Demonstration Project for Lewiston Park Mutual Water Company Alternatives Analysis for Improved Drinking Water Quality

Technical Assistance for Disadvantaged Water and Wastewater Providers

North Coast Resource Partnership

California Department of Water Resources

September 2014

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1. Introduction

The Lewiston Park Mutual Water Company (LPMWC) is a small community located between Trinity Dam Blvd. and Lewiston Road, about 25 miles Northwest of Redding, and 8 miles Southeast of Weaverville, off Highway 299 in Trinity County, California. A map of the project location is shown in **Figure 1** in **Appendix A**. The LPMWC provides drinking water to 167 connections and approximately 500 residents. The system was originally built in the 1950's to service dam workers.

The water system is supplied by five groundwater wells and a surface water treatment plant (WTP) with a permitted diversion from the Trinity River. The water system has one redwood storage tank with a capacity of 150,000 gallons. Historically, water demands have been met by the groundwater wells for the majority of the year. However, during peak usage months (summer), the LPMWC must rely on surface water from the Trinity River to meet demands. The LPMWC's water treatment plant is well past its useful life, and is not in compliance with the Surface Water Treatment Rule and does not meet Title 22 Standards. During the summer months when the water supply is augmented with surface water, the system must remain under a continuing Boil Order.

1.1 Purpose of this report

The purpose of the report is to demonstrate the use of tools from the Small Community Toolbox and to further the infrastructure improvement goals for Lewiston Park Mutual Water Company. This report serves as an evaluation of the cost-benefit of several alternatives to improve the drinking water quality of the LPMWC. These alternatives include:

- Improving the existing water treatment plant so that it can provide finished water compliant with current State of California standards
- Construction of a new water treatment plant
- Consolidation with the neighboring Lewiston Community Services District's (LCSD) water system

This report will also serve as a "Preliminary Engineering Report", which is an element required by the California State Water Resources Control Board, Division of Drinking Water (DDW) (formerly California Department of Public Health) for the Agency's application for project funding under the Safe Drinking Water State Revolving Fund (SDWSRF).

1.2 Scope and limitations

This report was prepared by Water Works Engineers and reviewed by GHD for the North Coast Resource Partnership. The Lewiston Park Mutual Water Company has signed a participation agreement relating to the demonstration project that is the subject of this report. It should be emphasized that the report is to be used as an example of how tools and processes can be used to help further infrastructure improvement projects for a variety of communities throughout the North Coast region.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. This report has been prepared based on information provided by others, which has not been independently verified or checked.

Any cost estimates presented in this report or through related Toolbox elements are for conceptual purposes only. Actual prices, costs and other variables may be different at the time of an actual project and so are to those used to prepare the Cost Estimate and may change. Actual costs will depend on final project configuration and requirements. There is no warranty or guarantee that the project as currently conceived can or will be undertaken at a cost which is the same or less than costs that may be inferred from this report.

2. Use of the Small Community Toolbox

This Small Community Toolbox provides resources and references that allow small communities to approach the management of local water and wastewater infrastructure in a systematic fashion. The Toolbox is not a substitute for professional assistance with operations, management, engineering and legal issues. Rather it is intended to help small utilities develop a “first order” understanding of what their options are, how they should begin to budget, and how to get help.

The Small Community Toolbox is organized around the concept of the Utility Management Cycle illustrated in **Figure 2.1**.

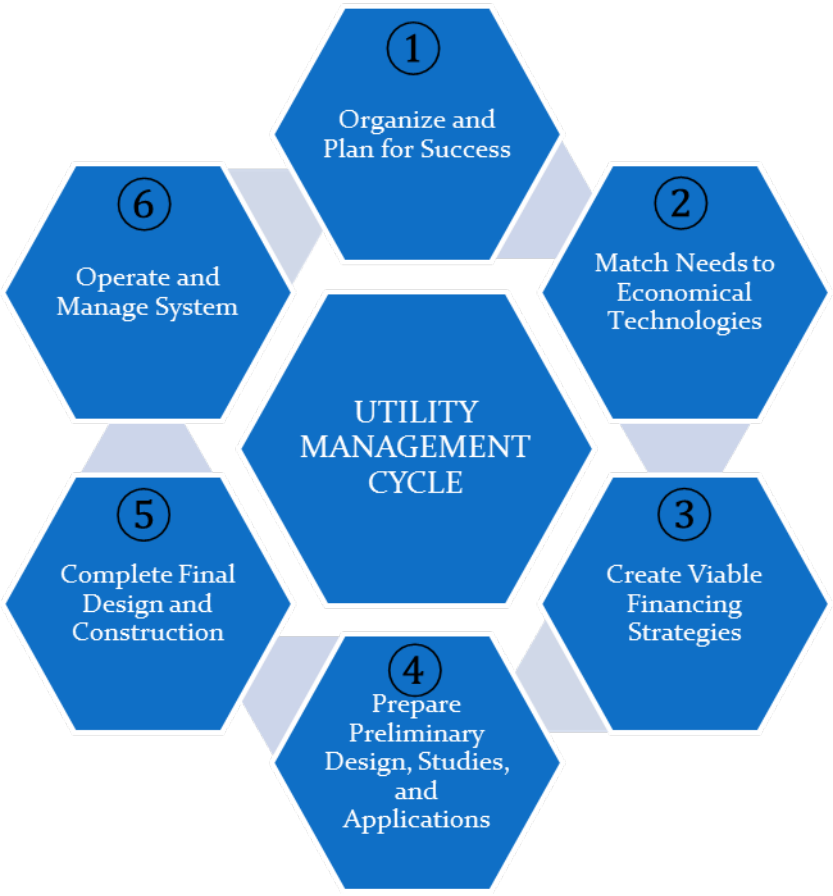


Figure 2.1 Utility Management Cycle

Individual tools have been prepared for each of the elements of the Utility Management Cycle which are summarized in **Table 2.1**. The tools used for this demonstration project are highlighted throughout this report. The Small Community Toolbox summaries should be referenced for additional information regarding the tools and their use.

Table 2.1 Small Community Toolbox Elements

Utility Management Cycle Element	Toolbox Element	What it is and How it can be Used
Utility Management Cycle Element 1: *Organize and Plan for Success*	**1.1:** Community Networking Directory:	A contacts database of willing participants interested in collaboration for advice and assistance.
	1.2: Governance Summaries:	An overview of options, benefits, and steps required to form various types of service entities.
	1.3: GIS Layers:	Census, legislative, and other public data to help agencies access information needed for applications.
Utility Management Cycle Element 2: *Match Needs to Economical Technologies*	**2.1:** Technology Overviews:	Overviews of common issues, technologies, and evaluation factors to help select alternatives.
	2.2: General Cost Estimating Charts:	Cost estimating charts to help develop order of magnitude estimates for various types and sizes of infrastructure to begin scoping overall funding strategies.
Utility Management Cycle Element 3: *Create Viable Financing Strategies*	**3.1:** Funding Program Summaries:	A one-stop information shop about funding programs suited to small community infrastructure projects.
	3.2: Capital Recovery Tables:	Lookup tables to translate the portion of total project costs not paid by grant into annual debt service requirements met through a revenue mechanism.
	3.3: Financing District Summaries:	Summary of strategy options for generating revenue to pay the annual debt service.
	3.4: Cash Flow Considerations:	Assists entities in understanding the funds needed to move a project through planning, design, and construction
Utility Management Cycle Element 4: *Prepare Preliminary Design, Studies, and Applications*	**4.1:** Consolidated Preliminary Engineering Report Template:	Consolidated report outline, with model tables that will meet the needs commonly used funding programs.
	4.2: CEQA/NEPA Exemptions and Checklists:	Summary of CEQA/NEPA exemptions and checklists to aid in meeting State and Federal environmental requirements and funding program requirements.
	4.3: Common Permit Triggers:	Summary chart of typical project components that often trigger different types of permits.
Utility Management Cycle Element 5: *Complete Final Design and Construction*	**5.1:** Guidance for Hiring Professionals:	As a project moves from initial planning towards implementation, detailed, community-specific designs are required and communities will need to retain professional support.
	5.2: Public Bidding Process Overview:	Understanding how the public bidding process works, how to set up a successful project bid, and how the low bid contractor is selected
Utility Management Cycle Element 6: *Operate and Manage System*	**6.1:** Technical, Managerial, and Financial (TMF) Resources:	Tools to help agencies be organized and managed to improve overall operations and funding competitiveness.
	6.2: Regulatory Resources:	Sources to provide information to the utility operator on various federal and state regulations.
	6.3: Rate Setting Guidance:	Linking the costs of projects to the need to rate increases and methods to set and change rates
	6.4: Capital Improvement Planning Resources:	Part of the on-going Utility Management Cycle of planning for future system improvements

3. Existing Water System Description

3.1 Service Area

The LPMWC provides drinking water to 167 connections and approximately 500 residents. The service connections are primarily residential with eight non-residential connections including the Elementary School, the Old Schoolhouse Library, Fabtron, Bear Mechanics Weld, the Community Center, the Volunteer Fire Department, the Community Church, and the Veterinary Office. There are also several private small-scale agricultural users within the service area. LPMWC is currently in the process of installing water meters, but until meters are installed on all connections, the system will remain a flat rate utility.

