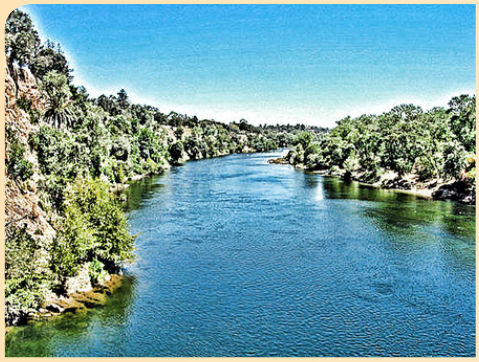
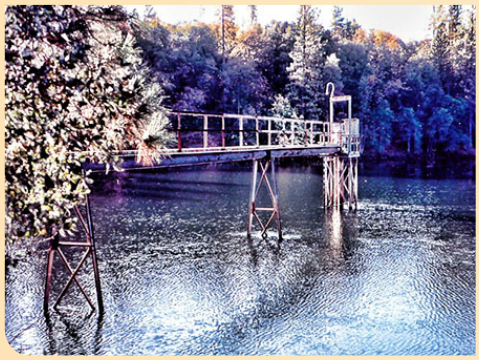
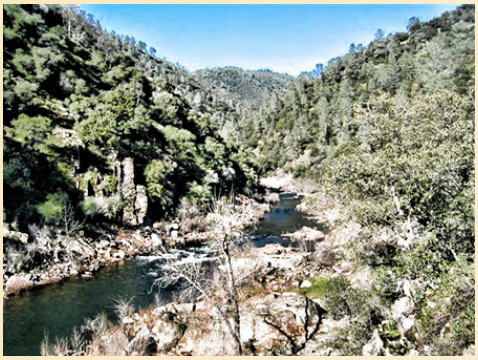
Attachment 3
Project Justification



Attachment 3: Project Justification

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Project Summary Table

	Drought Project Element	Upper Amador Canal Untreated Pipeline	Ione WTP Backwash Water Reuse Project
D.1	Provide immediate regional drought preparedness	X	X
D.2	Increase local water supply reliability and the delivery of safe drinking water	X	X
D.3	Assist water supplier and regions to implement conservation programs and measures that are not locally cost-effective		
D.4	Reduce water quality conflicts or ecosystem conflicts created by the drought	X	
	IRWM Project Element		
IR.1	Water Supply reliability, water conservation, and water use efficiency	X	X
IR.2	Stormwater capture, storage, clean-up, treatment, and management		
IR.3	Removal of invasive non-native species, the creation and enhancement of wetlands, and the acquisition, protection, and restoration of open space and watershed lands		
IR.4	Non-point source pollution reduction, management, monitoring	X	
IR.5	Groundwater recharge and management		
IR.6	Contaminant and salt removal through reclamation, desalting, and other treatment technologies and conveyance of reclaimed water for distribution to users		
IR.7	Water banking, exchange, reclamation, and improvement of water quality	X	X
IR.8	Planning, implementation of multipurpose flood management programs		
IR.9	Watershed protection and management		
IR.10	Drinking water treatment and distribution		X
IR.11	Ecosystem and fisheries restoration and protection	X	

Project Descriptions

The following table briefly describes the two projects included in this proposal, both of which are proposed by Amador Water Agency (AWA). Following the table are one-page descriptions of each project.

Table 3-1: 25-word Project Descriptions

Project	Description (25 Word Limit Based on PSP)
Upper Amador Canal Untreated Pipeline Project	AWA will install a pipeline in place of 18 miles of the unlined Amador Canal to conserve ~1,800 AFY of water lost through seepage/evaporation.
Ione Water Treatment Plant (WTP) Backwash Water Reuse Project	AWA will implement improvements at the Ione WTP to reclaim and treat ~50,000 gpd backwash water thus creating an average 56AFY additional water supply.

Upper Amador Canal Untreated Pipeline Project

AWA serves potable and raw (untreated) water to more than 25,000 people for municipal, industrial, and irrigation uses in Amador County. AWA operates the Amador Water System (AWS) which conveys Mokelumne River water to two water treatment plants (WTPs) – the Ione WTP and Tanner WTP. Mokelumne River water is first diverted to the Electra Tunnel, a PG&E facility, to Lake Tabeaud (which also serves as the forebay to the PG&E Electra Powerhouse). From Lake Tabeaud, water is diverted to the Amador Canal and gravity fed to the two WTPs. The Amador Canal is an earthen ditch that runs 23 miles from Lake Tabeaud to Tanner Reservoir on Ridge Road in Amador County, conveying raw water to the two WTPs while also providing raw water to users along the canal route that do not have an alternate source of supply. The supply is intended to be used for raw water purposes only, with users along the canal required to purchase bottled water for consumption and cooking purposes. However, there are ongoing compliance concerns associated with ensuring users do not utilize raw water from the canal for cooking and consumption instead of bottled water. The canal has significant water loss through seepage and evaporation, and water quality and security concerns because the canal is open, accessible to animals (see image in Attachment 7), and susceptible to environmental contaminants such as sediment, surface runoff, and failed leach fields. In July 2000, CDPH recommended AWA pipe the Canal as a means for protecting water quality.

The proposed project is the second of two phases of the Amador Transmission Project. The first phase, which was completed in 2007, replaced a portion of the Canal with 8.8 miles of 30-inch pipeline, connecting Lake Tabeaud to Tanner Reservoir. The proposed Upper Amador Canal Untreated Pipeline Project is the second phase and will replace 18 miles of the earthen, unlined Amador Canal (from New York Ranch Reservoir to Lake Tabeaud) with a 6- to 12-inch diameter pipeline to reduce water loss, improve water supply reliability, and protect water quality to the raw water users. While this pipeline will initially serve untreated water to users along the canal, it is an essential prerequisite to AWA's ultimate goal of providing these users treated water, eliminating the need by these users to use bottled water and thus fulfilling the Human Right to Water Policy.

Replacing the canal will conserve approximately 1,800 AFY of water that is lost through seepage, helping AWA address drought-related impacts to water supply. Should the drought continue, **AWA will be at risk of not meeting drinking water demands; the Upper Amador Canal Untreated Pipeline Project will provide immediate regional drought preparedness by conserving water lost through seepage.** Because groundwater is not used in the area, water lost through seepage is not a useable water supply. Design of the project is underway and environmental documentation is complete.

The Project will reduce water loss, improve operational efficiency, improve water supply reliability to AWA customers along the canal, reduce risk to mosquito-borne illnesses, reduce sediment transported in the water supply (improving water quality), reduce livestock/wildlife drowning, and enhance fire protection in the area through the addition of fire hydrants at strategic road crossings. The users along the Canal are within DACs (see Attachment 8 for more detail). Expedited funding is imperative to allow for immediate project implementation without impacting the already disadvantaged communities.

Ione WTP Backwash Water Reuse Project

The Ione WTP Backwash Water Reuse Project will provide immediate regional drought preparedness and will increase local water supply reliability and the delivery of safe drinking water to AWA's AWS customers. The Project consists of reclaiming and treating the backwash water at the Plant's headworks creating up to 50,000 gpd of additional water supply. Creating a new water supply for AWA and improving the existing treatment process will also contribute to the Human Right to Water Policy by delivering clean, affordable, and accessible water for human consumption, cooking, and sanitary purposes to its users, including DACs. The project will allow for continued, high quality delivery of potable water supplies to users and the water produced will be less expensive to those receiving service and thus more affordable to AWA and its customers which include DACs. Additionally, the Ione WTP is not currently serving customers that have requested service, so implementation of this project will help AWA meet customer demands.

The Ione WTP is a conventional water treatment facility that includes flocculation, clarification, filtration, and disinfection. Raw water is delivered in a pipeline from the Tanner Reservoir to Ione. Each of the four filters at the Ione WTP produces approximately 25,000 gallons of backwash water. Since the filters are typically backwashed in pairs, each backwash cycle produces approximately 50,000 gallons of waste, and one pair of filters is backwashed every 18 to 36 hours. Filter backwash water is discharged to a 95,000 gallon Backwash Waste Tank (BWT) which is drained into the City of Ione's sewer collection system which is then treated at the City's wastewater treatment facility (WWTF). Reducing the amount of backwash water sent to the sewer collection system and ultimately the City's WWTF is a secondary benefit. With this project, backwash water will instead be pumped from the BWT through the filter and returned to the raw water line ahead of chemical treatment, reducing backwash water discharged to the sewer by approximately 90%. The Project requires a pump station, filter, filter media, and filter aid feed equipment as well as filter backwash equipment. The project is currently under design (approximately 60% design complete). Agency Counsel has preliminarily indicated that project environmental documentation will likely consist of a Categorical Exemption. Construction is expected to begin within 6 months.

Should the drought continue, **AWA will be at risk of not meeting drinking water demands; this project will help create a new supply, improving drinking water supply reliability and providing drought preparedness.** Similar to the Upper Amador Canal Untreated Pipeline Project, expedited funding is required for this Project so that AWA can immediately implement the Ione WTP Backwash Water Reuse Project, creating new supply for its users, increasing water supply reliability and the delivery of safe drinking water and providing immediate drought preparedness without putting a financial burden on its customers in the AWS, many of which are disadvantaged (see Attachment 8 for more detail).

Regional and Project Maps

Figure 3-1: Regional Map

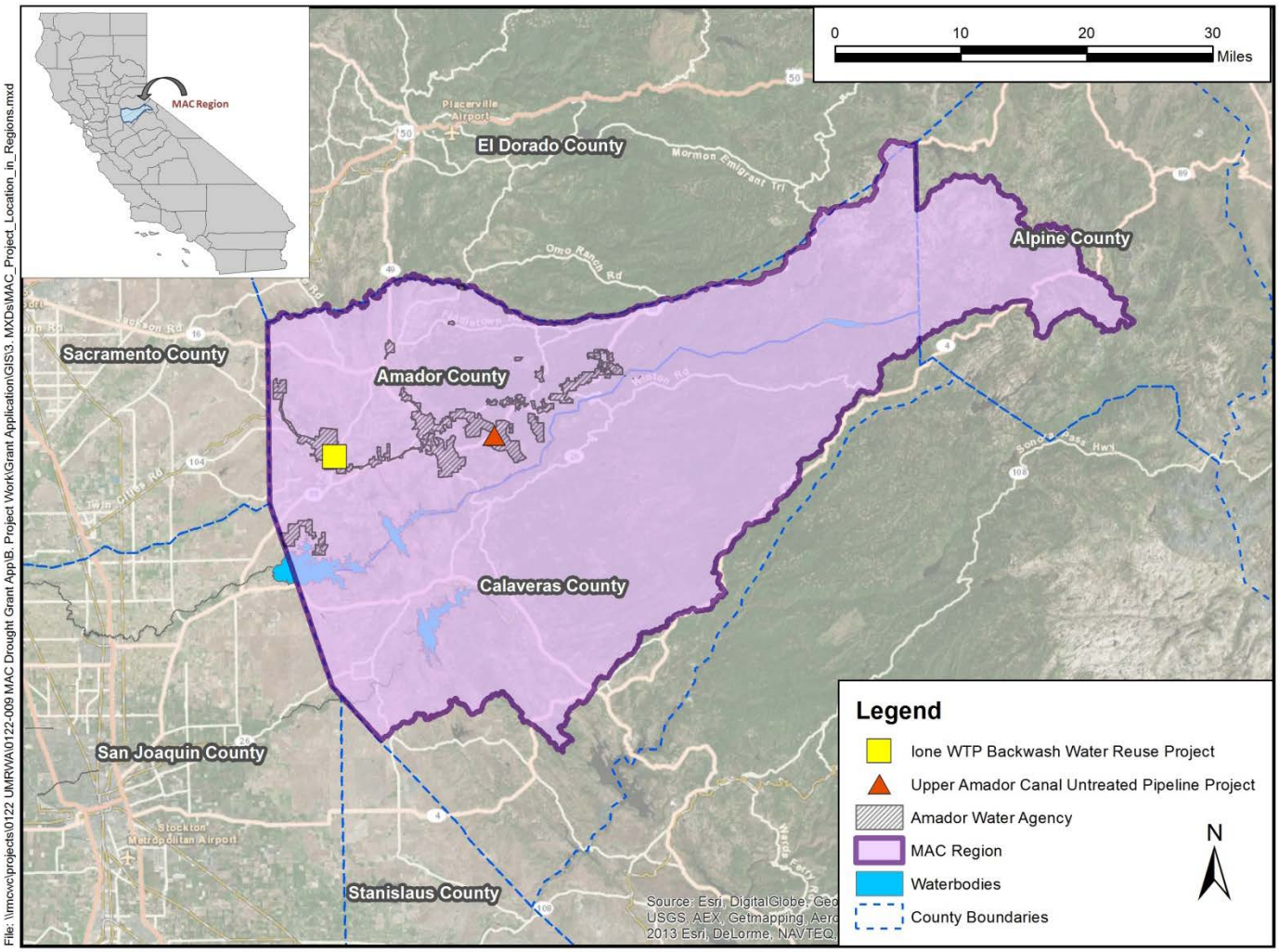


Figure 3-2: Upper Amador Canal Untreated Pipeline Project Map

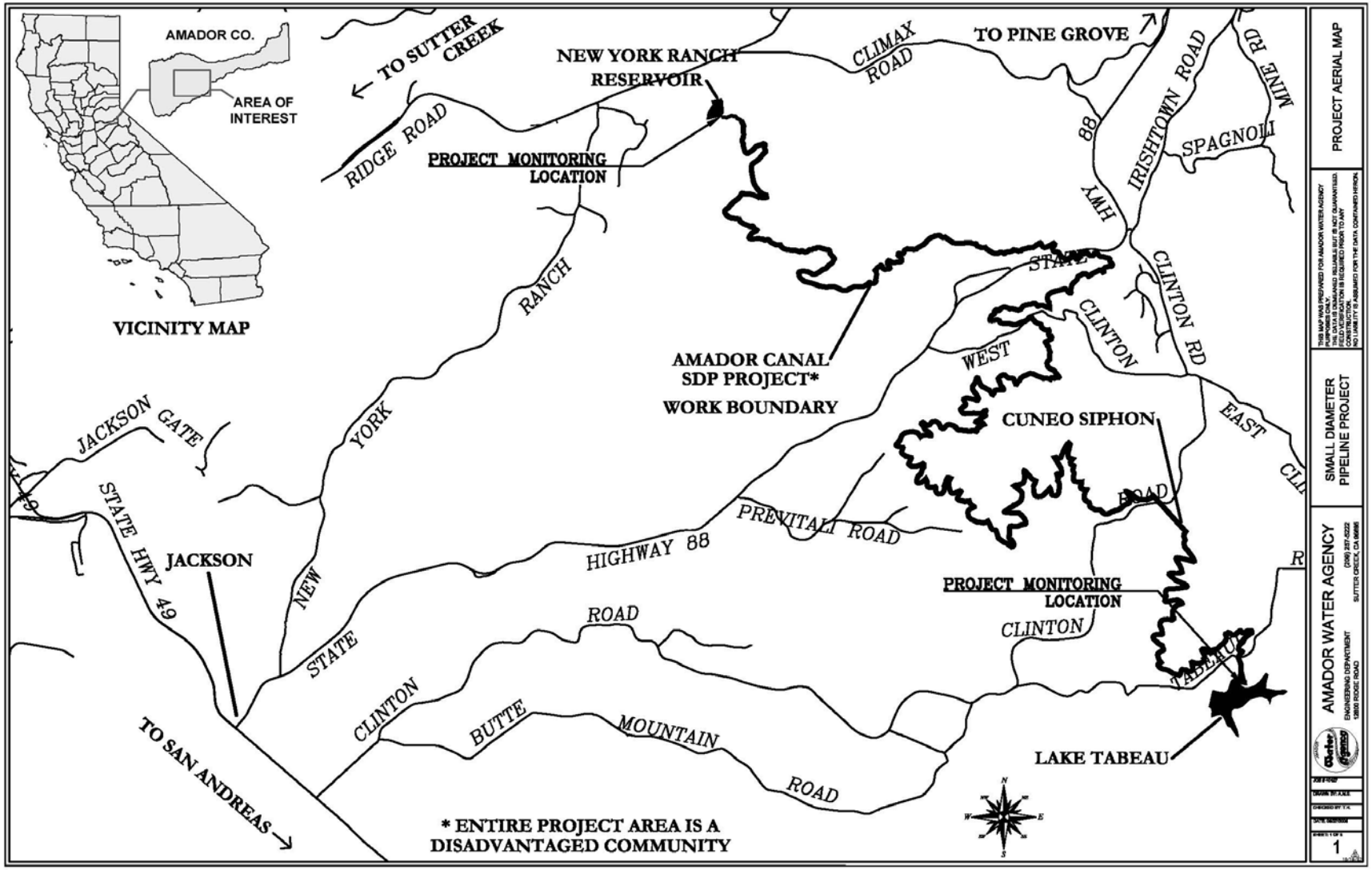
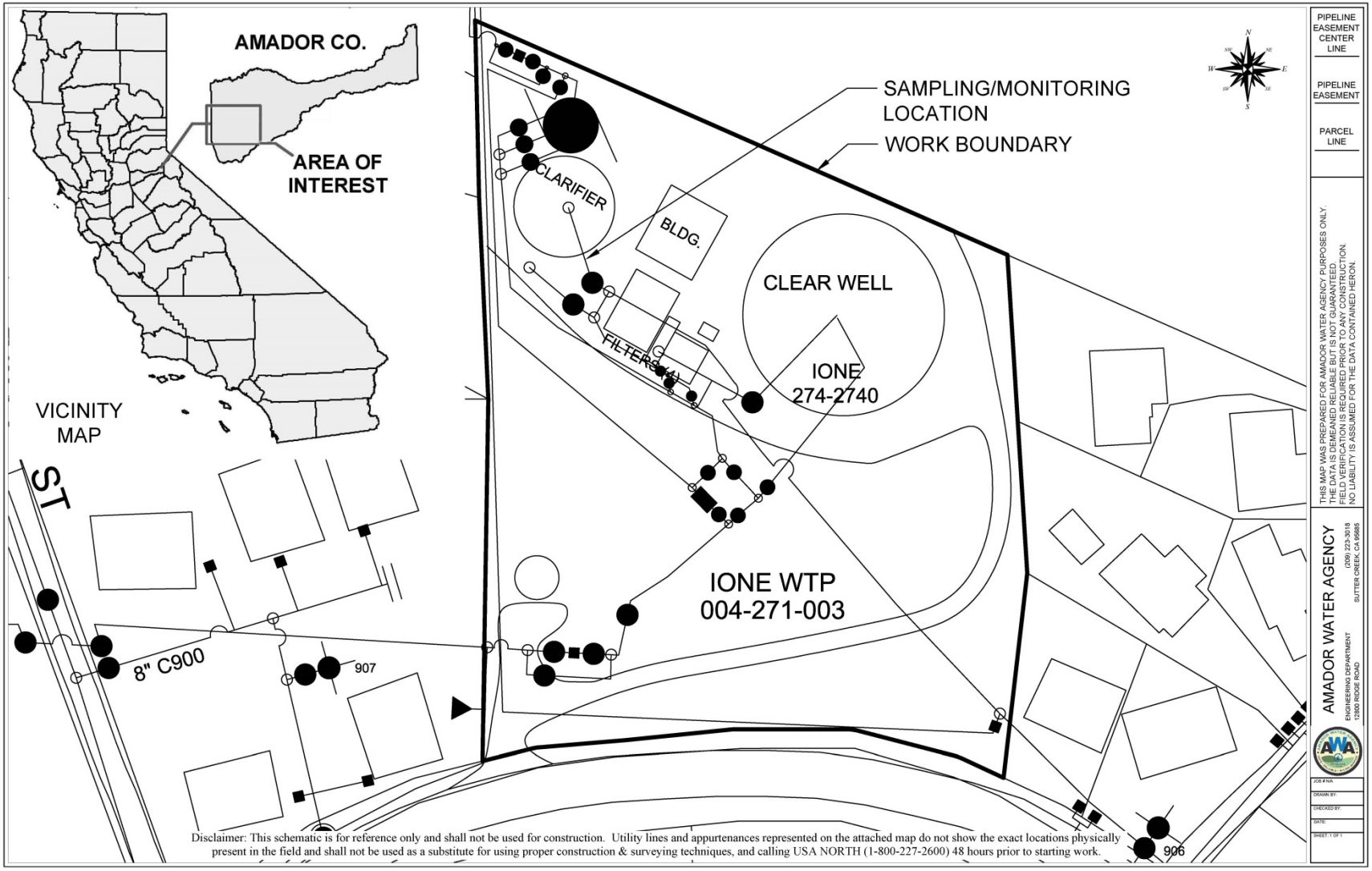


Figure 3-3: Ione WTP Backwash Water Reuse Project Map



Project Physical Benefits, Technical Analysis, and Cost Effectiveness Analysis

The physical benefits, technical analysis of the benefits, and the cost effectiveness analysis are described in the following sections for the three projects included in this proposal.

Upper Amador Canal Untreated Pipeline Project

Project Physical Benefits

The primary physical benefit of the Upper Amador Canal Untreated Pipeline Project will be the conservation of about 1,800 AFY of water that is typically lost through seepage and evaporation in Amador Canal. Because this supply is pumped, reduced pumping will result in energy savings and avoided CO2 emissions. These benefits are quantified in the following tables.

Table 3-2: Annual Project Physical Benefit – Water Savings (AFY)

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Upper Amador Canal Untreated Pipeline Project Type of Benefit Claimed: Water Savings Units of the Benefit Claimed : acre-feet per year (AFY) Additional Information About this Benefit: water saved by replacing 18 miles of unlined Amador Canal with pipeline			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016 – 2091	0	1,800	1,800
Comments: Sources - AWA flow data. See Small Diameter Pipe Project Memorandum (AWA, 2014) in Appendix 3.1			

Table 3-3: Annual Project Physical Benefit – Energy Savings (

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Upper Amador Canal Untreated Pipeline Project Type of Benefit Claimed: Energy Savings Units of the Benefit Claimed : kWh/year Additional Information About this Benefit: By replacing 18 miles of the unlined, earthen Amador Canal, water will not be lost through seepage and evaporation resulting in an associated energy savings in proportion to the water savings.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016 - 2091	31,452	19,740	11,711
Comments: Sources - AWA flow data and energy usage. See Small Diameter Pipe Project Memorandum (AWA, 2014) in Appendix 3.1. A reduction in energy usage is assumed to be proportional to water savings.			

Table 3-4: Annual Project Physical Benefit – CO2 Emissions Avoided (MT)

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Upper Amador Canal Untreated Pipeline Project Type of Benefit Claimed: CO2 Emissions Avoided Units of the Benefit Claimed : Metric Tons (MT) of Carbon Dioxide Equivalents Additional Information About this Benefit: By replacing 18 miles of the unlined, earthen Amador Canal, water will not be lost through seepage and evaporation. There will be an associated energy savings in proportion to the water savings resulting in avoided CO2 emissions.			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2016 - 2091	0	47.85	47.85
Comments: Sources - AWA flow data and energy usage. See Small Diameter Pipe Project Memorandum (AWA, 2014) in Appendix 3.1.			

Technical Analysis of Physical Benefits Claimed

Technical Basis of the Project

Studies in support of the Upper Amador Canal Untreated Pipeline Project include the following. These are provided in Appendix 3.1.

- Application to the Department of Water Resources 2004 Water Use Efficiency (WUE) Grant Program: Amador Transmission Project. In January 2005 AWA applied for a WUE grant for the Amador Transmission Project. The Upper Amador Canal Untreated Pipeline Project is the second phase of the project described in the WUE application. Information from the application was used to information presented in this Proposal.

- Hydrologic Analysis of Existing Conditions Report for Upper Amador Canal (Atkins, 2014)
- Small Diameter Pipe Project Memorandum (AWA, 2014)
- Small Diameter Pipeline Sizing, Lower Portion Memorandum (AWA, 2007)

Recent and Historical Conditions

Improving water efficiency in Amador Canal is a vital water management strategy which AWA has been working toward for years. Nearly 9 miles of the Amador Canal have been replaced with a pipeline (Phase 1 of the Amador Transmission Project), contributing to water savings in the system. The remaining 18 miles of Canal, from Lake Tabeaud to New York Ranch Reservoir, is still unlined and open, resulting in water loss through seepage, leaks, and evaporation, as well as allowing for exposure to environmental contaminants such as runoff and wildlife. Replacing the Canal with a pipeline will reduce water loss and improve water quality. Pursuant to a July 2001 agreement with CDPH (Appendix 3.2), AWA currently delivers untreated water from the Canal to users along the alignment. Under that agreement each customer on the Amador Canal that receives raw water must be provided hauled or bottled water until it becomes feasible for AWA to deliver potable drinking water to those customers through a piped system.

AWA's goal is to deliver treated water to these users; the implementation of the Upper Amador Canal Untreated Pipeline Project will help make forward progress and allow AWA to ultimately deliver treated water. Since these users currently rely on untreated water, allowing for future delivery of treated drinking water contributes to the Human Right to Water Policy.

Project implementation will conserve water supplies in AWA's system, improve water supply reliability to the users along the Canal, and benefit habitat in the Mokelumne River. The volume of water that is currently lost in the Amador Canal would remain in the Mokelumne River and be available for in-stream beneficial uses until it is needed by Amador County.

Without Project Conditions

Without project implementation, AWA would continue to experience significant water loss through seepage, leaks, and evaporation in Amador Canal. Approximately 1,800 AF of water is lost each year, and this would continue if the Canal is not replaced with a small diameter pipeline. This water is vital to AWA during these drought conditions when supplies are limited and the Agency is at risk of not meeting water demands in its service area. Also, if the project is not implemented, it is unknown when AWA would be able to deliver treated water to the users along the Canal.

Methods Used to Estimate Benefits

Annual water savings are estimated to be consistent throughout the project life. Flows are expected to remain constant based on historic usage and AWA staff knowledge. The water savings were calculated using available flow data from June 2012 through May 2014. Data for flow into Amador Canal at Lake Tabeaud, flow out of Amador Canal at New York Ranch

Reservoir, and the amount of water used along the way was compiled. The difference in flow equated to water loss. The average was taken resulting in an average water loss and therefore an annual water savings of 1,844 AFY. This number was rounded to the nearest hundred as shown in Table 3-2.

Energy savings are proportional to the water savings. Using real data, AWA calculated estimated energy savings from reduced pumping required through monthly water savings. Using subregion data from the U.S. Environmental Protection Agency (EPA) eGrid (eGrid 9th edition Version 1.0 Year 2010 Summary Tables, created February 2014), carbon dioxide equivalent (CO_2e) emission factors were compiled to develop a statewide emission factor associated with power generation. To develop the statewide estimate, a weighted average was used to account for imported power from nearby states. Energy splits by region by percentage were estimated based on data from the California Energy Commission for California electrical energy generation (http://energyalmanac.ca.gov/electricity/electricity_generation.html). This resulted in an average CO_2e emission factor of 0.34 metric tons per megawatt-hour (MT/MWh). Multiplying the emission factor times the monthly energy savings results in the metric tons of CO2 emissions savings each month, from June 2012 through May 2014. The average monthly avoided CO2 emissions were multiplied by 12 to account for an annual MT of CO2 emissions avoided. Because flow is expected to remain constant, the energy savings and CO2 emissions avoided would also remain constant through the project life.

New Facilities, Policies, and Actions Required

In order to achieve the physical benefits claimed, the pipeline from Lake Tabeaud to New York Ranch Reservoir is required. No additional policies or actions are required.

Adverse Physical Effects

No significant, long-term adverse physical effects are expected to result from the implementation of the Upper Amador Canal Untreated Pipeline Project. Any potential environmental effects have been identified in the Environmental Impact Report prepared for the Amador Transmission Project. Mitigation measures were identified and will be implemented accordingly. For example, replacing the open canal with a pipe will reduce water available to wildlife; therefore, as part of the project, wildlife watering stations will be installed throughout the alignment.

Cost Effectiveness Analysis

Cost Effectiveness Analysis (Table 6 from PSP)		
Project Name: Upper Amador Canal Untreated Pipeline Project		
Question 1	Types of benefits provided as shown in previous tables	Water Savings CO2 Emissions Avoided
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as proposed project been identified?	Yes
	If no, why?	N/A

	If yes, list the methods (including the proposed project) and estimated costs.	Chapter 6 of the Amador Transmission Project Draft Environmental Impact Report (September 2000) analyzed alternatives to the proposed project, including the No Project Alternative, Canal Life Extension Alternative, Electra Tunnel Outlet to Station 1313+27 Alternative, and the Three Pipeline Siphon Alternative. As described on pages 2-1, 3-4, and 3-5 of the Draft EIR, a key objective of the proposed project is to reduce O&M costs. At the time of EIR preparation, canal maintenance and repair (e.g. leak repair, algae control, ongoing maintenance, etc.) required 90 percent time by three full-time AWA staff members. It was estimated replacing the 23-mile canal with pipe would save AWA $75,000 / year in O&M costs. The other alternatives considered would not generate O&M cost savings and would therefore not achieve this objective.
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	While the EIR does not present estimated costs for the proposed project or its alternatives, it does indicate on page 6-30 that the proposed project was the most costly alternative. However, it was the only alternative that achieves all of the project objectives and it was determined to be the environmentally superior alternative. Piping the canal is also the only alternative which will provide the benefits quantified in the previous tables.
Comments:		

Ione WTP Backwash Water Reuse Project

Project Physical Benefits

The Ione WTP Backwash Water Reuse Project will recycle plant backwash water by treating it at the headworks of the plant, creating new supply. The primary benefit of this Project is

the creation of approximately 1,800 million gallons (MG), or 56 AF, of new supply over the estimated 50-year project life. The secondary benefit is the reduction in the amount of backwash water sent to the Ione sewer collection system and ultimately treated at the City's wastewater treatment plant (WWTP). The backwash water produced by the Ione and Tanner WTPs currently accounts for approximately 20 to 25% of flows to the Ione WWTP. Over the life of the project, it is estimated approximately 1,800 MG of water will be saved from requiring treatment at the Ione WWTP.

Table 3-5: Annual Project Physical Benefit – New Water Supply Created

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Ione WTP Backwash Water Reuse Project Type of Benefit Claimed: New Water Supply Created Units of the Benefit Claimed : Million Gallons (MG) Additional Information About this Benefit: 90% of the backwash water produced at Ione WTP will be treated at the headworks, creating new supply			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2014			
2015			
2016	0	16	16
2017	0	16	16
2018	0	17	17
2019	0	17	17
2020	0	18	18
2021	0	18	18
2022	0	19	19
2023	0	20	20
2024	0	20	20
2025	0	21	21
2026	0	21	21
2027	0	22	22
2028	0	23	23
2029	0	23	23
2030	0	24	24
2031	0	25	25
2032	0	26	26
2033	0	26	26
2034	0	27	27
2035	0	28	28
2036	0	29	29
2037	0	30	30

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Ione WTP Backwash Water Reuse Project Type of Benefit Claimed: New Water Supply Created Units of the Benefit Claimed : Million Gallons (MG) Additional Information About this Benefit: 90% of the backwash water produced at Ione WTP will be treated at the headworks, creating new supply			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project
2038	0	31	31
2039	0	32	32
2040	0	33	33
2041	0	34	34
2042	0	35	35
2043	0	36	36
2044	0	37	37
2045	0	38	38
2046	0	39	39
2047	0	40	40
2048	0	41	41
2049	0	43	43
2050	0	44	44
2051	0	45	45
2052	0	47	47
2053	0	48	48
2054	0	50	50
2055	0	51	51
2056	0	53	53
2057	0	54	54
2058	0	56	56
2059	0	58	58
2060	0	60	60
2061	0	61	61
2062	0	63	63
2063	0	65	65
2064	0	67	67
2065	0	69	69
Total	0	1,815	1,815
Comments: Sources - Table 3-10 of AWA's 2010 UWMP. See Appendix 3.3			

Table 3-6: Annual Project Physical Benefit – Reduction in Backwash Water Sent to Sewer/Ione WWTP

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Ione WTP Backwash Water Reuse Project Type of Benefit Claimed: Reduction in Backwash Water Sent to Sewer Collection System and Ione WWTP Units of the Benefit Claimed : Million Gallons (MG) Additional Information About this Benefit: By recycling the backwash water, the amount of backwash water sent to the sewer collection system and Ione WWTP will be reduced			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project (b) – (c)
2014			
2015			
2016	18	2	16
2017	18	2	16
2018	19	2	17
2019	19	2	17
2020	20	2	18
2021	20	2	18
2022	21	2	19
2023	22	2	20
2024	22	2	20
2025	23	2	21
2026	24	2	21
2027	24	2	22
2028	25	3	23
2029	26	3	23
2030	27	3	24
2031	28	3	25
2032	28	3	26
2033	29	3	26
2034	30	3	27
2035	31	3	28
2036	32	3	29
2037	33	3	30
2038	34	3	31
2039	35	4	32
2040	36	4	33
2041	37	4	34
2042	38	4	35
2043	40	4	36

Table 5 (from PSP) – Annual Project Physical Benefits Project Name: Ione WTP Backwash Water Reuse Project Type of Benefit Claimed: Reduction in Backwash Water Sent to Sewer Collection System and Ione WWTP Units of the Benefit Claimed : Million Gallons (MG) Additional Information About this Benefit: By recycling the backwash water, the amount of backwash water sent to the sewer collection system and Ione WWTP will be reduced			
(a)	(b)	(c)	(d)
	Physical Benefits		
Year	Without Project	With Project	Change Resulting from Project
2044	41	4	37
2045	42	4	38
2046	43	4	39
2047	45	4	40
2048	46	5	41
2049	47	5	43
2050	49	5	44
2051	50	5	45
2052	52	5	47
2053	54	5	48
2054	55	6	50
2055	57	6	51
2056	59	6	53
2057	60	6	54
2058	62	6	56
2059	64	6	58
2060	66	7	60
2061	68	7	61
2062	70	7	63
2063	72	7	65
2064	75	7	67
2065	77	8	69
Total	2,016	202	1,815
Comments: Sources - Table 3-10 of AWA's 2010 UWMP. See Appendix 3.3			

Technical Analysis of Physical Benefits Claimed

Technical Basis

The Project is supported by a number of studies. The following supporting studies are provided in Appendix 3.3.

- The *Ione WTP Backwash System Improvements Preliminary Design Technical Memorandum* (Peterson, Brustad, Inc., 2014). This TM evaluated alternatives for

reducing discharges of backwash water to the sewer. In April 2014, a revised evaluation of alternative and recommendation was prepared. The alternatives evaluation including costs is provided on page 4 of 5 of the Revised Evaluation of Alternatives and Recommendation.

- 60% design cost estimate for the project (June 2014).
- AWA prepared its 2010 UWMP and has since made revisions to it based on DWR input. The revised UWMP includes information specific to the Ione WTP and backwash water produced at the Plant (specifically Table 3-10).

Recent and Historical Conditions

Currently, approximately 45,000 gpd of backwash water is produced at the Ione WTP. This water is discharged to the sewer collection system and delivered to the City of Ione WWTP for treatment. Due to the drought, AWA is at risk of not meeting drinking water demands. The Ione WTP Backwash Water Reuse Project would treat 90% of the backwash water produced at the Ione WTP creating a new water supply. This supply is essential in helping AWA respond to the drought and improve water supply reliability to its customers in the Amador Water System, many of which are DACs.

Without Project Conditions

If the Ione WTP Backwash Water Reuse Project is not implemented, AWA will continue discharging the backwash water produced at the Plant to the sewer system, contributing significantly to the flows at the Ione WWTP. Additionally, there will be increased fees for discharging backwash water to the sewer, so if AWA does not implement this project and reduce the amount of backwash water sent to the sewer and ultimately the Ione WWTP, it would incur additional fees. If the Project is not implemented, there could be a shortfall of water supplies in which AWA would not meet the drinking water demands in Amador Water System. There would be few options if AWA cannot meet demands; it could rely on the State to continue some emergency baseline levels of surface water available for diversion which could have negative impacts on the State as a whole, since emergency diversions would deplete flows in the Mokelumne River which flows to downstream users including the Delta, and would also impact habitat in the River. Another option would be to truck water in to users, but it is uncertain where this water would come from and if drought conditions continue, it is likely that trucking water would become more unreliable and more costly.

Methods Used to Estimate Benefits

Backwash water produced at the Tanner and Ione WTPs is quantified in the AWA Revised 2010 UWMP in Table 3-10. These values are estimated from 2010 through 2030 in five-year increments. Based on available data and AWA operational knowledge, approximately half of the amount of backwash water produced shown in Table 3-10 is for Tanner WTP and the other half is for Ione WTP. This ratio was applied to determine the estimated backwash water produced at the Ione WTP from 2010 through 2030. The increase for each time step was calculated to develop the estimated annual increase in backwash water produced at the Plant. The annual increase of 0.03 was applied to the backwash water produced beginning at 45 AFY in 2010 through the project life (ending in 2065). Based on preliminary studies, 90%

of the backwash water produced at Ione WTP will be reused through treatment at the headworks, resulting in an equivalent amount of new water supply created. Typically, the backwash water produced is sent to the sewer collection system for treatment at the Ione WWTP. Since 90% of the backwash water produce will be treated, this reduces the amount of water sent to the sewer system. The difference between backwash water produced and backwash water treated equals the backwash water sent to the sewer after project implementation.

New Facilities, Policies, and Actions Required

For the Ione WTP Backwash Water Reuse Project benefits to be realized, the following project facilities are required:

- New piping, equipment and instrumentation to integrate treatment of the backwash water into the existing treatment system
- A pump station
- A filter, filter media, filter aid feed equipment, and filter backwash equipment

No policies or actions would be required.

Adverse Physical Effects

No significant, long-term adverse physical effects are anticipated from project implementation. Because the project involves minor alteration of existing facilities at the WTP site, there will be no significant impacts. A Categorical Exemption will be required to comply with CEQA.

Cost Effectiveness Analysis for the Ione WTP Backwash Water Reuse Project

Cost Effectiveness Analysis (Table 6 from PSP)		
Project Name: Ione WTP Backwash Water Reuse Project		
Question 1	Types of benefits provided as shown in previous tables	New water supply created Reduction in backwash water sent to sewer/Ione WWTP
Question 2	Have alternative methods been considered to achieve the same types and amounts of physical benefits as proposed project been identified?	Yes
	If no, why?	N/A
	If yes, list the methods (including the proposed project) and estimated costs.	The *Ione WTP Backwash System Improvements Preliminary Design Technical Memorandum* (Peterson, Brustad, Inc., 2014) evaluated alternatives for reducing backwash water discharged to the sewer. Three backwash water recycling alternatives were evaluated based on technical merits, impacts to limited space on the site, O&M costs, and estimated construction costs. The Project (Alternative

		1) is the least costly alternative. Construction costs are as follows: Alternative 1 (this Project) - $725,000;[1] Alternative 2 (Decant Backwash Tank and New Tank) - $854,000; Alternative 3 (Provide Sludge Thickening) - $831,000. Alternatives that would create new supply *and* reduce discharge of backwash water to the sewer (providing the same benefits as the proposed project) were not specifically evaluated.
Question 3	If the proposed project is not the least cost alternative, why is it the preferred alternative? Provide an explanation of any accomplishments of the proposed project that are different from the alternative project or methods.	The project was the least cost alternative evaluated in the *Ione WTP Backwash System Improvements Preliminary Design Technical Memorandum*. Increasing water supply through groundwater pumping is not a viable alternative due to variable water supply and quality. Other potential water supplies, such as water transfers, would be less reliable and more costly than the proposed project.
Comments:		

1. The project construction cost included in the grant application differs from the estimate in the April 2014 Revised Evaluation of Alternatives and Recommendation (see Revised Table 4 on page 4 of 5), as the cost for the application is based on the 60% design and cost estimate (see Appendix 3.3).

Appendix 3.1 – Upper Amador Canal Untreated Pipeline Project References

Application to the Department of Water Resources 2004 Water Use Efficiency (WUE) Grant Program: Amador Transmission Project

Application to the Department of Water Resources' 2004 Water Use Efficiency Grant Program:

Amador Transmission Project

Amador Water Agency

January 11, 2005

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List of Attached Documents

- Amador County Public Works Agency. Encroachment Permit. September 2004.
- Amador Water Agency. Revised Section 4.1 of the Environmental Impact Report (EIR) for the Amador Transmission Project (SCH #2000022106)
- Amador Water Agency. Notice of Availability of Revised Section 4.1 of the Environmental Impact Report (EIR) for the Amador Transmission Project (SCH #2000022106)
- Department of Fish and Game Sacramento Valley and Sierra Region. Notice of Determination. September 2004.
- EIP Associates. Amador Transmission Project Draft Environmental Impact Report SCH #2000022106: Prepared for Amador Water Agency. September 2000
- EIP Associates. Amador Transmission Project Final Environmental Impact Report SCB #2000022106: Prepared for Amador Water Agency. May 2001
- KASL Consulting Engineers. Evaluation and Update of the Amador Transmisison Main Project Pipeline Alternative. September 2000
- Kennedy/Jenks Consultants. Project Manual Including Specifications for Amador Water System Transmission Project (100% Design Submittal): Prepared for Amador Water Agency. August 2004
- Kennedy/Jenks Consultants. List of Drawings. August 2004
- Regional Water Quality Control Board Central Valley Region. CWA S401 Permit. July 2004
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1 Statement of Work: Relevance and Importance

1.1 Setting

The proposed project is located in the North Fork Mokelumne River watershed which lies mostly in Amador County and partially within Alpine and Calaveras counties (Figure 1). The North Fork of the Mokelumne River is the major tributary to the main stem flowing approximately 55 miles from its source at the Sierras, near the Upper and Lower Blue Lakes, to its confluence with the South Fork Mokelumne River. Flow in the North Fork is mainly regulated by Pacific Gas & Electric's (PG&E) Mokelumne Hydroelectric Project. The North Fork subwatershed contains nearly all the major impoundments and diversion systems located in the Upper Mokelumne River Watershed including seven storage reservoirs storing approximately 220,000 acre-feet (AF) of water per year. Flow rates in the river are therefore governed by release rates from these reservoirs.

After the confluence with the South Fork, the main stem of the Mokelumne River drains into Pardee Reservoir. This reservoir is the primary water supply source (over 90 percent) for the East Bay Municipal Water Utility District (EBMUD) (EBMUD, December 2000). From Pardee Reservoir, a portion of Mokelumne River water is diverted and transported to EBMUD's service area in the San Francisco Bay Area. The remaining water drains into the Camanche Reservoir, another EBMUD facility. A portion of the raw water is then diverted to serve EBMUD's Camanche South Shore Recreation Area. The remaining water travels downstream to the confluence with Cosumnes River and onto the Bay-Delta system.

1.2 Amador Water Agency Background

The Amador Water Agency ("Agency") was formed in 1959 to provide water and wastewater services to residents of Amador County. The Agency's main source of fresh water supply is the North Fork of the Mokelumne River which originates in the California Sierra Nevada Mountains. Water supplied from rainfall and snowmelt is diverted from the river into the Tiger Creek Afterbay or Lake Tabeaud Forebay (Lake Tabeaud). From here, the water either gravity flows or is pumped to one of the Agency's treatment plants.

The Agency's two main water systems are the Amador Water System (AWS) and the Central Amador Water Project System (CAWP). These two systems provide water to the cities of Jackson, Ione, Sutter Creek, Amador City and Drytown as well as communities along Highway 88. The systems are shown in Figure 2.

Amador Water System (AWS)

The AWS consists of two water treatment plants at Sutter Hill (Tanner Water Treatment Plant) and Ione (Ione Water Treatment Plant). Mokelumne River water is first diverted to the Electra Tunnel, a PG&E facility, to Lake Tabeaud which serves as a forebay to the PG&E Electra Powerhouse. From here, the water is diverted into the Amador Canal and is gravity fed to the two water treatment plants. The AWS also provides raw water for agricultural, industrial, commercial, and domestic irrigation needs for customers located along the Amador Canal. Based on terms of a 1985 agreement with PG&E, the Agency is entitled to divert up to 15,000 acre feet (AF) per year of water stored at Lake Tabeaud at a peak flow rate of 30 cubic feet per second (cfs) (KASL Consulting Engineers, September 2000). However, at present, the agency is

unable to use the full entitlement of water due to limitations and conditions of Amador Canal. The remaining Lake Tabeaud water is driven through the Electra Powerhouse for hydropower generation and is then returned to the main stem of the Mokelumne River.

Central Amador Water Project System (CAWP)

The CAWP provides wholesale and treated water by pumping it from the Tiger Creek Afterbay, a PG&E facility, and treating it at the Buckhorn Water Treatment Plant. The Agency currently has the right to store 1,600 AF of water per year and divert 1,150 AF per year from the Tiger Creek Afterbay (Amador Water Agency, 2004).

The agency also provides water service to the Lake Camanche and La Mel Heights areas. The water supply for these areas does not originate from the Mokelumne River but is instead pumped from groundwater wells. Groundwater pumping averages approximately 200 AF per year (Amador Water Agency, 2004).

Some recycled water is also provided from two wastewater treatment plants in the Ione and North Shore Camanche areas. Recycled water is currently used to irrigate approximately 1,500 acres of farm and pasture land. The Agency has partnered with Amador County and the communities of Sutter Creek, Ione, and Jackson to develop a Regional Wastewater Consolidation Study. The study will determine the feasibility of expanding wastewater recycling in the region.

Further discussion on the Agency's service area and existing infrastructure will focus on the Amador Water System since the proposed project relates solely to the Amador Canal.

1.3 Transmission Pipeline Project Location and Background

As previously mentioned, the project is focused on the Amador Canal. As shown in Figure 2, the Canal begins adjacent to Lake Tabeaud and ends at Tanner Reservoir. It is approximately 23.5 miles long and carries raw water for treatment at the Agency's water treatment plants as well as serving the need for raw water use along the way. The Canal was constructed 134 years ago by the Sutter Canal and Mining Company and was bought by the Agency from PG&E in 1985. Water destined for the Canal is first diverted from the Mokelumne River at PG&E's Tiger Creek Afterbay into the Electra Tunnel which then discharges to Lake Tabeaud. A pump station at the Electra Tunnel outlet lifts the water through a 30 inch diameter pipeline to the Amador Canal. The Electra Tunnel pump station and pipeline are owned and operated by PG&E.

The Canal is generally an unlined trapezoidal-shaped conveyance ditch with a bottom width of approximately 6 feet, side slopes varying from nearly vertical to 2:1, and berm top widths varying from 4 to 8 feet. Limited portions of the Canal have been gunite-lined or hypalon-lined.

1.4 Transmission Pipeline Project Need

The canal system experiences deficiencies associated with water loss, reliability relative to conveyance of the water supply, water supply utilization, water quality, and operation and maintenance (O&M) costs. These deficiencies are described in more detail below.

Water Loss

The existing earthen open ditch canal system is subject to loss of water through evaporation, seepage, and inefficient operation. A four-year water balance for Amador Canal is shown in Table 1. On average, the Agency has documented annual losses ranging between 40 and 50 percent of the total intake volume. The Agency has attempted to control losses through repairs of leaks and seepage but new leaks appear constantly. The Agency also experiences operational water losses due to high surface runoff resulting in a compromised supply with extreme turbidity. In addition when weather changes reduce the need for water pumped into the canal, the water not needed is wasted down existing waste gates. Flows are also interrupted annually when the canal is cleared for maintenance activities including silt and debris removal or vegetation management.

Reliability and Conveyance

Based on Agency records, 117 leak repairs and two substantial blow-out and near blow-outs occurred between May 1999 and August 2000 (EIP Associates, September 2000). Water flow is also sometimes impaired by fallen trees and other debris. In addition, flow changes at the head of the 23-mile canal take approximately 24 hours before reaching the end of the canal at Tanner Reservoir. Due to this time lag in flow rate modifications, sudden changes in water demand can result in overflows or shortages.

Water Supply Utilization

The Agency currently has an Agreement with PG&E to obtain 15,000 AF of water per year at a maximum rate of 30 cfs. However, due to the open, earthen canal system, the amount of flow reaching Tanner Reservoir is reduced by forty to fifty percent. Based on Department of Finance projections of population and business growth for the Sutter Creek area, without conveyance improvements in the Canal, the area is estimated to experience water shortages of 2,503 AF in the year 2010 and 4,433 AF in 2020 (EIP Associates, September 2000). In contrast, with conveyance improvements, the area is estimated to experience a surplus of 2,747 AF in 2010 and 817 AF in 2020 (EIP Associates, September 2000).

Table 1 Amador Canal Water Balance

Year	Water In (Head Amador Canal) (AF)	Water Out (Accounted) (AF)							Water Loss (Unaccounted) (AF)	
		Tanner Plant	Ione Plant	Ione Canal	Ione Pipeline	Amador Canal (Metered)	Amador Canal (Unmetered)	Total Accounted Water	Acre-feet	% of Water In
2000	12,419	2,296.28	1,573.7	915	849.9	340.1	203.4	6,178.4	6,240.6	50.3%
2001	10,984	2,519.67	1,714.96	730	671.7	384	176.3	6,196.6	4,787.4	43.6%
2002	9,761	2,515.67	1,715.9	485	827.2	306.9	192.5	6,043.2	3,717.8	38.1%
2003	9,695	2,519.24	1,671.48	365	787.4	238.6	159.4	5741.1	3,953.9	40.8%
2004	8,101	2,260.46	1,433.39	274	955.1	309.9	180.8	5,413.7	2687.3	33.2%
Average	**10,192**	**2,766**	**1,622**	**554**	**818**	**316**	**183**	**5,915**	**4,277**	**42%**

Water Quality

The open canal system is subject to contamination of its water supply by runoff from adjacent agricultural, cattle grazing, and domestic land uses and atmospheric deposition. In addition, it may also be adversely impacted by potential septic field intrusion. The water quality is currently monitored by measuring coliform and fecal coliform from the head waters at Lake Tabeaud to the Tanner Water Treatment Plant. Table 2 provides data collected as total and fecal coliform levels over a six year period.

Table 2 Total Coliform (TC) and Fecal Coliform (FC) Levels along Amador Canal

		1996	1997	1998	1999
Tiger Creek (Water In)	Min. FC	2	2	2	2
	Max. FC	13	130	13	30
	Min. TC	2	4	2	2
	Max. TC	900	900	500	2,400
Lake Tabeaud (Water In)	Min. FC	2	N/A	N/A	2
	Max. FC	300	N/A	N/A	240
	Min. TC	4	N/A	N/A	2
	Max. TC	900	N/A	N/A	900
Tanner Reservoir (Water Out)	Min. FC	4	9	11	2
	Max. FC	300	240	300	900
	Min. TC	30	34	26	2
	Max. TC	2,400	1,600	2,400	2,400

As depicted in Table 2, the degradation of the water quality along the canal is significant. The open canal system is also susceptible to deliberate and/or accidental contamination of the water supply since it parallels or crosses twelve different public roads all providing easy access to the canal.

Operations and Maintenance Costs

Ongoing O&M costs incurred from leak repairs and weed and algae control activities are expensive due to the open earthen nature and age of the canal. Currently a crew of three staff members spends 90% of their time operating and maintaining it (EIP Associates, September 2000).

1.5 Transmission Pipeline Project Description

The Amador Transmission Pipeline Project proposes to replace the existing canal system with approximately 46,500 lineal feet (8.8 miles) of 30 to 36-inch diameter pressure main. The water transmission main would travel directly from Lake Tabeaud to Tanner Reservoir. Service to raw water customers would be provided by a raw water service line in the existing Amador Canal. The service line would be a 6 to 12-inch diameter pipeline buried within the existing route of Amador Canal. Amador Canal would therefore be dewatered and backfilled. The alignment of the existing Amador Canal and that of the proposed pipelines is shown on Figure 3. The water in the pipelines would flow by gravity to avoid the need for pumping. Further detail on each pipeline alignment is given in Section 2 (*Statement of Work : Technical/Scientific Merit and Feasibility*).

The project would be implemented in two phases. The water transmission main would be constructed during the first phase of the project with an estimated project duration of 21 months (March 2005 through November 2006). Design for Phase 1 has been completed and the Final Plans and Specifications have been attached to this application. This phase of the project is ready for construction. The second phase of the project would involve replacement of the existing Amador Canal with the raw water service line. This phase would have an estimated project duration of 2 years including one year for design completion and a second year for construction (October 2006 through October 2008). **It is important to note that funding is requested only for Phase 1 of the proposed Amador Transmission Pipeline Project.** Further detail on the proposed scope of work and schedule is given in Section 2 (*Statement of Work: Technical/Scientific Merit and Feasibility*).

1.6 Transmission Pipeline Project Objectives

In order to address the deficiencies outlined above, the proposed project objectives are to:

1. Reduce Water Loss:

Since the pipe would be sealed and buried below grade, all losses from seepage, leaks, and evaporation would be substantially eliminated. The pipeline would also provide improved operational control since it allows for almost instantaneous changes in flows, thereby eliminating the current procedure of wasting unneeded water via waste gates. As a result, the project would be consistent with CALFED's as well as the Agency's Urban Water Management Plan's policies on water conservation.

The CALFED 2000 Record of Decision (ROD) establishes an estimated statewide water savings from water use efficiency in the urban sector at 520,000 to 688,000 AF (CALFED, August 2000). This water is currently unavailable in part because it is lost to excessive evaporation. As shown in Table 1, the existing Amador Canal contributes to this excessive loss with approximately 4,300 AF lost annually through evaporation, seepage, and inefficient operation. The proposed project would therefore implement CALFED's goal to "reduce existing irrecoverable losses – by reducing losses currently unavailable for reuse …, CALFED will increase the overall volume of available water." (CALFED, August 2000). In addition, the project would meet multiple objectives by making the volume of water savings available for in-stream flows in the North Fork of the Mokelumne River. As a result, the project will contribute to the overall improvement of in-stream habitat for anadromous fish and other species in this section of the river. The additional volume of in-stream flows will eventually reach EBMUD's Pardee Reservoir. The Agency has entered into an agreement with EBMUD to make this volume available for EBMUD's drought contingency flows.

As stated in their UWMP, elimination of excessive water loss in Amador Canal would also contribute to the Agency's goal of "ensuring the implementation of water conservation programs that will promote efficient use of the existing water supplies." (Amador Water Agency, 2004). More specifically, it would contribute to the established Urban Best Management Practice (BMP) of "System Water Audits, Leak Detection, and Repair" (i.e. the Agency's Water Demand Management Measure number three). Additional Water Demand Management Measures implemented to achieve this goal are described in Section 1.7 (*Water Demand Management Activities*). Since Amador Canal is also used to provide raw water service to customers along its route, its replacement can also be considered to implement the established Agricultural Efficient Water Management Practice (EWMP) of lining or piping ditches and canals.

2. Improve Reliability and Conveyance of the Water Supply:
The pipelines would not be subject to flow impedance from fallen trees or other debris. In addition, electrical power would not be required to supply the flow of water since no pumping would be needed. As a result, the water supply would not be subject to flow interruptions due to power failures.

3. Attain the Agency's Full Water Entitlement of 15,000 AF:
As described in their Urban Water Management Plan, the Agency has sufficient water to meet its customer needs through the year 2020, provided its full entitlement of water (15,000 AF) is available (Amador Water Agency, 2004). This entitlement would be available upon implementation of the proposed project since the proposed pipelines would not be subject to drastic water losses. As previously shown in Table 1, the current water demand is approximately 6,000 AF with an average of 4,300 AF lost through evaporation, seepage, leaks, or inefficient management. This amount would be instead made available for in-stream flows and when needed, EBMUD's drought contingency flows. Implementation of the proposed project would preserve local flexibility by making the Agency's full entitlement available when needed. It would therefore achieve CALFED's goal of "… maintaining the flexibility of implementing water use management and efficiency improvements at the local level …" (CALFED, August 2000).

4. Continue Service to the Agency's Customers with Improved Reliability:
The current raw water customers would be served via a pipeline along the existing Amador Canal.

5. Improve Raw Water Quality:
The proposed pipelines would eliminate water supply contamination from surface runoff. In a July 24, 2000 letter, the Department of Health Services states that:

> "The Department recommends that the Amador Water Agency continue to investigate the feasibility of piping the Amador Canal in order to protect the quality of raw water along the 23.5 [2]-mile distance that the open canal currently carries water to the treatment plant. Animals would not have direct access to the raw water along the former canal route and during winter storms, runoff would no longer have a degrading impact on the water quality downstream of the start of the pipeline at Lake Tabeaud." (EIP Associates, September 2000)

The new pipelines would therefore eliminate the risk of water supply contamination from livestock, human contact, or accidental discharges.

6. Reduce O&M Costs:
It is estimated that the agency would save approximately $75,000 a year in routine O&M costs (EIP Associates, September 2000). These savings could be used to perform preventative maintenance on the Amador Water System distribution facilities.

1.7 Water Demand Management Activities

The objectives of the proposed project are consistent with water conservation goals and policies outlined in the Agency's 2004 Urban Water Management Plan (UWMP). The UWMP has been attached to this application for reference purposes. Several water conservation measures have been implemented to ensure the efficient use of existing water supplies. These measures are described in detail in Section 6 of the UWMP and are listed and summarized in Table 3. The proposed Transmission Pipeline Project would specifically implement Demand Management Measure three (DMM3) (System Water Audits, Leak Detection and Repair).

Table 3 Amador Water Agency's Water Demand Management Measures (DMM)

Water Demand Management Measure (DMM)	Description
DMM1 – Water Survey Program	This program offers free residential water surveys including sprinkler system efficiency.
DMM2 – Residential Plumbing Retrofit	The agency offers free water-saving kits that contain free shower head replacements and other devices to reduce toilet flush water requirements.
DMM3 – System Water Audits, Leak Detection and Repair	**The Agency has a continuous water leak detection and repair program. Records are kept annually on water production versus consumption to track unaccounted water. High water losses in the conveyance system have been attributed to Amador Canal. However, these losses will be eliminated with implementation of the proposed project.**
DMM4 – Metering with Commodity Rates	Properties currently under a flat rate service are required to convert to metered service upon transfer of ownership.
DMM5 – Large Landscape Conservation Programs	The Agency reviews landscape plans for proposed new developments. Drought tolerant plants are recommended and a demonstration garden is maintained for the public to view.
DMM6 – High-Efficiency Washing Machine Rebate Programs	This DMM was recently added to the Agency's practices.
DMM7 – Public Information Programs	The Agency promotes public awareness of water conservation issues by developing bill inserts, brochures, special events and water conservation programs sponsored in local schools.
DMM8 – School Education Programs	Educational materials and videos are provided to schools upon request.
DMM9 – Conservation Programs for Commercial, Industrial, and Institutional	Review of plans for new commercial, industrial, and institutional customers is done upon request.
DMM10 – Wholesale Agency Programs	The agency does not have a wholesale program.
DMM11 – Conservation Pricing	Tiered rates for the Amador Water System are not currently in place. However, the does use tiered service rates for customers in the Central Amador Water Project System.

Water Demand Management Measure (DMM)	Description
DMM12 – Water Conservation Coordinator	This function is fulfilled by customer service representatives whose responsibilities include providing conservation information upon request.
DMM13 – Water Waste Prohibition	The Agency has both voluntary and mandatory conservation policies including unattended water prohibitions; shortening of irrigation season; car, boat, building, and trailer washing restrictions; restrictions on filling of swimming pools; etc.
DMM14 – Residential Ultra-Low-Flush Toilet Replacement Programs	This program is not currently in place.

2 Statement of Work: Technical/Scientific Merit, Feasibility

2.1 Description of Proposed Project and Pipe Materials

As previously described, the proposed project will replace the existing canal system with a water transmission main and raw water service line. It includes 46,521 linear feet (LF) of 30 to 36-inch water transmission main and approximately 117,600 LF of 6 to 12-inch raw water service pipeline. The proposed pipeline alignments are shown in Figure 3. Flow will be gravity driven thereby avoiding the need for pumping. In order to make the project more manageable for the Agency, construction of the pipelines will be divided into two phases. Phase 1 involves the construction of the water transmission main, while Phase 2 will replace the existing Amador Canal with a raw water service line to continue service to raw water customers. Details on each alignment and pipe materials are given below. **It is important to note that funding is only requested for Phase 1 of the proposed Amador Transmission Project.** The varying estimated project costs are different due to the size of the pipelines and the elimination of pre-installation activities in Phase 2 of the proposed project. As previously described, the proposed raw water service line will be buried within the existing route of Amador Canal. As a result, pre installation activities such as vegetation removal, clearing, and excavation will not be necessary. In addition, Phase 2 will be implemented with the Agency's forces and will not go out for bid.

Water Transmission Main (Phase 1) – ($15,032,281)

The recommended water transmission main includes:

- 600 LF of intake pipe at Lake Tabeaud;
- 11,650 LF of pipeline located within public roadways;
- 33,560 LF of pipeline located within private easement areas; and
- 721 LF of pipeline located at the Tanner Water Treatment Plant Site.

The water transmission main will be a 30 to 36-inch pipe with a design flow of 30 cfs. Cement lined and wrapped Ductile Iron Pipe (DIP) will be used for pipe sections with pressures in excess of 150 psi. For pipe segments with 150 psi or less, DIP, PVC C905, or HDPE pipe will be used.

Nineteen easements were identified along the route of the proposed main. Three of these have been acquired by the Agency covering over forty percent of the alignment route. The remaining easements will be obtained upon recertification of the Final Environmental Impact Report (EIR) (see Section 2.3 - *Task List and Schedule* for a description of the status of environmental documentation and permits). Design of the main was completed by Kennedy/Jenks Consultants in August 2004. Copies of the Final Plans and Specifications have been attached to this application for reference purposes.

Service Pipe (Phase 2) – ($2,500,000)

Current raw water services along Amador Canal will be maintained by construction of a service pipeline within the existing Amador Canal route (Figure 3). The raw water service pipelines will be HDPE pipes ranging in size from 6 to 12 inches in diameter. Design flows for the pipes depend on raw water demand and range from 0.01 to 1.7 cfs.

The planning and pre-design activities for construction of this pipeline were completed by the Agency and KASL Consulting Engineers. Final design is planned to begin in October 2006 or

sooner. Construction of the pipeline will be done with Agency's resources instead of going out to bid.

2.2 Description of Phase 1 Construction Methods, Procedures and Equipment

Clearing and Vegetation Removal

Where necessary, clearing will be conducted within the permanent and temporary construction easements. A 15-foot wide permanent easement will be required for the proposed transmission main together with a 20-foot wide temporary construction easement. The total area to be cleared was estimated to be approximately 26.5 acres (KASL Consulting Engineers, September 2000). This area will be revegetated upon completion of construction activities. Equipment needed for this clearing activity will include jackhammers, pavement saws, mowers, graders, front-end loaders, and trucks.

Traffic Control

Approximately 11,650 LF of pipeline is located within public roadways. Based on an average production rate of 150 LF per day of pipeline installation, approximately 80 days of traffic control will be required (KASL Consulting Engineers, September 2000).

Excavation

Construction will be completed using open trench installation using conventional cut-and-cover construction techniques. The typical trench section is shown in Figure 4. Approximately half of the excavation will be conducted in rock or on slopes. The proposed pipe was aligned to avoid rocky surface areas. However, in areas where rock outcropping are visible and unavoidable, blasting may be required to remove the rock. Potential equipment to be used during excavation would include:

- Track mounted excavators
- Backhoes
- Cranes
- Dump trucks
- Concrete delivery trucks
- Welding equipment
- Compactors
- Water trucks
- Forklifts
- Compressors/jack hammers

Dewatering

Trench dewatering will be required at below-grade drainage and creek crossings. The proposed pipeline crosses 18 stream, creek, or drainage courses (KASL Consulting Engineers, September 2000). Amador Water Agency will obtain all necessary permits including the Waste Discharge Requirements and NPDES Permit for Stormwater and management during construction. All permit conditions will be followed during dewatering activities.

