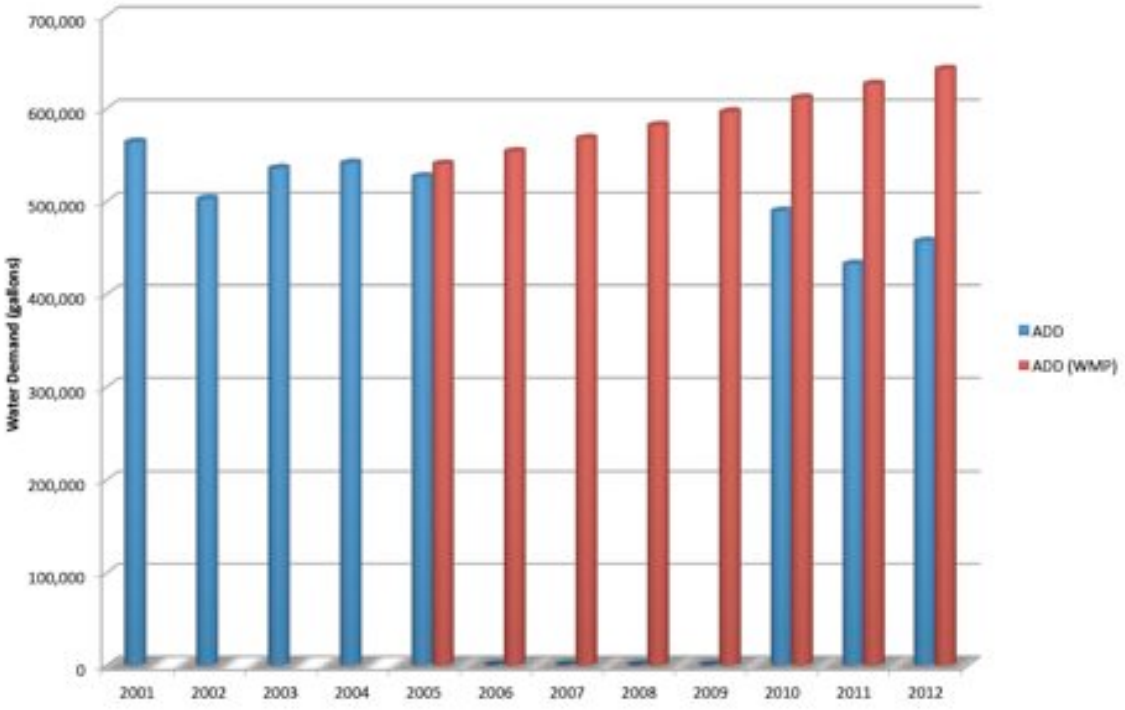


Table ES1 provides a summary of actual historic water system data, as well as projections developed in the WMP from 2001 - 2012. Abbreviation definitions are provided on page iii of the Table of contents.

Table ES1 – Historic Water Demand (2001 – 2012)
(Units in gallons per day unless otherwise noted)

	AAD (gallons)	ADD* (WMP)	ADD	MMD	MDD	PHD	Notes
2001	205,583,800		563,243	901,189	1,464,433	2,816,216	WMP
2002	183,322,900		502,255	803,607	1,305,862	2,511,273	WMP
2003	195,308,600		535,092	856,147	1,391,239	2,675,460	WMP
2004	197,397,000		540,814	865,302	1,406,116	2,704,068	WMP
2005	192,009,737	540,000	526,054	841,687	1,367,741	2,630,270	WRS
2006	202,027,500	553,500	-	-	-	-	WMP
2007	207,078,370	567,338	-	-	-	-	WMP
2008	212,255,165	581,521	-	-	-	-	WMP
2009	217,561,535	596,059	-	-	-	-	WMP
2010	178,499,353	610,960	489,039	782,463	1,271,502	2,445,197	This Study
2011	157,746,490	626,234	432,182	691,491	1,123,674	2,160,911	This Study
2012	166,653,345	641,890	456,585	730,535	1,187,120	2,282,923	This Study

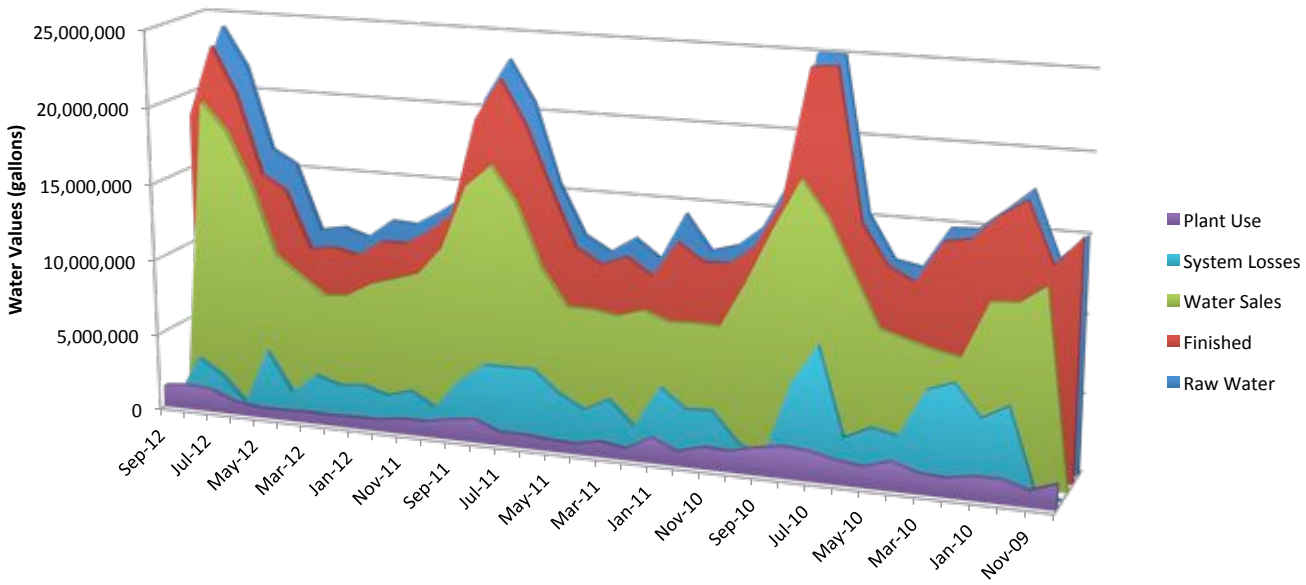
* This column reflects the future projection developed in the WMP.

Table ES1 provides a comprehensive picture of the previous decade of water system demand. Key aspects to note are table cells highlighted in orange and green. The orange cells show that current ADD (2012) is in excess of 80,000 gallons per day less than the ADD developed in the WMP (2005). The green cells show that the current Average Annual Demand (AAD) is nearly 29 million gallons less than that developed in the WMP. Conservation-encouraging policies, operational efficiency improvements, system leak mitigation, and lower than projected population have played important roles in water system demand reduction. This has provided valuable time for the Authority to continue cost-effective infrastructure development projects and future planning efforts.

Figure ES2 provides a comprehensive illustration of water system characteristics for the period of 2010-2012. The figure represents all major aspects of the water system from the raw water intake, to the end consumer. Some key qualitative observations from Figure ES2 include:

- Please note that the horizontal axis historically progresses from right to left.
- Monthly water system demand growth has remained flat, or slightly decreased, over the period. This validates the findings of the study, especially related to the milestone-based planning guidelines, as well as the current water system demand projections.
- Water system losses have decreased historically, proving that actions to repair leaks in the water system have resulted in significant reductions in overall losses. This may also have contributed to the slight reduction seen in overall demand over the period.
- Water plant usage has remained consistent and efficient over the period.
- Water conservation encouraging water rate structure has continued to prove effective.
- Water sales increased in 2012, yet overall system demand remained flat. The reasons for this are not entirely understood, however, Tri City efficiently delivered this water to users.

Figure ES2 – Historic Monthly Water System Characteristics (2010 – 2012)



ES2 Projected Water System Characteristics

This study has developed a comprehensive evaluation of the previous decade of water system characteristics and produced a milestone-based demand tool that will guide future water system needs. The population growth rate developed in the WMP has been utilized in this study, yet the updated future population projection developed in this study shows the 2010 US Census value as the new baseline. Table ES2 provides this milestone-based tool, including comparative values to those developed in the WMP, and the values developed in this study. Maximum Monthly Demand (MMD) and Maximum Daily Demand (MDD) are important water system characteristics that directly affect the design of water infrastructure improvements. The cells highlighted in blue illustrate an important key finding. The 2013 MDD projected in the WMP will not actually occur until sometime after 2025, unless significant development occurs. This table can be utilized as an infrastructure-planning tool. Demand characteristics of new development can be added to the current status of water system demand at any time, in order to project which improvements could be required. Figure ES2 clearly shows that infrastructure improvements called for in the WMP may be deferred long into the future, as long as existing water infrastructure is well maintained and efficiently operated.

Table ES2 – Comparison of Projected Demand*

	Water Master Plan Projection		Study Projection	
Year	MMD	MDD	MMD	MDD
2013	1,053,919	1,711,856	748,799	1,216,798
2014	1,080,266	1,754,652	767,519	1,247,218
2015	1,107,273	1,798,518	786,707	1,278,398
2016	1,134,954	1,843,481	806,374	1,310,358
2017	1,163,328	1,889,568	826,534	1,343,117
2018	1,192,412	1,936,807	847,197	1,376,695
2019	1,222,222	1,985,228	868,377	1,411,112
2020	1,252,777	2,034,858	890,086	1,446,390

2021	1,284,097	2,085,730	912,338	1,482,550
2022	1,316,199	2,137,873	935,147	1,519,614
2023	1,349,104	2,191,320	958,526	1,557,604
2024	1,382,832	2,246,103	982,489	1,596,544
2025	1,417,403	2,302,255	1,007,051	1,636,458
2026	-	-	1,032,227	1,677,369
2027	-	-	1,058,033	1,719,303

* Values are compared between the projections in the Water Master Plan (HBH, 2006) and this preliminary engineering report.

ES3 Current Status of the Water System

Tri City's water system was well characterized and presented in the WMP. The focus of the present study is to verify the current status of this water system, and re-characterize its various aspects. This will help Tri City to provide reliable and cost-effective water service for the community well into the future.

The bulleted list below is a chronological summary of recent efforts relating to the water system.

- The Authority developed a **Water Master Plan** (HBH, 2006), which provided infrastructure assessment and planning for the coming twenty years (2006-2026).
- In 2007, the Authority commissioned a **water rate study** and implemented its recommended water rate structure. The goal of the new structure was to encourage maximum conservation within the system through a purely consumptive model. Water demand fell significantly, which is supported by the analysis provided in this study.
- Authority installed an **on-demand hypochlorite disinfectant generation system** in 2008, which reduces the potential of disinfection byproduct risk, enhances disinfection effectiveness and efficiency, and reduces chlorine gas system health and safety risk. This also reduces cost and supply chain risks associated with chlorine gas systems.
- Tri City procured the **Pruner Road Hotel Impact Study** (Civil West, 2008) to study the resources and improvements that would be required to service a hotel in the industrial park.
- **Clearwell baffling** was installed in 2010. This ensures greater disinfection effectiveness by enhancing mixing and minimizing short-circuiting of finished water. Treatment effectiveness is enhanced through greater log reduction of pathogens prior to the first customer.
- In 2010, Tri City constructed **Raw Water Intake improvements**, including the installation of a fish-friendly Johnson Tee Screen (fish screen), airburst system, and related equipment.
- The Authority commissioned a **Water System Risk Failure Analysis** (HBH, 2011) in order to assess risk within the water system, and prioritize recommended improvements based upon the potential risks and outcomes, should various types of failure occur. This study reinforced the relative importance of various improvements called for in the Water Master Plan, including the Back Acres water storage tank, which is developed in the present study.
- In 2011, the Dyer Partnership was consulted to assist the Authority with the **analysis of potential operational improvements and conservations measures** that could be implemented in the water treatment plant (WTP). A copy of the technical letter can be found in Appendix D. The recommended improvements included modifications to the backwash cycle for improved efficiency, installation of a variable frequency drive (VFD) for the backwash pump, the installation of electrically actuated valves, and the future consideration of improvements of the backwash filter system and underdrains with an air scour system.
- In 2012 Midea Development provided recommendations to **improve the operational effectiveness of the current backwash treatment system**. The Authority implemented the

recommended improvements in 2012 during normal backwash basin cleaning operations. This will result in significant improvements to backwash water quality and treatment efficiency.

- In 2012 the Authority commissioned Midea Development to answer specific questions concerning the capacity and upgradeability of the water treatment system. The goal was to **identify the level of service that could be provided to the industrial park** on the west side of Interstate 5. The results of the technical letter provided general information, yet a more detailed, multi-year analysis would be required to answer the question with sufficient certainty. A secondary question was concerned with the level of improvements that would be required to provide higher levels of water service, should a larger development become a possibility. A copy of this letter can be found in Appendix D.
- In 2012, the Authority began planning for the **installation of a VFD** on the backwash pump, per the Dyer Partnership's recommendation. This will allow improved operational flexibility, performance, and efficiencies. The system will be integrated into the computer control system of the WTP, which will enable the Authority to optimize treatment, while minimizing waste and power usage. It could further reduce electrical loading and costs to the WTP. This improvement is to be completed prior to the publishing date of this study.
- The Authority **replaced existing lighting in its facility with high-efficiency lighting**, which is anticipated to significantly reduce electricity demand. The majority of existing lighting fixtures were replaced in approximately 2009, and then the remainder were replaced in 2012 and 2013. Older incandescent, halogen, and T12 florescent fixtures were replaced with more efficient T8 fixtures.
- The efforts above defined the need for this present study. Tri City developed the funding application that lead to the present grant. The overarching goal is to provide a recent analysis that answers important questions for the future, including the high-level pressure zone water storage needs, water system capacity, water conservation and efficiency. The Authority was **awarded grant funding for this study**, which supports this study, in part.

ES4 Water System Needs

The WMP provides detailed information concerning justifiable need for improvements to the water system. The Water System Risk Failure Analysis (HBH, 2011) reinforces and expands upon the recommendations called for in the WMP, with specific focus on a risk assessment framework. The improvement needs developed in these studies are specifically related to the demand projections developed in the WMP. This study developed an updated water system analysis, which includes actual recent demand characteristics and population values from the 2010 census. The present analysis validates the impacts resulting from thoughtful actions taken by Tri City, which has encouraged significant levels of conservation.

It is the general consensus of the above studies, and this study, that specific improvements are required for Tri City's water system, depending upon various factors, including actual water system demand. This is true, with some significant exceptions. Population and water demand are significantly less than projected in the WMP. Other exceptions will require additional analysis and consideration in order to develop practical and cost-effective improvement alternatives.

Water Rights Recommendations

Current water rights are adequate for future needs at current levels of usage and growth. However, this could change significantly should the level of demand increase due to development in the Industrial Park. Demand in excess of 1,000 gpm also creates additional required improvements to the water treatment facility, including the raw water pumps, and water treatment processes, which are discussed below. The raw water pump station should continue to be developed and improved in order to ensure

that the full water rights can be utilized, which would enhance the discussion toward water right certification. Concerns with the raw water intake and pump station are limiting factors to the utilization of additional water storage rights. Water storage rights are presently available in Galesville reservoir. Tri City should pursue water rights as a practical and forward-looking part of their overall water system development strategy.

Intake & Pump Stations Recommendations

The mitigation of raw water intake and pumping concerns should be investigated in greater detail. During low river level periods, drawing the necessary flow rate has proven difficult. The infrastructure lacks automation, redundancy, and commonality of equipment. Various potential alternatives are provided in Section 7, which enables a beginning point for further analysis. The goal should be to provide cost effective solutions that progress full water right development, minimize operational risks, and ensure that water can be delivered even during low river level periods.

Water Treatment Facility Recommendations

Viable filtration alternatives that adequately consider the specific circumstances in Tri City must be developed. The alternatives developed in the WMP are inadequate to properly compare viable alternatives, and do not provide consideration for actual construction phasing requirements. Viable alternatives must consider operational and demand needs of the community. This dramatically affects the cost estimates and feasibility of the proposed projects developed in the WMP. Re-developed alternatives would include preliminary engineering cost estimates, and would provide valuable information to help Tri City to make informed decisions. A detailed investigation should be implemented to further consider the most practical and cost-effective alternatives that would meet the treatment goals of Tri City, and the needs of the community.

One New Potential Alternative
One new alternative that could be considered is the phased upgrading of the facility to the type of facility currently being constructed to treat the City of Sutherlin's Cooper Creek Reservoir water rights. The system Sutherlin selected is a Siemen's Trident HS (high solids) packaged conventional mixed-media system. This type of facility is more efficient and effective than conventional mixed-media filtration equipment, and is capable of treating surface water that is impossible to treat with membrane facilities. The system was compared to various membrane technologies and proved to be the most cost-effective and reliable alternative for Sutherlin. The Sutherlin WTP is designed to treat 5 cfs, which is similar to the needs of Tri City (4.87 cfs). This packaged equipment has dual treatment trains with tube settler modules capable of providing settlement and flocculation capacity prior to entering absorption clarification, and mixed-media filtration with media-retention underdrains, and an air scour system. Electrically actuated control valves can be utilized rather than pneumatic control valves, which enhances control and reliability of the facility, while also minimizing energy usage associated with pneumatically-actuated valve systems.

A major component to membrane treatment facility costs is the additional cost required for pre-treatment of raw water, prior to the membrane equipment. Tri City's WTP is currently deficient in settling and flocculation capacity. The WMP calls for an expensive improvement to the sedimentation / flocculation basins, yet this new alternative may be designed to negate the need for new basins. This alternative would utilize the existing sedimentation basin as a pre-settling and pre-flocculation basin, with secondary flocculation and settling occurring in the new treatment equipment.

The existing WTP would continue to operate while the new equipment is constructed. Once commissioned, the existing WTP would be decommissioned. The facility and mechanical piping would be sized to handle growth for the next 10 years, when the existing equipment would be demolished and an additional Trident treatment train would be installed in the existing building. This alternative would

create a viable, simple and scalable water system, while utilizing as much of the existing equipment and infrastructure as possible. It is further recommended that Tri City staff tour the Sutherlin facility in order to gain a greater understanding of what is involved with the construction of a new facility, while continuing to operate an existing water treatment facility.

Summary
The most cost-effective medium-term solution for the water treatment facility is to to expand the capabilities of the existing facility in order to maximize the operational life of the existing plant. This could include the installation of additional mixed-media filters, while also installing new underdrains, electrically-actuated valves, filter media, air-scour systems, and repairing existing operational and mechanical deficiencies within the existing treatment facility. Additional settling and flocculation capability will be required in order to significantly enhance water treatment facility capacity; therefore additional filtration alone will not solve the existing operational and capacity deficiencies in the facility. Improvement of the existing facility could be combined with the alternative mentioned above. However, this functionally equates to the operation of two separate treatment facilities with different water treatment capacities and capabilities, which would result in significant operational difficulties. Finally, expenditures toward the existing facility should be carefully considered, as this capital could be invested toward the future needs of the water treatment system. The future water system will be considerably different than the current facility. Investments made toward the improvement of overall long-term deficiencies could prove to be more prudent than investments toward the enhancement of the existing facility. This topic must be considered in greater detail in order to enable an informed decision.

Back Acres Water Storage Tank Recommendations

The alternative chosen by the Authority for the Back Acres high-level pressure zone inline storage tank should meet long-term strategic requirements for the water system. This improvement will bring the overall storage system, and the high-level pressure zone within water system storage requirements. The high-level pressure zone is currently deficient in storage highlighting the need for this improvement. Table ES3 summarizes projected water system storage needs. The current minimum water storage deficiency is in excess of 250,000 gallons, but a larger storage tank is recommended to enhance fire suppression capability. A 350,000 gallon tank would bring the water storage system under compliance approximately beyond the year 2020, unless a large water user connects to the water system.

Table ES3 – Projected Water Storage Requirements

	Study Projection		Study Projected Storage Requirements		
Year	MMD	MDD	Storage	Need	Deficient
2013	748,799	1,216,798	2,017,300	2,060,998	(43,698)
2015	786,707	1,278,398	2,017,300	2,137,998	(120,698)
2020	890,086	1,446,390	2,017,300	2,347,988	(330,688)
2025	1,007,051	1,636,458	2,017,300	2,585,572	(568,272)
2030	1,139,386	1,851,502	2,017,300	2,854,377	(837,077)

Tank Site Alternative 2 is the recommended alternative for consideration. Other alternatives developed in this study are equally viable and have their own advantages and disadvantages. This affords Tri City excellent flexibility during the actual siting process for the project. Figure ES3 illustrates the recommended alternative, including alternatives for supply pipeline routing. A GPS survey was conducted in order to assess these alternatives and their viability. This incorporated various factors, including easy access, and excellent site characteristics, including drainage. Two possible routings are possible to the tank site, which provides flexibility during land acquisition negotiations and geotechnical studies. It could be possible with this alternative to leverage the improved fire flows, and improved

service for development owners toward favorable land acquisition terms. In an ideal situation, the property owner would donate land for the new tank, and consider the tax benefits, and the future added value to the land as an excellent tradeoff. Alternative 2 provides the best combination of benefits, for only a 16% premium over Alternative 1. Figure 7.4.3 provides a conceptual engineering drawing of the water tank site for Alternative 2; however this conceptual drawing could be applied to any site during the actual design.

Table ES4 provides a summary of water storage tank alternatives that were considered in this study. Although Alternative 2 is modestly more expensive than Alternative 1 and Alternative 3, significant additional benefits can be realized, including enhanced serviceability characteristics and fire flows to the high-level pressure zone. The existing water tank would remain in operation, which would allow operations staff to service either tank without affecting the continuity of service to the high-level pressure zone. This alternative also enhances fire flows and minimizes risks to service to the existing community, as well as to new development that is likely to occur to the north and west of the current pressure zone.

Figure ES3 – New Tank Site Alternatives 2A / 2B / 3

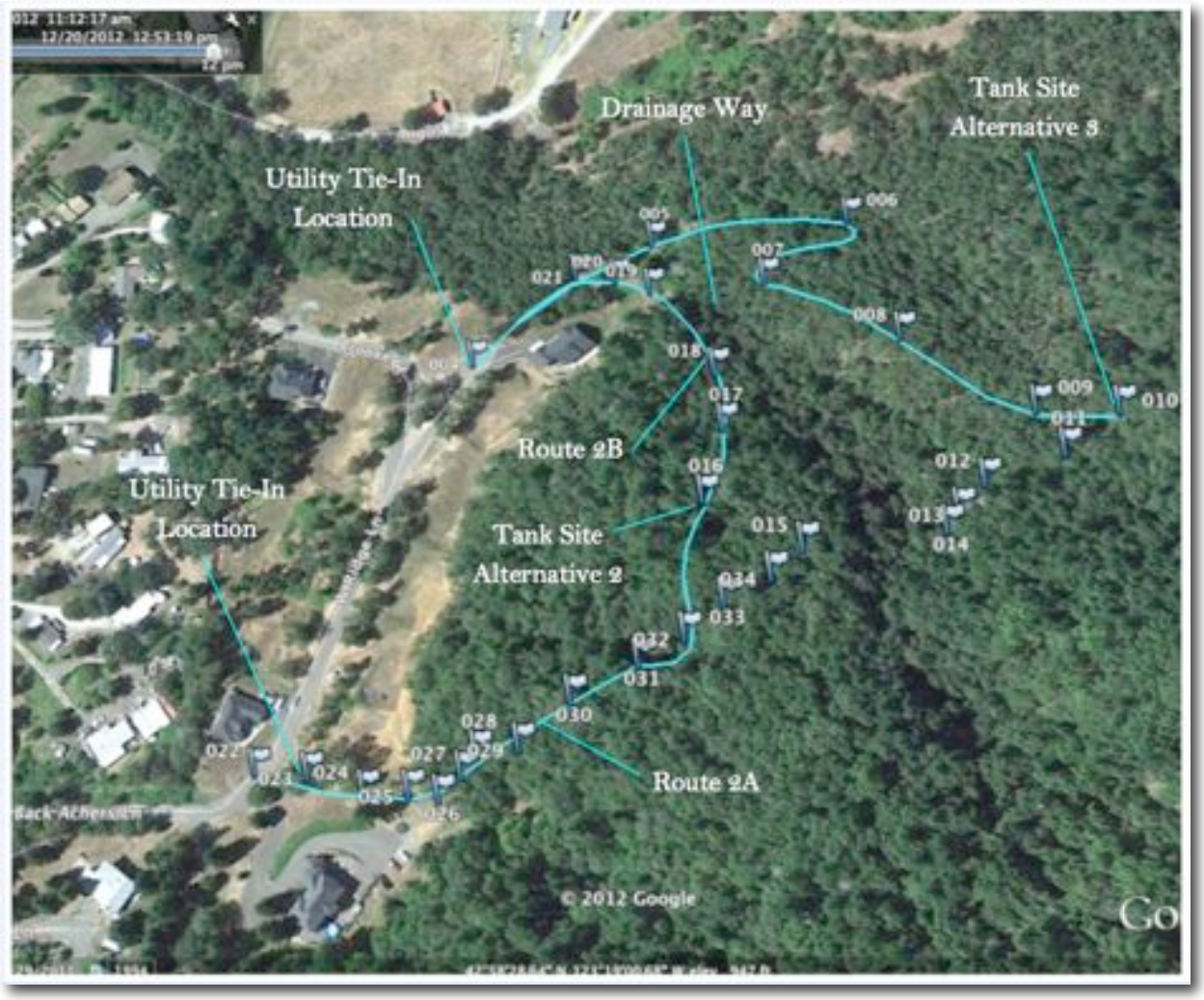


Table ES4 – Back Acres Tank Site Alternatives Summary

Back Acres Inline Water Storage Tank Alternatives Summary Table			
Alternative No.	Total Alt. Cost	% Alt 1 Difference	Notes
Alternative 1A	$883,100	-	Least Cost, Residence Impacts, No Fire Flow Increase, No Supply Redundancy, No Growth Incentive.
Alternative 1B	$909,400	+ 3 %	Residence Impacts, No Fire Flow Increase, No Supply Redundancy, No Growth Incentive.
Alternative 2	$1,024,300	+ 16 %	Fire Flow Increase, Supply & Maintenance Redundancy, Growth Incentive.
Alternative 3	$1,110,500	+ 26 %	Fire Flow Increase, Supply & Maintenance Redundancy, Growth Incentive.