3.2 Water Demand

Based on data from 2010, 2011, and 2014, the current average day demand is 357,077 gallons or approximately 0.36 mgd. At a current population of 500 and 167 connections, this equates to 715 gallons per capita day (gpcd) and 2138 gpd per connection. The maximum day demand (MDD) is 535,616 gallons or 372 gpm and 3207 gpd per connection. These are extremely high water usage rates that are well above typical demand values for similar communities. In comparison, the MDD for a metered water system with 167 connections is estimated at as high as 200 gpm (288,000 gpd, or 1725 gpd/connection) according to Chart 1 of the 2000 Waterworks Standards. An additional comparison is the neighboring community of Weaverville (metered), which has a MDD of 2,100,000 gpd with 1626 service connections, or 1292 gpd/connection. Water demand data for the LPMWC is summarized in **Table 3.1** below.

Table 3.1 Water Demand Data for LPMWC

Existing Demand	Average Day Demand		Maximum Day Demand		Peak Hour Demand	
	(gpd)	(gpm)	(gpd)	(gpm)	(gph)	(gpm)
Demand per Connection	2138	1.49	3207	2.23	200	3.34
Total Demand	357,077	248	535,616	372	33,476	558

3.3 Raw Water Supply

The water system is supplied by five groundwater wells and a surface water treatment plant with a permitted diversion from the Trinity River. The water system has one redwood storage tank with a capacity of 150,000 gallons. The wells' production capacities vary due to fluctuations of the groundwater table. As of June 2014 (under drought conditions), the wells were capable of producing flows significantly less than the historically reported capacities. The non-drought and drought condition well capacities are listed below in **Table 3.2**.

To supplement the groundwater during the summer months, surface water is pumped to the water treatment plant from an infiltration gallery adjacent to the Trinity River. The LPMWC has a permitted surface water right of 192 gpm from the Trinity River. The infiltration gallery serves a raw water pump station which is essentially a large diameter culvert with two submersible pumps suspended in it. One of the pumps was recently replaced and the second pump is reportedly in good working condition. A valve on the raw water line near the Trinity River controls plant flow at approximately 190 gpm (274,000 gpd). A portion of the infiltration gallery piping is exposed as it passes through a

small side channel. This pipe is severed and, although partially blocked with rocks, likely allows fish passage into the wetwell and should be reconstructed.

Table 3.2 Raw Water Supply Capacities

Equipment ID	Reported Capacity: Non-Drought (gpd)	June 2014 Capacity: Drought (gpd)
Well 2	66,240	60,000
Well 4	40,320	15,000
Well 5	43,200	30,000
Well 6	40,320	30,000
Well 7	28,800	7,500
Groundwater Daily Capacity	218,800	142,500
Treatment Plant Capacity	274,000	274,000
Total System Capacity	**492,800**	**416,500**

The water treatment plant is normally only operated during the summer months. When it is operated, it is done intermittently for short periods (batch mode basis) to supplement well production to help meet the system's peak demands.

3.4 Treatment Plant

The existing treatment plant was constructed in the late 1950s and is not in compliance with current regulations. The existing plant is shown in **Figure 3.1**. Raw water is pumped from the Trinity River at a rate of 190 gpm and enters a 14-foot diameter Infilco clarifier. A raw water meter, as seen in **Figure 3.1**, was recently installed on the clarifier inflow line to measure plant inflow. Coagulant and chlorine are added upstream of the clarifier; however, the flocculator drive unit has been out of service for several years. This prevents the clarifier from forming a suitable sludge blanket and performing as originally intended. Water from the clarifier is filtered through two parallel 8-ft diameter, single media, gravity filters. A 12,000 gallon clearwell provides chlorine contact time. Two vertical turbine booster pumps deliver water to the distribution system and the redwood storage tank. See **Figure 3.1**.

Figure 3.1 The LPMWC Plant, New Raw Water Meter, and Booster Pump

3.5 System Storage

Storage for the LPMWC system is provided by a 150,000 gallon redwood storage tank that is approximately 2000 linear feet from the treatment plant. The tank was recently lined with a flexible liner. See **Figure 3.2**.

Figure 3.2 LPMWC 150,000 Gallon Redwood Storage Tank

4. Alternative 1: Improve Existing Water Treatment Plant

4.1 Improve Existing Water Treatment Plant

The existing water treatment plant was constructed by the government in the mid-1950's to provide water for the workers constructing Trinity and Lewiston Dams. No significant upgrades have been made since then, and most major equipment is past its useful life. Several studies were conducted in the past that assessed the condition of the existing water treatment plant. These include a Draft Report on Technical Assistance Request - Lewiston Park MWC by the California Rural Water Association (CRWA) and Condition Assessment – Lewiston Park Mutual Water Co. by Mike Hulbert, owner of MWH Design.

Conclusions from the CRWA Draft Report include the following:

- The treatment plant is largely obsolete.
- No process monitoring or control instrumentation is in place and/or functioning; no turbidimeter, functioning pH meter, jar test apparatus, or alkalinity titration apparatus.
- The flash mixer is inoperative. Mixing of coagulant is inadequate.
- No evidence of floc formation in the up-flow clarifier.
- No evidence of sludge formation at the bottom of the clarifier not method to discharge sludge.
- Filtration rate is uncontrolled.
- Water level in the gravity filters is uncontrolled. Filter influent water was observed cascading over the backwash troughs rather than distributed from submerged backwash troughs.

The Condition Assessment by MWH Design, which focused mainly on mechanical equipment and controls, identified several deficiencies within the plant. The major failings identified were that the floculator paddles are not operative, there is inadequate chlorine contact time within the stilling well, and the plant lacks an adequate control system.

Essentially the entire water treatment plant would have to be replaced. There is not enough room on-site to construct a new treatment plant while keeping the existing plant functional; the existing plant would have to be demolished in order to make room for construction of an improved plant. However, this is not feasible since the water treatment plant is located within a small easement on private property. There has been a history of legal battles between the landowner and the LPMWC over the water treatment plant. It is not practicable to improve the existing water treatment plant. It is recommended that this alternative should no longer be pursued.

5. Alternative 2: Construct New Water Treatment Plant

5.1 Project Location Options

The Lewiston Community Services District owns the parcel adjacent to the parcel that the LPMWC WTP is currently located on. The LPMWC could purchase approximately 1 acre of this property and perform a lot line adjustment, or obtain an easement from the LCSD, and locate a new treatment plant approximately 250 feet northeast of the current plant. See **Figure 2** in **Appendix A**. This location would be ideal due to proximity to the raw water pipeline from the river, and the finished water pipeline to distribution.

5.2 Project Description

Construction of a new water treatment plant would include the following:

1. Reconstruction of the existing infiltration gallery
2. Installation of a new 192-gpm capacity direct filtration system with contact clarification followed by pressure filtration
3. Installation of new coagulant and chlorine feed systems
4. Installation of a 2900 ft long, 8” diameter finished water pipeline from the new WTP directly to the existing redwood storage tank
5. Miscellaneous electrical and instrumentation upgrades to allow incorporation of new equipment

Direct filtration using pressure filters is recommended over other types of filtration technologies (i.e. slow sand, conventional gravity, membrane) since they are more cost effective at this size, are relatively simple, are capable of handling fluctuations in water quality, and can be optimized to meet the current and future water quality requirements.

5.3 Water Treatment Plant Design

5.3.1 Design Flow for New Water Treatment Plant

The State of California Safe Drinking Water State Revolving Fund (SDWSRF) typically allows projects to be designed for current MDD plus 10%, which equates to 589,000 gpd and over 3500 gallons per connection per day for LPCSD’s existing water usage. This is extremely high. In comparison, the MDD for a metered water system with 167 connections is estimated at as high as 200 gpm (288,000 gpd, or 1725 gpd/connection) according to Chart 1 of the 2000 Waterworks Standards. An additional comparison is the neighboring community of Weaverville (metered), which has a MDD of 2,100,000 gpd with 1626 service connections, or 1292 gpd/connection. Based on these ranges of values, and assuming water meters will be installed in the LPMWC system, an appropriate MDD design value is 1500 gpd/connection. Assuming a growth rate of 10% to 184 service connections, the design MDD is therefore 276,000 gpd, or (conveniently) approximately 192 gpm. Since the LPMWC’s current water right is for 192 gpm and it is not feasible to increase that amount since the Trinity River is already fully appropriated, the California Waterworks Standard was

used to estimate the recommended design average day demand (ADD) and the peak hour demand (PHD) of Lewiston Park as shown in **Table 5.1**.

Table 5.1 LPMWC Design Capacities For a New WTP

Design Period	Average Day Demand		Maximum Day Demand		Peak Hour Demand	
	(gpd)	(gpm)	(gpd)	(gpm)	(gph)	(gpm)
Demand per Connection	1000	0.70	1500	1.04	94	1.57
Total Demand	184,000	128	276,000	192	17,250	288

5.3.2 Infiltration Gallery

Since the LPMWC's existing gallery is partially collapsed and likely allowing fish to enter the wetwell, a new infiltration gallery is recommended to divert water from the Trinity River to the existing pump station. The proposed infiltration gallery design is similar to the Weaverville Community Service District's (Weaverville CSD) infiltration gallery in Douglas City and the new infiltration gallery currently under construction for the LCSD. This design involves excavating a trapezoidal trench in the gravel bar to approximately 3 feet below the low flow water surface, installing a perforated/slotted collection pipe to convey water to the intake pump station, backfilling the trench with washed and graded gravels wrapped in a filter fabric, and covering with rock armor. A backwash system for the laterals is not expected to be required since the Trinity River does not have a significant fine sediment load at this location due to proximity to Trinity and Lewiston Dams. See **Figure 5.1**.