Aerial Crossings

There are two aerial crossings along the proposed alignment, one located over the South Fork of Jackson Creek and the second located over Jackson Creek. The first aerial crossing will be aligned along the existing bridge while the second will be placed upstream of the existing culvert.

Bored and Jack Crossings

There are two bore and jack crossings along the alignment. Both bores will require a 48-inch diameter steel casing.

Hauling

Native material excavated from the pipeline trench may not be suitable for bedding or initial backfill. As a result, unsuitable material will be either spread onsite or hauled offsite.

Bedding and Backfill

A 6-inch thick pipe bedding will be provided together with an initial 6 inches of backfill above the top of the pipe. Dump trucks will be used to deliver imported backfill, although native soil will be reused for backfill whenever possible (i.e. if it meets the properties necessary for compaction and stability). A vibratory compactor and jets of water would then be used to compact and consolidate the backfill material. Select native material with cobbles less than 3 inches in diameter would be used for the final backfill in easement areas.

Surface Restoration

After completion of backfill activities, the surface will be restored. Where the pipe is installed in a paved roadway, repaving will be conducted. For unpaved surfaces, restoration would involve replacing the topsoil and replanting.

Pipeline Testing

Once installation is complete, the pipeline will be pressure tested.

2.3 Task List and Schedule

The project plan for the proposed Phase 1 of the Amador Transmission Main project is outlined below. A schedule for this work is included at the end of this section. For reference purposes, this schedule also includes an abbreviated timeline of Phase 2 activities.

Task 1 – Easements ($135,850)

This task consists of identifying and defining the required temporary construction and permanent easements and securing those easements. Nineteen permanent easements were identified along the water transmission main alignment. Three of these have been acquired covering over forty percent of the alignment. The remaining Phase 1 easements will be obtained following adoption of the final EIR at the end of February 2005.

Deliverables: plat maps and legal descriptions for up to 19 parcels along the pipeline alignments

Task 2 – Planning/Design/Engineering ($1,240,694)

Subtask 2.1 Preliminary Design

This subtask would include design criteria development, materials evaluations, route evaluations, field reconnaissance, preliminary hydraulic and geotechnical analyses, and public outreach activities. This subtask has been completed by the Agency and several feasibility studies and preliminary design reports are available for review including:

- *Amador Water Transmission System Master Plan (Amador Water Agency, July 1991)* – In 1991, the Agency conducted master planning of a proposed pressure transmission main to replace the Amador Canal.
- *Amador Water System Transmission Project, Preliminary Design Report (Dewante & Stoewell, September 1994)* – This report described five transmission main alternatives and included estimated construction and acquisition costs. One alternative (Alternative E) was recommended based on cost, ease of construction, and ease of serving existing raw water customers.
- *Canal Life Extension Study (KASL Consulting Engineers, April 1999)* – this report studied the feasibility of extending the life of the existing Amador Canal. Capital improvements and operation and maintenance activities to reduce losses, improve conveyance, preserve water quality, and provide watershed management were evaluated and recommended.
- *Evaluation & Update of Amador Transmission Main Project Pipeline Alternative (KASL Consulting Engineers, September 2000)* - After completion of the 1994 report, the agency conducted preliminary environmental studies and discussions with property owners in the pipeline project area. This study evaluated the findings and recommendations made in the previous 1994 Preliminary Design Report to address the environmental concerns and respond to modifications requested by property owners. In addition, the study updated construction and acquisition costs to allow the Agency to conduct an up-to-date comparison with improvements recommended in the Canal Life Extension Study. Field investigations were conducted along the entire length of the previously recommended alternative (Alternative E) and proposed adjustments were made based on environmental, cultural, and residential concerns. This report also provided engineering support for completion of environmental

documents. The final recommended and updated water transmission main alignment was based on field findings, input from the Agency's environmental consultants, and input from the project area property owners. Public meetings were held to present updated findings and recommendations. Records of correspondence in support of this alternative have been attached to this application. A copy of this report has also been attached to this application for reference purposes.

Deliverables (attached to application): Evaluation & Update of Amador Transmission Main Project Pipeline Alternative (KASL Consulting Engineers, September 2000), correspondence in support of alternative

Subtask 2.2 Design

This subtask would include:

- Surveying and mapping and field reconnaissance along the proposed pipeline alignment.
- Researching existing underground utilities located within the pipeline corridor.
- Conducting a geotechnical investigation including development of geotechnical design recommendations, and review of the design documents to verify conformance with geotechnical recommendations.
- Conducting a corrosion investigation including field soil resistivity surveys along the pipeline route, laboratory analysis of soil samples for corrosivity, evaluation of data and development of corrosion protection alternatives.
- Developing the 30, 60, and 90 percent interim design submittals.
- Developing the final design submittal including final plans and specifications for bidding and construction.

With the exception of the corrosion investigation, all other Phase 1 (i.e. construction of water transmission main) design work has been completed. The corrosivity study will be completed once remaining Phase 1 easements are obtained. Copies of the water transmission main Final Plans and Specifications have been attached to this application for reference purposes.

Deliverables (attached to application): Water Transmission Main (Phase 1) Final Plans, Specifications, and Certification Statements

Task 3 – Permit Procurement and Development of Applicable Environmental Documentation ($212,850)

Subtask 3.1 Environmental Documentation

The Agency began preparation of an Environmental Impact Report (EIR), as required by the California Environmental Quality Act (CEQA), in February 2000. A Notice of Preparation (State Clearing House Number 2000022106) and Initial Study were published on February 29, 2000. The Draft EIR was then published on September 20, 2000. After the 45- day review period, stakeholder comments were incorporated into the Final EIR which was certified by the Agency's Board on May 15, 2001. Copies of the NOP, Initial Study, and Draft EIR are attached to this application. The NOP and Initial Study can be found in Appendix A of the Draft EIR. The checklist accompanying the Initial Study has also been attached to this application and can also be found in Appendix A of the Draft EIR.

The Final EIR certification was subsequently challenged by members of the Protect the Historic Amador Waterways (PHAW) group and other private citizens. On August 12, 2004, the Agency Board of Directors set aside the Final EIR certification pursuant to the Peremptory Writ of Mandate issued on August 10, 2004 by the Amador County Superior Court in *Protect The Historic Amador Waterways v. Amador Water Agency* (Amador County Superior Court Case No. 01CV1191). The agency was mandated to rewrite Section 4.1 (Water Resources) of the Final EIR. The Agency has revised this section and has circulated it for public review and comment. The 45-day public review period ended on October 18, 2004 and the revised Final EIR is currently in the recertification process. The Agency plans to certify the revised Final EIR in February. Copies of the Final EIR and revised Section 4.1 (Water Resources) have been attached to this application.

Deliverables (attached to this application): Environmental Impact Checklist, Draft EIR, Final EIR, and Revised Section 4.1

Subtask 3.2 Permits

A list of required permits and associated jurisdiction is provided in the table below. The Agency has completed preparation of all required permit applications for Phase 1 of the proposed project (construction of water transmission main) and is awaiting approval notices. However, due to the recertification of the Final EIR, the Agency needs to reprocess permits granted based partly on EIR findings. These may include CWA Section 401 permits, Lake or Streambed Alteration Agreements, etc. Permits will be reprocess prior to construction. All comments received from the permitting agencies will be incorporated into the construction documents. Table 4 below describes the status of each permit application.

Task 4 – Construction ($12,494,669)

Subtask 4.1 Bidding, Contract Award, and Notice to Proceed

The Agency foresees a minimum bid period of four weeks initiated by the formal advertisement for bids. A pre-bid conference will be conducted early in the bid period for interested contractors and material and equipment suppliers. Upon receiving bids, the Agency will review them for responsiveness and recommend to the Board award of the contract. After award of the contract by the Board, the Agency will issue a notice to proceed to the contractor.

Deliverables: Advertisement for bid, pre-bid conference agenda, bid package

Subtask 4.2 Construction & Construction Management

The Agency will oversee and manage construction of the project, including performing inspection, material testing, and observing construction to verify conformance with the contract documents. The construction contractor will execute the work in accordance with the construction contract document requirements and at the Agency's further direction. An operations and maintenance (O&M) manual will be prepared prior to commencing water delivery services. Quality Assurance and Quality Control (QA/QC) activities will be conducted to ensure all work is peer reviewed.

Table 4 Status of Permit Applications

Permit	Jurisdiction	Status
Section 401 and 404 of Clean Water Act	Regional Water Quality Control Board (RWQCB), Central Valley Region U.S. Army Corps of Engineers	Certification received on July 14, 2004. A copy of this certification has been attached for reference purposes. The Agency applied for a Nationwide Permit 12 (Utility Line Activities).
Waste Discharge Requirements and NPDES Permit (for discharge of stormwater associated with construction activities)	Regional Water Quality Control Board, Central Valley Region	The Notice of Intent (NOI) for the NPDES permit will be submitted once a contractor is selected.
Lake or Streambed Alteration Agreement	California Department of Fish & Game	Notice of Determination (NOD) received on September 9th 2004. The NOD has been attached for reference purposes.
Caltrans Encroachment Permit	CalTrans	Encroachment permit awarded on July 19, 2004. The permit has been attached for reference purposes.
County Encroachment Permits	Amador County	Encroachment permit awarded on September 13, 2004. The permit has been attached for reference purposes.
Air Pollution Control Board District Authorization	Amador County Air Pollution Control District	Not Required
Section 10 Rivers & Harbors Act	U.S. Army Corps of Engineers	Not Required
National Wild & Scenic Rivers Act	U.S. Department of the Interior, National Park Service	Not Required
State Wild & Scenic Rivers Act	The Resources Agency of California	Not Required
National Historic Preservation Act	Office of Historic Preservation	Not Required
Endangered Species Act	U.S. Fish & Wildlife Service	Biological Assessment completed in 2003.
Underground Classification	CA Dept. of Industrial Relations	Agency received classification.
FERC (Section 851) approval	Public Utilities Committee	The Agency was granted approval.
Dam Safety Permit	California Department of Water Resources	The Agency applied for a Dam Safety Permit through PG&E. The permit was granted.

Deliverables: Construction documentation, including record drawings, submittals, construction correspondence, responses to contractor requests for information, construction meeting summaries, change order documentation, and contract document modifications. Final O&M Manual. QA/QC reports.

Subtask 4.3 Startup and Testing

Once installation of the pipeline is complete, the pipeline will be cleaned, flushed, and then filled for pressure testing. All appurtenances will be checked out for proper operational function. Agency staff will be trained in the operation and maintenance of the project facilities.

Subtask 4.4 Final Inspection and Acceptance

After successful startup and testing, final inspections and walk-through will be performed. A punch list will be generated of items remaining to be completed by the contractor. Upon successful completion and inspection of the punch list items, the Agency will accept the project and close out the construction contract.

Task 5 – Public Outreach ($12,430)

Information about the project will be shared with the public through newspaper announcements and regular newsletters sent to Agency customers. Signage will be provided along the pipeline alignment during construction activities. Special outreach information with details on the project will be provided to stakeholders who are directly impacted by the project. Regular public board meetings will also be held monthly.

Deliverables: Newspaper announcements, Agency newsletters, and other public outreach documents

Task 6 – Monitoring and Assessment ($12,430)

The Agency will continue to have a mechanism to track the system's water balance. A meter will be installed at the head works and end of the water transmission main to track any potential water losses. However, water losses through pipe leaks are expected to be minimal especially in the first years of the pipe's lifespan.

Task 7 – Project Management ($923,358)

This task includes coordination of resources and provision of procedures and guidance documents to efficiently complete the work. Other activities will include constant communication with all team members, monitoring the status and performance of the project, and reporting progress to the Department of Water Resources, Office of Water Use Efficiency.

Subtask 7.1 Project Kick-off Meeting

A kickoff meeting will be conducted with the final design team, Agency staff, contractor, DWR Agency of Water Use Efficiency staff, and other pertinent Agency consultants. A review of the project's scope and purpose will be conducted. This kickoff meeting will be designed to ensure that the roles and responsibilities of each team member are clearly understood and to establish a communication approach between team members.

Deliverables: Kickoff meeting minutes and action item list

Subtask 7.2 Insurance Requirements

Meet and obtain all necessary legal and insurance requirements.

Subtask 7.3 Report Progress

Monthly progress reports will be submitted to the Agency's Board to describe the work accomplished during the reporting period, the anticipated work during the next reporting period and provide schedule and budget summaries. A project issue/resolution list will also be provided reflecting the nature of the issue as well as how and when it was solved. These monthly reports will be compiled into a quarterly report to be submitted to the Department of Water Resources, Office of Water Use Efficiency.

Deliverables: Quarterly progress reports

Subtask 7.4 Monthly Project Meetings

Regular monthly meetings will be held with the project team to review the progress of the work.

Deliverables: Monthly project meeting minutes

3 Statement of Work: Monitoring and Assessment ($12,430)

Project monitoring will be conducted regularly to document water savings and water quality improvements.

The Agency routinely tracks the canal's water budget to identify losses in the system. A water balance is conducted monthly with records from flow meters at the head of Amador Canal (Water In) and at all water use points along the canal (i.e. Tanner and Ione water treatment plants, Ione Canal and pipeline, and raw water customers). Pre-project conditions on water supply are therefore well documented and will be used for comparison purposes. Upon project completion, flow records will be maintained at the intake and at all water use points along the pipelines. Water balances will be developed to track any potential water losses. Water savings will be identified by comparing flow records at the intake of the proposed pipelines with existing records of flow at the head of Amador Canal.

The Agency routinely monitors water quality in the existing canal system by measuring total and fecal coliform levels in the water. As a result, water quality data on pre-project conditions is available for comparison purposes. Upon project completion, the Agency will continue to monitor water quality into and out or the pipelines. Water quality samples will be taken at Lake Tabeaud (Intake) and immediately upstream of the Tanner Water Treatment Plant to monitor any potential water quality degradation along the pipeline. However, because the pipeline will be sealed, the water quality is not expected to vary significantly.

During the first five years following project completion, monitoring results will be summarized in annual reports to the Department of Water Resources, Office of Water Use Efficiency. These reports will also be available to the public upon request. A summary of water quality data on the system's raw water source will continue to be published annually in Amador Water Agency's Annual Consumer Confidence Report.

4 Qualifications of the Applicants and Cooperators

A resume for Mr. Erik M. Christeson, the Project Manager for the proposed Amador Transmission Main Project is attached to this application. Mr. Christeson is a registered civil engineer (CA C058428) with ten years of civil engineering design and construction management experience.

PG&E is a cooperator in this project in the sense that PG&E facilities (Electra Tunnel, Lake Tabeaud, and Electra Powerhouse) are interrelated to the Agency's Amador Water System. As previously described, water is diverted from the North Fork Mokelumne River via the Electra Tunnel to Lake Tabeaud. The agency then diverts its entitlement of water from Lake Tabeaud and the remaining supply is driven through the Electra Powerhouse. Upon implementation of the proposed Amador Transmission Project, the Agency will be able to divert significantly less than its full entitlement. The remaining water will be able to be driven through PG&E's Electra Powerhouse thereby augmenting their energy generation. The Agency has entered into an agreement with PG&E to be reimbursed for a portion of the electricity generated from surplus flows. PG&E has agreed to pay the Agency a maximum of $8,000,000 (December 2004 dollars) in regular payments over the lifetime of the proposed project (25 years) (assuming a wholesale

energy price of approximately $0.08/KWh). These payments will be put in a sinking fund to be used to repay project costs. Assuming a 6% interest rate over the 25 year lifespan of the project (i.e. A/F factor equal to 0.0182), the annualized payments would be approximately $145,600. These payments have been included in the Agency's applicant share of construction costs. They have also been listed in Table C-6 as local monetary benefits. Additional details and calculations are described in Section 7 (*Benefits and Costs*).

The Agency has not received any previous water use efficiency grants. However, the Agency has implemented a number of water conservation programs, as described in Table 3.

5 Outreach, Community Involvement, and Acceptance

The environmental documents of the proposed project have been reviewed by the public and the Agency has received comments from numerous agencies, organizations, and individuals. Some of these included the California RWQCB, Department of Health Services, City of Jackson, East Bay Municipal Utility District, Jackson Valley Irrigation District, members of Protect The Historic Amador Waterways (PHAW), and other private citizens. Forty two comment letters were submitted on the Draft EIR. These were incorporated into Section 5 (Comments and Responses) of the Final EIR.

The Agency has encountered opposition to the project by members of PHAW and other private citizens. Concerns primarily consist of:

- Impacts to wildlife and other plant species along the canal;
- Adverse impacts to property values along the canal;
- Increased risk of fire hazard;
- Adverse effects on adjacent creeks (Jackson Creek and Sutter Creek) which currently receive additional flows from canal water seepage; and
- Impacts to the historic nature of the canal.

Opposition by PHAW resulted in a legal challenge to the Agency's adopted Final EIR. The Amador County Superior Court initially ruled against PHAW. However, the court's decision was subsequently reversed on appeal to the Third District Court of Appeal in Sacramento. As a result, on August 12, 2004, the Agency Board of Directors set aside the Final EIR certification pursuant to the Peremptory Writ of Mandate issued on August 10, 2004 by the Amador County Superior Court in *Protect The Historic Amador Waterways v. Amador Water Agency* (Amador County Superior Court Case No. 01CV1191). The agency was mandated to rewrite Section 4.1 (Water Resources) of the Final EIR. The Court of Appeal did not require the Agency to start the EIR process again. Instead, the Agency was only required to address deficiencies in Section 4.1 of the Final EIR. The Agency has revised this section and has circulated it for public review and comment. The 45-day public review period ended on October 18, 2004 and the revised Final EIR is currently in the recertification process. The Agency plans to certify the revised Final EIR in February. Copies of the original Final EIR and revised Section 4.1 (Water Resources) have been attached to this application. The Agency's Notice of Availability has also been attached to this application for reference purposes.

A partial list of impacts identified in the Draft EIR and associated mitigation measures are shown in Table 5 below. The complete list can be found in Table 2-1 of the Draft EIR. Detailed

descriptions of the impacts and mitigation measures are included in Section 4 (Environmental Analysis) of the Draft EIR and Section 2 (Revisions to the Draft EIR) of the Final EIR.

Table 5 Partial list of project impacts and mitigation measures (EIP Associates, September 2000)

Project Impacts[1]	Mitigation Measure(s)
4.3-1 "Construction and maintenance activities associated with the proposed project would disturb soils that could result in increased rates of erosion or could alter existing erosion patterns."	"Prior to initiation of construction activities, the Agency shall develop an erosion control and sediment plan. The plan shall include the following, or equally effective measures: (i) The kinds and intensity of control work shall be adjusted to ground and weather conditions and the need for controlling erosion …"
4.4-1 "Implementation of the proposed project could result in the damage or destruction of previously identified cultural resources."	"Prior to initiation of any alteration to PA-94-13, the bridge shall be photo-documented with archival quality black-and-white photographs, analyzed by an architectural historian, and further research shall be conducted by a professionally qualified historian."
4.4-2 "Implementation of the proposed project would alter the integrity of the appearance, design, materials, and workmanship of the Amador Canal."	"Prior to initiation of any modifications to the Amador Canal, the canal and associated features shall be photo-documented with archival quality black-and-white photograph. Further research shall be conducted by a professionally qualified historian with a goal of the production of a professional quality publication that documents and partially preserves the memory of the canal. The report shall be made available to the general public through distribution to local schools and libraries."
[1] Only impacts with a level of significance equal to or higher than Potentially Significant (PS) are shown. Impacts determined to have a level of significance less than PS are shown in Table 2-1 of the Draft EIR.	

As described in Task 5 (Public Outreach), information about the project will be shared with the public through newspaper announcements and regular newsletters sent to Agency customers. Signage will be provided along the pipeline alignment during construction activities. Special outreach information with details on the project will be provided to stakeholders who are directly impacted by the project.

6 Innovation

It is a well-known fact that unlined earthen canals lose water to evapotranspiration, seepage, and inefficient operation. The Amador Water Agency had documented annual losses ranging between forty and fifty percent. In this day and age, piped and closed conduits are the preferred facility for transferring water. A piped system can be pressurized so that the pipe can be placed in varied terrain elevations thereby reducing the length of the current 23-mile canal to 8.8 miles. In addition, piped systems react almost instantaneously to flow changes providing more flexibility for the water manager. The water quality is also improved since urban and agricultural runoff cannot enter the pipe. A piped system would significantly improve the efficiency of the current conveyance system.

7 Benefits and Costs

7.1 Table C-1: Project Costs (Budget)

The overall cost of Phase 1 is $15,032,281. For a detailed breakdown of this cost, refer to the attached Table C-1. A description of assumptions taken to estimate project costs is given in Table 6. Unless otherwise specified, the applicant share of project costs was assumed to be equal to 75%. The overall cost share percentage (77%), as shown in row (o), column (V) of Table C-1, is higher due to the addition of costs incurred by the Agency since November 15th, 2002. These costs are described in Table 6 and are available for review upon request.

Table 6 Project Costs Assumptions

Category (from Table C-1)	Assumption
(a) Total Administration Costs	Assumed to be 5% of construction costs (Category j).
(b) Planning/Design/Engineering	Equal to design costs incurred by the Agency since November 15th, 2002. Applicant share assumed to be 100%.
(c) Equipment Purchases/Rentals/Rebates/Vouchers	Not Applicable. Material costs are included in construction costs (Category j).
(d) Materials/Installation/Implementation	Not Applicable. Installation costs are included in construction costs (Category j).
(e) Implementation Verification	Include pressure testing and startup of system.
(f) Project Legal/License Fees	Equal to litigation expenses incurred by the Agency since November 15th, 2002 ($124,775) plus cost of insurance and bonds. Applicant share is greater than 75% due to addition of costs incurred after November 15th, 2002.
(g) Structures	Not Applicable.
(h) Land Purchase/Easements	Equal to acquisition costs incurred by the Agency since November 15th, 2002 ($49,500) plus cost of sixteen remaining easements. Easement cost assumed to equal $4,620/parcel. Applicant share is greater than 75% due to addition of costs incurred after November 15th, 2002.

Category (from Table C-1)	Assumption
(i) Environmental Compliance/Mitigation/Enhancement	Equal to costs incurred by the Agency since December 31st, 2002 ($137,000) plus 0.5% of constructions costs (Category j). Applicant share is greater than 75% due to addition of costs incurred after November 15th, 2002.
(j) Construction	Obtained from Engineer's Cost Estimate. Includes material and installation costs.
(k) Other (specify) – Public Outreach	Assumed to be 0.1% of construction costs (Category j).
(l) Monitoring and Assessment	Assumed to be 0.1% of construction costs (Category j).
(m) Reporting Preparation	Not Applicable. Costs of report preparation included in administration costs as part of the project management.

7.2 Table C-5: Project Annual Physical Benefits (Qualitative and Quantitative)

Physical benefits realized by implementing the proposed project include:

1. Addition of in-stream flows for beneficial uses -
   The volume of water that is currently lost in Amador Canal through seepage, leaks, and evaporation would remain in the Mokelumne River and would be available for in-stream beneficial uses until needed by Amador County. The duration of this benefit is difficult to estimate. However, as stated in the UWMP, "Once the open ditch conveyance system is replaced with a closed pipe delivery system, the Agency will be able to meet projected demand in the Amador Water System at least for the next 20 years (assuming a 2% growth rate)." (Amador Water Agency, 2004). In addition, Department of Finance Projections for the Sutter Creek vicinity, with conveyance improvements, indicate there would be a surplus of 2,747 AF in 2010 and 817 AF in 2020 (EIP Associates, September 2000).

   The addition of in-stream flows for beneficial uses such as habitat enhancement is a local benefit and an indirect benefit to the Bay-Delta. The Mokelumne River's in-stream habitat from the Electra Tunnel diversion to EBMUD's Pardee Reservoir will be improved thus benefiting anadromous fish and other species in this stretch of the river. However, this benefit is somewhat limited to this local stretch of the river because of the existence of EMBUD's Pardee Reservoir which poses a major obstacle for migratory fish species. In theory, if EBMUD did not need the surplus water, it would be allowed to pass their Pardee and Camanche reservoirs to eventually reach the confluence with Consumnes River and onto the Bay-Delta system. As a result, because of the numerous reservoirs below the Electra Tunner diversion, the addition of in-stream flows is an indirect benefit to the Bay-Delta system.
2. Addition of in-stream flows for downstream users –
   The additional volume of in-stream flows will eventually reach EBMUD's Pardee Reservoir. The Agency has entered into an agreement with EBMUD to make this volume available for EBMUD's drought contingency flows. This Agreement is on an interim basis and the Agency retains the right to divert its full entitlement of water (15,000 AF) if needed.

The additional volume of in-stream flows will also be available for increased power generation by PG&E at Pardee Reservoir.

The addition of in-stream flows for downstream users is a local and direct benefit to the Bay-Delta water supply system since the proposed project would increase the overall volume of available water. These surplus flows would directly benefit EBMUD's drought contingency plans. EBMUD is a major Bay-Delta water user with service to residents of the San Francisco Bay Area's East Bay. Water diverted from the Pardee Reservoir provides over 90 percent of EBMUD's water supply.

3. Enhancement of raw water quality –
   The proposed project would eliminate water supply contamination from surface runoff. The raw water quality reaching the Agency's water treatment plans and being served to raw water customers would therefore be improved. The improvement would be limited to the Amador Water System and is therefore a local benefit.
4. Preserve local flexibility to manage water supply sources –
   Local flexibility would be preserved by making the Agency's full entitlement available when needed. The current canal system experiences losses of up to 50 percent. As a result, the Agency is unable to use its full entitlement of water. This improvement is considered a local benefit.
5. Reduction in O&M costs –
   It is estimated that the agency would save approximately $75,000 a year in routine O&M costs (EIP Associates, September 2000). These savings could be used to perform preventative maintenance on the Amador Water System distribution facilities. The benefit would be limited to the Agency's infrastructure and is therefore a local benefit.

7.3 Table C-6: Project Annual Local Monetary Benefits

Monetary benefits realized by implementing the proposed project are described in this table.

(a) EBMUD Annualized Payments -

EBMUD has agreed to pay the Agency $4,500,000 for the increased water supply. This payment will be used to repay project costs. Assuming a 6% interest rate over the 25 year lifespan of the project (i.e. A/F factor equal to 0.0182), the annualized local benefit would be approximately $81,900.

(b) PG&E Annualized Payments -

The Agency has entered into an agreement with PG&E to be reimbursed for a portion of the electricity generated from surplus in-stream water flows. PG&E has agreed to pay the Agency regular payments over the lifetime of the proposed project (25 years) up to a maximum of $8,000,000. These payments will be put in a sinking fund to be used to repay project costs. Assuming a 6% interest rate over the 25 year lifespan of the project (i.e. A/F factor equal to 0.0182), the annualized payments would be approximately $145,600.

(c) Avoided O&M Costs -

It is estimated that the agency would save approximately $75,000 a year in routine O&M costs (EIP Associates, September 2000).

7.4 Table C-8: Applicant's Cost Share and Description

The applicant's cost share percentage is at 77%, or $11,584,384. The proposed project has the potential to contribute significant annual water savings for beneficial in-stream uses and downstream users like EBMUD and PG&E. However, there are also significant local benefits including improved raw water quality, enhanced flexibility to manage its water supply system, reduction in O&M costs, monetary compensation from EBMUD and PG&E, and avoided costs of purchasing additional water supply. As a result, it was subjectively determined that the ratio of Bay-Delta benefits to local benefits was approximately 1:4. The corresponding cost share was set at 25% state share grant and 75% applicant share. With the addition of project costs incurred by the Agency after November 15th, 2002, the state's cost share decreased to 23% and the applicant's increased to 77%. These costs were described in Section 7.1. A summary table is provided below. Documents recording these costs are available for review upon request.

Table 7 Applicant's costs incurred after November 15th, 2002

Category	Amount
(b) Planning/Design/Engineering	$ 1,240,694
(f) Project Legal/License Fees	$124,776
(h) Land Purchase/Easements	$49,500
(i) Environmental Compliance/Mitigation/Enhancement	$137,000
TOTAL:	$1,551,970

8 Bibliography

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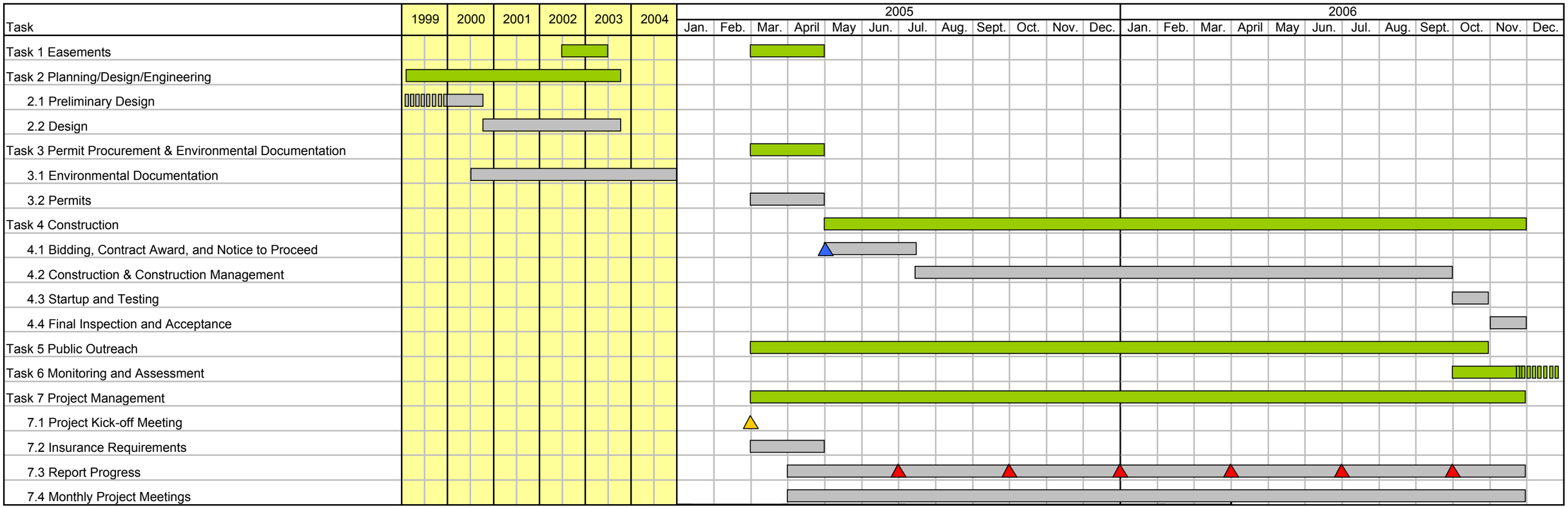
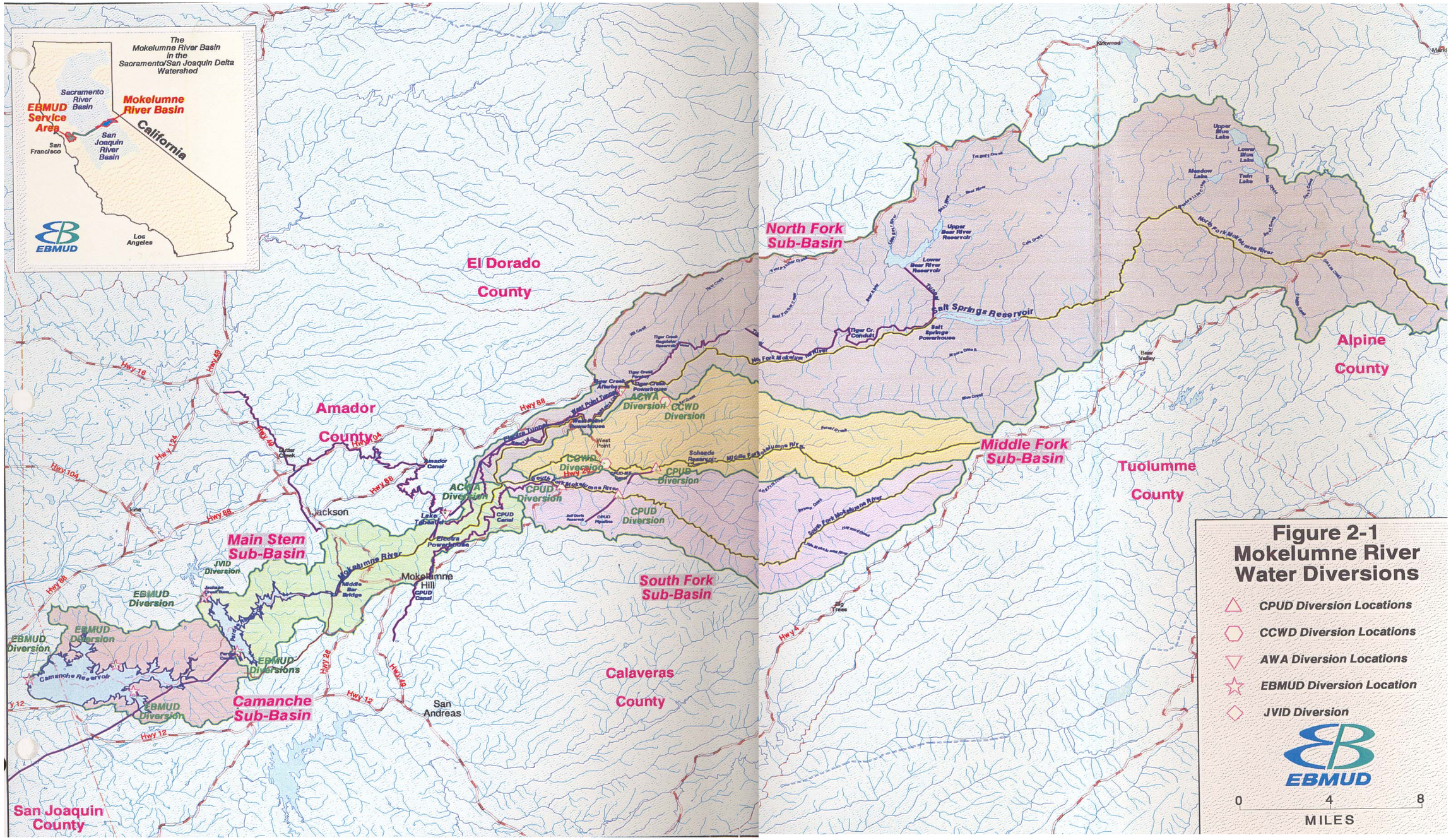
Amador Water Agency
Transmission Pipeline Project (Phase 1)



- Project Kick-off Meeting
- DWR Quarterly Progress Report
- Pre-Construction Bid Conference
- Work Previously Performed by the Agency

Figure 1 North Fork Mokelumne River Watershed



Source: EBMUD, December 2000

Figure 2 Amador Water Agency's Water Systems

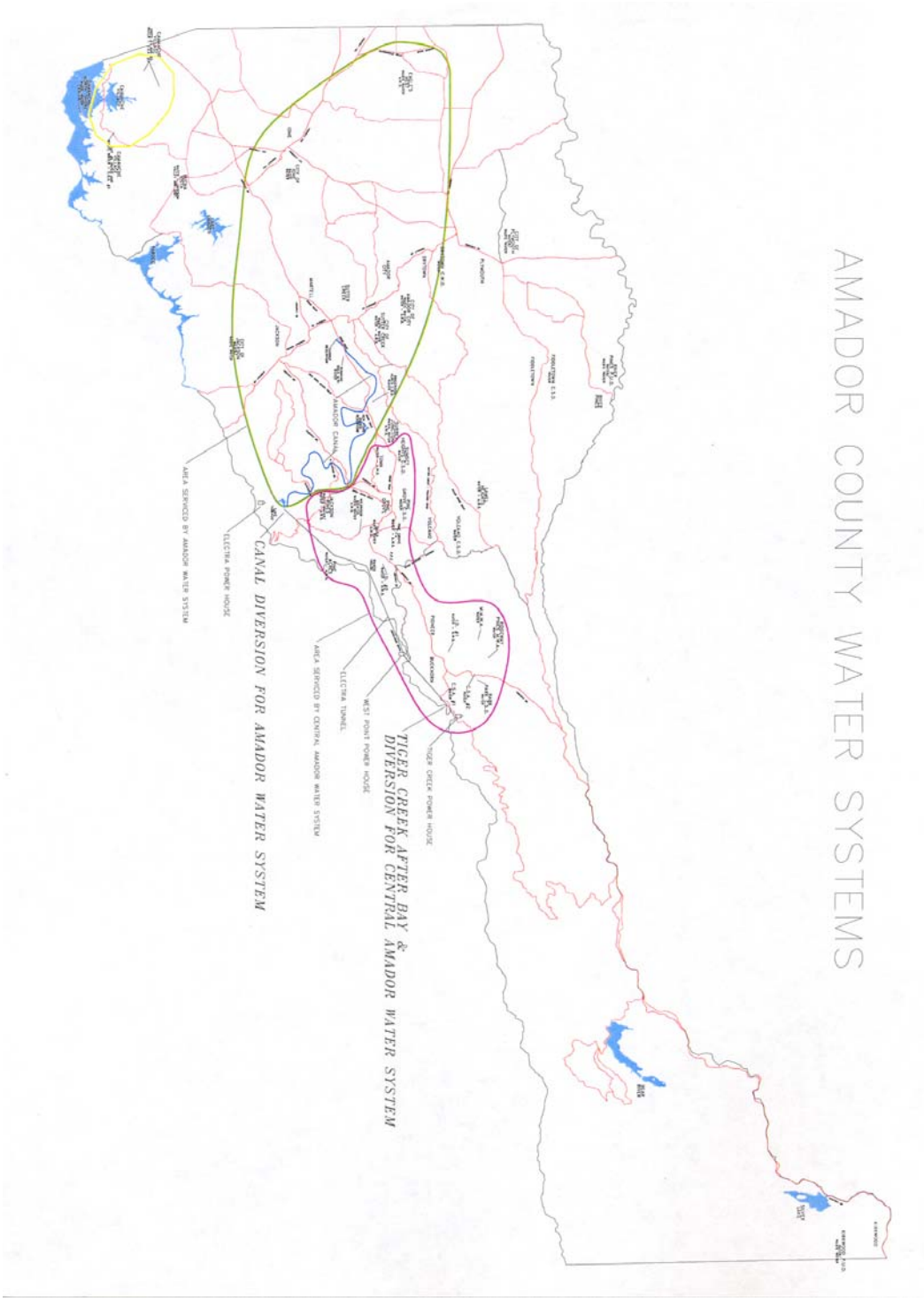
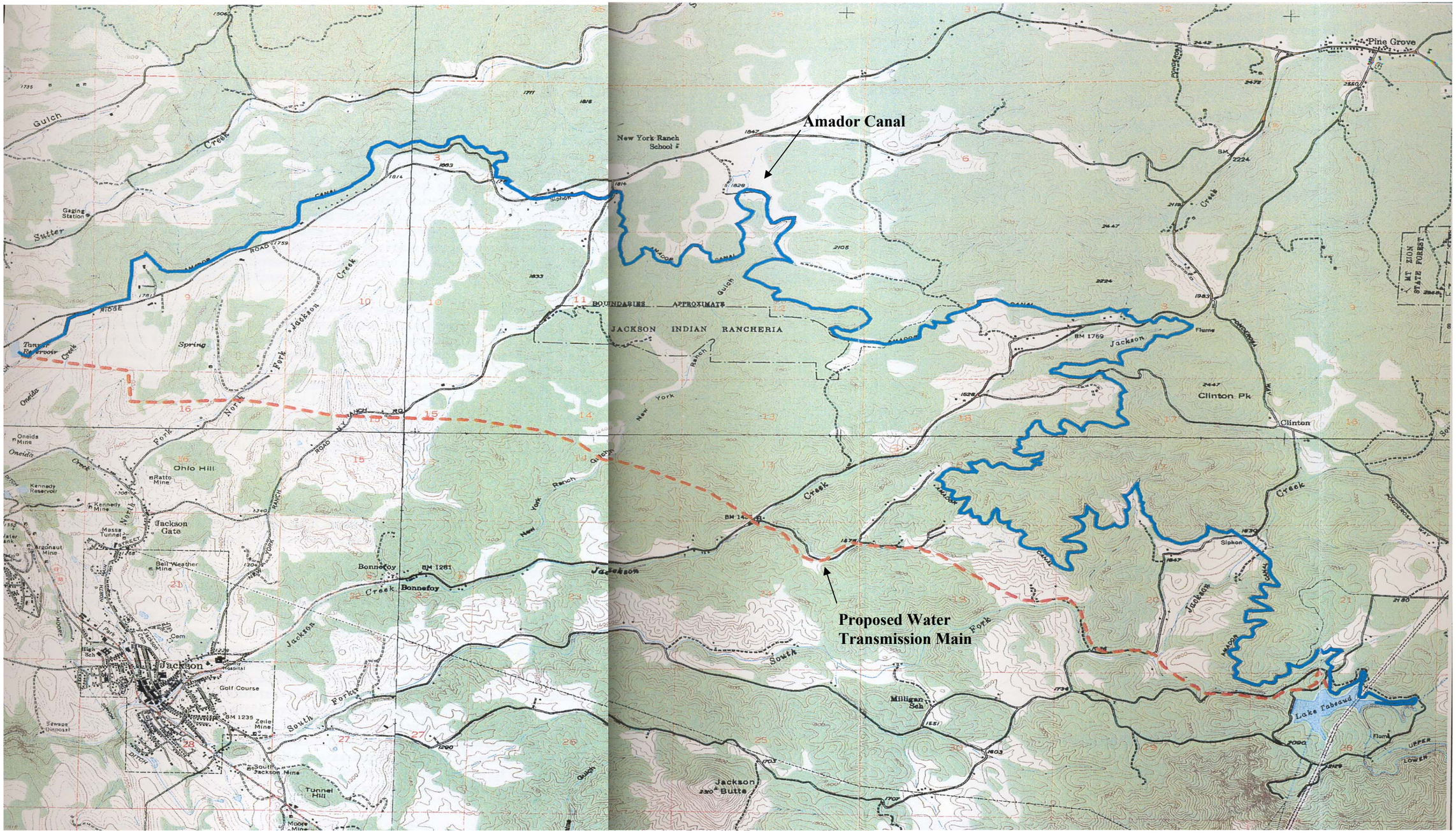
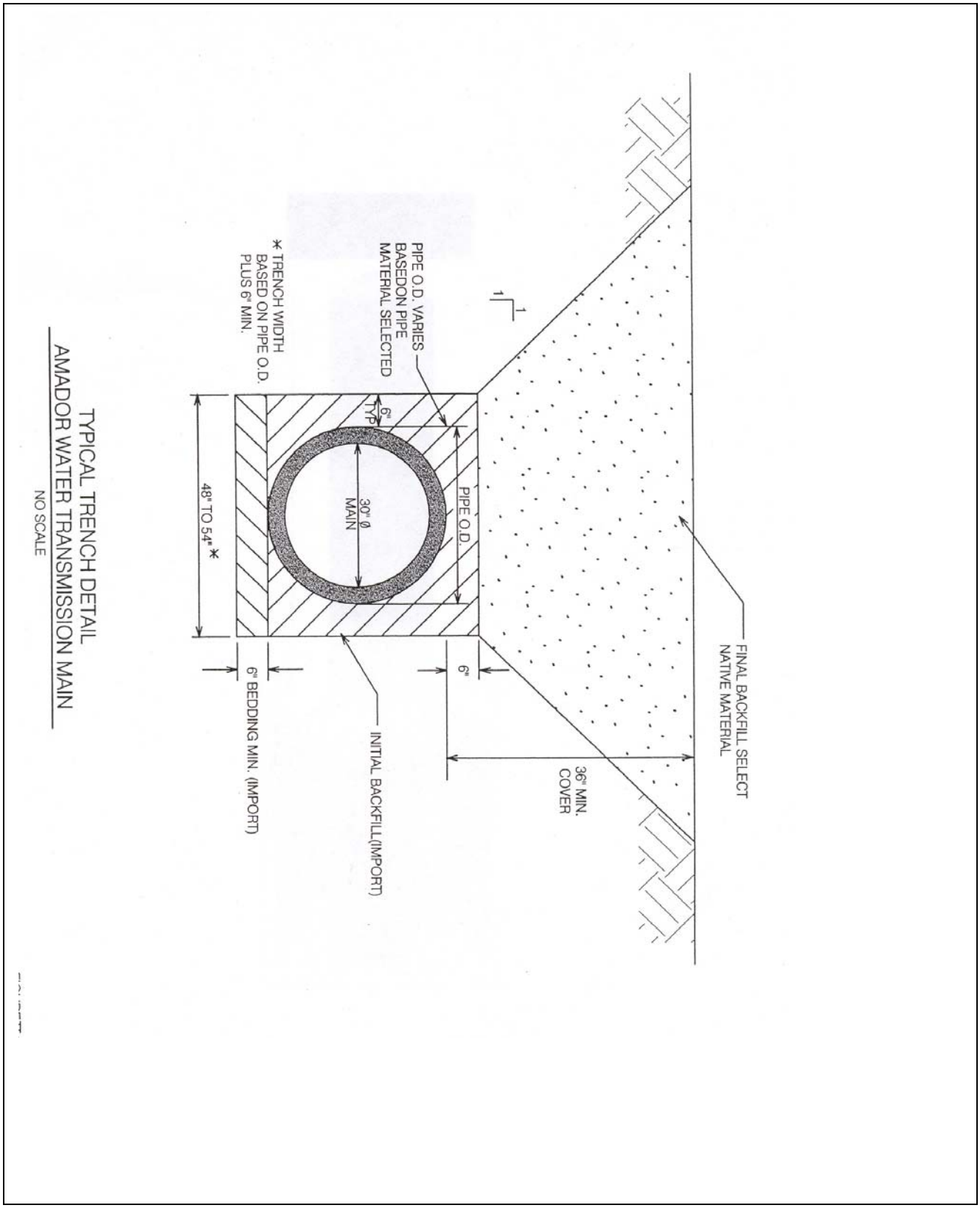


Figure 3 Alignments of Existing Amador Canal and Proposed Pipelines



Source: EIP Associates (September 2000)

Figure 4 Typical Trench Section



Source: KASL Consulting Engineers (September 2000)

Hydrologic Analysis of Existing Conditions Report for Upper Amador Canal (Atkins, 2014)

ATKINS

Hydrologic Analysis of Existing Conditions Report for the Upper Amador Canal

Bosse-Previtali Small Diameter Pipeline

May 16, 2014

Prepared for the Amador Water Agency

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DRAFT

Plan Design Enable

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1. Introduction and Purpose

1.1. Background

The Amador Canal (Canal) was constructed in 1870 by the Sutter Canal and Mining Company to transport water to the Jackson-Sutter Creek area for mining and millings operations. In 1985, the Canal was purchased by the Amador Water Agency (Agency) from Pacific Gas & Electric PG&E, which entitled the Agency to divert up to 15,000 acre-feet of water annually from Lake Tabeaud to the Canal at a flow rate not to exceed 30 cubic feet per second (cfs). The Canal is divided into an Upper Canal (approximately 16 miles from Lake Tabeaud to the New York Ranch Reservoir) and a Lower Canal (approximately 7 miles from the New York Ranch Reservoir to the Tanner Reservoir). The Canal provided raw water service to numerous properties located along the Canal alignment and also conveyed raw water to the Agency's Tanner Water Treatment Plant adjacent to the Tanner Reservoir. Although the Canal was constructed to avoid major creeks (via overhead crossing structures), the Canal intercepts and conveys runoff from upslope areas along much of the Canal alignment. To manage flows in the Canal during storm events, waste gates can be manually opened to discharge runoff and prevent overtopping or damage to the Canal.

In 2009, the Agency implemented the Amador Transmission Project, which included a 30-inch pipeline from Lake Tabeaud to the Tanner Reservoir, to divert most of the water that was then conveyed in the Canal and to convey raw water under pressure directly to the Tanner Water Treatment Plant. Agency customers located along the Lower Canal have already been provided water service via small pipeline extensions from adjacent service locations. Water releases to the Lower Canal have been terminated and portions of the Lower Canal have been re-graded and reseeded effectively removing the Lower Canal from raw water conveyance service. The Amador Transmission Project also proposed installation of a new small diameter pipeline, within or adjacent to the Upper Canal to provide raw water to customers along the Upper Canal alignment. Since completion of the Amador Transmission Project, the Agency has reduced flows in the Upper Canal from 30 cfs to 4 or 5 cfs but maintains raw water service to approximately 110 customers along the Upper Canal alignment, locally known as the Bosse-Previtali residential area.

1.2. Project Location and Description

The hydrologic analysis discussed herein focuses on the Upper Canal from Lake Tabeaud (upstream end) to the New York Ranch Reservoir (downstream end), northeast of the City of Jackson in Amador County, California. The general project location is shown on the vicinity map, **Figure 1-1**. This segment of the Canal is located within Sections 1 and 12 of Township 6 North, Range 11 East and Sections 7, 8, 17, 18, 19, 20, 21, 28, and 29 of Township 6 North, Range 12 East.

The Canal currently provides raw water service to approximately 110 customers located in the area known as the Bosse-Previtali residential area (study area). The purpose of the small diameter pipeline project is to abandon the Canal between Lake Tabeaud and the New York Ranch Reservoir and replace it with a subsurface, small-diameter water distribution pipeline that will provide domestic water service to the 110 customers along the Upper Canal within the study area.

This report provides a summary of the hydrologic analysis of the existing conditions in the study area. In order to conduct this analysis, peak flow rates for the 2-, 25-, and 100-year storm events were selected as representative storms for most drainage paths that intersect the Upper Canal alignment. The results of this hydrologic analysis will quantify the existing drainage conditions along the Upper Canal. Prior to

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installation of the small diameter pipeline and abandonment of the Upper Canal alignment, these same results can be used to evaluate how alterations to the existing drainage patterns could adversely impact any downstream homeowners through increased overland flows of stormwater runoff.

1.3. Drainage Analysis Team

Table 1-1 Drainage Analysis Team

Name	Title	Responsibility
Seth Ahrens, P.E., CFM	Senior Engineer III	Task Manager
Dan Stucky, P.E.	Senior Engineer I	Lead Engineer
Brian Janes, P.E., CFM	Senior Engineer III	QA/QC Review

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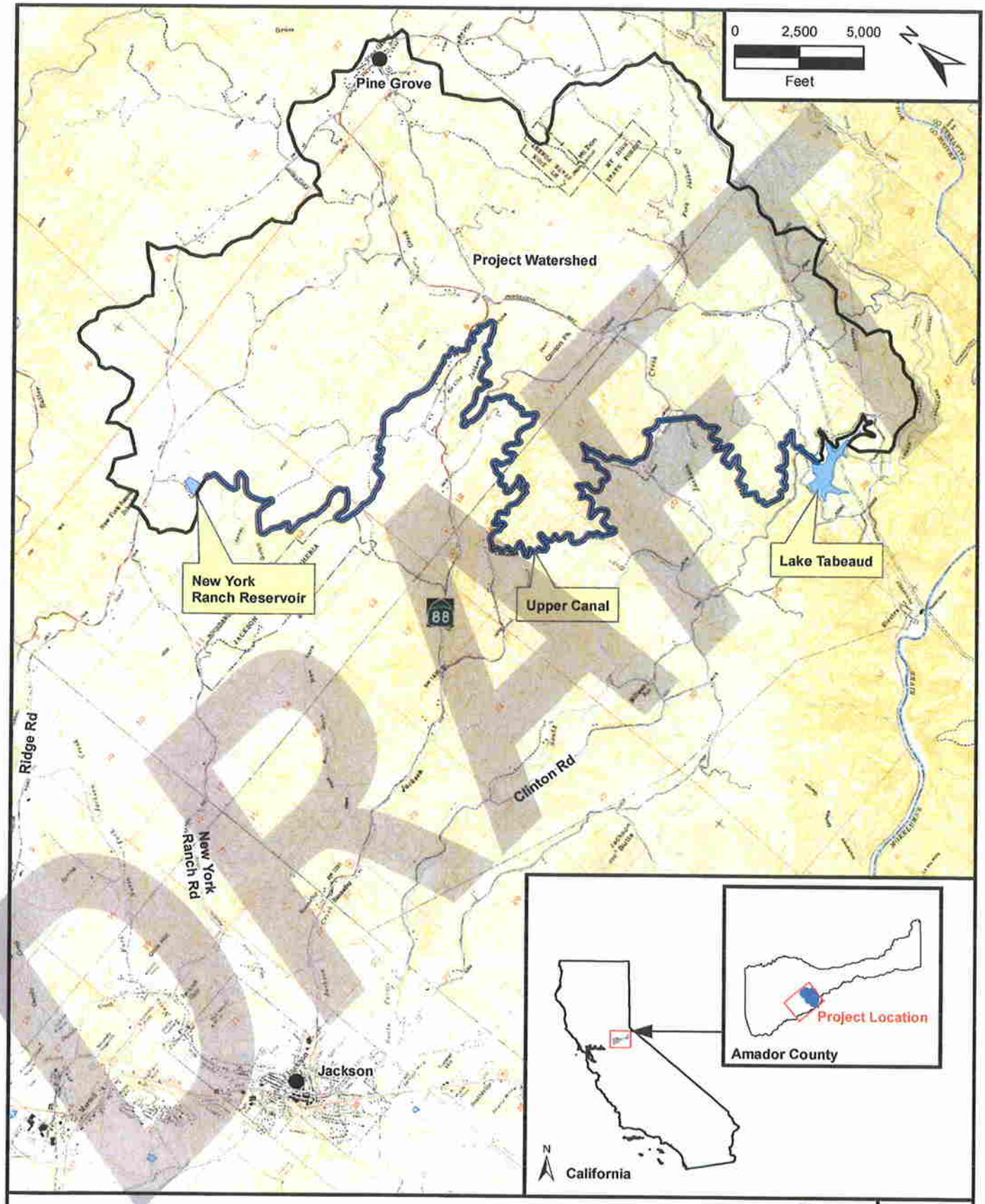

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Bosse-Previtali Small Diameter Pipeline
Vicintiy Map

Figure 1-1

2. Hydrologic Procedures and Criteria

This section includes information about the criteria, methodologies, assumptions, and procedures that were used to complete the hydrologic analysis of the existing drainage conditions in the study area. These criteria, methodology, assumptions, and procedures are generally consistent with the approach described in the County of El Dorado Drainage Manual (CEDDM), adopted in March 1995. A guidance document from outside of Amador County was selected since Amador County did not have its own drainage manual. The CEDDM was chosen because El Dorado County is in close proximity to the study area, the CEDDM is thorough and its methods are widely accepted, and the topography and land uses in Amador County are similar to what is found in portions of El Dorado County.

The guidance in the CEDDM indicated that the Rational Method and the Soil Conservation Service (SCS) Curve Number and Unit Hydrograph Method were reasonable approaches for completing the hydrologic analysis contained herein. Additional discussion about each of these methodologies follows in Section 2.1 through 2.6.

Some portions of this analysis deviate slightly from what is recommended in the CEDDM. An example is the time-of-concentration[1] calculations in Section 2.2.5. Deviations such as these occurred only where they would result in more realistic and more defendable results. Note that the CEDDM states that it is acceptable for procedures not described in the manual to be applied provided that the procedures provide reasonable results.

2.1. Selection of Methodology

For sub-basins less than 100 acres in size, the Rational Method was used to estimate peak discharges. For sub-basins exceeding 100 acres in size, estimated peak discharges were determined using the SCS Curve Number and Unit Hydrograph Method. For these larger sub-basins, the United States Army Corps of Engineers' Hydrologic Engineering Center-Hydrologic Modeling System (HEC-HMS), Version 3.5, was used in the hydrologic analysis.

2.2. Sub-Basin Delineation

The study area watershed, which drains generally to the west and southwest, was subdivided into hydrologic sub-basins that were relatively homogeneous and drain to either a single concentration point or specific section along the Upper Canal. The sub-basins were delineated using 40-foot contours on quadrangle maps developed by the United States Geological Survey (USGS). The delineated sub-basins are shown on the Hydrologic Summary Map (**Figure 3-1**) located in the map pocket at the end of the report.

Of the 111 sub-basins for which peak flow rates were computed, 106 had a drainage area less than 100 acres and five had a drainage area greater than 100 acres. Therefore, 106 sub-basins were modelled using the Rational Method and the five sub-basins exceeding 100 acres were modelled in HEC-HMS using the SCS Curve Number and Unit Hydrograph Method.

Note that baseflow was assumed to be zero in all sub-basins that were modelled.

[1] The time of concentration of a sub-basin is the time it takes a drop of runoff to travel from the hydraulically most distant point of the sub-basin to the sub-basin outlet.

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2.3. Design Storm

Design storms associated with the 2-, 25-, and 100-year events were used to determine the peak stormwater flow rates at significant drainage crossings along the Upper Canal within the study area. These storm frequencies were chosen because they are representative of a wide range of storms that may impact the Upper Canal.

For those sub-basins modeled using HEC-HMS, a 24-hour storm duration was chosen for consistency with the recommendations of the CEDDM. For those sub-basins modeled using the Rational Method, the storm duration for each sub-basin was equal to that sub-basin's time of concentration.

2.4. Precipitation Depths, Intensities, and Temporal Distributions

Precipitation data published by the National Oceanic and Atmospheric Administration (NOAA) in NOAA Atlas 14, Precipitation–Frequency Atlas of the United States (Volume 6, Version 2) was used for this hydrologic analysis. NOAA rainfall data from the web-based Precipitation Frequency Data Server (PFDS) was obtained using centroid locations of 12 drainage regions along the Upper Canal. 100-year, 6-hour rainfall totals ranged from 2.78 inches to 2.90 inches across the study area while 100-year, 24-hour totals ranged from 5.88 inches to 6.33 inches.

A sensitivity analysis was performed to determine how the spatial variation of rainfall across these 12 points might impact the computed flow rates. 25-year peak flow rates were determined using the Rational Method for a 10-acre basin (i.e. a representative basin) using rainfall from all 12 points. Peak flow rates derived from the maximum rainfall totals were approximately 7 percent larger than the peak flow rates computed using the minimum rainfall totals. Since the peak flow rates were relatively insensitive to the rainfall totals that were used, the drainage region with the highest precipitation values (Elevation 2,082 feet, Lat 38.4075°, Long -120.7058°) was used for all study area sub-basins. At this location, the precipitation depths for the 24-hour storms for the 2-, 25-, and 100-year recurrence intervals were 3.12, 5.19, and 6.33 inches, respectively.

The Rational Method requires the rainfall intensities for each design storm. Rainfall intensities for the 2-, 25-, and 100-year events were acquired from the PFDS for storms with durations of 5, 10, 15, 30, and 60 minutes. These rainfall intensities may be found in **Table A-1** of **Appendix A**. Note that the additional intensities in this table were computed via linear interpolation of the PFDS values.

As directed by the CEDDM, the SCS Type IA rainfall distribution was used in the HEC-HMS model since the average elevation of all sub-basins was higher than 1,640 feet.

2.5. SCS Curve Number and Unit Hydrograph Method

For the five sub-basins with a drainage area of more than 100 acres, the SCS Curve Number and Unit Hydrograph Method was used to determine the peak flow rates. Parameters for this methodology were determined using Geographic Information Systems (GIS) data and spreadsheet calculations. These parameters were then entered into HEC-HMS, which computed the peak flow rates.

Although only five sub-basins were modeled using the SCS Curve Number and Unit Hydrograph Method, curve numbers and times of concentration were computed for all sub-basins. This effort was undertaken

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because the methodology in the CEDDM stated that the runoff coefficients for the Rational Method should be derived from these two parameters.

Sections 2.5.1 through 2.5.7 discuss the development of the parameters associated with the SCS Curve Number and Unit Hydrograph Method as well as the results generated with this methodology.

2.5.1. Depth-Area Reduction Factors

The precipitation depths obtained from NOAA Atlas 14 and discussed in Section 2.4 were point rainfall totals. Typically Depth-Area Reduction Factors (DARFs) are applied to point rainfall depths to lower them to account for the fact that intense rainfall is usually not distributed equally over a large area. Guidance in the CEDDM stated that DARFs should be applied only when the sub-basin area exceeds 6,000 acres. Since the largest sub-basin in the study area was 1,356 acres, no DARFs were applied to the point rainfall totals.

2.5.2. Land Use

Existing Land Use Classifications (2007) for Amador County obtained from the Amador County GIS Data website provided the base land use conditions. These classifications were modified as a result of site visit observations by Atkins in September 2013, current parcel data, and newer aerial imagery to create an updated existing land use GIS shapefile encompassing the study area. To select the appropriate curve numbers, land uses in the study area were re-classified according to the cover types listed in Table 2.2 in the National Conservation Resources Service's (NRCS) Technical Release No. 55 (TR-55) (1986).

Figure A-1 in **Appendix A** shows the existing land use classifications within the study area.

2.5.3. Soils

The most recent available soil survey data for the study area was downloaded from the NRCS Web Soil Survey 2.3 website in GIS shapefile format. The soil survey that encompassed the study area was CA628 (Amador Area, California). The polygons in this GIS shapefile represented the different soil map units that were present in the study area. A soil map unit is an area where the soils are relatively homogeneous. Each soil map unit in the soil survey includes the Hydrologic Soil Group (HSG) for that map unit. NRCS methodology divides soils into four HSGs, as defined below:

HSG A: High infiltration rate, low runoff potential

HSG B: Moderate infiltration rate, moderately low runoff potential

HSG C: Slow infiltration rate, moderately high runoff potential

HSG D: Very slow infiltration rate, high runoff potential

The soils in each soil map unit may consist of soil types that have different HSGs. In these cases, the HSG assigned to a soil map unit is the HSG of the most common soil type in that map unit.

The dominant HSG for each soil map unit in the study area's watershed may be found in **Figure A-2** in **Appendix A**. The soils within the study area's watershed were predominantly HSG B and HSG C soils.

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2.5.4. SCS Curve Numbers

Rainfall losses due to soil infiltration, depression storage, and other factors were calculated using the SCS Curve Number Method described in the CEDDM. The curve number for an area was derived from the HSGs, the land uses, and the antecedent moisture conditions (AMC) that were present.

An average AMC of AMC II was assumed for all curve number calculations.

Base curve numbers for each land use/HSG combination present in the study area are listed in Table 2-1. These values were derived from Table 2.2 in TR-55. Although some land areas with parcel sizes ranging from 2 to 5 acres appear to be vacant lots with significant woods and/or woods/grass combination cover, these were classified as "Residential-2 to 5 Acres" to represent existing zoning conditions and because the curve numbers for this classification were only slightly lower than the curve numbers for undeveloped lands.

Table 2-1 Land Use Categories and Runoff Curve Numbers

Land Use/Cover Description	Runoff Curve Numbers			
	HSG A	HSG B	HSG C	HSG D
Agricultural Lands- Woods [1]	36	60	73	79
Agricultural Lands- Woods and grass combination [1]	43	65	76	82
Commercial and Business	89	92	94	95
Industrial	81	88	91	93
Paved; open ditches	83	89	92	93
Residential < 1 Acre	54	70	80	85
Residential-1 to 2 Acres	51	68	79	84
Residential-2 to 5 Acres	46	65	77	82
Water	98	98	98	98

[1] Agricultural lands were assumed to be in fair hydrologic condition.

Following the assignment of the base curve numbers, an overall curve number was assigned to each sub-basin by intersecting the sub-basin boundaries with the soil map unit layer and the land use layer. Curve numbers were computed for each land use/soil type combination present in a given sub-basin via area-weighted calculations and then a second area-weighted calculation was completed to determine the overall composite curve number for that sub-basin.

Supporting documentation for the curve number calculations may be found in **Appendix A.** Existing condition sub-basin curve number calculations have been summarized in **Table A-2** in **Appendix A**.