Please note that land acquisition costs are not included in these estimates, as this is impossible to determine at this time (other than the fair market value). Also note that the assumed tank size is 340,000 gallons, per the Water Master Plan (2006).

Study Analysis and Conservation Strategy

The development strategy for the present study was first to perform a comprehensive analysis of recent water system data in order to assess the current status of water system characteristics. The results of this analysis was contrasted and compared to a significant body of previous work. A brief summary of previous work is included in Section ES3, and is referred to in a multitude of locations throughout this study. The analysis and comparison work laid the groundwork for the development of the following discussion concerning the topic of conservation.

The study consultant presupposed that the WMP framework was acceptable, but that current water system characteristics, and demand projections, were very different. The study analysis clearly shows this to be true. Not only are current population characteristics very different than those called for in the WMP, but significant conservation has also been encouraged through the implementation of a new water rate structure in 2007. Midea used various sources of data, including the 2010 US Census, previous studies, water treatment system data, and other previous work to determine the current status of the water system.

The current status of the water system characteristics creates a unique opportunity to investigate additional means of conservation. This study develops the discussion in a comprehensive fashion. Examples of this include the deferral of major water system improvements, such as the diversion of righted water for a period of time. The Authority can utilize the present study as a tool, or guide, for when to develop specific water system needs on demand-based milestone criteria. Essentially, as demand reaches certain pre-established criteria, the Authority can act toward the development of needed improvements. Tri City can now plan for these improvements proactively.

The efficient use of energy and water resources maximizes the level of cost-effective service that can be provided to the community and defers necessary improvements into the future. This study develops a comprehensive list of projects that Tri City has implemented since 2006, and provides recommendations for additional conservation measures. The work presented proves that Tri City has actively pursued conservation projects as a means to minimize costs, as well as impacts to the environment. These projects include the installation of high-efficiency lighting fixtures and pump motor equipment, variable frequency pump drives, backwash system and operational improvements. The present study discusses other resource conservation topics such as backwash wastewater recycling.

Summary

One of the most effective conservation activities Tri City can pursue is the reduction of energy and resource use. Tri City is pursuing this as a part of its overall strategy, which includes the goal to maximize the useful life of the existing facility. This can only be accomplished if conservation-encouraging measures are adopted, such as the updated water rate structure. The strategy is further supported through capital projects and operational improvements that further reduce energy and water use. These projects include high efficiency pump motors and lighting, and other improvements discussed in this study. The actions taken by Tri City have enabled the water system to meet the needs of the community well into the near future. The inline water storage tank improvement developed in this study provides improved water service to the community, while also enabling operational flexibility and buffering of raw water diversion. Tri City is committed to taking further action toward conservation as discussed throughout this study, including the optimization of raw water pumping and treatment facilities, and operational improvements as well. Finally, this work will allow Tri City to defer the full development of water rights into the future. This includes the future improvement needs of the water treatment facility. The highly efficient facility will include state-of-the-art control and monitoring technologies, which will maximize efficiency and conservation. The demand-based tools developed in this study will serve to guide the future capital improvements needs for the community.

Section

1

Introduction

1.1 Background and Objective

Tri City Water & Sanitary Authority (Tri City, Authority) has diligently pursued the improvement of its water system in order to ensure excellent service to its customers. This study affirms the Authority's commitment to the community and answers key questions concerning various aspects of the water system. These aspects include the current status of water system characteristics, updated projections for future water system needs, conservation measures, and other important needs.

The need for this study became apparent over time, as the Authority has worked to prioritize improvements needs, address perceived system deficiencies, and accommodate potential growth. An important potential driver of water system demand could include development of the industrial park on the west side of Interstate 5. Development groups have asked the Authority to provide estimations of the level of utility service (water and wastewater) that can currently be provided, as well as what improvements would be required to accommodate a significant utility consumer. The answers to these questions require a detailed analysis of current water system characteristics, and a comprehensive understanding of the current status of the water system. The analysis forms the basis for answering other questions concerning the water system, including a new high-level pressure zone inline water storage tank (Back Acres), and conservation measures that could be implemented practically into the water system. This study provides a functional, milestone-based framework that will guide the efforts of the Authority in the coming years, including the level of service that could be provided to the industrial park should a developer become seriously engaged. The required demand characteristics will trigger the development planning for important improvements.

This study was funded in part (50% matching) through a grant awarded by the Oregon Water Resources Department (Grant Agreement No. 0056 13). In addition to the objectives above, a requirement of the grant funding includes statutory tasks that must be considered in the study. This discussion is developed in Appendix A.

1.2 Study Objective

The primary objective of the present study is to provide a preliminary engineering study for an inline water storage tank within the high-level pressure zone of Tri City's water system. Other objectives of the study are summarized in the bulleted list below. The analysis is supported by a comprehensive analysis of recent water system data and previously published work.

- Compile necessary data, including the validation of the Water Master Plan data. Ensure that water requirements are adequate to meet water system needs.
- Identify potential alternatives to improve current deficiencies in the water system.
- Evaluate each alternative, including preliminary engineering cost estimates for each.

- Provide recommendations for the most feasible and cost effective alternative to meet water system needs.

- Provide recommendations for water conservation and efficiency measures.

In addition to the objectives above, grant funding requirements call for specific statutory tasks to be considered in the study. These tasks are regarded in more detail in Appendix A.

1.3 Scope of Study

This study mirrors the format provided in the WMP in order to ensure that the context of the material can be properly connected to specific sections. The study should be considered an updated investigation of the current status of the water system, with revised recommendations for improvement milestones, conservation measures, and a detailed analysis for the requirements of the high-level Back Acres pressure zone.

Planning Period

The planning period for the WMP provides the overall framework for the needs of the Authority's water system through the year 2026. This study is supplementary to the WMP, and provides more recent analyses and important updates to specific topics of the plan.

1.4 Authorization

Tri City Water & Sanitary Authority contracted with Midea Development, LLC on July 6, 2012 to develop the Back Acres Preliminary Engineering Report. The scope of this Plan was based on a Scope of Engineering Services included in the contract with the City, and within the grant agreement.

1.5 Acknowledgements

The development of this preliminary engineering report would not have been possible without the combined efforts of many individuals and agencies. The participation of these parties in collecting data, answering questions, reviewing drafts, and providing guidance for this report is greatly appreciated. The efforts and expertise of Paul Wilborn, Bill Thomas, Tri City office staff, and the Tri City Board of Directors are of particular importance.

The assistance and cooperation of the Oregon Department of Human Services, the Drinking Water Program, and the Oregon Department of Water Resources in the development of the Plan is appreciated, especially the participation of Mr. Scott Curry of the Drinking Water Program and Mr. Bill Fujii of the Department of Water Resources. This project would have been difficult to fund and to develop without the support Mr. Fujii provided.

Section

2

Study Area Characteristics

The Tri City study area characteristics are well developed in the Water Master Plan (WMP) (HBH, 2006). Specific topics are included below to provide additional or updated information to their current status when appropriate for the development of this study.

2.1 Socioeconomic Environment

Population

The WMP developed current and projected population through the utilization of a disclosed methodology. Population projections are typically developed through the utilization of census data, population research data, and with the coordinated population projection data in the comprehensive plan of Douglas County. This study presented an opportunity to compare the recent 2010 census data with the projection developed in the WMP. This can be used as a tool by the Authority to ensure that adequate levels of service are provided to actual users, as compared to the generic projections.

Figure 2.1.1 illustrates the comparison between the population projections provided in the WMP, and the current status of population in the area based upon the 2010 US Census.

Figure 2.1.1 – Population Comparison – WMP vs. 2010 Census

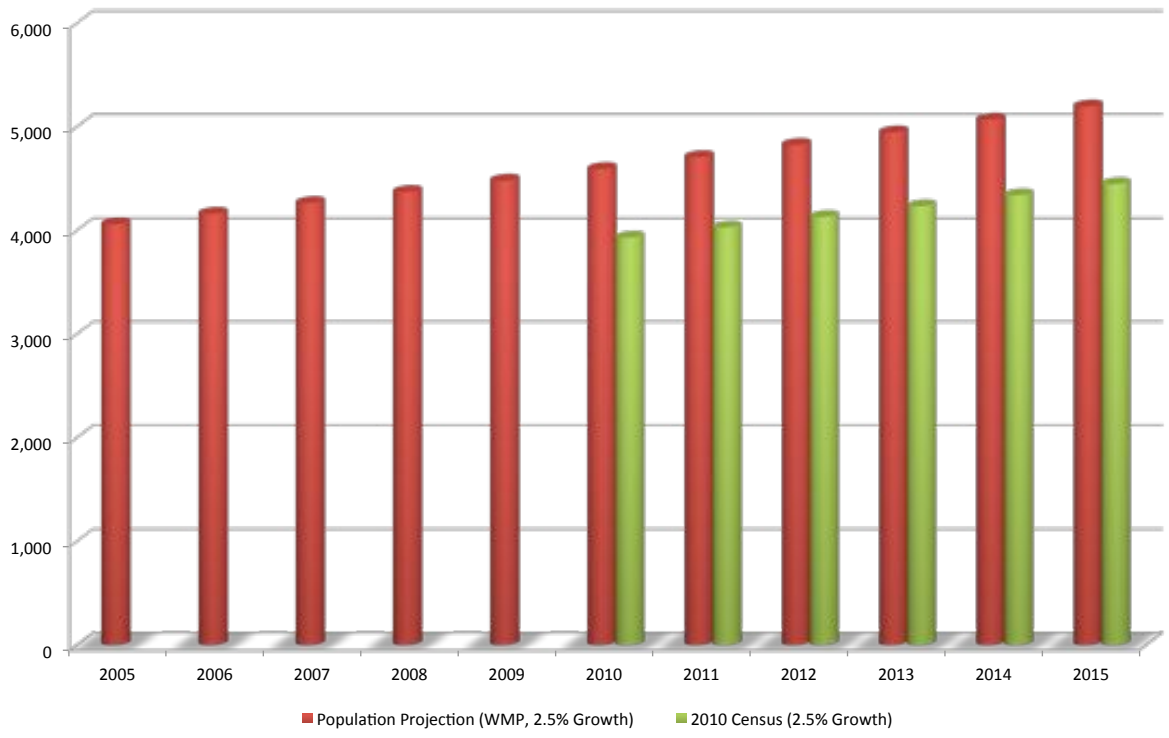
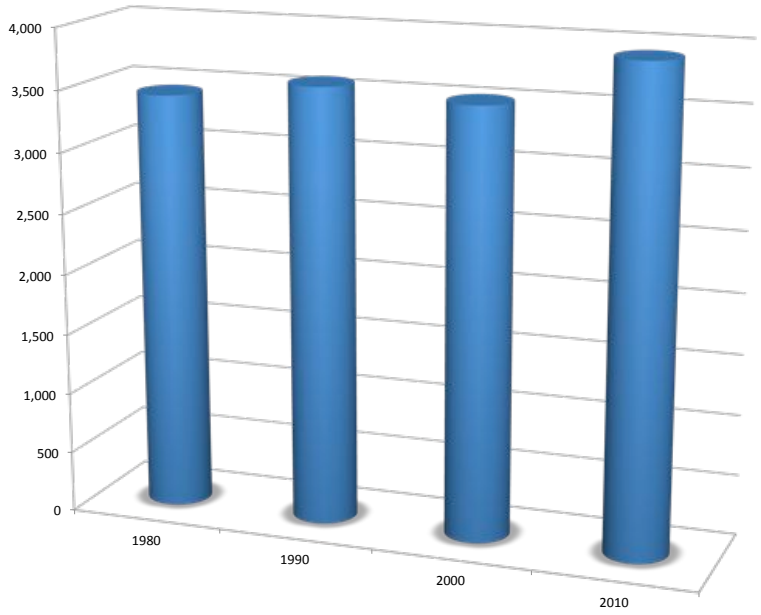


Figure 2.1.1 illustrates an updated population projection (green bars) with the growth assumptions developed in the WMP (red bars). The 2010 census population is actually less than the WMP projection for 2005. This results in a significant gap between the WMP developments of needs as compared to the actual population needs. Population is the critical driver of demand for a water system. The actual needs of the community, rather than generic population projections, should be thoroughly considered in the planning of infrastructure projects. The analysis conducted in this study shows that the current population lags behind that shown in the WMP by approximately seven years.

Historic Population

Historic census population data can be used for a general understanding of growth in the Tri City area. Figure 2.1.2 shows historic census data from 1980 – 2010. The population remained fairly stable in the earliest decades, at just below 3,500 residents. The total population grew 11.7% from 2000 – 2010. Although this level of growth is not necessarily expected to continue, it can be used as a general tool to verify our understanding of population in the area.

Figure 2.1.2 – Historic Census Population Data



Future Population

If we assume the same level of growth illustrated between 2010 – 2020 and between 2000 - 2010, then the 2020 population would be approximately 4,390. For the sake of comparison, the WMP projects a 2020 population of 5,879, which is nearly 1,500 residents in excess of our analysis performed above (11.7% growth for the decade). This is a significant deviation. However, it should be noted that the analysis developed in the WMP is based upon required methodologies, and has been reviewed by the Oregon Health Authority.

Section

3

Regulatory Environment

Regulatory requirements were well developed in the Water Master Plan (HBH, 2006). This study does not update the work performed.

Water Use and Projected Demands

Section 4

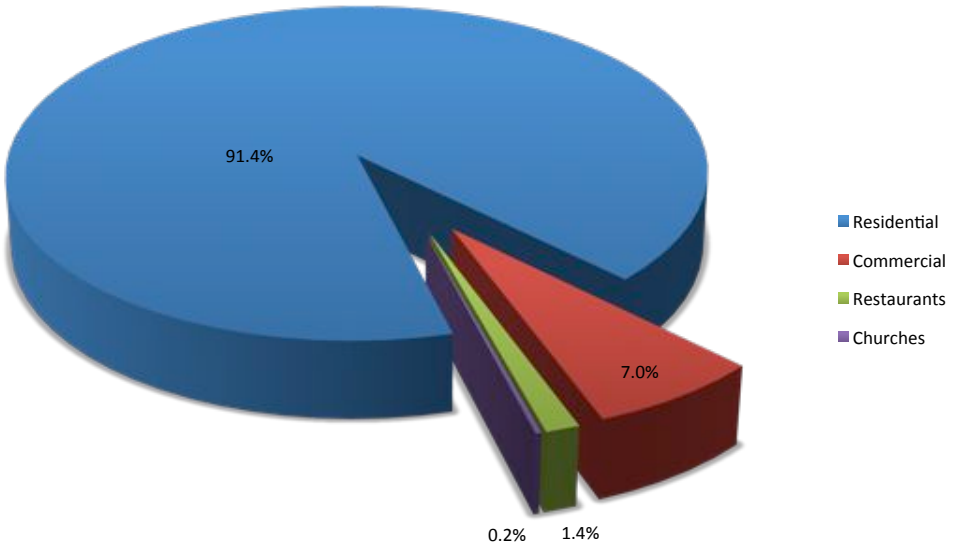
Tri City Water & Sanitary Authority (Tri City, Authority) has diligently pursued the improvement of its water system in order to ensure excellent service to its customers. This study analyzes the past decade of water system data in order to understand the current status of the water system. The last three years of data are analyzed in detail and compared to previous work, including the Water Master Plan (WMP) (2006, HBH), and the water rate study (2007). The goal of this analysis is to understand current water system characteristics as a means to ensure that excellent service can continue.

4.1 Current Water Demand

Current water system demand has been thoroughly evaluated, including water consumed, water treated, and water diverted. The development of this analysis enhances a comprehensive understanding of water system characteristics. The characterization of the current water system will procure an understanding of water system efficiency, including a reasonable potential explanation of unaccounted water losses.

Residential sources account for approximately 91 percent of all water consumed within Tri City. Commercial, churches, and restaurants account for the remaining 9 percent of water consumed, as shown in Figure 4.1.1. It is important to note that actual billed water consumption by consumers does not include losses from the water system, including non-accounted water.

Figure 4.1.1 – Average Water Consumption by Type (2010 – 2012)



Equivalent Dwelling Units

This study does not redefine the EDU as developed in the Water Master Plan. Although water consumption has decreased in the recent years, for various reasons, the current EDU consumption value will result in a conservative planning criteria.

Water Treated

A detailed explanation of metered consumption is critical for the understanding of financial and user-type characteristics within a water system. Water system planning requires a thorough look at water production, to ensure that water leakage and unaccounted water are considered. The methodology makes certain that water demands from the system can be accommodated. Treated water produced, pumped to the water distribution system, and utilized for backwash and wasting cycles are discussed below.

Water Treatment Plant Production

Tri City operations staff maintains detailed records concerning various aspects of water treatment plant (WTP) operations. Treated water is conveyed to the water distribution system for user consumption. This treated water produced by the WTP is typically the difference between water diverted from the source, and the water utilized within the boundaries of the WTP. The water used by the WTP includes backwash water, wastewater, and other water consumed at the site.

Water production characteristics were well defined in the Water Master Plan (WMP). This study assumes that the peaking factors developed in the WMP continue to be valid. This assumption will result in the conservative analysis. These peaking factors are applied to the water system characteristics developed in this study from water records. The definition of the water system characteristics are illustrated in the WMP, and include Average Daily Demand (ADD), Maximum Monthly Demand (MMM), Maximum Daily Demand (MDD), and Peak Hourly Demand (PHD). These water system characteristics are important to properly assess, plan, and design water system infrastructure as discussed in the WMP.

This study investigated water system characteristics over the last decade, from 2001 – 2012. This was accomplished with the thorough analysis of water system records for the years 2010 – 2012, and the review of previous water system planning documents, including the WMP, and the Water Rate Study (2007). Figure 4.1.1 summarizes water system characteristics between 2001 – 2012.

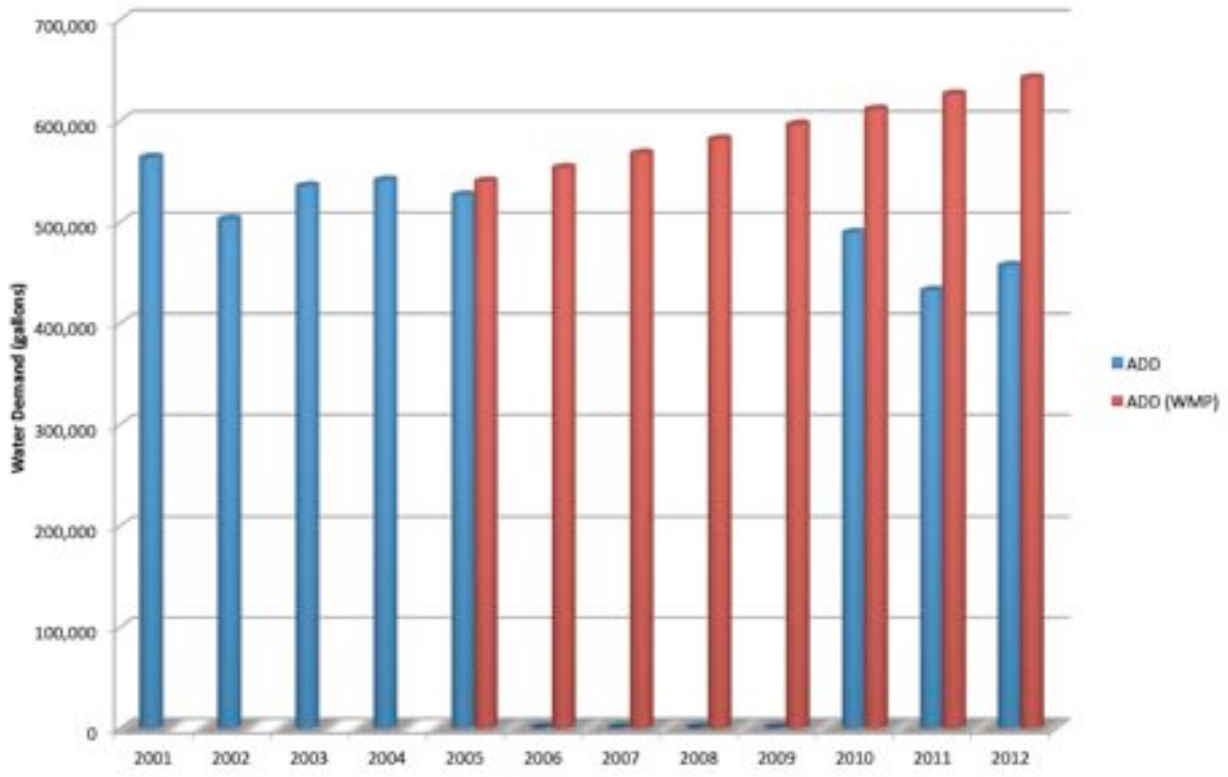
Table 4.1.1 – Historic Water Demand (2001 – 2012)
(Units are in gallons per day unless otherwise noted)

	AAD (gallons)	ADD* (WMP)	ADD	MMD	MDD	PHD	Notes
2001	205,583,800		563,243	901,189	1,464,433	2,816,216	WMP
2002	183,322,900		502,255	803,607	1,305,862	2,511,273	WMP
2003	195,308,600		535,092	856,147	1,391,239	2,675,460	WMP
2004	197,397,000		540,814	865,302	1,406,116	2,704,068	WMP
2005	192,009,737	540,000	526,054	841,687	1,367,741	2,630,270	WRS
2006	202,027,500	553,500	-	-	-	-	WMP
2007	207,078,370	567,338	-	-	-	-	WMP
2008	212,255,165	581,521	-	-	-	-	WMP
2009	217,561,535	596,059	-	-	-	-	WMP
2010	178,499,353	610,960	489,039	782,463	1,271,502	2,445,197	This Study
2011	157,746,490	626,234	432,182	691,491	1,123,674	2,160,911	This Study
2012	166,653,345	641,890	456,585	730,535	1,187,120	2,282,923	This Study

* This column reflects the future projection developed in the WMP.

Figure 4.1.2 shows a compilation of data from the Authority's water system for the past decade. Data from 2001 – 2005 was utilized to develop the WMP. WMP ADD demand projections can be seen in the figure. Population projection comparisons between the WMP and this current study can be viewed in Section 2. The new water rate structure implemented in 2007 is based on a purely consumptive model, which typically encourages conservation by consumers. The data presented for the years 2010 – 2012 illustrate the comparison between the WMP and the analysis performed by the consultant (only for ADD). It is clear that the current demand characteristics in the service area are very different than those called for in the WMP. Since the same peaking factors are assumed in this study, as developed in the WMP, other factor comparisons would reflect the similar trend shown in this figure.

Figure 4.1.2 – Historical Average Daily Demand (2001 – 2012)



Nonaccount Water

Water volume sold is always less than the treated water conveyed to the distribution system. This is due to leaks and other unmetered water, including some water used at the WTP. It is not entirely clear how much miscellaneous water is used at the WTP, but this amount is very small, and does not affect this analysis. Water system losses have been characterized in this study for the years 2010 – 2012, which are summarized in Figure 4.1.3. These losses are basically the difference between the amount of water conveyed to the distribution system, and the water actually sold. It should be noted that a significant drop in water losses occurred in 2012. This may be attributed to a significant water leak discovered and repaired by Tri City staff near the water treatment facility. This leak was located after leaving the water treatment facility, but prior to the first customer. This could be a significant improvement, yet one or more additional years of WTP data should be evaluated to ensure that no other factor could have caused the improvement. Previous to the improvement, water system losses were within a similar level as those developed in the WMP. Table 4.1.2 summarizes water system losses for each year as well as the three-year average.