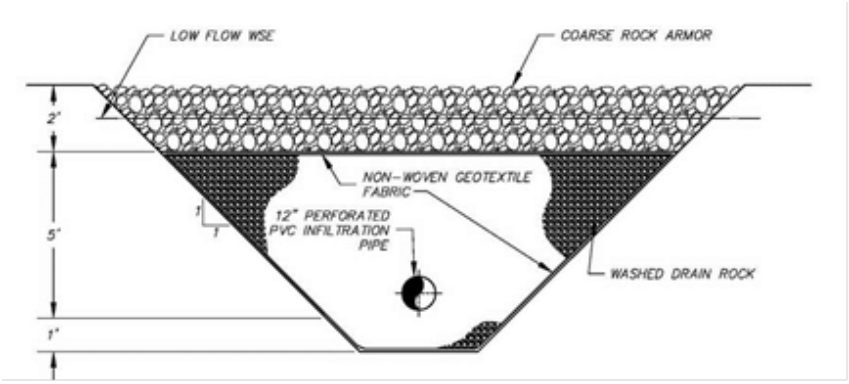


Figure 5.1 Infiltration Gallery Cross Section

Design loading rates for infiltration galleries depend on substrate, water level and river flow, but are generally between 1 and 3 gpm/ft of infiltration pipe. Assuming a conservative loading rate of 2.0 gpm/ft, and a design flow rate of 192 gpm, the new lateral should be at least 96 feet long. Assuming a 100-ft long lateral, the loading rate at 192 gpm is 1.92 gpm/ft. alternatively, 2 or more infiltration pipes could be used to reduce the overall length required.

5.3.3 Raw Water Pumps

The existing raw water pump station is in good working order and will continue to be used under this alternative.

5.3.4 Coagulant Feed System

A coagulant will be fed upstream of the filter system into the body of a static mixer that will allow for complete mixing of pre-filtration chemicals. Chlorine solution can also be injected into the body of the mixer. Water quality testing and/or jar testing has not been performed on the raw water supply. To better understand the type and usage of coagulant that will likely be used at the WTP, a neighboring water district, Weaverville CSD, was contacted. The Weaverville CSD operates two direct filtration water treatment plants that have similar raw water sources as the LPMWC, one of which draws water from the Trinity River at Douglas City. The Weaverville CSD staff indicated that the use of 0.7 to 2.5 mg/L of polyaluminum chloride (PACl) injected both immediately before the clarifier and the filters at a solution strength of 5% to 10% has been effective at reducing seasonal maximum raw water turbidities of approximately 100 NTUs to less than 0.02 NTUs using the direct filtration treatment process. The coagulant feed rate will be flow paced to an operator selected dosage, under the control of the filter system PLC. The design criteria for the coagulant feed system are summarized in **Table 5.2**.

Table 5.2 PACl Demand Projection

Design Parameter	Maximum Day Demand (MDD)		Average Day Demand (ADD)	
Water Demand	192 gpm		130 gpm	
	276,4800 gpd		184,320 gpd	
Required Dose	0.5 mg/L	3 mg/L	0.5 mg/L	3 mg/L
Concentration	10%			
Hours of Operation	24 hour	24 hour	24 hours	24 hours
Typical Pumping Rate	0.05 gph	0.28 gph	0.03 gph	0.19 gph
Average Daily Usage	1.12 gpd	6.70 gpd	0.74 gpd	4.46 gpd
	2.93 mL/min	17.60 mL/min	1.96 mL/min	11.74 mL/min
Storage Volume	110 gallons (Two 55 gallon drums)			
Days of Storage	98.6	16.5	147.8 days	24.6 days

A new peristaltic chemical feed pump capable of automatic control by a 4-20 mA signal will be used to dose the coagulant. The design criteria of the new feed pumps are listed below in **Table 5.3**.

Table 5.3 Coagulant Metering Pump Design Criteria

Parameter	Value
Number of Pumps	2 (1 Duty, 1 Standby)
Type	Peristaltic
Dose	0.5 to 3 mg/L
Feed Rate	0.03 to 0.28 gph
Drive	Variable Speed
Power	120 V/1-Phase/60 Hz

5.3.5 Direct Filtration

Direct filtration is defined as a treatment process including coagulation, flocculation, and filtration, but excluding sedimentation. Coagulation and flocculation unit processes are required to be in use

at all times during which conventional and direct filtration treatment plants are in operation. Direct filtration is an approved filtration technology per Section 64653 of Title 22 of the California Code of Regulations (CCR). Per Section 64660 of Title 22, for pressure filters, filtration rates shall not exceed 2.0 gpm/sq. ft for single media filters and 3.0 gpm/sq. ft for dual, mixed media, or deep bed filters.

The direct filtration treatment system for the WTP consists of chemical feed, two contact clarifiers (flocculation step), two dual media pressure filters, and the associated piping, valves and controls required for complete process automation.

Clarifiers

The contact clarifiers would consist of two 4.5-foot diameter pressure vessels with coarse sand media. The feed water (rapid mixed raw water and coagulant) will be split evenly between the two clarifiers and enters the tanks. The filter media and filter loading rate is specifically designed for coagulation and flocculation. The contact clarifier design also serves as a “pre-filter” to the pressure filters. The contact clarifiers will likely filter out small debris that would otherwise pass directly into the pressure filters, causing an increased filter backwash frequency.

Pressure sensors are provided on the inlet and outlet of each contact clarifier vessel. When the differential pressure between these sensors reaches the high differential set point (typical maximum of 10 psi) or the contact clarifier filtrate turbidity breakpoint (typical maximum of 4 NTUs), the filter controls initiate the contact clarifier backwash sequence. The contact clarifier is backwashed at a backwash flowrate of 239 gpm to the underdrain system at the bottom of the clarifier (239 gpm; 15 gpm/ft^2). A surface wash is provided at a rate of 32 gpm to the surface wash distribution piping at the top of the filter (32 gpm; 2 gpm/ft^2). The typical backwash time is 8 minutes (239 gpm) with a 4 minute surface wash (32 gpm) and a 4 minute filter-to-waste duration (96 gpm) producing a contact clarifier backwash volume of 2,424 gallons per clarifier.

Pressure Filters

The pressure filters consist of two 6.5-foot diameter pressure vessels that house dual media consisting of sand and anthracite. The feed water (clarified water) is split evenly between the two filters and enters the tanks. The filter media and filter loading rate is specifically designed to produce a filtrate with a turbidity of less than 0.2 NTU.

Pressure sensors are provided on the inlet and outlet of each pressure filter vessel. When the differential pressure between these sensors reaches the high differential setpoint (typical maximum of 10 psi) or the filtrate turbidity breakpoint (maximum of 0.2 NTUs), the filter controls initiate the pressure filter backwash sequence. The pressure filter is backwashed, at a flowrate of 498 gpm to the underdrain system at the bottom of the clarifier (498 gpm; 15 gpm/ft2). A surface wash is provided at a flowrate of 66 gpm to the surface wash distribution piping at the top of the filter (66 gpm; 2 gpm/ft2). The typical backwash time is 8 minutes (498 gpm) with a 4 minute surface wash (66 gpm) and a 4 minute filter-to-waste duration (96 gpm) producing a filter backwash volume of 4,632 gallons per filter. The design criteria for the direct filtration system are summarized in **Table 5.4**.

Table 5.4. Direct Filtration System[a]

Parameter	Value
Pressure Clarifiers	
Configuration	
Number of Clarifiers (configuration)	2 (parallel)
Diameter	4.5-feet
Sidewall Height	6-feet
Surface Area	31.8 ft^2 (15.9 ft^2 per clarifier)
Media	
Type	Coarse Sand
Depth	36-inches
Clarification Operating Parameters	
Design Flowrate	192 gpm (96 gpm/clarifier)
Loading Rate	6.0 gpm/ft^2
Backwash Operating Parameters	
Backwash Flowrate	239 gpm (15 gpm/ft^2)
Backwash Time	8 minutes
Surface Wash Flowrate	32 gpm (2 gpm/ft^2)
Surface Wash Time	4 minutes
Rinse Flowrate	96 gpm
Rinse Time	4 minutes
Backwash + Rinse Volume	4,848 gallons (2,424 gallons/clarifier)
Pressure Filters	
Configuration	
Number of Filters (configuration)	2 (parallel)
Diameter	6.5-feet
Sidewall Height	6-feet
Surface Area	66.4 ft^2 (33.2 ft^2 per clarifier)
Media	
Type	Dual (Sand and Anthracite)
Depth	30-inches
Filtration Operating Parameters	
Design Flowrate	192 gpm (96 gpm/filter)
Loading Rate	2.9 gpm/ft^2
Backwash Operating Parameters	
Backwash Flowrate	498 gpm (15.0 gpm/ft^2)
Backwash Time	8 minutes
Surface Wash Flowrate	66 gpm (2 gpm/ft^2)
Surface Wash Time	4 minutes
Rinse Flowrate	96 gpm
Rinse Time	4 minutes
Backwash + Rinse Volume	9,264 gallons (4,632 gallons/filter)

[a]Typical Parameters

5.3.6 Disinfection System

Sodium hypochlorite will be used at the WTP for disinfection. A sodium hypochlorite solution will be fed directly downstream of the filter system into the filtrate outlet pipe through an injection quill. The sodium hypochlorite feed system will be loop controlled to meet an operator-input setpoint using a chlorine analyzer sampling water on the filtrate pipeline prior to exiting the filter building and a chlorine analyzer sampling finished water from the water storage tank. Chlorine contact time will be provided by the 2900 ft long, 8" diameter finished water pipeline. The design criteria for the disinfection system are summarized in **Table 5.5**.