2.5.5. Time of Concentration

The time of concentration of a sub-basin is the time it takes for runoff to travel from the most hydraulically distant part of the sub-basin to the sub-basin outlet. Per the recommendation of the CEDDM, the time of concentration (T_c) calculation for each sub-basin was divided into three components:

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T_c = $T_{T1} + T_{T2} + T_{T3}$, where:

T_{T1} = sheet flow travel time (hours)
T_{T2} = shallow concentrated flow travel time (hours)
T_{T3} = channel flow travel time (hours)

The methodology outlined in TR-55 was followed to compute T_{T1}, T_{T2}, and T_{T3} for each sub-basin. A discussion of this methodology follows.

Sheet flow travel time (T_{T1}) is typically calculated via a simplified solution to the kinematic-wave equation:

$$T_{T1} = \frac{0.007(nL)^{0.8}}{P_2^{0.5} S^{0.4}}, \text{ where:}$$

n = overland flow roughness coefficient
L = flow length (feet)
P_2 = 2-year, 24-hour rainfall depth (inches)
S = land slope, feet/foot

Application of this equation can be tricky since it can be difficult to determine the flow length. The TR-55 manual provided very little guidance for computing this length and the CEDDM provided no guidance. Guidance in the Caltrans Highway Design Manual (CHDM) said that in cases "where the designer cannot reasonably identify the point where sheet flow transitions to shallow concentrated flow," the following equation may be used to compute the total travel time for sheet flow and shallow concentrated flow:

$$T_{T1} + T_{T2} = (3.28) * K * S^{0.5}, \text{ where:}$$

K = the intercept coefficient
S = the slope in per cent

The intercept coefficient (K) was available in Table 816.6B in the CHDM. This table has been replicated in **Table 2-2**.

Table 2-2 Intercept Coefficients for Shallow Concentrated Flow – CHDM Table 816.6B

Land Cover/Flow Regime	K
Forest with heavy ground litter; hay meadow	0.076
Trash fallow or minimum tillage cultivation; contour or strip cropped; woodland	0.152
Short grass pasture	0.213
Cultivated straight row	0.274
Nearly bare and untilled alluvial fans	0.305
Grassed waterway	0.457

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Intercept coefficients were selected via visual inspection of aerial photography of the study area. The minimum value that was chosen was 0.114, which is halfway between the first two classifications in the table. This value was selected on the assumption that the forested portions of the watershed included ground litter cover about halfway between that in a woodland area and that in a forest with a maximum amount of ground litter. The maximum value that was chosen was 0.213. In these areas, the forest had been cleared and it was assumed that cleared areas could be considered short grass pasture.

For T_{T3}, the channel flow velocity (V in feet/second) was estimated using Manning's equation:

$V = (1.49/n)*R^{2/3}* S_o^{0.5}$, where

n = Manning's roughness coefficient for open channel flow
R = hydraulic radius (feet), assuming discharge from the 2-year event is present in the channel
S_o = slope (feet/foot)

The equation for computing V may be simplified to

$V = C*S_o^{0.5}$, where
$C = (1.49/n)*R^{2/3}$
S_o = slope (feet/foot)

Coefficients (C) were calculated for multiple sub-basin channel flow segments within the project limits using channel geometry, channel slope, and an estimated discharge for the 2-year event. These coefficients were averaged to generate a representative coefficient (C=19.77) to be used for all sub-basin channel flow segments.

The total time of concentration for each sub-basin was the sum of the travel times for the combined sheet flow/shallow concentrated flow and the channel flow for that particular sub-basin. Channel flow segments were determined based on evidence of clearly-defined channels from the USGS contours, the aerial photography, or Atkins site visit observations. GIS spatial editing tools, 40-foot contours from the USGS quadrangle maps, and elevations from the National Elevation Dataset (NED) were used to determine longest flow paths, slopes, and the various travel time lengths required for calculating the T_c components. A minimum time of concentration (T_c) value of five minutes was assumed for both developed (paved) and undeveloped sub-basins per the CHDM. Typically, the minimum T_c for an undeveloped sub-basin is 10 minutes, but since the slopes in the study area were greater than 10 percent, the CHDM stated that a minimum T_c of five minutes was reasonable.

In a developed sub-basin, an urbanized basins check ($T_c = L/180 + 10$) is typically used to check against initial T_c estimates. Although there was some development within the study area, most T_c flow paths traveled predominantly over undeveloped land; therefore, it was assumed that the time of concentration values were governed by undeveloped conditions and no urban check was required.

Time of concentration calculations have been summarized in **Table A-3** of **Appendix A**.

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2.5.6. Lag Time

The SCS Unit Hydrograph Method was used to transform rainfall excess hydrographs into sub-basin hydrographs in HEC-HMS. As described in the CEDDM, input data for the SCS Unit Hydrograph Method consists of a single parameter, T_{LAG}, which equals the lag time between the center of mass of the rainfall excess and the peak of the unit hydrograph. The lag time is related to the time of concentration by the following empirical relationship:

$T_{LAG} = 0.6*T_c$, where:

T_{LAG} = sub-basin lag time (hours)
T_c = sub-basin time of concentration (hours)

Sub-basin lag times for existing conditions have been included in **Table A-3** of **Appendix A**.

2.5.7. HEC-HMS Results

Drainage areas, composite curve numbers, and lag times for the five sub-basins with a drainage area greater than 100 acres were entered into HEC-HMS. Peak flow rates for the 2-, 25-, and 100-year events were computed for each sub-basin. These flow rates may be found in **Table 3-3**. The HEC-HMS model may be found on the DVD included with this report.

2.6. Rational Method

For those sub-basins whose drainage area was less than 100 acres, the Rational Method was used to determine estimated peak discharges. This approach was defined by the following equation:

Q = CiA, where:

Q = peak discharge (cfs)
C = runoff coefficient (unitless)
i = rainfall intensity (inches/hour) over a duration equal to T_c
A = sub-basin area (acres)

Sections 2.6.1 through 2.6.3 discuss the development of the parameters associated with the Rational Method as well as the results that were generated.

2.6.1. Runoff Coefficients

Rational Method runoff coefficients were determined by converting the composite sub-basin SCS curve numbers discussed above in Section 2.5.4 into runoff coefficients using the technique outlined in Section 2.5 of the CEDDM. This conversion was useful because it meant that consistency was maintained between the processes used to develop the runoff coefficients for the Rational Method and the curve numbers for the SCS Curve Number/Unit Hydrograph method.

The CEDDM stated that these conversions were to be made using the curves shown on Figures 2.5.1 to 2.5.4 in the CEDDM. These figures presented the relationship between the runoff coefficient and the curve number for the 10-year, SCS Type IA event; the 100-year, SCS Type IA event; the 10-year, SCS Type I event;

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and the 100-year, SCS Type I event, respectively. Each figure included four curves, each of which was based on a different time of concentration (10, 15, 30, or 60 minutes). Since all sub-basins were above 1,640 feet in elevation, only the Type IA curves were used since the Type I event curves did not apply to this hydrologic analysis.

Since the publication of Figures 2.5.1 to 2.5.4 (in 1995), they have been superseded. In 2007, David Ford Consulting Engineers (DFCE) revised these figures on behalf of El Dorado County. The new figures were similar in format to the old figures with the exception that the curves on the new figures are based on times of concentration of 5, 7.5, 10, 15, and 30 minutes. Both sets of figures (CEDDM and DFCE) may be found in **Appendix A**.

For this report, DFCE Figure 5 and Figure 7 were employed to convert the sub-basin SCS curve numbers to runoff coefficients. Figure 5 applied to the 10-year event and Figure 7 applied to the 100-year event. For this analysis, it was assumed that the 10-year curves adequately represented the conversions for the 2-year event. To facilitate the conversions, a spreadsheet was developed that represented the DFCE figures numerically instead of graphically. The curve number and time of concentration for each sub-basin was then added to this spreadsheet to generate runoff coefficients for the 2-year and 100-year event for each sub-basin.

To develop runoff coefficients for the 25-year event, the runoff coefficients were multiplied by 0.88 per guidance in Section 819.2 in the CHDM.

Runoff coefficient values for all design storms have been included in **Table 3-3** located at the end of **Section 3**.

2.6.2. Rainfall Intensities

The rainfall intensities that were required by the Rational Method for each sub-basin were based on the sub-basin times of concentration and the rainfall intensities downloaded from NOAA's PFDS. These rainfall intensities may be found in **Table A-1** in **Appendix A.** This table includes rainfall densities for the 2-, 25-, and 100-year events for rainfall durations ranging from five minutes to sixty minutes. To determine the rainfall intensities for these three events for each sub-basin, the duration time was assumed to be equal to the time of concentration and the intensities for that duration time were extracted from the table.

2.6.3. Rational Method Results

Rational Method peak flow rates were computed by multiplying the runoff coefficient, the rainfall intensity, and the sub-basin area for each event for each sub-basin. These parameters and the resulting peak flow rates have been compiled in **Table 3-3** located at the end of **Section 3**.

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3. Summary and Conclusions

It is the intent of the Agency to abandon the Upper Canal as part of the Amador Transmission Project and replace it with a new small diameter pipeline, within or adjacent to the current alignment of the Upper Canal. In anticipation of this effort, peak flow rates for the 2-, 25-, and 100-year events for existing conditions were estimated for most drainage crossings that intersected the Upper Canal between Lake Tabeaud and the New York Ranch Reservoir.

- Peak flow rates were determined for 111 sub-basins along the Upper Canal alignment using the SCS Curve Number and Unit Hydrograph Method (sub-basin area greater than 100 acres) or the Rational Method (sub-basin area less than 100 acres).
- Five sub-basins were modelled using the SCS Curve Number and Unit Hydrograph Method and 106 sub-basins were modelled using the Rational Method.

Note that these methodologies were selected by following guidance in the CEDDM. Guidance in the CHDM was used to augment the information in the CEDDM. Peak flow rates were not computed for major drainage crossings that the Upper Canal bypassed/crossed via overhead flumes.

The existing condition peak flow rates presented in **Table 3-1**, **Table 3-2**, and **Table 3-3** quantify the current hydrologic conditions along the Upper Canal. **Table 3-1** and **Table 3-2** provide a summary of the estimated peak flow rates throughout the study area while **Table 3-3** presents the estimated peak flow rates for all study area sub-basins. **Figure 3-1** (see map pocket at end of report) shows the sub-basin delineations for the study area watershed. Once the design for the new pipeline commences, these peak flow rates will be useful for evaluating whether any proposed alterations to the existing drainage patterns that may result from the installation of the new pipeline would potentially adversely impact homeowners downstream from the Upper Canal.

For ease of reference, the results have been summarized in the following two tables:

Table 3-1 Peak Flow Rates for the Sub-Basins Modelled Using the SCS Curve Number/Unit Hydrograph Method

Sub-Basin	2-Year Peak Flow Rate (cfs)	25-Year Peak Flow Rate (cfs)	100-Year Peak Flow Rate (cfs)
AC85	20	65	94
AC106	26	101	151
AC107	23	94	141
LT01	49	166	241
NYR01	120	496	747

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Table 3-2 Summary of Peak Flow Rates for the Sub-Basins Modelled Using the Rational Method

Event	Minimum Peak Flow Rate (cfs)	Average Peak Flow Rate (cfs)	Maximum Peak Flow Rate (cfs)
2-Year	Less than 1	4	21
25-Year	Less than 1	8	42
100-Year	Less than 1	12	62

Table 3-1 shows the peak flow rates that were computed using the SCS Curve Number/Unit Hydrograph Method while **Table 3-2** shows the range of peak flow rates that were computed using the Rational Method. In **Table 3-1**, sub-basins LT01 and NYR01 exhibit the largest flow rates; however, these sub-basins drain to Lake Tabeaud and the New York Ranch Reservoir, respectively, and not directly into the Upper Canal. During the September 2013 site visit, it was not possible to access the portion of the Upper Canal where the outlets for sub-basins AC106 and AC107 are located. **(AWA – do you know whether there are flumes at these locations?)** Therefore, it is possible that there is an overhead flume at one or both of these crossings. At the downstream end of sub-basin AC85, there is a small pipe, whose diameter may be 24 inches, that conveys runoff that reaches this location across the Upper Canal. This pipe is likely able to accept most, if not all of the runoff from the 2-year storm event; however, the pipe would be overwhelmed by the runoff from the 25- and 100-year storm events.

The peak flow rates in **Table 3-2** apply to the smaller sub-basins in the study area and represent what can be considered the typical peak flow rates that may impact the Upper Canal. Runoff from these sub-basins is intersected by the Upper Canal since there is no infrastructure in place that would allow runoff to bypass the Upper Canal. Note that the capacity of the Upper Canal is approximately 30 cfs. Since the Upper Canal currently conveys raw water at a rate of 4 to 5 cfs, runoff rates greater than 25 or so cfs will overtop the Upper Canal and flow downhill away from the Upper Canal. Waste gates located sporadically along the Upper Canal can mitigate the impacts of larger flow rates into the Upper Canal but they will not prevent overtopping. Although the Agency desires to decommission and no longer maintain or operate these waste gates following the installation of the pipeline, it may be necessary to keep one or more of the gates in service for stormwater management purposes.

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Table 3-3
Bosse-Previtali Small Diameter Pipeline
Estimated Peak Flow Rates for All Sub-Basins Under Existing Conditions

BASIN	AREA (ac)	AREA (mi²)	TC (min)	TLAG (min)	CN	Runoff Coefficents			Rainfall Intensity (in/hr)			Design Storm Flows (cfs)		
						C_2	C_{25}	C_{100}	I_2	I_{25}	I_{100}	Q_2	Q_{25}	Q_{100}
AC01	4.3	0.0067	6.1	3.0	74.7	0.22	0.24	0.28	1.94	3.44	4.47	1.8	3.6	5.3
AC02	12.4	0.0194	8.1	3.2	73.0	0.23	0.27	0.31	1.71	3.03	3.94	4.9	10.2	15.0
AC03	48.5	0.0759	16.9	6.7	74.0	0.33	0.37	0.42	1.17	2.07	2.68	18.5	36.9	54.5
AC04	24.0	0.0374	9.9	4.2	74.2	0.27	0.30	0.34	1.60	2.83	3.67	10.2	20.3	29.9
AC05	15.2	0.0238	6.9	4.4	73.7	0.22	0.26	0.29	1.94	3.44	4.47	6.7	13.4	19.8
AC06	20.4	0.0318	6.9	4.4	73.0	0.21	0.25	0.28	1.94	3.44	4.47	8.5	17.4	25.7
AC07	5.4	0.0085	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	2.1	4.2	6.2
AC08	5.2	0.0081	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	2.0	4.0	5.9
AC09	4.2	0.0065	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	1.6	3.2	4.8
AC10	6.5	0.0102	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	2.5	5.0	7.4
AC11	6.0	0.0094	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	2.3	4.7	6.9
AC12	9.4	0.0147	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	3.6	7.3	10.7
AC13	11.0	0.0173	5.0	3.0	73.6	0.20	0.22	0.25	2.06	3.65	4.74	4.5	8.8	13.0
AC14	12.7	0.0198	5.0	3.0	74.2	0.20	0.22	0.25	2.06	3.65	4.74	5.1	10.1	14.9
AC15	4.3	0.0067	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	1.7	3.3	4.9
AC16	13.9	0.0218	5.0	3.0	75.3	0.21	0.22	0.25	2.06	3.65	4.74	5.9	11.4	16.8
AC17	32.5	0.0508	10.4	6.4	60.4	0.12	0.18	0.21	1.48	2.62	3.40	5.8	15.4	22.6
AC18	3.2	0.0050	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.6	1.5	2.2
AC19	4.0	0.0063	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.7	1.9	2.8
AC20	3.3	0.0051	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.6	1.6	2.3
AC21	6.9	0.0108	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.3	3.3	4.8
AC22	8.6	0.0134	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.6	4.1	6.0
AC23	1.8	0.0028	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.3	0.9	1.3
AC24	2.8	0.0044	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.5	1.3	2.0
AC25	9.0	0.0140	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.7	4.3	6.3
AC26	74.2	0.1159	10.9	6.6	60.0	0.12	0.19	0.21	1.48	2.62	3.40	13.6	36.2	53.4
AC27	11.9	0.0186	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	2.2	5.7	8.3
AC28	6.5	0.0101	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.2	3.1	4.5
AC29	6.1	0.0095	5.9	3.0	64.3	0.13	0.17	0.19	2.06	3.65	4.74	1.6	3.8	5.5
AC30	5.5	0.0087	5.0	3.0	70.2	0.16	0.19	0.22	2.06	3.65	4.74	1.8	3.9	5.8
AC31	57.2	0.0893	10.8	6.6	62.9	0.16	0.21	0.24	1.48	2.62	3.40	13.1	31.8	46.9
AC32	25.3	0.0395	13.0	6.2	72.0	0.27	0.31	0.36	1.36	2.42	3.14	9.3	19.2	28.3
AC33	15.0	0.0234	5.0	3.0	62.4	0.10	0.14	0.16	2.06	3.65	4.74	3.2	7.8	11.5
AC34	3.8	0.0059	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.7	1.8	2.6
AC35	1.7	0.0026	5.0	3.0	61.0	0.10	0.14	0.15	2.06	3.65	4.74	0.3	0.8	1.2
AC36	3.6	0.0056	5.0	3.0	60.7	0.10	0.14	0.15	2.06	3.65	4.74	0.7	1.8	2.6
AC37	4.4	0.0069	5.0	3.0	66.0	0.13	0.17	0.19	2.06	3.65	4.74	1.2	2.7	4.0
AC38	7.5	0.0117	5.5	3.0	65.9	0.13	0.17	0.19	2.06	3.65	4.74	2.0	4.6	6.7
AC39	4.5	0.0070	5.0	3.0	64.0	0.12	0.15	0.18	2.06	3.65	4.74	1.1	2.5	3.7
AC40	11.8	0.0185	10.7	6.7	63.0	0.16	0.21	0.24	1.48	2.62	3.40	2.7	6.6	9.7
AC41	19.0	0.0297	8.2	5.1	62.3	0.13	0.18	0.21	1.71	3.03	3.94	4.1	10.6	15.6
AC42	11.4	0.0178	8.1	5.2	60.0	0.11	0.17	0.19	1.71	3.03	3.94	2.1	5.8	8.5
AC43	2.5	0.0039	5.0	3.0	60.5	0.09	0.13	0.15	2.06	3.65	4.74	0.5	1.2	1.7
AC44	2.9	0.0045	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.5	1.4	2.0
AC45	6.8	0.0106	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.3	3.2	4.7
AC46	3.4	0.0053	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.6	1.6	2.4
AC47	3.0	0.0047	5.5	3.0	60.0	0.10	0.14	0.16	2.06	3.65	4.74	0.6	1.6	2.3
AC48	2.0	0.0031	5.0	3.0	60.8	0.10	0.14	0.15	2.06	3.65	4.74	0.4	1.0	1.5
AC49	4.4	0.0068	5.0	3.0	60.2	0.09	0.13	0.15	2.06	3.65	4.74	0.8	2.1	3.1
AC50	17.4	0.0273	11.2	7.0	60.2	0.12	0.19	0.21	1.42	2.52	3.27	3.1	8.2	12.1
AC51	1.2	0.0019	5.0	3.0	64.6	0.13	0.16	0.18	2.06	3.65	4.74	0.3	0.7	1.1
AC52	3.3	0.0051	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	0.6	1.5	2.3
AC53	6.8	0.0108	5.0	3.0	60.0	0.09	0.13	0.15	2.06	3.65	4.74	1.3	3.2	4.8
AC54	9.2	0.0143	5.0	3.0	62.9	0.11	0.15	0.17	2.06	3.65	4.74	2.1	5.0	7.3
AC55	5.9	0.0092	5.0	3.0	67.3	0.14	0.17	0.20	2.06	3.65	4.74	1.7	3.7	5.5
AC56	2.0	0.0032	5.0	3.0	72.5	0.18	0.21	0.23	2.06	3.65	4.74	0.7	1.5	2.3
AC57	9.3	0.0145	5.0	3.0	70.3	0.16	0.19	0.22	2.06	3.65	4.74	3.1	6.5	9.6
AC58	1.6	0.0025	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	0.6	1.2	1.8
AC59	5.2	0.0081	5.5	3.5	73.0	0.20	0.23	0.26	2.06	3.65	4.74	2.1	4.3	6.4
AC60	1.5	0.0023	5.0	3.0	73.0	0.19	0.21	0.24	2.06	3.65	4.74	0.6	1.2	1.7
AC61	8.0	0.0124	5.3	3.2	72.7	0.19	0.21	0.24	2.06	3.65	4.74	3.1	6.1	9.1
AC62	11.2	0.0174	5.1	3.1	72.8	0.19	0.21	0.24	2.06	3.65	4.74	4.3	8.6	12.7
AC63	9.3	0.0145	5.0	3.0	72.9	0.19	0.21	0.24	2.06	3.65	4.74	3.6	7.2	10.6
AC64	17.0	0.0265	6.5	3.9	61.0	0.10	0.15	0.17	1.94	3.44	4.47	3.4	8.7	12.8
AC65	33.6	0.0526	8.7	5.4	66.3	0.17	0.23	0.26	1.71	3.03	3.94	9.8	23.0	33.9
AC66	3.8	0.0060	5.0	3.0	61.3	0.10	0.14	0.15	2.06	3.65	4.74	0.8	1.9	2.8
AC67	4.6	0.0072	6.0	3.6	65.1	0.13	0.18	0.20	2.06	3.65	4.74	1.3	2.9	4.3
AC68	9.3	0.0145	5.0	3.0	64.6	0.13	0.16	0.18	2.06	3.65	4.74	2.4	5.5	8.1
AC69	2.6	0.0041	5.0	3.0	60.7	0.10	0.14	0.15	2.06	3.65	4.74	0.5	1.3	1.9
AC70	1.8	0.0027	5.0	3.0	64.3	0.12	0.15	0.18	2.06	3.65	4.74	0.4	1.0	1.5
AC71	1.6	0.0026	5.0	3.0	64.8	0.13	0.16	0.18	2.06	3.65	4.74	0.4	1.0	1.4
AC72	3.8	0.0059	8.2	4.8	62.3	0.13	0.18	0.21	1.71	3.03	3.94	0.8	2.1	3.1
AC73	2.9	0.0045	5.0	3.0	65.6	0.13	0.17	0.19	2.06	3.65	4.74	0.8	1.8	2.6
AC74	2.9	0.0045	5.0	3.0	72.5	0.18	0.21	0.23	2.06	3.65	4.74	1.1	2.2	3.2
AC75	2.8	0.0044	5.0	3.0	69.8	0.16	0.19	0.22	2.06	3.65	4.74	0.9	2.0	3.0
AC76	18.4	0.0287	7.1	4.2	72.6	0.21	0.25	0.28	1.83	3.24	4.20	7.2	14.7	21.8
AC77	41.9	0.0655	10.2	6.0	73.0	0.26	0.29	0.33	1.48	2.62	3.40	15.9	31.9	47.0

Table 3-3
Bosse-Previtali Small Diameter Pipeline
Estimated Peak Flow Rates for All Sub-Basins Under Existing Conditions

BASIN	AREA (ac)	AREA (mi²)	TC (min)	TLAG (min)	CN	Runoff Coefficients			Rainfall Intensity (in/hr)			Design Storm Flows (cfs)		
						C_2	C_{25}	C_{100}	I_2	I_{25}	I_{100}	Q_2	Q_{25}	Q_{100}
AC78	4.6	0.0072	7.9	4.9	73.0	0.23	0.27	0.31	1.83	3.24	4.20	1.9	4.0	5.9
AC79	5.5	0.0085	6.5	3.0	73.0	0.20	0.23	0.26	1.94	3.44	4.47	2.1	4.3	6.4
AC80	31.9	0.0498	10.8	5.0	75.2	0.29	0.32	0.36	1.48	2.62	3.40	13.7	26.7	39.4
AC81	1.9	0.0030	5.0	3.0	78.1	0.23	0.24	0.28	2.06	3.65	4.74	0.9	1.7	2.5
AC82	0.9	0.0014	5.0	3.0	78.4	0.23	0.24	0.28	2.06	3.65	4.74	0.4	0.8	1.2
AC83	0.5	0.0007	5.0	3.0	83.2	0.27	0.27	0.31	2.06	3.65	4.74	0.3	0.4	0.7
AC84	20.4	0.0319	12.1	5.9	74.1	0.29	0.32	0.37	1.36	2.42	3.14	8.0	15.9	23.4
AC85	1.6	0.0025	5.0	3.0	73.1	0.19	0.21	0.24	2.06	3.65	4.74	0.6	1.3	1.9
AC86	126.4	0.1976	30.4	18.3	74.4	0.39	0.44	0.51	0.83	1.47	1.91	19.8	65.0	93.8
AC87	8.8	0.0137	7.4	4.5	74.7	0.24	0.26	0.30	1.83	3.24	4.20	3.8	7.5	11.0
AC88	21.9	0.0342	9.2	4.5	73.0	0.24	0.28	0.32	1.60	2.83	3.67	8.5	17.5	25.9
AC89	10.0	0.0156	5.4	3.4	73.0	0.19	0.21	0.24	2.06	3.65	4.74	3.9	7.7	11.4
AC90	38.7	0.0605	16.1	9.9	73.0	0.31	0.35	0.40	1.17	2.07	2.68	13.9	28.1	41.5
AC91	30.4	0.0474	22.3	13.4	73.0	0.34	0.39	0.44	1.02	1.81	2.35	10.4	21.2	31.3
AC92	7.0	0.0110	9.4	5.7	73.0	0.24	0.28	0.32	1.60	2.83	3.67	2.7	5.7	8.3
AC93	59.4	0.0928	20.4	12.4	73.0	0.33	0.37	0.43	1.07	1.90	2.46	20.7	42.1	62.2
AC94	12.0	0.0188	17.7	11.0	73.0	0.32	0.36	0.41	1.14	2.02	2.63	4.3	8.8	13.0
AC95	12.8	0.0201	15.3	6.9	68.7	0.25	0.30	0.35	1.19	2.11	2.74	3.8	8.2	12.1
AC96	12.5	0.0195	14.7	6.8	65.6	0.21	0.27	0.31	1.25	2.21	2.87	3.3	7.5	11.1
AC97	15.6	0.0243	16.1	7.5	64.1	0.19	0.26	0.29	1.17	2.07	2.68	3.5	8.2	12.1
AC98	3.3	0.0052	10.3	5.0	71.6	0.24	0.28	0.32	1.48	2.62	3.40	1.2	2.5	3.6
AC99	7.6	0.0119	12.2	5.4	62.4	0.15	0.21	0.24	1.36	2.42	3.14	1.6	3.9	5.7
AC100	4.8	0.0075	8.6	4.1	60.0	0.11	0.18	0.20	1.71	3.03	3.94	0.9	2.6	3.8
AC101	7.9	0.0124	17.9	8.3	60.0	0.15	0.22	0.25	1.14	2.02	2.63	1.3	3.5	5.2
AC102	13.9	0.0218	9.8	4.6	60.1	0.12	0.18	0.21	1.60	2.83	3.67	2.7	7.1	10.5
AC103	14.5	0.0227	6.8	3.2	64.2	0.13	0.18	0.21	1.94	3.44	4.47	3.8	9.1	13.4
AC104	11.1	0.0174	5.0	3.0	65.1	0.13	0.16	0.18	2.06	3.65	4.74	2.9	6.5	9.7
AC105	18.8	0.0294	12.2	3.9	65.7	0.19	0.25	0.28	1.36	2.42	3.14	4.9	11.2	16.6
AC106	231.5	0.3617	32.3	19.4	71.6	0.37	0.43	0.49	0.81	1.44	1.87	26.2	101.2	150.5
AC107	244.7	0.3824	42.0	25.5	70.8	0.40	0.48	0.55	0.73	1.29	1.67	23.0	94.0	141.4
AC108	66.7	0.1042	27.6	13.4	63.2	0.21	0.29	0.33	0.90	1.60	2.08	12.6	30.7	45.3
AC109	21.9	0.0341	13.1	6.1	73.5	0.30	0.33	0.38	1.31	2.31	3.00	8.5	16.9	24.9
LT01	303.6	0.4743	15.8	9.6	73.2	0.31	0.35	0.40	1.19	2.11	2.74	48.6	166.0	241.2
NYR01	1356.0	2.1188	47.1	28.5	70.8	0.42	0.52	0.59	0.68	1.21	1.58	119.5	495.6	747.4

Flows computed using SCS Curve Number/Unit Hydrograph Method in HEC-HMS

Notes:

- C_2, C_{25}, and C_{100} values computed using runoff coefficient frequency factors explained in Section 2.6.1 of report
- Unless otherwise noted, peak flow estimates were computed using the Rational Method, Q=CiA

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  - NOAA Atlas 14 Rainfall Depths and Intensities
  - TR-55 – Table 2.2 – Runoff Curve Numbers
  - County of El Dorado Drainage Manual – CN to C Curves
  - County of El Dorado Drainage Manual – CN to C Curves - Revised

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ATKINS

Bosse-Previtali Small Diameter Pipeline
Existing Condition Land Use Map

Figure A-1

ATKINS

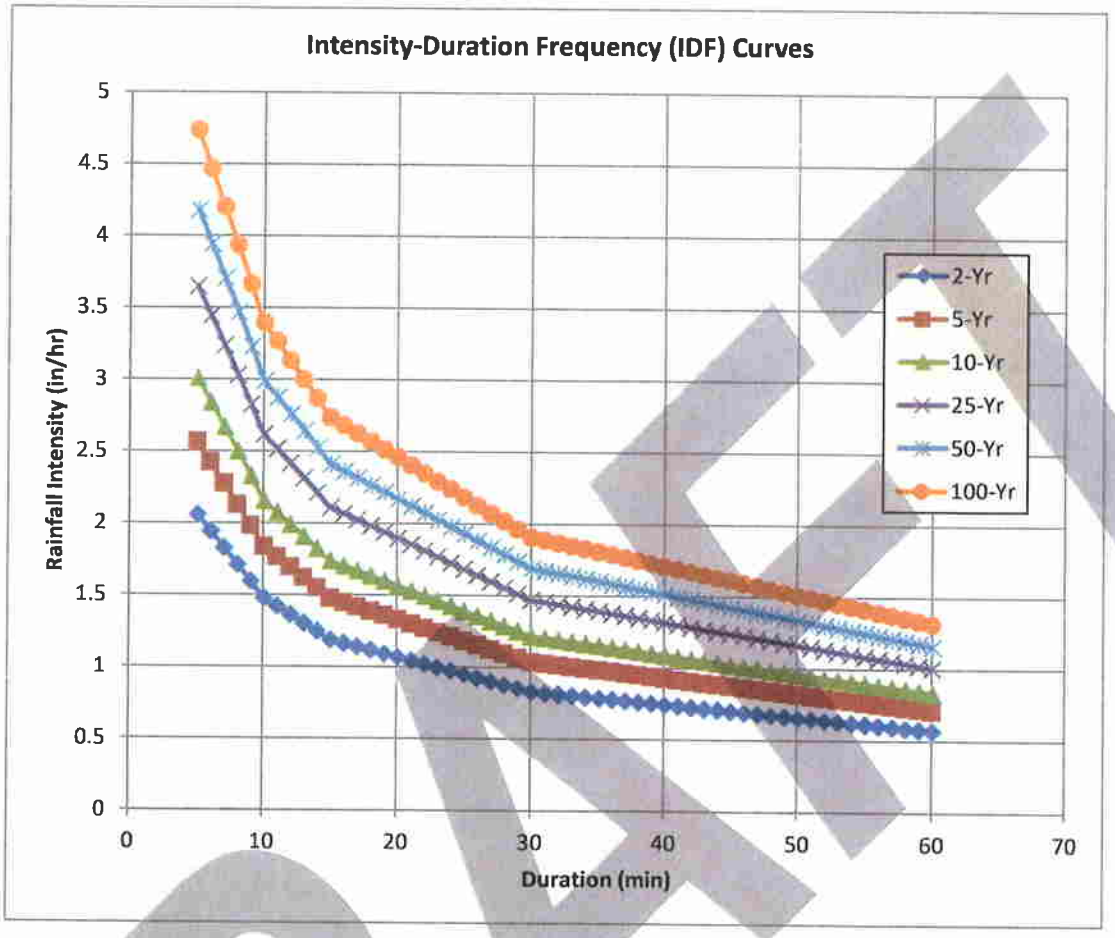
Bosse-Previtali Small Diameter Pipeline
Soils Map

Figure A-2

Table A-1
Bosse-Previtali Small Diameter Pipeline
NOAA Atlas 14 PDS-Based Point Precipitation Frequency Estimates- Rainfall Intensity
Coordinates: 38.4075 N, 120.7058 W
Elevation: 2082 ft

Duration Time (min)	Rainfall Intensity (in/hr) per Average Recurrence Interval					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	***2.06***	***2.57***	***3.01***	***3.65***	***4.18***	***4.74***
6	1.94	2.42	2.84	3.44	3.94	4.47
7	1.83	2.28	2.67	3.24	3.70	4.20
8	1.71	2.13	2.50	3.03	3.47	3.94
9	1.60	1.99	2.33	2.83	3.23	3.67
10	***1.48***	***1.84***	***2.16***	***2.62***	***2.99***	***3.40***
11	1.42	1.77	2.08	2.52	2.87	3.27
12	1.36	1.70	1.99	2.42	2.76	3.14
13	1.31	1.62	1.91	2.31	2.64	3.00
14	1.25	1.55	1.82	2.21	2.53	2.87
15	***1.19***	***1.48***	***1.74***	***2.11***	***2.41***	***2.74***
16	1.17	1.45	1.71	2.07	2.36	2.68
17	1.14	1.42	1.67	2.02	2.31	2.63
18	1.12	1.39	1.64	1.98	2.27	2.57
19	1.09	1.36	1.60	1.94	2.22	2.52
20	1.07	1.33	1.57	1.90	2.17	2.46
21	1.05	1.30	1.53	1.85	2.12	2.41
22	1.02	1.27	1.50	1.81	2.07	2.35
23	1.00	1.25	1.46	1.77	2.03	2.30
24	0.98	1.22	1.43	1.73	1.98	2.24
25	0.95	1.19	1.39	1.68	1.93	2.19
26	0.93	1.16	1.36	1.64	1.88	2.13
27	0.90	1.13	1.32	1.60	1.83	2.08
28	0.88	1.10	1.29	1.56	1.79	2.02
29	0.86	1.07	1.25	1.51	1.74	1.97
30	***0.83***	***1.04***	***1.22***	***1.47***	***1.69***	***1.91***
31	0.82	1.03	1.21	1.45	1.67	1.89
32	0.81	1.02	1.19	1.44	1.65	1.87
33	0.81	1.01	1.18	1.42	1.64	1.85
34	0.80	1.00	1.17	1.41	1.62	1.83
35	0.79	0.99	1.16	1.39	1.60	1.81
36	0.78	0.97	1.14	1.38	1.58	1.79
37	0.77	0.96	1.13	1.36	1.57	1.77
38	0.76	0.95	1.12	1.35	1.55	1.75
39	0.75	0.94	1.10	1.33	1.53	1.73
40	0.75	0.93	1.09	1.32	1.51	1.71
41	0.74	0.92	1.08	1.30	1.50	1.69
42	0.73	0.91	1.07	1.29	1.48	1.67
43	0.72	0.90	1.05	1.27	1.46	1.65
44	0.71	0.89	1.04	1.26	1.44	1.63
45	0.70	0.88	1.03	1.24	1.43	1.62
46	0.69	0.87	1.02	1.22	1.41	1.60
47	0.68	0.86	1.00	1.21	1.39	1.58
48	0.68	0.84	0.99	1.19	1.37	1.56
49	0.67	0.83	0.98	1.18	1.35	1.54
50	0.66	0.82	0.96	1.16	1.34	1.52
51	0.65	0.81	0.95	1.15	1.32	1.50
52	0.64	0.80	0.94	1.13	1.30	1.48
53	0.63	0.79	0.93	1.12	1.28	1.46
54	0.62	0.78	0.91	1.10	1.27	1.44
55	0.62	0.77	0.90	1.09	1.25	1.42
56	0.61	0.76	0.89	1.07	1.23	1.40
57	0.60	0.75	0.87	1.06	1.21	1.38
58	0.59	0.74	0.86	1.04	1.20	1.36
59	0.58	0.72	0.85	1.03	1.18	1.34
60	***0.57***	***0.71***	***0.84***	***1.01***	***1.16***	***1.32***

DRAFT


Intensity-Duration Frequency (IDF) Curves
Rainfall Intensity (in/hr)
Duration (min)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
10
20
30
40
50
60
70
2-Yr
5-Yr
10-Yr
25-Yr
50-Yr
100-Yr

DRAFT

Table A-2
Bosse-Previall Small Diameter Pipeline
Existing Conditon Curve Number Summary Table

BASIN	LAND USE CATEGORY	PREDOMINANT HYDROLOGIC SOIL GROUP	SUBREGION AREA (ACRES)	SUBBASIN AREA (ACRES)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	SUBREGION CN	AREA-WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
AC01	Agricultural Lands-Woods	D	1.23	4.30	28.55%	28.6%	79	22.56	22.56	
AC01	Agricultural Lands-Woods	C	3.07	4.30	71.45%	100.0%	73	52.15	74.71	74.7
AC02	Agricultural Lands-Woods	C	0.10	12.42	0.81%	0.8%	73	0.59	0.59	
AC02	Agricultural Lands-Woods	C	0.20	12.42	1.59%	2.4%	73	1.16	1.75	
AC02	Agricultural Lands-Woods	C	2.79	12.42	22.48%	24.9%	73	16.41	18.16	
AC02	Agricultural Lands-Woods	C	9.33	12.42	75.12%	100.0%	73	54.84	73.00	73.0
AC03	Agricultural Lands-Woods	C	21.50	48.54	44.28%	44.3%	73	32.33	32.33	
AC03	Agricultural Lands-Woods	C	0.22	48.54	0.45%	44.7%	73	0.33	32.65	
AC03	Agricultural Lands-Woods	C	10.27	48.54	21.16%	65.9%	73	15.45	48.10	
AC03	Agricultural Lands-Woods and grass combination	C	1.18	48.54	2.43%	68.3%	76	1.84	49.95	
AC03	Agricultural Lands-Woods and grass combination	C	15.32	48.54	31.55%	99.9%	76	23.98	73.93	
AC03	Residential-1 to 2 AC	C	0.02	48.54	0.04%	99.9%	79	0.03	73.96	
AC03	Residential-2 to 5 AC	C	0.04	48.54	0.08%	100.0%	77	0.06	74.02	74.0
AC04	Agricultural Lands-Woods	C	12.75	23.95	53.24%	53.2%	73	38.87	38.87	
AC04	Agricultural Lands-Woods	C	1.41	23.95	5.90%	59.1%	73	4.31	43.17	
AC04	Agricultural Lands-Woods and grass combination	C	9.60	23.95	40.10%	99.2%	76	30.48	73.65	
AC04	Agricultural Lands-Woods and grass combination	C	0.02	23.95	0.10%	99.3%	76	0.07	73.72	
AC04	Residential-1 to 2 AC	C	0.16	23.95	0.66%	100.0%	79	0.52	74.24	74.2
AC05	Agricultural Lands-Woods	C	11.45	15.25	75.11%	75.1%	73	54.83	54.83	
AC05	Agricultural Lands-Woods	C	0.16	15.25	1.05%	76.2%	73	0.77	55.60	
AC05	Agricultural Lands-Woods and grass combination	C	3.63	15.25	23.84%	100.0%	76	18.12	73.71	73.7
AC06	Agricultural Lands-Woods	C	3.80	20.37	18.64%	18.6%	73	13.60	13.60	
AC06	Agricultural Lands-Woods	C	16.51	20.37	81.02%	99.7%	73	59.14	72.75	
AC06	Agricultural Lands-Woods	C	0.07	20.37	0.34%	100.0%	73	0.25	73.00	73.0
AC07	Agricultural Lands-Woods	C	5.41	5.41	100.00%	100.0%	73	73.00	73.00	73.0
AC08	Agricultural Lands-Woods	C	5.17	5.17	100.00%	100.0%	73	73.00	73.00	73.0
AC09	Agricultural Lands-Woods	C	4.18	4.18	100.00%	100.0%	73	73.00	73.00	73.0
AC10	Agricultural Lands-Woods	C	6.52	6.52	100.00%	100.0%	73	73.00	73.00	73.0
AC11	Agricultural Lands-Woods	C	6.03	6.03	100.00%	100.0%	73	73.00	73.00	73.0
AC12	Agricultural Lands-Woods	C	8.58	9.40	91.27%	91.3%	73	66.62	66.62	
AC12	Agricultural Lands-Woods	C	0.82	9.40	8.73%	100.0%	73	6.38	73.00	73.0
AC13	Agricultural Lands-Woods	C	8.47	11.04	76.68%	76.7%	73	55.97	55.97	
AC13	Agricultural Lands-Woods	C	0.42	11.04	3.83%	80.5%	73	2.79	58.77	
AC13	Agricultural Lands-Woods and grass combination	C	0.42	11.04	3.85%	84.4%	76	2.92	61.69	
AC13	Agricultural Lands-Woods and grass combination	C	1.73	11.04	15.65%	100.0%	76	11.89	73.58	73.6
AC14	Agricultural Lands-Woods	C	8.05	12.69	63.46%	63.5%	73	46.33	46.33	
AC14	Agricultural Lands-Woods	C	0.12	12.69	0.93%	64.4%	73	0.68	47.01	
AC14	Agricultural Lands-Woods and grass combination	C	0.63	12.69	4.99%	69.4%	76	3.79	50.80	
AC14	Agricultural Lands-Woods and grass combination	C	3.19	12.69	25.15%	94.5%	76	19.11	69.91	
AC14	Residential-1 to 2 AC	C	0.69	12.69	5.47%	100.0%	79	4.32	74.23	74.2
AC15	Agricultural Lands-Woods	C	4.21	4.29	98.18%	98.2%	73	71.67	71.67	
AC15	Agricultural Lands-Woods	C	0.05	4.29	1.21%	99.4%	73	0.88	72.55	
AC15	Agricultural Lands-Woods and grass combination	C	0.03	4.29	0.62%	100.0%	76	0.47	73.02	73.0
AC16	Agricultural Lands-Woods	C	2.94	13.93	21.08%	21.1%	73	15.39	15.39	
AC16	Agricultural Lands-Woods	C	0.31	13.93	2.24%	23.3%	73	1.63	17.02	
AC16	Agricultural Lands-Woods	C	0.01	13.93	0.09%	23.4%	73	0.06	17.08	
AC16	Agricultural Lands-Woods and grass combination	C	6.75	13.93	48.49%	71.9%	76	36.85	53.93	
AC16	Agricultural Lands-Woods and grass combination	C	1.27	13.93	9.13%	81.0%	76	6.94	60.87	
AC16	Agricultural Lands-Woods and grass combination	C	2.45	13.93	17.60%	98.6%	76	13.38	74.25	
AC16	Residential-1 to 2 AC	C	0.19	13.93	1.36%	100.0%	79	1.09	75.34	75.3
AC17	Agricultural Lands-Woods	B	0.00	32.48	0.00%	0.0%	60	0.00	0.00	
AC17	Agricultural Lands-Woods	B	27.48	32.48	84.58%	84.6%	60	50.75	50.75	
AC17	Agricultural Lands-Woods	B	2.54	32.48	7.81%	92.4%	60	4.68	55.43	
AC17	Agricultural Lands-Woods and grass combination	B	2.15	32.48	6.63%	99.0%	65	4.31	59.75	
AC17	Agricultural Lands-Woods and grass combination	B	0.32	32.48	0.97%	100.0%	65	0.63	60.38	60.4
AC18	Agricultural Lands-Woods	B	2.12	3.18	66.81%	66.8%	60	40.09	40.09	
AC18	Agricultural Lands-Woods	B	1.05	3.18	33.19%	100.0%	60	19.91	60.00	60.0
AC19	Agricultural Lands-Woods	B	3.73	4.00	93.09%	93.1%	60	55.85	55.85	
AC19	Agricultural Lands-Woods	B	0.28	4.00	6.91%	100.0%	60	4.14	60.00	60.0
AC20	Agricultural Lands-Woods	B	3.22	3.28	98.14%	98.1%	60	58.88	58.88	
AC20	Agricultural Lands-Woods	B	0.06	3.28	1.86%	100.0%	60	1.12	60.00	60.0
AC21	Agricultural Lands-Woods	B	6.82	6.90	98.94%	98.9%	60	59.36	59.36	
AC21	Agricultural Lands-Woods	B	0.07	6.90	1.06%	100.0%	60	0.64	60.00	60.0
AC22	Agricultural Lands-Woods	B	8.23	8.59	95.83%	95.8%	60	57.50	57.50	
AC22	Agricultural Lands-Woods	B	0.36	8.59	4.17%	100.0%	60	2.50	60.00	60.0
AC23	Agricultural Lands-Woods	B	1.47	1.82	81.06%	81.1%	60	48.63	48.63	
AC23	Agricultural Lands-Woods	B	0.34	1.82	18.94%	100.0%	60	11.37	60.00	60.0
AC24	Agricultural Lands-Woods	B	2.52	2.80	90.18%	90.2%	60	54.11	54.11	
AC24	Agricultural Lands-Woods	B	0.27	2.80	9.82%	100.0%	60	5.89	60.00	60.0
AC25	Agricultural Lands-Woods	B	8.06	8.97	89.85%	89.8%	60	53.91	53.91	
AC25	Agricultural Lands-Woods	B	0.91	8.97	10.15%	100.0%	60	6.09	60.00	60.0
AC26	Agricultural Lands-Woods	B	13.86	74.18	18.68%	18.7%	60	11.21	11.21	
AC26	Agricultural Lands-Woods	B	0.15	74.18	0.20%	18.9%	60	0.12	11.33	
AC26	Agricultural Lands-Woods	B	58.04	74.18	78.24%	97.1%	60	46.94	58.27	
AC26	Agricultural Lands-Woods	B	2.14	74.18	2.88%	100.0%	60	1.73	60.00	60.0
AC27	Agricultural Lands-Woods	B	10.95	11.93	91.84%	91.8%	60	55.11	55.11	
AC27	Agricultural Lands-Woods	B	0.97	11.93	8.15%	100.0%	60	4.89	60.00	60.0
AC28	Agricultural Lands-Woods	B	6.20	6.47	95.82%	95.8%	60	57.49	57.49	
AC28	Agricultural Lands-Woods	B	0.27	6.47	4.18%	100.0%	60	2.51	60.00	60.0
AC29	Agricultural Lands-Woods	C	2.01	6.11	32.94%	32.8%	73	23.97	23.97	
AC29	Agricultural Lands-Woods	B	4.10	6.11	67.16%	100.0%	60	40.30	64.27	64.3
AC30	Agricultural Lands-Woods	C	4.34	5.54	78.27%	78.3%	73	57.14	57.14	
AC30	Agricultural Lands-Woods	B	1.20	5.54	21.73%	100.0%	60	13.04	70.17	70.2
AC31	Agricultural Lands-Woods	C	12.23	57.16	21.40%	21.4%	73	15.62	15.62	
AC31	Agricultural Lands-Woods	B	43.95	57.16	76.89%	98.3%	60	46.13	61.76	
AC31	Agricultural Lands-Woods	B	0.56	57.16	0.98%	99.3%	60	0.59	62.34	
AC31	Residential-2 to 5 AC	C	0.42	57.16	0.73%	100.0%	77	0.56	62.90	
AC31	Residential-2 to 5 AC	B	0.00	57.16	0.00%	100.0%	65	0.00	62.90	62.9
AC32	Agricultural Lands-Woods	C	17.87	25.28	70.70%	70.7%	73	51.61	51.61	
AC32	Agricultural Lands-Woods	C	0.00	25.28	0.00%	70.7%	73	0.00	51.62	
AC32	Agricultural Lands-Woods	B	3.06	25.28	12.11%	82.8%	60	7.26	58.88	
AC32	Agricultural Lands-Woods	B	0.21	25.28	0.81%	83.6%	60	0.49	59.37	
AC32	Paved; open ditches	C	0.74	25.28	2.91%	86.5%	92	2.68	62.05	
AC32	Paved; open ditches	C	0.00	25.28	0.00%	86.5%	92	0.00	62.05	
AC32	Residential-2 to 5 AC	C	2.54	25.28	10.03%	96.6%	77	7.72	69.77	
AC32	Residential-2 to 5 AC	B	0.11	25.28	0.43%	97.0%	65	0.28	70.05	
AC32	Residential-2 to 5 AC	B	0.76	25.28	3.00%	100.0%	65	1.95	72.00	72.0

Table A-2
Bosse-Previtali Small Diameter Pipeline
Existing Conditon Curve Number Summary Table

BASIN	LAND USE CATEGORY	PREDOMINANT HYDROLOGIC SOIL GROUP	SUBREGION AREA (ACRES)	SUBBASIN AREA (ACRES)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	SUBREGION CN	AREA-WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
AC33	Agricultural Lands-Woods	C	2.26	14.96	15.13%	15.1%	73	11.05	11.05	
AC33	Agricultural Lands-Woods	B	12.45	14.96	83.23%	98.4%	60	49.94	60.98	
AC33	Paved; open ditches	B	0.24	14.96	1.64%	100.0%	89	1.46	62.44	62.4
AC34	Agricultural Lands-Woods	B	3.77	3.77	99.98%	100.0%	60	59.99	59.99	
AC34	Paved; open ditches	B	0.00	3.77	0.01%	100.0%	89	0.01	60.00	60.0
AC35	Agricultural Lands-Woods	B	1.37	1.70	80.89%	80.9%	60	48.54	48.54	
AC35	Agricultural Lands-Woods and grass combination	B	0.32	1.70	19.11%	100.0%	65	12.42	60.95	61.0
AC36	Agricultural Lands-Woods	B	3.14	3.62	86.89%	86.9%	60	52.14	52.14	
AC36	Agricultural Lands-Woods and grass combination	B	0.47	3.62	13.11%	100.0%	65	8.52	60.65	60.7
AC37	Agricultural Lands-Woods	B	3.51	4.41	79.40%	79.4%	60	47.64	47.64	
AC37	Agricultural Lands-Woods	B	0.00	4.41	0.01%	79.4%	60	0.01	47.65	
AC37	Paved; open ditches	B	0.91	4.41	20.57%	100.0%	89	18.30	65.95	
AC37	Paved; open ditches	B	0.00	4.41	0.01%	100.0%	89	0.01	65.97	66.0
AC38	Agricultural Lands-Woods	B	5.92	7.46	79.37%	79.4%	60	47.62	47.62	
AC38	Agricultural Lands-Woods	B	0.00	7.46	0.00%	79.4%	60	0.00	47.62	
AC38	Paved; open ditches	B	1.52	7.46	20.36%	99.7%	89	18.12	65.74	
AC38	Paved; open ditches	B	0.00	7.46	0.00%	99.7%	89	0.00	65.74	
AC38	Residential-1 to 2 AC	B	0.01	7.46	0.19%	99.9%	68	0.11	65.85	
AC38	Residential < 1 AC	B	0.01	7.46	0.11%	100.0%	70	0.07	65.93	65.9
AC39	Agricultural Lands-Woods	B	3.85	4.48	86.05%	86.0%	60	51.63	51.63	
AC39	Agricultural Lands-Woods	B	0.00	4.48	0.01%	86.1%	60	0.00	51.63	
AC39	Paved; open ditches	B	0.62	4.48	13.94%	100.0%	89	12.41	64.04	
AC39	Paved; open ditches	B	0.00	4.48	0.01%	100.0%	89	0.01	64.05	64.0
AC40	Agricultural Lands-Woods	C	1.02	11.83	8.62%	8.6%	73	6.30	6.30	
AC40	Agricultural Lands-Woods	B	10.04	11.83	84.87%	93.5%	60	50.92	57.22	
AC40	Agricultural Lands-Woods	B	0.00	11.83	0.00%	93.5%	60	0.00	57.22	
AC40	Paved; open ditches	B	0.77	11.83	6.49%	100.0%	89	5.78	63.00	
AC40	Paved; open ditches	B	0.00	11.83	0.00%	100.0%	89	0.00	63.01	63.0
AC41	Agricultural Lands-Woods	C	0.33	18.99	1.72%	1.7%	73	1.26	1.26	
AC41	Agricultural Lands-Woods	B	18.91	18.99	89.08%	90.8%	60	53.44	54.69	
AC41	Agricultural Lands-Woods	B	0.00	18.99	0.00%	90.8%	60	0.00	54.70	
AC41	Agricultural Lands-Woods	B	0.20	18.99	1.06%	91.9%	60	0.64	55.33	
AC41	Paved; open ditches	C	0.16	18.99	0.83%	92.7%	92	0.76	56.10	
AC41	Paved; open ditches	C	0.00	18.99	0.00%	92.7%	92	0.00	56.10	
AC41	Paved; open ditches	B	0.93	18.99	4.89%	97.6%	89	4.35	60.45	
AC41	Paved; open ditches	B	0.00	18.99	0.00%	97.6%	89	0.00	60.45	
AC41	Paved; open ditches	B	0.13	18.99	0.68%	98.2%	89	0.60	61.05	
AC41	Residential-2 to 5 AC	C	0.13	18.99	0.70%	98.9%	77	0.54	61.59	
AC41	Residential-2 to 5 AC	C	0.00	18.99	0.00%	98.9%	77	0.00	61.59	
AC41	Residential-2 to 5 AC	B	0.14	18.99	0.75%	99.7%	65	0.49	62.07	
AC41	Residential-2 to 5 AC	B	0.06	18.99	0.31%	100.0%	65	0.20	62.27	62.3
AC42	Agricultural Lands-Woods	B	11.38	11.39	99.98%	100.0%	60	59.99	59.99	
AC42	Residential-2 to 5 AC	B	0.00	11.39	0.02%	100.0%	65	0.01	60.00	60.0
AC43	Agricultural Lands-Woods	B	2.32	2.48	93.78%	93.8%	60	56.27	56.27	
AC43	Residential-1 to 2 AC	B	0.15	2.48	6.22%	100.0%	68	4.23	60.50	60.5
AC44	Agricultural Lands-Woods	B	2.91	2.91	100.00%	100.0%	60	60.00	60.00	60.0
AC45	Agricultural Lands-Woods	B	6.78	6.78	100.00%	100.0%	60	60.00	60.00	60.0
AC46	Agricultural Lands-Woods	B	3.39	3.39	99.79%	99.8%	60	59.87	59.87	
AC46	Residential-1 to 2 AC	B	0.01	3.39	0.21%	100.0%	68	0.14	60.02	60.0
AC47	Agricultural Lands-Woods	B	3.01	3.02	99.88%	99.9%	60	59.93	59.93	
AC47	Residential-2 to 5 AC	B	0.00	3.02	0.12%	100.0%	65	0.08	60.00	60.0
AC48	Agricultural Lands-Woods	B	1.76	2.01	87.57%	87.6%	60	52.54	52.54	
AC48	Residential-1 to 2 AC	B	0.04	2.01	2.19%	89.8%	68	1.49	54.03	
AC48	Residential-2 to 5 AC	B	0.17	2.01	8.38%	98.1%	65	5.44	59.48	
AC48	Residential < 1 AC	B	0.04	2.01	1.86%	100.0%	70	1.30	60.78	60.8
AC49	Agricultural Lands-Woods	B	0.91	4.38	20.71%	20.7%	60	12.42	12.42	
AC49	Agricultural Lands-Woods	B	3.32	4.38	75.75%	96.5%	60	45.45	57.88	
AC49	Residential-2 to 5 AC	B	0.11	4.38	2.49%	99.0%	65	1.62	59.50	
AC49	Residential-2 to 5 AC	B	0.05	4.38	1.05%	100.0%	65	0.68	60.18	60.2
AC50	Agricultural Lands-Woods	C	0.27	17.44	1.57%	1.6%	73	1.15	1.15	
AC50	Agricultural Lands-Woods	B	0.61	17.44	3.51%	5.1%	60	2.11	3.25	
AC50	Agricultural Lands-Woods	B	16.55	17.44	94.90%	100.0%	60	56.94	60.19	
AC50	Agricultural Lands-Woods	B	0.00	17.44	0.02%	100.0%	60	0.01	60.20	60.2
AC51	Agricultural Lands-Woods	C	0.43	1.23	35.24%	35.2%	73	25.72	25.72	
AC51	Agricultural Lands-Woods	B	0.22	1.23	18.14%	53.4%	60	10.88	36.61	
AC51	Agricultural Lands-Woods	B	0.57	1.23	46.62%	100.0%	60	27.97	64.58	64.6
AC52	Agricultural Lands-Woods	B	1.04	3.26	31.98%	32.0%	60	19.19	19.19	
AC52	Agricultural Lands-Woods	B	2.22	3.26	68.01%	100.0%	60	40.81	60.00	60.0
AC53	Agricultural Lands-Woods	B	0.61	6.80	8.92%	8.9%	60	5.35	5.35	
AC53	Agricultural Lands-Woods	B	6.19	6.80	91.08%	100.0%	60	54.65	60.00	60.0
AC54	Agricultural Lands-Woods	C	2.07	9.16	22.60%	22.6%	73	16.50	16.50	
AC54	Agricultural Lands-Woods	B	0.37	9.16	4.04%	26.6%	60	2.42	18.92	
AC54	Agricultural Lands-Woods	B	6.72	9.16	73.36%	100.0%	60	44.02	62.94	62.9
AC55	Agricultural Lands-Woods	C	3.33	5.91	56.42%	56.4%	73	41.19	41.19	
AC55	Agricultural Lands-Woods	B	2.58	5.91	43.58%	100.0%	60	26.15	67.33	67.3
AC56	Agricultural Lands-Woods	C	1.96	2.04	96.06%	96.1%	73	70.12	70.12	
AC56	Agricultural Lands-Woods	B	0.08	2.04	3.94%	100.0%	60	2.36	72.49	72.5
AC57	Agricultural Lands-Woods	C	7.32	9.26	79.00%	79.0%	73	57.67	57.67	
AC57	Agricultural Lands-Woods	B	1.94	9.26	21.00%	100.0%	60	12.60	70.27	70.3
AC58	Agricultural Lands-Woods	C	1.59	1.59	100.00%	100.0%	73	73.00	73.00	73.0
AC59	Agricultural Lands-Woods	C	5.18	5.18	100.00%	100.0%	73	73.00	73.00	73.0
AC60	Agricultural Lands-Woods	C	1.49	1.49	100.00%	100.0%	73	73.00	73.00	73.0
AC61	Agricultural Lands-Woods	C	7.80	7.96	97.95%	98.0%	73	71.51	71.51	
AC61	Agricultural Lands-Woods	B	0.16	7.96	2.04%	100.0%	60	1.23	72.73	72.7
AC62	Agricultural Lands-Woods	C	11.02	11.15	98.82%	98.8%	73	72.14	72.14	
AC62	Agricultural Lands-Woods	B	0.13	11.15	1.18%	100.0%	60	0.71	72.85	72.8
AC63	Agricultural Lands-Woods	C	9.19	9.27	99.11%	99.1%	73	72.35	72.35	
AC63	Agricultural Lands-Woods	B	0.08	9.27	0.89%	100.0%	60	0.53	72.88	72.9
AC64	Agricultural Lands-Woods	C	1.25	16.98	7.36%	7.4%	73	5.37	5.37	
AC64	Agricultural Lands-Woods	B	14.80	16.98	87.15%	94.5%	60	52.29	57.66	
AC64	Agricultural Lands-Woods	B	0.93	16.98	5.49%	100.0%	60	3.29	60.96	61.0
AC65	Agricultural Lands-Woods	C	0.13	33.64	0.38%	0.4%	73	0.28	0.28	
AC65	Agricultural Lands-Woods	B	13.01	33.64	38.67%	39.1%	60	23.20	23.48	
AC65	Agricultural Lands-Woods	B	3.28	33.64	9.76%	48.8%	60	5.86	29.34	
AC65	Agricultural Lands-Woods	C	16.26	33.64	48.35%	97.2%	73	35.30	64.63	
AC65	Agricultural Lands-Woods	B	0.95	33.64	2.84%	100.0%	60	1.70	66.33	66.3

Table A-2
Bosse-Previtall Small Diameter Pipeline
Existing Conditon Curve Number Summary Table