Figure 4.1.3 – Historic Water System Losses (2010 – 2012)

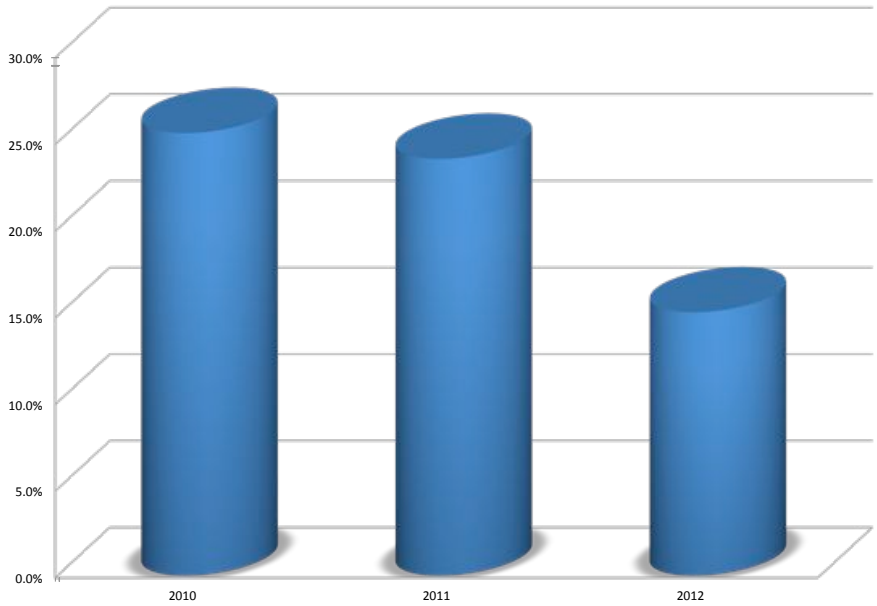


Table 4.1.2 – Historic Water System Losses (2010 – 2012)

Average 3 Year System Loss	21.8%
2009-10 Actual System Loss	25.5%
2010-11 Actual System Loss	24.0%
2011-12 Actual System Loss	15.2%

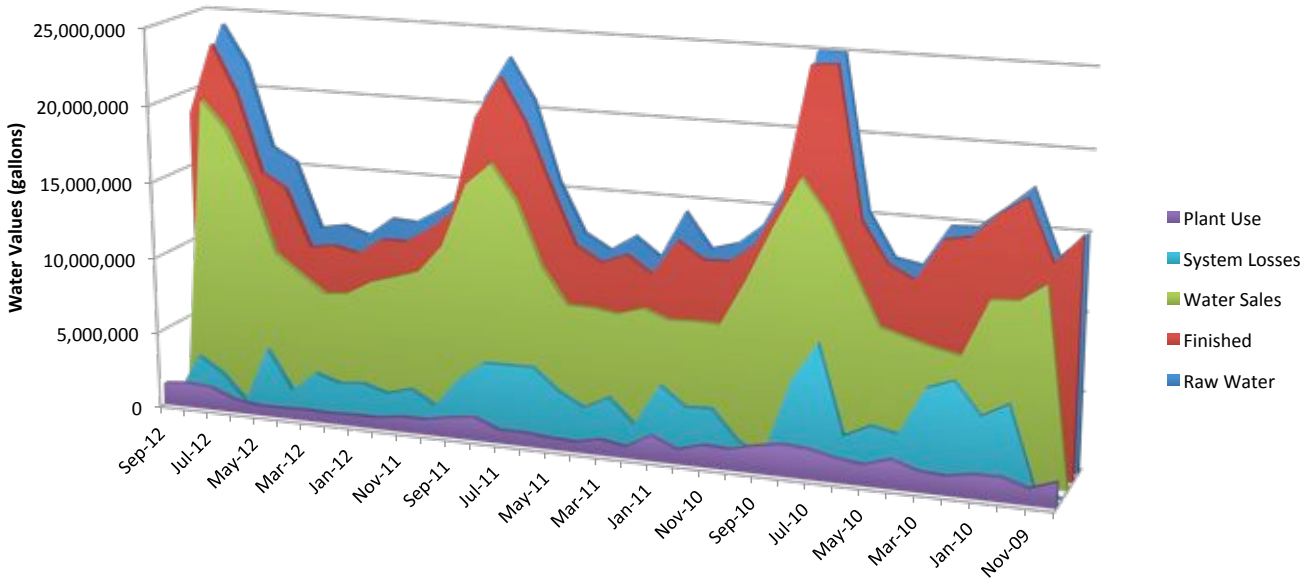
Other potential sources of water losses could include leakage, inaccurate flow meters, unauthorized connections, and other unmetered water such as hydrant flushing, fire suppression, or water tank flushing. Tri City should continue to identify and eliminate unaccounted water. Reductions in water losses can result in increased revenue, conservation of source water, and the longevity of the water system to meet future water needs.

Water System Characteristics

The overall performance of Tri City's water system can be summarized in one efficient graphic as shown in Figure 4.1.4. The graphic illustrates total monthly values over the study period for raw water diverted, finished water produced, water sold, plant use, and system losses. *It is important to note that the horizontal axis represents time from right to left.* Raw water diverted is shown in the deepest background layer (dark blue), with a peak monthly diversion of approximately 25 million gallons. The next layer is finished water produced (red). The difference between these layers is equivalent to the WTP waste. This can be seen as the dark blue band that is visible above the red profile. Water sales are illustrated in green. The difference between the red and green profiles results in the visualization of water system losses, which is also individually illustrated with the light blue profile. Plant use is shown in the foreground in violet. It should be noted specifically that one clear trend is apparent, which is that water system losses have been reduced over the study period. As noted previously, Tri City staff located and

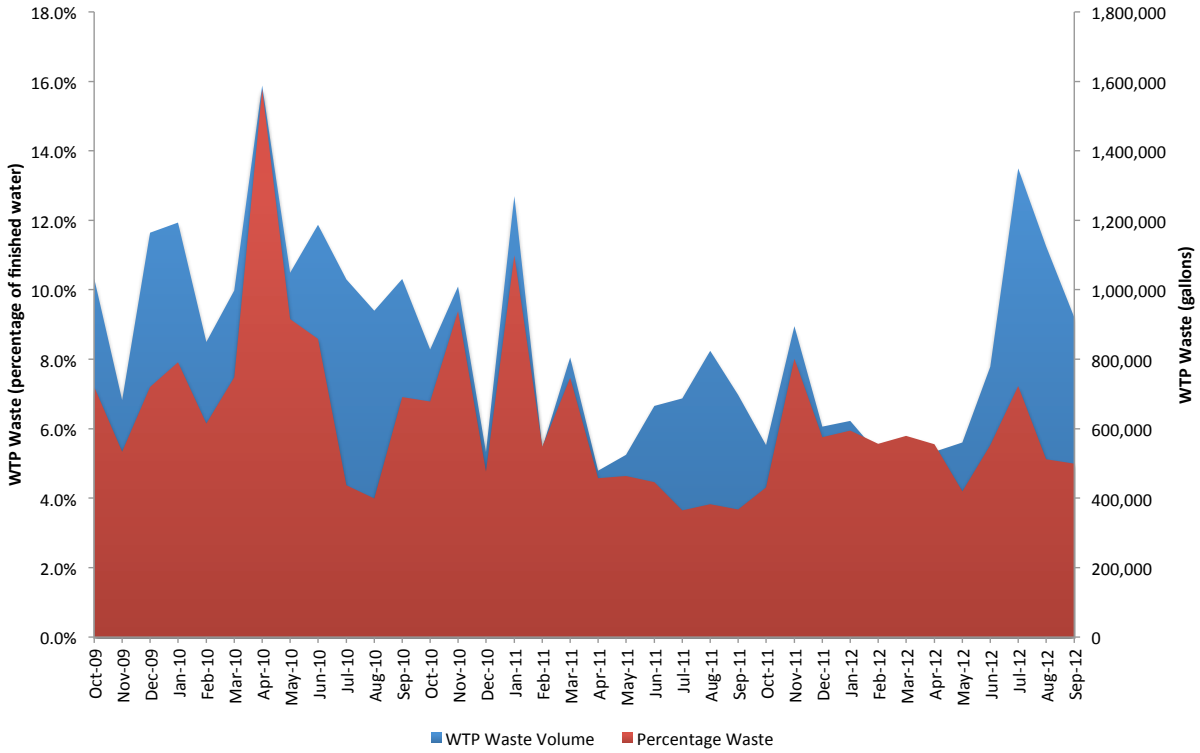
repaired a water leak in the system after the master meter, and prior to the first customer. This could have potentially contributed to this reduction.

Figure 4.1.4 – Historic Monthly Water System Characteristics (2010 – 2012)



The overall performance of Tri City's water treatment plan can also be summarized in one efficient graphic as shown in Figure 4.1.5. The graphic illustrates total monthly values over the study period for actual WTP waste on one axis, and the percentage of total treated water produced on a secondary axis.

Figure 4.1.5 – Historic Monthly Water Treatment Plant Waste (2009 – 2012)



It should be noted that during times of poor raw water quality (late summer and winter), WTP efficiencies and total waste water volumes increase. This is to be expected. It should be also noted that waste volumes have decreased and treatment efficiency has increased over the study period, with the exception of the summer period of 2012. This is expected as Tri City is working to improve its overall efficiencies through focused operational and equipment improvements.

Summary

Current water system characteristics were analyzed in detail for 2010 – 2012, and the entire previous decade of data was reviewed in order to create a comprehensive picture of the current status of the water system. This data was utilized to assess the system, evaluate future requirements, and investigate potential conservation measures that can be implemented to ensure quality service to customers. The results of this analysis are presented throughout this study.

4.2 Projected Water Demand

Future water demand can be difficult to accurately project. The WMP developed a 20-year planned projection, which also calls for specific capital infrastructure improvements that would be required to meet the demand. Although these projections are not valid temporally, they continue to be valid on a milestone basis. For example, the plan calls for a specific level of demand in the future, driven by projected population growth, which would require specific improvements to the WTP capacity. Then it provides alternatives for how to meet the demand with these improvements. Tri City should periodically review water system characteristics in order to track actual demand milestones, and then reflect to the WMP, and this study, for guidance. It is reasonable to anticipate the actual timing of needed projects, rather than simply applying generic timelines. This analysis can also be utilized to assess the water right needs of Tri City in the future, which is discussed in Section 7.

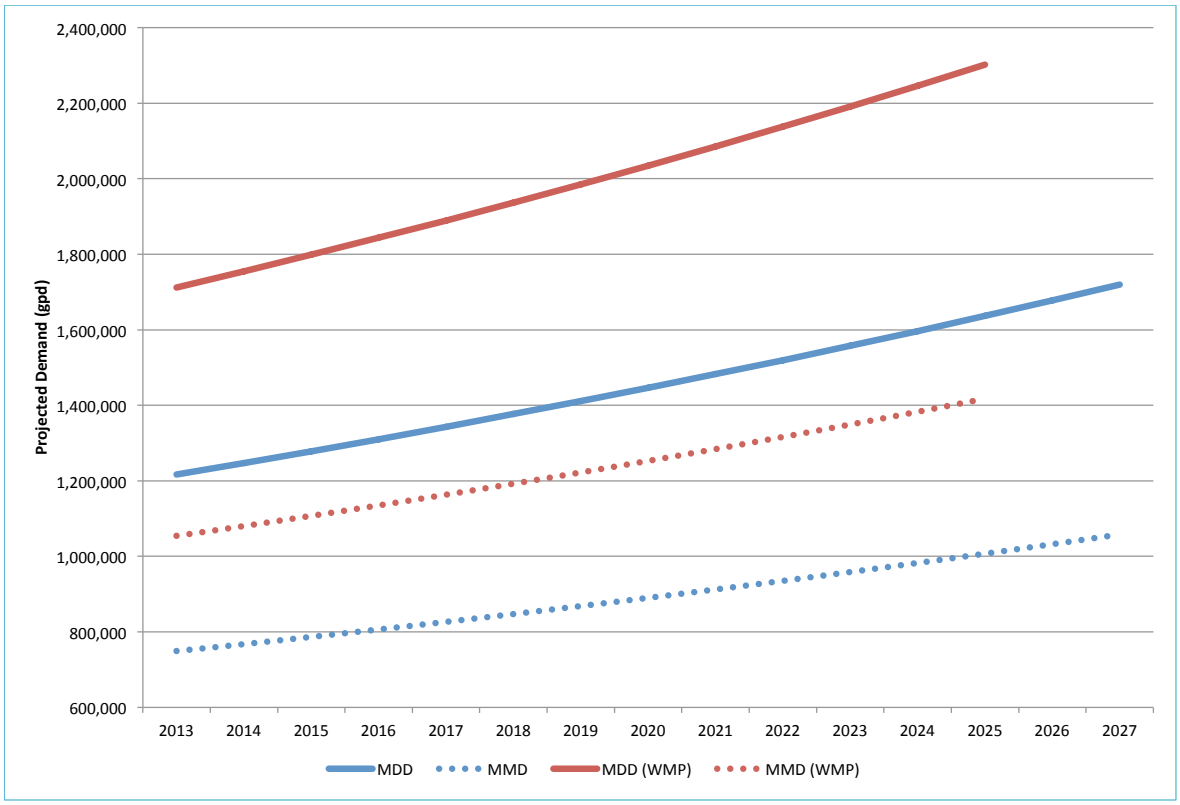
Projected demand values developed in this study assume the equivalent level of growth as provided in the WMP (2.5%) beginning from 2012 data. Table 4.2.1 summarizes the comparison between the WMP projection, and the projection developed in this study. Table 4.2.1 can be used as a tool during the planning efforts for needed capital improvement projects. This tool enables a demand milestone-based capability, which relates back to the improvements called for in the WMP. It should be noted that the new projected level of demand does not equal the 2013 projected value from the WMP, until beyond the 20-year planning period of the WMP. This is noted in the table in red and in blue. Figure 4.2.1 is a graphical illustration of Table 4.2.1.

Table 4.2.1 – Comparison of Projected Demand*

	Water Master Plan Projection		Study Projection	
Year	MMD	MDD	MMD	MDD
2013	1,053,919	1,711,856	748,799	1,216,798
2014	1,080,266	1,754,652	767,519	1,247,218
2015	1,107,273	1,798,518	786,707	1,278,398
2016	1,134,954	1,843,481	806,374	1,310,358
2017	1,163,328	1,889,568	826,534	1,343,117
2018	1,192,412	1,936,807	847,197	1,376,695
2019	1,222,222	1,985,228	868,377	1,411,112
2020	1,252,777	2,034,858	890,086	1,446,390
2021	1,284,097	2,085,730	912,338	1,482,550
2022	1,316,199	2,137,873	935,147	1,519,614
2023	1,349,104	2,191,320	958,526	1,557,604
2024	1,382,832	2,246,103	982,489	1,596,544
2025	1,417,403	2,302,255	1,007,051	1,636,458
2026	-	-	1,032,227	1,677,369
2027	-	-	1,058,033	1,719,303

* Values are compared between the projections in the Water Master Plan (HBH, 2006) and this preliminary engineering report.

Figure 4.2.1 – Comparison of Projected Demand*



Design Criteria and Service Goals

Section

5

This section is adequately developed in the Water Master Plan (HBH, 2006).

Section

6

Existing Water System

Tri City's water system is well characterized and presented in the Water Master Plan (WMP) (HBH, 2006). The focus of the current study is to verify the status and re-characterize various aspects of the water system, for quality assurance purposes.

6.1 Current Status of the Water System

The bulleted list below is a chronological summary of recent efforts relating to the water system.

- The Authority developed a **Water Master Plan** (HBH, 2006), which provides infrastructure assessment and planning for the coming twenty years (2006-2026).
- In 2007, the Authority commissioned a **water rate study** and implemented its recommended water rate structure. The goal of the new structure was to encourage maximum conservation within the system through a purely consumptive model. Water demand fell significantly, which is supported by the analysis provided in this study.
- Authority installed an **on-demand hypochlorite disinfectant generation system** in 2008, which reduces the potential of disinfection byproduct risk, enhances disinfection effectiveness and efficiency, and reduces chlorine gas system health and safety risk. This also reduces cost and supply chain risks associated with chlorine gas systems.
- Tri City procured the **Pruner Road Hotel Impact Study** (Civil West, 2008) to study the resources and improvements that would be required to service a hotel in the industrial park.
- **Clearwell baffling** was installed in 2010. This ensures greater disinfection effectiveness by enhancing mixing and minimizing short-circuiting of finished water. Treatment effectiveness is enhanced through greater log reduction of pathogens prior to the first customer.
- In 2010, Tri City constructed **Raw Water Intake improvements**, including the installation of a fish-friendly Johnson Tee Screen (fish screen), airburst system, and related equipment.
- The Authority commissioned a **Water System Risk Failure Analysis** (HBH, 2011) in order to assess risk within the water system, and prioritize recommended improvements based upon the potential risks and outcomes, should various types of failure occur. This study reinforced the relative importance of various improvements called for in the Water Master Plan, including the Back Acres water storage tank, which is developed in the present study.
- In 2011, the Dyer Partnership was consulted to assist the Authority with the **analysis of potential operational improvements and conservations measures** that could be implemented in the water treatment plant (WTP). A copy of the technical letter can be found in Appendix D. The recommended improvements included modifications to the backwash cycle for improved efficiency, installation of a variable frequency drive (VFD) for the backwash pump, the installation of electrically-actuated valves, and the future consideration of improvements of the backwash filter system and underdrains with an air scour system.
- In 2012 Midea Development provided recommendations to **improve the operational effectiveness of the current backwash treatment system**. The Authority implemented the recommended improvements in 2012 during normal backwash basin cleaning operations. This will result in significant improvements to backwash water quality and treatment efficiency.

- In 2012 the Authority commissioned Midea Development to answer specific questions concerning the capacity and upgradeability of the water treatment system. The goal was to **identify the level of service that could be provided to the industrial park** on the west side of Interstate 5. The results of the technical letter provides general information on this matter, yet a more detailed, multi-year analysis would be required to answer the question with sufficient certainty. A secondary question warranted the level of improvements that would be required to provide higher levels of water service, should a larger developer become interested. A copy of this letter can be found in Appendix D.
- In 2012, the Authority began planning for the **installation of a VFD** on the backwash pump, per the Dyer Partnership's recommendation. This will allow improved operational flexibility, performance, and efficiencies. The system will be integrated into the computer control system of the WTP, which will enable the Authority to optimize treatment, while minimizing waste and power usage. It could further reduce electrical loading and costs to the WTP. This improvement is to be completed prior to the publishing date of this study.
- The Authority **replaced existing lighting in its facility with high-efficiency lighting**, which is anticipated to significantly reduce electricity demand. The majority of existing lighting fixtures were replaced in approximately 2009, and then the remainder were replaced in 2012 and 2013. Older incandescent, halogen, and T12 florescent fixtures were replaced with more efficient T8 fixtures.
- The efforts above define the need for this present study. Tri City developed the funding application that lead to the present grant. The overarching goal is to provide a recent analysis that answers important questions for the future, including the high-level pressure zone water storage needs, water system capacity, and water conservation and efficiency. The Authority was **awarded grant funding for this study**, which supports this study, in part.

Improvement Needs

Section 7

7.1 Background

The improvement needs developed in the Water Master Plan (WMP) (HBH, 2006) provide detailed information concerning the water system. The Water System Risk Failure Analysis (HBH, 2011) reinforces and expands upon the recommendations called for in the WMP, with specific focus on a risk assessment framework. The improvement needs called for in these studies specifically relate to the demand projections developed in the WMP.

This present study develops an updated water system analysis, which includes actual recent demand characteristics and population values from the 2010 census. Tri City's restructured water rates were implemented following the Water Rate Study (WRS) (2007). The present analysis validates the impacts resulting from thoughtful actions of Tri City, which has encouraged significant levels of conservation.

It is the general consensus of the above studies, and this study, that specific improvements are required for Tri City's water system. This is true, with some significant exceptions. Population and water demand are significantly less than projected in the WMP. Section 4 provides an updated evaluation of water demand and provides comparisons to the projections developed in the WMP. This study provides a milestone-based tool to help with the development of improvement planning, including practical and conservation-encouraging improvements, while also minimizing risk to the water system.

This section develops additional information concerning the need and milestone-based criteria for specific improvements.

7.2 Raw Water Sources and Water Rights

This section will provide updated information concerning raw water sources and water rights.

7.2.1 Water Rights

Tri City's water rights analysis was properly developed in the WMP, although the demand characteristics are currently much different than illustrated in the WMP. The current total water right can provide adequate water supply throughout the study period of the WMP. The primary risks associated with the water rights include the relatively frequent reduction of Tri City's junior water rights during low stream flows. This is further complicated by difficulties experienced with the raw water intake and pump station, as discussed below. This analysis will focus on low stream flow periods, with the goal of providing a quantitative tool for assessing water supply needs for the future.

The analysis from Section 4 shows that the current water rights in Galesville reservoir should be adequate throughout the study period of the WMP. The analysis from page 7-1 of the WMP, applied to the current analysis, shows that during the low flow period, with water right reductions, the Galesville water right will allow approximately 100 days of supplemental flow for the MMD of approximately 865,000 gallons. The present analysis shows this should not occur prior to the year 2019. It should be noted that this circumstance could change for various reasons, including the scenario that significant development occurs in the industrial park.

Recommendations

The current water rights are adequate for the needs into the near future at current levels of usage and growth. However, this could change significantly should the level of demand increase due to development in the Industrial Park. Demand in excess of 1,000 gpm also creates additional required improvements to the water treatment facility, including the raw water pumps, and water treatment processes, which are discussed below. The raw water pump station should continue to be developed and improved in order to ensure that the full water rights can be utilized, which would enhance the discussion toward water right certification. Finally, Tri City should pursue additional water storage rights in Galesville reservoir as soon as possible in order to ensure that future needs can be met.

7.2.2 Intake and Pump Station

The existing water treatment system effectiveness is reduced as diverted flows extend beyond approximately 1,150 gpm, due to limitations of the sedimentation / flocculation system. This will be discussed below, but is mentioned here to provide context for the raw water intake and pump station discussion. When future demand requires flows in excess of 1,150 gpm, both raw water pumps will need to simultaneously operate in order to meet the demand as well. During low stream level periods, the raw water intake capacity is limited to between 900 – 1,200 gpm, which creates a third limiting factor for the water treatment system. This is the most critical and important deficiency to mitigate. Tri City installed a new intake fish screen system in 2010. The capacity of the system is more than adequate to meet future demand through at least 2025. However, during low river level periods, the capacity of the intake system is significantly reduced due to low water levels. The raw water intake is hydraulically capable of supporting flow of 1,740 gpm. This is more than adequate to support growth through the year 2025, so long as a major industrial source of water is not added to the system. The addition of one additional fish screen and piping should allow for hydraulic flows in excess of the current water rights of 2,186 gpm.

Tri City could mitigate the low water flow rate deficiency in a number of ways, which should be considered in detail beyond this study. Here are some potential alternatives for further investigation:

- Reconstruct the intake to ensure full submersion of equipment, specifically during a low river level period.
- Construct a raw water storage tank that would provide buffering to the system. This tank could be filled during off-peak periods, or when the water treatment facility is not operating. The system could be easily controlled in an automated fashion.
- Change the point of diversion downstream to a deeper site, more suitable to ensure full submersion. This would require the construction of a new intake, pipework, and potentially more significant equipment.
- Construct a third pumping system that can provide suction pumping capabilities. This would enable adequate flows beyond the gravity-based hydraulic capacity of the intake to the wetwell, which is specifically only a problem during low river level periods.
- Construct active PID control with level sensing of the wetwell to ensure that raw water pumps are paced to water replenished into the wetwell.

The intake pump station is currently comprised of a newer Flygt Model NP3171.180 Type HT (installed 2004) and a Fairbanks Morse Model D5433MV (installed 2000). The Fairbanks pumps originally installed had various and persistent problems, which led to multiple rebuilds and significant costs and man-hours to resolve. This led to the installation of the Flygt pump in 2004, which has operated well. The old Fairbanks Morse pump has been rebuilt and now functions as a standby pump for the pump that is still operational.

The full water right cannot currently be delivered to the treatment process by the pump station. With both pumps operating, less than 2,000 gpm can be delivered. Note that the current capacity of the raw water intake is only 1,740 gpm. Not only is this less than the current water right, but this also leaves no redundancy for the pumping operations. Here are some potential alternatives to consider further:

- Replace pumps and select the proper pump to individually deliver the full water right of 2,185.8 gpm. This would require a significantly larger pump than the current pump. Two of these pumps could also be costly, and driving the pumps near 50% pumping capacity could sacrifice the benefit of the high efficiency pump motors.
- Replace pumps and select three identical pumps, two of which would deliver the full water right, and one pump could deliver the current approximately 1,000 gpm. This alternative would allow additional operational flexibility and reliability. In the event a pump failed, the third pump could be swapped out with the pump that requires service. The existing wetwell is unlikely to support installation of a third pump, due to size restrictions.
- A phased alternative could also be viable, and could improve the pumping situation toward an automated solution. When maximum daily demand approaches the current water right, and the intake requires improvements to accommodate the demand, a second wetwell could be constructed and tied together with the existing wetwell. The third pump could be installed in the new wetwell, which would not only accommodate the necessary demand, but could also switch and alternate in an automated fashion. The automation would function to evenly wear pumps and to automatically switch should another pump fail, or trigger a service alarm.

Recommendations

Alternatives should be pursued to mitigate the low water level condition, and the lack of redundancy. The various alternatives discussed above should serve as a starting place for this discussion.

7.3 Water Treatment Facility

The WMP develops a discussion concerning operational characteristics and deficiencies of the water treatment facility, including flocculation / sedimentation, filtration, disinfection, and finished water conveyance. Each section then provides the justification of need for various improvements, including alternatives. The water treatment facility has various process bottlenecks, which could be addressed in any number of ways. The following subsections will discuss the most practical solutions concerning the current status of the system, and also consider updated demand projections.

7.3.1 Flocculation / Sedimentation

Flocculation and sedimentation currently limit the capability of the WTP to deliver greater volumes of treated water without sacrificing finished water quality. If the existing WTP technology continues to be utilized, additional flocculation and sedimentation capacity will be required. Water quality begins to decrease at a flow rate of approximately 1,150 gpm. This flow rate is also greater than a single raw water pump can deliver from the raw water pump station. Although two pumps can be operated simultaneously, this also reduces operational redundancy, and raw water pumping capacity becomes the process bottleneck, as discussed in Section 7.2.2.