Table 5.5. Disinfection System Design Criteria

Parameter	Value
Sodium Hypochlorite Pumps	
Number of Pumps	2 (1 Duty, 1 Standby)
Type	Peristaltic
Dose	0.5 to 2 mg/L
Feed Rate	0.03 to 0.28 gph (assumes 10% strength)
Drive	Variable Speed
Power	120 V/1-Phase/60 Hz
Treated Water Pipeline	
Length	2,900 ft
Diameter	8"
Material	Ductile Iron or PVC
Contact Time Required[a]	38
Actual Contact Time[a]	40

[a] Contact time assumes max flow of 192 gpm, minimum temperature of 40 deg F, maximum pH of 8.0, and free chlorine residual at end of pipe of 1.0 mg/L.

5.3.7 Backwash System

The backwash water pressure will be supplied by the head of the finished water supply in the water storage tank. The filter system backwash waste will be discharged into a new backwash tank, and a backwash recycle pump with a floating supernatant collector will be used to recycle water off the top of the tank to upstream of the filtration system at a flowrate of 19 gpm (approximately 10% of the plant flow). The design parameters for the back wash recycle pumps are listed in **Table 5.6**.

Table 5.6. Backwash Recycle Pump Design Criteria

Parameter	Value
Number of Pumps	2 (1 duty; 1 standby)
Type	Multistage Centrifugal
Flow	20 gpm
TDH	250-feet
hp, per pump	3 hp
Drive	Constant Speed
Power	460 V/3-Phase/60 Hz

The backwash equalization tank is sized to contain 1.3 times the total waste produced by backwashing both clarifiers and both filters plus 3-feet of sludge blanket and required freeboard. This equates to an 18-ft diameter by 16-ft high tank. The design parameters for the back wash system are listed in **Table 5.7**.

Solids present in the raw water supply will be captured in the direct filter system. These solids will be backwashed out of the contact clarifiers and pressure filters and will accumulate in the backwash equalization tank. Periodically the contents of the backwash equalization tank must be disposed of to the sewer system.

Table 5.7 Backwash Equalization Tank Design Criteria

Parameter	Value
Total Backwash Volume	14,112 gallons
Equalization Volume	18, 350 gallons
Total Required Tank Volume (2.9' freeboard; 3' sludge storage depth)	**26,475 gallons**
Tank Type	Bolted Steel; Flat Bottom
Dimensions	18-ft D x 16-ft H

5.3.8 WTP Process Control System

The filter system will have a PLC that will control operation of the raw water pumps, automated valves, the backwash recycle pump, and the chemical feed pumps. The PLC will also monitor and log data received from instrumentation included as part of the treatment system equipment including:

- Raw water flow meter
- Filter vessel flow meters (one per vessel)
- Filter vessel differential pressure gauges
- Turbidities
- Backwash recycle pump flow meter
- Backwash equalization tank level transducer
- Filtrate chlorine residual
- Finished water chlorine residual, temperature, and pH

Key functions of the PLC are:

- Receive water storage tank level via telemetry and operate raw water pumps based on operator selected set points.
- Trigger a backwash cycle based on operator selected time interval, high differential pressure set point, or gallons processed.
- Orchestrate operation of automatically actuated valves for backwashing.
- Disallow a backwash if the level in the backwash equalization tank is too high.
- Stop the backwash recycle pump at a backwash equalization tank low level setpoint
- Flow pace all chemical feeds

5.3.9 New Treatment Building

The new treatment building will be a 35-foot by 20-foot CMU building that houses the chemical feed equipment, valves, and contains an electrical/control room. The clarifiers and filters are located outside of the building. See **Figure 5.2**.

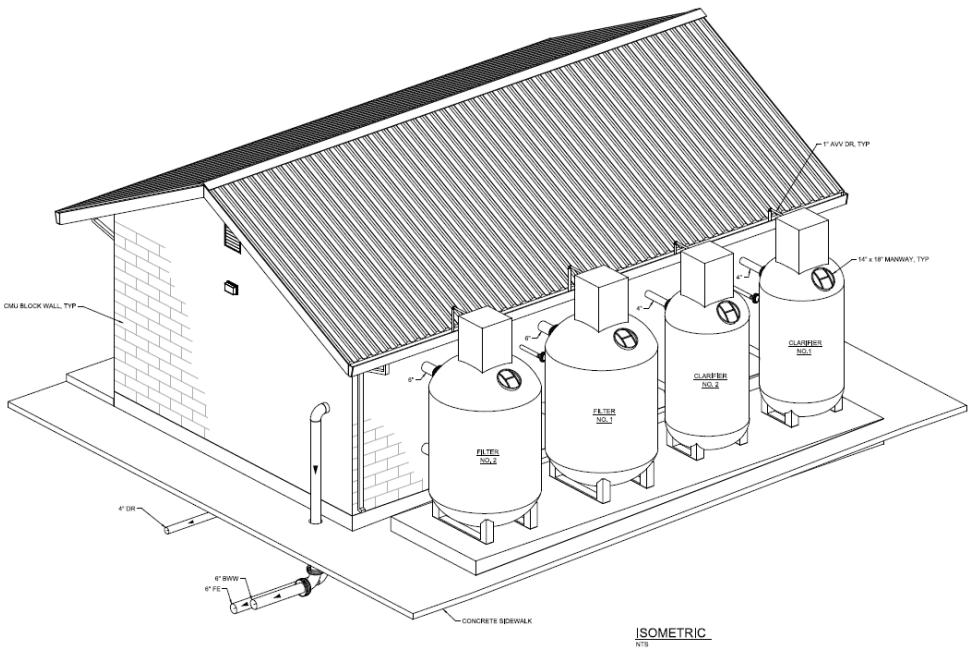


Figure 5.2 Schematic of New Treatment Building

5.3.10 New Water Treatment Plant Cost Estimate

The estimated cost for a new water treatment plant, including land acquisition, construction, and engineering is $3,092,000. This is summarized in **Table 5.8**. A detailed cost estimate is located in **Appendix C**.

Table 5.8. Estimated Costs for a New Water Treatment Plant

Project Budget Summary	Estimated Costs
Engineering Design, Permitting, Bid Assistance, & SDC	$300,000
Construction Management	$300,000
Construction	$2,167,000
Contingency	$325,000
Total Project Budget	**$3,092,000**

6. Alternative 3: Merge with Lewiston Community Services District

6.1 Background and Project Description

The Lewiston Community Services District (LCSD) water system is located north of the LPMWC area and serves 40 connections, which include a 22-site trailer park, a hotel/restaurant, and on occasion sells bulk water. The total service area is approximately 150 people, roughly equal to 65 single family dwelling (SFD) equivalents and all connections are metered. The LCSD water system is currently being upgraded. After the upgrades are complete, the system will consist of the following:

- Raw water infiltration gallery on the Trinity River
- 170 gpm raw water pump station with two vertical turbine pumps
- Raw water pipeline
- New 170 gpm direct filtration treatment plant consisting of two 4.5-ft diameter clarifiers and two 6-ft diameter pressure filters
- 21,000 gallon (nominal) backwash equalization tank
- 318,000 gallon (nominal) water storage tank

The LCSD has appropriative water rights from the Trinity River that date back to June 1957 (Application No. 17669, Permit No. 11106, License No. 6566). The right is for up to 0.75 cfs (337 gpm, 543 acre-ft/year) for domestic and fire protection purposes. Because this right is so much greater than the current MDD, the new LCSD water system was designed so that it could be easily expanded in the future.

For LPMWC to merge with LCSD, the two would have to merge their water rights. Section 1700 of the California Water Code allows the holder of an appropriate water right to change the point of diversion, place of use, or purpose of use, so long as other rights are not injured by the change. Changes are made to a water right by completing a “Petition for Change” form and submitting it to the State of California Water Resources Control Board (SWRCB) Division of Water Rights, along a completed “Environmental Information for Petitions” form and appropriate environmental studies (e.g., mitigated negative declaration). Once a change application is filed and the SWRCB completes their environmental review, public notice is given to interested parties (including California Department of Fish and Game) by posting the notice for 40 days in two conspicuous locations near project site. This indicates an opportunity to file protests against the proposed change. If differences cannot be resolved, a field investigation or a State Water Board hearing is conducted.

The time frame involved in obtaining a license in California is highly variable. If the change is minor, it could take approximately three months. If the change is major or controversial, it will take longer.

In order for the LCSD’s WTP to be capable of handling the increased demand of merging with the LPMWC, the following equipment must be modified:

- The capacity of the raw water pumps must be increased.
- Additional clarification and filtration capacity must be added.
- The capacity of the backwash recycle pump must be increased.

- A finished water pipeline must be added to connect the LCSD storage tank to the LPMWC tank and distribution system.

The design criteria for these upgrades are discussed in the following sections.

6.2 LCSD Water Treatment Plant Upgrades Design

6.2.1 Design Flow

If the LPMWC has 167 connections, and the LCSD has 65 equivalent connections (40 connections, 22-site trailer park, hotel, and bulk water sales), a 10% growth rate would equate to 256 service connections. If an MDD design value of 1500 gpd/connection is used, the design MDD is therefore 384,000 gpd, or approximately 267 gpm. The California Waterworks Standard was used to estimate the design average day demand (ADD) and the peak hour demand (PHD) as shown in **Table 6.1**.