BASIN	LAND USE CATEGORY	PREDOMINANT HYDROLOGIC SOIL GROUP	SUBBASIN AREA (ACRES)	SUBBASIN AREA (ACRES)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	SUBBASIN CN	AREA-WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
AC66	Agricultural Lands-Woods	C	0.08	3.82	1.99%	2.0%	73	1.45	1.45	
AC66	Agricultural Lands-Woods	C	0.30	3.82	7.96%	9.9%	73	5.81	7.26	
AC66	Agricultural Lands-Woods	B	3.44	3.82	90.06%	100.0%	60	54.03	61.29	61.3
AC67	Agricultural Lands-Woods	C	1.82	4.60	39.55%	39.5%	73	28.87	28.87	
AC67	Agricultural Lands-Woods	B	2.78	4.60	60.45%	100.0%	60	36.27	65.14	65.1
AC68	Agricultural Lands-Woods	C	3.28	9.30	35.26%	35.3%	73	25.74	25.74	
AC68	Agricultural Lands-Woods	B	6.02	9.30	64.74%	100.0%	60	38.84	64.58	64.6
AC69	Agricultural Lands-Woods	B	2.29	2.64	86.60%	86.6%	60	51.96	51.96	
AC69	Residential-2 to 5 AC	B	0.35	2.64	13.40%	100.0%	65	8.71	60.67	60.7
AC70	Agricultural Lands-Woods	B	0.23	1.76	13.06%	13.1%	60	7.84	7.84	
AC70	Agricultural Lands-Woods and grass combination	B	0.00	1.76	0.23%	13.3%	65	0.15	7.98	
AC70	Residential-2 to 5 AC	B	1.52	1.76	86.71%	100.0%	65	56.36	64.35	64.3
AC71	Agricultural Lands-Woods	C	0.01	1.65	0.71%	0.7%	73	0.52	0.52	
AC71	Agricultural Lands-Woods	B	0.08	1.65	5.07%	5.8%	60	3.04	3.56	
AC71	Residential-2 to 5 AC	C	0.00	1.65	0.29%	6.1%	77	0.23	3.79	
AC71	Residential-2 to 5 AC	B	1.55	1.65	93.92%	100.0%	65	61.05	64.84	64.8
AC72	Agricultural Lands-Woods	C	0.19	3.80	4.95%	4.9%	73	3.61	3.61	
AC72	Agricultural Lands-Woods	B	2.37	3.80	62.47%	67.4%	60	37.48	41.09	
AC72	Residential-2 to 5 AC	B	1.24	3.80	32.58%	100.0%	65	21.18	62.27	62.3
AC73	Agricultural Lands-Woods	C	0.65	2.90	22.33%	22.3%	73	16.30	16.30	
AC73	Agricultural Lands-Woods	B	1.02	2.90	35.10%	57.4%	60	21.06	37.36	
AC73	Agricultural Lands-Woods and grass combination	C	0.14	2.90	4.77%	62.2%	76	3.62	40.98	
AC73	Agricultural Lands-Woods and grass combination	B	1.00	2.90	34.47%	96.7%	65	22.41	63.39	
AC73	Residential-2 to 5 AC	B	0.10	2.90	3.33%	100.0%	65	2.16	65.55	65.6
AC74	Agricultural Lands-Woods	C	2.12	2.90	73.08%	73.1%	73	53.35	53.35	
AC74	Agricultural Lands-Woods and grass combination	C	0.43	2.90	14.80%	87.9%	76	11.25	64.60	
AC74	Agricultural Lands-Woods and grass combination	B	0.35	2.90	12.12%	100.0%	65	7.88	72.47	72.5
AC75	Agricultural Lands-Woods	C	2.14	2.84	75.38%	75.4%	73	55.03	55.03	
AC75	Agricultural Lands-Woods	B	0.70	2.84	24.62%	100.0%	60	14.77	69.80	69.8
AC76	Agricultural Lands-Woods	C	9.72	18.36	52.93%	52.9%	73	38.64	38.64	
AC76	Agricultural Lands-Woods	C	5.62	18.36	30.59%	83.5%	73	22.33	60.97	
AC76	Agricultural Lands-Woods	B	0.53	18.36	2.89%	86.4%	60	1.74	62.71	
AC76	Residential-2 to 5 AC	C	1.63	18.36	8.90%	95.3%	77	6.86	69.56	
AC76	Residential-2 to 5 AC	B	0.86	18.36	4.68%	100.0%	65	3.04	72.60	72.6
AC77	Agricultural Lands-Woods	C	32.45	41.91	77.41%	77.4%	73	56.51	56.51	
AC77	Agricultural Lands-Woods	C	9.47	41.91	22.59%	100.0%	73	16.49	73.00	73.0
AC78	Agricultural Lands-Woods	C	4.58	4.58	100.00%	100.0%	73	73.00	73.00	73.0
AC79	Agricultural Lands-Woods	C	5.47	5.47	100.00%	100.0%	73	73.00	73.00	73.0
AC80	Agricultural Lands-Woods	C	21.84	31.87	68.53%	68.5%	73	50.03	50.03	
AC80	Agricultural Lands-Woods	C	1.10	31.87	3.44%	72.0%	73	2.51	52.54	
AC80	Paved; open ditches	C	0.25	31.87	0.81%	72.8%	92	0.74	53.28	
AC80	Paved; open ditches	C	0.00	31.87	0.00%	72.8%	92	0.00	53.28	
AC80	Paved; open ditches	C	0.66	31.87	2.10%	74.9%	92	1.96	55.24	
AC80	Paved; open ditches	C	0.00	31.87	0.00%	74.9%	92	0.00	55.24	
AC80	Residential-1 to 2 AC	C	3.30	31.87	10.35%	85.3%	79	8.17	63.41	
AC80	Residential-1 to 2 AC	C	1.87	31.87	5.86%	91.1%	79	4.63	68.04	
AC80	Residential < 1 AC	C	0.82	31.87	2.59%	93.7%	80	2.07	70.11	
AC80	Residential < 1 AC	C	0.00	31.87	0.00%	93.7%	80	0.00	70.11	
AC80	Residential < 1 AC	C	2.01	31.87	6.30%	100.0%	80	5.04	75.15	
AC80	Residential < 1 AC	C	0.00	31.87	0.00%	100.0%	80	0.00	75.15	75.2
AC81	Agricultural Lands-Woods	C	0.01	1.95	0.41%	0.4%	73	0.30	0.30	
AC81	Agricultural Lands-Woods	D	0.44	1.95	22.43%	22.8%	79	17.72	18.02	
AC81	Agricultural Lands-Woods	C	1.11	1.95	57.22%	80.1%	73	41.77	59.79	
AC81	Agricultural Lands-Woods	C	0.00	1.95	0.01%	80.1%	73	0.00	59.79	
AC81	Paved; open ditches	C	0.39	1.95	19.92%	100.0%	92	18.33	78.12	
AC81	Paved; open ditches	C	0.00	1.95	0.01%	100.0%	92	0.01	78.13	78.1
AC82	Agricultural Lands-Woods	C	0.64	0.89	71.72%	71.7%	73	52.36	52.36	
AC82	Paved; open ditches	C	0.25	0.89	28.28%	100.0%	92	26.02	78.37	78.4
AC83	Agricultural Lands-Woods	C	0.21	0.46	46.36%	46.4%	73	33.85	33.85	
AC83	Paved; open ditches	C	0.24	0.46	53.63%	100.0%	92	49.34	83.19	83.2
AC84	Agricultural Lands-Woods	C	5.17	20.42	25.34%	25.3%	73	18.50	18.50	
AC84	Agricultural Lands-Woods and grass combination	C	2.55	20.42	12.50%	37.8%	76	9.50	28.00	
AC84	Agricultural Lands-Woods and grass combination	B	0.08	20.42	0.38%	38.2%	65	0.25	28.25	
AC84	Agricultural Lands-Woods and grass combination	C	5.52	20.42	27.05%	65.3%	76	20.56	48.81	
AC84	Agricultural Lands-Woods and grass combination	B	2.88	20.42	14.10%	79.4%	65	9.16	57.97	
AC84	Paved; open ditches	C	0.09	20.42	0.43%	79.8%	92	0.40	58.37	
AC84	Residential-1 to 2 AC	C	1.99	20.42	9.74%	89.5%	79	7.70	66.06	
AC84	Residential-2 to 5 AC	C	2.13	20.42	10.45%	100.0%	77	8.05	74.11	74.1
AC85	Agricultural Lands-Woods	C	1.60	1.63	97.95%	97.9%	73	71.50	71.50	
AC85	Residential-2 to 5 AC	C	0.03	1.63	2.05%	100.0%	77	1.58	73.08	73.1
AC86	Agricultural Lands-Woods	C	56.80	126.45	44.92%	44.9%	73	32.79	32.79	
AC86	Agricultural Lands-Woods	C	6.72	126.45	5.32%	50.2%	73	3.88	36.68	
AC86	Agricultural Lands-Woods and grass combination	C	12.50	126.45	9.89%	60.1%	76	7.51	44.19	
AC86	Agricultural Lands-Woods and grass combination	C	3.68	126.45	2.91%	63.0%	76	2.21	46.40	
AC86	Agricultural Lands-Woods and grass combination	B	5.04	126.45	3.99%	67.0%	65	2.59	48.99	
AC86	Residential-1 to 2 AC	C	2.61	126.45	2.06%	69.1%	79	1.63	50.62	
AC86	Residential-2 to 5 AC	C	22.72	126.45	17.97%	87.0%	77	13.83	64.45	
AC86	Residential-2 to 5 AC	C	16.38	126.45	12.95%	100.0%	77	9.97	74.42	74.4
AC87	Agricultural Lands-Woods	C	5.73	8.76	65.37%	65.4%	73	47.72	47.72	
AC87	Residential-1 to 2 AC	C	1.32	8.76	15.04%	80.4%	79	11.88	59.60	
AC87	Residential-2 to 5 AC	C	1.72	8.76	19.59%	100.0%	77	15.08	74.68	74.7
AC88	Agricultural Lands-Woods	C	21.83	21.87	99.80%	99.8%	73	72.85	72.85	
AC88	Residential-2 to 5 AC	C	0.04	21.87	0.20%	100.0%	77	0.15	73.01	73.0
AC89	Agricultural Lands-Woods	C	10.01	10.01	100.00%	100.0%	73	73.00	73.00	73.0
AC90	Agricultural Lands-Woods	C	1.10	38.71	2.84%	2.8%	73	2.08	2.08	
AC90	Agricultural Lands-Woods	C	37.61	38.71	97.15%	100.0%	73	70.92	73.00	73.0
AC91	Agricultural Lands-Woods	C	0.42	30.36	1.38%	1.4%	73	1.01	1.01	
AC91	Agricultural Lands-Woods	C	3.57	30.36	11.77%	13.2%	73	8.59	9.60	
AC91	Agricultural Lands-Woods	C	26.36	30.36	86.84%	100.0%	73	63.40	73.00	73.0
AC92	Agricultural Lands-Woods	C	7.05	7.05	100.00%	100.0%	73	73.00	73.00	73.0
AC93	Agricultural Lands-Woods	C	33.90	59.40	57.08%	57.1%	73	41.66	41.66	
AC93	Agricultural Lands-Woods	C	9.92	59.40	16.70%	73.8%	73	12.19	53.86	
AC93	Agricultural Lands-Woods	C	5.77	59.40	9.71%	83.5%	73	7.09	60.94	
AC93	Agricultural Lands-Woods	C	9.81	59.40	16.51%	100.0%	73	12.05	73.00	73.0
AC94	Agricultural Lands-Woods	C	8.86	12.02	73.69%	73.7%	73	53.79	53.79	
AC94	Agricultural Lands-Woods	C	3.16	12.02	26.31%	100.0%	73	19.20	73.00	73.0

Table A-2
Bosse-Previtali Small Diameter Pipeline
Existing Conditon Curve Number Summary Table

BASIN	LANDUSE CATEGORY	PREDOMINANT HYDROLOGIC SOIL GROUP	SUBREGION AREA (ACRES)	SUBBASIN AREA (ACRES)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	SUBREGION CN	AREA-WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
AC95	Agricultural Lands-Woods	C	3.83	12.85	29.77%	29.8%	73	21.73	21.73	
AC95	Agricultural Lands-Woods	B	4.26	12.85	33.18%	63.0%	60	19.91	41.64	
AC95	Agricultural Lands-Woods	C	4.76	12.85	37.03%	100.0%	73	27.03	68.68	68.7
AC96	Agricultural Lands-Woods	C	1.95	12.49	15.60%	15.6%	73	11.39	11.39	
AC96	Agricultural Lands-Woods	B	7.14	12.49	57.17%	72.8%	60	34.30	45.69	
AC96	Agricultural Lands-Woods	C	3.40	12.49	27.22%	100.0%	73	19.87	65.57	65.6
AC97	Agricultural Lands-Woods	C	0.03	15.56	0.21%	0.2%	73	0.15	0.15	
AC97	Agricultural Lands-Woods	B	10.63	15.56	68.33%	68.5%	60	41.00	41.15	
AC97	Agricultural Lands-Woods	C	4.89	15.56	31.46%	100.0%	73	22.96	64.11	64.1
AC98	Agricultural Lands-Woods	B	0.36	3.35	10.66%	10.7%	60	6.40	6.40	
AC98	Agricultural Lands-Woods	C	2.99	3.35	89.34%	100.0%	73	65.22	71.61	71.6
AC99	Agricultural Lands-Woods	B	6.20	7.65	81.15%	81.2%	60	48.69	48.69	
AC99	Agricultural Lands-Woods	C	1.44	7.65	18.84%	100.0%	73	13.76	62.45	62.4
AC100	Agricultural Lands-Woods	B	4.81	4.82	99.74%	99.7%	60	59.85	59.85	
AC100	Agricultural Lands-Woods	B	0.01	4.82	0.25%	100.0%	60	0.15	60.00	60.0
AC101	Agricultural Lands-Woods	B	7.89	7.92	99.59%	99.6%	60	59.75	59.75	
AC101	Agricultural Lands-Woods	B	0.03	7.92	0.41%	100.0%	60	0.25	60.00	60.0
AC102	Agricultural Lands-Woods	C	0.08	13.94	0.61%	0.6%	73	0.44	0.44	
AC102	Agricultural Lands-Woods	B	13.85	13.94	99.39%	100.0%	60	59.63	60.07	60.1
AC103	Agricultural Lands-Woods	C	0.15	14.51	1.01%	1.0%	73	0.74	0.74	
AC103	Agricultural Lands-Woods	B	7.53	14.51	51.87%	52.9%	60	31.12	31.86	
AC103	Agricultural Lands-Woods and grass combination	C	2.32	14.51	16.01%	68.9%	76	12.17	44.03	
AC103	Agricultural Lands-Woods and grass combination	B	3.74	14.51	25.75%	94.6%	65	16.73	60.77	
AC103	Agricultural Lands-Woods and grass combination	B	0.78	14.51	5.36%	100.0%	65	3.48	64.25	64.2
AC104	Agricultural Lands-Woods	B	0.65	11.12	5.82%	5.8%	60	3.49	3.49	
AC104	Agricultural Lands-Woods	B	0.00	11.12	0.00%	5.8%	60	0.00	3.49	
AC104	Agricultural Lands-Woods	B	0.18	11.12	1.60%	7.4%	60	0.96	4.45	
AC104	Agricultural Lands-Woods and grass combination	C	0.44	11.12	3.97%	11.4%	76	3.01	7.47	
AC104	Agricultural Lands-Woods and grass combination	B	0.17	11.12	1.53%	12.9%	65	0.99	8.46	
AC104	Agricultural Lands-Woods and grass combination	B	4.72	11.12	42.46%	55.4%	65	27.61	36.07	
AC104	Agricultural Lands-Woods and grass combination	B	4.96	11.12	44.60%	100.0%	65	28.99	65.06	65.1
AC105	Agricultural Lands-Woods	B	0.01	18.79	0.03%	0.0%	60	0.02	0.02	
AC105	Agricultural Lands-Woods and grass combination	C	0.90	18.79	4.81%	4.8%	76	3.66	3.68	
AC105	Agricultural Lands-Woods and grass combination	B	3.39	18.79	18.04%	22.9%	65	11.73	15.40	
AC105	Agricultural Lands-Woods and grass combination	C	0.28	18.79	1.47%	24.4%	76	1.12	16.52	
AC105	Agricultural Lands-Woods and grass combination	B	14.21	18.79	75.64%	100.0%	65	49.16	65.69	65.7
AC106	Agricultural Lands-Woods	C	8.58	231.50	3.70%	3.7%	73	2.70	2.70	
AC106	Agricultural Lands-Woods	C	25.20	231.50	10.89%	14.6%	73	7.95	10.64	
AC106	Agricultural Lands-Woods	B	0.31	231.50	0.13%	14.7%	60	0.08	10.72	
AC106	Agricultural Lands-Woods	C	93.00	231.50	40.17%	54.9%	73	29.33	40.05	
AC106	Agricultural Lands-Woods	B	14.92	231.50	6.45%	61.3%	60	3.87	43.92	
AC106	Agricultural Lands-Woods and grass combination	C	16.83	231.50	7.27%	68.6%	76	5.53	49.44	
AC106	Agricultural Lands-Woods and grass combination	C	34.58	231.50	14.94%	83.5%	76	11.35	60.80	
AC106	Agricultural Lands-Woods and grass combination	B	0.02	231.50	0.01%	83.6%	65	0.01	60.81	
AC106	Agricultural Lands-Woods and grass combination	C	0.33	231.50	0.14%	83.7%	76	0.11	60.91	
AC106	Agricultural Lands-Woods and grass combination	C	1.84	231.50	0.80%	84.5%	76	0.60	61.52	
AC106	Agricultural Lands-Woods and grass combination	B	35.88	231.50	15.50%	100.0%	65	10.08	71.59	71.6
AC107	Agricultural Lands-Woods	B	2.75	244.74	1.12%	1.1%	60	0.67	0.67	
AC107	Agricultural Lands-Woods	C	4.75	244.74	1.94%	3.1%	73	1.42	2.09	
AC107	Agricultural Lands-Woods	C	129.64	244.74	52.97%	56.0%	73	38.67	40.76	
AC107	Agricultural Lands-Woods	B	21.24	244.74	8.68%	64.7%	60	5.21	45.97	
AC107	Agricultural Lands-Woods	B	1.01	244.74	0.41%	65.1%	60	0.25	46.22	
AC107	Agricultural Lands-Woods	B	23.69	244.74	9.68%	74.8%	60	5.81	52.02	
AC107	Agricultural Lands-Woods and grass combination	C	53.21	244.74	21.74%	96.5%	76	16.52	68.55	
AC107	Agricultural Lands-Woods and grass combination	B	2.54	244.74	1.04%	97.6%	65	0.67	69.22	
AC107	Agricultural Lands-Woods and grass combination	B	5.88	244.74	2.40%	100.0%	65	1.56	70.78	
AC107	Residential-2 to 5 AC	C	0.01	244.74	0.00%	100.0%	77	0.00	70.79	70.8
AC108	Agricultural Lands-Woods	C	1.61	66.66	2.42%	2.4%	73	1.76	1.76	
AC108	Agricultural Lands-Woods	B	11.54	66.66	17.32%	19.7%	60	10.39	12.15	
AC108	Agricultural Lands-Woods	B	0.79	66.66	1.19%	20.9%	60	0.71	12.86	
AC108	Agricultural Lands-Woods	C	11.58	66.66	17.34%	38.3%	73	12.66	25.52	
AC108	Agricultural Lands-Woods	B	20.80	66.66	31.20%	69.5%	60	18.72	44.24	
AC108	Agricultural Lands-Woods	B	11.93	66.66	17.90%	87.4%	60	10.74	54.98	
AC108	Agricultural Lands-Woods and grass combination	B	0.35	66.66	0.52%	87.9%	65	0.34	55.32	
AC108	Agricultural Lands-Woods and grass combination	C	0.24	66.66	0.36%	88.2%	76	0.27	55.60	
AC108	Agricultural Lands-Woods and grass combination	B	7.83	66.66	11.75%	100.0%	65	7.64	63.24	63.2
AC109	Agricultural Lands-Woods	C	4.48	21.85	20.50%	20.5%	73	14.97	14.97	
AC109	Agricultural Lands-Woods	C	14.36	21.85	65.73%	86.2%	73	47.98	62.95	
AC109	Agricultural Lands-Woods and grass combination	C	0.03	21.85	0.12%	86.4%	76	0.09	63.04	
AC109	Residential-2 to 5 AC	C	2.90	21.85	13.27%	99.6%	77	10.22	73.26	
AC109	Residential-2 to 5 AC	C	0.08	21.85	0.38%	100.0%	77	0.29	73.55	73.5
LT01	Agricultural Lands-Woods	B	2.41	303.58	0.79%	0.8%	60	0.48	0.48	
LT01	Agricultural Lands-Woods	C	9.80	303.58	3.23%	4.0%	73	2.36	2.83	
LT01	Agricultural Lands-Woods	C	8.35	303.58	2.75%	6.8%	73	2.01	4.84	
LT01	Agricultural Lands-Woods	C	94.79	303.58	31.23%	38.0%	73	22.79	27.64	
LT01	Agricultural Lands-Woods	C	170.50	303.58	56.16%	94.2%	73	41.00	68.64	
LT01	Agricultural Lands-Woods	D	0.76	303.58	0.25%	94.4%	79	0.20	68.83	
LT01	Agricultural Lands-Woods	D	12.69	303.58	4.18%	98.6%	79	3.30	72.14	
LT01	Agricultural Lands-Woods	Water	0.00	303.58	0.00%	98.6%	98	0.00	72.14	
LT01	Agricultural Lands-Woods and grass combination	C	0.89	303.58	0.29%	98.9%	76	0.22	72.36	
LT01	Residential < 1 AC	B	0.43	303.58	0.14%	99.0%	70	0.10	72.46	
LT01	Residential < 1 AC	D	0.05	303.58	0.02%	99.0%	85	0.02	72.47	
LT01	Residential-1 to 2 AC	B	2.07	303.58	0.68%	99.7%	68	0.46	72.94	
LT01	Residential-1 to 2 AC	C	0.82	303.58	0.27%	100.0%	79	0.21	73.15	73.2

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Table A-2
Bosse-Previtali Small Diameter Pipeline
Existing Conditon Curve Number Summary Table

BASIN	LAND USE CATEGORY	PREDOMINANT HYDROLOGIC SOIL GROUP	SUBREGION AREA (ACRES)	SUBBASIN AREA (ACRES)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	SUBREGION CN	AREA-WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
NYR01	Agricultural Lands-Woods	A	35.79	1356.05	2.64%	2.6%	36	0.95	0.95	
NYR01	Agricultural Lands-Woods	A	0.00	1356.05	0.00%	2.6%	36	0.00	0.95	
NYR01	Agricultural Lands-Woods	B	32.28	1356.05	2.36%	5.0%	60	1.43	2.38	
NYR01	Agricultural Lands-Woods	B	9.47	1356.05	0.70%	5.7%	60	0.42	2.80	
NYR01	Agricultural Lands-Woods	B	0.40	1356.05	0.03%	5.7%	60	0.02	2.82	
NYR01	Agricultural Lands-Woods	B	35.48	1356.05	2.62%	8.4%	60	1.57	4.38	
NYR01	Agricultural Lands-Woods	B	170.22	1356.05	12.55%	20.9%	60	7.53	11.92	
NYR01	Agricultural Lands-Woods	B	0.00	1356.05	0.00%	20.9%	60	0.00	11.92	
NYR01	Agricultural Lands-Woods	B	0.00	1356.05	0.00%	20.9%	60	0.00	11.92	
NYR01	Agricultural Lands-Woods	C	21.49	1356.05	1.58%	22.5%	73	1.16	13.07	
NYR01	Agricultural Lands-Woods	C	0.74	1356.05	0.05%	22.6%	73	0.04	13.11	
NYR01	Agricultural Lands-Woods	C	78.51	1356.05	5.79%	28.3%	73	4.23	17.34	
NYR01	Agricultural Lands-Woods	C	8.30	1356.05	0.61%	29.0%	73	0.45	17.79	
NYR01	Agricultural Lands-Woods	C	4.99	1356.05	0.37%	29.3%	73	0.27	18.06	
NYR01	Agricultural Lands-Woods	C	47.69	1356.05	3.52%	32.8%	73	2.57	20.62	
NYR01	Agricultural Lands-Woods	C	207.10	1356.05	15.27%	48.1%	73	11.15	31.77	
NYR01	Agricultural Lands-Woods	Water	0.00	1356.05	0.00%	48.1%	98	0.00	31.77	
NYR01	Agricultural Lands-Woods and grass combination	A	12.19	1356.05	0.90%	49.0%	43	0.39	32.16	
NYR01	Agricultural Lands-Woods and grass combination	B	6.38	1356.05	0.47%	49.5%	65	0.31	32.46	
NYR01	Agricultural Lands-Woods and grass combination	B	2.21	1356.05	0.16%	49.6%	65	0.11	32.57	
NYR01	Agricultural Lands-Woods and grass combination	B	5.19	1356.05	0.38%	50.0%	65	0.25	32.82	
NYR01	Agricultural Lands-Woods and grass combination	B	6.21	1356.05	0.46%	50.5%	65	0.30	33.12	
NYR01	Agricultural Lands-Woods and grass combination	B	26.34	1356.05	1.94%	52.4%	65	1.26	34.38	
NYR01	Agricultural Lands-Woods and grass combination	C	18.36	1356.05	1.35%	53.8%	76	1.03	35.41	
NYR01	Agricultural Lands-Woods and grass combination	C	2.09	1356.05	0.15%	53.9%	76	0.12	35.52	
NYR01	Agricultural Lands-Woods and grass combination	C	0.17	1356.05	0.01%	54.0%	76	0.01	35.53	
NYR01	Agricultural Lands-Woods and grass combination	C	0.97	1356.05	0.07%	54.0%	76	0.05	35.59	
NYR01	Agricultural Lands-Woods and grass combination	C	104.05	1356.05	7.67%	61.7%	76	5.83	41.42	
NYR01	Agricultural Lands-Woods and grass combination	Water	0.38	1356.05	0.03%	61.7%	98	0.03	41.45	
NYR01	Paved; open ditches	A	6.30	1356.05	0.46%	62.2%	83	0.39	41.83	
NYR01	Paved; open ditches	A	0.00	1356.05	0.00%	62.2%	83	0.00	41.83	
NYR01	Paved; open ditches	B	1.80	1356.05	0.13%	62.3%	89	0.12	41.95	
NYR01	Paved; open ditches	B	1.53	1356.05	0.11%	62.4%	89	0.10	42.05	
NYR01	Paved; open ditches	B	10.29	1356.05	0.76%	63.2%	89	0.68	42.73	
NYR01	Paved; open ditches	B	0.00	1356.05	0.00%	63.2%	89	0.00	42.73	
NYR01	Paved; open ditches	B	0.00	1356.05	0.00%	63.2%	89	0.00	42.73	
NYR01	Paved; open ditches	C	3.33	1356.05	0.25%	63.4%	92	0.23	42.95	
NYR01	Paved; open ditches	C	2.18	1356.05	0.16%	63.6%	92	0.15	43.10	
NYR01	Paved; open ditches	C	1.23	1356.05	0.09%	63.7%	92	0.08	43.18	
NYR01	Paved; open ditches	C	2.43	1356.05	0.18%	63.9%	92	0.17	43.35	
NYR01	Paved; open ditches	C	13.27	1356.05	0.98%	64.8%	92	0.90	44.25	
NYR01	Paved; open ditches	C	0.00	1356.05	0.00%	64.8%	92	0.00	44.25	
NYR01	Residential < 1 AC	A	0.63	1356.05	0.05%	64.9%	54	0.03	44.28	
NYR01	Residential < 1 AC	B	1.56	1356.05	0.11%	65.0%	70	0.08	44.36	
NYR01	Residential < 1 AC	C	0.00	1356.05	0.00%	65.0%	80	0.00	44.36	
NYR01	Residential < 1 AC	C	0.31	1356.05	0.02%	65.0%	80	0.02	44.37	
NYR01	Residential < 1 AC	C	0.05	1356.05	0.00%	65.0%	80	0.00	44.38	
NYR01	Residential < 1 AC	C	12.07	1356.05	0.89%	65.9%	80	0.71	45.09	
NYR01	Residential < 1 AC	C	0.00	1356.05	0.00%	65.9%	80	0.00	45.09	
NYR01	Residential-1 to 2 AC	A	7.60	1356.05	0.56%	66.5%	51	0.29	45.37	
NYR01	Residential-1 to 2 AC	B	0.60	1356.05	0.04%	66.5%	68	0.03	45.40	
NYR01	Residential-1 to 2 AC	B	2.72	1356.05	0.20%	66.7%	68	0.14	45.54	
NYR01	Residential-1 to 2 AC	B	3.04	1356.05	0.22%	67.0%	68	0.15	45.69	
NYR01	Residential-1 to 2 AC	B	9.02	1356.05	0.66%	67.6%	68	0.45	46.15	
NYR01	Residential-1 to 2 AC	B	0.00	1356.05	0.00%	67.6%	68	0.00	46.15	
NYR01	Residential-1 to 2 AC	C	2.44	1356.05	0.18%	67.8%	79	0.14	46.29	
NYR01	Residential-1 to 2 AC	C	1.15	1356.05	0.09%	67.9%	79	0.07	46.36	
NYR01	Residential-1 to 2 AC	C	0.01	1356.05	0.00%	67.9%	79	0.00	46.36	
NYR01	Residential-1 to 2 AC	C	114.75	1356.05	8.46%	76.3%	79	6.69	53.04	
NYR01	Residential-2 to 5 AC	A	12.01	1356.05	0.89%	77.2%	46	0.41	53.45	
NYR01	Residential-2 to 5 AC	B	4.81	1356.05	0.35%	77.6%	65	0.23	53.68	
NYR01	Residential-2 to 5 AC	B	4.02	1356.05	0.30%	77.9%	65	0.19	53.87	
NYR01	Residential-2 to 5 AC	B	20.53	1356.05	1.51%	79.4%	65	0.98	54.86	
NYR01	Residential-2 to 5 AC	B	21.31	1356.05	1.57%	81.0%	65	1.02	55.88	
NYR01	Residential-2 to 5 AC	B	0.00	1356.05	0.00%	81.0%	65	0.00	55.88	
NYR01	Residential-2 to 5 AC	C	5.33	1356.05	0.39%	81.4%	77	0.30	56.18	
NYR01	Residential-2 to 5 AC	C	8.55	1356.05	0.63%	82.0%	77	0.49	56.67	
NYR01	Residential-2 to 5 AC	C	15.87	1356.05	1.17%	83.2%	77	0.90	57.57	
NYR01	Residential-2 to 5 AC	C	3.09	1356.05	0.23%	83.4%	77	0.18	57.74	
NYR01	Residential-2 to 5 AC	C	4.78	1356.05	0.35%	83.7%	77	0.27	58.01	
NYR01	Residential-2 to 5 AC	C	213.44	1356.05	15.74%	99.5%	77	12.12	70.13	
NYR01	Water	A	0.00	1356.05	0.00%	99.5%	98	0.00	70.13	
NYR01	Water	C	0.15	1356.05	0.01%	99.5%	98	0.01	70.15	
NYR01	Water	C	0.10	1356.05	0.01%	99.5%	98	0.01	70.15	
NYR01	Water	C	0.00	1356.05	0.00%	99.5%	98	0.00	70.15	
NYR01	Water	C	0.12	1356.05	0.01%	99.5%	98	0.01	70.16	
NYR01	Water	Water	6.54	1356.05	0.48%	100.0%	98	0.47	70.63	70.6

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Table A-3
Bosse-Previtali Small Diameter Pipeline
Existing Condition Time of Concentration and Lag Time Summary

Sub-basin ID	Hydrology Group	Area	Slope	Sheet Flow Length	Sheet Flow Slope	Sheet Flow Velocity	Shallow Concentrated Flow Length	Shallow Concentrated Flow Slope	Shallow Concentrated Flow Velocity	Channel Flow Length	Channel Flow Slope	Channel Flow Velocity	Tc	Lag Time
AC01	UD	4.20	0.0067	100	0.120	0.152	1.7	4.8					1.8	3.3
AC02	UD	12.42	0.0184	300	0.132	0.213	0.3	3.6	531	0.099	5.1	1.7	3.2	3.3
AC03	UD	48.34	0.0202	1225	0.136	0.213	2.5	6.8	1638	0.100	5.2	4.5	11.2	6.7
AC04	UD	23.55	0.0374	600	0.169	0.213	3.1	3.7	1018	0.200	8.3	2.2	7.0	4.2
AC05	UD	15.25	0.0510	417	0.206	0.114	1.7	6.1	540	0.168	9.0	1.1	7.3	4.4
AC06	UD	20.37	0.0218	594	0.326	0.114	1.7	5.7	693	0.136	7.3	1.6	7.3	4.4
AC07	UD	5.41	0.0065	367	0.501	0.213	2.9	1.7	231	0.210	9.3	0.5	3.2	3.3
AC08	UD	5.17	0.0081	321	0.201	0.152	0.9	3.1					2.1	3.3
AC09	UD	4.18	0.0064	387	0.298	0.152	0.7	3.6					2.0	3.3
AC10	UD	9.58	0.0122	249	0.252	0.152	3.0	1.8	158	0.204	11.4	0.2	2.1	3.3
AC11	UD	3.43	0.0084	166	0.170	0.114	1.0	4.0	127	0.474	6.1	0.3	1.2	3.3
AC12	UD	9.43	0.0147	600	0.353	0.114	2.7	4.9					4.6	3.3
AC13	UD	11.24	0.0173	625	0.420	0.114	2.4	2.9	90	0.224	9.8	0.3	3.0	3.3
AC14	UD	12.10	0.0108	458	0.244	0.152	2.8	2.7	242	0.311	11.0	0.5	2.2	3.3
AC15	UD	4.29	0.0067	455	0.267	0.152	3.0	3.3					3.0	3.3
AC16	UD	12.93	0.0216	472	0.347	0.152	3.9	2.7	287	0.302	11.2	0.4	3.1	3.3
AC17	UD	32.46	0.0028	881	0.378	0.114	2.9	0.3	1027	0.081	5.0	2.3	10.2	6.1
AC18	UD	2.19	0.0033	345	0.573	0.114	3.3	4.2					1.7	3.3
AC19	UD	4.09	0.0063	507	0.309	0.114	2.3	4.2					3.5	3.3
AC20	UD	3.29	0.0051	369	0.428	0.114	2.4	4.1					4.1	3.3
AC21	UD	9.90	0.0108	458	0.266	0.114	2.2	3.4	341	0.216	9.2	0.6	1.0	3.3
AC22	UD	8.53	0.0174	511	0.417	0.114	2.4	2.5	455	0.176	8.4	1.0	4.5	3.3
AC23	UD	1.82	0.0039	300	0.395	0.114	3.0	4.3					4.3	3.3
AC24	UD	2.93	0.0044	370	0.362	0.114	3.0	3.0					3.0	3.3
AC25	UD	8.97	0.0140	543	0.403	0.114	2.5	2.6	277	0.232	9.1	0.7	1.0	3.3
AC26	UD	74.18	0.1123	817	0.377	0.114	2.2	7.8	1074	0.070	5.1	3.3	11.1	6.8
AC27	UD	11.20	0.0196	510	0.206	0.152	2.5	3.3	271	0.180	8.7	0.5	4.0	3.3
AC28	UD	8.47	0.0131	520	0.251	0.152	2.5	3.3	210	0.167	8.1	0.5	3.1	3.3
AC29	UD	6.11	0.0095	509	0.192	0.152	2.7	4.6					3.6	3.3
AC30	UD	9.54	0.0087	419	0.313	0.114	2.1	3.3	165	0.286	10.4	0.3	2.6	3.3
AC31	UD	57.18	0.0263	883	0.391	0.114	2.2	5.1	1640	0.018	3.3	5.8	10.9	6.5
AC32	UD	23.28	0.0355	658	0.128	0.152	1.8	4.9	90	0.154	7.8	1.2	10.2	6.1
AC33	UD	14.39	0.0234	529	0.202	0.152	2.6	3.5	368	0.209	11.2	0.4	3.8	3.3
AC34	UD	3.77	0.0053	360	0.306	0.152	2.3	2.9					2.6	3.3
AC35	UD	4.70	0.0039	352	0.240	0.152	2.2	2.5					2.7	3.3
AC36	UD	3.63	0.0053	288	0.145	0.152	2.5	3.6					2.0	3.3
AC37	UD	4.41	0.0069	300	0.281	0.152	3.0	3.2					2.2	3.3
AC38	UD	7.16	0.0117	318	0.305	0.152	2.8	4.4					1.4	3.3
AC39	UD	1.18	0.0070	130	0.306	0.152	3.1	3.3	108	0.238	9.9	0.3	0.7	3.3
AC40	UD	11.83	0.0185	1258	0.175	0.114	1.6	12.2					11.2	6.7
AC41	UD	19.69	0.0267	585	0.206	0.152	1.7	8.7	677	0.114	6.7	1.7	8.1	5.1
AC42	UD	11.38	0.0178	620	0.124	0.114	1.3	7.6	204	0.120	7.2	0.5	3.7	3.3
AC43	UD	3.18	0.0038	370	0.244	0.152	1.8	3.6					3.4	3.3
AC44	UD	2.21	0.0043	416	0.278	0.114	2.7	2.6					3.8	3.3
AC45	UD	8.78	0.0038	499	0.299	0.114	2.0	3.6					3.3	3.3
AC46	UD	3.28	0.0052	390	0.327	0.152	3.0	3.7					2.3	3.3
AC47	UD	3.42	0.0067	390	0.270	0.213	3.2	3.0					2.0	3.3
AC48	UD	2.61	0.0031	280	0.324	0.152	3.0	3.4					1.4	3.3
AC49	UD	4.28	0.0064	475	0.250	0.114	2.2	3.3					3.3	3.3
AC50	UD	17.44	0.0273	577	0.187	0.114	1.6	10.1	324	0.070	5.1	1.0	11.0	7.0
AC51	UD	1.23	0.0018	228	0.252	0.114	1.9	2.1					2.1	3.3
AC52	UD	2.29	0.0021	418	0.275	0.114	2.8	3.0					2.5	3.3
AC53	UD	5.60	0.0106	424	0.368	0.114	2.3	4.6					4.5	3.3
AC54	UD	3.19	0.0143	300	0.273	0.114	2.1	4.4	109	0.098	10.2	0.3	4.7	3.3
AC55	UD	5.91	0.0062	367	0.373	0.114	2.3	2.7	391	0.126	7.4	0.7	5.3	3.3
AC56	UD	2.04	0.0032	300	0.349	0.114	2.2	4.0					4.0	3.3
AC57	UD	4.08	0.0145	180	0.478	0.114	2.6	3.1	245	0.176	8.4	0.7	3.6	3.3
AC58	UD	1.58	0.0025	341	0.211	0.114	1.7	2.6					2.6	3.3
AC59	UD	3.19	0.0041	300	0.163	0.114	1.5	3.0					3.5	3.3
AC60	UD	1.49	0.0023	330	0.191	0.114	1.8	3.5					3.3	3.3
AC61	UD	7.96	0.0101	630	0.283	0.114	2.2	4.5	203	0.135	7.3	0.6	5.4	3.3
AC62	UD	11.16	0.0174	631	0.352	0.114	2.4	4.4	375	0.207	9.0	0.7	5.1	3.3
AC63	UD	9.27	0.0143	610	0.402	0.114	2.4	4.2	222	0.440	13.7	0.3	4.5	3.3
AC64	UD	16.88	0.0255	627	0.365	0.114	2.3	5.0					5.0	3.3
AC65	UD	33.64	0.0508	878	0.436	0.114	1.9	7.8	360	0.135	7.3	1.2	8.2	5.1
AC66	UD	3.82	0.0063	604	0.311	0.114	2.5	4.4					4.4	3.3
AC67	UD	4.80	0.0072	618	0.384	0.114	2.3	4.0					5.0	3.3
AC68	UD	5.39	0.0145	520	0.440	0.114	2.3	3.3	310	0.193	8.7	0.6	4.1	3.3

Table A-3
Bosse-Previtali Small Diameter Pipeline
Existing Condition Time of Concentration and Lag Time Summary

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
AC68	UD	0.04	0.0041	470	0.105	forested	0.114	2.3	3.8					3.4	470	N/A	5.0	5.0	3.8
AC70	UD	1.78	0.0027	367	0.256	forested	0.114	1.6	2.1					2.7	367	N/A	5.0	5.0	3.4
AC71	UD	1.65	0.0055	318	0.239	forested	0.114	1.4	2.2					2.3	318	N/A	5.0	5.0	3.5
AC72	UD	0.80	0.0058	492	0.671	forested	0.114	1.0	3.8					8.0	492	N/A	5.0	5.0	4.8
AC73	UD	2.98	0.0045	272	0.370	forested	0.114	1.4	2.3					2.3	272	N/A	5.0	5.0	3.5
AC74	UD	2.88	0.0045	247	0.350	forested	0.114	2.0	2.1					2.1	247	N/A	5.0	5.0	3.3
AC75	UD	2.94	0.0044	213	0.303	forested	0.114	2.2	1.8					1.8	213	N/A	5.0	5.0	3.0
AC76	UD	18.36	0.0067	759	0.314	forested	0.114	2.1	5.1	104	0.209	8.8	0.2	7.0	1254	N/A	5.0	7.0	4.3
AC77	UD	41.61	0.0033	1027	0.208	forested	0.114	2.2	7.4	1195	0.135	8.2	2.1	18.1	1276	N/A	5.0	18.1	5.0
AC78	UD	4.58	0.0072	977	0.251	forested	0.114	2.0	8.2					4.2	977	N/A	5.0	6.2	4.0
AC79	UD	0.47	0.0085	942	0.211	mostly forested	0.152	2.6	5.9					5.0	942	N/A	5.0	5.0	3.9
AC80	UD	31.97	0.0038	1240	0.302	mostly forested	0.152	2.7	7.6	536	0.279	10.3	0.8	8.4	1706	N/A	5.0	8.4	5.0
AC81	UD	1.05	0.0030	255	0.300	forested	0.114	2.5	2.5					2.2	255	N/A	5.0	5.0	3.0
AC82	UD	0.89	0.0014	357	0.301	forested	0.114	2.1	1.7					2.7	357	N/A	5.0	5.0	3.3
AC83	UD	0.10	0.0007	133	0.190	forested	0.114	1.8	1.1					1.5	133	N/A	5.0	5.0	3.0
AC84	UD	30.43	0.0319	969	0.209	mostly forested	0.152	2.3	7.2	401	0.398	5.8	2.3	4.0	1093	N/A	5.0	5.0	4.0
AC85	UD	1.83	0.0023	300	0.194	forested	0.114	1.8	2.8					2.3	300	N/A	5.0	5.0	3.0
AC86	UD	128.43	0.1574	1702	0.137	forested	0.114	1.4	21.2	402	0.136	2.1	9.3	30.5	5364	N/A	5.0	30.5	15.2
AC87	UD	6.76	0.0137	670	0.307	forested	0.114	2.1	4.0	261	0.077	4.3	2.5	7.5	1161	N/A	5.0	7.5	4.5
AC88	UD	31.87	0.0242	855	0.303	mostly forested	0.152	2.8	5.0	218	0.138	7.1	1.9	7.5	1274	N/A	5.0	7.5	4.5
AC89	UD	13.91	0.0058	471	0.275	forested	0.114	2.0	3.7					5.7	471	N/A	5.0	5.7	3.4
AC90	UD	78.11	0.0025	1169	0.123	forested	0.114	1.0	14.0	1113	0.120	7.1	2.2	16.5	2537	N/A	5.0	16.5	9.9
AC91	UD	20.28	0.0474	2162	0.201	forested	0.114	1.7	21.9	331	0.196	6.8	1.4	22.3	3839	N/A	5.0	22.3	13.4
AC92	UD	7.05	0.0110	1270	0.219	forested	0.114	1.8	12.0					9.9	1573	N/A	5.0	9.9	5.7
AC93	UD	58.42	0.0020	2237	0.219	forested	0.114	1.8	20.1					29.7	3237	N/A	5.0	29.7	17.8
AC94	UD	12.02	0.0148	1281	0.066	forested	0.114	1.0	18.9					19.1	1281	N/A	5.0	19.1	11.5
AC95	UD	12.95	0.0021	1230	0.122	mostly forested	0.152	1.8	11.3					11.5	1230	N/A	5.0	11.5	6.9
AC96	UD	19.48	0.0095	1231	0.153	mostly forested	0.152	1.9	11.0					11.4	1231	N/A	5.0	11.4	6.8
AC97	UD	15.08	0.0243	1412	0.143	half creek/half forest	0.133	1.9	12.5					12.5	1412	N/A	5.0	12.5	7.5
AC98	UD	3.35	0.0032	698	0.068	half creek/half forest	0.152	1.0	9.2					8.3	848	N/A	5.0	8.3	5.0
AC99	UD	7.53	0.0118	600	0.040	mostly forested	0.152	1.1	9.8					5.0	600	N/A	5.0	5.0	3.4
AC100	UD	4.67	0.0075	368	0.033	mostly forested	0.152	0.9	6.9					3.8	368	N/A	5.0	5.0	3.1
AC101	UD	7.52	0.0104	867	0.053	mostly forested	0.152	1.2	10.9					13.8	867	N/A	5.0	13.8	8.3
AC102	UD	13.94	0.0018	1234	0.205	mostly forested	0.152	2.3	7.8					7.6	1234	N/A	5.0	7.6	4.6
AC103	UD	14.53	0.0017	923	0.093	mostly forested	0.152	2.8	5.4					5.4	923	N/A	5.0	5.4	3.3
AC104	UD	11.12	0.0074	492	0.099	mostly forested	0.152	2.7	3.0					3.3	492	N/A	5.0	5.0	3.0
AC105	UD	19.29	0.0034	1510	0.136	mostly [illegible]	0.152	2.6	9.5					6.5	1510	N/A	5.0	6.5	3.9
AC106	UD	231.50	0.0017	1195	0.075	forested	0.114	2.0	10.2	6056	0.053	4.5	22.8	28.1	7251	N/A	5.0	28.1	16.9
AC107	UD	244.74	0.0024	2378	0.182	forested	0.114	1.8	24.0	4436	0.044	4.2	17.8	41.5	6763	N/A	5.0	41.5	25.0
AC108	UD	89.68	0.0043	1539	0.103	half creek/half forest	0.133	1.8	17.3	1462	0.097	4.7	5.2	22.3	2123	N/A	5.0	22.3	13.4
AC109	UD	31.55	0.0243	1032	0.175	mostly forested	0.152	1.9	9.0					19.1	1032	N/A	5.0	19.1	6.1
L101	UD	303.64	0.0143	753	0.302	forested	0.114	2.1	8.0	2000	0.030	5.9	10.6	16.0	4336	N/A	5.0	16.0	9.6
NVR01	UD	1398.00	0.1166	943	0.179	forested	0.114	3.6	8.4	10000	0.067	4.7	37.5	47.9	11383	N/A	5.0	47.9	28.8

Notes and Equations:

- $T_c = Tt_1 + Tt_2 + Tt_3$
- $Tt_1 = \frac{0.007\,(nL)^{0.8}}{P_2^{0.5}\,S_o^{0.4}}$

  $P_2 =$ 3.12 2 yr. 24-hr rainfall depth from NOAA Atlas 14

  $T_{lag} = 0.6\ T_c$
- $Tt_2 = Tt_3 = \frac{L}{60V}$
- For the travel time (Tt_2) calculations, $V = 16.1345 * S^{0.5}$ for unpaved surfaces and $V = 20.3283 * S^{0.5}$ for paved surfaces per El Dorado County Drainage Manual
- For the travel time (Tt_3) calculations, $V = CS^{0.5}$

  where C= 19.77, based on estimating 2-yr runoff for a variety of basins and using Manning's equation to determine C

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Appendix A

Hydrologic Calculations

NOAA Atlas 14 Point Rainfall Depths and Intensities

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NOAA Atlas 14, Volume 6, Version 2
Location name: Sutter Creek, California, US*
Coordinates: 38.4075, -120.7058
Elevation: 2082ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF tabular | PF graphical | Maps & aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.141 (0.125-0.160)	0.172 (0.152-0.196)	0.214 (0.189-0.245)	0.251 (0.219-0.290)	0.304 (0.254-0.367)	0.348 (0.283-0.431)	0.395 (0.312-0.505)	0.447 (0.341-0.591)	0.524 (0.380-0.730)	0.589 (0.410-0.857)
10-min	0.202 (0.179-0.230)	0.246 (0.218-0.281)	0.307 (0.271-0.352)	0.360 (0.314-0.416)	0.436 (0.365-0.526)	0.498 (0.406-0.618)	0.566 (0.447-0.723)	0.640 (0.489-0.847)	0.751 (0.544-1.05)	0.845 (0.587-1.23)
15-min	0.244 (0.216-0.278)	0.297 (0.263-0.339)	0.371 (0.328-0.425)	0.435 (0.380-0.503)	0.527 (0.441-0.636)	0.603 (0.491-0.747)	0.684 (0.541-0.875)	0.774 (0.591-1.03)	0.908 (0.658-1.27)	1.02 (0.710-1.49)
30-min	0.341 (0.303-0.389)	0.416 (0.368-0.475)	0.519 (0.458-0.595)	0.608 (0.531-0.704)	0.737 (0.617-0.890)	0.843 (0.687-1.05)	0.957 (0.757-1.22)	1.08 (0.827-1.43)	1.27 (0.920-1.77)	1.43 (0.993-2.08)
60-min	0.469 (0.416-0.534)	0.572 (0.506-0.652)	0.714 (0.630-0.817)	0.836 (0.730-0.967)	1.01 (0.847-1.22)	1.16 (0.944-1.44)	1.32 (1.04-1.68)	1.49 (1.14-1.97)	1.74 (1.26-2.43)	1.96 (1.36-2.85)
2-hr	0.687 (0.610-0.783)	0.819 (0.725-0.934)	0.998 (0.881-1.14)	1.15 (1.00-1.33)	1.37 (1.14-1.65)	1.54 (1.26-1.91)	1.73 (1.36-2.20)	1.92 (1.47-2.55)	2.21 (1.60-3.08)	2.44 (1.70-3.55)
3-hr	0.855 (0.759-0.974)	1.01 (0.895-1.15)	1.22 (1.08-1.40)	1.40 (1.22-1.62)	1.65 (1.38-1.99)	1.85 (1.50-2.29)	2.05 (1.62-2.63)	2.28 (1.74-3.01)	2.59 (1.88-3.61)	2.85 (1.98-4.14)
6-hr	1.26 (1.12-1.44)	1.48 (1.31-1.69)	1.78 (1.57-2.04)	2.02 (1.77-2.34)	2.36 (1.97-2.85)	2.62 (2.14-3.25)	2.89 (2.29-3.70)	3.18 (2.42-4.20)	3.57 (2.59-4.97)	3.88 (2.70-5.64)
12-hr	1.79 (1.59-2.04)	2.13 (1.89-2.43)	2.59 (2.28-2.96)	2.95 (2.58-3.41)	3.44 (2.88-4.15)	3.82 (3.11-4.73)	4.20 (3.32-5.36)	4.59 (3.50-6.07)	5.12 (3.71-7.13)	5.53 (3.84-8.03)
24-hr	2.54 (2.32-2.85)	3.12 (2.84-3.49)	3.85 (3.49-4.32)	4.43 (3.99-5.02)	5.19 (4.53-6.08)	5.77 (4.92-6.89)	6.33 (5.28-7.75)	6.91 (5.60-8.69)	7.67 (5.97-10.0)	8.24 (6.20-11.2)
2-day	3.32 (3.03-3.72)	4.14 (3.77-4.64)	5.15 (4.68-5.79)	5.95 (5.36-6.74)	6.98 (6.09-8.17)	7.74 (6.61-9.25)	8.49 (7.08-10.4)	9.23 (7.49-11.6)	10.2 (7.94-13.4)	10.9 (8.23-14.8)
3-day	3.92 (3.57-4.38)	4.91 (4.47-5.51)	6.14 (5.58-6.90)	7.10 (6.40-8.04)	8.34 (7.27-9.76)	9.24 (7.89-11.0)	10.1 (8.44-12.4)	11.0 (8.91-13.8)	12.1 (9.43-15.9)	13.0 (9.75-17.6)
4-day	4.34 (3.95-4.86)	5.47 (4.98-6.13)	6.86 (6.23-7.71)	7.93 (7.14-8.98)	9.30 (8.11-10.9)	10.3 (8.79-12.3)	11.3 (9.39-13.8)	12.2 (9.90-15.4)	13.4 (10.5-17.6)	14.3 (10.8-19.4)
7-day	5.36 (4.89-6.00)	6.80 (6.19-7.62)	8.53 (7.75-9.59)	9.85 (8.88-11.2)	11.5 (10.0-13.5)	12.7 (10.8-15.2)	13.8 (11.5-16.9)	15.0 (12.1-18.8)	16.4 (12.7-21.4)	17.4 (13.1-23.6)
10-day	6.17 (5.63-6.91)	7.85 (7.15-8.80)	9.86 (8.95-11.1)	11.4 (10.2-12.9)	13.2 (11.5-15.5)	14.6 (12.4-17.4)	15.8 (13.2-19.4)	17.0 (13.8-21.5)	18.6 (14.5-24.3)	19.7 (14.8-26.7)
20-day	8.29 (7.55-9.28)	10.6 (9.65-11.9)	13.3 (12.1-14.9)	15.3 (13.8-17.3)	17.7 (15.4-20.7)	19.4 (16.5-23.1)	20.9 (17.4-25.6)	22.4 (18.1-28.2)	24.2 (18.8-31.7)	25.5 (19.1-34.5)
30-day	10.1 (9.25-11.4)	13.0 (11.8-14.5)	16.2 (14.7-18.2)	18.6 (16.8-21.1)	21.4 (18.7-25.1)	23.4 (20.0-27.9)	25.2 (21.0-30.8)	26.8 (21.7-33.7)	28.8 (22.4-37.8)	30.2 (22.7-41.0)
45-day	12.6 (11.5-14.1)	16.1 (14.6-18.0)	20.0 (18.1-22.4)	22.8 (20.5-25.8)	26.1 (22.8-30.6)	28.3 (24.2-33.9)	30.3 (25.3-37.2)	32.2 (26.1-40.5)	34.4 (26.8-45.2)	36.0 (27.1-48.8)
60-day	15.0 (13.6-16.7)	18.9 (17.2-21.2)	23.4 (21.2-26.3)	26.5 (23.9-30.1)	30.3 (26.4-35.4)	32.7 (27.9-39.1)	34.9 (29.1-42.8)	37.0 (30.0-46.5)	39.4 (30.6-51.6)	41.0 (30.9-55.6)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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Appendix A

Hydrologic Calculations

TR-55 – Table 2.2 – Runoff Curve Numbers

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Table 2-2a Runoff curve numbers for urban areas [1]

Cover description: Cover type and hydrologic condition	Average percent impervious area [2]	Curve numbers for hydrologic soil group: A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1] Average runoff condition, and $I_a = 0.2S$.
[2] The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3] CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4] Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5] Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

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Table 2-2b Runoff curve numbers for cultivated agricultural lands [1]

Cover description			Curve numbers for hydrologic soil group			
Cover type	Treatment [2]	Hydrologic condition [3]	A	B	C	D
Fallow	Bare soil	—	77	86	91	94
	Crop residue cover (CR)	Poor	76	85	90	93
		Good	74	83	88	90
Row crops	Straight row (SR)	Poor	72	81	88	91
		Good	67	78	85	89
	SR + CR	Poor	71	80	87	90
		Good	64	75	82	85
	Contoured (C)	Poor	70	79	84	88
		Good	65	75	82	86
	C + CR	Poor	69	78	83	87
		Good	64	74	81	85
	Contoured & terraced (C&T)	Poor	66	74	80	82
		Good	62	71	78	81
	C&T+ CR	Poor	65	73	79	81
		Good	61	70	77	80
Small grain	SR	Poor	65	76	84	88
		Good	63	75	83	87
	SR + CR	Poor	64	75	83	86
		Good	60	72	80	84
	C	Poor	63	74	82	85
		Good	61	73	81	84
	C + CR	Poor	62	73	81	84
		Good	60	72	80	83
	C&T	Poor	61	72	79	82
		Good	59	70	78	81
	C&T+ CR	Poor	60	71	78	81
		Good	58	69	77	80
Close-seeded or broadcast legumes or rotation meadow	SR	Poor	66	77	85	89
		Good	58	72	81	85
	C	Poor	64	75	83	85
		Good	55	69	78	83
	C&T	Poor	63	73	80	83
		Good	51	67	76	80

[1] Average runoff condition, and I_a=0.2S
[2] Crop residue cover applies only if residue is on at least 5% of the surface throughout the year.
[3] Hydraulic condition is based on combination factors that affect infiltration and runoff, including (a) density and canopy of vegetative areas, (b) amount of year-round cover, (c) amount of grass or close-seeded legumes, (d) percent of residue cover on the land surface (good ≥ 20%), and (e) degree of surface roughness.

Poor: Factors impair infiltration and tend to increase runoff.

Good: Factors encourage average and better than average infiltration and tend to decrease runoff.

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Table 2-2c Runoff curve numbers for other agricultural lands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition	A	B	C	D
Pasture, grassland, or range—continuous forage for grazing. [2]	Poor	68	79	86	89
	Fair	49	69	79	84
	Good	39	61	74	80
Meadow—continuous grass, protected from grazing and generally mowed for hay.	—	30	58	71	78
Brush—brush-weed-grass mixture with brush the major element. [3]	Poor	48	67	77	83
	Fair	35	56	70	77
	Good	30 [4]	48	65	73
Woods—grass combination (orchard or tree farm). [5]	Poor	57	73	82	86
	Fair	43	65	76	82
	Good	32	58	72	79
Woods. [6]	Poor	45	66	77	83
	Fair	36	60	73	79
	Good	30 [4]	55	70	77
Farmsteads—buildings, lanes, driveways, and surrounding lots.	—	59	74	82	86

1 Average runoff condition, and $I_a = 0.2S$.
2 *Poor:* <50%) ground cover or heavily grazed with no mulch.
Fair: 50 to 75% ground cover and not heavily grazed.
Good: > 75% ground cover and lightly or only occasionally grazed.
3 *Poor:* <50% ground cover.
Fair: 50 to 75% ground cover.
Good: >75% ground cover.
4 Actual curve number is less than 30; use CN = 30 for runoff computations.
5 CN's shown were computed for areas with 50% woods and 50% grass (pasture) cover. Other combinations of conditions may be computed from the CN's for woods and pasture.
6 *Poor:* Forest litter, small trees, and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

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Table 2-2d Runoff curve numbers for arid and semiarid rangelands [1]

Cover description		Curve numbers for hydrologic soil group			
Cover type	Hydrologic condition [2]	A [3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

1 Average runoff condition, and $I_a = 0.2S$. For range in humid regions, use table 2-2c.
2 Poor: <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: > 70% ground cover.
3 Curve numbers for group A have been developed only for desert shrub.