7.3.2 Filtration

The WMP develops the limitations of the current WTP, and provides various potential alternatives for expanding filtration capacity. These include expansion of the current plant with similar technology, a packaged membrane microfiltration system, and an immersed membrane ultrafiltration system. A

review of the alternatives reveals that each alternative is limited by a lack of understanding of water treatment facility construction processes, and robust engineering cost estimation. The current facility must continue to operate, or only cease to operate for short periods of time, during construction of upgraded facilities. It is beyond the scope of this study to fully develop cost estimates and alternatives to the water treatment facility, but the goal of this discussion is to provide information that could help Tri City develop plans to successfully address the concerns discussed below.

7.3.2.1 Option A – Conventional Granular Media Filtration

The expansion of the existing WTP with conventional media filtration equipment is the most viable and cost-effective alternative, though various difficulties could arise from the improvement as shown. The cost estimate is inadequate, and it does not consider the importance of continuity of treatment operations during construction. It calls for the removal of the flocculation and sedimentation equipment internal to the building to provide adequate room for the new mixed-media filters. This would require significant demolition and modifications to the existing building. The existing treatment processes would be inoperable for a considerable period of time during this construction. A new flow splitting and influent piping structure would be necessary, and would need to be constructed prior to the demolition of the current flocculation and sedimentation structure, as it currently integrates the flow splitter and influent piping. The piping could also require significant earthwork below the ground, which requires additional expansion of demolition activities. Modifications of restrictions in the current piping are also problematic to continued operation of the facility during construction, with potentially significant impacts to treatment operations. The WMP states that virtually all of the mechanical piping will require significant modifications, without providing a viable plan for how treatment operations will continue to operate during the improvements. The majority of the building will need to be removed, and rebuilt, which was not accounted for in the discussion and cost estimation. All of these factors increase the costs of these facility improvements, and add significant risk to this alternative.

7.3.2.2 Option B – Package Membrane Microfiltration

Conversion of the existing WTP to a packaged membrane microfiltration system holds many of the challenges mentioned above, but additional and more serious concerns are prevalent. These similar challenges include significantly insufficient cost estimates for the improvement, continuity of treatment operations, demolition scope and scale, to name a few. The most important oversight is that the existing facility must continue to operate during construction of the new equipment. The WMP shows the new equipment in place of the existing equipment, in the same building. This alone makes this alternative unviable unless the design and estimations are significantly modified. The alternative also neglects important elements of a membrane treatment facility, including significant tankage and mixing systems, compression air systems, storage of additional chemicals, and other significant oversights. This results in an infeasible alternative and insufficient engineering cost estimates. Figure 7.3.1 shows a Pall membrane WTP in Cottage Grove, Oregon. It should be noted that the plant requires Amiad filtration at the front of the plant, and a significant level of additional tankage and other equipment, including a large volume of chemical mixing tanks and infrastructure. The equipment is shown without the membrane modules installed.

Figure 7.3.1 – Cottage Grove Pall Membrane WTP

The WMP also states that there would be significant operational and chemical cost saving with the operation of the membrane facility. Depending upon the water quality and age of the membrane facility, and the type of chemical exposure membranes go through during operations, could require significant maintenance. This includes opening membrane modules and plugging failed membrane fibers, and providing additional chemical treatment. The chemicals are expensive and also reduce the life of the membranes. Membranes require that relatively clean water be delivered to them, and do not handle flashy surface water conditions well. There

are also significant costs associated with compressed air and blowers with membrane technologies. Although the filtrate from a membrane can be superior, this also depends upon how well the membranes are maintained, including how many fibers have failed. The WMP also states that less operator skill and attention is required. This is certainly not true, as any facility requires skilled operators. In addition, Tri City staff is already familiar with conventional treatment technologies, and would require significant training in order to become comfortable operating a membrane facility. This training is available, yet the time investment is significant. Finally, the WMP states that an additional exterior sedimentation basin would not be required for membrane filtration. Conventional mixed-media filtration is very capable of filtering sludge upset and floc carryover, which occurs at current flows. This would only increase with higher flow, which would be a problem for membrane technology. A minimum requirement would be for additional screens to be installed ahead of the membrane system. These costs are not reflected in the WMP analysis. This alternative as developed in the WMP does not account for a viable development plan, which would cost significantly more than illustrated. A membrane plant would most likely require construction of an entirely separate facility, which would then be switched over to the new facility, once prepared for commissioning.

7.3.2.3 Option C – Immersed Membrane Ultrafiltration

This alternative is considered to be unviable, and will not be discussed in this study, yet the major concerns with this alternative are similar to Section 7.3.2.2, above.

7.3.3 Disinfection

Tri City installed a hypochlorite on-demand disinfectant generation system in 2008, which diminishes the potential of disinfection byproduct risk, enhances disinfection effectiveness and efficiency, and reduces chlorine gas system health and safety risk. Cost and supply chain risks associated with chlorine gas systems are also lowered. The system is capable of delivering 60 pounds per day of equivalent chlorine gas. This method is scalable as the water system is expanded with additional tankage, generation, pumping and other equipment as required.

7.3.4 Water Treatment Facility Recommendations

Viable filtration alternatives that adequately consider the specific circumstances in Tri City must be developed. The options developed in the WMP are inadequate for proper comparison of viable alternatives, and do not provide consideration for actual construction phasing requirements. Viable alternatives must consider operational and demand needs of the community. This dramatically affects the cost estimates and feasibility of the proposed projects developed in the WMP. Redeveloped alternatives would include preliminary engineering cost estimates, and would provide valuable information to help Tri City to make informed decisions. A detailed investigation should be implemented to further consider the most practical and cost-effective alternatives that would meet the treatment goals of Tri City, and the needs of the community.

One New Potential Alternative
One new alternative that could be considered is the phased upgrading of the facility to the type of facility currently being constructed to treat the City of Sutherlin's Cooper Creek Reservoir water rights. The system Sutherlin selected is a Siemen's Trident HS (high solids) packaged conventional mixed-media system. This type of facility is more efficient and effective than conventional mixed-media filtration equipment, and is capable of treating surface water that is impossible to treat with membrane facilities. The system was compared to various membrane technologies and proved to be the most cost-effective and reliable alternative for Sutherlin. The Sutherlin WTP is designed to treat 5 cfs, which is similar to the needs of Tri City (4.87 cfs). This packaged equipment has dual treatment trains with tube settler modules, capable of providing settlement and flocculation capacity prior to entering adsorption

clarification, and mixed-media filtration with media-retention underdrains and air scour system. Electrically-actuated control valves can be utilized rather than pneumatic control valves, which enhances control and reliability of the facility, while also minimizing energy usage associated with pneumatically-actuated valve systems.

A major component to membrane treatment facility costs is the additional cost required for pre-treatment of raw water, prior to the membrane equipment. Tri City's WTP is currently deficient in settling and flocculation capacity. The WMP calls for an expensive improvement to the sedimentation / flocculation basins, yet this new alternative may be designed to negate the need for new basins. This option would utilize the existing sedimentation basin as a pre-settling and pre-flocculation basin, with secondary flocculation and settling occurring in the new treatment equipment.

The existing WTP would continue to operate while the new equipment is constructed. Once commissioned, the existing WTP would be decommissioned. The facility and mechanical piping would be sized to handle growth for the next 10 years, when the existing equipment would be demolished, and an additional Trident treatment train would be installed in the existing building. This alternative would create a viable, simple and scalable water system, while utilizing as much of the existing equipment and infrastructure as possible. It is further recommended that Tri City staff tour the Sutherlin facility in order to gain a greater understanding of what is involved with the construction of a new facility, while continuing to operate an existing water treatment facility.

Summary
The most cost-effective, medium-term solution for the water treatment facility is to expand the capabilities of the existing facility in order to maximize its operational life. This could include the installation of additional mixed-media filters, the addition of new underdrains, electrically actuated valves, filter media, air-scour systems, and the repair of operational and mechanical deficiencies within the existing treatment facility. Additional settling and flocculation capability will be required in order to significantly enhance water treatment facility capacity. Therefore, additional filtration alone will not solve the existing operational and capacity deficiencies in the facility. Improvement of the existing facility could be combined with the alternative mentioned above. However, this functionally equates to the operation of two separate treatment facilities with different water treatment capacities and capabilities, which would result in significant operational difficulties. Finally, expenditures toward the existing facility should be carefully considered, as this capital could be invested toward the future needs of the water treatment system. The future water system will be considerably different than the current facility. Investments made toward the improvement of overall long-term deficiencies could prove to be more prudent than investments toward the enhancement of the existing facility. This topic must be considered in greater detail in order to enable an informed decision.

7.3.5 WTP Backwash Waste Water Reuse

One potential water conservation alternative is the reuse of backwash water, which is discharged from the WTP into the recently improved backwash pond adjacent to the WTP. Water from the primary backwash pond is discharged into a secondary backwash pond prior to the supernatant being discharged back into the South Umpqua River. During peak water demand periods (June through September) the amount of plant total wastewater was recently between 3.5 - 4.0 million gallons, or approximately less than 1 million gallons per month. Total plant waste is well within typical levels for a well-operated facility at approximately 3.5 – 5.5%.

Concerns from operations staff regarding the use of recycled wastewater include the introduction of filter water, with viruses and other microbiological pathogens, as well as accumulated algae from the ponds. The WTP is well operated, and is capable of treating various water qualities, but the introduction of varying recycled wastewater quality could affect the treatment processes in

unpredictable ways. This also makes troubleshooting of treatment processes more difficult, as treatment issues are more difficult to narrow by source. Although less than 1 million gallons of wastewater is discharged from the plant per month during the peak demand period, this amount of water would not be available for retreatment. Evaporation and seepage from the backwash basins significantly reduce the amount available.

Plant wastewater recycling would require the installation of a new pumping facility, with an approximate 4-inch diameter system. The EPA Filter Backwash Recycle Rule requires that all plant wastewater must undergo complete treatment through the WTP with introduction at the head of the facility. A control system would be required in order to minimize water quality impacts, and to ensure adequate levels are maintained in the facilities.

Backwash recycling would occur primarily in the dry season from June through October. Assuming that approximately 30 percent is lost through evaporation and seepage, and some water would be needed to maintain operation of the backwash ponds, very little water would be available. Backwash waste would be discharged into the backwash pond, where it would travel around the entire loop to ensure maximum water quality, prior to being pumped back to the facility. This would enable approximately 50% of backwash water to be available for recycling. This equates to approximately 0.4 – 0.6 million gallons of water per month. This is approximately 2.5% of finished water volumes. Additional analysis will be required in order to understand whether the costs and risk associated with the construction of wastewater improvement are justifiable.

7.4 Treated Water Storage

The WMP develops the need for water storage through the study period under the assumption of specific population growth. The current study helps illustrate the need for the projects once the actual system water demand justifies the improvements. In general, the required storage goal is to provide 1.25 times the maximum daily demand (MDD), plus 540,000 gallons for fire reserve storage. Additional information is presented concerning the current status of the water storage system in Tri City, including the development of pre-design criteria for a new water storage tank for the Back Acres pressure zone.

7.4.1 Existing Storage and Projected Storage Need

The current MDD is 1.217 mgd, which would require 2,062,000 gallons of storage. Tri City currently has 2,017,300 gallons of storage, so is at this time only slightly deficient in storage on a system-wide basis. Should Tri City install an additional storage tank to the high-level Back Acres pressure zone between 350,000 – 500,000 gallons, it will no longer be deficient in storage. Although this is true, the Back Acres pressure zone is deficient in storage, including fire reserve. Once the tank is constructed, the storage system will be well within compliance at least through the year 2020, and potentially through the year 2025 (depending upon the tank volume installed). Table 7.4.1 summarizes the projected demands in the water system, the current storage, storage need, and the projected deficiency, assuming no additional tankage is constructed. This can be used as a tool to guide the timeframe and desired impacts of the tank improvements to the Back Acres pressure zone. It should be noted that if a major industrial user connects to the system in the industrial park, this analysis should be revisited in order to ensure that adequate fire flows could be delivered to the new user. This topic is considered in some detail in Tri City's Pruner Road Hotel Impact Study (Civil West, 2008). Additional analysis would be needed to address the requirements surrounding the specific type of development.

Table 7.4.1 – Projected Water Storage Requirements

	Study Projection		Study Projected Storage Requirements		
Year	MMD	MDD	Storage	Need	Deficient
2013	748,799	1,216,798	2,017,300	2,060,998	(43,698)
2015	786,707	1,278,398	2,017,300	2,137,998	(120,698)
2020	890,086	1,446,390	2,017,300	2,347,988	(330,688)
2025	1,007,051	1,636,458	2,017,300	2,585,572	(568,272)
2030	1,139,386	1,851,502	2,017,300	2,854,377	(837,077)

7.4.2 Back Acres Tank Improvements

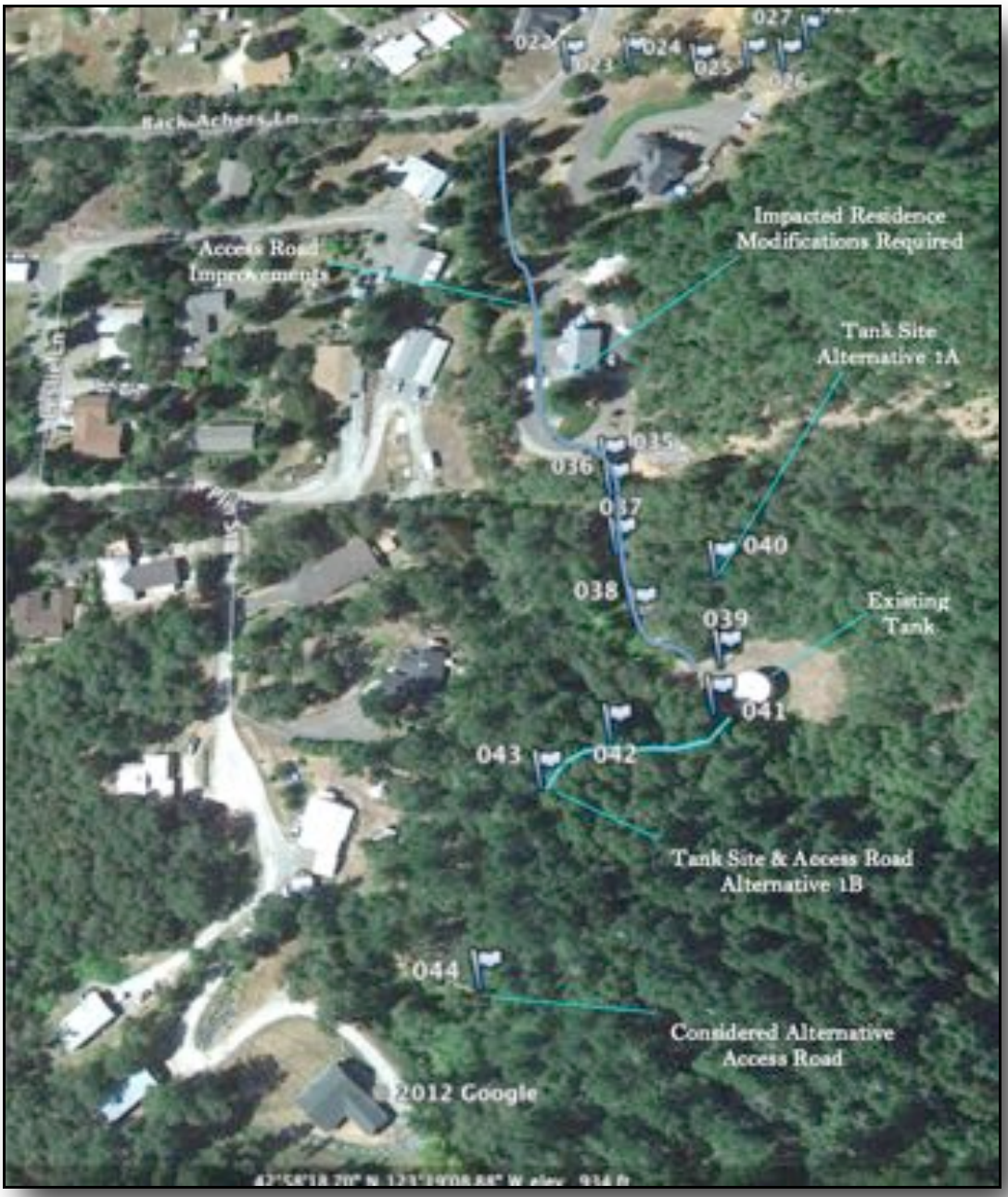
A major driving component to this study is the need for additional storage in the high-level pressure zone currently serviced by the Back Acres tank. Presently the tank is capable of storing 87,000 gallons of water. The pressure zone is currently deficient approximately 250,000 gallons, and additional storage to accommodate future growth is recommended. A minimum of 350,000 gallons of additional storage is recommended. The WMP states that the most cost-effective alternative is to remove the existing tank, and reconstruct a new tank on the existing site. The following alternatives are presented, including cost estimates for a new tank at each of four potential sites, and a discussion of the positive and negative features of each alternative.

7.4.2.1 Tank Site Alternatives 1A & 1B

The existing Back Acres tank site could potentially be utilized for a new additional water storage tank. This analysis has shown that the high-level pressure zone is deficient by approximately 250,000 gallons. There are two potential new tank site alternatives directly adjacent to the current water tank site; one directly to the south of the existing tank across a natural drainage way; a second directly to the north of the existing tank. Please see Figure 7.4.1, below. The figure shows the alternatives, including GPS survey waypoints. Re-routing of the current access road was also considered from the south.

Site 1 alternatives would utilize the existing access roadway, but a private residence would be significantly impacted by construction, and roadway improvements will be required. The access road would require de-limbing of mature vegetation, and realignment and repaving of the access road. A strong relationship will be required with the property owner. Acquisition of additional land will be required for either alternative. Finally, this alternative does not provide redundancy of water tank supply to the community. Should maintenance be required on the supply line or the tank itself, high-level users would be without service (including fire service). Excellent drainage is available to the site. It should be noted that a geotechnical investigation will be required as part of the design process. If any geotechnical issues are found, one alternative could be favored over another.

Figure 7.4.1 – Existing Tank Site and New Tank Alternatives 1A / 1B



Alternative Advantages:
Least expensive alternatives.
Utilizes existing access roadway and utilities to the site.

Alternative Disadvantages (Risks):
Lack of redundant water supply.
Will not improve fire flow rates to high-level pressure zone.
Will not encourage future housing developments.
Significant impacts to private residence.
Significant access road improvements required.

7.4.2.1 Tank Site Alternative 2

Tank Site Alternative 2 has two potential access road routings, as shown in Figure 7.4.2, below.

Route 2A is along an existing logging road, which would require development (gravel and pavement). The access is in excellent condition, but a steep section exists at the bottom. This routing is advantageous, since the existing 8-inch water system is easily accessed. A blowoff for the existing distribution system is readily accessible, and an existing easement extends Back Acres Lane through the east boundary of existing property boundaries.

Route 2B could also be easily developed, due to existing logging roads. It extends to the same tank site as Route 2A, and is slightly longer than Route 2A. This route can also be readily connected to the existing water distribution system.

It should be noted that the water utility routing could be constructed along one route, while the access road itself is constructed along the other route. This could have some advantage for cost savings. Excellent drainage is available to the site.

Alternative Advantages:
Enhanced fire flows to Westridge, and future development to the north.
Created redundancy of water storage and supply.
Provided capability to maintain water distribution and storage tanks.

Alternative Disadvantages (Risks):
Slightly higher costs.

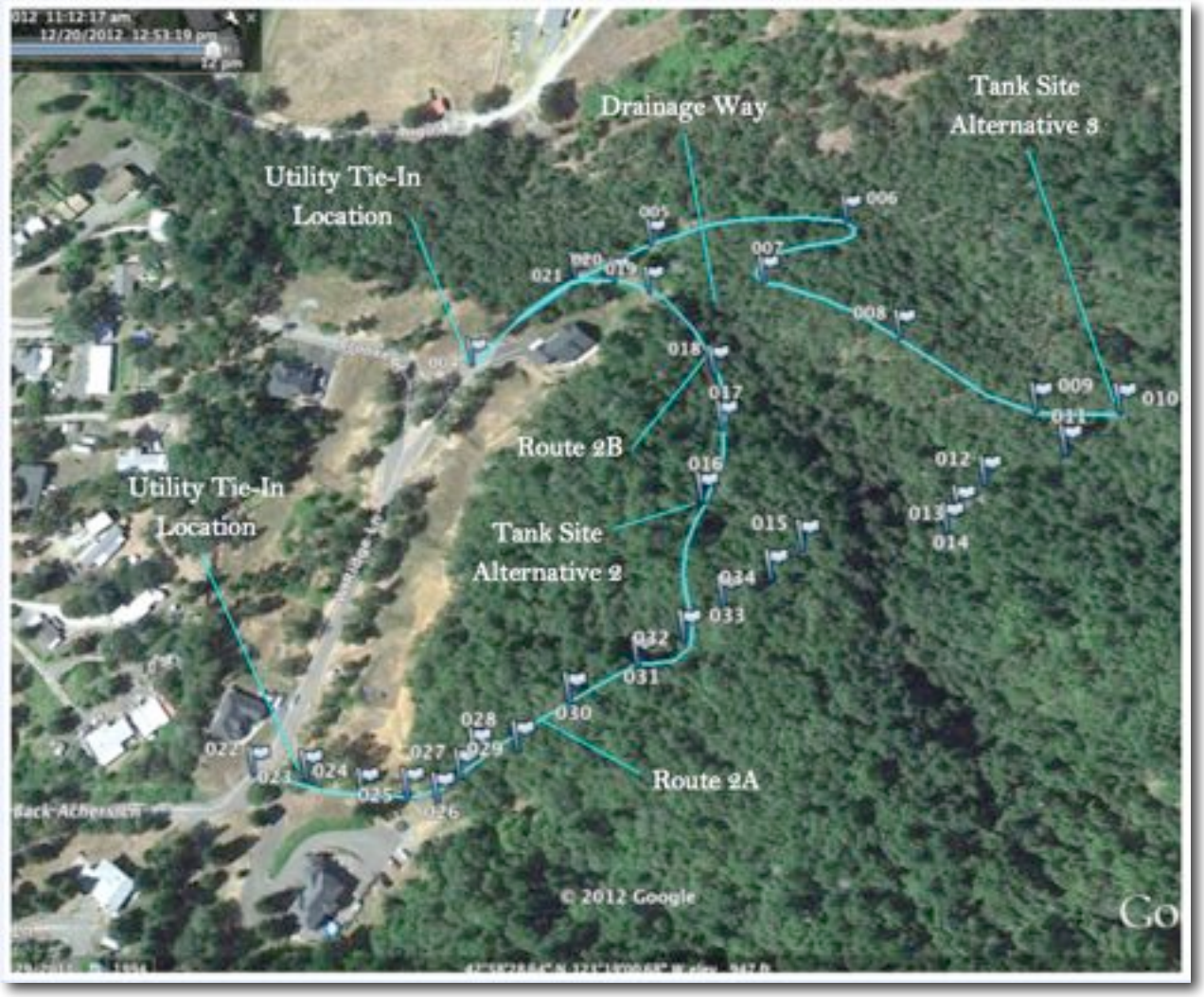
7.4.2.3 Tank Site Alternative 3

Tank Site Alternative 3 is the longest and most expensive alternative, yet has many of the advantages of Alternative 2, as shown in Figure 7.4.2, below. An existing logging road exists for the first portion of the access to the tank site, but a new access would require development for the remainder. The tank site is also somewhat steeper than that for the other tank sites. Excellent drainage is available to the site.

Alternative Advantages:
Enhanced fire flows to Westridge, and future development to the north.
Created redundancy of water storage and supply.
Provided capability to maintain water distribution and storage tanks.

Alternative Disadvantages (Risks):
Most expensive alternative.

Figure 7.4.2 – New Tank Site Alternatives 2A / 2B / 3



Recommendations

The alternative chosen by the Board should support a long-term strategy for development and service. Table 1 summarizes all considered alternatives, including cost, cost difference, and lists pros and cons for each alternative. Each of these alternatives is feasible. If cost is deemed the most important factor, then Alternative 1 is the clear choice. If enhanced fire flow rates, encouragement of long-term residential development, and supply/maintenance redundancy are desired, then Alternatives 2 and 3 should be considered.

Please note that land acquisition costs are not included in these estimates, as this is impossible to determine at this time (other than the fair market value). Also note that the assumed tank size is 340,000 gallons, per the Water Master Plan (2006). The minimum tank size required is approximately 165,000 gallons, although it is recommended that a larger tank volume be constructed in order to enhance fire flow and service capability.

My professional opinion is to pursue Alternative 2. Two possible routings are possible to the tank site, which provides flexibility during the land acquisition negotiations and geotechnical studies. It might be possible with this alternative to leverage the improved fire flows, and improved service for development

owners, toward favorable land acquisition terms. In an ideal situation, the property owner would donate land for the new tank, and consider the land donation tax and development benefits as a fair trade. Alternative 2 provides the best combination of benefits, for only a 16% premium over Alternative 1. Figure 7.4.3 provides a conceptual engineering drawing of the water tank site for Alternative 2, though this conceptual drawing could be applied to any site during actual design.