Table 6.1 Design Flow LCSD-LPMWC Plant Merge

Design Period	Average Day Demand		Maximum Day Demand		Peak Hour Demand	
	(gpd)	(gpm)	(gpd)	(gpm)	(gph)	(gpm)
Demand per Connection	1000	0.70	1500	1.04	94	1.57
Total Demand	256,000	178	384,000	267	24,030	400

6.2.2 Raw Water Pumps

The existing vertical turbine pumps will have to be replaced to accommodate the increased demand. Each new pump will have a capacity of 267 gpm instead of 170 gpm at approximately 450 feet total dynamic head (TDH). The pumps will be constant speed and controlled off of the LCSD's water storage tank levels. Design criteria for the raw water pumps are listed in **Table 6.2**.

Table 6.2 Raw Water Pump Design Criteria for LCSD/LPMWC Merge

Parameter	Value
Number of Pumps	2 (1 Duty, 1 Standby)
Type	Lineshaft Vertical Turbine
Flow	267 gpm, Each
TDH	450 ft
hp, per pump	50 hp, Each
Drive	Constant Speed
Power	460 V/3-Phase/60 Hz

6.2.3 Direct Filtration

The LCSD's existing water treatment plant consists of two 4.5-ft diameter clarifiers. One additional 4.5-ft diameter clarifier would need to be added to provide a loading rate of 5.6 gpm/ft^2, which is below the recommended maximum loading rate of 6.0 gpm/ft^2. There are two existing 6.0-ft diameter filters at the LCSD's water treatment plant. One additional 6.5-ft diameter filter would need to be added to provide a loading rate of 2.98 gpm/ft^2, which is below the maximum loading rate of 3.0 gpm/ft^2. Modulating valves would continue to be used to control the flows into the vessels. The

clarifiers and filters at the LCSD are located outside the treatment building, so additional vessels could easily be added. A layout of the direct filtration system upgrades for the existing LCSD plant is shown in **Figure 6.1**. The design criteria for the direct filtration system are summarized in **Table 6.3**.

Table 6.3. Direct Filtration Design Criteria for LCSD/LPMWC Merge

Parameter	Value
Pressure Clarifiers	
Existing	
Number of Clarifiers (configuration)	2 (parallel)
Diameter	4.5-feet
Surface Area	31.8 ft^2 (15.9 ft^2 per clarifier)
New	
Number of Clarifiers (configuration)	1 (parallel)
Diameter	4.5-feet
Surface Area	15.9 ft^2
Total	
Number of Clarifiers (configuration)	3 (parallel)
Total Surface Area	47.7 ft^2
Loading Rate	5.6 gpm/ft^2
Pressure Filters	
Existing	
Number of Filters (configuration)	2 (parallel)
Diameter	6.0-feet
Surface Area	56.5 ft^2 (28.3 ft^2 per filter)
New	
Number of Clarifiers (configuration)	1 (parallel)
Diameter	6.5-feet
Surface Area	33.2 ft^2
Total	
Number of Clarifiers (configuration)	3 (parallel)
Total Surface Area	89.7 ft^2
Loading Rate	2.98 gpm/ft^2

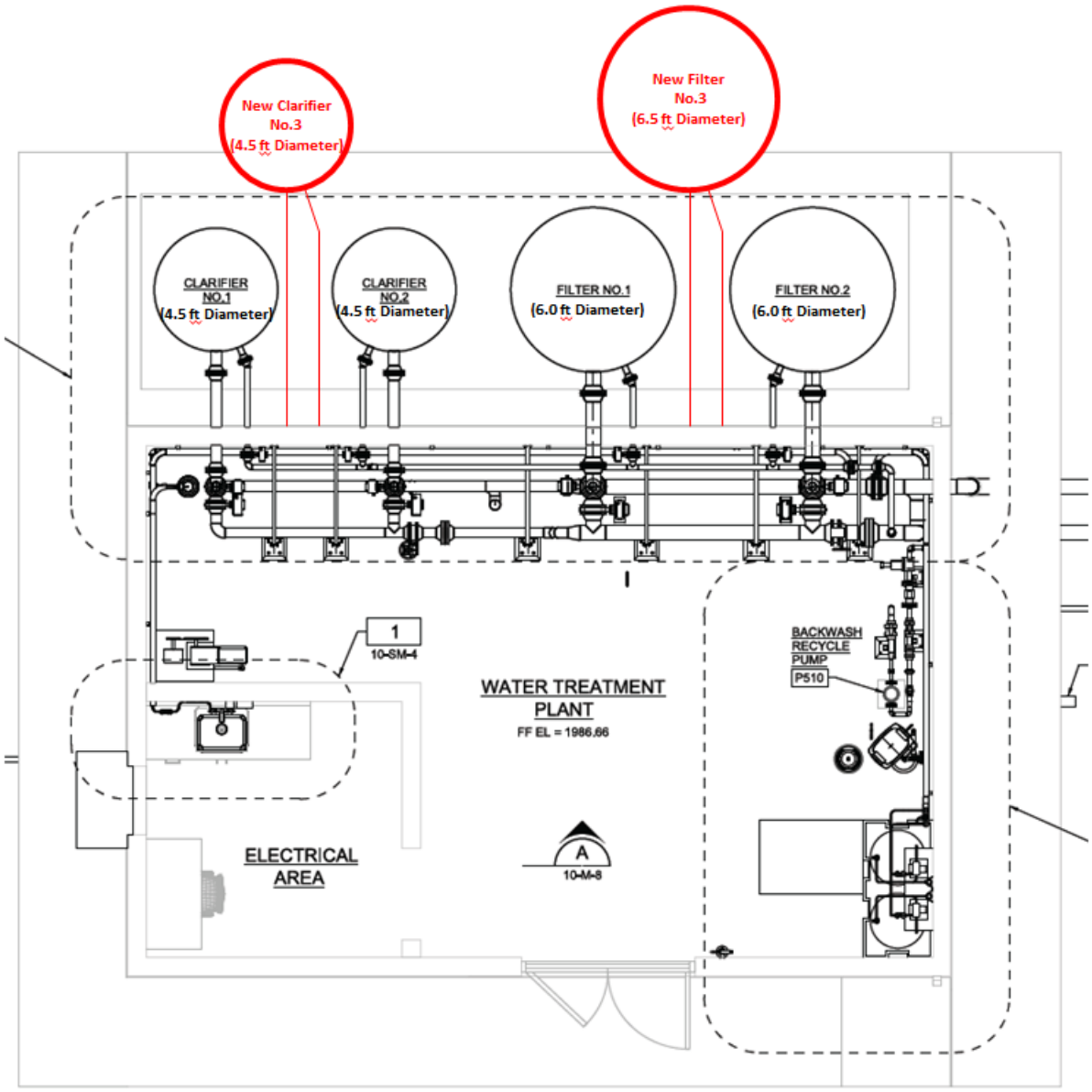


Figure 6.1 Expansion of the Direct Filtration System for LCSD/LPMWC Merge

6.2.4 Backwash System

The backwash water pressure will be supplied by the head of the finished water supply in the water storage tank. The filter system backwash waste is discharged into the backwash recycle tank, and the backwash recycle pump with a floating supernatant collector is used to recycle water off the top of the tank to upstream of the filtration system at a flowrate of approximately 10% of the plant flow. The backwash recycle pumps will have to be replaced with 27 gpm pumps. The design parameters for the backwash recycle pumps are listed in **Table 6.4**.

Table 6.4. Backwash Recycle Pump Design Criteria for LCSD/LPMWC Merge

Parameter	Value
Number of Pumps	2 (1 duty; 1 standby)
Type	Multistage Centrifugal
Flow	27 gpm
TDH	260-feet
hp, per pump	3 hp
Drive	Constant Speed
Power	460 V/3-Phase/60 Hz

6.2.5 LCSD Intertie Pipeline

Because the water surface elevations of LPMWC redwood storage tank and the LCSD's new steel storage tank are nearly the same, the two can be hydraulically connected via an intertie pipeline that would connect the two systems. This will enable water from the treatment plant to flow into the existing LPMWC distribution system. The pipeline would be approximately 4,000 feet long. The location is illustrated in **Figure 2** of **Appendix A.**

6.2.6 Cost Estimate

The estimated project cost for the expanded water treatment plant and intertie pipeline is $1,900,000. This is summarized in **Table 6.5**. A detailed cost estimate is located in **Appendix C**.

Table 6.5. Estimated Costs for Consolidation of LPWMC & LCSD Water Systems

Project Budget Summary	Estimated Costs
Engineering Design, Permitting, Bid Assistance, & SDC	$300,000
Construction Management	$250,000
Construction	$1,119,000
Contingency	$168,000
Total Project Budget	**$1,900,000**

7. Comparison of Alternatives

Table 7.1 compares the three alternatives to improve the drinking water quality of the LPMWC.

Table 7.1 Project Alternative Comparison Summary

Alternative	Estimated Cost	Comments
Improve Existing WTP	N/A	This alternative is not recommended. All major equipment is beyond its useful life, and there is not enough room onsite to install new equipment while keeping the existing plant operational. LPMWC does not own the WTP property site.
Construct New WTP	$3,092,000	This alternative can be considered; however, it is costly.
LPMWC Merge with LCSD	$1,900,000	This alternative has the lowest overall cost and most straight forward solution to the problem.