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Appendix A

Hydrologic Calculations

County of El Dorado Drainage Manual – CN to C Curves

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FIG. 2.5.1 Runoff Coefficients for 10-yr Event above 1,640'

(SCS type IA storm)

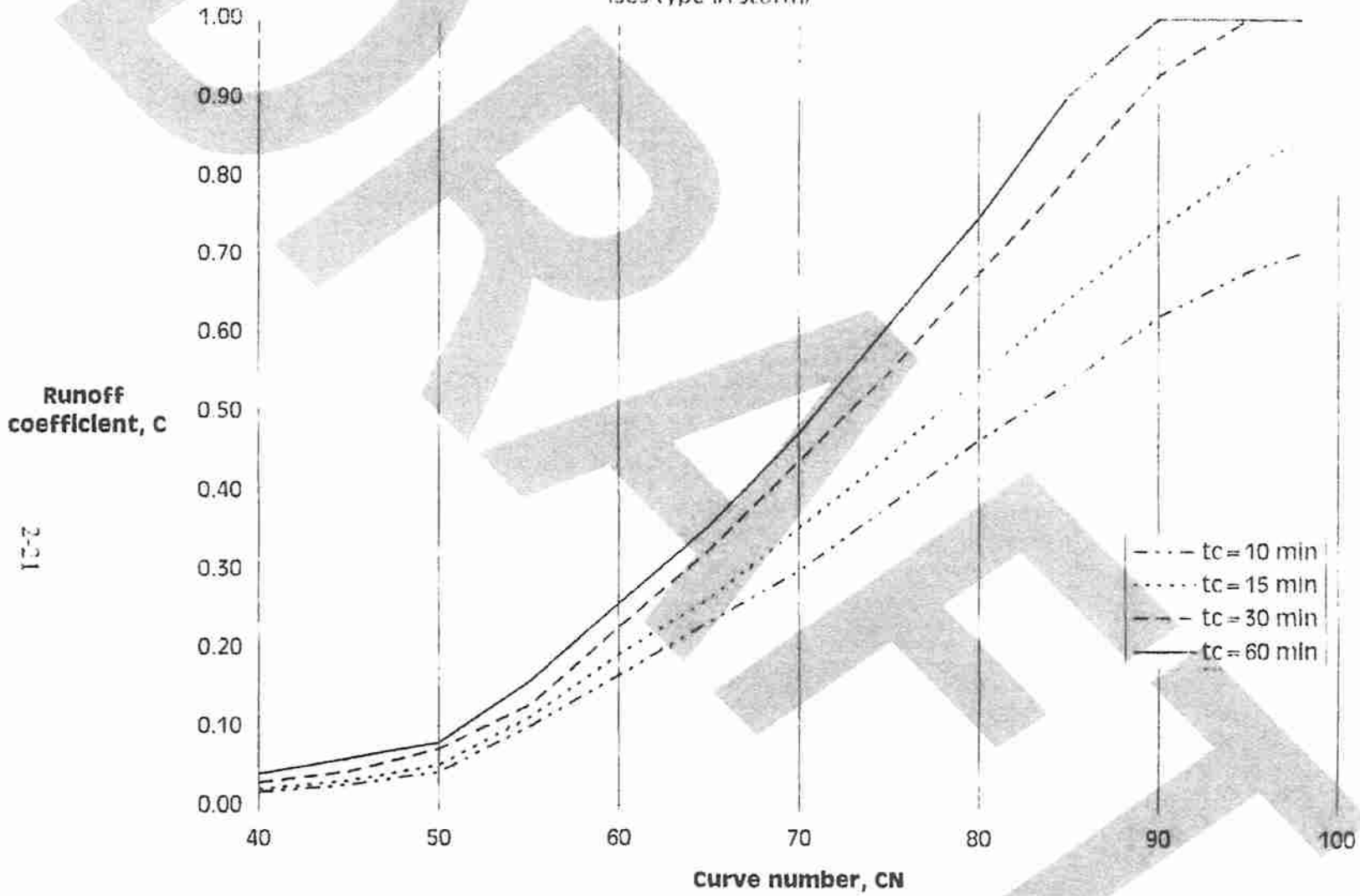

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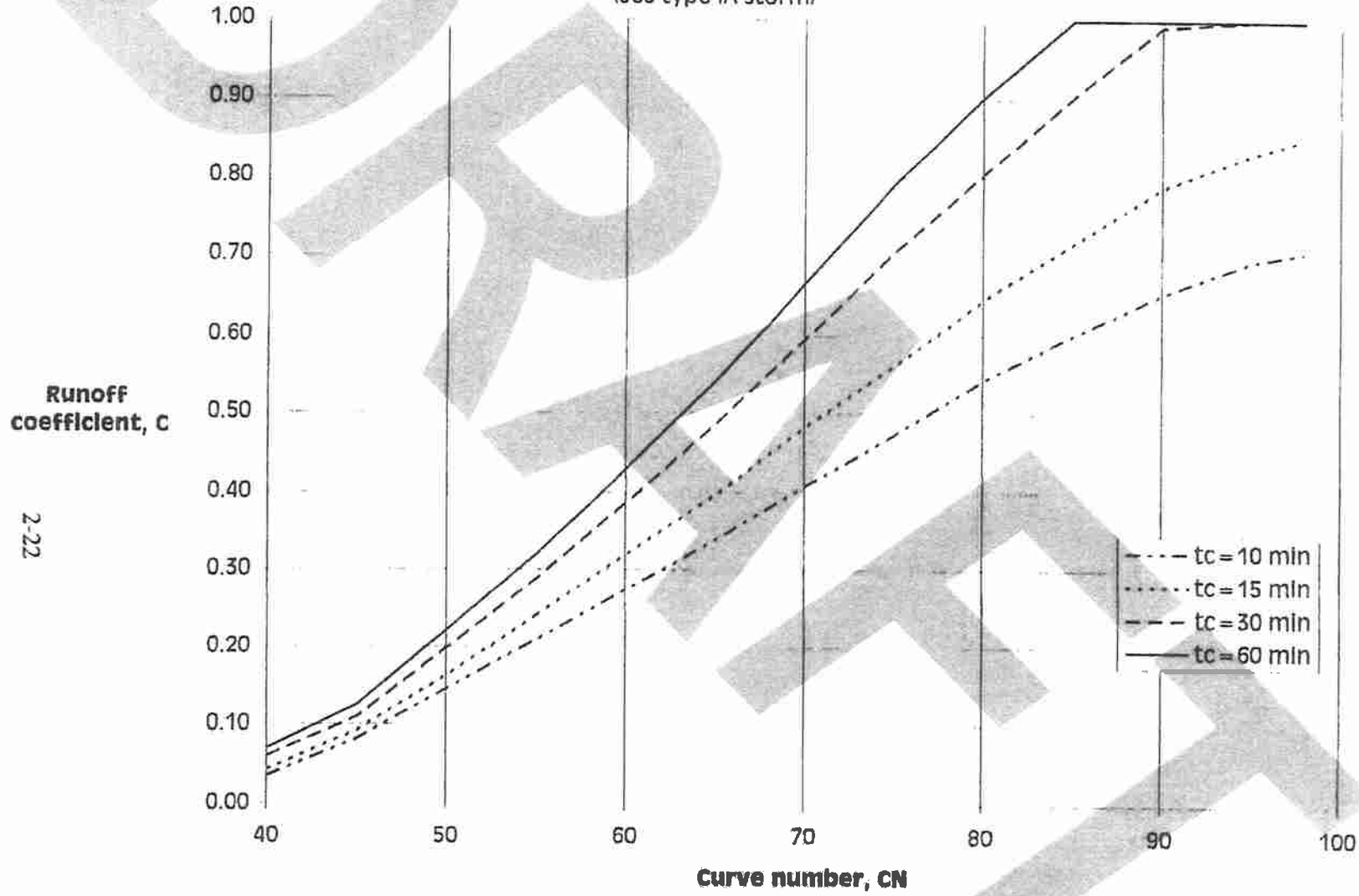
Fig. 2.5.2 Runoff Coefficients for 100-yr Event above 1,640'

(SCS type IA storm)



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Appendix A

Hydrologic Calculations

County of El Dorado Drainage Manual – CN to C Curves - Revised

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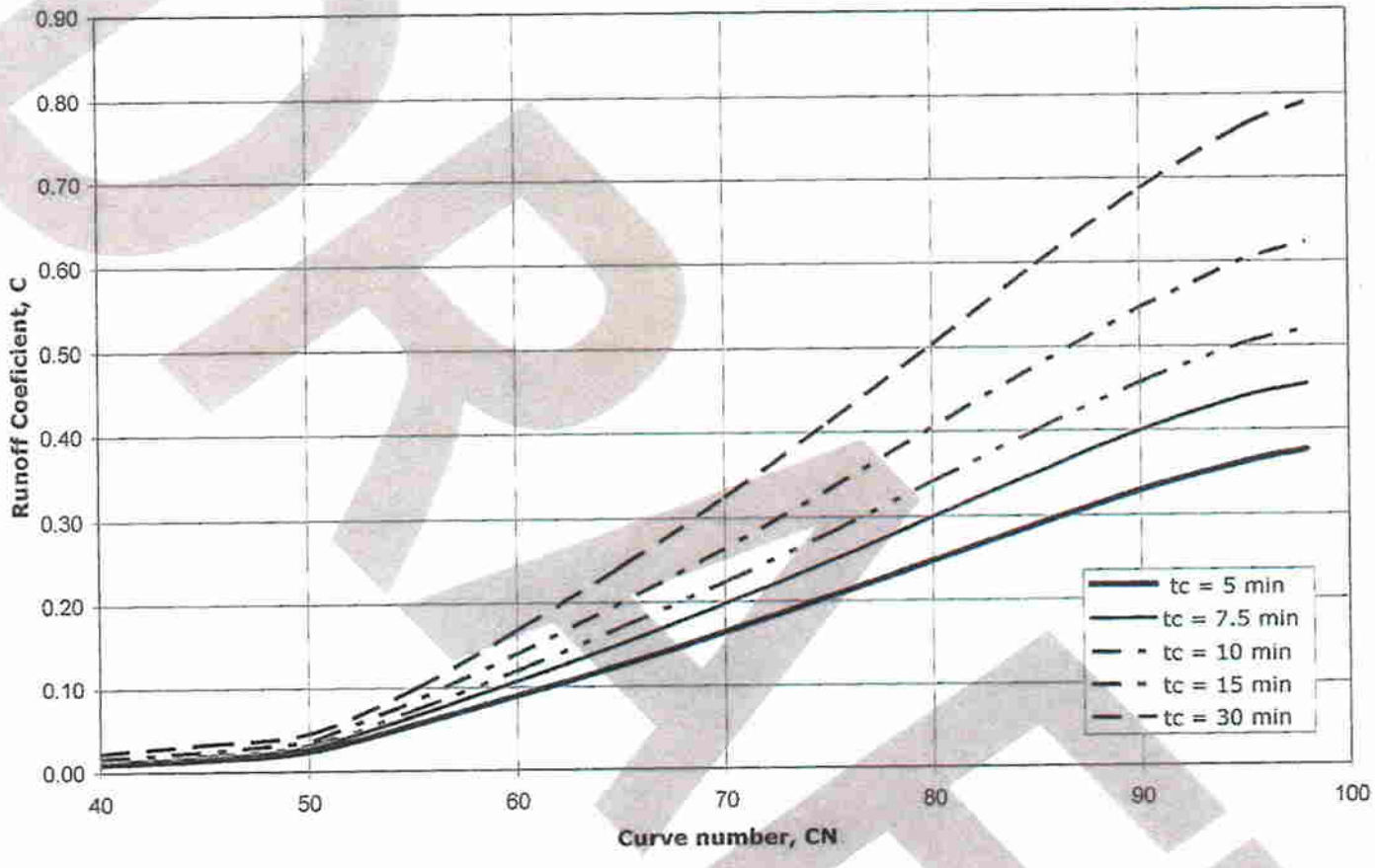

Figure 5. Runoff coefficients for 10-yr event above 1,640 ft (NRCS type 1A storm)

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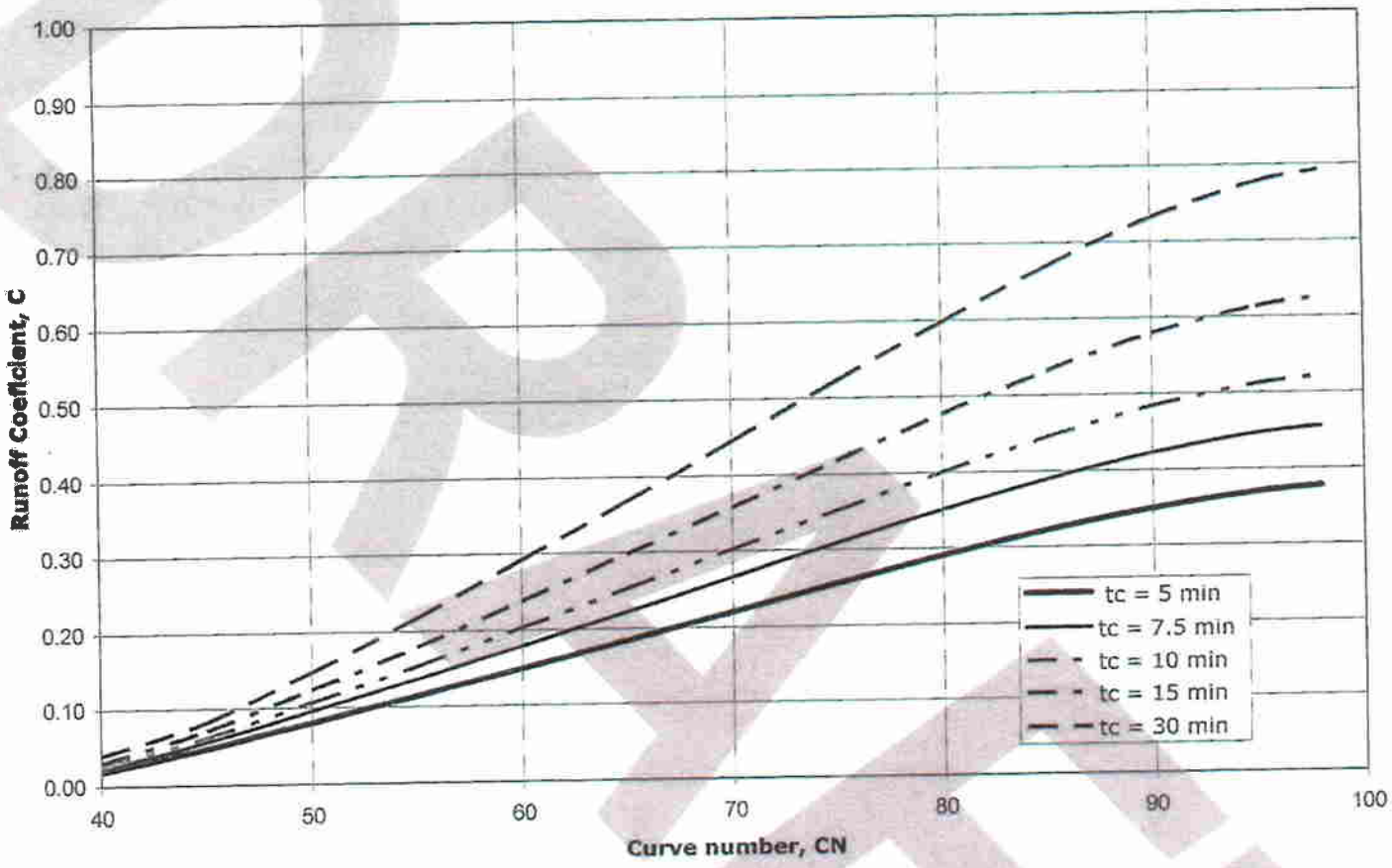

Figure 7. Runoff coefficients for 100-yr event above 1,640 ft (NRCS type 1A storm)

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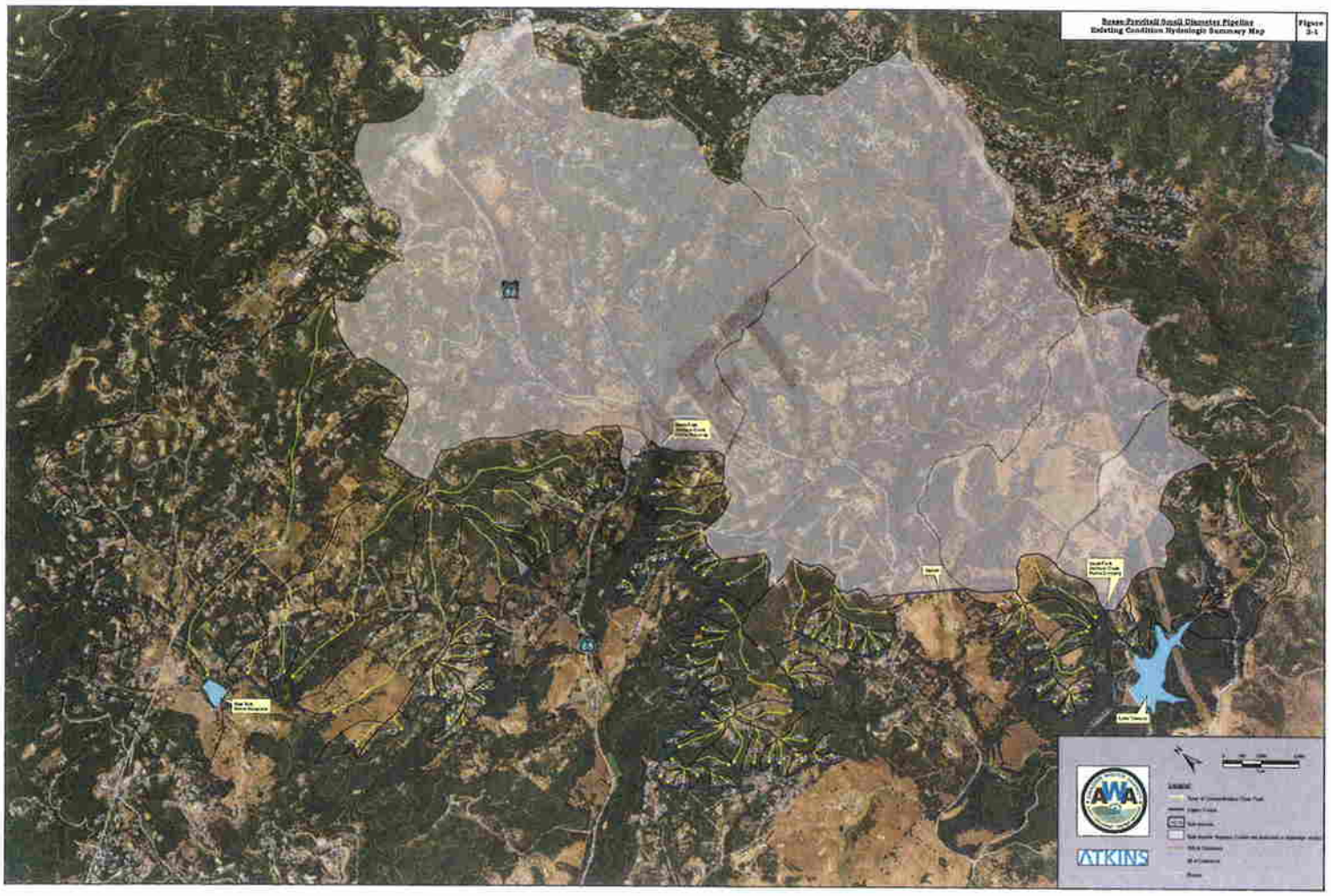
Bexar-Frontiers Small Diameter Pipeline
Existing Condition Hydrologic Summary Map
Figure 3-1
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Small Diameter Pipe Project Memorandum (AWA, 2014)

A Public Agency 12800 RIDGE ROAD, SUTTER CREEK, CA 95685 (209) 223-3018 Fax: (209) 257-5267

MEMORANDUM

Date: July 1, 2014

To: Cris Thompson, Assistant General Manager

CC: Gene Mancebo, General Manager

From: Chris McKeage, Field Services Manager

RE: Small Diameter Pipe Project

Cris,

As we discussed last week, there are multiple benefits to the Small Diameter Pipe project on the section of the ditch from New York Ranch Rerservoir to Lake Tabeau.

- Historically we lose approximately 1800 acre feet of water per year that would be preserved with the small diameter pipe.
- Ability to leave more water in the Mokelumne River for downstream users or possibly save in reservoirs.
- Reduce dollars spent on ditch maintenance (weed abatement, leak repair, clogged service connections etc...) which helps us control water rates.
- Save approximately 141,000 kwh/yr for the electricity used in pumping the water lost annually from the ditch.
- Reduced greenhouse effects due to reduced power consumption.
- Potentially make more water available for environmental habitat.

These items should be noted in our grant application.

Secondary Benefits Worksheet
(Small Diameter Pipe Project)

Month / Year	Water to Canal @ Tabeaud x 1000 gal	Customer use on Canal gal x 1000	Ave CFS out of NYRR	Ave Gal out of NYRR gal x 1000	Gals lost on Canal gal x 1000	Water Loss (AFY)	Energy Savings (KWh used in lost water from Canal)	Energy Savings (MWh used in lost water from Canal)	GHG Emission Reduction (MT)	
June 2012	62,376	19,381	1.04	20,164	22,831	840.18	6,300	6.30	2.14	
July 2012	101,572	33,084	1.04	20,836	47,652	1,753.59	11,160	11.16	3.80	
Aug 2012	101,572	22,231	1.04	20,836	58,505	2,152.98	13,175	13.18	4.49	
Sept 2012	95,355	23,420	1.04	20,164	51,771	1,905.17	10,800	10.80	3.68	
Oct 2012	120,315	7,196	1.04	20,836	92,283	3,396.01	21,700	21.70	7.39	
Nov 2012	97,736	5,677	1.04	20,164	71,895	2,645.74	15,000	15.00	5.11	
Dec 2012	57,840	3,142	1.04	20,836	33,862	1,246.12	8,370	8.37	2.85	
Ave 2012	**90,966.57**	**16,304.43**	**1.04**	**20,548.00**	**54,114.14**	**1,991.40**	**12,358**	**12**	**4**	
Jan 2013	60,500	6,380	1.10	22,038	32,082	1,180.62	8,060	8.06	2.74	
Feb 2013	64,653	4,974	0.82	14,838	44,841	1,650.15	10,920	10.92	3.72	
Mar 2013	62,819	9,507	0.87	17,430	35,882	1,320.46	8,990	8.99	3.06	
Apr 2013	91,456	26,502	0.92	17,837	47,117	1,733.91	11,580	11.58	3.94	
May 2013	98,004	27,856	1.10	22,038	48,110	1,770.45	11,470	11.47	3.90	
Jun 2013	96,282	22,156	1.06	21,236	52,890	1,946.35	12,090	12.09	4.12	
Jul 2013	113,694	28,738	1.11	22,238	62,718	2,308.02	14,260	14.26	4.85	
Aug 2013	88,006	26,965	0.99	19,194	41,847	1,539.97	10,170	10.17	3.46	
Sept 2013	80,194	14,459	0.65	12,602	53,133	1,955.29	12,150	12.15	4.14	
Oct 2013	95,307	12,910	0.62	12,421	69,976	2,575.12	15,655	15.66	5.33	
Nov 2013	64,933	7,742	0.62	12,021	45,170	1,662.26	11,700	11.70	3.98	
Dec 2013	81,762	7,854	0.62	12,421	61,487	2,262.72	13,950	13.95	4.75	
Ave 2013	**83,134**	**16,337**	**1**	**17,193**	**49,604**	**1,825**	**11,750**	**12**	**4**	
Jan 2014	74,267	5,804	0.62	12,421	56,042	2,062.35	12,555	12.56	4.27	
Feb 2014	56,281	3,052	0.68	11,219	42,010	1,545.97	10,080	10.08	3.43	
Mar 2014	58,749	4,563	0.62	12,421	41,765	1,536.95	9,920	9.92	3.38	
Apr 2014	64,268	4,563	0.76	14,735	44,970	1,654.90	10,800	10.80	3.68	
May 2014	73,884	10,958	0.72	14,425	48,501	1,784.84	11,780	11.78	4.01	
Ave 2014	65,489.80	5,788.00	0.68	13,044.20	46,657.60	1,717.00	**11,027**	**11**	**4**	
2012-2014 Avg	**79,863.51**	**12,809.78**	**0.86**	**16,928.34**	**50,125.39**	**1,844.61**	**11,711.48**	**11.71**	**3.99**	**MT per month**
									47.85	**MT per year**

Secondary Benefits Worksheet
(Small Diameter Pipe Project)

Energy Savings

water savings %	energy use without project (kWh/year)	energy use with project (kWh/year)	energy savings (should equal cell H31)
63%	31,451.88	19,740.40	11,711.48

Share		Region	EGRID subregion name	CO2e Emission Factor	
70%		California	WECC California	613.28	lbs/MWh
10% import		Pacific Northwest	WECC Northwest	846.97	lbs/MWh
20% import		Pacific Southwest	WECC Southwest	1182.89	lbs/MWh
		weighted average		750.571	lbs/MWh
		weighted average		0.34	MT/MWh

Small Diameter Pipeline Sizing, Lower Portion Memorandum
(AWA, 2007)

Memorandum

To: Gene Mancebo
From: Liam Bailey
Date: August 31, 2007
Subject: Small Diameter Pipeline sizing, lower portion

The water model for piping in the upper portion of the canal from Tabeaud to the New York Ranch Reservoir including the option of treated water from Jackson Pines. This model used the average day, peak month (five years of data) flows for each of the parcels and assumed no flow for the flat rate customers. 6 hours a day of constant run time was assumed for all connections (e.g. daily average x 4). Kreg Miller's estimate for the flat rate users was 10 gpm for all but Tom Oneto, who is assumed to be using 25+gpm. I used 15 gpm for all these and 50 gpm for Oneto to provide some extra capacity. Many of these connections are using well below the maximum volume of water they could be using based on their meter size.

The first option considered was raw water through the entire canal. This option assumes a small pump at Tabeaud, providing 40' of head and 1500 gpm. With this configuration, 29,990' of 12" is required out of Tabeaud, followed by 33,640' of 10", 6380' of 8", 130' of 6" and 23,785' of 4". This provides for pressures along the canal between 5 and 25 psi, and is about the minimal sizing possible with that size pump. Of course, different pump options would change the pipe sizes required and significantly change the price of the option (lower). An approximate total cost for raw water from Tabeaud to the top of the Harmon siphon is $4,480,845. The raw water cost to the bottom of the Harmon siphon is approximately $473,045, giving a total cost to pipe the entire canal with raw water at $4,996,050.

The second option considered was treated water between New York Ranch Reservoir and the Clinton Siphon, with raw water in the rest of the canal. This option considers a treated pipeline that proceeds from the north end of Jackson Pines (near the north sewer pump station) cross country to the canal. The final map conditions for Jackson Pines require providing a 1000 gpm fireflow. The system in its present state does not quite fulfill this obligation (residual pressures in one court drop below 20 psi), so maintaining the system at its current state is all that was considered. A short section in the Jackson Pines subdivision (1145') would need to be upgraded from 8" to 10". The pipe in the canal providing treated water would be sufficiently sized for current demands, with 6" and 8" pipe, so 8" pipe in its entirety was assumed based on the Agency's minimum line size for dead ends. The cluster of three services around Cuneo would be served raw water with a 4" pipeline and an appropriately sized pump. The raw water would be fed the same as before to the bottom of the Harmon Siphon via transmission line pressure. This options total cost would be approximately $3,928,095.

The third option considered was the same as the above option, except treated water to Evitt and Ron Oneto would be provided off Trent Way at an approximate cost of $112,000. The total cost for this option would be approximately $3,882,405.

The fourth option considered was the same as the above option, except that treated water would be fed all the way up to the Cuneo service cluster and Boggs would be provided a separate lone connection. The Boggs service would cost approximately $53,000, assuming $30,000 for a pump station since he cannot be gravity fed. If Boggs were required to provide his own pumping, the cost would be appropriately less. The total cost for this option would be approximately $3,818,835.

Items of concern/note:

- It takes 10,740' of pipe past the last connection (Oneto) that uses water to get treated water to Double S Bar Ranch, at a cost of $375,900, and they currently have a meter, but use no water.

- Treated water off Jackson Pines provides for a situation we would probably never allow developers to do: very long, smaller diameter, dead ends. In addition, access for maintenance/repair along the canal is a significant concern.

- Bringing water past Gates in the lower part of the canal is a significant expense ($573,145) to serve raw water to a group of people who all (with the exception of Nunn and Evitt) have treated water service.

- In the upper part of the canal, with a treated water feed, water outages could be an issue. For example, if someone between Jackson Pines and Marz is using more water than their current assumed usage, then Marz could easily be out of water. Furthermore, being treated water, every time this happens, we have to test for bacteria. The upsize of the line to the Agency minimum of 8" helps significantly, and all the users in the area are generally small, but this is still a possibility.

Appendix 3.2 – CDPH-AWA Agreement

RECEIVED
JUL 20 2001
ENGINEERING OPERATIONS

COMPLIANCE AGREEMENT

THIS COMPLIANCE AGREEMENT between the CALIFORNIA DEPARTMENT OF HEALTH SERVICES ("DHS") and the AMADOR WATER AGENCY ("Amador") is entered into pursuant to Health and Safety Code *Sections 116275(s), 116286, 116287, and 116655.*

RECITALS

1. The Department of Health Services (DHS) regulates public water systems in the State of California pursuant to state statute. In addition, the DHS has been delegated primacy by the United States Environmental Protection Agency ("EPA") for implementing the provisions of the Federal Safe Drinking Water Act as they apply to public water systems within the State of California.

2. The term "public water system" means a system for the provision to the public of water for human consumption through pipes or other constructed conveyances, if such system has at least 15 "service connections" or regularly serves at least 25 individuals.

3. The California Health and Safety Code defines "service connection" as the point of connection between the customer's piping or constructed conveyance, and the water system's meter, service pipe, or constructed conveyance.

4. The California Health and Safety Code defines "human consumption" to mean drinking, cooking, bathing, showering, dishwashing, and maintaining oral hygiene.

5. A "community water system" means a public water system that serves at least 15 service connections used by year-long residents or regularly serves 25 year-long

residents of the area.

6. "Approved bottled water" means water bottled by a supplier licensed by the DHS Food and Drug Division in conformance with the requirements of *Section 111070, California Health and Safety Code.*

7. "Equivalent water" means water from a source approved by the DHS Food and Drug Division and delivered to customers either in bottles or in bulk by haulers licensed by the DHS Food and Drug Division (approved bottled water) and water treated by Amador at the Sutter Creek (Tanner) water treatment plant and sold in containers to raw water customers on the Amador Canal-Ione Pipeline raw water system.

8. Point of Entry (POE) treatment systems are those water treatment systems installed at untreated water service connections to provide treatment that results in a treated water that provides an equivalent level of public health protection as provided by water from a public water system that utilizes central filtration and disinfection in compliance with the regulatory standards for public water systems. Approved POE systems are those systems installed on or before July 1, 1999 and approved by Amador and those installed after July 1, 1999 that are approved by DHS. Conditions for approval of POE systems by either Amador or DHS are specified in the DHS document, "Requirements for Point of Entry (POE) Systems on Constructed Conveyance Water Systems", attached to this agreement as Exhibit A.

9. As of August 6, 1998, systems that deliver water for human consumption through constructed conveyances, other than pipes, to the requisite number of connections and/or individuals will be defined as a public water system subject to regulation under

state law and the Federal Safe Drinking Water Act.

10. Pursuant to Health and Safety Code Section 116275(s) there are three mechanisms by which a connection to a constructed conveyance will not be treated as a "service connection" for purposes of determining whether such system is a regulated public water system. These three exclusions are:

(a) The water is used exclusively for purposes other than human consumption uses, consisting of drinking, bathing, and cooking or other similar uses ("Other Than Human Consumption Use Exclusion").

(b) DHS determines that alternative water to achieve the equivalent level of public health protection provided by the applicable primary drinking water regulation is provided for human consumption or similar uses for drinking and cooking ("Alternative Water Exclusion").

(c) DHS determines that the water provided for human consumption or similar uses for drinking, cooking, and bathing is centrally treated or treated at the point of entry by the provider, a pass through entity, or the user to achieve the equivalent level of protection provided by the applicable primary drinking water regulations ("Treatment Exclusion").

11. Amador maintains a raw water conveyance system consisting of a constructed conveyance (canal) segment, known as the Amador Canal, and a pipeline segment, known as the Ione Pipeline, that may constitute a conveyance system subject to regulation as a public water system as of August 6, 1998, depending, among other things, on the number of service connections maintained on the raw water system. This

system, of two segments, is recognized by DHS as a single constructed conveyance raw water system referred to in this document as the Amador Canal-Ione Pipeline raw water system.

12. A purpose of this Agreement is to identify the steps required for Amador to qualify for the Alternative Water Exclusion, respecting connections receiving untreated water from the Amador Canal-Ione Pipeline raw water system. Nothing in this Agreement, however, is intended to preclude Amador from excluding such service connections associated with the Amador Canal-Ione Pipeline system by utilizing either the Other Than Human Consumption Exclusion or the Treatment Exclusion. Similarly, nothing in this Agreement is intended to preclude Amador from excluding such service connections by extending potable water service from one of its permitted domestic water treatment and distribution systems to such water service connections currently receiving untreated water. Those customers that receive raw water from the Amador Canal-Ione Pipeline raw water system, but obtain their water for human consumption from a potable water supply well, are excluded from the provisions of this Agreement.

NOW THEREFORE, the parties hereto agree as follows:

I. LIST OF CUSTOMERS THAT RECEIVE WATER FOR HUMAN CONSUMPTION

Amador shall develop and maintain a list of customers that receive raw water for human consumption from the Amador Canal-Ione Pipeline raw water system. Human consumption means, in this document, the use of water for drinking, cooking, bathing, showering, dishwashing, and maintaining oral

hygiene wherever such uses may occur, whether they be in a home, business, or any other location. This list of customers shall be developed through a customer survey process identified in this document and shall be provided to DHS. The format of the survey shall be reviewed and approved by DHS prior to its issuance. The list shall be maintained for inspection by either DHS or EPA pursuant to the recordkeeping provisions contained in this Agreement.

II. INITIAL SURVEY AND COMPLETION MILESTONES.

A. On or about March 15, 1999, Amador initiated a preliminary survey process directed toward those persons and/or entities that have connections and acquire untreated water along the Amador Canal segment of the raw water system.

B. On or about February 8, 2000, Amador distributed a newly developed survey to identify a complete list of all current customers that receive raw water for human consumption along the Amador Canal segment of the system. A draft of the survey form was subsequently provided to DHS for review and approval for use in conducting the new survey. The form was approved by DHS. The survey solicited information from customers that have Point Of Entry alternative filtration treatment systems so that Amador can make a subsequent determination if the units, including the type and arrangement of treatment units, have received DHS approval pursuant to *Section 64653(f), Title 22, California Code of Regulations*, or approval by Amador pursuant to the provisions of the DHS document, "Requirements for Point of Entry (POE) Systems on Constructed Conveyance Water Systems".

Additionally, the survey inquired if groundwater from a private well is used by the residence. The survey form and letter of explanation are attached to this document as Exhibit B.

C. By November 15, 2001 Amador shall mail out survey forms, approved by the DHS, to all affected raw water customers on the Amador Canal segment of the system that did not respond to the February 8, 2000 questionnaire and to all raw water customers on the Ione Pipeline segment of the system.

D. Amador shall initiate the following procedure with respect to those customers who fail to complete the survey and return it to Amador by January 1, 2002:

1. Prior to April 30, 2002, Amador representatives will conduct the first site visit to customers who have failed to complete the survey. If the survey information cannot be obtained during the site visit, Amador will leave a letter requesting the completion of the survey, a copy of the survey, and a return envelope. The letter will explain that failure to complete the survey constitutes grounds for termination of service at the customer's connection.

2. If the survey information has not been obtained by June 15, 2002, Amador representatives will conduct a second site visit. Again, copies of the letter, survey, and return envelope will be left, if the survey information cannot be ascertained. The letter will explain that failure to complete the survey constitutes grounds for termination of service at the customer's connection.

3. If by August 15, 2002, Amador has not obtained the information

requested by the survey (either directly or indirectly), then Amador shall, prior to September 30, 2002, provide thirty (30) days written notice to each such survey recipient, with a copy to Amador County, of Amador's intent to terminate such customer's service at the connection, unless the completed survey is submitted prior to the deadline.

4. If the foregoing steps do not result in the required survey information being obtained, Amador shall commence action to terminate the customer's water service. Where the termination of water service to any customer is necessary, such service termination shall be completed by November 1, 2002, consistent with law.

E. By December 1, 2002, Amador shall either submit a report to DHS that demonstrates that it is in compliance with Section 116275 or apply for a Public Water Supply permit; provided, however, that DHS shall not deem Amador to be out of compliance if there are more than 15 connections for the Ione Pipeline and Amador Transmission Pipeline during the interim periods referenced in Articles III, VIII, and XI. Within30 days of receiving this report, DHS will issue a determination on whether Amador is in compliance or not. DHS shall defer any decision as to whether Amador is a public water system until such determination is issued.

F. On or before March 31 of each following year, commencing in 2003, Amador shall complete a survey of customers that receive raw water for human consumption from the Amador Canal and the Ione Pipeline if so requested by DHS. DHS reserves the right to request modifications of the annual survey

from year to year as necessary to meet the requirements of federal and state law.

III. INTERIM MEASURES TO PROTECT PUBLIC HEALTH RESPECTING UNTREATED WATER CUSTOMERS ALONG THE AMADOR CANAL-IONE PIPELINE RAW WATER SYSTEM UTILIZING THE ALTERNATIVE WATER EXCLUSION

Unless a customer uses a well or POE for water for human consumption, each customer on the Amador Canal-Ione Pipeline raw water system that receives raw water for human consumption shall be provided hauled or bottled water until it becomes feasible for Amador to deliver potable drinking water for "human consumption" to such customers through a piped distribution system.

Alternative water shall be provided by Amador to all such customers that request this service. Amador may charge the customers for the cost of alternative water supplied by Amador. Amador may contract with a third party to deliver the water to the customer, but Amador remains responsible for ensuring that the alternative water is provided to the customers.

In lieu of purchasing potable water from a provider of hauled or bottled water, the customer may elect to purchase treated water at Amador's Tanner Water Treatment Plant until it becomes feasible for Amador to deliver potable drinking water for "human consumption" to such customers through a piped distribution system. Amador shall keep records of such purchases for the purpose of determining compliance, by

this method, with the Alternative Water Exclusion.

An additional interim measure to protect public health shall be the distribution of public notifications as described in Article VII of this document.

IV. RESPONSE ACTIONS WHEN WATER FROM AN APPROVED PROVIDER, TREATED WATER FROM A DHS APPROVED POE TREATMENT SYSTEM, EQUIVALENT WATER, OR WATER FROM A POTABLE WATER SUPPLY WELL IS NOT USED FOR DRINKING OR COOKING PURPOSES.

1. In the event Amador determines through the survey or otherwise that, with respect to the customers that receive untreated water for human consumption from the Amador Canal-Ione Pipeline raw water system, any such customer is not using water for human consumption from a well, a POE, an Approved Provider, or the Tanner Water Treatment Plant for drinking or cooking purposes, Amador will take the following immediate steps to ensure that such person or entity receives approved water for drinking and cooking purposes from a provider of hauled or bottled water who has been approved by DHS pursuant to Section V of this Agreement ("Approved Provider") or through purchases of treated water at Amador's Tanner Water Treatment Plant:

    1. By April 30, 2002 or within seven calendar days of Amador obtaining knowledge that a customer is not using water from an approved source for drinking or cooking purposes, whichever is later, Amador representatives will conduct a site visit and/or contact the customer by telephone to make arrangements for having an Approved Provider supply alternative water for drinking and cooking purposes to such

customer or having the customer purchase treated water at the Tanner Water Treatment Plant.

2. If actual contact cannot be made with the customer not using water from an approved source for drinking or cooking purposes within the seven-day period, then Amador representatives will leave a letter, along with a list of Approved Providers, directing such customer to immediately make arrangements for the purchase of alternative water for drinking and cooking purposes. Such customer shall be provided seven days to contact Amador to confirm that alternative water for drinking and cooking purposes has been secured from an Approved Provider or will be purchased at the Tanner Water Treatment Plant.

3. If a positive response has not been received within seven days of making actual contact or leaving the letter, Amador shall provide thirty (30) days written notice to the customer not using water from an approved source for drinking and cooking purposes of Amador's intent to terminate such customer's untreated water service.

4. Amador shall confirm that the customer has made arrangements for acquiring alternative water for drinking and cooking purposes directly from the Approved Provider or through purchases of treated water at the Tanner Water Treatment Plant.

5. If the customer fails to secure alternative water for drinking and cooking purposes from an Approved Provider or through purchases of treated water at the Tanner Water Treatment Plant within this 30-day

period, Amador shall terminate such customer's untreated water service at the end of the 30-day notice period.

V. APPROVED PROVIDERS AND COMPLETION MILESTONES.

A. The DHS-Division of Drinking Water and Environmental Management (DDWEM) will provide Amador with a list of water haulers serving Amador County that have been licensed by the DHS-Food and Drug Branch. The DHS-DDWEM will notify Amador whenever any provider serving Amador County is no longer licensed by DHS. Unless and until Amador is notified that a hauler has been removed from the list of licensed water haulers, Amador shall presume that all haulers that have been licensed by DHS-Food and Drug Branch are acceptable to the DHS-DDWEM as Approved Providers.

1. Amador will inform providers, who have been licensed by DHS, that in order to become Approved Providers, they must enter into a contract with Amador consistent with the provisions of this Agreement.

2. Providers will be removed from the Approved Provider list whenever any one of the following occurs:

(a) The provider's certification is suspended or revoked by DHS, or

(b) The provider fails to meet the requirements outlined in the contractual agreement with Amador.

B. Amador shall develop and execute contracts with Approved Providers. Copies of the contracts shall be included with this document as Exhibit C.

C. By November 15, 2001, and annually thereafter, Amador will provide the

Approved Provider list to each customer receiving untreated water for human consumption from the Amador Canal-Ione Pipeline raw water system.

D. In the event that any provider loses its status as an Approved Provider, Amador will remove the unapproved provider from the list of Approved Providers. In addition, Amador will, within 30 days of being notified by the DHS, contact all of the above-referenced customers who are utilizing the unapproved provider. These customers will have 30 days to enter into arrangements with one of the remaining Approved Providers to supply alternative water for drinking and cooking purposes. Any such customer failing to transfer its alternative water service to one of the remaining Approved Providers or failing to purchase treated water at the Tanner Water Treatment Plant within the 30-day grace period will be subject to the termination of water service by Amador.

VI. OPERATIONS MANUAL - DEVELOPMENT AND COMPLETION MILESTONES.

A. Amador shall prepare an Operations Manual ("Operations Manual"). The Operations Manual shall contain, at a minimum:

1. A description of the processes that Amador is utilizing to track all of the locations at which Amador's untreated water from the Amador Canal-Ione Pipeline raw water system may be used for human consumption.

2. A description of Amador's process for handling theft of water.

3. A procedure for assuring that no new customers receive untreated water

from the Amador Canal-Ione Pipeline raw water system for human consumption.

4. A procedure for removing any unauthorized connections to the Amador Canal or Ione Pipeline raw water system.

5. A procedure for tracking customer changes for a premise, including changes in tenants at rental properties.

6. A procedure for receiving information from water haulers.

7. Procedures for enforcement of the requirements to obtain water from an Approved Provider, consistent with the terms of this Agreement.

8. Procedures for maintaining records that, upon audit, will verify that customers who do not obtain water from an Approved Provider continuously obtain an adequate supply of water from a well or a POE, or at Amador's Tanner Water Treatment Plant.

9. A description of Amador's process for dealing with customers who fail to pay for alternative water.

10. A procedure describing Amador's approval, maintenance, operation, and performance testing of POE treatment systems in conformance with DHS's "Requirements for Point of Entry (POE) Systems on Constructed Conveyance Water Systems" (Exhibit A of this document).

B. Amador shall update the plan as required by the DHS to include other items appropriate for inclusion in the Operations Manual.

C. By June 30, 2002, Amador will provide DHS with a draft of the

Operations Manual for review.

D. Within 30 days of receiving comments from the DHS on the draft Operations Manual, Amador will finalize the Operations Manual.

E. Amador will request the assistance and the cooperation of the Amador County Building, Planning, and Environmental Health Departments in determining unauthorized connections and in precluding any new service connections that provide water for human consumption in the Amador Canal-Ione Pipeline raw water system service area without an approved source of potable water. Approved sources of water for new services shall be limited to a potable water supply well approved for domestic use by the Amador County Department of Environmental Health or a potable water service from one of Amador's domestic water supply systems that is permitted by DHS. No new service connections involving human consumption shall be established with POE treatment of raw water from the Amador Canal-Ione Pipeline raw water system as a source of water for human consumption.

VII. PERIODIC NOTIFICATION

A. Amador will notify all of its customers along the Amador Canal-Ione Pipeline raw water system who receive untreated water that such water is suitable for irrigation and stock watering purposes only and does not meet State or Federal drinking water standards for "human consumption".

1. The notice will inform customers that they must use approved hauled or bottled water for "human consumption" in order to protect their

health, unless they use an approved POE, that is operated, maintained, and monitored by Amador, or a potable water supply well approved by the Amador County Department of Environmental Health, or purchase treated water at the Tanner Water Treatment Plant.

2. The notice will be mailed to all customers at least quarterly.

3. The notice will inform property owners of their responsibilities to warn any tenant, guest or subsequent owner that the untreated water is not fit for human consumption.

B. By October 1, 2001 and each year thereafter, Amador will provide all of its customers along the Amador Canal-Ione Pipeline raw water system who receive untreated water with the following notification relevant to the health risks associated with the use of such water:

The water provided through your service connection by the Amador Water Agency is raw water that has received no treatment whatsoever. That means that it is probably not safe for domestic uses, including drinking, cooking, oral hygiene, and other typical household uses of water to support human life and to maintain human hygiene. The water may contain contaminants, including bacteria, viruses, parasites and other pathogenic organisms, that can cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and associated headaches and fatigue. These symptoms, however, are not just associated with disease-causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water.

State and Federal law mandate that customers receiving raw water must also be provided with alternate water that meets Safe Drinking Water Act health standards for drinking and cooking. This alternate water may be bottled water or hauled bulk treated water that is provided by a vendor licensed by the Food and Drug Branch of the California Department of Health Services. The alternate water may also be obtained from an approved Point Of Entry (POE) water treatment system that is approved by the Amador Water Agency and is operated, maintained, and monitored by the Amador Water Agency, or

the alternate water may be treated water purchased at the Amador Water Agency's Tanner Water Treatment Plant at Sutter Hill.

The law does not mandate that alternate water be provided for domestic (common household human consumption) uses other than drinking and cooking, such as oral hygiene, ice preparation, bathing, dish washing, irrigating or cleaning wounds, and food preparation including washing fruits and vegetables and meat products. However, that does not mean that there is no risk of illness or disease from untreated water used for these purposes. Therefore, you need to be aware that these uses can also cause disease if pathogens are present in the water. The adverse effects are typically more severe in infants, the elderly, and those with compromised immune systems and life threatening illnesses. To reduce your risk, you should:

- use the alternate source for oral hygiene, ice preparation, irrigating or cleaning wounds, and when washing any food that will not subsequently be cooked;
- avoid getting any raw water in your mouth when bathing or showering; and
- rinse dishes in the hottest water you can manage and do not use until they have been completely dried, either by the air or a clean towel.

Note that many home treatment units lack the technological features and reliability to assure that the treated water is consistently safe for domestic use. Therefore, when using a home treatment unit, make sure you understand how to maintain it so that it operates well and perform the required maintenance on it on schedule. If purchasing a unit, query the salesperson thoroughly to learn about reliability features and maintenance and how you can help ensure that the unit keeps your water safe.

VIII. COMPLIANCE WITH SAFE DRINKING WATER ACT RESPECTING UNTREATED WATER SERVICE FROM THE IONE PIPELINE

Amador will explore alternatives to eliminate untreated water service for customers that receive raw water for human consumption along the Amador Canal-Ione Pipeline raw water system. Amador will develop a plan which identifies all customers that receive raw water for human consumption from the Amador Canal-Ione Pipeline raw water system. The plan also shall:

1. Identify housing clusters and prioritize those areas with the greatest number of service connections in close proximity to each other.

2. Propose a piping plan that starts with the largest housing cluster and incorporates smaller housing clusters sequentially until all customers that receive raw water for human consumption from the Amador Canal-Ione Pipeline raw water system are provided treated potable water in lieu of untreated water.

Amador will document the economic feasibility of piping treated potable water to each group or cluster of customers that receive raw water for human consumption, since economic feasibility will be a determinant of the priority of extending potable water to such customers as the piping plan is developed. The use of money available through the Safe Drinking Water State Revolving Fund shall be one of the factors considered in determining the economic feasibility of piping treated potable water to customers that receive raw water for human consumption from the Amador Canal-Ione Pipeline raw water system.

Amador will update the economic assessment of the feasibility of providing treated potable water through a piped distribution system to customers that receive untreated water for human consumption from the Amador Canal-Ione Pipeline raw water system every 5 years or more frequently if new development warrants the extension of treated water service to such areas.

IX. NEW SERVICES AND CHANGE OF OWNERSHIP

A. No new connections for raw water service for human consumption from the

Amador Canal- Ione Pipeline raw water system will be permitted as the source of water for domestic purposes.

B. As treated water becomes available in areas where customers are receiving untreated water from the Amador Canal-Ione Pipeline system for human consumption and connecting to treated water mains is economically feasible for such customers, connection to the treated water main shall be required on a change of ownership; otherwise, service shall be terminated.

X. RECORD KEEPING.

A By August 1, 2002, Amador shall implement a recordkeeping procedure to ensure that all customers that receive raw water for human consumption from the Amador Canal-Ione Pipeline raw water system are receiving an approved alternative supply.

B. Amador shall maintain the following records at its central offices located at 12800 Ridge Road, Sutter Creek, CA 95685.

1. The list of customers that receive untreated water for human consumption identified in Article I of this Agreement and their alternative water supply.
2. All completed surveys generated pursuant to this Agreement.
3. The list of Approved Providers of alternative water for drinking and cooking purposes which is maintained pursuant to this Agreement.
4. Copies of all correspondence sent to customers for noncompliance and records of the date that the correspondence was sent.

5. Copies of all notices sent to customers warning them of the potential negative health effects from drinking untreated water.

6. Records indicating the dates of all phone/site visit contacts made as required by this Agreement.

7. Records of all service connections that have been terminated due to noncompliance ("Failures").

8. Records of all customers purchasing treated water at the Amador Tanner Water Treatment Plant indicating dates of purchase and quantities purchased by each such customer.

C. These records shall be updated on a quarterly basis and maintained for 5 years and shall be available for inspection by the DHS and the Amador County Department of Environmental Health.

D. On or before May 1 of each year, commencing in 2002, Amador will submit an annual report (for the previous year) to DHS that includes, but is not limited to, a summary of "Failures" that occurred during the year, the results of the annual survey (if required), a summary of the records listed in Article X, and such other documentation that DHS may need to assure itself that Amador's Amador Canal-Ione Pipeline raw water system has not become a public water system.

XI. AMADOR WATER SYSTEM TRANSMISSION PROJECT.

In the event that Amador constructs the Amador Water System Transmission Project ("AWSTP") to replace the Amador Canal, then the provisions herein that apply to connections

for untreated water service for human consumption from the Amador Canal-Ione Pipeline raw water system, including, but not limited to those provisions in Articles III, VIII, and IX, shall apply to those connections receiving water service from the AWSTP which had received untreated water service for human consumption from the Amador Canal.

XII. NON-INTERFERENCE WITH CONTRACTUAL RELATIONSHIPS.

Nothing in this Agreement shall interfere with rights of Approved Providers to enter into independent water supply contracts with Amador's customers that receive untreated water for human consumption. All costs of obtaining alternative water shall be the responsibility of each of the customers that receives untreated water for human consumption.

XIII. TERMINATION.

Either Amador or DHS may terminate this Agreement by providing thirty days' written notice.

XIV. SEVERABILITY.

The requirements of this Agreement are severable, and the parties shall comply with each and every provision thereof, notwithstanding the effectiveness of any provision.

XV. EFFECTIVE DATE.

The effective date of this Compliance Agreement shall be the date on which this Agreement is fully executed.

CALIFORNIA DEPARTMENT HEALTH SERVICES

Date: 7-30-01

By: _____

Name: Richard L. Haberman, P.E., Chief
Title: Central California Region
Southern California Branch
Drinking Water Field Operations

AMADOR WATER AGENCY

Date: July 12, 2001

By: _____
Name: Heinz Hamann
Title: President, Board of Directors
Amador Water Agency

Attest: July 12, 2001

By: _____
Name: Kimberly A. Toma
Title: Clerk, Board of Directors
Amador Water Agency

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Exhibit A

Requirements for Point of Entry (POE) Systems on Constructed Conveyance Water Systems (Irrigation Districts)

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1. INTRODUCTION

Effective August 6, 1998, revisions to the federal Safe Drinking Water Act (Section 1401(4)(A)) expanded the definition of a public water system (PWS). The new definition states that an entity delivering water to the public through a pipe or "constructed conveyance" is considered a PWS if 15 or more connections are receiving and using the water for domestic purposes. Such systems may apply for an exemption from the PWS classification by either supplying the customers with an alternative water supply or by installing and maintaining point-of-entry (POE) treatment devices approved by the Department. The agency operating the constructed conveyance system is responsible for delivering the alternative water and/or overseeing the maintenance and operation of POE devices.

The purpose of this document is to provide guidance for irrigation districts and other entities that have recently been included in this expanded definition of a PWS that may want to utilize POE devices to provide customers with "equivalent water" and thereby qualify for an exemption. This document does not provide guidance for agencies intending to receive an exemption by delivering an alternative water supply, such as bottled water or hauled water. These requirements are outlined in a separate document.

The U.S. Environmental Protection Agency (EPA) has published a guidance document, dated July 31, 1998, on the definition of a public water system under the 1996 Safe Drinking Water Act amendments. The EPA guidance document states that the words "equivalent level of public health protection" are meant to distinguish the situation of providers covered by this section from the situation of public water systems which must comply with all relevant aspects of the applicable regulations, including sampling and testing requirements and sometimes details of treatment. For example, a point-of-entry treatment device for filtration and disinfection might not comply with all requirements of relevant drinking water rules for monitoring, extent of surveillance of the disinfection process, and so forth. But, it would meet the "equivalent level of public health protection" intent of this section if the quality of the water it produces is similar to that from central filtration and disinfection. Thus, this guidance sets performance criteria, attempting to assure that the quality of the water that affected residential users receive will be similar to that from central treatment.

The Department believes that POE devices used in accordance with the criteria outlined in this document are capable of providing "equivalent water" to that provided by an approved public water supply treatment facility. However, it is the opinion of the Department that the use of POE device treatment systems by individual customers of a constructed conveyance system may not provide a continuous safe, potable supply of water due to in-appropriate operation and inadequate maintenance of these systems.

The Department will approve POE devices installed after July1, 1999 using the same procedures it currently uses for the approval of alternative treatment technologies. Existing POE devices will be evaluated following the criteria outlined in Section 2 of this

document. New POE devices which are identical to existing POE devices should not be installed at new locations without first complying with the criteria for "New POE Device Installations" as outlined in Section 4.

An irrigation district (ID) or other entity, including a third party consultant working with the constructed conveyance system, that is considering the use of POE devices by customers of their "constructed conveyance", should follow the guidance provided in this document. Prior to the Department's review of any new or existing POE devices, the constructed conveyance system should submit a plan to the Department indicating how the recommendations of these guidelines will be addressed.

2. CONSTRUCTED CONVEYANCE MONITORING AND OVERSIGHT REQUIREMENTS & RESPONSIBILITIES

The following general guidance applies to the constructed conveyance as a whole, and not specifically to individual POE devices.

2.1 System Responsibilities

Operators of constructed conveyance systems using POE devices are responsible for the following:

1. Ensuring that the devices installed have been reviewed by the Department.
2. Ensuring that the devices have been properly installed.
3. Ensuring that the devices are properly operating.
4. Conducting the recommended monitoring of the POE devices and constructed conveyance system.
5. Maintaining operation and maintenance records.
6. Maintaining records of the recommended monitoring results.
7. Providing the necessary annual report to the Department.
8. Providing education to customers on the operation of POE devices.
9. Ensuring that operators and maintenance workers who oversee the POE devices are properly trained.

2.2 Source Water Assessment

A source water assessment should be completed to assure that the constructed conveyance system, especially an agricultural ID, does not allow the blending of surface water with effluent from a wastewater treatment plant or any other significantly degraded water that would require additional treatment. This is especially important if the constructed conveyance is supplying water for domestic purposes.

2.3 Raw Water Monitoring Requirements

The monitoring guidance outlined in this section apply at the turnout to the constructed conveyance system and are not required monitoring of each individual POE device. The constructed conveyance operator responsible for the POE devices can use data from PWSs existing on the same constructed conveyance, provided the data is documented to be representative of the water being treated by the POE devices.

Turbidity - Turbidity should be monitored continuously and recorded by a data recorder at the turnout into the constructed conveyance. If water is added to the constructed conveyance at several points that results in significant changes in the constructed conveyance's raw water turbidity, monitoring at each of these points should be required.

Bacteriological water quality - Raw water total and fecal coliform density analysis should be performed weekly (MMO-MUG media should not be used).

Chemical and Radiological - Inorganic, organic, general mineral, general physical and radiochemical analyses should be conducted at the same frequency required of PWSs.

3. EXISTING INSTALLED POE DEVICE APPROVAL

The Department does not have the resources to review and approve all existing POE devices following the criteria outlined in Section 4 of this document. Therefore existing POE devices installed prior to July 1, 1999 can be considered as performing properly, provided the constructed conveyance system or a third party consultant acceptable to both the constructed conveyance system and the Department collects the data needed to document compliance with the performance criteria outlined below:

3.1 Membrane Filtration

All alternative technologies that use membranes and are currently approved by the Department have been assigned a 0.2 NTU performance standard. A 3-log *Giardia* removal credit will be granted to existing installed POE membrane devices if compliance with the 0.2 NTU turbidity performance standard is documented.

3.2 Bag and Cartridge Filtration

All alternative technologies that use bag and cartridge systems and are currently approved by the Department have been assigned a 0.2 NTU performance standard. A 1½-log *Giardia* removal credit will be granted to existing installed POE bag and cartridge devices if compliance with the 0.2 NTU turbidity performance standard is documented.

3.3 Media Filtration

Existing POE media filtration devices, including diatomaceous earth and other granular media filters, should meet a 0.3 NTU performance standard. This is the performance standard set under the Interim Enhanced Surface Water Treatment Rule. A 2-log *Giardia* removal credit will be granted to existing installed POE media filtration systems if compliance with the 0.3 NTU turbidity performance standard is documented.

3.4 Inactivation

Existing inactivation devices should be capable of achieving the needed contact time (CT) inactivation criteria for the removal system with which they are installed. Ultra-violet (UV) inactivation credit will only be granted for virus. No *Giardia* inactivation credit will be granted for UV systems at the present time. If it is not possible to determine UV virus inactivation credit for an existing installed system, weekly coliform samples should be collected from the treated water after the UV treatment process for 3 months to determine if the unit is operating properly. Coliform-free water is needed to confirm virus inactivation credit.

Due to the limited data used to support the approval process of existing installed POE devices, the Department recommends that additional log inactivation be provided by the inactivation system if at all possible. This can be done by adding contact time, increasing the chlorine residual, or both for systems using chlorine. Systems that cannot meet the above outlined performance criteria should be replaced with a new approved device. The homeowner should be advised of the problems associated with the existing POE device and be advised to use bottled water until improvements have been provided.

4. NEW POE DEVICE INSTALLATIONS

The Department's Surface Water Treatment Rule (SWTR) Committee will review and approve the treatment capability of proposed POE devices following the same process and procedures used to review and approve an alternative treatment technology system (Policy # 94-002). To conserve the Department's staff time required to complete a POE device review, the Department will not undertake a POE device review unless a constructed conveyance system has expressed a serious interest in the installation of the devices to be tested. Existing POE devices accepted under the criteria outlined in Section 3 should not be installed at new sites unless they have been evaluated for performance effectiveness using the criteria outlined in this section.

4.1 Treatment Performance Criteria

POE devices should be capable of achieving a total of 3-log *Giardia* cyst reduction and 4-log virus reduction. This level of treatment is consistent with the United States Environmental Protection Agency's (EPA) Surface Water Treatment Rule, promulgated in June 1989.

Appendix 3.3 – Ione WTP Backwash Water Reuse Project References

Ione WTP Backwash System Improvements Preliminary Design Technical Memorandum (Peterson, Brustad, Inc., 2014)

PETERSON . BRUSTAD . INC .
ENGINEERING . CONSULTING

Ione WTP Backwash System Improvements
Preliminary Design

Amador Water Agency *March 28, 2014*

Prepared by: **Dave Murbach**

Reviewed by: **Karl Brustad**

Purpose

The Ione Water Treatment Plant (WTP) has two key issues that require improvements:

- increased fees for discharging backwash water to the sewer are driving the need to reduce the volume of backwash waste being disposed into the sewer
- additional treatment capacity is needed to meet near future demand increases and to provide redundant filter capacity per the California Department of Public Health's request

The purpose of this Technical Memorandum (TM) is to address the first issue – reduce the volume of backwash waste discharged to the sewer. A second TM will be developed to address the additional treatment capacity requirements for the Ione WTP.

This TM will evaluate options to provide backwash recycling and will provide analysis of these options based on their technical merits, impacts to the limited space on the site, relative operations & maintenance costs, and estimated construction costs. Flow schematics and site layouts will be presented for each of the options evaluated.

Background

The Ione WTP is a conventional water treatment facility that includes flocculation, clarification, filtration and disinfection. Raw water is delivered in a pipeline from the Tanner WTP. Hydroclear 860 (a proprietary combination of polymer and aluminum chlorohydrate, ACH) is added to the raw water as a flocculant aid along with lime (for pH control) and sodium hypochlorite (for disinfection). The WTP has one 230,000 gallon clarifier and four dual-media (sand and granular activated carbon) filters each with a surface area of 120 square feet. Filtered water is disinfected in the 730,000 gallon baffled clearwell before exiting to the distribution system.

The backwash waste produced from each of the four filters is approximately 25,000 gallons. Since the filters are typically backwashed in pairs, approximately 50,000 gallons of waste is produced during each backwash cycle. Based on our review of the WTP's production data from 2011-2013, the filters are

backwashed every 24 to 48 hours. According to Agency staff the backwashes of the two pairs of filters are evenly spaced; thus, one pair of filters is backwashed every 18 hours for a 36 hour backwash frequency.

The pipeline that delivers water to the Ione WTP was installed in 2007 replacing the remainder of the original ditch supply system. The completion of this pipeline has allowed low turbidity water to be consistently supplied to the WTP, averaging between 0.6 and 1.0 NTU each month from 2011-2013. The maximum turbidity reported from 2011-2013 was 2.6 NTU in August 2011. Table 1 presents the average monthly water production and raw water turbidity throughout the year based on the WTP operating records from 2011-2013. The table also presents the average Hydroclear 860 dose for each month and the calculated solids production – based on the water production, raw water turbidity, and dosing data.

Table 1. Ione WTP Production Data, 2011 through 2013

Month	Average Daily Production (mgd)	Average Raw Water Turbidity (NTU)	Average HC 860 Dose (mg/L)	Average Solids Production (lb/day)
January	0.94	0.80	2.9	18
February	0.95	0.73	2.8	17
March	0.98	0.87	3.0	20
April	1.20	1.03	3.1	27
May	1.60	1.00	3.2	36
June	1.66	0.90	2.9	34
July	1.94	0.77	2.9	37
August	1.89	0.77	2.9	36
September	1.69	0.57	1.8	22
October	1.23	0.57	2.6	19
November	0.95	0.53	2.6	15
December	0.93	0.83	2.9	18
Annual Average	**1.4**	**0.8**	**2.8**	**26**
Maximum Observed During Period	**2.2**	**2.6**	**7.6**	**--**

Filter backwash water is discharged into a 95,000 gallon Backwash Waste Tank (BWT). The BWT is drained into the City of Ione's sewer collection system, which limits the discharge rate to about 130 gpm. Therefore, it currently takes about 6 hours to drain each 50,000 gallon backwash cycle to the sewer.

Jar Test Results

Agency staff performed jar tests to simulate settling of the solids in the BWT. The purpose of the test was to determine if the backwash water could settle in the BWT to produce a turbidity level acceptable for recycling the water to the WTP. Two sources of water were used for these tests:

- Filter backwash trough – composite sample during filter backwash
- BWT – while filling due to filter backwash

The jar tests were performed at various Hydroclear 860 doses (0, 5, 10, and 20 mg/L) and settling times (0, 3, 6, and 24 hours). At the end of the settling time, a sample was taken from the top of the container and tested for turbidity. The maximum turbidity allowed for recycled water by the California Department of Public Health (CDPH) is 2 NTU. Table 2 presents the results of these jar tests. Based on the jar test results in Table 2, a settling time of 6 hours coupled with a dose of 5 mg/L should produce recycled water with an acceptable turbidity level.

Table 2. Backwash Waste Settling Time Jar Test Results

Source: Backwash Waste Tank				
Dose (mg/L)	Settling Time (hours)			
	0	3	6	24
	Turbidity (NTU)			
0	51.7	2.50	1.70	0.62
5		0.90	0.88	0.20
10		2.60	1.80	0.35
20		1.80	1.60	0.25
Source: Filter Backwash Trough				
Dose (mg/L)	Settling Time (hours)			
	0	3	6	24
	Turbidity (NTU)			
0	16.0	4.0	1.94	0.50
5		3.0	1.0	0.33
10		3.9	2.0	0.84
20		4.5	3.0	1.0

Description of Alternatives

Four alternatives were identified to recycle the backwash waste water at the Ione WTP and reduce the volume discharged to the sewer:

- Decant BWT
- Filter Backwash Waste
- Decant BWT and New Tank
- Provide Sludge Thickening

A description of each alternative is presented below. All alternatives will be subject to the CDPH requirements for recycled water that limit the flow to 10% of the WTP production and require the turbidity of the recycled water to be less than 2 NTU.

Decant BWT

Backwash waste from top of existing BWT will be decanted with a floating decanter and pumped back to the raw water line ahead of chemical addition. Figure 1 presents a flow schematic that shows the new piping, equipment and instrumentation to integrate this alternative into the existing water treatment process. This alternative requires modification to the interior of the existing tank to add decant piping and direct the existing inlet upwards to minimize disturbance of settled solids. To construct these improvements, temporary tankage will be provided during construction.

Per the jar testing results presented in Table 2, coagulant addition is required to provide settling in a 6 hour period. Table 3 presents an analysis of the time required to decant the backwash water between filter backwashes while maintaining the 10% flow limit.

Table 3. Decant Recycle Time Compared to Filter Run Time

Operating Parameters	Filter Run Time		
	48 Hours	**36 Hours**	**24 Hours**
Minimum WTP Production	1.0 mgd	1.5 mgd	2.0 mgd
Backwash Volume/Frequency	50,000 gal every 24 hours	50,000 gal every 18 hours	50,000 gal every 12 hours
Recycle Pumping Rate	70 gpm	105 gpm	140 gpm
Time to Settle before Draining	6 hours	6 hours	6 hours
Time to Drain	12 hours	8 hours	6 hours
Total Time to Recycle	**18 hours**	**14 hours**	**12 hours**
Total Time Available Between Backwashes	**24 hours**	**18 hours**	**12 hours**

This alternative will concentrate the solids in the bottom of the 4 ft of the BWT. This method of concentrating solids typically produces a sludge concentration of 1-3%. This volume could be discharged to the sewer on a regular basis if desired. However, the bottom 4 ft of the BWT has the ability to hold up to 1,100 lbs of 1% sludge, which is equivalent to 42 days at current water production rates.

Table 3 shows that the total time required to decant and recycle each backwash is less than or equal to the time available between backwashes. Therefore, this alternative is a viable option and will be evaluated as Alternative 1.

Filter Backwash Waste

Backwash waste will be treated using the Agency's existing pressure filter. Backwash waste will be pumped from the BWT through the filter and return the treated water to the raw water line ahead of chemical treatment. Figure 2 presents a flow schematic that shows the new piping, equipment and instrumentation needed to integrate this alternative into the existing water treatment process. This alternative requires a pump station, filter, filter media, and filter aid feed equipment as well as filter backwash equipment. To minimize the amount of solids that are placed on this filter, it is recommended that this alternative include the decanting improvements to the interior of the BWT proposed in Alternative 1. Note that the backwash waste from the new filter will be returned to the BWT tank and solids will accumulate and be disposed of similar to Alternative 1.

Since the jar test results have shown that decanting the recycled water from the BWT will produce water with turbidity levels less than 2.0 NTU, the addition of the filter treatment provides redundancy and is a viable option. Therefore, this alternative is a viable option and will be evaluated as Alternative 2.

Decant BWT and New Tank

This alternative is nearly identical to Alternative 1, but provides additional settling time in a second backwash waste tank. Since the jar test results and the analysis presented in Table 3 show that the volume provided by the existing BWT is sufficient to produce recyclable water, this alternative will not be

evaluated further in this TM. This alternative will be considered again in the Ione WTP capacity expansion preliminary design TM.

Provide Sludge Thickening

This option uses a plate settler to thicken the sludge prior to disposal in the sewer. Figure 3 presents a flow schematic that shows the new piping, equipment and instrumentation needed to integrate this alternative into the existing water treatment process. In addition to the plate settler, two pump stations will be required: one to deliver backwash waste to the plate settler and a second to return the treated backwash water into the raw water pipeline. This alternative does not require the interior BWT improvements utilized in Alternatives 1 and 2 since the plate settler will separate and dispose of the solids to the sewer. This alternative will be evaluated as Alternative 3.

Evaluation of Alternatives

Three of the alternatives described above will be evaluated further to determine the preferred alternative. Figures 4, 5, and 6 provide the proposed site layout for each of these alternatives. Table 4 presents a summary of the estimated construction costs for the three alternatives. Detailed cost estimates for the three alternatives are presented in Attachment 1.

Table 4. Summary of Alternative Construction Costs

Estimated Construction Cost	Alternative 1	Alternative 2	Alternative 3
	$ 157,000	$ 273,000	$ 346,000

Table 5 presents a summary of the alternatives evaluation for backwash recycling improvements at the Ione WTP.