Figure 7.4.3 – Alternative 2 Conceptual Engineering Drawing

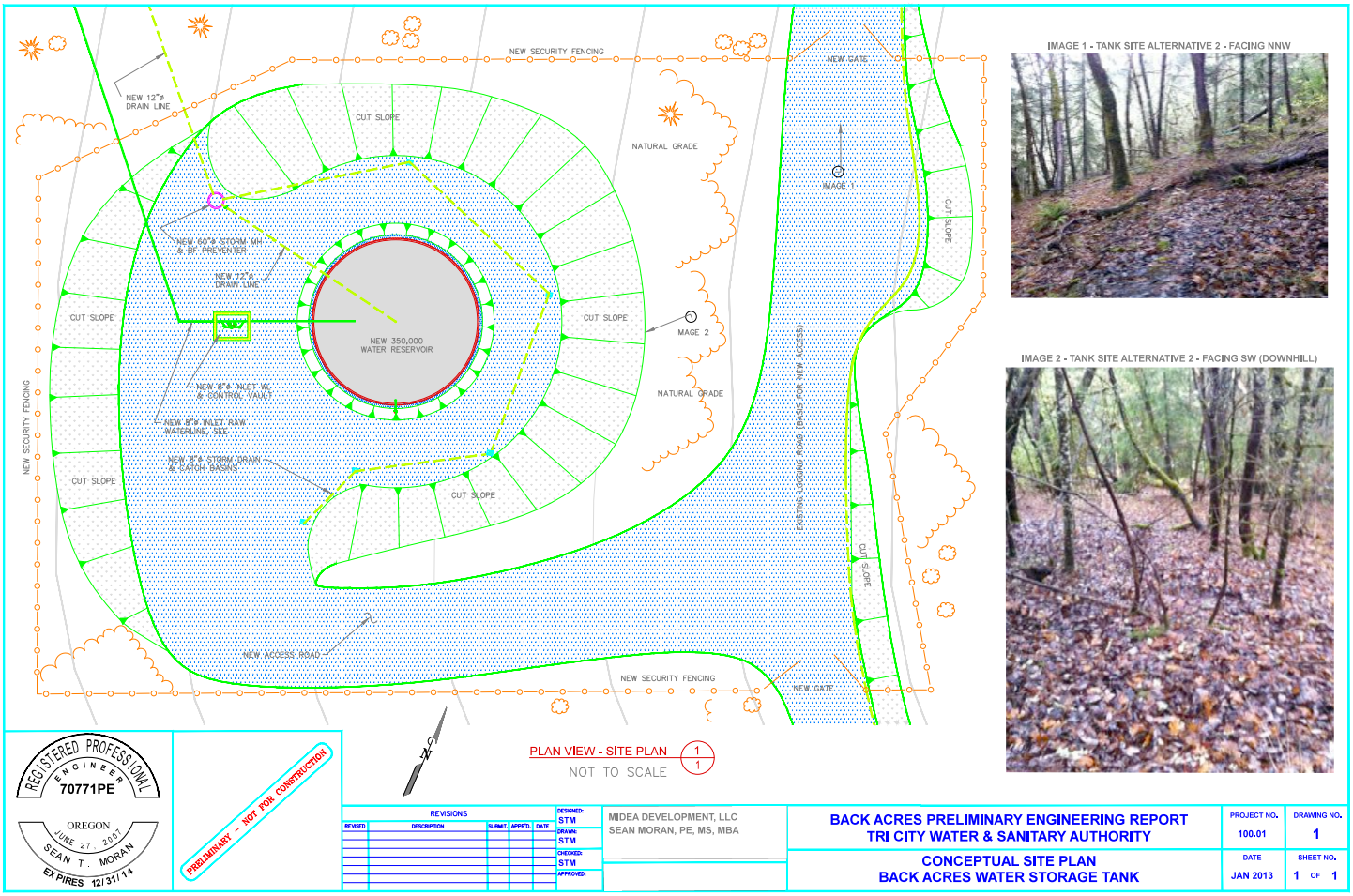


Table 7.4.2 – Back Acres Tank Site Alternatives Summary* **

Back Acres Inline Water Storage Tank Alternatives Summary Table			
Alternative No.	Total Alt. Cost	% Alt 1 Difference	Notes
Alternative 1A	$883,100	-	Least Cost, Residence Impacts, No Fire Flow Increase, No Supply Redundancy, No Growth Incentive.
Alternative 1B	$909,400	+ 3 %	Residence Impacts, No Fire Flow Increase, No Supply Redundancy, No Growth Incentive.
Alternative 2	$1,024,300	+ 16 %	Fire Flow Increase, Supply & Maintenance Redundancy, Growth Incentive.
Alternative 3	$1,110,500	+ 26 %	Fire Flow Increase, Supply & Maintenance Redundancy, Growth Incentive.

* 340,000 gallon water tank has been assumed. Minimum tank size is approx. 165,000 gallons.
** Land acquisition costs are not included in these preliminary engineering estimates.

7.5 Water Distribution Piping System Deficiencies

The condition and deficiencies of the water distribution system have been well developed in the WMP. Tri City should seriously consider which alternatives present the highest risk for interruption of service, and fire flow deficiencies, and address those improvements in a strategic and cost-effective manner.

Section

8

Capital Improvement Plan

The Capital Improvement Plan (CIP) provided in the Water Master Plan (WMP) (HBH, 2006) is adequately developed with the exceptions noted in this study. These exceptions are primarily associated with the filtration system portion of the water treatment plant (WTP), the Back Acres high-level pressure zone, and the water intake and pump station. These exceptions are developed and discussed in Section 7.

This study explicitly developed an updated analysis of water demand and system characteristic, and validated many of the assumptions of previous work, including the WMP, the Water Rate Study (2007), Water System Risk Failure Analysis (HBH, 2011), and other studies. Additional investigation and analysis may be required in order to fully assess and update alternatives to some of the operational issues and deficiencies currently identified in this study.

This study can be utilized as a tool for future planning of projects called for on a milestone basis of water system demand. The current study provides recommendations and guidelines for this application.

References

These References are in chronological order, rather than alphabetic order.

Tri City Joint Water & Sanitary Authority, Water System Master Plan; HBH Consulting Engineers; May 2006.

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U.S. Census Bureau; Profile of General Population & Housing Characteristics: 2010; 2010 Demographic Profile Data; Tri City CDP, Oregon.

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Tri City Joint Water & Sanitary Authority, Technical Letter: Water Treatment Facility Assessment, Facility Improvements Recommendations; Dyer Partnership Engineers & Planners, Inc.; April 6, 2011.

Tri City Joint Water & Sanitary Authority, Technical Letter: Industrial Park Development, Utility Capacities & Costs; Midea Development, LLC.; April 16, 2012.

Tri City Joint Water & Sanitary Authority, Raw Water Intake Survey; SHN Consulting Engineers & Geologists, Inc.; September 2012.

Appendix

A

Statutory Requirements

This project is funded in part (50% matching) through a grant awarded by the Oregon Water Resources Department (Grant Agreement No. 0056 13). The primary goal of the study is to provide a preliminary engineering design study for an inline water storage tank within the high-level pressure zone of Tri City Water & Sanitary Authority's (Authority) water system. A requirement of the grant funding includes statutory tasks that must be considered in the study. These tasks are outlined in Table A-1, below. Additional goals include a comprehensive evaluation of the current status of the water system, and the investigation of potential water conservation and efficiency measures that could be practically implemented by the Authority.

Table A1 – Required Statutory Tasks

Statutory Task	Description of Progress (include methodology)*	Description of Proposed analysis (include methodology)*
(a) Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows;	Continue to report water use under OAR 690 Div 85. The use of water is reduced during typical peak flow needs.	Review current water rights on record to understand any issues for priority date.
(b) Comparative analyses of alternative means of supplying water including but not limited to the costs and benefits of conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives;		Provide recommendations for water conservation and efficiency measures.
(c) Analyses of environmental harm or impacts from the proposed storage project;	Recently installed new fish screens	Review existing fish screen specifications to understand the current requirements of the Oregon Fish And Wildlife Department
(d) Evaluation of the need for and feasibility of using stored water to augment in-stream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values; and		The amount of storage on hand will be less than 1% of the natural stream flow in a 24 hour period; flow augmentation could not be accomplished if water is being supplied. The grantee will analyze if there will be any greater flexibility to withdraw water at a reduced rate or less often with increased in line storage.

Analysis and Conservation Strategy

The development strategy for the present study was first to perform a comprehensive analysis of recent water system data, in order to assess the current status of water system characteristics. The results of this analysis were compared and contrasted to a significant body of previous work. A brief summary of previous work is included in Section 6, and is referred to in a multitude of locations throughout this study. The analysis and comparisons laid the groundwork for the development of the following discussion concerning the topic of conservation.

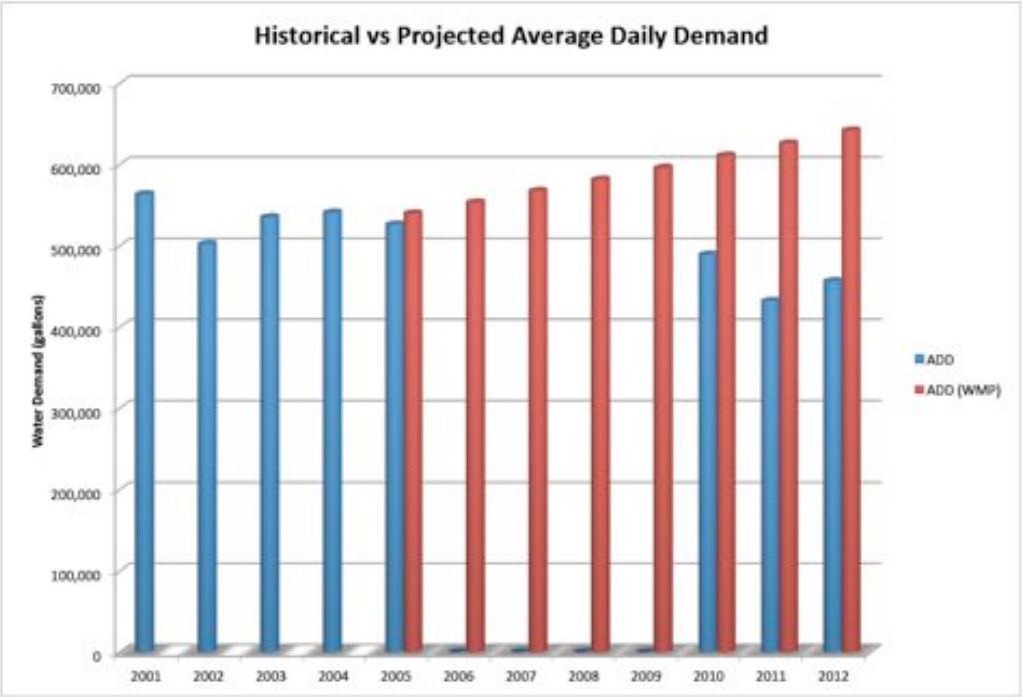
The study consultant presupposed that the WMP framework was acceptable, but that current water system characteristics, and demand projections were very different. The study analysis clearly shows this to be true. Not only are current population characteristics very different than called for in the WMP, but significant conservation has also been encouraged through the implementation of a new water rate structure in 2007. Midea used various sources of data, including the 2010 US Census, previous studies, water treatment system data, and other previous work to determine the current status of the water system.

The current status of water system characteristics creates a unique opportunity to investigate additional means of conservation. This study develops the discussion in a comprehensive fashion. Examples of this include the deferral of major water system improvements, such as the diversion of righted water for a period of time. The Authority can utilize the present study as a tool, or guide, for developing specific water system needs on demand-based milestone criteria. Essentially, as demand reaches certain pre-established criteria, the Authority can act toward the development of needed improvements. Tri City can now plan for these improvements proactively.

The efficient use of energy and water resources maximizes the level of cost-effective service that can be provided to the community, and defers necessary improvements into the future. This study develops a comprehensive list of projects that Tri City has implemented since 2006, and provides recommendations for additional conservation measures. The work presented proves that Tri City has actively pursued conservation projects as a means to minimize costs and impacts on the environment. These projects include the installation of high-efficiency lighting fixtures and pump motor equipment, variable frequency pump drives, a backwash system, and operational improvements. The present study discusses other resource conservation topics such as backwash wastewater recycling.

The analysis developed in this study provides a solid basis for the development of the statutory tasks. An example of this data is illustrated in Figure A1, which shows a compilation of data for the past decade regarding the Authority's water system. Data from 2001 – 2005 was utilized to develop the WMP. A larger version of this figure is presented in Figure ES1 in the Executive Summary. Required population and demand projections can be seen in red in the figure. The new water rate structure implemented in 2007 is based on a purely consumptive model, which typically strongly encourages conservation by consumers. The data presented for the years 2010 – 2012 illustrate the comparison between the WMP and the analysis performed by Midea (only for ADD). It is clear that the current demand characteristics in the service area are very different than those called for in the WMP. This creates a unique opportunity to investigate further conservation alternatives, which could take many forms. This study develops these discussions in a comprehensive fashion. Examples of this include the deferral of major improvements to the water system, including the diversion of righted water for a period of time. The Authority can utilize the present study as a tool, or guide, for developing specific water system needs on demand-based milestone criteria. Essentially, as demand reaches certain pre-established criteria, the Authority can act toward the development of needed improvements.

Figure A1



Discussion of Statutory Tasks

Midea has worked closely with the Authority and Mr. Bill Fujii of the Oregon Department of Water Resources Department (WRD) to thoroughly consider the statutory tasks called for under the grant agreement. Once Midea fully developed the current status of the water system, Midea had a detailed conversation with the WRD on February 22, 2013 to specifically consider the approach concerning the tasks. Midea intentionally deferred this discussion until this time to ensure that the necessary underlying analysis and water tank siting alternatives were sufficiently developed.

The findings of this study will be implemented by the Authority per the recommendations. Some additional study and analysis may need to occur for specific improvements, including improvements to the water treatment facility. The Authority has, and will continue to pursue, the responsible operation and improvement of its facilities. The findings of this study do not create issues concerning impacts to endangered species. Some parts of the project recommended in this study could require their own studies of potential impacts, depending upon the actual scope of those improvements. The Authority plans to pursue funding for the recommended project through an intelligent and thoughtful strategy, while also considering the financial impacts to its community.

Please note that the development of the discussion in statutory task one hold many common elements to other statutory tasks. This will be noted in each discussion, but typically not repeated for the sake of creating an efficient discussion.

Statutory Task a)
Review of previous work, including the WMP, has shown that the analysis of by-pass, optimum peak, flushing, and other ecological flows from permitted water rights is adequately developed. Current water rights are adequate to meet demand well into the near future, including through the study period of the WMP. The Authority has not currently fully developed existing permitted water rights. This study has developed a framework for when additional water rights could be needed. The current water system is incapable of treating the current water rights until significant improvements are completed. These

improvements are well developed in this study, and include water intake, intake pump station, water treatment facility, and other improvements. During low water periods, the Authority is sometimes required to divert water from Galesville reservoir, in order to meet peak demand. This discussion is well developed in the WMP. In addition, a fish friendly intake screen was recently constructed, as discussed in this study.

The proposed water tank in the high-level Back Acres pressure zone is an important improvement for the water system. This improvement will allow for additional operational and diversion flexibility. Operations staff can fill the water tank during off-peak demand periods, which will flatten the diverted water curve (by serving as a demand buffer). Water tank circulation equipment will ensure adequate tank mixing, which will produce excellent water quality. The water tank will end the current water storage deficiency for the water system, allow for improved fire suppression flows and volume, and will enable tank serviceability while continuing water service (from the second tank), since the existing water tank will continue to operate. During a drought period, many water users will be required to implement water conservation measures. The current water tank improvement will enable some operational flexibility that could mitigate potential effects.

It is important to note that the proposed project in this preliminary engineering report is for a high-pressure zone inline water storage tank. The project will NOT divert any additional water from the source stream. No permit will be required for this project to impound additional water.

This study has shown that water demand from the water system is significantly less than projected in the water master plan, significantly in part due to direct conservation-encouraging actions, including the restructuring of water rates.

Finally, should this statutory section be read independently of the study, please note the Executive Summary, and other parts of the study, which discuss the significant efforts the Authority has devoted to conservation, and the responsible diversion of its water rights. The Authority will continue to pursue this high level of care as discussed in this study, which will include such improvements to enhance water treatment facility efficiency.

Statutory Task b)
This study did not develop a discussion concerning means for alternative water supply. Various alternatives have been developed for specific improvement needs, as required, including the new inline storage tank. Alternative water supply includes water from Galesville reservoir as discussed above. Water supply from other communities is entirely cost-prohibitive due to the distance to the adjacent water systems in Riddle or Myrtle Creek. Water conservation measures are discussed above, as well as throughout this study.

Statutory Task c)
This statutory task is concerned with the potential environmental harm, or impacts from the proposed project. The current inline storage project is not anticipated to have any adverse impact. The construction site will be sited in the surrounding hills of the area in order to service the Authority's only high-level pressure zone. This construction will follow all applicable permitting and regulatory requirements, including the execution of applicable erosion control measures, should they be required. Many of the factors discussed in statutory task a, above, also apply here, including the recent construction of a fish friendly intake screen.

Statutory Task d)
It is important to note that this project calls for the development of an inline water storage tank, not a water impoundment or reservoir. Therefore, this statutory task does not apply to this project. This project does not create an opportunity to enhance, or augment, in-stream flows.

Appendix

B

Water Use and Projected Demand Documentation

Water System Characteristics							
				Metered Sales		Water	
Month	Raw Water	Finished	Plant Use	3 Day M.A.	Metered Sales	System Loss	% Loss System
Sep-12	20,071,200	18,424,900	1,421,239		16,547,856		
Aug-12	24,142,700	23,105,889	1,577,129	19,691,097	20,051,657	2,962,552	13.1%
Jul-12	21,577,100	20,032,728	1,468,968	17,962,319	22,473,779	1,950,869	9.8%
Jun-12	16,207,500	14,869,107	815,877	14,583,924	11,361,520	248,413	1.7%
May-12	15,312,400	13,905,612	606,742	9,921,784	9,916,473	3,936,798	28.4%
Apr-12	11,058,700	10,155,183	610,913	8,724,595	8,487,358	1,353,858	13.4%
Mar-12	11,362,300	10,387,582	683,362	7,592,014	7,769,955	2,680,588	26.1%
Feb-12	10,864,600	10,033,184	638,804	7,756,495	6,518,730	2,166,769	21.8%
Jan-12	12,098,600	11,089,451	702,931	8,678,606	8,980,801	2,330,565	21.2%
Dec-11	12,009,300	11,115,611	714,171	9,158,551	10,536,287	1,848,200	16.8%
Nov-11	12,936,200	12,062,047	959,567	9,684,407	7,958,564	2,313,120	19.3%
Oct-11	14,085,200	13,371,686	973,286	11,564,821	10,558,371	1,386,065	10.7%
Sep-11	20,634,700	19,657,520	1,288,850	15,679,804	16,177,527	3,385,786	17.8%
Aug-11	23,279,800	22,339,013	1,478,753	17,111,159	20,303,514	4,572,814	21.1%
Jul-11	20,604,700	19,541,028	833,498	14,791,693	14,852,437	4,603,365	23.7%
Jun-11	15,499,600	15,578,084	855,882	10,755,539	9,219,128	4,632,355	30.1%
May-11	12,298,300	11,854,992	698,412	8,432,620	8,195,052	3,249,152	27.8%
Apr-11	11,368,900	10,935,690	634,220	8,411,842	7,883,680	2,368,418	22.0%
Mar-11	12,412,800	11,585,474	980,364	8,191,574	9,156,793	3,219,110	28.2%
Feb-11	11,208,000	10,481,798	706,138	8,695,201	7,534,249	1,624,757	15.7%
Jan-11	14,280,300	12,814,843	1,614,613	8,109,575	9,394,561	4,360,198	35.0%
Dec-10	12,033,100	11,715,656	917,686	8,200,374	7,399,914	3,129,852	27.6%
Nov-10	12,515,000	11,768,522	1,390,472	8,169,034	7,806,647	3,218,938	28.3%
Oct-10	13,872,900	13,038,431	1,316,781	11,218,139	9,300,541	1,331,842	10.6%
Sep-10	16,951,300	15,966,090	1,743,080	14,711,877	16,547,229	542,323	3.6%
Aug-10	25,285,400	24,441,667	2,020,307	17,820,572	18,287,860	5,539,855	23.7%
Jul-10	25,002,900	24,597,711	1,900,101	15,602,286	18,626,628	8,124,535	34.2%
Jun-10	15,261,200	15,014,733	1,506,013	12,262,761	9,892,371	2,433,492	16.6%
May-10	12,512,100	12,497,789	1,313,079	8,981,363	8,269,284	3,252,136	26.6%
Apr-10	12,201,900	11,650,322	1,845,702	8,488,393	8,782,435	2,904,049	25.5%
Mar-10	14,780,400	14,346,992	1,308,812	8,028,009	8,413,461	6,008,063	42.8%
Feb-10	14,872,500	14,661,160	1,193,800	7,696,537	6,888,130	6,620,783	46.2%
Jan-10	16,194,500	16,260,871	1,488,251	11,360,147	7,788,020	4,605,544	28.8%
Dec-09	17,641,600	17,338,958	1,521,098	11,451,539	19,404,290	5,530,479	32.6%
Nov-09	13,497,500	13,462,280	1,021,810	12,637,030	7,162,306	485,820	3.7%
Oct-09	15,068,600	15,355,609	1,621,659		11,344,494		
	561,003,800	535,458,213	42,372,370	382,125,681	409,791,902	108,921,463	22.2%

DP-1

Profile of General Population and Housing Characteristics: 2010

2010 Demographic Profile Data

NOTE: For more information on confidentiality protection, nonsampling error, and definitions, see http://www.census.gov/prod/cen2010/doc/dpsf.pdf.

Geography: Tri-City CDP, Oregon

Subject	Number	Percent
SEX AND AGE		
Total population	3,931	100.0
Under 5 years	229	5.8
5 to 9 years	225	5.7
10 to 14 years	270	6.9
15 to 19 years	269	6.8
20 to 24 years	190	4.8
25 to 29 years	184	4.7
30 to 34 years	241	6.1
35 to 39 years	223	5.7
40 to 44 years	229	5.8
45 to 49 years	268	6.8
50 to 54 years	304	7.7
55 to 59 years	305	7.8
60 to 64 years	284	7.2
65 to 69 years	200	5.1
70 to 74 years	175	4.5
75 to 79 years	154	3.9
80 to 84 years	122	3.1
85 years and over	59	1.5
Median age (years)	42.8	(X)
16 years and over	3,142	79.9
18 years and over	3,044	77.4
21 years and over	2,892	73.6
62 years and over	882	22.4
65 years and over	710	18.1
Male population	1,980	50.4
Under 5 years	116	3.0
5 to 9 years	118	3.0
10 to 14 years	150	3.8
15 to 19 years	128	3.3
20 to 24 years	104	2.6
25 to 29 years	104	2.6
30 to 34 years	108	2.7
35 to 39 years	116	3.0
40 to 44 years	123	3.1
45 to 49 years	127	3.2
50 to 54 years	154	3.9
55 to 59 years	140	3.6
60 to 64 years	143	3.6
65 to 69 years	94	2.4
70 to 74 years	84	2.1
75 to 79 years	81	2.1
80 to 84 years	60	1.5
85 years and over	30	0.8

Subject	Number	Percent
Median age (years)	41.5	(X)
16 years and over	1,568	39.9
18 years and over	1,524	38.8
21 years and over	1,440	36.6
62 years and over	440	11.2
65 years and over	349	8.9
Female population	1,951	49.6
Under 5 years	113	2.9
5 to 9 years	107	2.7
10 to 14 years	120	3.1
15 to 19 years	141	3.6
20 to 24 years	86	2.2
25 to 29 years	80	2.0
30 to 34 years	133	3.4
35 to 39 years	107	2.7
40 to 44 years	106	2.7
45 to 49 years	141	3.6
50 to 54 years	150	3.8
55 to 59 years	165	4.2
60 to 64 years	141	3.6
65 to 69 years	106	2.7
70 to 74 years	91	2.3
75 to 79 years	73	1.9
80 to 84 years	62	1.6
85 years and over	29	0.7
Median age (years)	44.1	(X)
16 years and over	1,574	40.0
18 years and over	1,520	38.7
21 years and over	1,452	36.9
62 years and over	442	11.2
65 years and over	361	9.2
RACE		
Total population	3,931	100.0
One Race	3,789	96.4
White	3,608	91.8
Black or African American	2	0.1
American Indian and Alaska Native	119	3.0
Asian	24	0.6
Asian Indian	7	0.2
Chinese	2	0.1
Filipino	9	0.2
Japanese	0	0.0
Korean	2	0.1
Vietnamese	0	0.0
Other Asian [1]	4	0.1
Native Hawaiian and Other Pacific Islander	6	0.2
Native Hawaiian	1	0.0
Guamanian or Chamorro	0	0.0
Samoan	0	0.0
Other Pacific Islander [2]	5	0.1
Some Other Race	30	0.8
Two or More Races	142	3.6
White; American Indian and Alaska Native [3]	96	2.4
White; Asian [3]	4	0.1
White; Black or African American [3]	8	0.2
White; Some Other Race [3]	7	0.2
Race alone or in combination with one or more other races: [4]		
White	3,740	95.1
Black or African American	18	0.5
American Indian and Alaska Native	232	5.9

Subject	Number	Percent
Asian	35	0.9
Native Hawaiian and Other Pacific Islander	18	0.5
Some Other Race	44	1.1
HISPANIC OR LATINO		
Total population	3,931	100.0
Hispanic or Latino (of any race)	176	4.5
Mexican	137	3.5
Puerto Rican	7	0.2
Cuban	2	0.1
Other Hispanic or Latino [5]	30	0.8
Not Hispanic or Latino	3,755	95.5
HISPANIC OR LATINO AND RACE		
Total population	3,931	100.0
Hispanic or Latino	176	4.5
White alone	110	2.8
Black or African American alone	0	0.0
American Indian and Alaska Native alone	8	0.2
Asian alone	0	0.0
Native Hawaiian and Other Pacific Islander alone	1	0.0
Some Other Race alone	30	0.8
Two or More Races	27	0.7
Not Hispanic or Latino	3,755	95.5
White alone	3,498	89.0
Black or African American alone	2	0.1
American Indian and Alaska Native alone	111	2.8
Asian alone	24	0.6
Native Hawaiian and Other Pacific Islander alone	5	0.1
Some Other Race alone	0	0.0
Two or More Races	115	2.9
RELATIONSHIP		
Total population	3,931	100.0
In households	3,931	100.0
Householder	1,526	38.8
Spouse [6]	775	19.7
Child	1,013	25.8
Own child under 18 years	711	18.1
Other relatives	288	7.3
Under 18 years	129	3.3
65 years and over	38	1.0
Nonrelatives	329	8.4
Under 18 years	47	1.2
65 years and over	21	0.5
Unmarried partner	166	4.2
In group quarters	0	0.0
Institutionalized population	0	0.0
Male	0	0.0
Female	0	0.0
Noninstitutionalized population	0	0.0
Male	0	0.0
Female	0	0.0
HOUSEHOLDS BY TYPE		
Total households	1,526	100.0
Family households (families) [7]	1,077	70.6
With own children under 18 years	387	25.4
Husband-wife family	775	50.8
With own children under 18 years	220	14.4
Male householder, no wife present	105	6.9
With own children under 18 years	63	4.1
Female householder, no husband present	197	12.9
With own children under 18 years	104	6.8

Subject	Number	Percent
Nonfamily households [7]	449	29.4
Householder living alone	329	21.6
Male	173	11.3
65 years and over	60	3.9
Female	156	10.2
65 years and over	85	5.6
Households with individuals under 18 years	477	31.3
Households with individuals 65 years and over	506	33.2
Average household size	2.58	(X)
Average family size [7]	2.93	(X)
HOUSING OCCUPANCY		
Total housing units	1,633	100.0
Occupied housing units	1,526	93.4
Vacant housing units	107	6.6
For rent	38	2.3
Rented, not occupied	0	0.0
For sale only	25	1.5
Sold, not occupied	2	0.1
For seasonal, recreational, or occasional use	4	0.2
All other vacants	38	2.3
Homeowner vacancy rate (percent) [8]	2.2	(X)
Rental vacancy rate (percent) [9]	8.1	(X)
HOUSING TENURE		
Occupied housing units	1,526	100.0
Owner-occupied housing units	1,096	71.8
Population in owner-occupied housing units	2,721	(X)
Average household size of owner-occupied units	2.48	(X)
Renter-occupied housing units	430	28.2
Population in renter-occupied housing units	1,210	(X)
Average household size of renter-occupied units	2.81	(X)

X Not applicable.