8. CEQA/NEPA Exemptions and Regulatory Permits

The project alternatives outlined in this report all require California Environmental Quality Act (CEQA) documentation that state how each project is exempt or is non-exempt from additional analysis. The different types of documentation required for each project are listed below and are based on the CEQA information provided in Small Community Toolbox Element 4.2 - CEQA-NEPA Exemptions and Checklists. In addition, a Clean Water State Revolving Fund (CWSRF) Environmental Package document must be completed that covers CEQA and Federal cross-cutting regulatory requirements.

Neither Alternative 2 nor 3 would qualify for any CEQA/NEPA exemptions. In Alternative 2 a new treatment plant would be constructed along with a treated water pipeline, and in Alternative 3, the capacity of the LCSD plant would be increased and an intertie pipeline constructed. Consequently, a Negative Declaration, Mitigated Negative Declaration, or Environmental Impact Report may be required.

In addition to the CEQA/NEPA documentation requirements, regulatory permits for the project alternatives outlined this report may be required from Local, State, and Federal regulatory agencies. Information detailing permits from regulatory agencies is based on the information provided in Appendix 4.3 “Summary of the Common Permit Triggers.” The list of applicable regulatory agencies that may require permits are listed below:

- U.S Fish and Wildlife Services (USFWS) / National Marine Fisheries Service (NMFS)
- State Historic Preservation Officer (SHPO)
- State Water Resources Control Board (SWRCB)
- California Department of Fish and Wildlife (CDFW)
- California Department of Transportation (Caltrans)

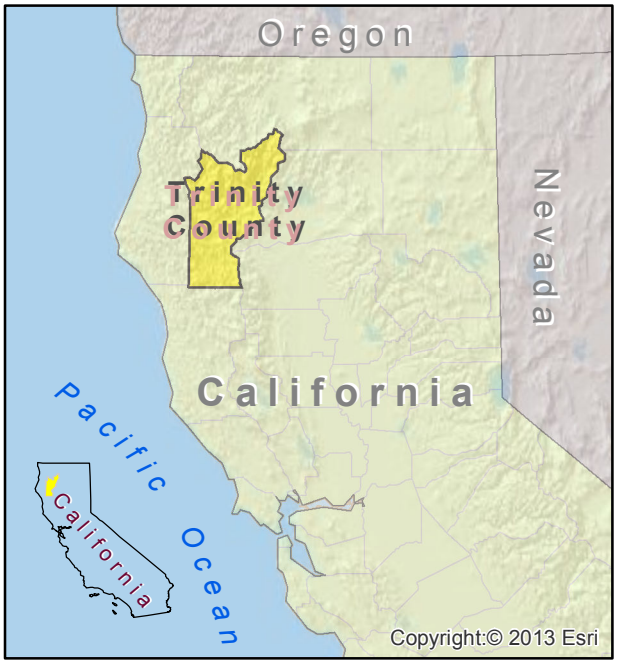
9. Recommendation, Implementation Strategy, & Next Steps

Water Works Engineers recommends that LPMWC merge with the LCSD's water system. Increasing the capacity at the LCSD's WTP is the most cost-effective way to improve the LPMWC's water quality. Because the LCSD WTP was designed so that the capacity could be easily increased, this alternative will be relatively straightforward to construct.

Water Works Engineers has already prepared and submitted a pre-application to CDPH for an SDWSRF planning grant, as LPMWC does not have the required project funding in reserve.

Appendices

Appendix A - Supplemental Figures



U.S. Highway
Major Road
Local Roads
Stream
River

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Feet
Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

GHD

Lewiston Park Mutual Water Company
Technical Assistance

Job Number 8410996
Revision A
Date 28 Jul 2014

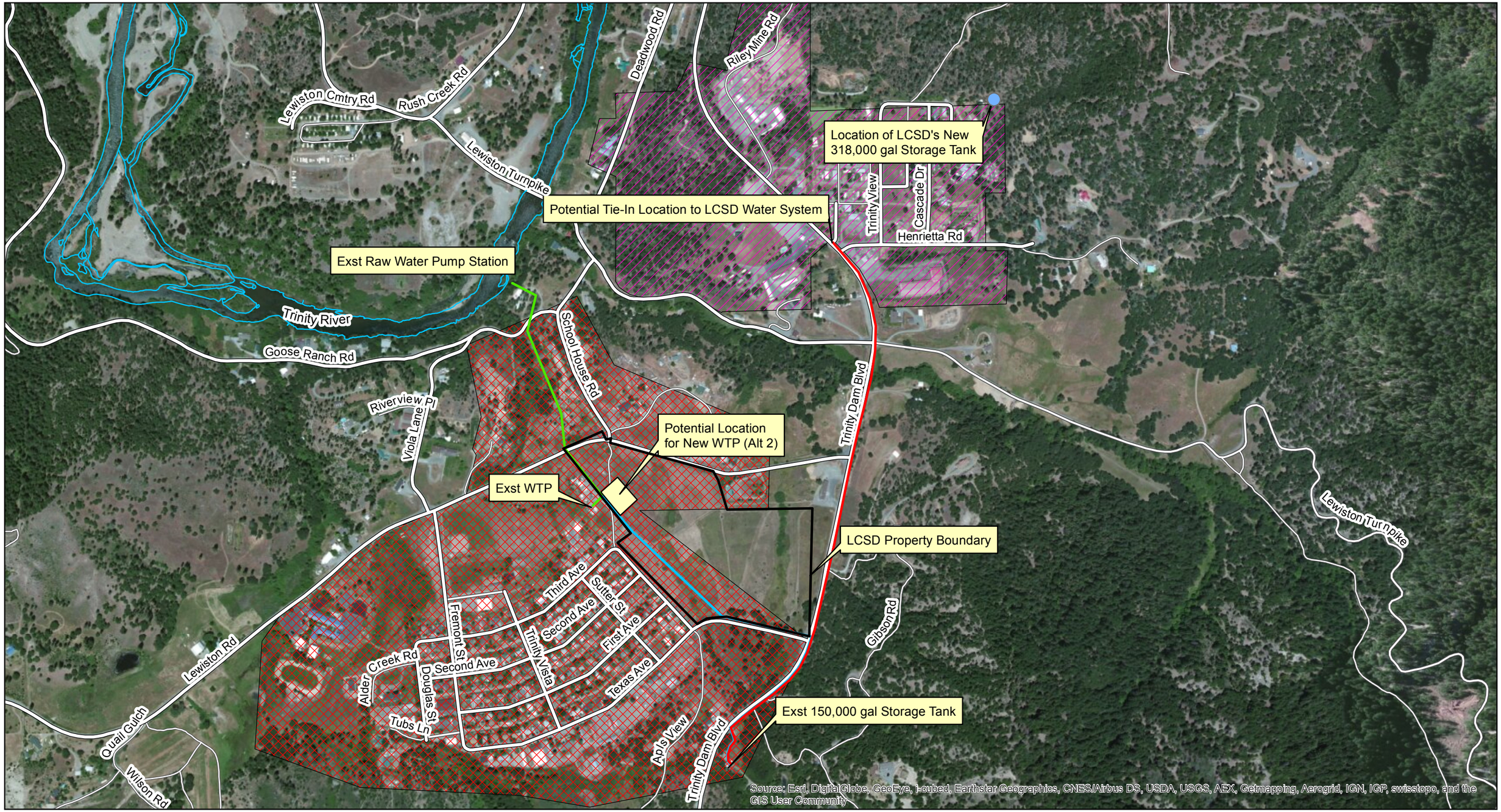
Vicinity Map

Figure 1

718 Third Street Eureka CA 95501 USA T 707 443 8326 F 707 444 8330 E eureka@ghd.com W www.ghd.com

\\ekasvr3\projects\01081 HumboldtCounty DPW\8410996 NCRP Water-WW Assistance\08-GIS\Maps\Figures\F1_Vicinity_Lewiston_Park_Mutual_Water_Co.mxd

Data source: ESRI Street Map; NAIP aerial 1m. Created by:porogers



Paper Size ANSI B

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Feet

Map Projection: Mercator Auxiliary Sphere
Horizontal Datum: WGS 1984
Grid: WGS 1984 Web Mercator Auxiliary Sphere

N

LEGEND

- Raw Water Pipeline (Exst, 1786')
- Treated Water Pipeline (Alt 2, 2917')
- LCSD Intertie Pipeline (Alt 3, 3951')
- LPMWC Service Area
- LCSD Service Area

Lewiston Park Mutual Water Company
Technical Assistance

Job Number 8410996
Revision A
Date 26 Sep 2014

Site Map

Figure 2

C:\Users\joer\Desktop\LPMWC STUFF\Lewiston Park MWC Map1.mxd

Data source: ESRI World Imagery Basemap. Created by: JRiess

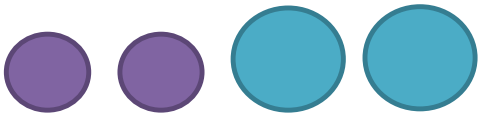
718 Third Street Eureka CA 95501 USA **T** 707 443 8326 **F** 707 444 8330 **E** eureka@ghd.com **W** www.ghd.com

Appendix B - Calculations

Maximum Design Flow	192	gpm	
Pipe Diameter per Vessel	3	in	
Pipe Velocity per Vessel	4.4	ft/s	