Table 5. Backwash Recycling Alternatives Evaluation

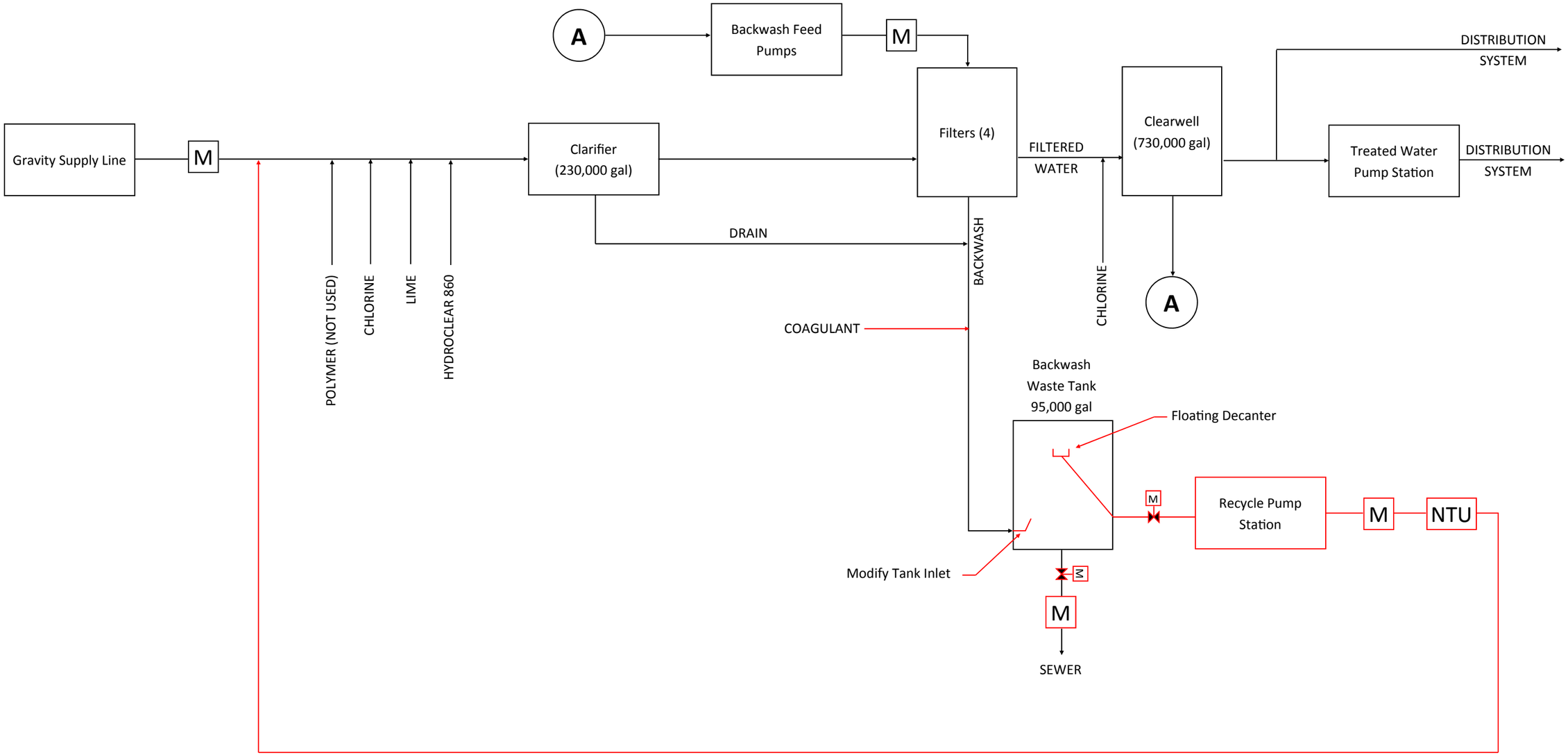
Issue	Alternative 1	Alternative 2	Alternative 3
Backwash Waste Volume Reduction	90%	95%	95%
Construction Cost	Lowest	Middle	Highest
Relative Operating Costs and Requirements	Low – requires operation of pump station and chemical feed system	High - requires operation of pump station, chemical feed system, filter, and filter backwash system	High - requires operation of two pump stations, chemical feed system, and plate settler
Construction Time	4-6 months	4-6 months - assuming filter installation concurrent with decanting system and pump station	6-9 months – includes 3 month lead time for delivery of plate settler
Impact on WTP Site for Future Expansion	No additional equipment installed at upper site	Equipment installed at upper site, eliminating space east of existing filters for WTP expansion	Equipment installed at upper site, eliminating space east of existing filters for WTP expansion

Recommendation

Based on the evaluation presented in Table 5, Alternative 1 provides the lowest capital and operating costs, the shortest construction schedule, and causes the least impact to the WTP site for the future capacity expansion. Therefore, Alternative 1 is the recommended alternative for the backwash system improvements.

Attachment 1.
Ione WTP Construction Cost Estimates
Backwash Recycling Alternatives

Description	Unit Cost	Unit	Alternative 1		Alternative 2		Alternative 3	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
BWT Modifications	$ 10,000	LS	1	$ 10,000	1	$ 10,000	-	$ -
Filter Installation	$ 45,000	EA	-	$ -	1	$ 45,000	-	$ -
Filter Media	$ 20,000	EA	-	$ -	1	$ 20,000	-	$ -
Floating Decanter	$ 5,000	EA	1	$ 5,000	1	$ 5,000	-	$ -
Recycle Pumps	$ 4,000	EA	3	$ 12,000	3	$ 12,000	6	$ 24,000
Backwash Pump	$ 12,000	EA	-	$ -	1	$ 12,000	-	$ -
Chemical Feed System	$ 25,000	LS	1	$ 25,000	1	$ 25,000	1	$ 25,000
Piping and Valves	$ 15,000	LS	1	$ 15,000	2	$ 30,000	2	$ 30,000
Automated Valve	$ 2,500	EA	2	$ 5,000	2	$ 5,000	1	$ 2,500
Plate Settler	$ 125,000	EA	-	$ -	-	$ -	1	$ 125,000
Flowmeter	$ 7,500	EA	2	$ 15,000	1	$ 7,500	3	$ 22,500
Turbidimeter	$ 7,500	EA	1	$ 7,500	1	$ 7,500	1	$ 7,500
Electrical/Instrumentation	25%	EQPT	1	$ 16,125	1	$ 28,500	1	$ 51,625
Tank Rental	$ 20,000	LS	1	$ 20,000	1	$ 20,000	-	$ -
			Subtotal	$ 130,625		$ 227,500		$ 288,125
Contingency	20%	SUBTOTAL		$ 26,125		$ 45,500		$ 57,625
			Total	**$ 156,750**		**$ 273,000**		**$ 345,750**

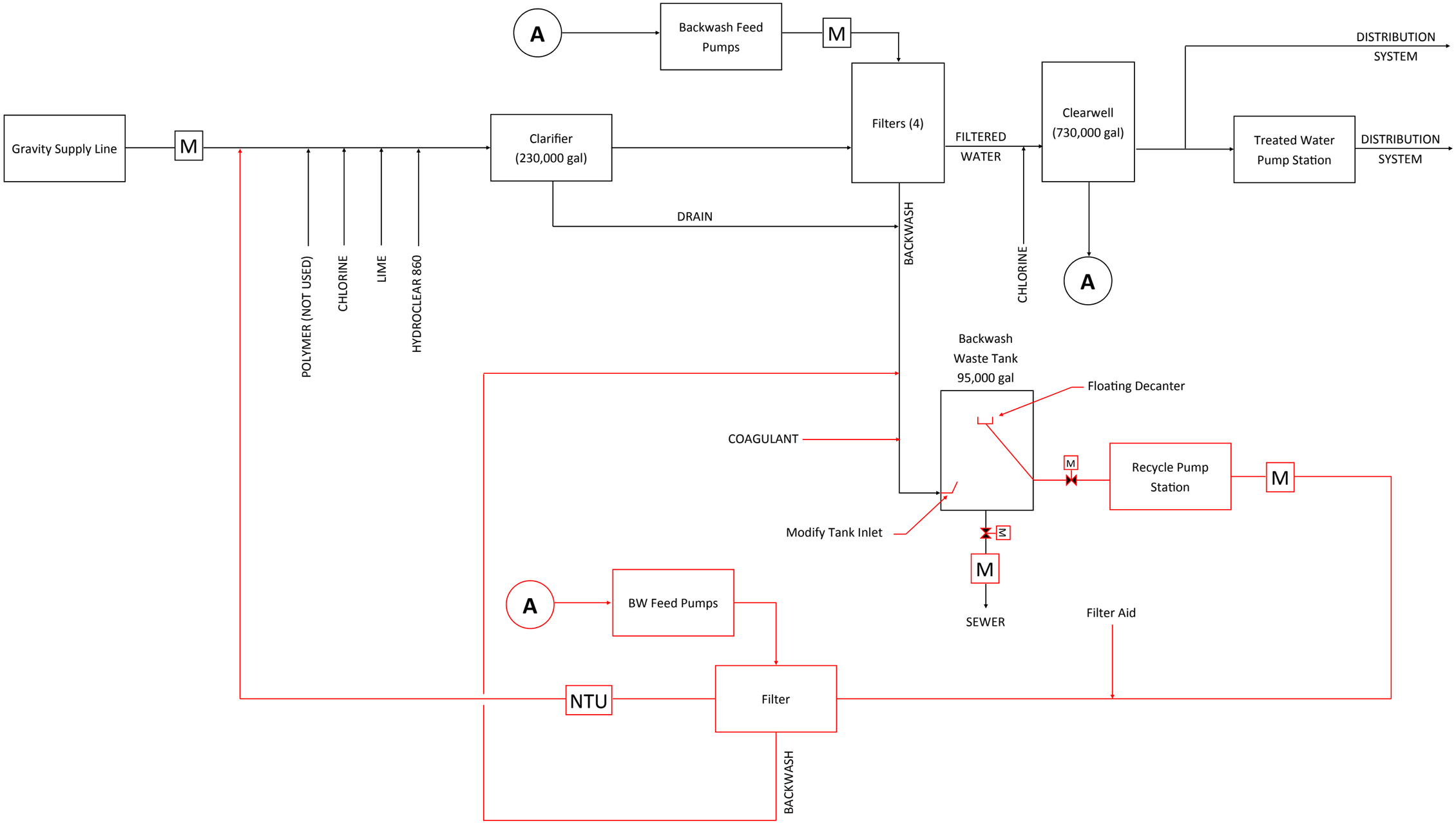


LEGEND:

Existing Equipment

New Equipment

Figure 1.
Ione WTP Flow Schematic
Alternative 1

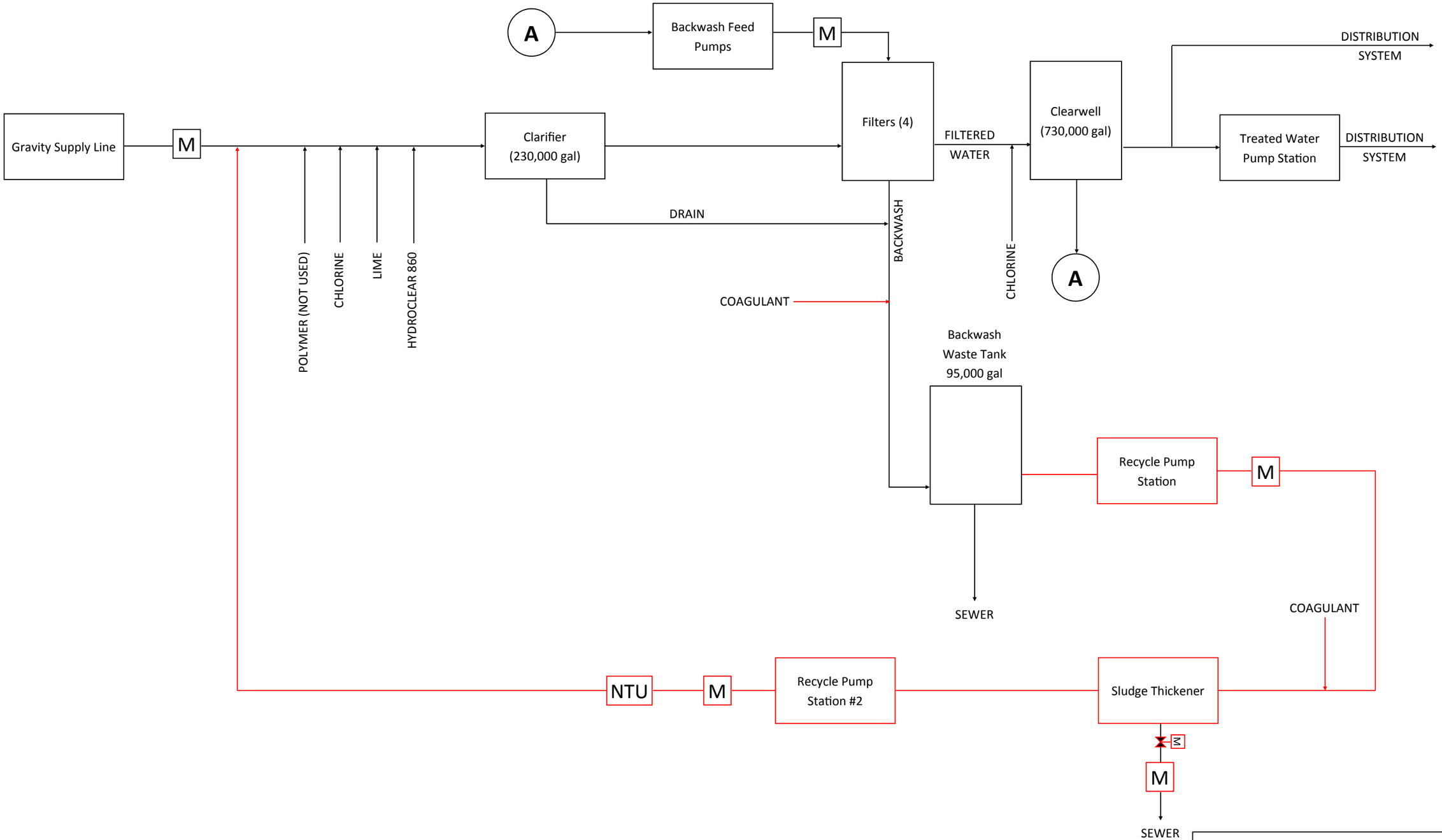


LEGEND:

Existing Equipment

New Equipment

Figure 2.
Ione WTP Flow Schematic
Alternative 2



LEGEND:

Existing Equipment

New Equipment

Figure 3.
Ione WTP Flow Schematic
Alternative 3

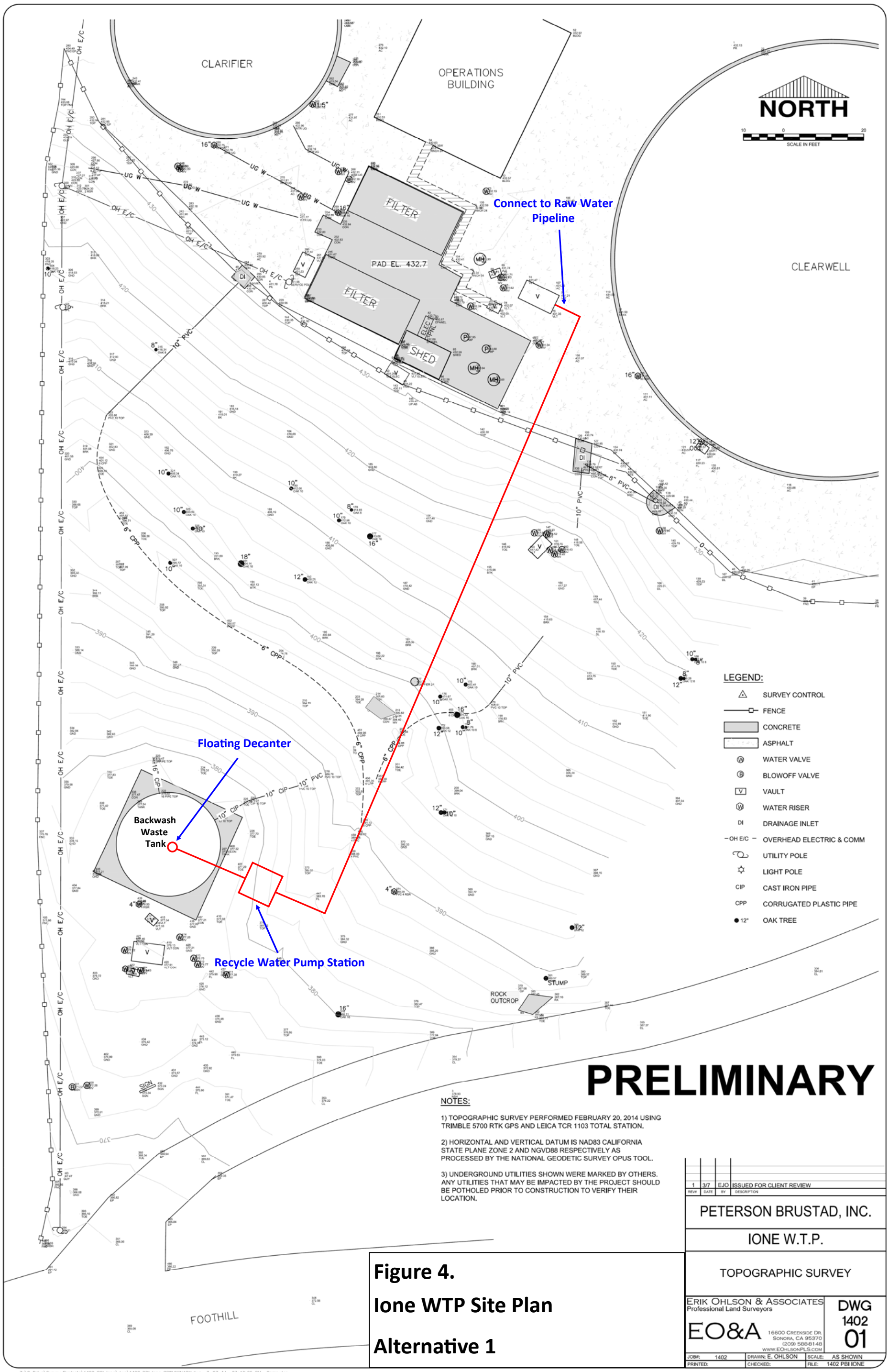


Figure 4.

Ione WTP Site Plan

Alternative 1

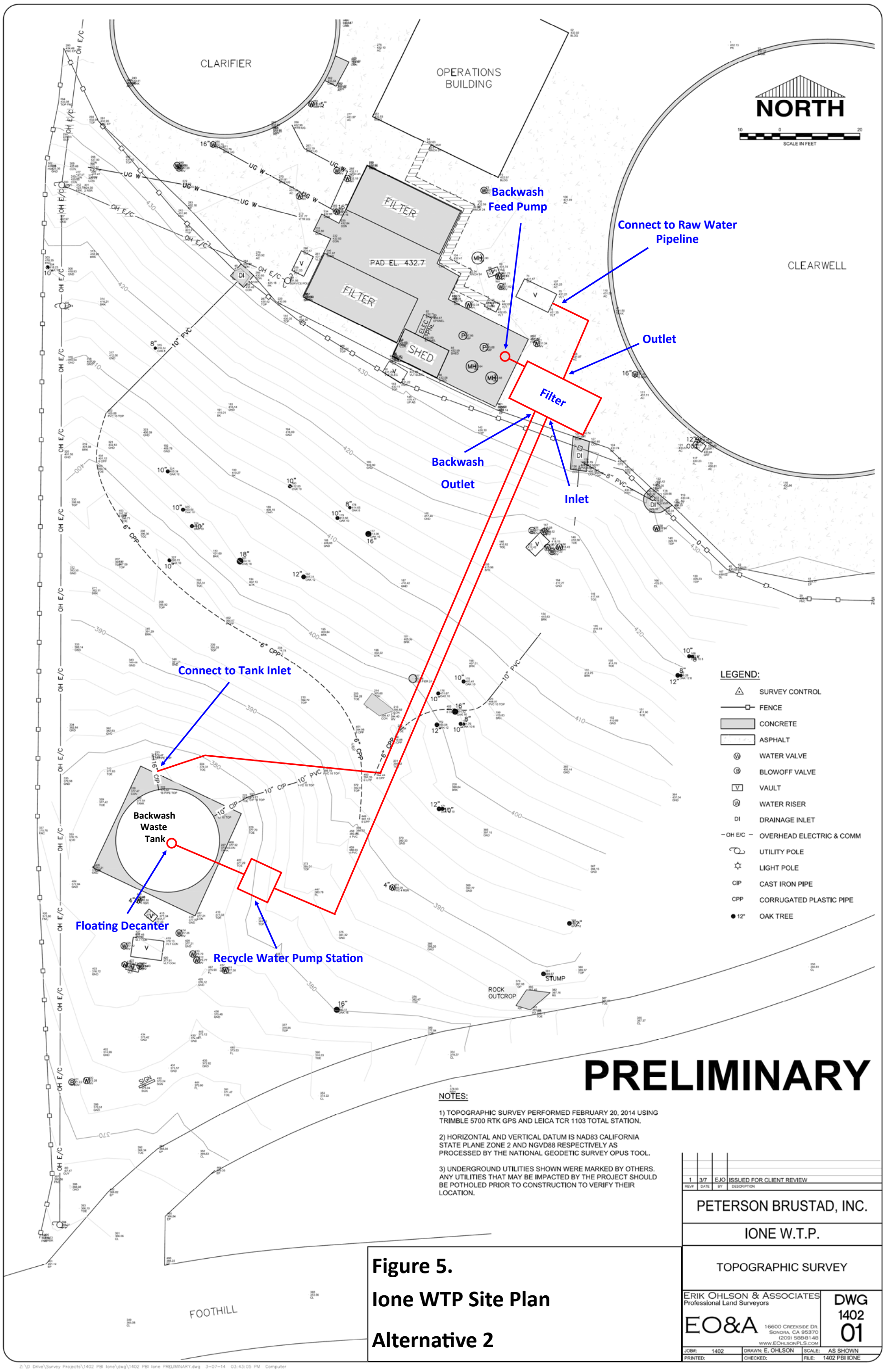


Figure 5.

Ione WTP Site Plan

Alternative 2

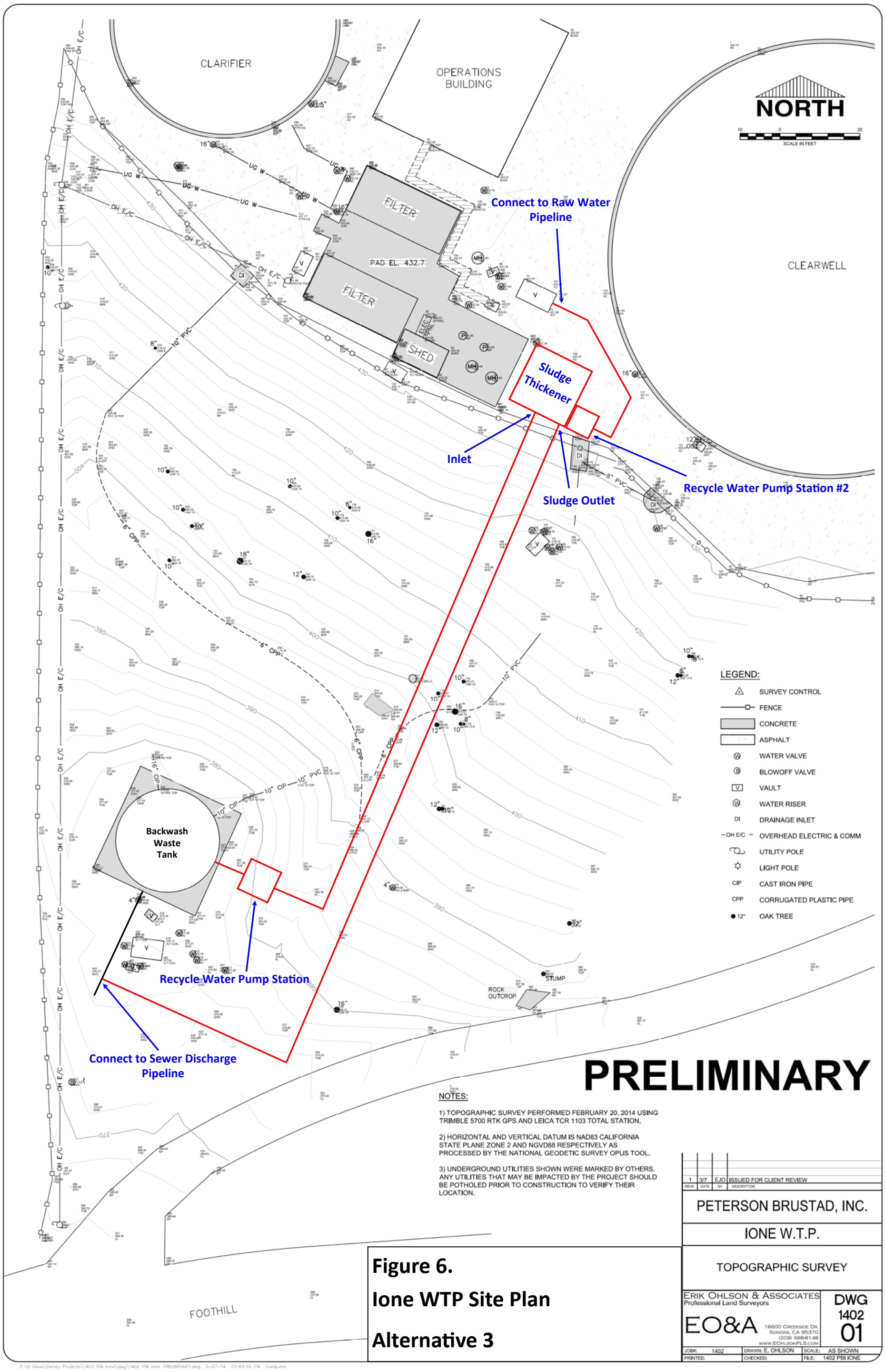


Figure 6.

Ione WTP Site Plan

Alternative 3

Responses to Review Comments

The written response to each of the Amador Water Agency comments is presented in bold text after each comment. A revised evaluation and recommendation are presented at the end of the responses to review comments.

Comments from Chris McKeage

1. With discharge to Ione WWTP still available, consider option 1. Run system for 3 months. May have to discharge 25% to the City. Then consider further options.

   Response: Noted.

2. Could plate settler be located lower than the BW tank and eliminate the second pump station?

   Response: Yes, realigning the entrance road or moving the underground piping would allow the plate settler to be installed downhill of the existing BWT; however, the topography in the area would not allow the BWT to be completely emptied – leaving 5-10 ft in the tank. If we move forward with Alternative 3, we'll look into eliminating the pump station.

3. What is the cost and size of a 2nd tank?

   Response: A tank identical in size to the existing BWT would be about $150,000.

4. Have alternative polymers been considered? EID uses an anionic polymer for best settling.

   Response: The jar tests were performed only with the Hydroclear 860 currently used at the WTP. No other polymers were evaluated. Polymer optimization would occur during startup for each of the Alternatives. For Alternative 1, it is likely that performance would improve with a properly selected polymer. The analysis was based on the worst case performance of the HC 860.

Comments from Damon Wyckoff and George Barnes

5. Is there enough storage in the BW tank to deal with a filter failure that requires backwash of all four filters sequentially?

   Response: There is not enough storage in the BWT to backwash all four filters sequentially for any of the Alternatives evaluated. This is

also true for the existing system. The only option is to backwash three filters and operate the plant at ¾ capacity until the 4th filter can be backwashed. Today, the wait is about 3 hours (25,000 gallons discharged to the sewer at 130 gpm) to make space in the BWT to backwash the 4th filter. For Alternative 1, the wait would be about 9 hours and for Alternatives 2 and 3, the wait would only be about 3 hours.

6. How will the addition of 2 more filters at the Ione WTP effect the overall BW water return process? It appears some sort of BW tank remediation will be needed to address the additional BW water volume 2 new filters will bring.

   Response: An additional BWT tank will be required for the Phase 1/2 expansions of the WTP. Note also that new clarifiers will be required for the Phase 1 WTP expansion to 4.2 mgd. These new clarifiers should remove the bulk of the solids and should concentrate these solids to the same level as the plate settler being considered as Alternative 3. This will greatly reduce the solids loading on the filters (potentially lengthening filter runs) and reduce the amount of solids placed in the BWT, improving the performance of Alternative 1.

Comments from Joel Mottishaw

7. If we don't have a long term commitment from the City of Ione in regards to the cost per gallon of our backwash water, do any of the Alternatives allow for zero discharge to the sewer.

   Response: Alternatives 1 and 2 could eliminate day-to-day discharge to the sewer with truck pumping to clean out the tank every 1-3 months. Alternative 3 provides pretreatment for dewatering equipment for disposal of the solids to the landfill.

Comments from Doug Yardley

8. Ione WTP uses caustic soda and not lime for pH control. The filters are multimedia and not dual media using GAC, sand, garnet sand, and garnet gravel.

   Response: Noted.

9. Since the Ione WTP does not operate 24 hours per day, and the plant must be running to recycle BW water, alternative one will not work without installing a second tank. Table 3 shows the total time it takes to recycle BW water which

doesn't account for the time it takes to complete a filter backwash. Add an hour to each of those total times. In the winter the plant may only run 10 to 12 hours and in the summer it may only run 18 hours which will not be enough time to recycle.

Response: The total time to recycle is a function of the rate at which the decant water can be returned to WTP. Since the time between the filter backwashes is based on the actual run time (not "clock" time) the impact of running the WTP less than a full day is minimal. Table 3 is revised below. These are worst case conditions assuming one pair of filters is backwashed at the beginning of the operating day and the second pair is backwashed halfway through the filter run time. Depending on the actual backwash timing, the decant system will have a portion of its settling time occur while the WTP is off-line.

Also, as noted in the Response to Comment #6, the addition of new clarifiers in the Phase 1 expansion to 4.2 mgd will reduce the load on the filters, which should improve the performance of Alternative 1.

Revised Table 3. Decant Recycle Time Compared to Filter Run Time

Operating Parameters	Filter Run Time		
	48 Hours	**36 Hours**	**24 Hours**
Minimum WTP Production	1,000 gpm, 10 hours per day	1250 gpm, 15 hours per day	1750 gpm, 18 hours per day
Backwash Volume/Frequency	50,000 gal every 2.5 days	50,000 gal every day	50,000 gal every 12 hours
Recycle Pumping Rate	100 gpm	125 gpm	175 gpm
Backwash Time	1 hour	1 hour	1 hour
Time to Settle before Draining	6 hours	6 hours	6 hours
Time to Drain	8 hours	7 hours	5 hours
Total Time to Recycle	**15 hours (1.5 days)**	**14 hours**	**12 hours**
Total Time Available Between Backwashes	**2.5 days**	**1.2 day days**	**12 hours**

10. Alternatives 2 and 3 do not have to wait after each backwash to start treatment.

Response: This is true, but they cannot operate without the WTP being in service. These Alternatives provide an additional 6 hour buffer between backwashes when compared to Alternative 1.

Revised Evaluation of Alternatives and Recommendation

Evaluation of Alternatives

Table 4 presents a summary of the estimated construction costs for the three alternatives, which includes the cost of a second BWT for Alternative 1. While the second BWT is not necessarily required, it does provide the additional buffer time between backwashes similar to the other alternatives. Table 4 also includes the annual sewer discharge costs and labor effort along with their associated life cycle cost over 20 years. Power costs were assumed to be equal, although additional filter backwash pumping is required for Alternative 2.

Revised Table 4. Summary of Alternative Costs

Estimated Cost	Alternative 1		Alternative 2		Alternative 3	
Construction	$ 337,000		$ 273,000		$ 346,000	
Labor	Cost/Year	Life Cycle Cost	Cost/Year	Life Cycle Cost	Cost/Year	Life Cycle Cost
	$ 13,000 (1 hr/day)	$ 194,000	$ 33,000 (2.5 hr/day)	$ 484,000	$ 26,000 (2 hr/day)	$ 388,000
Sewer Discharge(1)	Cost/Year	Life Cycle Cost	Cost/Year	Life Cycle Cost	Cost/Year	Life Cycle Cost
	$ 13,000 (90% Red)	$ 194,000	$ 6,500 (95% Red)	$ 97,000	$ 6,500 (95% Red)	$ 97,000
Total Construction & Life Cycle Costs	**$ 725,000**		**$ 854,000**		**$ 831,000**	

(1) Based on one pair of filters being backwashed every 18 hours and a sewer disposal charge of $0.54 per 100 gallons ($270 per 50,000 gallons)

Table 5 presents a summary of the alternatives evaluation for backwash recycling improvements at the Ione WTP.

Revised Table 5. Backwash Recycling Alternatives Evaluation

Issue	Alternative 1	Alternative 2	Alternative 3
Backwash Waste Volume Reduction	90%	95%	95%
Construction Cost	$ 337,000 with second BWT $ 157,000 without new BWT	$ 273,000	$ 346,000
Life Cycle Costs for Labor and Sewer Discharge	$ 388,000	$ 581,000	$ 485,000
Relative Operating Costs and Requirements	Low – requires operation of pump station and chemical feed system	High - requires operation of pump station, chemical feed system, filter, and filter backwash system	Moderate - requires operation of pump station, chemical feed system, and plate settler
Construction Time	4-6 months without the new BWT 9 months with second BWT	4-6 months - assuming filter installation concurrent with decanting system and pump station	6-9 months – includes 3 month lead time for delivery of plate settler
Impact on WTP Site for Future Expansion	No additional equipment installed at upper site	Equipment installed at upper site, eliminating space east of existing filters for WTP expansion	Equipment could be installed at BWT site, saving space east of existing filters for WTP expansion

Recommendation

Based on the evaluation presented in Table 5, Alternative 1 provides the opportunity for lowest capital and operating costs and the shortest construction schedule – if the decant system can be optimized to eliminate the need for a second BWT. Even if a second BWT is required, Alternative 1 provides the lowest overall construction and life cycle cost of the three alternatives. Therefore, Alternative 1 is the recommended alternative for the backwash system improvements – with initial construction of the decant system and recycle pump station only.

Attachment 1.
Ione WTP Construction Cost Estimates
Backwash Recycling Alternatives

Description	Unit Cost	Unit	Alternative 1		Alternative 2		Alternative 3	
			Quantity	Cost	Quantity	Cost	Quantity	Cost
BWT Modifications	$ 10,000	LS	1	$ 10,000	1	$ 10,000	-	$ -
Additional BWT	$ 150,000	EA	1	$ 150,000	-	$ -	-	$ -
Filter Installation	$ 45,000	EA	-	$ -	1	$ 45,000	-	$ -
Filter Media	$ 20,000	EA	-	$ -	1	$ 20,000	-	$ -
Floating Decanter	$ 5,000	EA	1	$ 5,000	1	$ 5,000	-	$ -
Recycle Pumps	$ 4,000	EA	3	$ 12,000	3	$ 12,000	6	$ 24,000
Backwash Pump	$ 12,000	EA	-	$ -	1	$ 12,000	-	$ -
Chemical Feed System	$ 25,000	LS	1	$ 25,000	1	$ 25,000	1	$ 25,000
Piping and Valves	$ 15,000	LS	1	$ 15,000	2	$ 30,000	2	$ 30,000
Automated Valve	$ 2,500	EA	2	$ 5,000	2	$ 5,000	1	$ 2,500
Plate Settler	$ 125,000	EA	-	$ -	-	$ -	1	$ 125,000
Flowmeter	$ 7,500	EA	2	$ 15,000	1	$ 7,500	3	$ 22,500
Turbidimeter	$ 7,500	EA	1	$ 7,500	1	$ 7,500	1	$ 7,500
Electrical/Instrumentation	25%	EQPT	1	$ 16,125	1	$ 28,500	1	$ 51,625
Tank Rental	$ 20,000	LS	1	$ 20,000	1	$ 20,000	-	$ -
			Subtotal	$ 280,625		$ 227,500		$ 288,125
Contingency	20%	SUBTOTAL		$ 56,125		$ 45,500		$ 57,625
			Total	**$ 336,750**		**$ 273,000**		**$ 345,750**

60% design cost estimate for the project (June 2014)

Engineer's Construction Cost Estimate (60 Percent Design)
Amador Water Agency Backwash Recycling Project

Estimated By: DMM
Date: 6/27/2014
Reviewed By: KBB
Date:

Description	Quantity	Units	Unit Cost		Subtotal Rounded
Division 1 - GENERAL REQ.					
Mobilization, demobilization, Insurance, & Bonds	1	LS	5.0%	$ 22,250	
Storm Water Pollution Prevention	1	LS	0.5%	$ 2,225	
Worker Safety	1	LS	0.5%	$ 2,225	
Environmental Compliance / DPH Reqts	1	LS	0.3%	$ 1,335	
Subtotal					**$ 28,000**
Division 2 - SITE WORK					
Earthwork - No Excav. Difficulty	100	CY	$25	$ 2,500	
Fill placement and compaction	100	CY	$10	$ 1,000	
Paving and Surfacing	400	SF	$15	$ 6,000	
Security Fencing	120	LF	$50	$ 6,000	
Gate	1	EA	$1,000	$ 1,000	
Piping	1	LS	$30,000	$ 30,000	
Subtotal					**$ 47,000**
Division 3 - CONCRETE					
Tank Foundation	70	CY	$500	$ 35,000	
Equipment Pads	5	CY	$350	$ 1,750	
Subtotal					**$ 37,000**
Division 11 - EQUIPMENT					
Backwash Waste Tank	1	EA	$150,000	$ 150,000	
Modify Existing BWT	1	LS	$10,000	$ 10,000	
Floating Decanter	2	EA	$5,000	$ 10,000	
Recycle Pumps	3	EA	$4,000	$ 12,000	
Chemical Feed System	1	EA	$25,000	$ 25,000	
Automated Valves	6	EA	$2,500	$ 15,000	
Backwash Pump*	1	EA	$60,000	$ 60,000	
Subtotal					**$ 282,000**
Division 13 - INSTRUMENTATION					
Flowmeter	2	EA	$7,500	$ 15,000	
Tank Level	2	EA	$4,000	$ 8,000	
Turbidimeter	1	EA	$2,500	$ 2,500	
Flow Switch	1	EA	$1,500	$ 1,500	
Tanks Level Switches	4	EA	$750	$ 3,000	
Controls/SCADA	1	LS	10.0%	$ 28,200	
Subtotal					**$ 58,000**
Division 16 - ELECTRICAL					
General Site Work	1	LS	7.5%	$ 21,150	
Subtotal					**$ 21,000**
SUBTOTAL					**$ 473,000**
Contingency	20%	%			**$ 95,000**
Construction Cost Estimate					**$ 568,000**

AWA 2010 UWMP

Amador Water Agency 2010 Urban Water Management Plan

September 2011
(Updated 2014)

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List of Abbreviations

AF	Acre-feet
AFY	Acre-feet per year
Agency	Amador Water Agency
ARSA	Amador Regional Sanitation Agency
AWS	Amador Water System
CAWP	Central Amador Water Project
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CII	Commercial, Industrial, and Institutional
DHS	California Department of Health Services
DMM	Demand Management Measure
DWR	California Department of Water Resources
EBMUD	East Bay Municipal Utility District
edu	Equivalent Dwelling Unit
EID	El Dorado Irrigation District
EIR	Environmental Impact Report
ETo	Reference EvapoTranspiration
gpcd	gallons per capita day
gpd	gallons per day
gpm	gallons per minute
HEWM	High Efficiency Washing Machine
ID	Improvement District
IRWMP	Integrated Regional Water Management Plan
mgd	Million gallons per day
NPDES	National Pollutant Discharge Elimination System
PG&E	Pacific Gas and Electric
ULFT	Ultra-Low-Flush Toilet
UWMP	Urban Water Management Plan
WWID	Wastewater Improvement District

Chapter 1 Plan Preparation

1.1 Introduction

This Urban Water Management Plan ('UWMP') has been prepared in accordance with the Urban Water Management Act ('Act'). The Act is defined by the California Water Code, Division 6, Part 2.6, and §§10610 through §§10657. The Act became part of the California Water Code with the passage of Assembly Bill 797 during the 1983-1984 regular session of the California legislature. The Act requires urban water suppliers providing municipal water to more than 3,000 connections or supplying more than 3,000 ac-ft of water annually to adopt and submit a plan every five years to the California Department of Water Resources (DWR). Subsequent assembly bills have amended the Act. In complying with the Act, the DWR Guidebook to Assist Urban Water Suppliers has been followed, as shown in the comprehensive checklist found in Appendix B . This 2010 UWMP provides an update to the 2005 UWMP.

Amador Water Agency ('Agency') provides potable and raw water to more than 25,000 people for municipal, industrial, and irrigation uses as well as wastewater collection and treatment services to meet the needs of our customers. While demands for Agency water have flattened during this recession, the Agency intends to use this UWMP to manage the Agency's water supplies and water demands over a range of normal and emergency conditions.

The Agency is committed to maximizing available water resources and minimizing the need to obtain additional water supplies. The Agency has done this and will continue to do this by utilizing water management tools and developing strategic partnerships with upstream, downstream, and nearby agencies and districts. As outlined in the Agency's Water Conservation Plan, water conservation practices will be implemented to mitigate identified shortfalls caused by drought-induced water shortages in addition to an on-going study of a regional water reclamation solution. Management practices can be developed and implemented to address various contingencies arising from an analysis of demand versus supply. The Agency is committed to working with the public and other agencies to facilitate regional water management efforts.

1.2 Integrated Regional Water Management Plan

The Agency recognizes that water is a regional resource as well as a local one. Therefore, regional partnerships in addition to projects and measures play a large role in maximizing resources. The Agency is currently partnering with numerous regional entities to develop an Integrated Regional Water Management Plan (IRWMP) for the Mokelumne River watershed in and around Amador County. The State promotes IRWMPs as a method to improve water management and its nexus to land use by better coordinating agencies and stakeholders within regions. In 2006, the Agency participated in completing the first IRWMP for the Mokelumne Watershed. Known as the Mokelumne Amador Calaveras IRWMP ('MAC IRWMP'), the MAC IRWMP established itself as one of the first regional plans in the state. The MAC IRWMP is under the governance of the Upper Mokelumne River Watershed Authority (www.umrwa.org) and was successful in the State's Regional Acceptance Program (RAP) as a state-recognized IRWMP geographic area.

There is also unintentional water transfer downstream to EBMUD whenever the Agency does not utilize its full contractual water right. The Agency predicts that, by working with their numerous partners and implementing the programs described throughout this plan, they will be able to continue managing and efficiently using their existing water supply sources through at least the year 2030.

1.3 Agency Coordination, Notification, & Participation

The Act requires the Agency to coordinate the preparation of its UWMP with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable. As required by the Act, the Agency sent letters to Amador County, the cities of Amador City, Ione, Jackson, Plymouth and Sutter Creek 60 days prior to adoption that the Plan was being reviewed and amended (Appendix C). Several agencies were consulted to compile data relevant to the 2010 update of the Agency's UWMP. Table 1-1 summarizes the UWMP coordination efforts with the necessary agencies and other stakeholders.

Table 1-1 Coordination with Appropriate Agencies

Agency	Was Contacted for Assistance	Participated in Developing the Plan	Commented on Draft	Attended Public Meetings	Was Sent Copy of Draft Plan	Was Sent Notice of Intention to Adopt
California Department of Water Resources (DWR)	X				X	
Amador County	X				X	X
City of Amador	X				X	X
City of Jackson	X				X	X
City of Ione	X				X	X
City of Plymouth	X				X	X
City of Sutter Creek	X				X	X

Additionally, the Agency will provide copies of the UWMP to all water retailers/suppliers to whom the Agency sells water wholesale.

1.4 Public Participation

The Act requires the encouragement of public participation and a public hearing as part of the UWMP approval process. As required by the Act, prior to adopting the update of the Plan, the Agency twice published a public notice in the Amador Ledger-Dispatch (Appendix D) highlighting the plan requirements, noting draft report availability, public hearing date and opportunity to comment. The Plan was made available for public inspection at the Agency's office as well as on the Agency's website (www.amadorwater.org). A a public hearing was held on August 11, 2011 to provide an opportunity for Agency's customers and residents in the service area to learn about the water supply situation and the plans for providing a reliable, safe, high quality water supply for the future. The hearing was an opportunity for people to ask questions and provide input regarding the current situation and the viability of future plans.

The Plan was adopted by the Agency's Board of Directors on Augsut 25, 2011. A copy of the adopted resolution is provided in Appendix E . Within 30 days of adoption of the UWMP, a copy will be submitted to the Amador County Library and will be available at the Agency as well as on the Agency website for public review. A copy of the adopted UWMP will be provided to Amador County and the cities of Amador City, Ione, Jackson, Plymouth and Sutter Creek within 60 days after submission to DWR. Additionally, copies will be provided to all water retailers who purchase water wholesale from the Agency.

Chapter 2 Service Area

2.1 Introduction

Amador Water Agency was formed in 1959 for the purpose of providing water and wastewater services to the residents of Amador County. The Agency has four general service areas: the Amador Water System, the Central Amador Water Project System, La Mel Heights, and Lake Camanche Village. These service areas are shown in **Figure 2-1**.

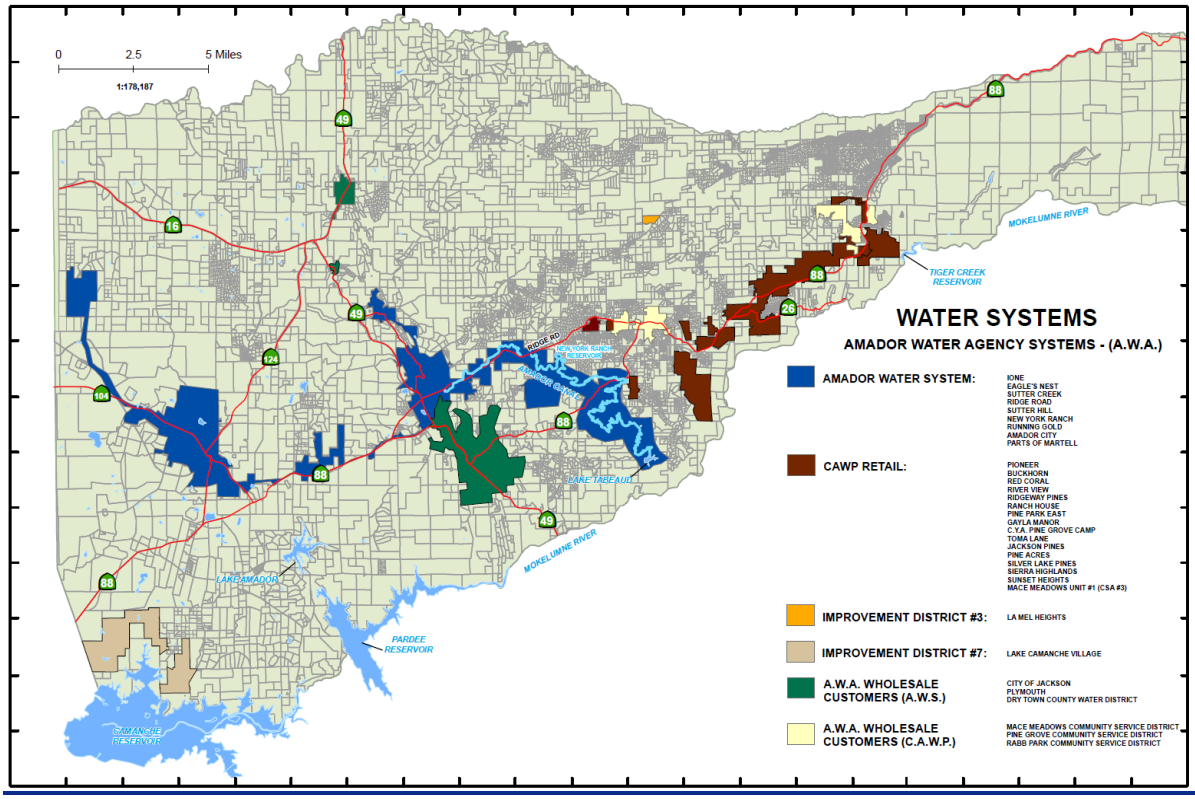
The Amador Water System (AWS) was formerly owned and operated by PG&E and currently serves the areas of Jackson, Martell, Sutter Creek, Sutter Hill, Ione, Amador City, Plymouth and Drytown. The Agency has two water treatment plants at Sutter Hill and Ione, but also serves raw (untreated) water from the Amador Canal to customers between Lake Tabeaud and Sutter Hill, and Sutter Hill and Ione.

The Central Amador Water Project (CAWP) System provides wholesale water to the communities of First Mace Meadows Water Association, Pine Grove Community Services District (CSD), and Rabb Park CSD. The CAWP System is also used to provide retail water to Mace Meadows Unit #1 (CSA #2), Sunset Heights, Jackson Pines, C.Y.A. Pine Grove Camp, Pine Acres, Ranch House, Pioneer, Ridgeway Pines, Silver Lake Pines, Sierra Highlands, Buckhorn, Red Coral, River View, Pine Park East, Gayla Manor, and Toma Lane.

The Lake Camanche Village is a major subdivision consisting of several Units (subdivisions) in western Amador County. The Agency supplies both water and wastewater services to this area, with water supplies coming from groundwater rather than the Mokelumne River (as with the other two service areas).

The Agency currently serves a population of approximately 25,640 people through more than 13,000 retail and wholesale water service connections. The Board of Directors is comprised of five members elected by the citizens within districts that mirror the Amador County Board of Supervisor districts.

Figure 2-1: Amador Water Agency Water Systems



2.2 Service Area Climate

The Agency's main water supply is the Mokelumne River, a snow and rain fed river originating in the Sierra Nevada. The Mokelumne River watershed is a relatively narrow and steep watershed located northeast of the Sacramento-San Joaquin Delta on the western slope of the Sierra Nevada. The watershed, upstream of Camanche Dam, covers an area of 627 square miles and extends from Highland Peak (elevation 10,934 feet above sea level) near the crest of the Sierra Mountains to Camanche Reservoir (elevation 235 feet above sea level) located in the lower western foothills near Clements.

Annual precipitation (rainfall and snowfall) in the Mokelumne River Watershed, and thus river runoff, is extremely variable in Northern California. Within a year, precipitation is highly seasonal with most precipitation normally occurring between November and May and very little occurring between late spring and fall. Peak flows in the Mokelumne River normally occur during winter storms or during the spring snow-melt season from March through June. River flows decrease to a minimum in late summer or fall.

Amador County has a varying range of temperature and precipitation. The Sierra Nevada foothill areas experience hot, dry summers and mild winters. The higher elevations, about 5,000 feet, experience long and severe winters accompanied by heavy snowfall. Table 2-1 shows typical reference evapotranspiration (ETo), precipitation and temperature values.

Table 2-1: Climate

Month	Jan	Feb	Mar	Apr	May	Jun	Jul
Standard Average ETo[a] (in.)	1.40	2.10	3.41	4.95	6.67	7.80	8.84
Average Rainfall[b] (in.)	5.48	4.49	4.93	2.59	0.96	0.32	0.11
Average Temperature[b] (deg F)	45.46	49.47	52.33	57.17	64.04	71.06	76.77

Month	Aug	Sep	Oct	Nov	Dec	Annual
Standard Average ETo[a] (in.)	7.75	5.70	3.88	1.95	1.24	55.65
Average Rainfall[b] (in.)	0.12	0.49	1.62	3.82	4.65	29.57
Average Temperature[b] (deg F)	75.33	71.30	63.13	52.83	45.98	60.47

Footnotes:

a. Source: CIMIS ETo Map using an average of Zones 13 and 14

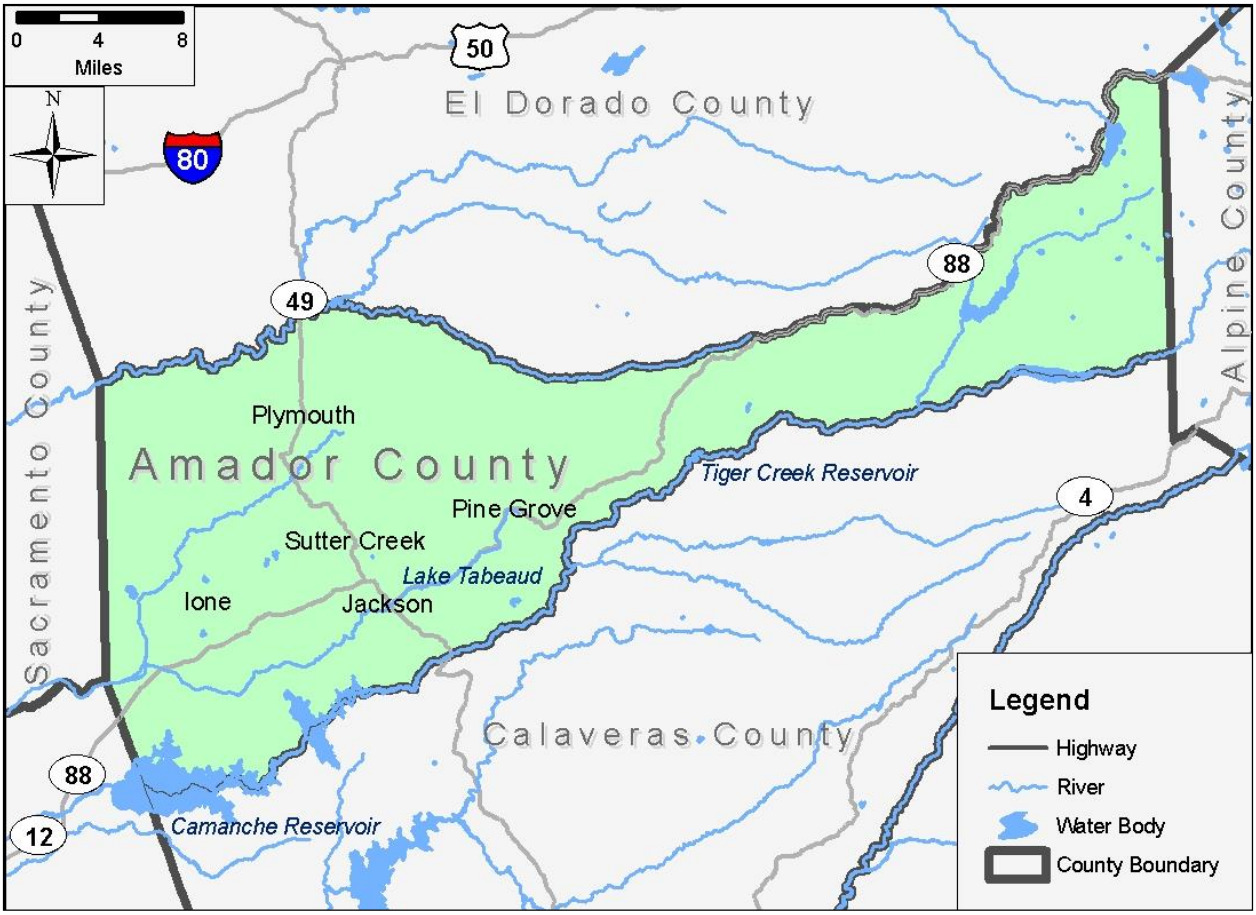
b. Source: Western Regional Climate Center #042728, Electra Power House

2.3 Service Area Description

The Agency is the main water purveyor for the western portion of Amador County. The Agency has the legal jurisdiction to serve water throughout Amador County (see**Figure 2-2**). The primary source of water is the Mokelumne River watershed which supplies the Agency's main water systems: the Amador Water System (AWS) and the Central Amador Water Project (CAWP). Lake Camanche Village and La Mel

Heights are served primarily through groundwater. There are a total of 7,465 water service connections in the Agency's service area, not including wholesale entity customers.

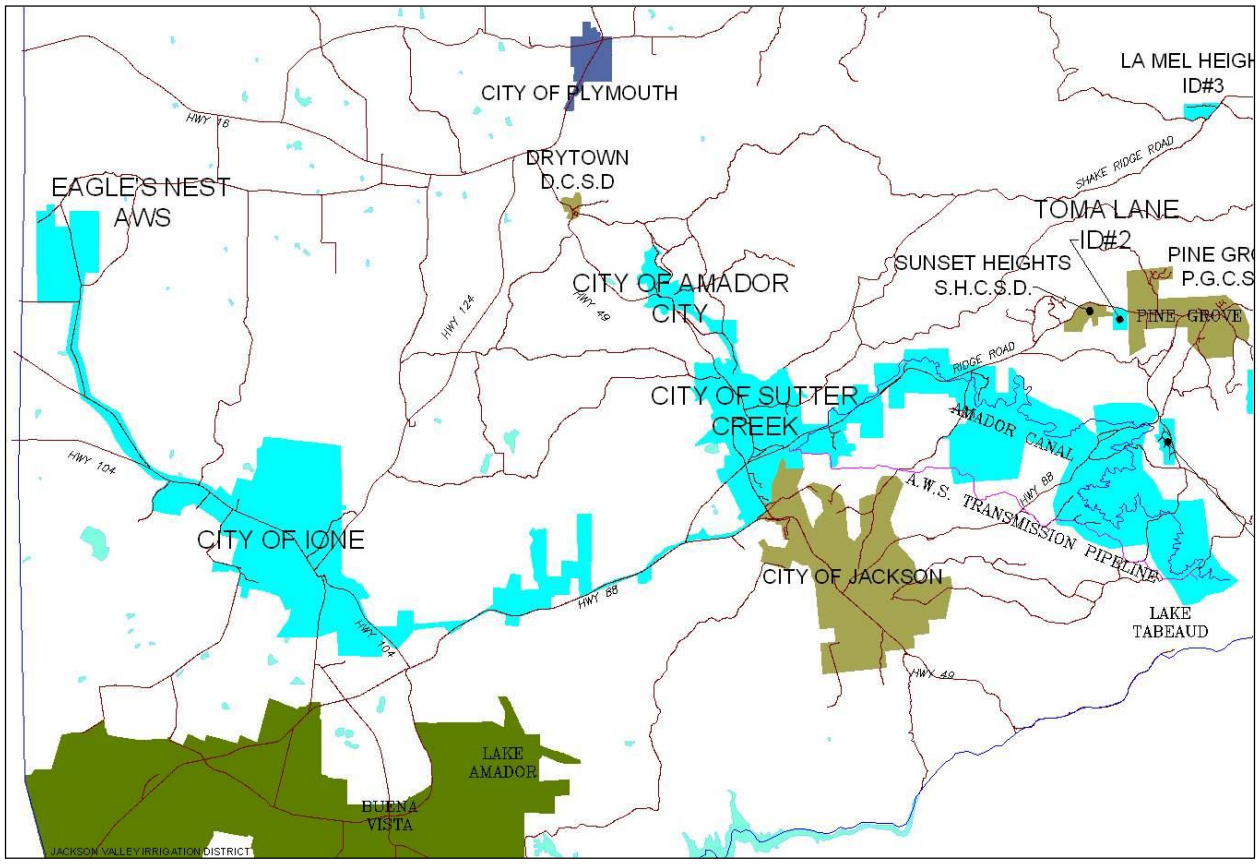
Figure 2-2: Map of Amador County



Amador Water System

The Amador Water System ('AWS') receives water from the Mokelumne River via Lake Tabeaud. The AWS delivery system consists of approximately 120 miles of water main piping for potable water customers and 23 miles of conveyance canals for untreated water customers. The Agency supplies both raw and treated water to customers in the AWS. Treated water supplied to AWS customers comes from the Ione Water Treatment Plant located in Ione or the Tanner Water Treatment Plant located in Sutter Creek. The service area covers over 450 square miles and serves the communities of Amador City, Ione, Sutter Creek, Sutter Hill and their vicinities, and portions of Ridge Road and New York Ranch Road. The Agency also provides wholesale water through the AWS to the communities of Jackson, Plymouth and Drytown. In addition, the system also supplies raw water for agricultural, industrial, commercial and domestic irrigation needs to both public facilities and individual raw water customers. There are 3,670 metered service connections in the AWS. Figure 2-3 shows the AWS service area.

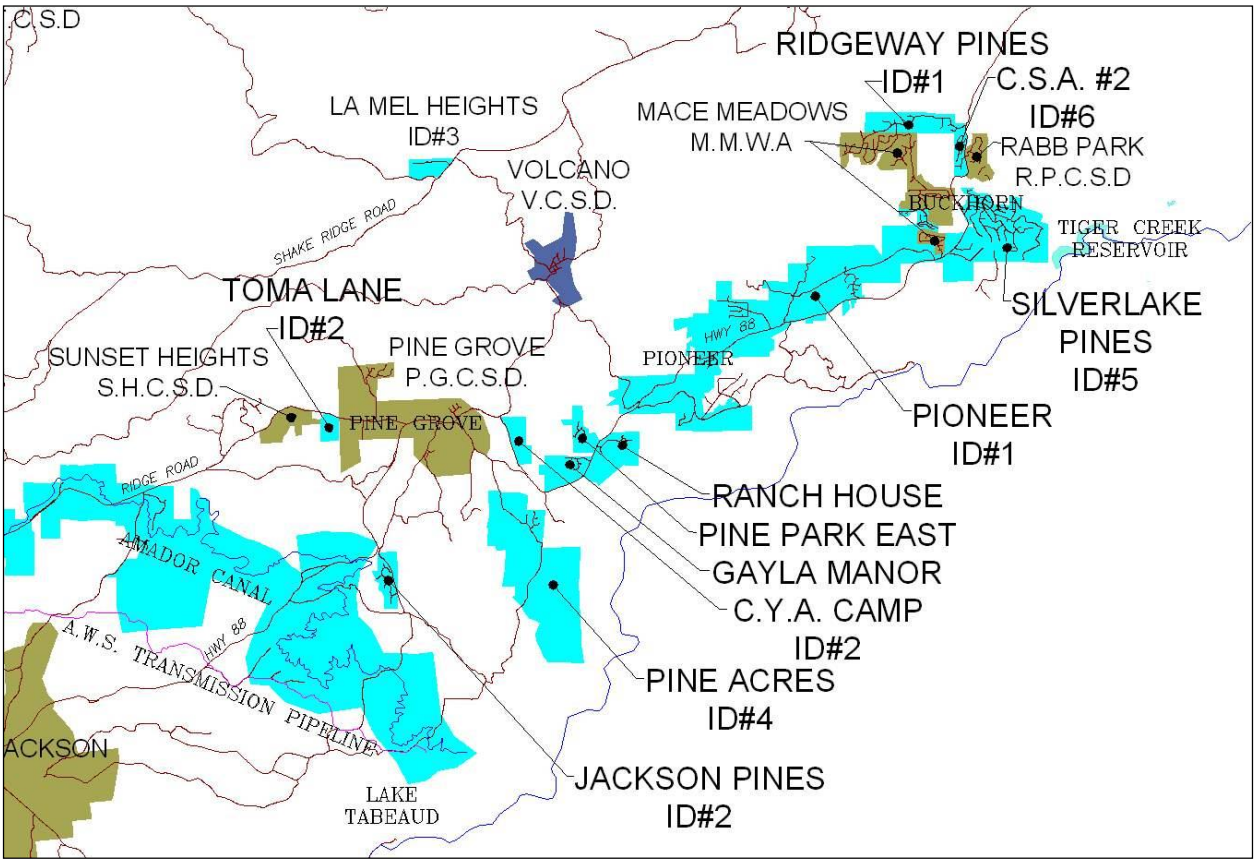
Figure 2-3: Amador Water System Service Area



Central Amador Water Project System

The Central Amador Water Project System ('CAWP') receives water from the Mokelumne River via Pacific Gas and Electric (PG&E)'s Tiger Creek Afterbay. Water supplied to CAWP customers is treated at the Buckhorn Water Treatment Plant located in Pioneer. The CAWP delivery system consists of approximately 90 miles of water main piping for potable water customers. The CAWP provides wholesale treated water to the upcountry communities of First Mace Meadows Water Association, Pine Grove Community Service District ('CSD'), and Rabb Park CSD. In addition to delivering wholesale water, the Agency also retails domestic water to 3,005 service connections in the communities of Jackson Pines, Pine Acres, Pioneer, Ridgeway Pines, Ranch House, Silver Lake Pines, the Sunset Heights area, Buckhorn, Red Coral, River View, Pine Park east, Gayla Manor, Toma Lane, and Sierra Highlands. Figure 2-4 shows the CAWP service area.