[1] Other Asian alone, or two or more Asian categories.

[2] Other Pacific Islander alone, or two or more Native Hawaiian and Other Pacific Islander categories.

[3] One of the four most commonly reported multiple-race combinations nationwide in Census 2000.

[4] In combination with one or more of the other races listed. The six numbers may add to more than the total population, and the six percentages may add to more than 100 percent because individuals may report more than one race.
[5] This category is composed of people whose origins are from the Dominican Republic, Spain, and Spanish-speaking Central or South American countries. It also includes general origin responses such as "Latino" or "Hispanic."
[6] "Spouse" represents spouse of the householder. It does not reflect all spouses in a household. Responses of "same-sex spouse" were edited during processing to "unmarried partner."
[7] "Family households" consist of a householder and one or more other people related to the householder by birth, marriage, or adoption. They do not include same-sex married couples even if the marriage was performed in a state issuing marriage certificates for same-sex couples. Same-sex couple households are included in the family households category if there is at least one additional person related to the householder by birth or adoption. Same-sex couple households with no relatives of the householder present are tabulated in nonfamily households. "Nonfamily households" consist of people living alone and households which do not have any members related to the householder.

[8] The homeowner vacancy rate is the proportion of the homeowner inventory that is vacant "for sale." It is computed by dividing the total number of vacant units "for sale only" by the sum of owner-occupied units, vacant units that are "for sale only," and vacant units that have been sold but not yet occupied; and then multiplying by 100.
[9] The rental vacancy rate is the proportion of the rental inventory that is vacant "for rent." It is computed by dividing the total number of vacant units "for rent" by the sum of the renter-occupied units, vacant units that are "for rent," and vacant units that have been rented but not yet occupied; and then multiplying by 100.
Source: U.S. Census Bureau, 2010 Census.

Water System Demand Tables
2003 - 2005 Comparative Analysis

Comparative Annual	Assume Average Loss Percentage for 2009-10						Appx. Actual Demand
2005						152,574,910	
ADD						**418,013**	526,054
Minimum						7,574,720	
Maximum						24,666,080	
2004						147,000,988	
ADD						**402,742**	402,742
Minimum						7,474,374	
Maximum						20,691,480	
2003						150,471,814	
ADD						**412,252**	412,252
Minimum						7,596,680	
Maximum						24,304,780	

Water System Demand Tables
2010

Month	Customers Billed	Commercial	Churches	Restaurants	Residential	Water Usage	Total Water Amount	Appx. System Loss	Appx. Loss %
Sep-10	1,507	1,478,667	31,110	197,215	14,840,237	16,547,229	$ 37,231	542,323	3.6%
Aug-10	1,514	1,719,106	31,190	200,626	16,336,938	18,287,860	$ 41,148	5,539,855	23.7%
Jul-10	1,501	1,198,589	29,230	165,155	17,233,654	18,626,628	$ 41,910	8,124,535	34.2%
Jun-10	1,502	624,306	24,360	168,555	9,075,150	9,892,371	$ 22,258	2,433,492	16.6%
May-10	1,490	497,918	19,020	153,350	7,598,996	8,269,284	$ 18,606	3,252,136	26.6%
Apr-10	1,481	575,154	26,110	171,320	8,009,851	8,782,435	$ 19,760	2,904,049	25.5%
Mar-10	1,490	551,870	26,580	155,030	7,679,981	8,413,461	$ 18,930	6,008,063	42.8%
Feb-10	1,495	456,500	16,100	128,630	6,286,900	6,888,130	$ 15,498	6,620,783	46.2%
Jan-10	1,492	463,040	17,490	131,700	7,175,790	7,788,020	$ 17,523	4,605,544	28.8%
Dec-09	1,500	646,220	44,930	186,090	18,527,050	19,404,290	$ 43,660	5,530,479	32.6%
Nov-09	1,508	427,580	13,660	157,920	6,563,146	7,162,306	$ 16,115	485,820	3.7%
Oct-09	1,506	974,980	52,950	148,430	10,168,134	11,344,494	$ 25,525	0	0.0%
Sep-09	1,503	1,829,690	37,060	208,750	14,904,500	16,980,000	$ 38,205	0	0.0%
Average	1,499	830,413	28,223	164,630	10,796,674	11,819,940	$ 26,595	3,792,063	25.8%
Minimum	1,481	427,580	13,660	128,630	6,286,900	6,888,130	$ 15,498	0	
Maximum	1,514	1,829,690	52,950	208,750	18,527,050	19,404,290	$ 43,660	8,124,535	
Total Annual	-						**$ 319,138**	**45,504,756**	
Overall Annual Usage		9,964,953	338,680	1,975,556	129,560,090	**141,839,279**			
ADD						388,601			

Water System Demand Tables
2011

Month	Customers Billed	Commercial	Churches	Restaurants	Residential	Water Usage	Total Water Amount	Appx. System Loss	Appx. Loss %
Sep-11	1,490	1,603,510	37,850	188,160	14,348,007	16,177,527	$ 36,399	3,385,786	17.8%
Aug-11	1,502	1,359,990	36,510	239,780	18,667,234	20,303,514	$ 45,683	4,572,814	21.1%
Jul-11	1,498	1,105,550	31,520	174,680	13,540,687	14,852,437	$ 33,418	4,603,365	23.7%
Jun-11	1,504	556,680	18,140	132,710	8,511,598	9,219,128	$ 20,743	4,632,355	30.1%
May-11	1,500	635,400	16,220	131,179	7,412,253	8,195,052	$ 18,439	3,249,152	27.8%
Apr-11	1,502	526,513	16,920	136,141	7,204,106	7,883,680	$ 17,738	2,368,418	22.0%
Mar-11	1,504	659,631	30,230	149,751	8,317,181	9,156,793	$ 20,603	3,219,110	28.2%
Feb-11	1,496	496,694	15,220	118,792	6,903,543	7,534,249	$ 16,952	1,624,757	15.7%
Jan-11	1,490	513,938	19,710	147,580	8,713,333	9,394,561	$ 21,138	4,360,198	35.0%
Dec-10	1,497	437,930	16,230	161,715	6,784,039	7,399,914	$ 16,650	3,129,852	27.6%
Nov-10	1,491	464,741	29,030	148,712	7,164,164	7,806,647	$ 17,565	3,218,938	28.3%
Oct-10	1,496	703,873	19,770	156,453	8,420,445	9,300,541	$ 20,926	1,331,842	10.6%
Average	1,498	755,371	23,946	157,138	9,665,549	10,602,004	$ 23,855	3,308,049	24.0%
Minimum	1,490	437,930	15,220	118,792	6,784,039	7,399,914	$ 16,650	1,331,842	
Maximum	1,504	1,603,510	37,850	239,780	18,667,234	20,303,514	$ 45,683	4,632,355	
Total Annual	-						**$ 286,254**	**39,696,587**	
Overall Annual Usage		9,064,450	287,350	1,885,653	115,986,590	**127,224,043**			
ADD						348,559			

Water System Demand Tables
2012

Month	Customers Billed	Commercial	Churches	Restaurants	Residential	Water Usage	Total Water Amount	Appx. System Loss	Appx. Loss %
Sep-12	1,486	1,457,159	43,164	149,427	14,898,106	16,547,856	$ 37,233	0	0.0%
Aug-12	1,490	1,555,948	44,133	186,890	18,264,686	20,051,657	$ 45,116	2,962,552	13.1%
Jul-12	1,483	1,017,209	32,960	149,557	21,274,053	22,473,779	$ 50,566	1,950,869	9.8%
Jun-12	1,484	864,387	26,195	130,609	10,340,329	11,361,520	$ 25,563	248,413	
May-12	1,486	826,215	22,589	132,697	8,934,972	9,916,473	$ 22,312	3,936,798	28.4%
Apr-12	1,484	585,121	18,219	157,923	7,726,095	8,487,358	$ 19,097	1,353,858	13.4%
Mar-12	1,478	550,725	15,380	137,929	7,065,921	7,769,955	$ 17,482	2,680,588	26.1%
Feb-12	1,483	502,988	13,934	124,849	5,876,959	6,518,730	$ 14,667	2,166,769	21.8%
Jan-12	1,478	501,507	14,185	142,720	8,322,389	8,980,801	$ 20,207	2,330,565	21.2%
Dec-11	1,477	548,910	14,700	135,159	9,837,518	10,536,287	$ 23,707	1,848,200	16.8%
Nov-11	1,487	169,031	16,068	124,072	7,649,393	7,958,564	$ 17,907	2,313,120	19.3%
Oct-11	1,483	1,227,111	25,470	150,880	9,154,910	10,558,371	$ 23,756	1,386,065	10.7%
Average	1,483	817,193	23,916	143,559	10,778,778	11,763,446	$ 26,468	1,931,483	18.1%
Minimum	1,477	169,031	13,934	124,072	5,876,959	6,518,730	$ 14,667	0	
Maximum	1,490	1,555,948	44,133	186,890	21,274,053	22,473,779	$ 50,566	3,936,798	
Total Annual	-						**$ 317,613**	**23,177,797**	
Overall Annual Usage		9,806,311	286,997	1,722,712	129,345,331	**141,161,351**			
ADD						386,743			

Basic Water Rate Analysis - 2012

Water Rates Effective October 1, 2007

Base monthly rate by meter size:

	Current No. Meters	Meter Size	Meter Rate	Monthly Base Revenue	Annual Base Revenue
	1451	5/8 X 3/4"	$ 26	$ 37,726	$ 452,712
	18	1"	$ 65	$ 1,170	$ 14,040
	5	1.5"	$ 130	$ 650	$ 7,800
	14	2"	$ 208	$ 2,912	$ 34,944
	1	6"	$ 390	$ 390	$ 4,680
Total	1489			$ 42,848	$ 514,176
Total 2012 Consumption Charges					$ 317,613
Approximate 2012 Water Reveue					$ 831,789

All water is billed @ $2.25 per 1,000 gallons.

Appendix

C

Analysis and Improvement Alternatives Calculations

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

April 6, 2011

Tri City Water & Sanitary Authority
215 North Old Pacific Highway
Myrtle Creek, OR 97457

Attn: Ms. Vicki Howren
General Manager

RE: Water Treatment Facility Assessment
Facility Improvements Recommendations

Dear Vicki:

Please accept the following assessment of various operational and equipment issues at your water treatment facility.

Introduction & Background

Dyer visited the water treatment facility and met with TCWSA Staff on January 18th and March 2nd to observe the facility. The observed issues primarily comprise the backwash / filter cycle and related equipment. Finished water treatment does not appear to be affected by these operational issues. The operational issues include:

1. Columnar surging of backwash water through the filter media at the beginning of the backwash cycle for all filters.
2. Poor filter water level control during backwash cycle. This requires manual adjustment of the filter-to-waste valve for each filter.
3. All 4 filters can no longer be backwashed in sequence. This was possible prior to the installation of new clearwell baffling.

Tri City Staff drained a filter and manually exposed the underdrain system and settled media. Staff observed that there appeared to be no problems with the underdrain or media.

The current backwash equipment consists of a single backwash pump and related piping and appurtenances. Backwash water is supplied from finished water in the clearwell. Pneumatic control valves provide control of the backwash cycle. Flow control is currently accomplished with a manually actuated knife valve immediately downstream of the backwash pump and a manually actuated filter-to-waste valve to the waste piping. A Griswold automatic flow control valve was utilized in the past to control flow. The core elements of the flow control valve were removed in the past to allow increased flow rate during the backwash cycle.

759 WEST CENTRAL AVENUE
SUTHERLIN, OREGON 97479
TELEPHONE: (541) 459-4619
FAX: (541) 459-4679
WEB: www.dyerpart.com

Discussion of Recommendation

The objectives of the improvement recommendations are to improve operational automation, flexibility and performance of the backwash cycle.

We believe that the columnar surging through the filter media at the beginning of the backwash cycle may be caused by poor control of backwash flow rate and the rate at which the on-off valve opens. The surge does not appear to contain air or to affect treatment. This could potentially cause, or contribute to, the columnar surging.

Installation of a variable frequency drive (VFD) to control the backwash pump could help operations in various ways. The VFD would allow operators to ramp up backwash flows, which could mitigate the filter surge. The VFD would also allow for excellent operational flexibility for flow and filter tank level control. The existing equipment in the filter tanks includes level transducers that measure water level. The signal is used to control finished water operations. We believe that this signal can also be used to provide tank level control for the backwash cycle. If a modulating valve is installed in place of the existing filter-to-waste control valve, the level signal from the filter tanks could be relayed to a Programmable Logic Controller (PLC) that would control the fluid level in the filter tanks during the backwash cycle. That same signal can be used for the PLC to control backwash pump output. This provides redundancy in flow control if a modulating valve malfunctions. This could be controlled regardless of the actual flow rate of the backwash pump. The VFD would be set to a flow profile and fluid level in the tank would be controlled by the modulating valve by the PLC. This would eliminate the existing problems created through manual actuation of the filter-to-waste valve during backwash operations. These improvements would create improved levels of operational flexibility. The modulating valve should be the same style and size as the existing filter-to-waste valve and have a new modulating actuator. The actuator could be either electric or pneumatic. The selection of the actual actuator style could be affected by project costs or space constraints in the vicinity of the valve. A simple paddlewheel flow meter should also be installed in the backwash supply pipeline. This would not be used to control the backwash cycle, but would indicate actual flow rates and help to provide operational information during the backwash cycle.

The new clearwell baffling appears to have created hydraulic constraints that no longer allow adequate supply of water to the backwash pump to provide for sequentially backwashing all four filters. Only two filters can be sequentially backwashed before clearwell hydraulic capacity is exhausted. It may be possible to improve backwash efficiency through trial and error with the recommended improvements and allow for sequential backwash of all four filters again. This is yet to be determined. We do not recommend any modifications to the clearwell baffling at this time until all other alternatives have been exhausted. It is further recommended that the backwash flush of the waste piping be ceased at the beginning of each backwash cycle, as it is unnecessary. This will save water and help improve backwashing operations.

Finally, we noted that the water treatment facility backwash cycle may be improved if a new underdrain and air scour system were to be installed on the existing equipment. This would consist of the installation of low pressure air blowers, air piping and media retention underdrain system. A backwash channel baffle would need to be installed to ensure filter media is retained in the filter tanks during the air scour cycle. There is adequate space in the facility to accommodate this improvement. The primary surface wash equipment could be removed as it

would no longer be necessary. This improvement would increase the cleaning efficiency of the backwash cycle and reduce the amount of required backwash water.

Recommendation Summary

Dyer recommends a phased approach to improvements to mitigate operational issues and improve operational flexibility at the water treatment facility. These improvements include:

1. Install a VFD on the backwash pump, PLC and new modulating filter-to-waste control valve to control the backwash cycle. The existing level sensors in the filter tanks can provide signals that could be used to control filter tank water level during the backwash cycle. A paddlewheel flow meter should be installed to indicate flow rates and to support operational improvement and monitoring efforts. Terry Nelson of Camtronics is highly recommended for this improvement
2. Remove waste piping backwash flush (currently 30 seconds) from backwash cycle. I believe operational staff has already applied this improvement as a result of the discussions during the March 2nd.
3. Install a new air scour backwash system in the future to increase backwash efficiency and to improve filter cleaning.
4. Reevaluate the need for clearwell baffle modifications after the backwash system has been updated.

If you have any questions, please feel free to call me.

Sincerely,
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

SEAN MORAN

Steve Major, PE
Sean Moran, PE, MS, MBA

Back Acres Tank Water Storage Requirement Calculation					
Alternative 1 @ 1,000 gpm				**Buildout**	
Storage Category	**Relevant Info.**	**Flow (gpm)**	**Duration (h)**	**Total (gal)**	
Fire Flow		1,000	2	120,000	
Equalization	0.25 MDD			26,018	
Emergency	MDD			104,073	
Appx. Service EDUs	180				
2012 EDU	2,053				
2012 MDD (gpd)	1,187,120				
2012 MDD / EDU (gpd/	578				
Buildout MDD (gpd)	104,073				
Total Storage Requirement				250,091	
Current Storage (gal)				87,000	
Storage Need (gal)				163,091	
Alternative 2 @ 1,500 gpm				**Buildout**	
Storage Category	**Relevant Info.**	**Flow (gpm)**	**Duration (h)**	**Total (gal)**	
Fire Flow		1,500	2	180,000	
Equalization	0.25 MDD			26,018	
Emergency	MDD			104,073	
Appx. Service EDUs	180				
2012 EDU	2,053				
2012 MDD (gpd)	1,187,120				
2012 MDD / EDU (gpd/	578				
Buildout MDD (gpd)	104,073				
Total Storage Requirement				310,091	
Current Storage (gal)				87,000	
Storage Need (gal)				223,091	

Pipe Loss Calculations
Back Acres Water Tank Site Alternatives
Fire Flow Event Asssumed

	Pipe Flow Calculations					
	Pipe Size (inch dia.)	8	10	12		
	Fire Flow (gpm)	1,500	1,500	1,500		Assumes all flow from new tank.
	Fire Flow (ft3/s)	3.34	3.34	3.34		
	Pipe Area (ft 2)	0.349	0.545	0.785		
	Flow Velocity (ft/s2)	9.6	6.1	4.3		9.6 ft/s flow rate ok
	Pressure Loss (psi)	13.6	4.5	1.8	Per 1000 feet, Assume = old PVC	
	Alt. Total Length (ft)					
1A	150	2.0	0.7	0.3	Total Alt 1A psi loss	
1B	300	4.1	1.4	0.5	Total Alt 1B psi loss	
2	900	12.2	4.1	1.6	Total Alt 2 psi loss	12.2 psi OK for fire flow loss
3	1,500	20.4	6.8	2.7	Total Alt 3 psi loss	20.4 psi not OK, needs to be 10-inch minimum

PRELIMINARY COST ESTIMATE

Back Acres Water Reservoir - Preliminary Engineering Design Report

Tri City Water & Sanitary Authority

Alternative 1A - Immediately North to Existing Tank

Project No. 100.01 January 6, 2013

No.	Item	Quantity	Unit	Unit Price ($)	Total Price ($)
1	Constr. Facilities & Temp. Controls	1	LS	$75,000	$ 75,000
2	Demolition & Site Preparation	1	LS	$50,000	$ 50,000
3	Foundation Stabilization	200	CY	$30	$ 6,000
4	8-inch Waterline	150	LF	$50	$ 7,500
5	8-inch Gate Valve	6	Each	$800	$ 4,800
6	8-inch Tees	2	Each	$600	$ 1,200
7	Misc. fittings, elbows	1	LS	$5,000	$ 5,000
8	12-inch Gate Valve	1	Each	$1,200	$ 1,200
9	12-inch Drain Line	80	LF	$60	$ 4,800
10	Flap Valves	2	Each	$800	$ 1,600
11	Altitude Valve & Appurtenances	1	Each	$10,000	$ 10,000
12	0.34 MG Reservoir	1	LS	$300,000	$ 300,000
13	Concrete Base	2200	SF	$15	$ 33,000
14	AC Pavement	200	Ton	$110	$ 22,000
15	Aggregate Base	400	Ton	$40	$ 16,000
16	Import Granular Fill	1500	CY	$20	$ 30,000
17	Precast Modular Retaining Wall	500	SF	$30	$ 15,000
18	8' Security Fencing	420	LF	$25	$ 10,500
19	24' Double Swing Gate	1	Each	$1,500	$ 1,500
20	Site & Roadway Excavation	1500	CY	$15	$ 22,500
21	Solar Powered Mixer	1	LS	$15,000	$ 15,000
22	Solar / Battery Alarm SCADA	1	LS	$20,000	$ 20,000
23	Landscaping	1	LS	$6,000	$ 6,000

Construction	**$**	**658,600**
Contingency	**$**	**65,900**
Engineering	**$**	**118,600**
Geotechnical	**$**	**20,000**
Admin / Legal	**$**	**20,000**
TOTAL ALTERNATIVE COST	**$**	**883,100**

PRELIMINARY COST ESTIMATE

Back Acres Water Reservoir - Preliminary Engineering Design Report

Tri City Water & Sanitary Authority

Alternative 1B - South of Existing Tank

Project No. 100.01 January 6, 2013

No.	Item	Quantity	Unit	Unit Price ($	Total Price ($)
1	Constr. Facilities & Temp. Controls	1	LS	$75,000	$ 75,000
2	Demolition & Site Preparation	1	LS	$50,000	$ 50,000
3	Foundation Stabilization	250	CY	$30	$ 7,500
4	8-inch Waterline	300	LF	$50	$ 15,000
5	8-inch Gate Valve	6	Each	$800	$ 4,800
6	8-inch Tees	2	Each	$600	$ 1,200
7	Misc. fittings, elbows	1	LS	$5,000	$ 5,000
8	12-inch Gate Valve	1	Each	$1,200	$ 1,200
9	12-inch Drain Line	80	LF	$60	$ 4,800
10	Flap Valves	2	Each	$800	$ 1,600
11	Altitude Valve & Appurtenances	1	Each	$10,000	$ 10,000
12	0.34 MG Reservoir	1	LS	$300,000	$ 300,000
13	Concrete Base	2200	SF	$15	$ 33,000
14	AC Pavement & Repair	200	Ton	$110	$ 22,000
15	Aggregate Base	500	Ton	$40	$ 20,000
16	Import Granular Fill	1500	CY	$20	$ 30,000
17	Precast Modular Retaining Wall	500	SF	$30	$ 15,000
18	8' Security Fencing	420	LF	$25	$ 10,500
19	24' Double Swing Gate	1	Each	$1,500	$ 1,500
20	Site & Roadway Excavation & Drainage	2000	CY	$15	$ 30,000
21	Solar Powered Mixer	1	LS	$15,000	$ 15,000
22	Solar / Battery Alarm SCADA	1	LS	$20,000	$ 20,000
23	Landscaping	1	LS	$6,000	$ 6,000

Construction	**$**	**679,100**
Contingency	**$**	**68,000**
Engineering	**$**	**122,300**
Geotechnical	**$**	**20,000**
Admin / Legal	**$**	**20,000**
TOTAL ALTERNATIVE COST	**$**	**909,400**