Clarifier/Filter Sizing

Pressure Vessel Orientation	Vertical		
No. Contact Clarifiers	2	ea	
Clarifier Diameter	4.5	ft	
Surface Area, ea	15.9	sq. ft	
Total Surface Area	31.8	sq. ft	
Maximum Loading Rate	6.0	gpm/sq. ft	Assume 6 gpm/sf max per Rescue Engineering
Loading Rate	6.0	gpm/sq. ft	OK
Backwash Loading Rate	15	gpm/sq. ft	
Backwash Rate per Vessel	239	gpm	Assume 1 vessel backwashing at a time
Surface Wash Loading Rate	2	gpm/sq. ft	per Randy Richey/ Loprest
Surface Wash Rate per Vessel	32	gpm	Assume 1 vessel backwashing at a time



No. Filters	2	ea	
Filter Diameter	6.5	ft	
Surface Area, ea	33.2	sq. ft	
Total Surface Area	66.4	sq. ft	
Maximum Loading Rate	3.0	gpm/sq. ft	3 gpm/sf max per Section 64660 of Title 22
Loading Rate	2.9	gpm/sq. ft	OK
Backwash Loading Rate	15	gpm/sq. ft	
Backwash Rate	498	gpm	Assume 1 vessel backwashing at a time
Surface Wash Loading Rate	2	gpm/sq. ft	per Randy Richey/ Loprest
Surface Wash Rate per Vessel	66	gpm	Assume 1 vessel backwashing at a time

Backwash Calcs/Clarifiers

Step 1-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	239	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	32	gpm	
Waste per Vessel	2036	gal	
Total BW+SW Waste all Vessels	4072	gal	
Backwash Supply Pipe Diameter	6	in	
Max Backwash Supply Pipe Velocity	2.71	ft/s	
Surface Wash Pipe Diameter	2	in	
Surface Wash Pipe Velocity	3.25	ft/s	
Backwash Waste Pipe Diameter	6	in	
Max Backwash Waste Pipe Velocity	3.07	ft/s	

Step 2-Filter to Waste

Filter to Waste Duration	4	minutes	
Filter to Waste Flow, combined	192	gpm	
Filter to Waster per vessel	384	gal	
Total FTW Waste all Vessels	768	gal	

Backwash Calcs/Filters

Step 1-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	498	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	66	gpm	
Waste per Vessel	4247	gal	
Total BW+SW Waste all Vessels	8495	gal	
Backwash Supply Pipe Diameter	6	in	
Max Backwash Supply Pipe Velocity	5.65	ft/s	
Surface Wash Pipe Diameter	2	in	
Surface Wash Pipe Velocity	6.78	ft/s	
Backwash Waste Pipe Diameter	6	in	
Max Backwash Waste Pipe Velocity	6.40	ft/s	

Step 2-Filter to Waste

Filter to Waste Duration	4	minutes	
Filter to Waste Flow, combined	192	gpm	
Total FTW Waste all Vessels	768	gal	

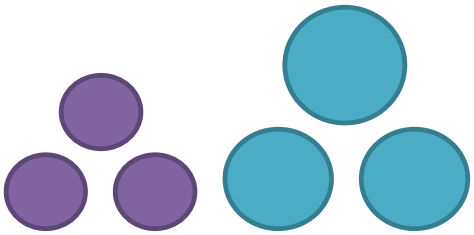
Total Backwash Waste per Cycle	14,102	gal
1.3 times Backwash Waste per Cycle	18333	gal

Backwash Recycle Rate	19.2	gpm
Time required to recycle 1 cycle	12.2	hours

Project No.: 14-048
Title: Lewiston Park Mutual Water Company-Merge with LCSD Alternative

Computed By: RLT
Date: 9/9/2014
Checked By: XXX
Date: XXX

Maximum Design Flow	267	gpm	
Pipe Diameter per Vessel	3	in	
Pipe Velocity per Vessel	6.1	ft/s	



Clarifier/Filter Sizing

Pressure Vessel Orientation	Vertical		
No. Contact Clarifiers-Existing	2	ea	
Clarifier Diameter-Existing	4.5	ft	Existing: 2 Clarifiers at 4.5 ft Diameter
Surface Area, Each-Existing	15.9	sq. ft	
No. Contact Clarifiers-New	1	ea	
Clarifier Diameter-New	4.5	ft	Existing: 2 Clarifiers at 4.5 ft Diameter
Surface Area, Each-New	15.9	sq. ft	
Total Surface Area	47.7	sq. ft	
Maximum Loading Rate	6.0	gpm/sq. ft	Assume 6 gpm/sf max per Rescue Engineering
Loading Rate	5.6	gpm/sq. ft	OK
Backwash Loading Rate	15	gpm/sq. ft	
Backwash Rate per Vessel-Existing	239	gpm	Assume 1 vessel backwashing at a time
Backwash Rate per Vessel-New	239	gpm	Assume 1 vessel backwashing at a time
Surface Wash Loading Rate	2	gpm/sq. ft	per Randy Richey/ Loprest
Surface Wash Rate per Vessel-New	32	gpm	Assume 1 vessel backwashing at a time
Surface Wash Rate per Vessel-New	32	gpm	Assume 1 vessel backwashing at a time
No. Filters-Existing	2	ea	
Filter Diameter-Existing	6	ft	Existing: 2 Filters at 6.0 ft Diameter
Surface Area, Each Existing	28.3	sq. ft	
No. Filters-New	1.0	ea	
Filter Diameter- New	6.5	ft	
Surface Area, Each New	33.2	sq. ft	
Total Surface Area	89.7	sq. ft	
Maximum Loading Rate	3.0	gpm/sq. ft	3 gpm/sf max per Section 64660 of Title 22
Loading Rate	3.0	gpm/sq. ft	OK
Backwash Loading Rate	15	gpm/sq. ft	
Backwash Rate-Existing	424	gpm	Assume 1 vessel backwashing at a time
Backwash Rate-New	498	gpm	
Surface Wash Loading Rate	2	gpm/sq. ft	per Randy Richey/ Loprest
Surface Wash Rate per Vessel-Existing	57	gpm	Assume 1 vessel backwashing at a time
Surface Wash Rate per Vessel-New	66	gpm	

Backwash Calcs/Clarifiers

Existing-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	239	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	32	gpm	
Waste per Vessel	2036	gal	
Total BW+SW Waste all Vessels-Existing	4072	gal	

New-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	239	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	32	gpm	
Waste per Vessel	2036	gal	
Total BW+SW Waste all Vessels-New	2036	gal	

Backwash Supply Pipe Diameter	6	in
Max Backwash Supply Pipe Velocity	2.71	ft/s
Surface Wash Pipe Diameter	2	in
Surface Wash Pipe Velocity	3.25	ft/s
Backwash Waste Pipe Diameter	6	in
Max Backwash Waste Pipe Velocity	3.07	ft/s

Filter to Waste

Filter to Waste Duration	4	minutes
Filter to Waste Flow, combined	267	gpm
Filter to Waster per vessel	356	gal
Total FTW Waste all Vessels	1068	gal

Backwash Calcs/Filters

Existing-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	424	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	57	gpm	
Waste per Vessel	3619	gal	
Total BW+SW Waste all Vessels	7238	gal	

New-Backwash and Surface Wash

Backwash Duration	8	minutes	
Backwash Flow/ Vessel	498	gpm	
Surface Wash Duration	4	minutes	per Randy Richey/ Loprest
Surface Wash Flow/ Vessel	66	gpm	
Waste per Vessel	4247	gal	
Total BW+SW Waste all Vessels	4247	gal	

Backwash Supply Pipe Diameter	6	in
Max Backwash Supply Pipe Velocity	5.65	ft/s
Surface Wash Pipe Diameter	2	in
Surface Wash Pipe Velocity	6.78	ft/s
Backwash Waste Pipe Diameter	6	in
Max Backwash Waste Pipe Velocity	6.40	ft/s

Filter to Waste

Filter to Waste Duration	4	minutes
Filter to Waste Flow, combined	267	gpm
Total FTW Waste all Vessels	1068	gal

Total Backwash Waste per Cycle	19,729	gal
1.3 times Backwash Waste per Cycle	25648	gal

Backwash Recycle Rate	26.7	gpm
Time required to recycle 1 cycle	12.3	hours

Appendix C - Cost Estimates

WATERWORKS ENGINEERS

Project No. 14-048
Title Lewiston Park MWC Water Treatment Plant Project - Alternative 2: New WTP Cost Estimate
Preliminary Design

Computed By RLT
Date 9/3/2014

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
General Items					**$115,000**
Mobilization	1	LS	$50,000		$50,000
Submittals	1	LS	$25,000		$25,000
SWPPP/Water Pollution Control	1	LS	$15,000		$15,000
Surveying	1	LS	$10,000		$10,000
Testing	1	LS	$10,000		$10,000
Shoring	1	LS	$5,000		$5,000
Site Work					**$66,719**
Water Treatment Plant					
Excavation	106	CY	$20		$2,116
Backfill-Agg Base	40	TON	$23	$1,347	$2,259
Gravel Access Road	338	TON	$22	$7,953	$15,378
Infiltration Gallery					
Excavation	400	CY	$20		$8,000
Dewatering	1	LS	$15,000		$15,000
Gravel Fill	400	CY	$50		$20,000
Backwash Equalization Tank					
Excavation and Subgrade Prep	1	LS	$2,000		$2,000
Backfill-Agg Base	11	TON	$23	$1,210	$1,466
Backwash Waste Wet Well					
Excavation and Backfill	1	LS	$500		$500
Major Electrical					**$518,000**
Site Electrical	1	LS	$150,000		$150,000
Service Entrance-WTP Site	1	LS	$15,000		$15,000
Backwash Recycle VFD	1	LS	$5,000	$1,000	$6,000
WTP PLC Control Panel	1	LS	$80,000		$80,000
Tank Panel	1	LS	$36,000		$36,000
Instrumentation	1	LS	$111,000		$111,000
SCADA System and PLC/SCADA Programming	1	LS	$120,000		$120,000