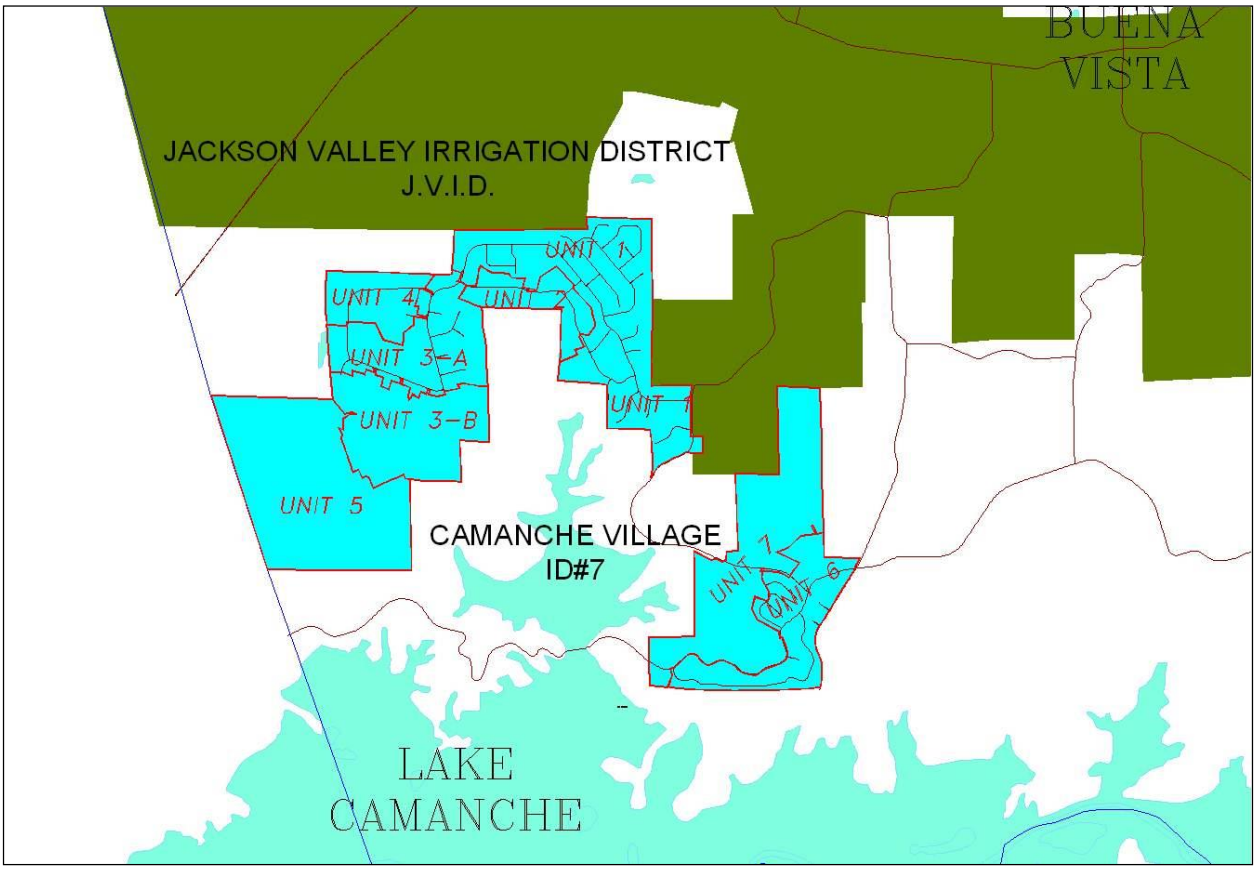
Figure 2-4: Central Amador Water Project Service Area



Lake Camanche Village Area

The Agency provides water service to 733 connections and small commercial businesses in the Lake Camanche Village area. The domestic water supply for Lake Camanche Village is currently based on groundwater which is treated by chlorine addition at each well head located throughout the Improvement District 7 (ID #7). Figure 2-5 shows the Lake Camanche Village service area.

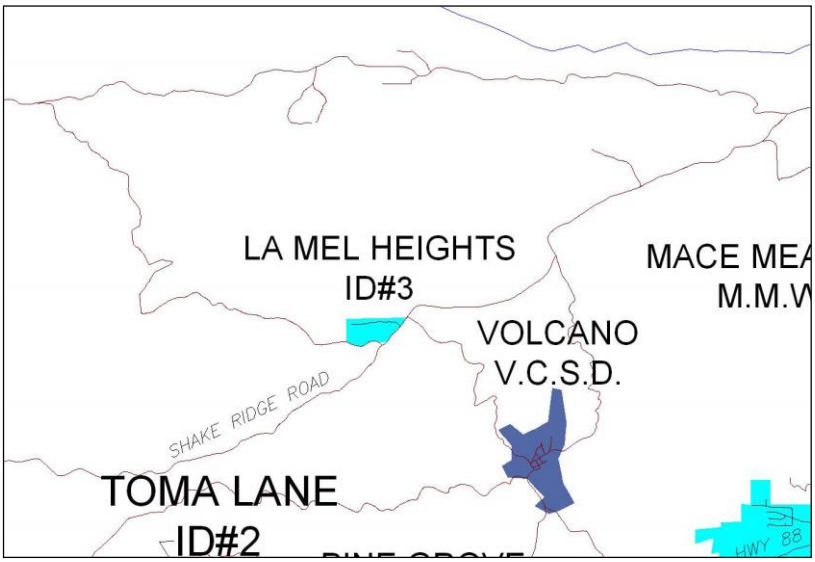
Figure 2-5: Lake Camanche Village Service Area



La Mel Heights

The Agency provides water service to La Mel Heights, a 57 unit subdivision. The only water supply is groundwater which is treated at the Improvement District 3 (ID #3) Water Treatment Plant. Figure 2-6 shows the La Mel Heights service area.

Figure 2-6: La Mel Heights Service Area



2.4 Population

Over time, the Agency has transitioned from serving mainly agricultural customers, to one that serves primarily residential, commercial, and industrial sectors although agriculture remains a significant water user. From 1995 to 2010, the individual service area populations grew between 14% and 17%, with the overall average population served by the Agency increasing 15%.

Growth projections utilized in this UWMP were obtained from the land use planning agencies within Amador County (Appendix F) and were based on historical patterns, market research, and new housing unit commitments (e.g., issued permits or approved subdivisions) for the near future. Analysis of services other than water, wastewater or reclaimed water are outside of the purview and authority of this UWMP and were therefore not considered by the Agency. The Agency therefore relied on the land use agencies expertise. Their reported calculations and projections analyzed the ability for services to accommodate their respective projected levels of development.

Taking the average projected growth rates from the land use agencies over the Agency's respective service areas yields an average annual projected growth rate of 1.8%, compared with a state annual growth rate of 1.4%. Table 2-2 below shows the population growth rates provided by the planning agencies and applied over the corresponding portions of the Amador Water Agency's service areas.

Table 2-2 Land Use Agency Growth Rates

Land Use Agency	Service Area(s)	Population Growth Rate
Amador County	AWS, CAWP, Lake Camanche, La Mel	1.7%
City of Amador City	AWS (Tanner)	0.0%
City of Ione	AWS (Ione)	2.3%
City of Jackson	AWS (Tanner)	1.0%
City of Plymouth	AWS (Tanner)	4.0%
City of Sutter Creek	AWS (Tanner)	0.5%

In addition to projected residential growth, potential increased demand for agricultural, commercial, industrial and raw water use is anticipated by the land use agencies. Currently the Agency is studying a regional reclamation solution to offset such demands by supplementing or replacing some raw water use with recycled water where appropriate. As connections increase, water management planning will include an assessment of wastewater disposal and associated recycled water options. See Table 2-3 for a summary of land use agency population projections through 2030.

Table 2-3 Current and Projected Population

	2010	2015	2020	2025	2030
Total Service Area Population	25,640	27,880	30,448	33,374	36,766

Footnotes:

a) Service area consists of Amador Water System (Ione & Tanner), Central Amador Water Project, Lake Camanche Village, and La Mel Heights.
b) Department of Finance data consisting of population per unit for 2010 was used to determine service area population for each five-year interval.
c) Growth projections are based on data provided by each land use agency.
d) Population projections include populations within the service area of six wholesale customers.
e) Number of units in future multi-family residences was calculated as two.
f) No change to the 2010 Group Quarter population was assumed.
g) No growth was assumed for City of Amador as no growth projections were received.
h) Remaining 17 undeveloped lots in La Mel were projected out over 10 years.

Chapter 3 Water System Demands

This section describes the Amador Water Agency's system demands, including calculating its baseline daily per capita water use and interim and urban water use targets as described in SBx7-7 for the Amador Water System (AWS), the Central Amador Water Project (CAWP), La Mel Heights (La Mel) and Lake Camanche Village (LCV). The current water system demand and projections by category are quantified over the planning horizon of the UWMP. These demands and projections include treated and raw water sales, water sales to other agencies, system water losses, and water use target compliance. When calculating future water demands, projected demands were based on the assumed reduction in per capita daily use determined from planning for and implementing actions associated with the Water Conservation Bill of 2009.

This section follows the technical methods and methodologies described in Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Bill of 2009) (DWR 2010a). The approach and criteria for developing the required baselines and targets are thoroughly described in the California Department of Water Resources Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan.

Water demand projections provide the basis for sizing and staging future water supply facilities. Water use and production records combined with future population and urban development projections provide the basis for estimating future water requirements to serve the Agency's customers. The Agency will serve most of the new projected growth and water demands within Amador County. This chapter summarizes past water use and future water demand projections through 2030.

3.1 Water Demands and Projections

Projected populations and respective water demands are taken from the Amador County General Plan, Amador County Housing Element, City of Jackson Housing Element, City of Plymouth Housing Element, City of Ione General Plan, City of Sutter Creek Housing Element, Amador Local Agency Formation Commission Municipal Services Review, and the City of Sutter Creek Wastewater Master Plan as shown in Section 2.4 Population. Projected demands are calculated based on the projected growth (residential, commercial, and industrial) shown in the above general plans and housing elements, the Amador County Housing Element average persons per household of 2.25 and the calculated daily per capita water use target for 2020 as described in SBx7-7.

Water use is presented in the following AWA defined user categories: single family residential; multi-family residential; commercial/ institutional; industrial; Drytown County Water District; City of Jackson; Mace Meadows Water Association; Pine Grove Community Services District; City of Plymouth; Rabb Park Community Services District; Backwash Water; Raw Water Billed; Raw Water Losses; Recycled Water; and System Losses.

Tables 3-1 through 3-11 provide summaries of actual and projected water uses.

Table 3-1 Water Deliveries – Actual, 2005 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	6,005	1,895	100	121	2,016
Multi-Family	31	152	0	0	152
Commercial/Institutional	242	1,144	0	0	1,144
Industrial	0	0	0	0	0
Total	6,278	3,192	100	121	3,312

Footnotes:

a. FY 2006-07 volumes are used in 2005 where 2005 actual data no longer exists.

Table 3-2 Water Deliveries – Actual, 2010 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	6,308	1,776	11	13	1,790
Multi-Family	30	161	0	0	161
Commercial/Institutional	346	1,088	1	1	1,089
Industrial	9	89	0	0	89
Total	6,693	3,115	12	14	3,129

Table 3-3 Water Deliveries – Projected, 2015 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	6,873	1,988	0	0	1,988
Multi-Family	116	193	0	0	193
Commercial/Institutional	940	1,311	0	0	1,311
Industrial	30	97	0	0	97
Total	7,959	3,590	0	0	3,590

Footnotes:

a. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).

Table 3-4 Water Deliveries – Projected, 2020 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	7,538	2,238	0	0	2,238
Multi-Family	206	227	0	0	227
Commercial/Institutional	1,537	1,536	0	0	1,536
Industrial	51	105	0	0	105
Total	9,332	4,106	0	0	4,106

Footnotes:
a. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).

Table 3-5 Water Deliveries – Projected, 2025 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	8,296	2,523	0	0	2,523
Multi-Family	306	265	0	0	265
Commercial/Institutional	2,152	1,767	0	0	1,767
Industrial	117	130	0	0	130
Total	10,871	4,684	0	0	4,684

Footnotes:
a. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita)..

Table 3-6 Water Deliveries – Projected, 2030 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	9,107	2,827	0	0	2,827
Multi-Family	406	302	0	0	302
Commercial/Institutional	2,755	1,993	0	0	1,993
Industrial	183	154	0	0	154
Total	12,451	5,277	0	0	5,277

Footnotes:
b. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).

Table 3-7 Water Deliveries – Projected, 2035 (AFY)

Water Use Sectors	Metered		Non Metered		Total
	# of Accounts	Volume	# of Accounts	Volume	Volume
Single Family	9,970	3,151	0	0	3,151
Multi-Family	506	340	0	0	340
Commercial/Institutional	3,358	2,219	0	0	2,219
Industrial	249	179	0	0	179
Total	14,083	5,890	0	0	5,890

Footnotes:
a. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).

Table 3-8 Low Income Water Demands (AFY)

Low Income Water Demands	2015	2020	2025	2030
Single-Family Residential	85	86	87	89
Multi-Family Residential	31	32	36	54
Total	115	118	123	142

Footnotes:

a. Number of low-income connections for Plymouth based on data provided by the City of Plymouth.
b. Number of low-income connections for Ione based on multi-family connections per City of Ione letter.
c. Number of low-income connections for all other areas based on 38% of growth projected per the Land Use Agency's letter.
d. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).
e. Persons per unit is based on 2010 data from California Department of Finance.
f. Low-income households are defined as 80% or below of median household income.

Table 3-9 Sales to Other Water Agencies (AFY)

Water Distributed	2005	2010	2015	2020	2025	2030
Drytown CSD	46	34	39	45	50	56
Jackson, City of	1,369	950	983	1,021	1,062	1,104
Mace Meadows WA	85	87	95	103	112	120
Pine Grove CSD	169	149	156	163	170	177
Plymouth, City of	0	144	193	253	327	418
Rabb Park CSD	15	13	16	18	21	23
Total	1,683	1,377	1,482	1,604	1,742	1,899

Footnotes:

a. Mace Meadows, Pine Grove & Rabb Park are 11.2%, 10.1% & 3.5% respectively of the overall number of CAWP connections.
b. Drytown is 1.4% of the overall number of Tanner connections.
c. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita).
d. Water use previously accounted for, in Tables 3-1 through 3-6, is not included in this table.

Table 3-10 Additional Water Uses and Losses (AFY)

Water Use	2005	2010	2015	2020	2025	2030
Backwash Water	143	90	103	118	135	153
Raw Water Billed	1,179	1,023	1,023	1,023	1,023	1,023
Raw Water Losses	2,907	2,343	2,343	2,343	2,343	2,343
Recycled Water	0	0	0	0	0	0
System losses	509	446	511	585	667	752
Total	4,738	3,901	3,980	4,068	4,168	4,270

Footnotes:

a. Backwash water at Ione and Tanner Water Treatment Plants is currently 3.8% and is assumed to remain constant.
b. Raw Water losses includes water pumped/siphoned from Lake Tabeaud less raw water intake at Tanner and Ione treatment plants, and include Amador Canal losses.
c. Raw Water Billed and Raw Water Losses is assumed to remain constant and not be proportional to urban growth.
d. Projected recycled water use excludes Gold Rush per Sutter Creek Wastewater Master Plan.

e. System Losses are unmetered water use resulting from system leaks, unauthorized connections, private fire service, fire support services, flushing programs, and meter inaccuracies. In 2010 the Agency's system losses were 15% which is equivalent to the general 15% for rural water districts and is expected to be proportional to growth.

f. Water use previously accounted for, in Tables 3-1 through 3-6 and 3-8, is not included in this table.

Table 3-11 Total Water Use (AFY)

Water Use	2005	2010	2015	2020	2025	2030
Total water deliveries (from tables 3-1 to 3-6)	3,312	3,129	3,590	4,106	4,684	5,277
Sales to other water agencies (from table 3-8)	1,683	1,377	1,482	1,604	1,742	1,899
Additional water uses and losses (from table 3-9)	4,738	3,901	3,980	4,068	4,168	4,270
Total	9,733	8,407	9,052	9,778	10,594	11,446

3.2 Water Use Baselines and Targets

The 2009 Delta Legislation, SB7X7, requires the state to reduce its urban water demands 20 percent by 2020. The California Department of Water Resources (DWR) produced the methodologies and procedures for showing compliance with 20x2020 as included in the DWR 2010 UWMP Guidelines. As required by the Water Conservation Act of 2009, the Agency has used the four step process to develop baseline and target values and selected a methodology to meet the target as outlined below.

Base period totals are for Agency retail distribution service areas only and do not include populations served by other water agencies shown in Table 3-8 or outside of Agency service areas. See appendix for distribution system population and volume calculations.

The Agency does not receive wholesale treated water supply from another retail agency.

Step 1 – Determine Base Daily per Capita Water Use

The Agency recycled water supply was less than 10% of the total supply in 2008, therefore the base period range for determining the baseline daily per capita water use is 10 years. Tables 3-11 and 3-12 provide the calculations used to determine the baseline.

Table 3-12 Base Period Ranges

Base	Parameter	Value	Units
10 to 15 year base period	2008 total water deliveries	4,279	AFY
	2008 total volume of delivered recycled water	0	AFY
	2008 recycled water as a percent of total deliveries	0.00	%
	Number of years in base period	10	Years
	Year beginning base period	2001	
	Year ending base period	2010	
5 year base period	Number of years in base period	5	Years
	Year beginning base period	2001	
	Year ending base period	2005	

Footnotes:

a. If the 2008 recycled water percent is less than 10 percent, then the first base period is a continuous 10-year period. If the amount of recycled water delivered in 2008 is 10 percent or greater, the first base period is a continuous 10- to 15-year period.

b. The ending year must be between December 31, 2004 and December 31, 2010.

Table 3-13 Base Daily Per Capita Water Use, 10 Year Range

Base Period Year		Distribution System Population	Daily System Gross Water Use (mgd)	Annual Daily Per Capita Water Use (gpcd)
Sequence Year	Calendar Year			
Year 1	2001	14,886	3.46	233
Year 2	2002	16,595	3.13	188
Year 3	2003	18,322	3.40	186
Year 4	2004	19,137	3.75	196
Year 5	2005	19,092	3.54	185
Year 6	2006	19,391	3.86	199
Year 7	2007	19,648	3.76	191
Year 8	2008	18,666	3.52	188
Year 9	2009	18,686	3.42	183
Year 10	2010	18,644	3.18	170
Base Daily Per Capita Water Use				192

Step 2 – Determine Urban Water Use Target

The Department of Water Resources provided four methods that an urban water supplier may choose from to develop its water use target. The Agency has selected Method 1, 80% of the base daily per capita use, to meet the urban water use target. The calculated base daily per capita use from Table 3-11 is 192 gpcd, therefore the target is 154 gpcd for 2020.

Step 3 – Confirm Urban Water Use Target

Table 3-13 provides the annual daily per capita use for a 5-year period. Since the 5-year base daily per capita water use is not less than 100 gpcd, 95% of the 5-year base daily per capita water use was also calculated which is188. The use target of 154 gpcd is compared to the 5-year base period to confirm that

the use target meets a minimum threshold. Since the target use of 154 gpcd is less than the 95% of the 5-year base daily per capita water use of 188, no adjustments are needed.

Table 3-14 Base Daily Per Capita Water Use, 5 Year Range

Base Period Year		Distribution System Population	Daily System Gross Water Use (mgd)	Annual Daily Per Capita Water Use (gpcd)
Sequence Year	Calendar Year			
Year 1	2001	14886	3.46	233
Year 2	2002	16595	3.13	188
Year 3	2003	18322	3.40	186
Year 4	2004	19137	3.75	196
Year 5	2005	19092	3.54	185
Base Daily Per Capita Water Use				198

Step 4 – Determine Interim Urban Water Use Target

The interim water use target is 90% of the base daily per capita use, to meet the urban water use target. Therefore, the interim water use target is 173 gpcd for 2015.

3.3 Water Use Reduction Plan

The Agency proposes to use the following actions to meet the use target:

- Expanded use of recycled water
- Capital improvements in the water system to reduce leakage
- Implementation of the Best Management Practices under the California Urban Water Conservation Council Memorandum of Understanding
- Conversion of raw water ditches to piped segments
- Water meter change-outs
- Conversion of un-metered services to metered services
- Assist land use agencies in establishing new building standards to achieve water demand reductions.

Chapter 4 Existing Sources of Water

4.1 Introduction

This section describes the sources of water available, a description of each water source, source limitations, water quality, water exchange and transfer opportunities, desalination, and reclaimed water. A discussion of surface water, groundwater, recycled water, desalinated water, stormwater, and any other source of water that is part of the Agency's water supply is included. Information regarding planned future water supplies projects and wholesale water supplies received from another source is also included.

4.2 Surface Water

Surface water accounts for approximately ninety-seven percent of the Agency's total water supply. Surface water is the sole supply source for both the Amador Water System (AWS) and the Central Amador Water Project (CAWP) and is obtained from the Mokelumne River watershed.

The Mokelumne River watershed is located on the Agency's southern boundary with the headwaters in parts of Amador, Alpine and Calaveras counties. The majority of flow is derived from snowmelt. The watershed ranges from peak elevations of approximately 10,000 feet at the Pacific Crest, down to 580 feet at Pardee Reservoir. The Mokelumne watershed upstream from Pardee Reservoir is approximately 578 square miles

The watershed above Pardee Reservoir is mostly protected and undeveloped, with a large portion located in the Mokelumne Wilderness. Many tributaries flow into the Mokelumne before it reaches Pardee Reservoir. Reservoirs in the higher portions of the watershed include Lower Bear and Salt Springs, both owned by Pacific Gas & Electric Company (PG&E). Upstream hydropower facilities owned and operated by PG&E include diversion tunnels and regulating reservoirs, with most of diverted flow released back into the river system. Pardee and its downstream companion, Lake Camanche, are owned and operated by the East Bay Municipal Utilities District (EBMUD). Pardee is operated for water supply and Camanche is operated for water supply, flood control, and in stream requirements.

The Agency is looking to increase Mokelumne River supplies through storage and regional collaboration efforts. The ongoing Mokelumne River Forum studies and negotiations identified potential storage and integrated supply planning options to increase supply reliability for all river stakeholders. Supply reliability and availability will be updated once the ongoing investigations are complete.

4.2.1 Amador Water System

In 1985, the Agency acquired the AWS from Pacific Gas and Electric (PG&E) and the contractual right to not more than 15,000 acre-foot per year (AFY) at a rate not to exceed 30 cubic feet per second (cfs). PG&E had been the major owner and operator for the purveyance of water in western Amador County since 1908.

4.2.2 Central Amador Water Project

In 1978, the Agency entered into an agreement with PG&E for the use of PG&E facilities to store and divert water under water rights acquired by the Agency for the CAWP water system. CAWP is a wholesale system in which water districts in the community areas continue to own and operate their own distribution systems. CAWP pumps water from the Mokelumne River at PG&E's Tiger Creek Afterbay. The CAWP surface water diversion is limited to a firm yield of 1,150 AFY. The Agency is currently working to obtain additional surface water rights for the CAWP system which would expand the surface water diversions to 2,200 AFY.

4.3 Groundwater

Groundwater accounts for approximately three percent of the Agency's total supply and is only used in the communities of La Mel Heights and Lake Camanche Village.

4.3.1 La Mel Heights Water System

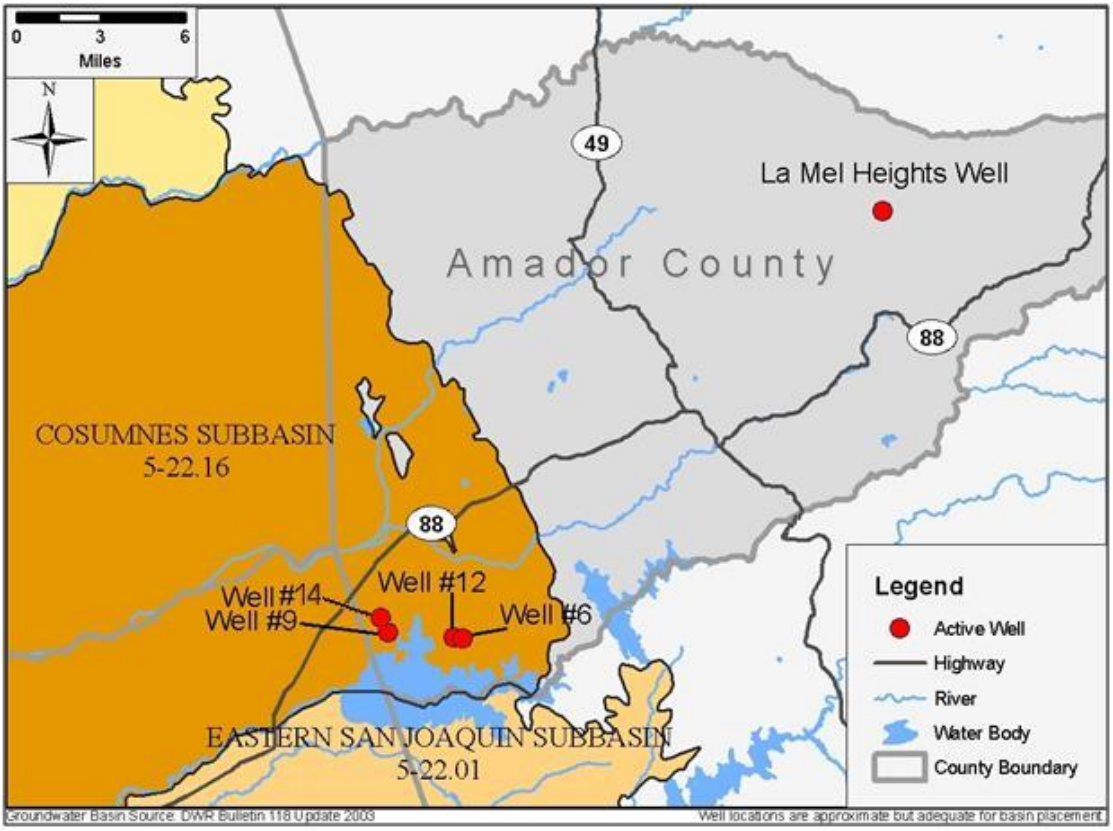
The Agency operates one well in the La Mel Heights area. The well pumps water from a groundwater aquifer that is not defined in Bulletin 118 published by the California Department of Water Resources (DWR). The well has a safe yield of 50 AFY, or 31 gpm. The old well has been retained as a back-up source.

4.3.2 Lake Camanche Village Area Water System

The Agency operates four wells in the Lake Camanche Village area. Well 6 has produces 161 AFY (100 gpm), Well 9 produces 500 AFY (310 gpm), Well 12 produces 145 AFY (90 gpm), and Well 14 produces 500 AFY (350 gpm). These wells pump water from the Cosumnes subbasin (subbasin 5-22.16) portion of the San Joaquin Valley Groundwater Basin (DWR Bulletin 188-80, California's Groundwater) as seen in Figure 4-1. This subbasin is not adjudicated. Well 14 experienced elevated turbidity and odor levels, and was not operated from September 2010 until July 2011. Well 14 is currently operating at reduced production levels pending the outcome of testing and redevelopment.

The Agency is currently in the process of preparing a Water Supply Sustainability Study for the Lake Camanche area, with grant assistance from the California Department of Water Resources, to study safe yields and potential management methods to improve use of the basin, which is expected to be completed in 2012. This Study is a precursor to preparation of a Groundwater Management Plan, which is planned for preparation in 2013.

Figure 4-1 Map of Cosumnes Subbasin and Amador Water Agency Wells



4.3.3 Quantity, Location and Sufficiency

The Cosumnes Subbasin (5-22.16) is approximately 439 square miles. It is bounded on the north and west by the Cosumnes River, on the east by the bedrock of the Sierra Nevada Mountains, and on the south by the Mokelumne River. Table 4-1 summarizes the rise and fall of the groundwater levels to the extent that data if available. The groundwater storage capacity is estimated to be about 6,000,000 acre-feet (AF) with an average specific yield of 7.4%. Basin inflows are estimated to be about 269,500 AFY. Water leaves the subbasin through subsurface flow (144,600 AFY), urban extraction (35,000 AFY), and agricultural extraction (94,200 AFY).

Table 4-1 Historic Groundwater Levels in Cosumnes Subbasin

Time Period	Change in Level	Change from Reference Level[a]
Mid-1960s	0	0
Mid-1960s - 1980	-20 to -30 feet	-20 to -30 feet
1980-1986	5 to 10 feet	-10 to -25 feet
1987-1992	-10 to -15 feet	-20 to -40 feet
1993-2000	15 to 20 feet	-5 to -20

Footnotes:

a. Reference level is taken to be the groundwater level during the mid-1960s.

Source: California's Groundwater Bulletin 118 Updated 2003

Because of growth in the area and concerns with groundwater quality and quantity, the Lake Camanche Village area desires to phase out the use of groundwater. There are currently conceptual discussions of a joint surface water treatment plant project between East Bay Municipal Utility District (EBMUD), Calaveras County Water District and the Agency. This project is still in the planning stages and the surface water rights have not yet been identified.

The La Mel Heights area is limited on growth such that build out will be achieved in the next ten years. Therefore, the amount of groundwater projected to be pumped is held constant after the year 2020. To help meet the water demand in La Mel Heights, the Agency recently constructed a new well which has a yearly yield of 50 AFY. The old well has been retained as a back-up source.

Table 4-2 Amount of Groundwater Pumped[a] (AF)

Basin Name	2006	2007	2008	2009	2010
San Joaquin Valley Cosumnes Basin 5-22.16 (Lake Camanche Village wells)	314	262	300	292	280
Unclassified Groundwater Aquifer (La Mel Heights well)	18.7	20.3	20.0	15.7	16.3
% of Total Supply	3.5%	3.1%	3.6%	3.5%	3.5%

Footnotes:

a. Amount of groundwater pumped from the Agency's annual reports to California Department of Health Services (DHS) for ID #3 and ID #7 Water Treatment Systems.

Table 4-3 Amount of Groundwater Projected to be Pumped (AFY)

Basin Name	2010	2015	2020	2025	2030
San Joaquin Valley Cosumnes Basin 5-22.16 (Lake Camanche Village wells)	280	338	396	455	513
Unclassified Groundwater Aquifer (La Mel Heights well)[a]	16.3	19.7	22.7	22.7	22.7
% of Total Supply	3.5%	3.6%	3.7%	3.9%	4.0%

Footnotes:

a. La Mel Heights area assumed to be built out by 2020.

b. 149 gallons of water delivered per capita per day was used (2010 actual delivery per capita)

4.4 Exchange or Transfer Opportunities

Currently, water demand in the AWS service area is below the Agency's surface diversions rights of 15,000 AFY. Recently, the construction of the Amador Transmission Pipeline was completed which reduced losses in the Amador Canal, which in turn has allowed surface water in excess of the AWS demand to remain in Mokelumne River and thus be incidentally captured in EBMUD's reservoirs. EBMUD participated in the funding of the pipeline but was not guaranteed a specific quantity of water. As water demand in the AWS service area increases with time, this incidental transfer will be reduced.

The Agency is not pursuing any other water transfers or exchanges at this time. The Agency would consider any future opportunities for short term and/or long-term water transfers and/or exchanges with other public agencies if both agencies would benefit from such an agreement.

4.5 Desalinated Water

Desalination is not considered to be a viable water supply option at this time for Amador Water Agency. The San Francisco Bay is about 70 miles from the boundary of Amador County. While the Bay Delta does extend toward the County, there is no forecasted need for an additional water supply that would financially justify the required transmission and desalination facilities. Currently, the groundwater salinity is low enough to not require any desalination. Should a need for additional water supplies be forecasted, desalination could be considered one of the potential long-term solutions.

4.6 Reclaimed Water

The Agency recognizes the benefit of recycled water to both reduce raw and potable water demands as well as providing a means of wastewater effluent disposal. Therefore, the Agency is currently preparing a Regional Approach for Water Reuse Project which proposes to maximize water recycling by developing a regional recycled water supply in lieu of raw and potable water. This project is being funded by a Proposition 84 grant through Sierra Nevada Conservancy and will be coordinated with local wastewater and planning agencies that have been identified as potential partners in the region. Additionally, multiple non-governmental agencies, organizations and interested parties have been identified to participate in future stakeholder workshops on the project. The project is anticipated to be complete in March 2013.

In 2005, the Agency prepared the Amador County Regional Wastewater Management Plan. This plan described the complex nature of wastewater treatment and disposal in the County while providing recommendations to the communities involved on the most effective way to incorporate expected growth in wastewater generation intelligently and economically. The Plan attempted to provide an overall roadmap for the County to respond to current and future service demands, technology trends, and regulatory

requirements. It is anticipated that the new Regional Approach for Water Reuse Project will supersede and replace the 2005 study.

4.6.1 Wastewater Systems

Although the Agency currently owns, operates and maintains ten geographically separate wastewater treatment plants throughout Amador County, none of the systems currently recycle water to reduce raw or potable water demands. Eight of the ten systems are community leachfield systems, while the other two systems treat wastewater to a secondary level that is then applied to land for disposal. These systems produce such limited quantities of wastewater or are so removed from reuse opportunities as to make recycling both inefficient and cost prohibitive.

However, the Agency currently collects, but does not treat, a significant quantity of wastewater in the Martell area of Amador County which is immediately adjacent to two other wastewater treatment purveyors and is the area of consideration for the Regional Approach for Water Reuse Project.

Table 4-4 2010 Agency Wastewater Collection and Treatment Systems

WW System Name	Collection Type[a]	Collection Piping (feet)	Treatment Type[b]	Treatment Volume (AF)	Disposal Method[c]
Eagles Nest	Effluent, Gravity	6,423	CLS	3.84	Subsurface
Fairway Pines	Effluent, Gravity	22,984[d]	CLS	6.22	Subsurface
Gayla Manor	Effluent, Gravity	7,725	Secondary	11.72	Subsurface & Spray
Jackson Pines	Effluent, Gravity	16,331	CLS	10.31	Subsurface
Lake Camanche	Conventional, Gravity	40,755	Secondary	58.28	Spray
Mace Meadows	Effluent, Gravity	22,984[d]	CLS	12.54	Subsurface
Martell	Conventional, Gravity	81,276	N/A	N/A	N/A[e]
Pine Grove	Effluent, Pressurized	18,264	CLS	12.25	Subsurface
Surrey Junction	Effluent, Gravity	3,049	CLS	1.07	Subsurface
Tiger Creek Estates	Effluent, Gravity	2,778	CLS	0.25	Subsurface
Viewpoint	Effluent, Gravity	1,834	CLS	0.37	Subsurface
Wildwood Estates	Effluent, Gravity	5,802	CLS	4.24	Subsurface

Footnotes:

a. Effluent=Septic Tank effluent, Conventional=Mixed liquor effluent, Gravity=Traditional gravity collection mains, laterals, manholes and lift stations; Pressurized=Pressurized collection mains and laterals without any lift stations.

b. CLS=Community Leachfield System; Secondary=Secondary Level Treatment for Land Disposal.

c. Subsurface=Disposal of effluent to leachfield trenches, Spray=Disposal of effluent to above ground spray fields
d. Mace Meadows and Fairway Pines CLS share a common collection system.
e. Disposal of wastewater collected in the Martell is under contract with the City of Sutter Creek for treatment.

Table 4-5 Agency Wastewater Collection and Treatment Volumes (AF)

	2010	2015	2020	2025	2030
WW Collected	172.25	180.14	187.82	197.43	207.90
WW Treated[a]	119.95	123.07	126.68	130.58	134.81
Recycled WW	0	0	0	0	0

Footnotes:
a. WW Treated is less than WW Collected because disposal of wastewater collected in the Martell is under contract with the City of Sutter Creek for treatment.

In addition to the wastewater systems owned, operated and maintained by the Agency, there are numerous other wastewater purveyors within the Agency Service Area.

Table 4-6 Non-Agency Wastewater Collection and Treatment Systems

WW System Name	Collection Type[a]	Treatment Type[b]	Treatment Volume (MG)	Disposal Method[c]
City of Amador City	Conventional, Gravity	Primary		N/A[d]
City of Ione	Conventional, Gravity	Tertiary		Reclaimed
City of Jackson	Conventional, Gravity	Secondary		NPDES
City of Plymouth	Conventional, Gravity	Secondary		Spray

Footnotes:
a. Conventional=Mixed liquor effluent, Gravity=Traditional gravity collection mains, laterals, manholes and lift stations.
b. Primary=Primary Level Treatment; Secondary=Secondary Level Treatment for Land Disposal; Tertiary=Tertiary Level of Treatment for Land Disposal
c. Spray=Disposal of effluent to above ground spray fields; NPDES=Disposal to surface water via an NPDES permit; Reclaimed=Disposal of effluent via permitted reclaimed water uses
d. Disposal of wastewater collected from Amador City is under contract with the City of Sutter Creek.

4.6.2 Existing Recycled Water

Currently, the only treated wastewater that meets recycled water standards within the Agency's service area is collected and treated by the City of Ione. This recycled water is then applied to the Castle Oaks Golf Course for irrigation.

4.6.3 Potential Recycled Water Use

Currently, the Agency does not produce any recycled or reclaimed water at any of its wastewater treatment plants due to economic and technical feasibility issues. However, in the future, the Agency anticipates development of a regional reclaimed water supply to offset raw and potable water demands. It is anticipated

that wherever economically and physically feasible and when such recycled water is of adequate quality and quantity, the Agency and its partners will endeavor to plan, collaborate and implement the use of recycled water.

Uses may include, but are not limited to, agricultural irrigation, commercial landscape irrigation, residential or multi-family dual plumbed landscape irrigation, construction water, industrial process water, and recreational impoundments.

The development of the Regional Approach for Water Reuse Project is seen as the first step in implementing a regional approach to water recycling. This plan and subsequent detailed studies will provide a roadmap for optimizing the use of recycled water in the Agency's service area. Once a technically and economically viable approach to regional water reuse is attained, the Agency anticipates that it and its partners will take actions to provide financial incentives and otherwise encourage the use of recycled water. Currently, the Agency has developed engineering standards for the installation of reclaimed water piping in new subdivisions where feasible, however the Agency Board has not adopted any ordinance mandating its implementation.

Anticipated areas of potential development and use of recycled water use in central Amador County are discussed below.

IONE AREA

Development in the greater Ione area is projected to result in a need to treat and dispose of approximately 4.3 mgd of municipal and State institutional wastewater through a combination of golf course irrigation, industrial reuse and crop irrigation overlying the Ione Valley groundwater aquifer.

AMADOR CITY/SUTTER CREEK/MARTELL AREA

Development in the greater Amador City/Sutter Creek/Martell area (i.e. the Amador Regional Sanitation Authority ('ARSA') service area) is projected to result in a need to treat and dispose of approximately 5.52 mgd of municipal wastewater. Potential uses for reclaimed water in this area would include the existing ARSA fodder crops, agricultural irrigation, landscape irrigation, golf courses, wildlife habitat enhancement, and industrial reuse.

JACKSON AREA

Development in the greater Jackson area is projected to result in a need to treat and dispose of approximately 2.42 mgd of municipal wastewater. Jackson reclaimed water could be utilized for agricultural irrigation, landscape irrigation, golf courses, wildlife habitat enhancement, and industrial reuse.

4.7 Summary of Current and Future Water Supplies

Table 4-7 summarizes the Agency's current and future water supplies. The future supplies are based on several assumptions. First, La Mel Heights will reach build out in 2020 and not require any additional water supply. Second, Lake Camanche Village will switch to surface water in the year 2015.

Table 4-7 Current and Planned Water Supplies (AFY)

Water Supply Sources	2010	2015	2020	2025	2030
Surface Water[a]	16150	17200	17200	17200	17200
Supplier Produced Groundwater	296	369	441	511	581
Recycled Water[b]	0	0	0	0	0
Incidental Transfer to EBMUD[c]	N/A	N/A	N/A	N/A	N/A
TOTAL[d]	16,446	17,569	17,642	17,711	17,781

Footnotes:

a. It is anticipated the Agency will obtain additional water rights in CAWP, increasing the right from 1,150 AFY to 2,200 AFY.

b. Recycled water is not supplied by the Agency but is used in a small portion of the Agency's service area. Future supply does not include several potential uses that are currently being investigated.

c. Quantities transferred to EBMUD are incidental and not guaranteed for any specific amount. They are therefore not projected.

d. Total does not reflect amount of water incidentally transferred out of supply to EBMUD.

4.8 Future Water Projects

The Agency participated in the preparation of the Integrated Regional Water Management Plan ('IRWMP') that laid out the roadmap for improving regional water resource management. Some of the projects identified in the IRWMP provide direct benefit to the Agency's water supply.

Specifically, the Agency, Calaveras County Water District, East Bay Municipal Utility District and San Joaquin County are together investigating the feasibility of increasing storage at Lower Bear River Reservoir by raising Lower Bear River Dam to provide an additional firm water supply and improve dry year yield and thereby helping meet future water supply needs. Raising Lower Bear River Dam is being considered as part of the larger Mokelumne Inter-Regional Conjunctive Use Project (IRCUP). The IRCUP could use a combination of groundwater banking, exchanges and transfers among project partners to result in a sustainable improvement in water supply reliability. Raising Lower Bear River Dam would also increase power generation at existing downstream hydroelectric power plants and is currently being considered by Pacific Gas & Electric independently of IRCUP.

There are several other components of IRCUP, some of which are controversial and have been the targets of litigation. While there may be barriers to implementation of some of the components of IRCUP, the Agency believes that regional cooperation of competing interests holds the best opportunity for success.

Since the IRCUP is still in the planning stages, at this time there are no projected supply volumes available.

Chapter 5 Water Supply Reliability & Contingency Planning

5.1 Introduction

The Agency regularly reviews and evaluates projected system demands versus available supplies in order to ensure a sufficient capacity within the Sevice Area. This chapter analyzes water supply and reliability under a wide variety of scenarios and its resultant effect on water demand management practices.

5.2 Reliability

Agency operational experience during normal, dry and multiple dry year conditions, such as 1988 to 1994, indicates that the spring runoff will continue to fill PG&E reservoirs to near capacity. These reservoirs form the head of both the AWS and CAWP surface water diversions. Even during unusually severe droughts, such as occurred in 1976/1977, and the prolonged drought of 1988 to 1994, the PG&E storage capacity and the priority of the water rights for such storage enables PG&E to deliver the full annual contract entitlements to the Agency.

The original La Mel Heights groundwater well has been run continuously through a variety of seasonal and climatic conditions and has continued to produce a steady yield. The Agency added a second well in the La Mel Heights area to provide additional supply as well as to provide redundancy.

The Agency is currently in process of a Groundwater Sustainability Study for the Lake Camanche Village service area, as directed by the State Department of Public Health (CDPH). The study is expected to be completed in Calendar Year 2012 and will allow the Agency to determine the number of connections that the groundwater basin can reliably supply. To date, the water Cosumnes Sub-basin that supplies Lake Camanche Village has supplied sufficient water, but it should be noted that the Agency did not receive ownership of the system until 2001, therefore supply data for dry and multiple dry years is not available.

5.3 Contingency Planning

5.3.1 Catastrophic Supply Interruption Plan

In addition to drought, the Amador Water Agency has planned for other catastrophes that could impact water supply and quality. For example, in case of a short-term, regional power outage the Agency has purchased or has access to emergency generators to pump and treat water. The Buckhorn, Tanner, and Ione Water Treatment Plants have been assessed for possible water supply emergency scenarios and action plans have been developed. Table 5-1 summarizes the catastrophes for which the Agency has prepared in some or all of their facilities. Appendix J contains the Agency's Emergency Handbook.

Due to the Agency's geographic location and the areas seismic classification, service interuption due to seismic activity is considered minimal and is therefore not addressed in the Emergency Handbook. The only like issue arising out of a seismic event would be a potential power outage which is addressed within the Emergency Handbook.

Table 5-1 Preparation Actions for a Catastrophe

Possible Catastrophe	Check if Discussed
Computer/PLC Failure	X
Power Failure	X
Raw Water Quality / Loss of Raw Water Supply	X
Disinfection Failure	X
Treated Water Turbidity Spike	X
Fire	X
Chemical Spill/Leak	X
Maximum Contaminant Level (MCL) Failure	X
Loss of Pressure	X

5.3.2 Consumption Reduction Methods & Mandatory Prohibitions

This section describes the program elements in place to reduce water use and eliminate waste when necessary and the penalties which exist to enforce the restrictions. Also see Appendix H for the existing Agency Code/Ordinance.

Table 5-2 details the restrictions that shall take effect should the Agency Board of Directors declare a water shortage emergency (Stage 2).

Table 5-2 Water Shortage Contingency - Mandatory Prohibitions

Examples of Prohibitions	Stage When Penalty Takes Effect
Irrigation between 9am and 7pm.	2
Washing of vehicles by a hose without an automatic shut-off valve or by use of water directly from faucets or other outlets.	2
Emptying and refilling of swimming pools and hot tubs.	2
Washing of sidewalks, walkways, driveways, patios, parking lots, tennis courts or other hard-surfaced areas by hose or by use of water directly from faucets or other outlets.	2
Operation of decorative fountains.	2
Sewer flushing with fresh water.	2
Irrigation that results in flooding or other run-off.	2
Unattended watering.	2
The use of water for scenic and recreational ponds and lakes, except for the minimum amount required to support fish life.	2

The Agency water shortage contingency plan also identifies several methods to reduce consumption of potable water. During a Stage 2 water emergency, these methods are considered to be mandatory. The amount of reduction required by each user is determined by the Board of Directors at the time of the declaration. The reduction methods include:

- Use of water conservation kits which may include a device to reduce toilet flush water requirements, a device to reduce shower flow rates, a dye tablet to determine if a toilet tank leaks, or other devices or information pertinent to water conservation.
- Applications for service connections for new construction shall be granted upon condition that water shall be used for only interior purposes for the duration of the drought or emergency.
- Restaurants shall serve water to customers only upon request.
- Industrial water uses shall be reduced to the lowest possible amount that will allow continued operation.

The Agency depends heavily on voluntary adherence to drought imposed restrictions. However, in the event that voluntary compliance is ignored during a Stage 2 emergency, penalties are included in the Water Shortage Contingency Plan. The penalties and charges are as follows:

- First Offense: Written warning from the Agency but no change in service.
- Second Offense: A flow restriction device is installed for a period of one week. The customer is responsible for paying a penalty for removal of the device.

Third and Subsequent Offense(s): A flow restriction device is installed for the duration of the state of emergency. The customer is responsible for paying a penalty for removal of the device.

Table 5-3 summarizes the consumption reduction methods.

Table 5-3 Consumption Reduction Methods

Consumption Reduction Method	Stage When Method Takes Effect	Projected Reduction (%)[a]
Enforcement of Prohibited Measures (outdoor water use restrictions, etc.)	2	31%[b]
Water conservation kits	2	8%[c]
New construction restrictions on outdoor water use	2	n/a[d]
Service of water in restaurants	2	0.5%
Reduction of volume of water used by industry	2	11%
Total Projected Reduction	---	50.5%

Footnotes:

a. Percent reductions are best estimates and have not been verified during a Stage 2 emergency. Estimates were based on Water Use and High Population Estimate in 2010.
b. Estimated based on reducing water use in each sector as follows: SFR-35%, MFR, Commercial, Institutional- 10%, Industrial- 5%, Landscape- 90%.
c. Estimated based on low-flow shower heads providing water savings of 5 gal/person/day.
d. Reductions based on construction restrictions depend upon the number of new meters being constructed during a Stage 2 water emergency.

5.3.3 Water Supply Shortage Stages

Table 5-4 Water Shortage Contingency - Rationing Stages to Address Water Supply Shortages

Stage Number	Supply Shortage Condition	Customer Demand Reduction Goal	Type of Conservation Program
1	None	0%	Normal
2	Drought or Water Emergency	0.5% to 50.5%	Mandatory

5.3.4 Penalties

In order to address waste of Agency water (running to a gutter, pooling, or running off of applied areas), the Agency has established penalties. After two warnings by mail or personal service to the customer, the Agency may disconnect the service for failure to comply. The disconnected service will be restored only upon correction of the water waste condition and payment of the Service Call Fee set forth in the Agency Rate Schedule. Water wasted will be estimated and charged for in accordance with the Agency's Water Service Rates and Charges. Table 5-5 summarizes the penalties and charges.

Table 5-5 Penalties and Charges

Penalties and Charges	Stage When Penalty Takes Effect
Charge for excess use[a]	1 & 2
Penalty for excess use	2
Flow restriction	2
Written warning	2
Service disconnection	2

Footnote:

a. The Agency uses tiered rate structure for some parts of its system at all times.

5.3.5 Revenue & Expenditure Analysis

Due to the reliable availability of water, even during long and severe droughts, revenue impacts to the Agency due to reduced water sales are minimal. The Agency does not maintain funding reserves for water shortages due to sufficient funds available to the Agency and the infrequent occurrence and short duration of Stage 2 emergencies. A significant portion of personnel costs are recovered through service. Wasted water is still metered and is not considered to be lost revenue. Water supply conditions that would reduce sales, would generally be considered part of the cost of maintenance. In the cases of anthropogenic impacts to water quality or man-made or natural disasters, it is anticipated that lost revenue could be recovered or absorbed due to the emergency situation.

5.4 Water Quality Impacts to Reliability

5.4.1 Surface Water – Amador Water System & Central Amador Water Project

The Mokelumne River, which is the source water for AWS and CAWP, is a high quality of source water for most of the year. During storm periods, the water quality becomes somewhat turbid but this has not caused changes in the availability of the water supply to either system.

5.4.2 Groundwater – Lake Camanche Village and La Mel Heights

For the groundwater sources, water quality is of moderate concern. There are six wells in the Lake Camanche Village area. Two of the wells were closed due to water quality concerns. These two wells are currently not used. No historical records are available to determine the extent of water quality issues at the two discontinued wells. Wells 9 and 14 have experienced some problems with water quality, particularly bacteria while Well 12 has occasionally had issues with iron and manganese, although recent change of operations of this well have seemed to eliminate this problem over the last few years. According to the Year 2010 well pumping records for Lake Camanche Village, approximately 13 percent of the supply is from Well 6, 41 percent of the supply is from Well 9, 25 percent of the supply is from Well 12 and 21 percent of the supply is from each Well 14. Wells 9 and 14 are located on the west side of Lake Camanche, while Wells 6 and 12 are both located east of the lake.

Well 14 was offline due to water quality issues from September 2010 until July 2011, however the remaining three wells have so far met the demands of Lake Camanche Village. Currently, Well 14 is operating at a reduced production rate and a plan has been developed to rehabilitate Well 14, but is pending approval of a rate increase to provide the revenue needed to implement the plan. The Agency will continue to monitor the safe yield and water quality of the wells as the Camanche Water Sustainability Study is completed and anticipates the return of Well 14 to production.

The groundwater from the La Mel Heights area well is of adequate quality and is not considered subject to changes in supply due to water quality concerns.

5.5 Seasonal and Climatic Shortage

During the recent extreme drought of 1976/1977 and prolonged drought of 1988 to 1994, spring runoff each year managed to fill PG&E's reservoirs to near capacity. By July, runoff is typically near zero and system water demands are met by storage facilities. The timing of the runoff is about the same for wet or dry years with the only difference being the magnitude of the runoff and the amount of reservoir spill. PG&E is able to provide the full annual water contract entitlements to the Agency due to the priority of the water rights involved and the amount of water stored on behalf of the Agency. Therefore, the supply available for normal, dry or multiple dry year scenarios remains the same for surface water diversions.

For the limited groundwater sources utilized by the Agency, the firm yield determined at the time of well installation indicates that the supply is consistent for normal, dry or multiple dry years. Climatic change is not considered to be a factor in the Agency's water supply reliability.

For planning purposes, the Agency assumes that demands do not change from the normal year demands during single or multiple dry year scenarios. Projected normal year demands are based on estimated customer connections and projected unit water demands to comply with 20% by 2020 requirements.

5.5.1 Water Supply

Table 5-6 summarizes the projected current water supply which is based on water rights, not demands. Note that it is anticipated the Agency will obtain additional water rights in CAWP, increasing the right from 1,150 AFY to 2,200 AFY by 2015.

Groundwater production is not included in the calculations, but rather safe yields of the respective wells are utilized. The Agency does not expect to encounter recurring water quality issues with its Lake Camanche Village wells, however the projections assume only Wells 6, 9 and 12 are on-line, and that a surface water treatment facility is not operational.

Finally, the table does not cover mechanical failures that may be experienced by the Agency, such as failure of the Tiger Creek and Silver Lake Pines Pump Stations for CAWP and well pumps for the La Mel and

Lake Camanche Village systems. The CAWP pump stations are greater than 30 years old and under capacity for current demands.

Table 5-6 Projected Normal Water Supply[a] (AFY)

Supply	Average Year	Dry Year	Multiple Dry Years		
			2011	2012	2013
AWS Surface Water Diversions	15,000	15,000	15,000	15,000	15,000
CAWP Surface Water Diversions[a]	1,150	1,150	1,150	1,150	1,150
La Mel Heights Groundwater	25	25	25	25	25
Lake Camanche Village Groundwater[b]	325	244	244	244	244
Total	16,500	16,419	16,419	16,419	16,419
% of Projected Normal Supply	100%	99.5%	99.5%	99.5%	99.5%

Footnotes:

a. It is anticipated that the Agency will obtain 1,050 AFY additional water rights in CAWP.

b. These water supply changes assume a loss of 25% production during the dry years.

5.5.2 Demand

Current groundwater production is estimated at 350 AFY, and does not include Well #14 in Lake Camanche Village. Supply in 2010 is 16,500 AFY. Additional customers are included for La Mel and Lake Camanche Village in 2015, 2020, 2025, and 2030. Should Camanche Groundwater Sustainability Study indicate the aquifer cannot support the additional connections anticipated by Amador County, either the additional connections would not be permitted or a new surface water treatment plant would be required. The calculations assume that additional water supply sources, either wells or new surface water treatment plant, will be on-line to accommodate the additional planned growth in the Lake Camanche Village area. It is anticipated that the Agency will obtain 1,050 AFY additional water rights in CAWP.

Normal Year

Table 5-7 compares the supply and demand during a normal year.

Table 5-7 Supply and Demand Comparison - Normal Year (AFY)

Demand	2010	2015	2020	2025	2030
Supply Totals	16,446	17,669	17,742	17,811	17,881
Demand Totals	8,407	9,052	9,778	10,594	11,446
Difference	8,039	8,617	7,963	7,217	6,435
Difference as % of Supply	49%	49%	45%	41%	36%
Difference as % of Demand	96%	95%	81%	68%	56%

Single Dry Year

Table 5-8 compares the supply and demand during a dry year.

Table 5-8 Supply and Demand Comparison – Single Dry Year (AFY)

	2010	2015	2020	2025	2030
Supply Totals	16,446	17,581	17,635	17,687	17,740
Demand Totals	8,407	8,964	9,672	10,470	11,305
Difference	8,039	8,617	7,963	7,217	6,434
Difference as % of Supply	49%	49%	45%	41%	36%
Difference as % of Demand	96%	96%	82%	69%	57%

Multiple Dry Years

Table 5-9 compares the supply and demand during multiple dry years.

Table 5-9 Supply and Demand Comparison – Multiple Dry Years (AFY)

	Supply	2010	2015	2020	2025	2030
Multiple Dry Years, First Year Supply	Supply Totals	16,446	17,581	17,635	17,687	17,740
	Demand Totals	8,407	8,964	9,672	10,470	11,305
	Difference	8,039	8,617	7,963	7,217	6,434
	Difference as % of Supply	49%	49%	45%	41%	36%
	Difference as % of Demand	96%	96%	82%	69%	57%
Multiple Dry Years, Second Year Supply	Supply Totals	16,446	17,581	17,635	17,687	17,740
	Demand Totals	8,407	8,964	9,672	10,470	11,305
	Difference	8,039	8,617	7,963	7,217	6,434
	Difference as % of Supply	49%	49%	45%	41%	36%
	Difference as % of Demand	96%	96%	82%	69%	57%
Multiple Dry Years, Third	Supply Totals	16,446	17,581	17,635	17,687	17,740
	Demand Totals	8,407	8,964	9,672	10,470	11,305
	Difference	8,039	8,617	7,963	7,217	6,434

	Supply	2010	2015	2020	2025	2030
Year Supply	Difference as % of Supply	49%	49%	45%	41%	36%
	Difference as % of Demand	96%	96%	82%	69%	57%

5.6 Use Reduction Monitoring

Appendix H contains the Agency's Water Shortage Contingency Plan, Sections 2.19 and 2.20 of the Agency's water code.

Water use during normal, wet, and dry periods is monitored by several means. Meters are installed on all new connections to an Agency water system and on all existing connections upon the occasion of a change of customer at the subject premises. Flat rate services are being phased out. Currently only about 200 of approximately 6,600 customers are not fully metered. Records are kept of both water production and consumption. These records are maintained and analyzed to identify losses in the system and to establish baselines in case of a declaration of emergency. In case of an emergency, achievement of reductions is determined by the Agency through comparison of the customer's prior year's seasonal usage with the seasonal usage during the year of the drought or other emergency. If the drought is severe enough, the Board can order monitoring of water production and uses on a weekly or even daily basis. The high, and growing, percentage of metered customers within the service area facilitates this effort. Table 5-10 summarizes the water use monitoring mechanisms.

Table 5-10 Water Use Monitoring Mechanisms

Mechanism for Determining Actual Reductions	Type of Data Expected
Comparison of production/billing records	Acre feet increase/decrease

Chapter 6 Demand Management Measures – Section 10631 (f)

CONSERVATION PROGRAMS

The Agency is committed to ensuring the implementation of water conservation programs that will promote efficient use of the existing water supplies. This section discusses existing and future water conservation measures, referred to interchangeably as Best Management Practices (BMPs) or Demand Management Measures (DMMs), being implemented by the Agency.

The Agency prepared an Urban Water Management Plan in 2005. The Agency adopted a Water Conservation Plan ('WCP') in 2010. The UWMP discussed fourteen potential conservation programs, referred to as DMMs. The California Urban Water Conservation Council ('CUWCC') adopted the 1991 *Memorandum of Understanding Regarding Urban Water Conservation in California* ('MOU'), outlining the same fourteen conservation programs (but calling them BMPs) to expedite implementation of reasonable water conservation measures in urban areas. The CUWCC MOU has since been amended in December of 2008. During this amendment, the BMPs were restructured into new BMP categories. This document references the original fourteen DMMs/BMPs to the extent possible in order to be consistent with the AB1420 legislation and reporting requirements.

Each of the fourteen DMMs documented in the UWMP guidelines and the AB1420 certification documents is discussed below. For each DMM, the description of the DMM, the goal for full compliance and compliance documentation required as set forth in the CUWMM MOU is presented. The CUWCC MOU requirements were used herein as measures for Agency compliance as the AB1420 legislation uses this document as its measure for State-wide compliance with the legislation.

Due to limited available funds, the Agency cannot meet the CUWCC goal for some of the DMMs within the specified period, but plans to implement each DMM to the level fiscally possible, as described in this Conservation Plan. If the Agency obtains outside funding, the conservation programs will be expanded and/or accelerated until the coverage requirements specified in the CUWCC MOU have been met. Appendix A contains the comprehensive plan that would be implemented if full funding were available and demonstrates how the programs would be expanded, given outside funding, to meet the goals set forth in the CUWCC's MOU.

6.1 Demand Management Measure 1

6.1.1 CUWCC Description

This DMM is intended to provide water survey programs for both single-family and multi-family residential customers. Survey programs are to encompass both indoor and outdoor water use. Specifically, DMM 1 is to include the following.

> Residential Assistance - Provide site-specific leak detection assistance that may include, but is not limited to a water conservation survey, water efficiency suggestions, and/or inspection.
>
> Landscape Water Survey - Perform site-specific landscape water surveys that shall include, but are not limited to, the following: check irrigation system and timers for maintenance and repairs needed; estimate or measure landscaped area; develop customer irrigation schedule based on precipitation rate, local climate, irrigation system performance, and landscape conditions; review the scheduling with customer; provide information packet to customer; and provide customer with evaluation results and water savings recommendations.

6.1.2 CUWCC Documentation Requirement

Provide reports, disaggregated by single-family and multi-family units, identifying the number of:

- Residential assistance/leak detection survey visits completed,
- WaterSense Specification (WSS) showerheads distributed, and
- WSS faucet aerators distributed during the reporting period.

In addition, provide the number of single-family and multi-family account landscape water surveys completed during the reporting period.

6.1.3 CUWCC Goal

Provide leak detection assistance averaging 1.5% per year of single-family accounts and 1.5% of multi-family accounts per year for the first ten years. After meeting the 10 year 15% target, maintain the program at level of high-bill complaints or not less than 0.75% per year of current single-family accounts and 0.75% per year of current multi-family accounts. The same level of compliance will be provided for landscape surveys.

6.1.4 Implementation Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.1.5 Existing AWA Program

Water surveys for residential users help raise awareness of water conservation in the home and water-saving kits conserve water during everyday use. In the past, the Agency has offered free residential water use surveys and water saving kits to customers upon request. The Agency has also provided landscape surveys when requested, including sprinkler system efficiency, distribution uniformity, seasonal scheduling and repairs or improvements. The Agency has had an informal water survey program since 1985, but has not tracked the number of surveys performed annually.

6.1.6 Future AWA Program

Herein, the Agency has formalized its program for residential water surveys, landscape water surveys, and WSS showerhead and faucet aerator distribution. Table 6-1 summarizes the estimated number of surveys to be completed over the next five years. These surveys include both indoor and outdoor investigations and suggestions for both single-family and multi-family residences. The numbers included in Table 6-1 assume residential landscape surveys will be conducted at the same time as indoor residential surveys.

Table 6-1: Projected Water Survey Program

	FY12	FY13	FY14	FY15	FY16
# of single-family surveys	50	100	100	100	100
# of multi-family surveys	1	1	2	3	4
# of landscape surveys	50	100	100	100	100

Note: In FY11, the Agency will perform 10 single-family surveys, 1 multi-family survey, and 10 landscape surveys.

6.2 Demand Management Measure 2

6.2.1 CUWCC Description

Provide site-specific leak detection to residential customers by providing plumbing retrofits, including showerheads and faucet-aerators that meet the current water efficiency standard as stipulated in the WaterSense Specifications (WSS).

6.2.2 CUWCC Documentation Requirement

Provide reports, disaggregated by single-family and multi-family units, identifying: the number of residential assistance/leak detection survey visits completed; number of WSS showerheads distributed; and number of WSS faucet aerators distributed during the reporting period.

6.2.3 CUWCC Goal

Plumbing device distribution and installation programs will be maintained at a level sufficient to distribute high quality, low-flow showerheads to not less than 10% of single-family residences and 10% of multi-family units constructed prior to 1992 each reporting period; or enactment of an enforceable ordinance requiring the replacement of high-flow showerheads and other use fixtures with their low-flow counterparts. Continue until coverage includes 75% of single family and multi-family units.

6.2.4 AWA Status

The Agency has not yet implemented this DMM.

6.2.5 Existing AWA Program

The Agency encourages its customers to conserve water during everyday use, but has not yet implemented a formal program to provide plumbing retrofits to users.

6.2.6 Future AWA Program

Implementation of this DMM will be combined with DMM 8, school education. As part of the school education programs discussed in DMM 8, the Agency will distribute low-flow showerheads to the fifth-grade classes targeted for presentations each year. Under this program, the Agency will distribute approximately 300 WSS showerheads each year. To evaluate the effectiveness of the school education program, the Agency will track the number of phone calls from parents/guardians requesting more information on conservation programs and/or the low-flow showerheads after the fifth-grade programs are held. The Agency may also compare water use at homes before and after the distribution of the WSS showerheads and other water saving devices. The number of showerheads distributed can be adjusted as necessary.

In addition to providing low-flow showerheads to the 5th grade classes under DMM 8, the Agency will either distribute additional low-flow showerheads as giveaways at other public events and/or provide a predetermined number of rebates for low-flow showerheads each year. The latter is assumed for purposes of future planning. Table 6-2 summarizes the total number of planned low-flow showerhead rebates provided for residential plumbing retrofits (in lieu of give-aways) each fiscal year.

Table 6-2 Planned Residential Plumbing Retrofits

	FY12	*FY13*	*FY14*	*FY15*	*FY16*
# showerhead rebates	195	389	389	389	389
AFY savings showerheads	2.7	5.4	5.4	5.4	5.4

Notes:

a) Rebates for low-flow toilets will not be included in DMM 2, as DMM 14 is devoted solely to providing WSS Toilets.

b) This DMM is not budgeted for in FY11.

6.3 Demand Management Measure 3

6.3.1 CUWCC Description

Per the CUWCC program, implementation of DMM 3 shall consist of at least the following actions:

1. Annually complete a pre-screening system audit to determine the need for a full-scale system-wide water audit. The pre-screening system audit shall be calculated as follows:
    a. Determine metered sales;
    b. Determine other system verifiable uses;
    c. Determine total supply into the system;
    d. Divide metered sales plus other verifiable uses by total supply into the system. If this quantity is less than 0.9, a full scale system audit is indicated.
2. When indicated, agencies shall complete water audits of their distribution systems using methodology consistent with that described in AWWA's Water Audit and Leak Detection Guidebook.
3. Agencies shall advise customers whenever it appears possible that leaks exist on the customer's side of the meter; perform distribution system leak detection when warranted and cost-effective; and repair leaks when found.