PRELIMINARY COST ESTIMATE

Back Acres Water Reservoir - Preliminary Engineering Design Report

Tri City Water & Sanitary Authority

Alternative 2 - East of Westridge

Project No. 100.01 January 6, 2013

No.	Item	Quantity	Unit	Unit Price ($)	Total Price ($)
1	Constr. Facilities & Temp. Controls	1	LS	$75,000	$ 75,000
2	Demolition & Site Preparation	1	LS	$50,000	$ 50,000
3	Foundation Stabilization	600	CY	$30	$ 18,000
4	8-inch Waterline	900	LF	$50	$ 45,000
5	8-inch Gate Valve	7	Each	$800	$ 5,600
6	8-inch Tees	2	Each	$600	$ 1,200
7	Misc. fittings, elbows	1	LS	$10,000	$ 10,000
8	12-inch Gate Valve	1	Each	$1,200	$ 1,200
9	12-inch Drain Line	80	LF	$60	$ 4,800
10	Flap Valves	2	Each	$800	$ 1,600
11	Altitude Valve & Appurtenances	1	Each	$10,000	$ 10,000
12	0.34 MG Reservoir	1	LS	$300,000	$ 300,000
13	Concrete Base	2200	SF	$15	$ 33,000
14	AC Pavement	200	Ton	$110	$ 22,000
15	Aggregate Base	1400	Ton	$40	$ 56,000
16	Import Granular Fill	1500	CY	$20	$ 30,000
17	Precast Modular Retaining Wall	500	SF	$30	$ 15,000
18	8' Security Fencing	420	LF	$25	$ 10,500
19	24' Double Swing Gate	1	Each	$1,500	$ 1,500
20	Site & Roadway Excavation & Drainage	2500	CY	$15	$ 37,500
21	Solar Powered Mixer	1	LS	$15,000	$ 15,000
22	Solar / Battery Alarm SCADA	1	LS	$20,000	$ 20,000
23	Landscaping	1	LS	$6,000	$ 6,000

Construction	**$ 768,900**
Contingency	**$ 76,900**
Engineering	**$ 138,500**
Geotechnical	**$ 20,000**
Admin / Legal	**$ 20,000**
TOTAL ALTERNATIVE COST	**$ 1,024,300**

PRELIMINARY COST ESTIMATE

Back Acres Water Reservoir - Preliminary Engineering Design Report

Tri City Water & Sanitary Authority

Alternative 3 - NE of Westridge

Project No. 100.01 January 6, 2013

No.	Item	Quantity	Unit	Unit Price ($)	Total Price ($)
1	Constr. Facilities & Temp. Controls	1	LS	$75,000	$ 75,000
2	Demolition & Site Preparation	1	LS	$50,000	$ 50,000
3	Foundation Stabilization	750	CY	$30	$ 22,500
4	8-inch Waterline	1500	LF	$50	$ 75,000
5	8-inch Gate Valve	8	Each	$800	$ 6,400
6	8-inch Tees	2	Each	$600	$ 1,200
7	Misc. fittings, elbows	1	LS	$15,000	$ 15,000
8	12-inch Gate Valve	1	Each	$1,200	$ 1,200
9	12-inch Drain Line	80	LF	$60	$ 4,800
10	Flap Valves	2	Each	$800	$ 1,600
11	Altitude Valve & Appurtenances	1	Each	$10,000	$ 10,000
12	0.34 MG Reservoir	1	LS	$300,000	$ 300,000
13	Concrete Base	2200	SF	$15	$ 33,000
14	AC Pavement	200	Ton	$110	$ 22,000
15	Aggregate Base	1700	Ton	$40	$ 68,000
16	Import Granular Fill	1500	CY	$20	$ 30,000
17	Precast Modular Retaining Wall	500	SF	$30	$ 15,000
18	8' Security Fencing	420	LF	$25	$ 10,500
19	24' Double Swing Gate	1	Each	$1,500	$ 1,500
20	Site & Roadway Excavation & Drainage	3500	CY	$15	$ 52,500
21	Solar Powered Mixer	1	LS	$15,000	$ 15,000
22	Solar / Battery Alarm SCADA	1	LS	$20,000	$ 20,000
23	Landscaping	1	LS	$6,000	$ 6,000

Construction	**$**	**836,200**
Contingency	**$**	**83,700**
Engineering	**$**	**150,600**
Geotechnical	**$**	**20,000**
Admin / Legal	**$**	**20,000**
TOTAL ALTERNATIVE COST	**$**	**1,110,500**

Equipment Supplier & Supporting Materials

Appendix

D

TO:	**ALL BIDDING CONTRACTORS**
BID:	**BUDGETARY TANK QUOTE** **MYRTLE CREEK, OR**
DATE:	**FEBRUARY 25, 2013**

BUDGETARY PROPOSAL

TANK:

ONE (1) GLASS FUSED TO STEEL "COBALT BLUE" *AQUASTORE®* BOLTED STORAGE TANK MANUFACTURED BY CST STORAGE OF DEKALB, ILLINOIS AND DESIGNED PER AWWA D-103 09 DESIGN STANDARDS

TANK ACCESSORIES:

1. EAI TO FURNISH COMPLETE TANK AND CONCRETE FOUNDATION DESIGN SUBMITTAL STAMPED BY THE TANK MANUFACTURER'S REGISTERED STRUCTURAL ENGINEER IN THE STATE OF OREGON.

2. EAI TO PROVIDE ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT FOR THE PURPOSE OF INSTALLING THE TANK.

3. TANK EXTERIOR COLOR SHALL BE COBALT BLUE, INTERIOR COLOR SHALL BE WHITE.

4. TANK FLOOR SHALL BE CONCRETE. *CONCRETE RINGWALL FOUNDATION AND FLOOR SHALL BE PROVIDED BY OTHERS.*

5. ONE (1) CLEAR SPAN ALUMINUM GEODESIC DOME, ONE (1) 24" GRAVITY VENTILATOR, ONE (1) ACCESS HATCH, ONE (1) STAINLESS STEEL SAFETY CABLE FROM ROOF HATCH TO VENT, 35 PSF SNOW LOAD, AND A 100 MPH WIND RATING.

6. ONE (1) PASSSIVE SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM TO PROTECT INTERIOR WETTED SURFACES OF TANK.

7. ONE (1) 24" SIDEWALL MANWAY DOOR WITH DAVIT ARM IN OUTER TANK.

8. ONE (1) ALUMINUM LADDER AND GALVANIZED SAFETY CAGE WITH OSHA APPROVED STEP-OFF PLATFORM.

9. ONE (1) 6" CARBON STEEL OVERFLOW PIPE WITH INTERIOR WEIR BOX AND PIPE TERMINATING AT TWENTY-FOUR (24") INCHES ABOVE GRADE.

10. ONE (1) 8" NOZZLE FOR INLET AND ONE (1) 8" NOZZLE FOR OUTLET. NOZZLES SHALL BE LOCATED ON THE EXTERIOR OF THE TANK ONLY.

11. TANK INSTALLED PER ENGINEERING AMERICA, INC FACTORY CERTIFIED AQUASTORE BUILDERS.

12. FREIGHT TO JOBSITE INCLUDED. *OWNER TO PROVIDE FORK LIFT FOR UNLOADING TANK MATERIALS.*

13. OWNER TO STAKE OUT CETNER OF TANK LOCATION.

14. SALES TAX INCLUDED.

EXCLUDED ITEMS:

1. ALL SITE WORK, EXCAVATING, STRUCTURAL FILL BACKFILLING, ETC.
2. ANY CONCRETE FOUNDATION WORK.
3. ALL UNDERGROUND PIPING.
4. ANY SPECIAL INSPECTIONS REQUIRED BY THE OWNER/GENERAL CONTRACTOR.
5. ANY SOILS OR COMPACTION TESTING.
6. ANY UNION OR PREVAILING WAGE LABOR RATES.
7. GEOTECHNICAL REPORT.
8. ANY ELECTRICAL.
9. FILLING/DRAINNING THE TANK WITH WATER.
10. INSULATION.
11. HEATER.
12. PERMITS.
13. OVERTIME PAY.

TANK PRICING:

ONE (1) 39' DIA. BY 29' HIGH GLASS FUSED TO STEEL TANK ……. $ 230,000.00
Tank Diameter: 39.16', Tank Height: 28.43', Tank Capacity: 256,148 Gallons (0" Freeboard)

ONE (1) 39' DIA. BY 29' HIGH EPOXY COATED TO STEEL TANK ……. $ 200,800.00
Tank Diameter: 39.16', Tank Height: 28.43', Tank Capacity: 256,148 Gallons (0" Freeboard)

ONE (1) 50' DIA. BY 24' HIGH GLASS FUSED TO STEEL TANK …….……. $ 271,000.00
Tank Diameter: 50.35', Tank Height: 23.84', Tank Capacity: 355,168 Gallons (0" Freeboard)

ONE (1) 50' DIA. BY 24' HIGH EPOXY COATED TO STEEL TANK …….……. $ 233,500.00
Tank Diameter: 50.35', Tank Height: 23.84', Tank Capacity: 355,168 Gallons (0" Freeboard)

VALIDITY: Price is firm for a period of thirty (30) days. Price is subject to change due to fluctuating iron ore and aluminum price increases. Price can be held upon receipt of letter of intent from owner.

APPROVAL DRAWINGS: Shop drawings on the tank and foundation are completed and stamped by our registered structural engineer in the State of Oregon.

DELIVERY: Delivery of materials is approximately eight (8) weeks after approved shop drawings.

QUALITY: Installation service offered in the Proposal will be performed by trained personnel regularly engaged in the installation of Aquastore storage tanks as manufactured by CST Storage. All work will be performed in an excellent workmanship manner and in accordance with the tolerances and specifications called for by the manufacturer.

BONDING: Payment & Performance bond is not included, but can be provided at an additional charge. Please contact us for the additional charge.

INSURANCE: We will provide a certificate of insurance covering our portion of the work and will meet the requirements of the owner's contract documents.

After you have had an opportunity to review the above proposal and should you have questions, feel free to call me at 503-320-6891.

SINCERELY,

ENGINEERING AMERICA, INC.

TROY CAIRNS
EAI SALES

Engineering America

TO:	**ALL BIDDING CONTRACTORS**
BID:	**BUDGETARY TANK QUOTE** **TRI - CITY, OR**
DATE:	**APRIL 3, 2013**

BUDGETARY PROPOSAL

TANK:

ONE (1) GLASS FUSED TO STEEL "COBALT BLUE" *AQUASTORE®* BOLTED STORAGE TANK MANUFACTURED BY CST STORAGE OF DEKALB, ILLINOIS AND DESIGNED PER AWWA D-103 09 DESIGN STANDARDS

TANK ACCESSORIES:

1. EAI TO FURNISH COMPLETE TANK AND CONCRETE FOUNDATION DESIGN SUBMITTAL STAMPED BY THE TANK MANUFACTURER'S REGISTERED STRUCTURAL ENGINEER IN THE STATE OF OREGON.

2. EAI TO PROVIDE ALL NECESSARY MATERIAL, LABOR, AND EQUIPMENT FOR THE PURPOSE OF INSTALLING THE TANK.

3. TANK EXTERIOR COLOR SHALL BE COBALT BLUE, INTERIOR COLOR SHALL BE WHITE.

4. TANK FLOOR SHALL BE CONCRETE. *EAI SHALL PROVIDE THE CONCRETE, REBAR, AND FORMWORK. EAI ASSUMES SOIL BEARING PRESSURE OF 3,000 PSF (POUNDS PER SQUARE FOOT). FOUNDATION PRICE MAY CHANGE UPON COMPLETION OF SITE SPECIFIC GEOTECHNICAL REPORT. GEOTECHNICAL SOILS REPORT PROVIDED BY OTHERS.*

5. ONE (1) CLEAR SPAN ALUMINUM GEODESIC DOME, ONE (1) 24" GRAVITY VENTILATOR, ONE (1) ACCESS HATCH, ONE (1) STAINLESS STEEL SAFETY CABLE FROM ROOF HATCH TO VENT, 35 PSF SNOW LOAD, AND A 100 MPH WIND RATING.

6. ONE (1) PASSSIVE SACRIFICIAL ANODE CATHODIC PROTECTION SYSTEM TO PROTECT INTERIOR WETTED SURFACES OF TANK.

7. ONE (1) 24" SIDEWALL MANWAY DOOR WITH DAVIT ARM IN OUTER TANK.

8. ONE (1) ALUMINUM LADDER AND GALVANIZED SAFETY CAGE WITH OSHA APPROVED STEP-OFF PLATFORM.

9. ONE (1) 6" CARBON STEEL OVERFLOW PIPE WITH INTERIOR WEIR BOX AND PIPE TERMINATING AT TWENTY-FOUR (24") INCHES ABOVE GRADE.

10. ONE (1) 8" NOZZLE FOR INLET AND ONE (1) 8" NOZZLE FOR OUTLET. NOZZLES SHALL BE LOCATED ON THE EXTERIOR OF THE TANK ONLY.

11. TANK INSTALLED PER ENGINEERING AMERICA, INC FACTORY CERTIFIED AQUASTORE BUILDERS.

12. FREIGHT TO JOBSITE INCLUDED. *OWNER TO PROVIDE FORK LIFT FOR UNLOADING TANK MATERIALS.*

13. OWNER TO STAKE OUT CETNER OF TANK LOCATION.

EXCLUDED ITEMS:

1. ALL SITE WORK, EXCAVATING, STRUCTURAL FILL BACKFILLING, ETC.
2. ALL UNDERGROUND PIPING.
3. ANY SPECIAL INSPECTIONS REQUIRED BY THE OWNER/GENERAL CONTRACTOR.
4. ANY SOILS OR COMPACTION TESTING.
5. ANY UNION OR PREVAILING WAGE LABOR RATES.
6. GEOTECHNICAL SOILS REPORT.
7. ANY ELECTRICAL.
8. FILLING/DRAINNING THE TANK WITH WATER.
9. INSULATION.
10. HEATER.
11. PERMITS.
12. OVERTIME PAY.
13. SALES TAX.

TANK PRICING:

ONE (1) 59' DIA. BY 24' HIGH GLASS FUSED TO STEEL TANK ……. $ 415,210.00

Tank Diameter: 58.75', Tank Height: 23.84', Tank Capacity: 483,422 Gallons (0" Freeboard)

ONE (1) 59' DIA. BY 24' HIGH EPOXY COATED TO STEEL TANK ……. $ 369,425.00

Tank Diameter: 58.75', Tank Height: 23.84', Tank Capacity: 483,422 Gallons (0" Freeboard)

VALIDITY: Price is firm for a period of thirty (30) days. Price is subject to change due to fluctuating iron ore and aluminum price increases. Price can be held upon receipt of letter of intent from owner.

APPROVAL DRAWINGS: Shop drawings on the tank and foundation are completed and stamped by our registered structural engineer in the State of Oregon.

DELIVERY: Delivery of materials is approximately eight (8) weeks after approved shop drawings.

QUALITY: Installation service offered in the Proposal will be performed by trained personnel regularly engaged in the installation of Aquastore storage tanks as manufactured by CST Storage. All work will be performed in an excellent workmanship manner and in accordance with the tolerances and specifications called for by the manufacturer.

BONDING: Payment & Performance bond is not included, but can be provided at an additional charge. Please contact us for the additional charge.

INSURANCE: We will provide a certificate of insurance covering our portion of the work and will meet the requirements of the owner's contract documents.

After you have had an opportunity to review the above proposal and should you have questions, feel free to call me at 503-320-6891.

SINCERELY,

ENGINEERING AMERICA, INC.

TROY CAIRNS
EAI SALES

647 Hale Ave N
Oakdale, MN 55128
Ph: 651-777-4041
Fax: 651-777-5312
www.engamerica.com

18900 W 158th Street, Suite E
Olathe, KS 66062
Ph: 913-782-7774
Fax: 913-782-7776
www.eai-central.com

6706 N Franklin
Loveland, CO 80538
Ph: 970-962-9400
Fax: 970-962-9412
www.eaiwest.com

300 S Hamilton Place
Gilbert, AZ 85233
Ph: 480-895-1106
Fax: 480-802-7704
www.engamerica.com

Medora Corporation
3225 Highway 22 • Dickinson, ND 58601
Tel: (701) 225-4495 • www.MedoraCo.com

Potable Water Quotation

Date: 04/03/2013

Re: Existing Back Acres Water Storage Tank and New Back Acres Water Storage Tank

Project #: 5342

To: Sean Moran, PE
Midea Development, LLC
lordofkarma@hotmail.com • 541-404-3729

From: Jim Joyce, PumpTech Inc., Medora Corporation local representative, Bellevue WA
jjoyce@pumptechnw.com • 425-644-8501

Harvey Hibl, Medora Corporation West U.S. Manager, Westminster CO
harvey.hibl@medoraco.com • 303-469-4001

Amy Dinius, Medora Corporation Sales Engineering Dept., Dickinson ND
amy.dinius@medoraco.com • 866-437-8076

Dear Sean,

Thank you for requesting this quotation. We are very pleased to work with your City to provide high quality potable water circulation equipment at an economical price. This project fits our capabilities well, and we will do everything possible to ensure your project flows smoothly and meets your goals and expectations. Please contact me or any of the contacts mentioned above with any questions. Thank you, Amy

PROJECT DESCRIPTION

1. Tank Names & Location

Existing Back Acres Water Storage Tank and New Back Acres Water Storage Tank are located in Myrtle Creek, OR.

2. Tank Descriptions

Existing Back Acres Water Storage Tank description: Welded-steel, ground storage tank, volume given 500,000 gallons however volume rated at 107,000 gallons, height 16 feet, diameter 33.75 feet, flow rate 73,000 gallons per day, max fill rate 160 gallons per minute.

New Back Acres Water Storage Tank description: New tank in the design phase, glass fused to steel, ground storage tank, volume given 355,000 gallons however volume rated at 425,700 gallons, height 29 feet, diameter 50 feet, flow rate 73,000 gallons per day, max fill rate 160 gallons per minute.

3. Project Objectives

The objective is to provide thorough mixing of the tanks to reduce water age, stagnation, stratification, short circuiting, and cold-climate ice buildup. Thorough mixing not only improves water quality, it also allows for representative sampling of the tank water, and disinfectant boosting if ever needed.

4. Medora Co. Recommendation/System Design for this Installation

To meet the above objectives, we recommend the installation of two (2) SB500PWc v18 machines, placing one unit in each tank.

Note: The minimum hatch size for this installation is 18" diameter with unobstructed clearance.

Performance Guaranty: This mixer will completely mix the subject tank. In continuous operation, (1) at least once per 24 hours all water temperatures within the tank shall converge to within 0.8 degrees C, and (2) at least once per 72 hours all chlorine concentrations within the tank shall converge to within 0.18 mg/l.

5. Equipment Description

SB500PWc v18: 500 gpm (0.72 MGD) total flow, 316-stainless steel and non-corrosion polymer construction, 25-year life high-efficiency brushless electric motor designed to provide day and night operation with a solar-charged battery power system, digital control system for intelligent power management specific to this application, six parameter SCADA outputs, two (2) 80-watt solar panels and control box mounted on a 316SS pedestal, 6” diameter fluid intake hose, and fluid intake injection assembly (injection hose from the intake to the top of the tank). NOTE: (A) This machine is a special collapsible unit; (B) There is minimal impact from mounting PV panels and control box (typically only one penetration), and the integrity of the tank's coating is maintained; (C) This model can be installed through a hatch with 18" diameter minimum unobstructed clearance; (D) See General Provisions - Medora Corporation's Limited Replacement Warranty for information on the most extensive warranty in the industry. Operating footprint: 96 inches diameter. Shipping crate size: 72 inches length x 48 inches width x 59 inches height. Shipping weight: 435 lbs.

6. Equipment Cost

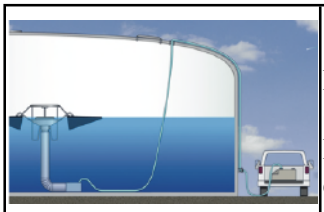
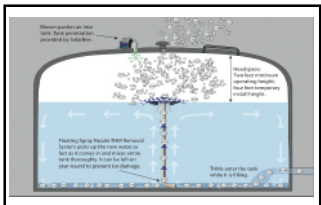
Solar Machine

Quantity	Equipment Description	Purchase Cost Each	Purchase Cost Total
2	SB500PWc v18 Machines. FOB Medora factory in Dickinson, ND	$20,440	$40,880
		Total for Equipment:	$40,880

This price expires in **90 days** per the terms below. For budgeting purposes, please add **10%** for inflation for orders after that time. Factory price adjustments due to inflation are usually required once or twice per year.

Installation of this equipment is not complicated, and well within the scope of work most cities or contractors can perform. An installation manual is provided with all machines. Placement right under a hatch is usually fine, however if this a chloramine system with nitrification problems, then the unit should be placed at or near the lowest part of the tank floor. If a "wet install" is desired, in- tank boats or divers can be used, or see the optional factory delivery and placement in the next section.

7. Machine Options

Options for the Solar-Powered Models		
Factory Delivery and Placement	Includes delivery and placement of the above equipment into the tank, and supplying any crane or lifting assistance that may be needed. It also includes bringing the electric cord from the mixer to the outside of the tank via a through-wall fitting Medora will supply and install through a tank wall, roof, or vertical side of a raised hatch. **Note:** a multiple unit delivery discount has been applied, both units must be installed during the same Factory Crew site visit for the discount to apply.	Valid for this project only For one unit $10,355, for two units $9,220 ea = $18,440
SCADA	*All v18 models come standard with a SCADA brain-board with six outputs*. For on-site communication options, please contact our SCADA Engineering Department.	Please request option list and pricing.
LED RPM Indicator	*Recommended when SCADA is not available.* An electronic pulsing monitor is added to the digital controller and a flashing green LED beacon is located outside of the tank. The LED indicates the SolarBee impeller rotational speed, and the beacon can be directionally targeted for ground level viewing.	$950 per mixer.
Beekeeper Service Program	The Beekeeper is a program that utilizes Factory Crews to service and maintain proprietary designed equipment. The Beekeeper provides for more than just maintenance and service: • It extends the warranty during the term of the Beekeeper • It covers damage from Acts of God and vandalism • It provides for power system upgrades and updates • It provides hardware, firmware, and software for computer upgrades • It provides scientific and technical support • It provides for scheduled and unscheduled field service calls • and more, please request the Beekeeper brochure for more details	Call for Pricing.
 Portable Disinfectant Boost System	*Consider when occasional on-site boosting is desired.* Portable Disinfectant Boost System (designed to be installed in the back of a pickup), safe, durable chemical transfer system to boost disinfectant in potable water reservoirs. Boosting rate up to 4 gpm, one system can treat multiple tanks, approximate dimensions: 20" W x 52" L x 20" H. Air compressor (4 cfm @ 60 psi) is required to operate the air-powered diaphragm pump; air compressor not included. Brochure available upon request.	$6,300
 THM Removal System	Effective and economical spray nozzle system that works in conjunction with a GridBee / SolarBee mixer to strip TTHM from potable water storage tanks and clearwells. For more information on the THM removal system, please contact us or visit MedoraCo.com.	Call for pricing.

8. General Provisions

A. Equipment Purchase, Not a Construction Project: This equipment is portable, and can be easily relocated or removed entirely from the premises at any time. It does not become an integral part of any building or other structure, or part of "real estate." Therefore, to purchase it, the City should use the same procedure as for purchasing other portable equipment, such as a forklift, a drill press, or an office desk. Medora reserves the right not to accept an order if the purchase is incorrectly characterized as a "construction" project." Medora has not found any State or other jurisdiction where construction or contractor statutes apply to portable equipment that is sold by a factory, with on-site final assembly and placement performed by factory personnel.

B. Assumptions: This quotation may be based on worksheets, calculations or other information that has been provided by the City. The City should bring to Medora's attention any discrepancies, errors in data, or false assumption that Medora may have made while preparing this quotation.

C. Expiration: This quotation expires in 90 days, or on the date of any new quotation for this project, whichever is sooner.

D. Delivery Time: Delivery time must fit the Medora crew schedule, and usually is 60-150 days.

E. Payment Terms: For a federal, state, or local government purchaser with a good credit rating, full payment is due in US dollars 30 days after invoice date, which is generally the date when the goods leave the Medora factory. For a non-government purchaser, full payment must be made by credit card or cashier's check before the goods leave the Medora factory though, in some cases, based on availability of a payment bonding or a bank Letter of Credit, 30 day credit terms may be extended upon special request by the purchaser. If there are any issues with these payment terms, please do not rely on this quotation until the issues have been resolved with Medora.

F. Add for Taxes and Any Governmental Fees: Except as indicated above, no taxes, tariffs or other governmental fees are included in the quote shown above, nor are there any costs added for special insurance coverage the customer may require. It is the customer's responsibility to pay all local, state, and federal taxes, including, sales and use taxes, business privilege taxes, and fees of all types relating to this sale, whether they are imposed on either Medora or the customer, or whether these taxes and fees are learned about after the customer orders the equipment. The customer's purchase order should indicate any taxes or fees due on equipment and/or services, and whether the customer will pay them directly to the governing body or include the tax payment with the purchase for Medora to submit them to the governing body.

G. Add for Special Insurance Requirements: Medora Corporation maintains adequate liability and workman's compensation insurance to generally comply with its requirements for doing business in all fifty U.S. states, and will provide at no charge certificates of insurance when requested. However, if additional insurance or endorsements beyond the company's standard policy are required by the customer, then the costs of those additional provisions and/or endorsements will be invoiced to the customer after the costs become known.

H. Add for Special Training, Safety, Signage, or Other Requirements: Medora has a very strong safety training program for its employees. If any special training classes for Medora personnel are required by the customer, please notify Medora well in advance. The cost of this training will be added to this quotation or invoiced to the customer separately. The same applies to any other special requirements the customer may have, including providing of project signage or any other requirement.

I. Safe and Accessible Tank Condition Required. This quotation is based on the best information made available to us by the above date. If this equipment is ordered, Medora's engineering and installation team will need detail information and photographs to plan the installation. If the detail information changes the installation scope significantly, Medora reserves the right to withdraw or alter this quotation, even if the equipment has already been ordered. To avoid surprises, the City should supply detailed tank information and photos as soon as possible. To ensure the safety of Medora's installation crews, it is the City's responsibility to make sure that all antennas (radio, cell phone, other) located at or near the tank site are inactivated during the installation and/or service of this equipment.