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
Major Structural					**$305,443**
Water Treatment Plant					
Building Foundation Slab	26	CY	$750		$19,444
Vessel Slab	26	CY	$750		$19,444
CMU Building	700	SF	$250		$175,000
Sidewalk	25	CY	$375		$9,387
Backwash Waste Tank					
Steel Tank	1	LS	$60,000		$60,000
Foundation Slab	22	CY	$750		$16,667
Backwash Waste Wet Well					
Precast Manhole	1	LS	$5,000		$5,000
Manhole Lid and Grating	1	LS	$500		$500
Major Equipment					**$181,747**
Coagulation and Chlorination Feed System					
Feed Pumps	2	EA	$3,500	$1,000	$8,000
Containment Pallet w/Ramp	1	EA	$1,000		$1,000
Piping and Valves	1	LS	$1,000	$750	$1,750
Clarifier and Filter System (Including Media)					
Clarifier and Filter Vessels	1	LS	$150,000	$7,500	$157,500
Compressed Air System	1	LS	$750	$500	$1,250
Backwash Recycle Pump					
Backwash Recycle Pump	1	EA	$2,500	$1,000	$3,500
Floating Supernatant Collector	1	EA	$5,000	$1,000	$6,000
Backwash Waste Pump					
Backwash Waste Pump	1	EA	$1,747	$1,000	$2,747
Major Piping and Valves					**$319,645**
Raw Water Intake					
12" PVC Infiltration Pipe, Slotted	100	LF	$120		$12,000
12" PVC Pipe to Wetwell	20	LF	$100		$2,000
Coagulation and Chlorination Feed System					
3/8" BAV-05 (PVC)	3	EA	$90		$270
3/8" BAV-06 (CPVC)	5	EA	$160		$800
Static Mixer	2	EA	$2,500	$200	$5,200

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
Clarifier and Filter System					
2" AVV-01 (Iron and Stainless Steel)	4	EA	$250	$240	$1,240
3/8" BAV-05 (PVC)	2	EA	$90	$120	$300
2" BFV-10 (Iron)	5	EA	$200	$300	$1,300
3" BFV-10 (Iron)	12	EA	$250	$720	$3,720
4" BFV-10 (Iron)	5	EA	$300	$300	$1,800
6" BFV-10 (Iron)	5	EA	$450	$300	$2,550
Pneumatic Actuators	24	EA	$650	$2,160	$17,760
3/8" Chemical Tubing	1	LS	$500	$500	$1,000
2" Welded Steel Pipe	60	LF	$30	$500	$2,300
3" Welded Steel Pipe	50	LF	$45	$600	$2,850
4" Welded Steel Pipe	100	LF	$60	$1,000	$7,000
6" Welded Steel Pipe	100	LF	$90	$1,200	$10,200
Backwash System					
1" ARV-03 (Iron and Stainless Steel)	1	EA	$200	$60	$260
1" BAV-01LF (Bronze-Lead Free)	1	EA	$100	$60	$160
2" BAV-01LF (Bronze-Lead Free)	2	EA	$350	$120	$820
3/8" BAV-05 (PVC)	1	EA	$90	$60	$150
1" CKV-01LF (Bronze-Lead Free)	1	EA	$100	$60	$160
2" CKV-01LF (Bronze-Lead Free)	1	EA	$200	$60	$260
1" FCV-10	1	EA	$500	$60	$560
2" GAV-10 (Iron)	1	EA	$150	$60	$210
3" GAV-10 (Iron)	1	EA	$350	$60	$410
6" GAV-10 (Iron)	1	EA	$800	$60	$860
1 1/2" Galvanized Steel Pipe	50	LF	$15	$500	$1,250
2" Galvanized	200	LF	$20	$1,000	$5,000
3" Welded Steel Pipe	3	LF	$45	$120	$255
Finished Water Pipeline (Contact Pipeline)					
8" Ductile Iron Pipe	2900	LF	$80		$232,000
Pipe Supports and Insulation	1	LS	$5,000		$5,000

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
Minor Equipment and Misc Furnishings					**$19,670**
Utility Sink	1	EA	$500	$240	$740
Casework	1	LS	$2,000	$960	$2,960
Safety Shower/Eyewash	1	EA	$800	$240	$1,040
HVAC Unit	1	EA	$5,000	$960	$5,960
Desk	1	EA	$200	$120	$320
Chair	1	EA	$150		$150
Cathodic Protection Systems for Tanks	1	EA	$8,500		$8,500
Subtotal, General Items					$115,000
Subtotal, Site Work					$66,719
Subtotal, Major Electrical					$518,000
Subtotal, Major Structural					$305,443
Subtotal, Major Equipment					$181,747
Subtotal, Major Piping and Valves					$319,645
Subtotal, Minor Equipment and Misc Furnishings					$19,670
				SUBTOTAL	**$1,526,000**
Allowance for Miscellaneous Items			20%		$305,200
General Conditions, Bonds, Insurance & Taxes			10%		$152,600
Contractor's Profit			12%		$183,120
CONSTRUCTION BID COST OPINION					***$2,167,000***
Construction Contingency			15%		$325,000

Project Budget Summary		
1	Engineering Design, Permitting, Bid Assistance, & SDC	$300,000
3	Construction Management & SCADA Programming	$300,000
4	Construction	$2,167,000
5	Contingency	$325,000
	TOTAL PROJECT BUDGET	**$3,092,000**

WATERWORKS ENGINEERS

Project No. 14-048
Title Lewiston Park MWC Water Treatment Plant Project - Alternative 3: Merge Cost Estimate Preliminary Design

Computed By RLT
Date 9/15/2014

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
General Items					**$115,000**
Mobilization	1	LS	$50,000		$50,000
Submittals	1	LS	$20,000		$20,000
SWPPP/Water Pollution Control	1	LS	$10,000		$10,000
Surveying	1	LS	$10,000		$10,000
Testing	1	LS	$20,000		$20,000
Shoring	1	LS	$5,000		$5,000
Major Electrical					**$56,000**
Site Electrical Update	1	LS	$50,000		$50,000
Backwash Recycle VFD	1	LS	$5,000	$1,000	$6,000
Major Structural					**$22,155**
Water Treatment Plant					
New Vessel Slab	26	CY	$750		$19,444
Sidewalk	7	CY	$375		$2,710
Major Equipment					**$240,500**
Raw Water Intake					
Raw Water Pumps	2	EA	$75,000	$1,000	$151,000
Clarifier and Filter System (Including Media)					
Clarifier and Filter Vessels	1	LS	$75,000	$7,500	$82,500
Backwash Recycle Pump					
Backwash Recycle Pump	1	EA	$3,000	$1,000	$4,000
Backwash Waste Pump					
Backwash Waste Pump	1	EA	$2,000	$1,000	$3,000
Major Piping and Valves					**$354,245**
Clarifier and Filter System					
2" AVV-01 (Iron and Stainless Steel)	2	EA	$250	$120	$620
3/8" BAV-05 (PVC)	2	EA	$90	$120	$300
2" BFV-10 (Iron)	5	EA	$200	$300	$1,300
3" BFV-10 (Iron)	6	EA	$250	$360	$1,860
4" BFV-10 (Iron)	3	EA	$300	$180	$1,080
6" BFV-10 (Iron)	3	EA	$450	$180	$1,530
Pneumatic Actuators	12	EA	$650	$1,080	$8,880
3/8" Chemical Tubing	1	LS	$500	$500	$1,000
2" Welded Steel Pipe	25	LF	$30	$500	$1,250
3" Welded Steel Pipe	25	LF	$45	$600	$1,725
4" Welded Steel Pipe	50	LF	$60	$1,000	$4,000
6" Welded Steel Pipe	50	LF	$90	$1,200	$5,700

Item	Quantity	Unit	Unit Cost	Installation Cost	Total Cost
LSCD Intertie Pipe Line					
10" Ductile Iron Pipe	4000	LF	$80		$320,000
Pipe Supports and Insulation	1	LS	$5,000		$5,000
Subtotal, General Items					$115,000
Subtotal, Major Electrical					$56,000
Subtotal, Major Structural					$22,155
Subtotal, Major Equipment					$240,500
Subtotal, Major Piping and Valves					$354,245
				SUBTOTAL	**$788,000**
Allowance for Miscellaneous Items			20%		$157,600
General Conditions, Bonds, Insurance & Taxes			10%		$78,800
Contractor's Profit			12%		$94,560
CONSTRUCTION BID COST OPINION					***$1,119,000***
Construction Contingency			15%		$168,000

Project Budget Summary		
1	Engineering Design, Permitting, Bid Assistance, & SDC	$300,000
3	Construction Management & SCADA Program Update	$250,000
4	Construction	$1,119,000
5	Contingency	$168,000
	TOTAL PROJECT BUDGET	**$1,900,000**