6.3.2 CUWCC Documentation Requirement

Documentation required in support of this DMM includes pre-screening audit results and supporting documentation, and in-house records of audit results or the completed AWWA Audit Worksheets for each completed audit period.

6.3.3 CUWCC Goal

Complete one pre-screening audit per year.

6.3.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.3.5 Existing AWA Program

Repair and maintenance of the water distribution systems are priorities for the Agency and the Agency has conducted system water audits since its founding. On a small scale, the Agency contacts individual customers when meter readings indicate unusually high usage. The Agency will then work with the owner to determine if a leak may have developed. System audits are also performed on a larger scale.

Records are kept annually on water production versus consumption to track unaccounted water in the system. As previously described, the Agency installed the Amador Transmission Pipeline, replacing the earthen Amador and Ione Canal, ultimately reducing the system leaks and high water losses. The new pipeline mitigates for water historically lost during conveyance through the Amador Canal, lowering effective system demand and allowing the Agency to more efficiently use its water entitlements. Also, by eliminating canal losses, the Agency has been able to better identify residential, commercial and industrial losses.

6.3.6 Future AWA Program

As required by DMM 3, the Agency will conduct an annual pre-screening audit of their entire distribution system. If indicated by the pre-screening audit, a system-wide detailed water audit will be performed. For

the purposes of budgeting for this DMM, it was assumed that a detailed water audit will be conducted every five years.

There is potential for the Agency to coordinate a joint leak detection and pipe repair program with its southern neighbor, the Calaveras County Water District. This would be implemented through the regional umbrella organization, the Upper Mokelumne River Watershed Authority, and could potentially achieve cost savings through a shared program.

6.4 Demand Management Measure 4

6.4.1 CUWCC Description

Implementation of this DMM shall consist of at least the following actions:

1. Require meters for all new service connections.
2. Establish a program for retrofitting existing unmetered service connections.
3. Read meters and bill customers by volume of use.
    - Establish and maintain billing intervals that are no greater than bi-monthly (every two months) for all customers.
    - For each metered connection, perform at least five actual meter readings (including remotely sensed) per twelve month period.
4. Prepare a written plan, policy or program that includes:
    - A census of all meters, by size, type, year installed, customer class served and manufacturer's warranty accuracy when new;
    - A currently approved schedule of meter testing and repair, by size, type and customer class;
    - A currently approved schedule of meter replacement, by size, type, and customer class; and
5. Identify intra- and inter-agency disincentives or barriers to retrofitting mixed use commercial accounts with dedicated landscape meters, and conducting a feasibility study(s) to assess the merits of a program to provide incentives to switch mixed use accounts to dedicated landscape meters.

Service lines dedicated to fire suppression systems are exempt from this requirement.

6.4.2 CUWCC Documentation Requirement

Documentation required for compliance with the CUWCC MOU is as follows:

- Confirmation that all new service connections are metered and are being billed by volume of use and provide:
    - Number of metered accounts;
    - Number of metered accounts read;
    - Number of metered accounts billed by volume of use;
    - Frequency of billing (i.e. six or twelve times per year) by type of metered customer (e.g. single-family residential, multiple-family residential, commercial, industrial, and landscape irrigation); and
    - Number of estimated bills per year by type of metered customer (e.g. single-family residential, multiple-family residential, commercial, industrial, and landscape irrigation) vs. actual meter readings.

- Number of unmetered accounts in the service area. For the purposes of evaluation, this shall be defined as the baseline meter retrofit target, and shall be used to calculate the agency's minimum annual retrofit requirement.
- Number of unmetered service connections retrofitted during the reporting period.
- Estimated number of CII accounts with mixed-use meters.
- Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.

6.4.3 CUWCC Goal

Meter 100% of existing unmetered accounts and bill by volume, including:

1. Initiating volumetric billing for all metered customers within one year.
2. Complete meter installation for all service connections within 6 years.
3. For unmetered service areas newly acquired or newly operated by otherwise metered agencies, meter installation shall be completed in these service areas within 6 years of the acquisition or operational agreement.
4. A feasibility study examining incentive programs to move landscape water uses on mixed-use meters to dedicated landscape meters to be completed by the end of Year Four.
5. A written plan, policy or program to test, repair and replace meters shall be completed and submitted electronically within one year.

6.4.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.4.5 Existing AWA Program

The Agency's treated water systems are not fully metered. The Agency has historically converted services from flat rate to metered service upon transfer of ownership. There are still approximately 27 residential, commercial and raw customers requiring metering, and approximately 153 accounts yet to be converted from flat rate to volumetric billing. As these properties transfer ownership, they are required to convert to metered service. Meters are installed with every new connection made to an Agency water system, whether treated or untreated, at the time that the service connection is installed.

6.4.6 Future AWA Program

Table 6-3 summarizes the planned commodity rate metering and retrofits for the next five fiscal years.

Table 6-3 Planned Commodity Rate Metering and Retrofits

	FY12	*FY13*	*FY14*	*FY15*	*FY16*
# of meter conversions	20	0	0	0	0
# of accounts from flat to volumetric use	153	0	0	0	0

Note: In FY11, the Agency will convert 7 unmetered accounts to metered.

6.5 Demand Management Measure 5

6.5.1 CUWCC Description

Under DMM 5, the Agency will provide support and incentives to improve non-residential customers' landscape water use efficiency. Support shall include:

1. Accounts with dedicated irrigation meters:

- Identify accounts with dedicated meters and assign ETo-based water use budgets equal to no more than an average of 70% of ETo of annual average local ETo per square foot of landscape area.
- Provide notices each billing cycle to accounts with water budget showing the relationship between the budget and actual consumption.
- Offer site-specific technical assistance to reduce water use to accounts that are 20% over budget.

2. Commercial, industrial, and institutional (CII) accounts without meters or with mixed-use meters
    - Develop and implement strategy targeting large landscape water use surveys to CII accounts with mixed-use meters.
    - In un-metered service areas, actively market landscape surveys to existing accounts with large landscapes or accounts with landscapes that are not water efficient.
3. Offer financial incentives.

6.5.2 CUWCC Documentation Requirement:

Under this DMM, the Agency shall preserve water use records and budgets for customers with dedicated landscape irrigation accounts for at last four years. In addition, the following information will be preserved for CII accounts without meters or with mixed-use meters:

- Number of accounts
- Number, type, dollar value of incentives, rebates, and no- or low-interest loans offered to, and received by, customers
- Number of surveys offered
- Number of surveys accepted
- Estimated annual water savings by customers receiving surveys and implementing

6.5.3 CUWCC Goal

Per the CUWCC MOU (set by AB1420 as the standard for DMM compliance), the goals for DMM 5 are as follows:

- At least 90% of all dedicated meters and 15% of all mixed-use and non-metered accounts will receive assistance over a ten year period.
- Develop ETo-based water use budget for 9% of all dedicated accounts per year over 10 years.
- Offer site specific technical assistance annually to accounts that are 20% over their budget within 6 years of the date implementation was to commence.

6.5.4 AWA Status

The Agency has not yet implemented this DMM.

6.5.5 Existing AWA Program

The Agency has approximately 30 accounts dedicated solely to large landscape irrigation. These accounts are mostly local parks and cemeteries. The Agency has offered surveys to large landscape accounts, along with all commercial, industrial, and institutional accounts since 1985 as an informal service; however, as the service was informal, no historic records have been kept.

6.5.6 Future AWA Program

The Agency will begin a program to formally offer surveys to large landscape accounts. Under this program, the Agency will visit customers who irrigate and recommend an efficient irrigation schedule and

improvements. The Agency will provide each dedicated irrigation account with an ETo-based water use budgets equal to no more than an average of 70% of ETo of annual average local ETo per square foot of landscape area. The recreational areas, like parks, may require additional water than allotted in the budget, but their use still may not exceed 100% of ETo on an annual basis. To aid the customer in tracking their water use, the Agency will provide notices each billing cycle to the accounts with water use budgets showing the relationship between the budget and their actual consumption. The Agency will offer technical assistance to customers that are 20% over budget. Surveys will also be provided to commercial, industrial and institutional accounts without meters or with mixed-use meters. Finally, the Agency will implement a weather based irrigation controller (WBIC) rebate program, offering $50/WBIC.

Table 6-4 summarizes the projected number of the large landscape surveys and rebates to be offered to customers under this DMM. Also shown below is the projected water savings resulting from the program implementation.

Table 6-4: Planned Large Landscape Conservation Programs

	FY12	FY13	FY14	FY15	FY16
# of budgets created	2	3	3	3	3
# of surveys completed	4	6	6	6	6
# of follow-up visits	2	3	3	3	3
# of rebates	1	2	2	2	2
Projected Water Savings- AFY	3.9	5.3	5.3	5.3	5.3

Note: This DMM is not budgeted for in FY11.

6.6 Demand Management Measurement 6

6.6.1 CUWCC Description

DMM 6 is implemented to provide incentives or establish ordinances requiring the purchase of high-efficiency clothes washing machines (HECWs) that meet an average water factor value of 5.0. If the WaterSense Specification (WSS) is less than 5.0, then the average water factor value will decrease by that amount. WaterSense is a partnership program sponsored by the U.S. Environmental Protection Agency (EPA) which makes it easier for Americans to save water by purchasing water-efficient products. Consumers can look for products with the WaterSense label to choose quality, water-efficient products. More information about WSS can be found at http://www.epa.gov/watersense/index.htm.

A water factor is the number of gallons per cycle per cubic foot that the clothes washer uses. The lower the water factor, the more efficient the machine is. For example, if a washer uses 30 gallons per cycle and has a tub volume of 3.0 cubic feet, then the water factor is 10.

6.6.2 CUWCC Documentation Requirement

Documentation required for DMM 6 includes the number of installations credited to the Agency's replacement program for HECWs with an average water factor value of 5.0. If the WSS is less than 5.0, then the water factor value will decrease to that amount.

6.6.3 CUWCC Goal

Incentives shall be provided to 0.9% of current single-family accounts during the first reporting period following implementation, rising to 1% per year for the remainder of a ten year period.

6.6.4 AWA Status

The Agency has not yet implemented this DMM.

6.6.5 Existing AWA Program

The Agency has not yet implemented this DMM.

6.6.6 Future AWA Program

Under the plans for implementing DMM 6, the Agency will initially offer a rebate program to customers residing in the Wastewater Improvement District #11 (WWID #11) which serves the Lake Camanche Village area. Wastewater disposal had become a concern in the Lake Camanche Village. Being able to reduce the quantity of wastewater produced in Lake Camanche Village by reducing water use was determined to be an effective method to counterbalance continued growth. Initially, a rebate of $75 will be offered. After the first year, the program can be adjusted and/or expanded to other customers throughout the County.

Table 6-5 summarizes program implementation and water savings. The Agency will also require all new residential development utilize HECWs.

Table 6-5: HECWs Rebate Program

Planned	*FY12*	*FY13*	*FY14*	*FY15*	*FY16*
# of rebates ($75 each)	35	70	70	70	70
Projected Water Savings (AFY)[a]	0.9	1.7	1.7	1.7	1.7

Notes:
1. Assuming 400 loads/household/year with non-conserving washing machines using 40 gal/load and HECWs using 20 gal/load.
2. This DMM is not budgeted for in FY11.

6.7 Demand Management Measure 7

6.7.1 CUWCC Description

Public information programs shall be implemented to promote water conservation and water conservation-related benefits. Implementation shall consist of at least the following actions:

1. The program should include, when possible, but is not limited to, providing speakers to employees, community groups and the media; using paid and public service advertising; using bill inserts; providing information on customers' bills showing use for the last billing period compared to the same period the year before; providing public information to promote water conservation measures; and coordinating with other government agencies, industry groups, public interest groups, and the media.
2. The program should include, when possible, social marketing elements which are designed to change attitudes to influence behavior. This includes seeking input from the public to shape the water conservation message; training stakeholders outside the utility staff in water conservation priorities and techniques; and developing partnerships with stakeholders who carry the conservation message to their target markets.
3. When mutually agreeable and beneficial, the wholesale agency or another lead regional agency may operate all or part of the public information program. If the wholesale agency operates the entire program, then it may, by mutual consent with the retail agency, assume responsibility for CUWCC reporting for this BMP. Under this arrangement, a wholesale agency may aggregate all or portions of the reporting and coverage requirements of the retail agencies joining into the mutual consent.

6.7.2 CUWCC Documentation Requirement

Agencies may report on all of the following activities, although agencies are only expected to meet the minimum requirements described above:

1. Newsletter articles on conservation
2. Flyers and/or brochures (total copies), bill stuffers, messages printed on bill, information packets
3. Landscape water conservation media campaigns
4. General water conservation information
5. Website
6. Email messages
7. Website - provide link to or list of qualified landscape professionals (WaterSense, California Landscape Contractors Association, Irrigation Association, etc.) and other helpful sites
8. Direct mail - seasonal postcards noting irrigation requirement changes
9. Direct mail or other notification to customer if water use is significantly higher than neighbors with similarly-sized lots
10. Customer notification when neighbor reports runoff or runoff is noticed by employees or meter reads show rise in use of 20% or more from same time previous year
11. Dedicated phone line or "on hold" messages with recorded conservation information
12. Booths at local fairs/events
13. Monthly water use reports provided with comparison of water use to water budget
14. Presentations
15. Point of purchase pieces, including internet point of purchase by type: high-efficiency clothes washers, weather based irrigation controller, high-efficiency toilets, plant palette information, other.
16. Media outreach: news releases, editorial board visits, written editorials, newspaper contacts, television contacts, radio contacts, articles or stories resulting from outreach. Provide names of local media markets: newspaper, TV stations, radio stations reached via media outreach program during the reporting period
17. Adult Education/Training Programs: Topic(s), number of presentations, number of attendees
18. Water Conservation Gardens: involvement in a garden that promotes and educates the public about water-efficient landscaping and conservation techniques. May include "Corporate" or "business" sponsorship or membership.
19. Sponsor or co-sponsor landscape workshops/training for homeowners and/or homeowners associations: number of presentations; number in attendance
20. Landscape watering calculator and watering index to assist with weekly irrigation scheduling
21. Additional program(s) supported by agency but not mentioned above
22. Total reporting period budget expenditure for public outreach/training/adult education programs (include all agency costs)

6.7.3 CUWCC Goal

At the minimum, a public information program shall consist of the following components:

1. Contacts with the public at least four times per year
2. Water supplier contacts with media at least four times per year
3. An actively maintained website that is updated at least four times per year
4. Description of materials used to meet minimum requirement
5. Annual budget for public outreach program

6.7.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.7.5 Existing AWA Program

The Agency believes public awareness of water conservation issues is an important factor in ensuring a reliable water supply. The Agency promotes public awareness of water conservation through many ways. These methods include bill inserts, brochures, a demonstration garden, and special events throughout the year, and water conservation programs sponsored in local schools. The Agency has had public information programs since 1985, but has not historically tracked information. Appendix B displays samples of public information distributed by Amador Water Agency.

6.7.6 Future AWA Program

To evaluate the effectiveness of their public information programs, the Agency may survey a sampling of customers to determine what percentage of their customers identifies their public information efforts.

The Agency will continue to implement public outreach strategies, but track them in a more organized fashion. The Agency plans to conduct public presentations and demonstrations, provide a presence at local fairs and events, provide media releases, provide monthly bill inserts, and keep a conservation webpage. The number of each planned activity per fiscal year is shown in Table 6-6.

Table 6-6: Planned Public Education Programs

	FY12	FY13	FY14	FY15	FY16
Public Presentations/Demos	4	4	4	4	4
Contacts with Media	4	4	4	4	4
Bill Messages	6	6	6	6	6
Update website	4	4	4	4	4

6.8 Demand Management Measure 8

6.8.1 CUWCC Description

School education programs are implemented to reach the youngest water users at an early age and enforce the need to engage in water conservation as a life-long behavior. Implementation shall consist of at least the following actions:

1. Implement a school education program to promote water conservation and water conservation-related benefits.
2. Programs shall include working with school districts and private schools in the water suppliers' service area to provide instructional assistance, educational materials, and classroom presentations

that identify urban, agricultural, and environmental issues and conditions in the local watershed. Educational materials shall meet the state education framework requirements and grade-appropriate materials shall be distributed.

3. When mutually agreeable and beneficial, the wholesale agency or another lead regional agency will operate all or part of the education program; if the wholesale agency operates all or part of the retail agency's school education program, then it may, by mutual consent with the retail agency, assume responsibility for CUWCC reporting of this BMP; under this arrangement, a wholesale agency may aggregate all or portions of the reporting and coverage requirements of the retail agencies joining into the mutual consent.

The Agency shall maintain an active school education program to educate students in the agency's service area about water conservation and efficient water use. An agency may participate in a mutual arrangement as described above.

6.8.2 CUWCC Documentation Requirement

Agencies may report on all of the following activities, although they are only expected to meet the minimum requirements described above:

1. Classroom presentations: number of presentations, number of attendees, topics covered: conservation, recycled water, water sources, pollution prevention, etc.
2. Large group assemblies: number of presentations, number of attendees
3. Children's water festivals or other events: number of presentations, number of attendees
4. Cooperative efforts with existing science/water education programs (various workshops, science fair awards or judging) and follow-up: number of presentations, number of attendees
5. Other methods of disseminating information (i.e. themed age-appropriate classroom loaner kits); Description; number distributed
6. Staffing children's booths at events & festivals: number of booths, number of attendees
7. Water conservation contests such as poster and photo; Description; number of participants
8. Offer monetary awards/funding or scholarships to students: number offered; total funding
9. Teacher training workshops: number of presentations, number of attendees
10. Fund and/or staff student field trips to treatment facilities, recycling facilities, water conservation gardens, etc.: number of tours or field trips, number of participants
11. College internships in water conservation offered: number of internships; total funding
12. Career fairs/workshops: number of presentations, number of attendees
13. Additional program(s) supported by agency but not mentioned above; Description; number of events (if applicable); number of participants
14. Total reporting period budget expenditures for school education programs (include all agency costs)

6.8.3 CUWCC Goal

The following are the goals for obtaining compliance with this DMM:

1. Curriculum materials developed and/or provided by agency (including confirmation that materials meet state education framework requirements and are grade-level appropriate).

2. Materials distributed to K-6 students. When possible, school education programs will reach grades 7-12 as well.
3. Description of materials used to meet minimum requirement.
4. Annual budget for school education program.
5. Description of all other water supplier education programs.

6.8.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.8.5 AWA Existing Program

In the past, the Agency has provided school education programs, including presentations and demonstrations, on a per request basis. Educational materials and videos for this program are provided by the Agency and include water-themed coloring books and conservation tips from "Aqua Annie." To appeal to younger children, a duck costume is available for a staff member to wear to the presentations as Aqua Annie. Appendix C contains examples of materials used for school education programs.

6.8.6 AWA Future Program

The Agency will formalize its school education program, focusing on outreach to fifth graders (the age best identified for reaching children and instilling the importance of water conservation). Specifically, the Agency will visit all fifth grade classes in their service area, giving a presentation that covers the agency's role in supplying water, the importance of managing water resources and water conservation tips. Each fifth grader will be given a low-flow showerhead to install in their own homes with their parents' permission. The effectiveness of school programs will be evaluated as part of the plumbing retrofit evaluations described in DMM 1. Table 6-7 summarizes the planned school education presentations to all fifth grade classes and the estimated water savings that may result from the low-flow showerhead distribution.

Table 6-7: Planned School Education Presentations

	FY12	FY13	FY14	FY15	FY16
# of giveaways	156	311	311	311	311
# presentations	3	6	6	6	6
total water savings	2.2	4.4	4.4	4.4	4.4

Note: In FY11, the Agency will give 2 presentations; giveaways will begin in FY12.

6.9 Demand Management Measure 9

6.9.1 CUWCC Description

Commercial, industrial, and institutional (CII) water use varies dramatically between business sectors and location. This DMM includes implementing measures to achieve a water savings. Potential measures include, but are not limited to:

- Industrial process water use reduction
- Industrial laundry retrofits
- Car wash recycling systems
- Water efficient commercial dishwashers
- Wet cleaning

6.9.2 CUWCC Documentation Requirement

The Agency shall report the measure type and quantity installed, as well as water savings attributed to water shortage measures, intervention and actions.

6.9.3 CUWCC Goal

The CUWCC goal is to save 10% of baseline CII water use over a 10-year period by reducing water use as follows:

- 0.5% by end of first reporting period (i.e. year 2)
- 2.4% by the end of year 4
- 4.3% by the end of year 6
- 6.4% by the end of year 8
- 9% by the end of year 10

Table 6-8: Demonstrated CII Water Savings[1]

Measure	Annual Savings (AF)	Measure Life (years)
HE Toilets	0.041748	25
HE Urinals	0.069086	25
Ultra Low Volume Urinals	0.080603	25
Zero Consumption Urinals	0.0921146	25
Commercial HE Single Load Clothes Washers	0.116618	10
Cooling Tower Conductivity Controllers	1.032250	5
Cooling Tower ph Controllers	3.981543	5
Connectionless Food Steamers	Per Steamer Compartment – 0.25	10
Medical Equipment Steam Sterilizers	1.538	20
Water-Efficient Ice Machines	0.834507	10
Pressurized Water Brooms	0.1534	5
Dry Vacuum Pumps	0.64	7

Source: CUWCC MOU Regarding Urban Water Conservation (December 2008)

6.9.4 AWA Status

The Agency has not yet implemented this DMM.

6.9.5 Existing AWA Program

Historically, the Agency has offered to review plans for new CII customers. The Agency has provided water use audits to any CII customer upon request since 1985 as an informal service; therefore, historical records have not been kept.

6.9.6 Future AWA Program

Currently, the Agency has about 389 CII accounts of which about 95 percent are mixed-use accounts. There is also one unmetered commercial account which will be retrofitted with a meter under DMM 4. The Agency will recognize a formal survey program for CII accounts which will include free water use surveys (upon request) and evaluations of water using apparatus and processes, and recommended efficiency measures. Table 6-9 summarizes the projected CII conservation program. Rebates will be provided for some water saving devices such as those included in Table 6-10. This DMM would not satisfy the level of coverage as described in the CUWCC. If additional funding were made available, the Agency could expand the program and provide additional surveys, rebates, and follow-up visits.

Table 6-9: Estimated CII Programs

	FY12	FY13	FY14	FY15	FY16
# of on-site surveys	10	15	15	20	30
# of rebates provided	5	10	10	10	10
# of follow-up visits	3	5	5	5	5
Projected water savings - AFY	2	3	3	4	6

Note: This DMM is not budgeted for in FY11.

Table 6-10: Agency CII Rebates

Device	Incentive Amount
WSS Toilets	$50
Urinal	$50
HECW	$75
Water Broom	$100
Cooling Tower Controller	$500

6.10 Demand Management Measure 10

6.10.1 CUWCC Description

This DMM addresses the assistance relationships between regional wholesale agencies and intermediate wholesale agencies as well as between wholesale agencies and retail agencies. These relationships are applied in the following way:

1. Financial investments and building partnerships

   When mutually agreeable and beneficial to a wholesaler and its retail agencies, a wholesaler will provide financial assistance and help build partnerships to accomplish conservation. Wholesale water suppliers will consider avoided capital costs when making financial investments and build regional partnerships to advance water conservation efforts and effectiveness. Where applicable, intermediate wholesale water suppliers that receive conservation-related financial incentives from regional wholesalers will pass through eligible financial incentives to retail agencies operating programs at the retail level.

2. Technical support

   When requested, wholesale water agencies will provide conservation-related technical support and information to retail agencies they serve. Support and information will include, but will not be limited to: workshops and support advice addressing conservation program planning, design, implementation, and evaluation.

3. Program management

   When mutually advantageous, wholesale and retail water agencies will join together to plan, design, implement, manage, and evaluate regional conservation programs.

   When mutually agreeable and beneficial, the wholesale agency or another lead regional agency will operate all or part of the conservation program; if the wholesale agency or other lead regional agency operates all or part of a program, then it may, by mutual consent with the retail agency,

assume responsibility for CUWCC reporting for funded BMPs; under this arrangement, a wholesale agency or other lead regional agency may aggregate all or portions of the reporting and coverage requirements of all retail agencies joining into the mutual consent.

4. Water shortage allocations

   Wholesale agencies shall pursue water shortage allocation policies or plans which minimize disincentives to long-term water conservation, and encourage and reward investments in long-term conservation shown to advance regional water supply reliability and sufficiency.

5. Non-signatory reporting

   To the extent possible, wholesale water agencies will provide reports on BMP implementation within their service area by retail water agencies that are not signatories to the MOU.

6. Encourage CUWCC membership

   Wholesale agencies will encourage all of their retail agencies to become MOU signatories, provide information to assist the CUWCC in recruitment targeting, and may assist in paying CUWCC dues for their retail agencies.

6.10.2 CUWCC Documentation Requirement

The following documentation is considered acceptable under this DMM:

- Financial investments and building partnerships: List the total monetary amount of financial incentives and equivalent resources provided to retail members to assist with, or to otherwise support, implementation of BMPs, subtotaled by BMP. List regional partnerships developed to encourage resource conservation and maximize economies of scale benefits.
- Technical support: Supply a summary of types of technical support provided to retail agencies.
- Program management: If the wholesale agency has assumed reporting responsibility, list the programs managed on behalf of its retail agencies.
- Water shortage allocation: If a water shortage allocation plan or policy has been developed, provide the date of adoption and electronic link to the document or hard copy.
- Non-signatory reporting: Receipt of reports.
- Encourage CUWCC membership: List of efforts to recruit retailers and amount of dues paid on behalf of retail agencies.

6.10.3 CUWCC Goal

Provide financial and managerial assistance to retail agencies for implementation of BMPs in the Agency's service area.

6.10.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.10.5 Existing AWA Program

The Agency has offered the same demand management programs and services to its wholesale customers as it does to its retail customers since 1980. The Agency wholesales water to six communities: Jackson, Plymouth, Drytown CSD, Pine Grove CSD, Rabb Park CSD, and Mace Meadows. Because the Agency's wholesale customers are provided the same demand management programs and services as retail customers, the wholesale program results have not been tracked or allocated separately.

6.10.6 Future AWA Program

To successfully implement the DMM, the Agency will extend its survey and rebate programs to include the service areas of its retailers. Table 6-11 documents the additional surveys and rebates that will be

offered to the Agency's wholesale areas. In addition to the surveys and rebates shown below, the Agency will offer program management assistance to its retailers and will initiate discussions regarding agreements for conservation planning implementation.

Table 6-11: Planned Assistance to Retail Agencies

	FY12	FY13	FY14	FY15	FY16
# of Surveys	5	10	10	10	10
# of Water Budgets	1	2	2	2	2
# of Residential Rebates	5	10	10	10	10
# of Industrial Rebates	3	6	6	6	6

Note: This DMM is not budgeted for in FY11.

6.11 Demand Management Measure 11

6.11.1 CUWCC Description

DMM 11 promotes water conserving retail water rate structures. This DMM recognizes that each agency or water enterprise fund has a unique rate setting system and history. When creating a rate case, professional judgments are made to determine whether costs are accounted to a variable or fixed cost center by the staff of the agency. The final water rate case is an accumulation of all the decisions and judgments made by staff and supplemented by the financial projections leading an agency to establish its final water rate recommendation. DMM 11 is not intended to supplant this process, but rather to reinforce the need to establish a strong nexus between volume-related system costs and volumetric commodity rates.

DMM 11 also applies to retail sewer service. Conservation pricing of sewer service provides incentives to reduce average or peak use, or both. Such pricing includes: rates designed to recover the cost of providing service, and billing for sewer service based on metered water use. Conservation pricing of sewer service is also characterized by one or more of the following components: rates in which the unit rate is the same across all units of service (uniform rates); rates in which the unit rate increases as the quantity of units purchased increases (increasing block rates); rates in which the unit rate is based upon the long-run marginal cost or the cost of adding the next unit of capacity to the sewer system. Rates that charge customers a fixed amount per billing cycle for sewer service regardless of the units of service consumed do not satisfy the definition of conservation pricing of sewer service. Rates in which the typical bill is determined by high fixed charges and low commodity charges also do not satisfy the definition of conservation pricing of sewer service.

Conservation pricing requires volumetric rates. While this DMM defines a minimum percentage of water sales revenue from volumetric rates, the goal of this DMM is to recover the maximum amount of water sales revenue from volumetric rates that is consistent with utility costs (which may include utility long-run marginal costs), financial stability, revenue sufficiency, and customer equity. In addition to volumetric rates, conservation pricing may also include one or more of the following other charges:

1. Service connection charges designed to recover the separable costs of adding new customers to the water distribution system.
2. Monthly or bimonthly meter/service charges to recover costs unrelated to the volume of water delivered or new service connections and to ensure system revenue sufficiency.
3. Special rates and charges for temporary service, fire protection service, and other irregular services provided by the utility.

The following volumetric rate designs are potentially consistent with the above definition:

1. Uniform rate in which the volumetric rate is constant regardless of the quantity consumed.
2. Seasonal rates in which the volumetric rate reflects seasonal variation in water delivery costs.
3. Tiered rates in which the volumetric rate increases as the quantity used increases.
4. Allocation-based rates in which the consumption tiers and respective volumetric rates are based on water use norms and water delivery costs established by the utility.

Adequacy of Volumetric Rates: A retail agency's volumetric rate shall be deemed sufficiently consistent with the definition of conservation pricing when it satisfies at least one of the following two options.

- Option 1: Let V stand for the total annual revenue for the volumetric rate(s) and M stand for total annual revenue from customer meter/service (fixed) charges, then:

$$\frac{V}{(V+M)} \geq 70\%$$

  This calculation shall only include utility revenues from volumetric rates and monthly or bimonthly meter/service charges. It shall not include utility revenues from new service connection charges; revenue from special rates and charges for temporary service, fire protection, or other irregular services; revenue from grants or contributions from external sources in aid of construction or program implementation; or revenue from property or other utility taxes.

- Option 2: Use the rate design model included with the Municipal Water and Wastewater Rate Manual published by the Canadian Water & Wastewater Association with the signatory's water system and cost information to calculate V', the uniform volumetric rate based on the signatory's long-run incremental cost of service, and M', the associated meter charge. [Let HCF be annual water delivery (in hundred cubic feet).] The volumetric rate(s) shall be deemed sufficiently consistent with the definition of conservation pricing if:

$$\frac{V}{(V+M)} \geq \frac{V'}{(V'+M')}$$

  The rate design model can be downloaded at http://www.cuwcc.org/resource-center/technical-resources/bmp-tools.aspx.

  This calculation shall only include utility revenues from volumetric rates and monthly or bimonthly meter/service charges. It shall not include utility revenues from new service connection charges; revenue from special rates and charges for temporary service, fire protection, or other irregular services; revenue from grants or contributions from external sources in aid of construction or program implementation; or revenue from property or other utility taxes.

The Agency shall maintain a rate structure that satisfies at least one of the options specified above. Conformance to Option 1 or Option 2 will first be assessed using the revenue from the most recent year. If the most recent year does not satisfy the option, the average revenue from the three (3) most recent years will be used.

6.11.2 CUWCC Documentation Requirement

For water, provide the following:

1. Report the rate structure in effect for each customer class for the reporting period.
2. Report the annual revenue derived from volume charges for each retail customer class, as defined above. (Note: Compliance with BMP 11 will be determined based on the Agency's total revenue from all retail customer classes.)
3. Report the annual revenue derived from monthly or bimonthly meter/service charges for each retail customer class, as defined above.
4. If agency does not comply with Option 1 in Section A, report v' and m' as determined by the Canadian Water & Wastewater Association rate design model described above.
5. If agency does not comply with Option 1 in Section A, submit the completed Canadian Water & Wastewater Association rate design model described above.

For sewer, provide the following:

1. Report annual revenue requirement for sewer service by customer class for the reporting period.
2. Report annual revenue for sewer service from commodity charges by customer class for the reporting period.
3. Report rate structure by customer class for sewer service.

6.11.3 CUWCC Goal

The CUWCC goal for DMM 11 varies depending on the option for volumetric pricing selected. Table 6-12 summarizes the CUWCC goals.

Table 6-12: CUWCC Goals for DMM 11

Years After Start Year	For Option 1	For Option 2
1	$\frac{V}{(V+M)} \geq 70\% \times 0.70$	$\frac{V}{(V+M)} \geq \frac{V'}{(V'+M')} \times 0.7$
2	$\frac{V}{(V+M)} \geq 70\% \times 0.80$	$\frac{V}{(V+M)} \geq \frac{V'}{(V'+M')} \times 0.8$
3	$\frac{V}{(V+M)} \geq 70\% \times 0.90$	$\frac{V}{(V+M)} \geq \frac{V'}{(V'+M')} \times 0.9$
4	$\frac{V}{(V+M)} \geq 70\% \times 1.00$	$\frac{V}{(V+M)} \geq \frac{V'}{(\square'+M')} \times 1.0$

6.11.4 AWA Status

The Agency is currently implementing this program, but has not yet achieved the CUWCC goal.

6.11.5 Existing AWA Program

The Agency's first conservation pricing rates were adopted in 1980. Since then, the rates have been adjusted and amended several times, most recently in 2005. The Agency uses a tiered structure for water service rates in the communities where it provides retail water service from the CAWP system. This is a major

factor in promoting effective water conservation. Tiered rates for the Amador Water System (2,500 foot elevation and below) have not yet been developed. The Agency's water rates and charges are included in Appendix D. Table 6-13 summarizes the Agency's current conservation pricing structure. Table 6-14 is an example of the water pricing structure. Table 6-15 is an example of the wastewater pricing structure for the Agency's wastewater customers.

Table 6-13: Amador Water Agency Conservation Pricing

Residential			
Water rate structure:	Service Charge plus a 2-tier commodity rate	Sewer rate structure:	Flat user charge
Year rate effective:	Varies by system[a]	Year rate effective:	Varies by system[a]
Commercial			
Water rate structure:	Service Charge plus a 1-tier commodity rate	Sewer rate structure:	Flat user charge
Year rate effective:	Varies by system[a]	Year rate effective:	Varies by system[a]
Industrial			
Water rate structure:	Service Charge plus a 1-tier commodity rate	Sewer rate structure:	n/a
Year rate effective:	Varies by system[a]	Year rate effective:	n/a
Institutional/Government			
Water rate structure:	Service Charge plus a 1-tier commodity rate	Sewer rate structure:	n/a
Year rate effective:	Varies by system[a]	Year rate effective:	n/a
Irrigation			
Water rate structure:	Service Charge plus a 1-tier commodity rate		
Year rate effective:	Varies by system[a]		
Wholesale			
Water rate structure:	Service Charge plus a 1-tier commodity rate		
Year rate effective:	Varies by system[a]		

Note: See Appendix D for price and dates adopted for each water and wastewater system.

Table 6-14: Example Water Pricing

Metered Treated (Routes 02-13)	**Per Month**	**Per Unit**
5/8" Monthly Service Charge	$25.20	$1.90
48 Hour Late Notice Charge	$10.00	
Meter set fee (5/8" meter)	$375.00	
AWS Treated Retail Participation fee (5/8" meter)	$11,300.00	
AWS Treated Participation fee (wholesale)	$8,030.00	
Flat Rate Treated (Routes 09-13)	**Per Month**	
Monthly Service Charge (7000 sq. ft. or less)	$76.96	
7001 to 16000 sq. ft.	$90.20	
16001 to 25000 sq. ft.	$203.15	
Additional dwelling unit	$44.20	
48 Hour Late Notice Charge	$10.00	
Metered Untreated (Route 01 and 08)	**Per Month**	**Per Unit**
5/8" Monthly Service Charge	$19.60	$0.53
48 Hour Late Notice Charge	$10.00	
Meter set fee (5/8" meter)	$375.00	
AWS Raw Water Participation Fee	$3,130.00	
Flat Rate Untreated (Route 01 and 08)	**Per Month**	
Monthly Service Charge (7000 sq. ft. or less)	$36.92	
7001 to 16000 sq. ft.	$40.61	
16001 to 25000 sq. ft.	$61.67	
Additional dwelling unit	$24.85	
48 Hour Late Notice Charge	$10.00	
CAWP Retail (Routes 15-21, 23, 31-32)	**Bi-monthly**	**Per Unit**
5/8" Bi-monthly service charge	$67.50	
1-20 units		$2.08
21 & more units		$3.12
Non-residential Commodity Rate (all units)		*$2.49*
48 Hour Late Notice Charge	$10.00	
Annual Assessment (July) *Unconnected accts. only*	$70.00 per year	
Meter set fee (5/8" meter)	$375.00	
CAWP Wholesale Annexation Fee	$5,645.00	
CAWP Retail Participation fee	$3,815.00	
ID#3 La Mel Heights (Route 22)	**Bi-monthly**	**Per Unit**
5/8" Bi-Monthly Service Charge	$80.00	$1.65 (1-100 units) $2.45 (101 units or more)
Annual Assessment $180.00	$30.00	
48 Hour Late Notice Charge	$10.00	
Meter set fee (5/8" meter)	$375.00	

Table 6-14 **continued from previous page**		
ID#7 Lake Camanche (Route 33)	**Bi-monthly**	**Per Unit**
5/8" Bi-Monthly Service Charge	$47.50	
1-50 units		$1.16
51+ units		$1.94
48 Hour Late Notice Charge	$10.00	
Meter set fee (5/8" meter)	$375.00	
ID#7 Retail Participation fee	$4,280.00	
ID#7 Equalization fee	$8,220.00	
Annual Non-metered Charge (Route 37)	*$100.00 Annually*	

Note: As of 2010

Table 6-15: Example Wastewater Pricing

Eagle's Nest- WW ID No.2	**Standby**	**User Rate**
Monthly Service Charge Route 51	$30.00	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Surrey Junction- WW ID No. 3	**Standby**	**User Rate**
Monthly Service Charge Route 52	$27.00	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Wildwood- WW ID No. 4	**Standby**	**User Rate**
Monthly Service Charge Route 53	$21.00	$86.55
Sewer Permit/Inspection Fee	$3500.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Gayla Manor- WW ID No. 5	**Standby**	**User Rate**
Monthly Service Charge Route 54	$34.00	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Jackson Pines- WW ID No. 6	**Standby**	**User Rate**
Monthly Service Charge Route 57	$39.60	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Fairway Pines- WW ID No. 7	**Standby**	**User Rate**
Monthly Service Charge Route 56	$39.60	$71.75
Sewer Permit/Inspection Fee	$250.00	$250.00
48 Late Notice Charge	$10.00	$10.00
Pine Grove- WW ID No. 8	**Standby**	**User Rate**
Monthly Service Charge Route 58	$27.73	$101.55
Sewer Permit/Inspection Fee	$350.00	$350.00
PGWW Buy in Fee	$3705.00	
48 Late Notice Charge	$10.00	$10.00
Viewpoint- WW ID No. 9	**Standby**	**User Rate**
Monthly Service Charge Route 55	$39.60	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00
Tiger Creek Estates- WW ID No. 10	**Standby**	**User Rate**
Monthly Service Charge Route 59	$32.56	$86.55
Sewer Permit/Inspection Fee	$350.00	$350.00
48 Late Notice Charge	$10.00	$10.00

Table 6-15 continued from previous page		
Lake Camanche- WW ID No. 11 (Route 35 & 39)	**Standby**	**User Rate**
Monthly Service Charge (with water meter)		$94.20
-without water meter		
Special Facility Fee/per unit of use	$5,565.00	
Facility Expansion Charge	$18,970.00	
Sewer Permit/Inspection Fee	$350.00	
48 Hour Late Notice Charge	$10.00	
Martell- WW ID No. 12 (Route 30)		**User Rate**
Monthly User Rate (Residential)		$64.39
Monthly User Rate (Commercial)		
Fixed Service Charge (per EDU)		$20.79
Low Strength Users (per CCF)		$7.95
Medium Strength Users (per CCF)		$9.70
High Strength Users (per CCF)		$13.20
Equalization Charge/per unit of use	$9,682.00	
Sewer Permit/Inspection Fee	$350.00	
48 Hour Late Notice Charge	$10.00	

Footnote: As of 2010

6.11.6 Future AWA Program

The Agency calculated V/(V+M), which equals 51%. V is equal to the total annual revenue from volumetric rates and M equals the total annual revenue from customer service (fixed) charges. For AWA, V is equal to $3.4 million and M is equal to $3.3 million. The Agency is currently meeting the requirement for Year 1 for Option 1, as 51% is greater than 0.7 x 70% (or 49%). The Agency will continue to charge volumetric pricing and increase the volumetric component until full coverage is achieved.

6.12 Demand Management Measure 12

6.12.1 CUWCC Description

Under DMM 12, a person will be designated as the agency's responsible conservation coordinator for program management, tracking, planning, and reporting on BMP implementation. Coverage shall consist of staffing and maintaining the position of trained conservation coordinator, or equivalent consulting support, and provide that function with the necessary resources to implement BMPs.

6.12.2 CUWCC Documentation Requirement

Provide the contact information for the conservation coordinator, or consultant assigned, and verification that the position is responsible for implementing the tasks identified above.

6.12.3 CUWCC Goal

Staff and maintain a position of a trained conservation coordinator.

6.12.4 AWA Status

Until recently, this DMM has been fully implemented.

6.12.5 Existing AWA Program

The Agency has historically has assigned conservation coordinator duties to a member of the Agency's staff. However, the Agency's recent Conservation Coordinator has retired and a new coordinator has not yet been named. Once appointed, the Agency's Conservation Coordinator will be responsible for the conservation program management, tracking, planning, and reporting on implementation of the DMMs as described in this Plan.

6.12.6 Future AWA Program

The Agency plans to appoint a replacement Conservation Coordinator, however, due to current budget constraints, this position will only be staffed half-time. If outside funding were obtained for program implementation, a full-time conservation coordinator will be hired.

6.13 Demand Management Measure 13

6.13.1 CUWCC Description

The CUWCC describes this DMM as applying in three different ways:

1. New development –Enact, enforce, or support legislation, regulations, ordinances, or terms of service that (1) prohibit water waste such as, but not limited to: single-pass cooling systems; conveyer and in-bay vehicle wash and commercial laundry systems which do not reuse water; non-recirculating decorative water fountains and (2) address irrigation, landscape, and industrial, commercial, and other design inefficiencies.
2. Existing users – Enact, enforce, or support legislation, regulations, ordinances, or terms of service that prohibit water waste such as, but not limited to: landscape and irrigation inefficiencies, commercial or industrial inefficiencies, and other misuses of water.
3. Water shortage measures – Enact, enforce, or support legislation, regulations, ordinances, or terms of service that facilitate implementation of water shortage response measures.

To successfully implement this DMM, the Water Agency shall do one or more of the following:

a) Enact and enforce an ordinance or establish terms of service that prohibit water waste

b) Enact and enforce an ordinance or establish terms of service for water efficient design in new development

c) Support legislation or regulations that prohibit water waste

d) Enact an ordinance or establish terms of service to facilitate implementation of water shortage response measures

e) Support local ordinances that prohibit water waste

f) Support local ordinances that establish permit requirements for water efficient design in new development.

6.13.2 CUWCC Documentation Requirement

Documentation requirements for DMM 13 include the following:

- A description of, or electronic link to, any ordinances or terms of service adopted by water agency to meet the requirements of this BMP
- A description of, or electronic link to, any ordinances or requirements adopted by local jurisdictions or regulatory agencies within the water agency's service area.
- A description of water agency efforts to cooperate with other entities in the adoption or enforcement of local requirement consistent with this BMP.

- A description of agency support positions with respect to adoption of legislation or regulations consistent with this BMP.

6.13.3 CUWCC Goal

Adopt and enforce a water waste ordinance.

6.13.4 AWA Status

The Agency has implemented this DMM through its adoption of a water conservation policy that supports local ordinance that prohibits water waste.

6.13.5 Existing AWA Program

The Agency first adopted a water shortage plan in 1985. The Agency has both voluntary and mandatory water conservation policies in the Amador Water Agency Water Code. Specific measures include:

- unattended watering prohibited
- shortening irrigation season
- restrictions on car, boat, building and trailer washing
- restrictions on the washing of sidewalks and driveways
- restrictions on filling of swimming pools
- restrictions on use of potable water for sewer flushing, dust control, earth compaction and other construction uses

The Agency's water shortage ordinance is included in Appendix E, but a water waste ordinance has not been adopted.

6.13.6 Future AWA Program

The Agency will consider the development and adoption of a water waste ordinance by the end of 2012. The ordinance would be a year-round policy that prohibits overwatering landscape, system leaks, and open hoses for example, among other water wasting actions. Violators would receive oral and/or written notice of violation. Repeat violators, both residential and commercial, could be fined up to $1,000 and $2,000, respectively.

6.14 Demand Management Measure 14

6.14.1 CUWCC Description

Under DMM 14, the Agency will provide financial incentives or ordinances requiring the replacement of existing toilets using 3.5 or more gallons per flush (gpf) with a toilet meeting WSS. WaterSense high efficiency toilets use a maximum of 1.28 gpf, which is 20% less than the current federal standard of 1.6 gpf. Ultra low-flow toilets (ULFT) differ in that they cannot be WaterSense certified and they do not save as much water. Numerous toilets have been certified to meet WaterSense criteria and retailers are committed to making them available in stores. A complete list of certified toilets can be accessed here:

http://www.epa.gov/WaterSense/pp/find_het.htm.

6.14.2 CUWCC Documentation Requirement

Documentation requirements for DMM 14 include a description of the program and the number of WSS toilet installations credited to the Agency's replacement program disaggregated by single-family or multi-family units.

6.14.3 CUWCC Goal

Demonstrate a number of toilet replacements of 3.5 gpf or greater, toilets at or above the level achieved through a retrofit on resale ordinance until 2014, or a market saturation of 75% is demonstrated, whichever is sooner.

6.14.4 AWA Status

The Agency has not yet implemented this DMM.

6.14.5 Existing AWA Program

The Agency has not yet implemented this DMM.

6.14.6 Future AWA Program

Similar to the High Efficiency Clothes Washers (HECWs) rebate program that the Agency will implement under DMM 6, the WSS Toilet rebate program will be available, initially, only to customers in Wastewater Improvement District #11 (WWID #11), which serves the Lake Camanche Village area, due to wastewater disposal problems in the area. After one year, the WSS Toilet rebate program will be evaluated for cost efficiency, public participation and response, and changes in quantity of wastewater effluent. Initially, $50 rebates will be offered for WSS Toilets. The program can then be adjusted, as necessary. The rebate program will likely be expanded and offered to the entire County by 2012. The WSS Toilet rebate program would have the multi-beneficial result of reducing both wastewater production and water demand in the Lake Camanche Village region.

Table 6-16 summarizes the planned program costs and water savings.

Table 6-16: Single Family WSS Toilet Replacement Program

	FY12	FY13	FY14	FY15	FY16
# of WSS Toilet rebates to be paid	15	30	30	30	30
Projected Water Savings (AFY)[a]	0.4	0.9	0.9	0.9	0.9

Note: Assuming 2.5 people per household with non-conserving toilets using 18.7 gal/day/person and WSS toilet using 8.3 gal per day per person.

6.15 Effectiveness Evaluation 15

In order to evaluate the effectiveness of each of the fourteen DMMs, the Agency will utilize two benchmarks: (1) did the Agency complete the task identified under each DMM and (2) did the water savings achieved meet or exceed the anticipated water savings. The benchmarks will be evaluated annually, and a formal report will be included in the 2015 update to the UWMP.

6.16 Estimate of Savings 16

Beginning Fiscal Year 2011-2012, the Agency will begin implementation of the WCP. Below is a summary of the estimated water savings for the next five years.

Table 6-17: Estimate of Water Savings

	FY11-12 (AF)	FY12-13 (AF)	FY13-14 (AF)	FY14-15 (AF)	FY15-16 (AF)
DMM 2	2.7	5.5	5.5	5.5	5.5
DMM 5	3.9	5.3	5.3	5.3	5.3
DMM 6	0.9	1.7	1.7	1.7	1.7
DMM 8	2.2	4.4	4.4	4.4	4.4
DMM 9	2.0	3.0	3.0	4.0	6.0
DMM 14	0.4	0.9	0.9	0.9	0.9
TOTAL SAVINGS	12.1	20.8	20.8	21.8	23.8

Note: Potential water savings from DMMs 1, 3, 4, 7, and 10-13 were not quantified in the 2010 Water Conservation Plan.

An evaluation of the effect of the conservation program on the Agency's ability to further reduce demand will be included in the 2015 update to the UWMP.

Chapter 7 Appendices

Appendix A References

Amador County 2010 Housing Element & General Plan

City of Sutter Creek 2008 Housing Element & General Plan

City of Plymouth 2011 Housing Element & General Plan

City of 2009 Ione General Plan & General Plan

City of Jackson 2010 Housing Element & General Plan

Amador County Regional Wastewater Management Plan- Initial Phasing and Interim Improvements

Regional Approach for Water Reuse Project (2005)

Amador Water Agency (2005-2010) Department of Health Services' Annual Report to the Drinking Water Program Buckhorn Water Treatment Plant

Amador Water Agency (2005-2010) Department of Health Services' Annual Report to the Drinking Water Program Tanner Water Treatment Plant

Amador Water Agency (2005-2010) Department of Health Services' Annual Report to the Drinking Water Program Ione Water Treatment Plant

Amador Water Agency (2005-2010) Department of Health Services' Annual Report to the Drinking Water Program La Mel Heights Water Treatment Plant

Amador Water Agency (2005-2010) Department of Health Services' Annual Report to the Drinking Water Program Lake Camanche Water Treatment Plant

Amador Water Agency (2005) Urban Water Management Plan

Amador Water Agency AWS Participation Fee Study 2007

Department of Water Resources 2003 California's Groundwater Bulletin 118: San Joaquin Valley Groundwater Basin Cosumnes Subbasin.

Amador Local Agency Formation Commission Municipal Services Review 2008

City of Sutter Creek Wastewater Master Plan 2007

California Water Code, Division 6, Part 2.6, and §§10610 through §§10657

California Assembly Bill 797

California Department of Water Resources Guidebook to Assist Urban Water Suppliers to Prepare a 2010 Urban Water Management Plan

Mokelumne Amador Calaveras Integrated Regional Water Management Plan (IRWMP)

State of California, Department of Finance, E-4 & E-5, May 2010.

State of California Water Conservation Bill of 2009

Methodologies for Calculating Baseline and Compliance Urban Per Capita Water Use (For the Consistent Implementation of the Water Conservation Bill of 2009) (DWR 2010a).

California Integrated Water Quality System 2010 Amador Water Agency Reports for Lake Camanche, Eagles Nest, Fairway Pines/Mace Meadows, Gayla Manor, Martell, Pine Grove, Jackson Pines, & Wildwood

Appendix B Completed UWMP Checklist

Table 7-1 Urban Water Management Plan checklist, organized by subject

No.	UWMP requirement [a]	CA Water Code Reference	Additional clarification	UWMP location
PLAN PREPARATION				
4	Coordinate the preparation of its plan with other appropriate agencies in the area, including other water suppliers that share a common source, water management agencies, and relevant public agencies, to the extent practicable.	10620(d)(2)		1.3
6	Notify, at least 60 days prior to the public hearing on the plan required by Section 10642, any city or county within which the supplier provides water that the urban water supplier will be reviewing the plan and considering amendments or changes to the plan. Any city or county receiving the notice may be consulted and provide comments.	10621(b)		1.3 App. C
7	Provide supporting documentation that the UWMP or any amendments to, or changes in, have been adopted as described in Section 10640 et seq.	10621(c)		1.4
54	Provide supporting documentation that the urban water management plan has been or will be provided to any city or county within which it provides water, no later than 60 days after the submission of this urban water management plan.	10635(b)		1.4
55	Provide supporting documentation that the water supplier has encouraged active involvement of diverse social, cultural, and economic elements of the population within the service area prior to and during the preparation of the plan.	10642		1.4

56	Provide supporting documentation that the urban water supplier made the plan available for public inspection and held a public hearing about the plan. For public agencies, the hearing notice is to be provided pursuant to Section 6066 of the Government Code. The water supplier is to provide the time and place of the hearing to any city or county within which the supplier provides water. Privately-owned water suppliers shall provide an equivalent notice within its service area.	10642	1.4 App. D
57	Provide supporting documentation that the plan has been adopted as prepared or modified.	10642	1.4
58	Provide supporting documentation as to how the water supplier plans to implement its plan.	10643	1.4
59	Provide supporting documentation that, in addition to submittal to DWR, the urban water supplier has submitted this UWMP to the California State Library and any city or county within which the supplier provides water supplies a copy of its plan no later than 30 days after adoption. This also includes amendments or changes.	10644(a)	1.4
60	Provide supporting documentation that, not later than 30 days after filing a copy of its plan with the department, the urban water supplier has or will make the plan available for public review during normal business hours	10645	1.4
SYSTEM DESCRIPTION			
8	Describe the water supplier service area.	10631(a)	2.3

9	Describe the climate and other demographic factors of the service area of the supplier	10631(a)		2.2
10	Indicate the current population of the service area	10631(a)	Provide the most recent population data possible. Use the method described in "Baseline Daily Per Capita Water Use." See Section M.	2.4
11	Provide population projections for 2015, 2020, 2025, and 2030, based on data from State, regional, or local service area population projections.	10631(a)	2035 and 2040 can also be provided to support consistency with Water Supply Assessments and Written Verification of Water Supply documents.	2.4
12	Describe other demographic factors affecting the supplier's water management planning.	10631(a)		2.4
SYSTEM DEMANDS				
1	Provide baseline daily per capita water use, urban water use target, interim urban water use target, and compliance daily per capita water use, along with the bases for determining those estimates, including references to supporting data.	10608.20(e)		3.1
2	*Wholesalers:* Include an assessment of present and proposed future measures, programs, and policies to help achieve the water use reductions. *Retailers:* Conduct at least one public hearing that includes general discussion of the urban retail water supplier's implementation plan for complying with the Water Conservation Bill of 2009.	10608.36 10608.26(a)	Retailers and wholesalers have slightly different requirements	1.4 3.3 App. G
3	Report progress in meeting urban water use targets using the standardized form.	10608.40	Standardized form not yet available.	N/A

25	Quantify past, current, and projected water use, identifying the uses among water use sectors, for the following: (A) single-family residential, (B) multifamily, (C) commercial, (D) industrial, (E) institutional and governmental, (F) landscape, (G) sales to other agencies, (H) saline water intrusion barriers, groundwater recharge, conjunctive use, and (I) agriculture.	10631(e)(1)	Consider 'past' to be 2005, present to be 2010, and projected to be 2015, 2020, 2025, and 2030. Provide numbers for each category for each of these years.	3.1
33	Provide documentation that either the retail agency provided the wholesale agency with water use projections for at least 20 years, if the UWMP agency is a retail agency, OR, if a wholesale agency, it provided its urban retail customers with future planned and existing water source available to it from the wholesale agency during the required water-year types	10631(k)	Average year, single dry year, multiple dry years for 2015, 2020, 2025, and 2030.	3.1 5.5
34	Include projected water use for single-family and multifamily residential housing needed for lower income households, as identified in the housing element of any city, county, or city and county in the service area of the supplier.	10631.1(a)		3.1
SYSTEM SUPPLIES				
13	Identify and quantify the existing and planned sources of water available for 2015, 2020, 2025, and 2030.	10631(b)	The 'existing' water sources should be for the same year as the "current population" in line 10. 2035 and 2040 can also be provided.	4.7
14	Indicate whether groundwater is an existing or planned source of water available to the supplier. If yes, then complete 15 through 21 of the UWMP Checklist. If no, then indicate "not applicable" in lines 15 through 21 under the UWMP location column.	10631(b)	Source classifications are: surface water, groundwater, recycled water, storm water, desalinated sea water, desalinated brackish groundwater, and other.	4.3

15	Indicate whether a groundwater management plan been adopted by the water supplier or if there is any other specific authorization for groundwater management. Include a copy of the plan or authorization.	10631(b)(1)		4.3
16	Describe the groundwater basin.	10631(b)(2)		4.3.2
17	Indicate whether the groundwater basin is adjudicated? Include a copy of the court order or decree.	10631(b)(2)	Groundwater Basin not Adjudicated	N/A
18	Describe the amount of groundwater the urban water supplier has the legal right to pump under the order or decree. If the basin is not adjudicated, indicate "not applicable" in the UWMP location column.	10631(b)(2)	Groundwater Basin not Adjudicated	N/A
19	For groundwater basins that are not adjudicated, provide information as to whether DWR has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition. If the basin is adjudicated, indicate "not applicable" in the UWMP location column.	10631(b)(2)		4.3.2
20	Provide a detailed description and analysis of the location, amount, and sufficiency of groundwater pumped by the urban water supplier for the past five years	10631(b)(3)		4.3.3
21	Provide a detailed description and analysis of the amount and location of groundwater that is projected to be pumped.	10631(b)(4)	Provide projections for 2015, 2020, 2025, and 2030.	4.3.3

24	Describe the opportunities for exchanges or transfers of water on a short-term or long-term basis.	10631(d)	4.4
30	Include a detailed description of all water supply projects and programs that may be undertaken by the water supplier to address water supply reliability in average, single-dry, and multiple-dry years, excluding demand management programs addressed in (f)(1). Include specific projects, describe water supply impacts, and provide a timeline for each project.	10631(h)	4.8
31	Describe desalinated water project opportunities for long-term supply, including, but not limited to, ocean water, brackish water, and groundwater.	10631(i)	4.5
44	Provide information on recycled water and its potential for use as a water source in the service area of the urban water supplier. Coordinate with local water, wastewater, groundwater, and planning agencies that operate within the supplier's service area.	10633	4.6
45	Describe the wastewater collection and treatment systems in the supplier's service area, including a quantification of the amount of wastewater collected and treated and the methods of wastewater disposal.	10633(a)	4.6.1
46	Describe the quantity of treated wastewater that meets recycled water standards, is being discharged, and is otherwise available for use in a recycled water project.	10633(b)	4.6.1 4.6.2
47	Describe the recycled water currently being used in the supplier's service area, including, but not limited to, the type, place, and quantity of use.	10633(c)	4.6.2

48	Describe and quantify the potential uses of recycled water, including, but not limited to, agricultural irrigation, landscape irrigation, wildlife habitat enhancement, wetlands, industrial reuse, groundwater recharge, indirect potable reuse, and other appropriate uses, and a determination with regard to the technical and economic feasibility of serving those uses.	10633(d)	4.6.3
49	The projected use of recycled water within the supplier's service area at the end of 5, 10, 15, and 20 years, and a description of the actual use of recycled water in comparison to uses previously projected.	10633(e)	4.7
50	Describe the actions, including financial incentives, which may be taken to encourage the use of recycled water, and the projected results of these actions in terms of acre-feet of recycled water used per year.	10633(f)	4.6.3
51	Provide a plan for optimizing the use of recycled water in the supplier's service area, including actions to facilitate the installation of dual distribution systems, to promote recirculating uses, to facilitate the increased use of treated wastewater that meets recycled water standards, and to overcome any obstacles to achieving that increased use.	10633(g)	4.6.3
WATER SHORTAGE RELIABILITY AND WATER SHORTAGE CONTINGENCY PLANNING [b]			
5	Describe water management tools and options to maximize resources and minimize the need to import water from other regions.	10620(f)	Chapter 5

22	Describe the reliability of the water supply and vulnerability to seasonal or climatic shortage and provide data for (A) an average water year, (B) a single dry water year, and (C) multiple dry water years.	10631(c)(1)	5.5
23	For any water source that may not be available at a consistent level of use - given specific legal, environmental, water quality, or climatic factors - describe plans to supplement or replace that source with alternative sources or water demand management measures, to the extent practicable.	10631(c)(2)	5.2 5.5.1
35	Provide an urban water shortage contingency analysis that specifies stages of action, including up to a 50-percent water supply reduction, and an outline of specific water supply conditions at each stage	10632(a)	5.3.3
36	Provide an estimate of the minimum water supply available during each of the next three water years based on the driest three-year historic sequence for the agency's water supply.	10632(b)	5.5
37	Identify actions to be undertaken by the urban water supplier to prepare for, and implement during, a catastrophic interruption of water supplies including, but not limited to, a regional power outage, an earthquake, or other disaster.	10632(c)	5.3.1
38	Identify additional, mandatory prohibitions against specific water use practices during water shortages, including, but not limited to, prohibiting the use of potable water for street cleaning.	10632(d)	5.3.2

39	Specify consumption reduction methods in the most restrictive stages. Each urban water supplier may use any type of consumption reduction methods in its water shortage contingency analysis that would reduce water use, are appropriate for its area, and have the ability to achieve a water use reduction consistent with up to a 50 percent reduction in water supply.	10632(e)		5.3.2
40	Indicated penalties or charges for excessive use, where applicable.	10632(f)		5.3.4
41	Provide an analysis of the impacts of each of the actions and conditions described in subdivisions (a) to (f), inclusive, on the revenues and expenditures of the urban water supplier, and proposed measures to overcome those impacts, such as the development of reserves and rate adjustments.	10632(g)		5.3.5
42	Provide a draft water shortage contingency resolution or ordinance.	10632(h)		5.3.2 App. H
43	Indicate a mechanism for determining actual reductions in water use pursuant to the urban water shortage contingency analysis.	10632(i)		5.6
52	Provide information, to the extent practicable, relating to the quality of existing sources of water available to the supplier over the same five-year increments, and the manner in which water quality affects water management strategies and supply reliability	10634	For years 2010, 2015, 2020, 2025, and 2030	5.4

53	Assess the water supply reliability during normal, dry, and multiple dry water years by comparing the total water supply sources available to the water supplier with the total projected water use over the next 20 years, in five-year increments, for a normal water year, a single dry water year, and multiple dry water years. Base the assessment on the information compiled under Section 10631, including available data from state, regional, or local agency population projections within the service area of the urban water supplier.	10635(a)		5.5
DEMAND MANAGEMENT MEASURES				
26	Describe how each water demand management measures is being implemented or scheduled for implementation. Use the list provided.	10631(f)(1)	Discuss each DMM, even if it is not currently or planned for implementation. Provide any appropriate schedules.	Chapter 6
27	Describe the methods the supplier uses to evaluate the effectiveness of DMMs implemented or described in the UWMP.	10631(f)(3)		6.15
28	Provide an estimate, if available, of existing conservation savings on water use within the supplier's service area, and the effect of the savings on the ability to further reduce demand.	10631(f)(4)		6.16
29	Evaluate each water demand management measure that is not currently being implemented or scheduled for implementation. The evaluation should include economic and non-economic factors, cost-benefit analysis, available funding, and the water suppliers' legal authority to implement the work.	10631(g)	See 10631(g) for additional wording.	Chapter 6

32	Include the annual reports submitted to meet the Section 6.2 requirements, if a member of the CUWCC and signer of the December 10, 2008 MOU.	10631(j)	Signers of the MOU that submit the annual reports are deemed compliant with Items 28 and 29.	N/A

a The UWMP Requirement descriptions are general summaries of what is provided in the legislation. Urban water suppliers should review the exact legislative wording prior to submitting its UWMP.

b The Subject classification is provided for clarification only. It is aligned with the organization presented in Part I of this guidebook. A water supplier is free to address the UWMP Requirement anywhere with its UWMP, but is urged to provide clarification to DWR to facilitate review.

Appendix C Public Agency Notifications

Appendix D Public Notices

Appendix E Resolution for Adoption

Appendix F Land Use Agencies' Growth Projections

Appendix G Agency Water Conservation Plan

Appendix H Agency Water Code

Appendix I Public Water System Statistic, Department of Water Resources (1994-2010) for Tanner, Ione, CAWP, La Mel & Camanche

Appendix J Amador Water Agency Emergency Handbook

Appendix K Additional Spreadsheets