J. Customer to Follow Medora's Maintenance and Safety Guidelines: The customer agrees to follow proper maintenance, operating, and safety instructions regarding the equipment as contained in the safety manual that accompanies the equipment or is sent to the customer's address.

K. Regulatory Compliance. The customer must comply with all applicable Federal and State governmental regulations. It is the customer's sole responsibility to inquire about governmental regulations and ensure that GridBee and SolarBee equipment is deployed and maintained so as to remain in compliance with these regulations and guidelines, and to hold Medora harmless from any liability caused by non-compliance with these regulations and guidelines.

L. Medora Corporation's Limited Replacement Warranty:

All new and factory-refurbished SolarBee™ equipment is warranted to be free of defective parts, materials, and workmanship for a period of 2 years from the date of installation. In addition, the SolarBee brushless motor is warranted for a period of 10 years from the date of installation. Photovoltaic modules (solar panels) carry manufacturer warranties, some ranging up to 25 years (see manufacturer's warranty for details). This warranty is valid only for SolarBee equipment used in accordance with the owner's manual, and consistent with any initial and ongoing factory recommendations. This warranty is limited to the repair or replacement of defective components, at Medora's discretion. The first 2 years of warranty include parts and onsite labor if SolarBee delivery and installation was purchased. Parts and in-factory service are included if the equipment was self-installed. In lieu of sending a factory service crew to the site for minor repairs, Medora may choose to send the replacement parts to the owner postage-paid and, in some cases, may pay the owner a reasonable labor allowance to install the parts.

Except as stated above, Medora and its affiliates expressly disclaim any and all express or implied conditions, representations and warranties, on products furnished hereunder, including without limitation all implied warranties of merchantability or fitness for a particular purpose. Please consult your state law regarding this warranty as certain states may have legal provisions affecting the scope of this warranty.

M. Other Limitation of Liability. Many of the employees at Medora Corporation have extensive scientific and practical knowledge relating to solving water quality problems. From time to time, they may offer solicited or unsolicited advice, ideas, judgment or opinions on how to deal with certain situations, none of which offers a guarantee of future events. Due to the many factors, complexity and uncertainty involved in solving water problems, the City agrees to release Medora Corporation and its affiliates, employees and agents from and against any and all claims, liabilities, costs and expenses which the City may incur or become subject to related to or arising out of any services or products furnished by Medora Corporation to the City, except to the extent that any claim, liability or expense results from the gross negligence or intentional misconduct of Medora as determined in a final judgment by a court of competent jurisdiction. In no event will Medora Corporation or its affiliates be liable for any damages caused by failure of buyer to perform buyer's responsibilities or for failure to follow Medora Corporation's advice. In no event will Medora Corporation or its affiliates be liable for any lost profits or use or other punitive, special, exemplary, consequential, incidental or indirect damages, however caused, on any theory of liability, whether or not Medora Corporation has been advised of such damages, or reasonably could have foreseen the possibility of such damages, or for any claim against buyer by another party.

N. Medora Corporation's Lease Provisions:

Standard Agreement: Pricing in the above quotation is based on 5 years, 60 monthly payments, and a $0 down payment. For a quotation based on other terms, please call Medora Corporation, at 1-866-437-8076.

Non-Appropriation Provision: Lessee's (borrower's) payment obligation will terminate if the lessee fails to appropriate in future budgets the funds needed to make the lease payments. Because of this non-appropriation provision, neither the lease nor the lease payments are considered debt, and payments can be made from the savings in your operating budget.

Maintenance of the Equipment: Lessee is to provide minor routine care and maintenance of the Equipment as described in the owners manual. The Beekeeper Service Program is required, and is included in the cost shown above for the term of the lease. See above for description of the Beekeeper program.

Additional Lease Provisions: If the lease option is selected, a master equipment lease/purchase agreement will be sent to lessee, that shall cover all terms and conditions of the lease.

9. To Accept This Quotation

To order the equipment, please issue a purchase order to Medora Corporation, 3225 Hwy. 22, Dickinson, ND 58601. The purchase order can be mailed to the address above, faxed to 866-662-5052, or emailed to the home office at orderprocessing@medoraco.com. The purchase order should refer to the date of this quotation, and will be assumed to include this entire quotation by reference.

If purchase orders are not utilized, please sign and date below, provide billing information, and fax to 866-662-5052 or email to orderprocessing@medoraco.com.

Signing below acknowledges acceptance of this quotation. Please indicate which one of the following options you have chosen.

☐ Solar Machine Purchase

☐ Machine Option_____

_____	_____
Signature	Date
_____	_____
Printed Name	Title

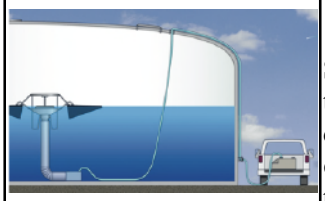
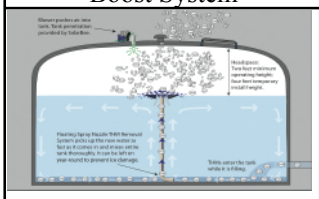
Medora Corporation
3225 Highway 22 • Dickinson, ND 58601
Tel: (701) 225-4495 • www.MedoraCo.com

Budget Estimate for GS-12-120v Potable Tank Mixer - Last updated: Feb 1, 2013

Equipment Description	Purchase Cost Each
GS-12-120v mixer with 75 feet of submersible cable. FOB Factory (estimated UPS $200). Note: Please verify price before ordering.	**$7,800**

The GS-12 mixer performance is guaranteed. It is the most effective and competitive mixer on the market. Full specifications are available at *www.MedoraCo.com*. Upon request, independent Computational Fluid Dynamics (CFD) modeling can be provided supporting an upward flow rate of 38,000 gpm in a 5 MG tank of dimensions 145 ft diameter x 40.5 ft tall, with water of 1.0000 specific gravity.

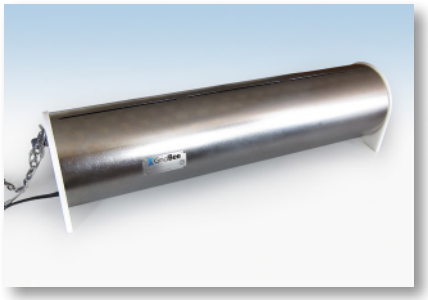
Installing this equipment is well within the scope of work that most cities and contractors can perform. An installation manual is provided with every machine. Placement under the hatch is usually fine; however, if this a chloramine system with nitrification problems, then the unit should be placed at or near the lowest part of the tank floor.

Optional Items		
 GS-12 Control Box with SCADA Monitoring	Control Box: NEMA 4X enclosure, UL listed, HOA switch, contactor for mixer control, 15-Amp GFCI, run indicator light, grounding lug, 120 VAC male molded plug, and locking latch for security. SCADA: 4-20 mAmp current transducer provides analog output for motor current which allows for monitoring proper operation, and a 24 VDC relay for remote on / off control of the mixer.	$950 Shipped with mixer for electrical contractor installation
Chemical Injection Line Kit	75 ft long x 1/2" ID injection hose kit connects to fitting on the intake of mixer and to top of tank; kit is shipped loose with mixer for customer / contractor installation.	$300
GS-12 Extended Warranty	Optional 7-year factory warranty, in lieu of standard 2-year warranty. This is a full-replacement warranty on the mixer, control box, and wiring.	$1,200
 Portable Disinfectant Boost System	*Consider when occasional on-site boosting is desired.* Portable Disinfectant Boost System (designed to be installed in the back of a pickup) is a safe, durable chemical transfer system to boost disinfectant in potable water reservoirs. Approximate dimensions: 20" W x 52" L x 20" H. With boosting rates up to 4 gpm, one system can treat multiple tanks. An air compressor (4 cfm @ 60 psi) is required to operate the air-powered diaphragm pump; electric or engine drven air compressor not included.	$6,300 FOB Factory
 THM Removal System	Proven and economical Spray Nozzle THM Removal Systems that work in conjunction with a GridBee / SolarBee mixer to strip TTHM from potable water storage tanks and clearwells. For more information on the THM removal systems, please contact us or visit *www.MedoraCo.com.*	Call for pricing.
 Factory Delivery and Placement	Includes delivery and placement of the mixer into the tank by a factory crew that is trained to work at heights, over water and in confined space with special equipment designed for this type of installation. Includes bringing the submersible electric cable from the mixer to the outside of the tank via a through fitting, which typically is installed through the roof or the vertical side of a raised hatch, cable is terminated in a junction box at the top of the tank.	$3,000 to $15,000 Varies with tank height and tank construction

GridBee GS-12 Submersible Mixer

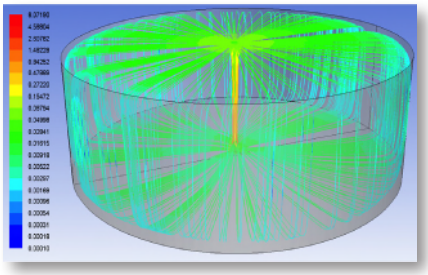
GridBee GS-12 submersible mixer thoroughly mixes potable water storage tanks of a wide size range - especially the bottom three feet, the most critical part of the tank. Economical to purchase and operate, the grid-powered GS-12 is easily installed by lowering through any 12" or larger tank hatch. There is no need to enter or drain the tank.

Features & benefits of the GS-12 submersible mixer:



- Eliminate ice damage to tanks in cold climates
- Provide uniform water age and disinfectant distribution
- Prevent stagnation, thermal stratification, and short-circuiting
- Reduce nitrification in chloraminated systems
- Use less disinfectant and produce fewer disinfection byproducts
- Impact the tank boundry layers where bacteria builds up

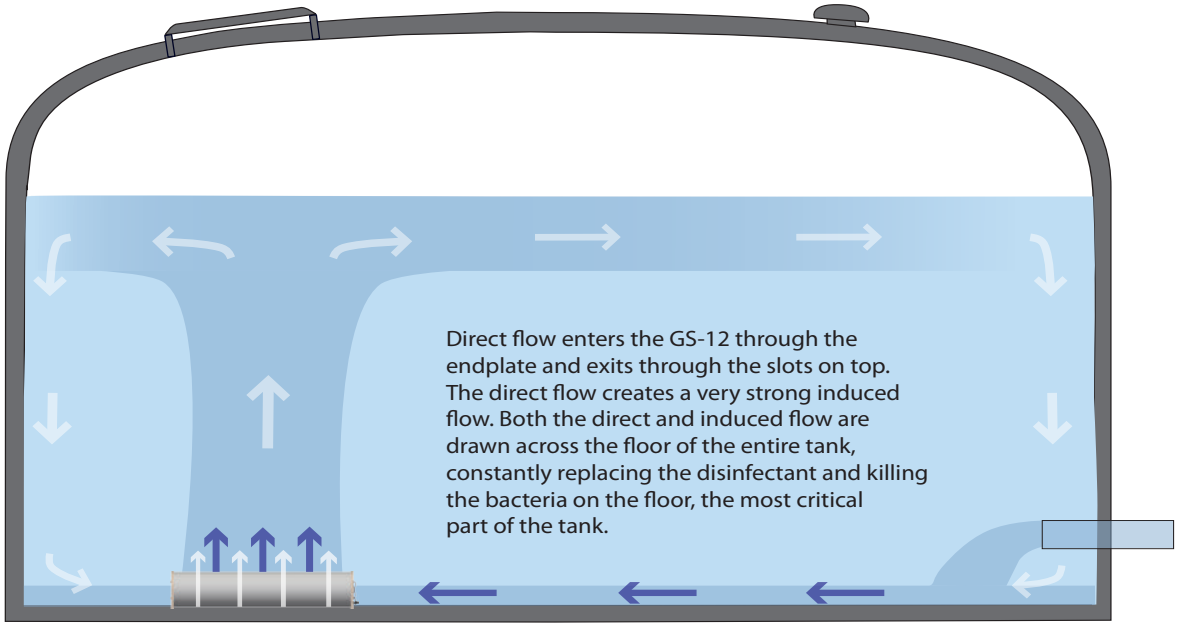
- Low power consumption
- Low-impact feet and endcaps will not damage interior tank coatings
- Certified to NSF / ANSI Std 61-G
- Optional NEMA 4X control box with SCADA monitoring
- Compatible with disinfectant boost and THM removal systems



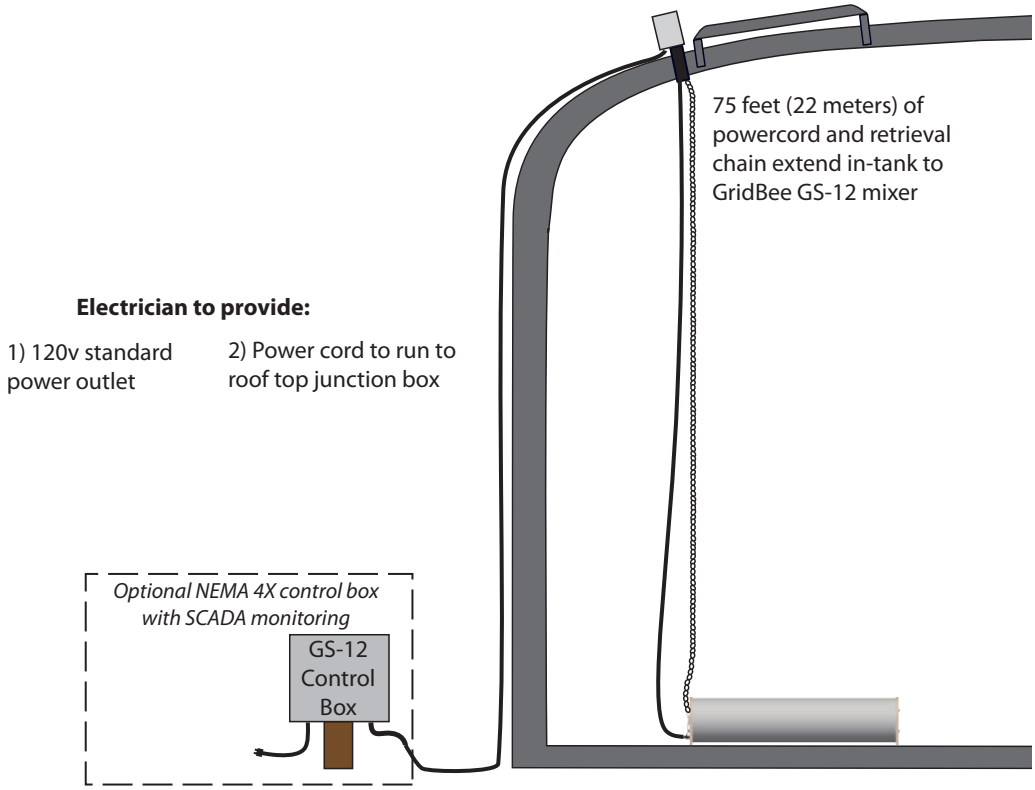
GS-12 in 5MG Reservoir

Specifications:

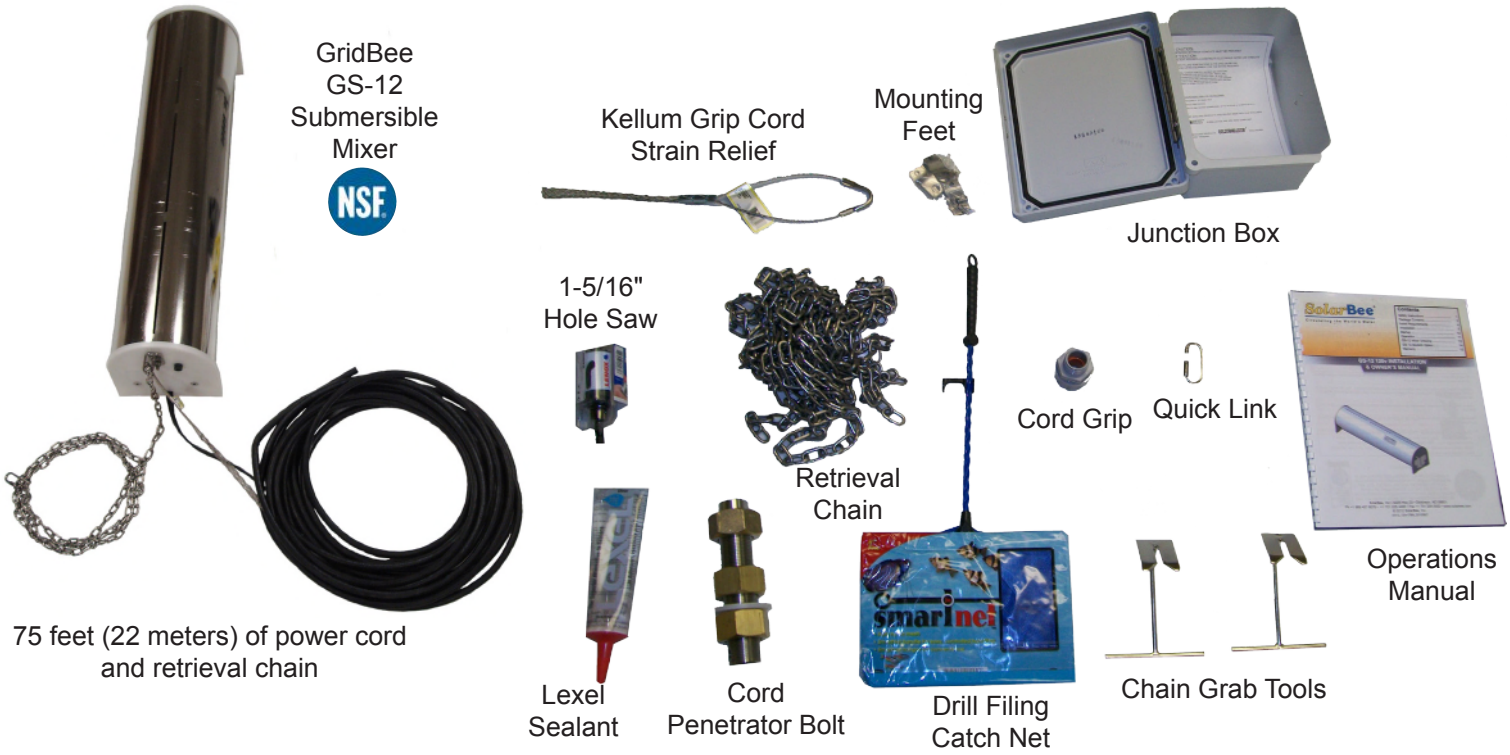
- Dimensions: 36 inches (92 cm) long, 11.5 inches (30 cm) diameter
- Weight: 70 pounds (32 kg); shipping weight 110 pounds (50 kg)
- 120v option draws 10 amps, requires 15 amp delay fuse or 20 amp standard fuse (48v and 240v options available)
- 2-year parts and labor warranty



Installation Overview



Package Contents



SolarBee® and GridBee® are brands of Medora Corporation

Medora Corporation
3225 Hwy 22 • Dickinson, ND 58601
Ph +1 866 437 8076 • www.medoraco.com
GS12_20130207 • © 2013 Medora Corporation

Locally Represented By:

SolarBee®

Circulating the World's Water

POTABLE WATER MIXERS

Why Mix Your Potable Tank?

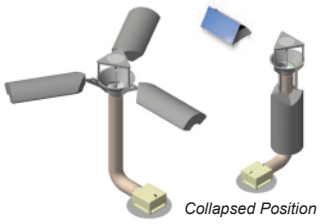
Active mixing in water storage tanks ensures uniform distribution of disinfectants and representative sampling. Well-mixed tanks consume less disinfectant chemical, produce fewer disinfection by-products, and eliminate the need for energy-intensive and costly deep-cycling or flushing.

Stagnation in Potable Water Storage Reservoirs Can Cause:

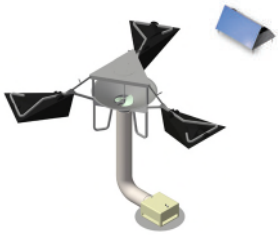
- Loss of residual disinfectant (chlorine or chloramine)
- Inconsistent water age, taste and odors
- Thermal stratification - even 0.1º C differential can inhibit mixing effects of normal inflow and outflow
- Nitrification and high heterotrophic plate counts
- Excessive ice buildup and tank damage in cold climates

SolarBee Offers a Complete Line of Potable Mixers

Mix Any Size and Shape of Tank, Corner to Corner



SB500PWc
SB1250PWc



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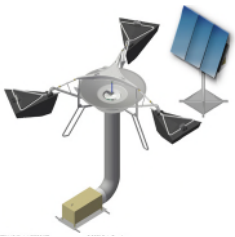

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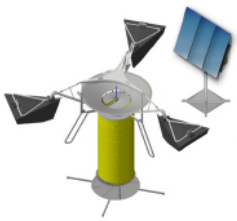

SB10000PW

Benefits of SolarBee's Potable Water Mixing:

- Uniform distribution of disinfectants, consistent residual readings, representative sampling
- Impacts the tank boundry layers where the bacteria build up, provides uniform water age
- Prevents stagnation, thermal stratification, and short-circuiting
- Reduces nitrification and high heterotrophic plate counts
- Reduces ice buildup and tank damage in cold climates

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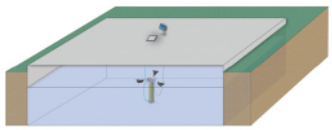
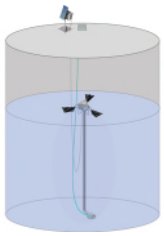
Features of SolarBee Mixing Equipment:

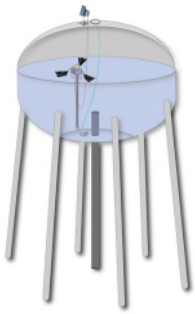
- Operates day and night on solar power or low energy grid power
- Collapsible design allows for customer or factory installation
- Fits through hatches as small as 18" diameter
- Certified to NSF / ANSI Std 61-G
- Injection system provided for boosting
- One moving part / 25 year expected life
- Self-adjusts for varying water levels
- SCADA outputs for monitoring
- Safe low voltage in the tank



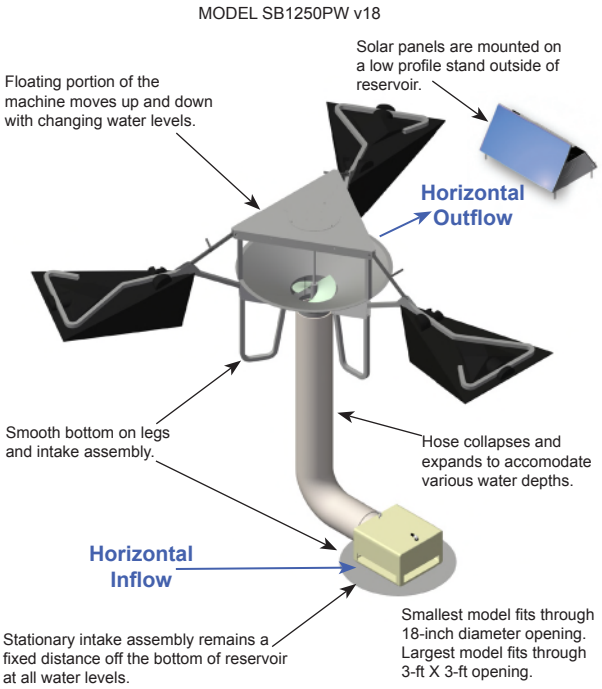
Underground Storage



Ground Storage

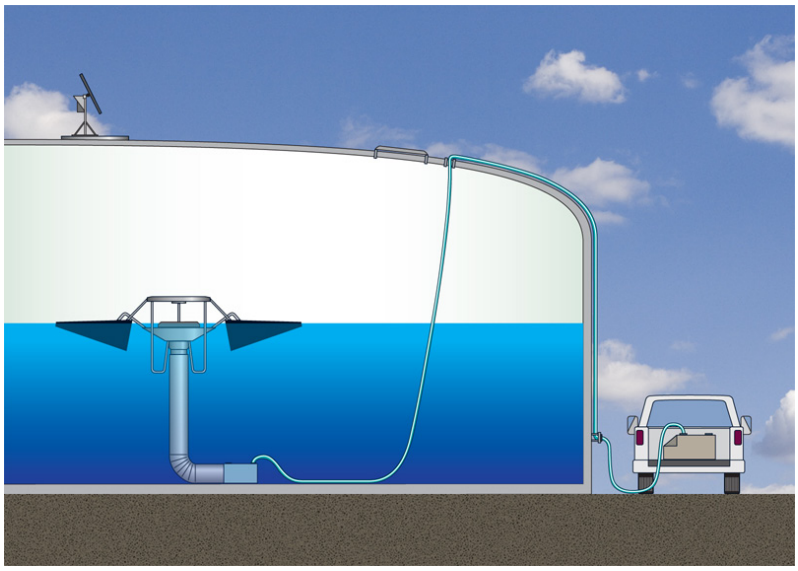


Elevated Storage



Mix First, Then Boost!

Frequent boosting with small doses of chlorine is far less costly than having a major problem occur in a tank. All SolarBee potable water mixers are equipped with chemical injection capability, and we offer an optional Chlorine Boost System accessory product to allow you to dose small amounts of chlorine as required to maintain your desired chlorine residual level. The Chlorine Boost System is a portable, air-operated chlorine injection system. It is designed to be mounted in the back of a pickup truck, allowing a single operator to safely and reliably boost multiple tanks in one day from ground level. SolarBee mixing, frequent sampling, and the Chlorine Boost System, helps to ensure water quality compliance.



See what SolarBee's potable tank mixing can do for you.
Watch the video at www.potable.solarbee.com/video

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