Appendix P Energy Intensity TM

FINAL Technical Memorandum

Amador Water Agency 2015 UWMP

Subject:	**Energy Intensity Assessment**
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1 Introduction

An urban water supplier's energy intensity (EI) of water is the amount of energy required for the process of supplying water from the point that it enters a system to the point at which it exits the system per unit volume of water. Appendix O, Energy Intensity, of the California Department of Water Resources (DWR) *2015 Urban Water Management Plans Guidebook for Urban Water Suppliers* (DWR, 2016) provides guidance for estimating EI associated with sources of water used by an urban water supplier. While estimating EI is an optional portion of an Urban Water Management Plan (UWMP), the Amador Water Agency (Agency) focuses on both energy and water use efficiency within its system and has chosen to estimate EI using the tables provided in Appendix O. The purpose of calculating the Agency's water EI is to:

- Develop a baseline energy use per acre-foot (AF) of water delivered by the water system.
- Aid in the identification of the most energy-intensive processes to provide focus for energy saving opportunities in the future.
- Allow for the comparison of energy use among similar agencies.

Water EI is measured by the total amount of energy (kWh) expended on a volumetric (AF) basis to take water from the location the Agency acquires it to the point of delivery. Thus, EI accounts for the extraction, diversion, storage, conveyance, treatment, and distribution processes that the Agency undertakes to deliver water to its customers. The Agency's water EI only accounts for the water management processes occurring within its operational control; energy use associated with the Agency's wholesale customer distribution is not accounted for. This technical memorandum (TM) describes the Agency's water EI and the methodology used in its calculation. In addition, the Agency estimated its wastewater EI, or the total energy to collect and treat wastewater within the Agency's service area per AF of effluent. This calculation is also documented herein.

2 Estimating the Agency's Energy Intensity (EI)

2.1 Water EI

2.1.1 Amador Water Agency's Water System

The Agency diverts 96% of its water supply from the Mokelumne River, with the remaining small amount of supply coming from groundwater wells. Mokelumne River water is stored in Lake Tabeaud for the Amador Water System (AWS) and in the Tiger Creek Afterbay and the Tiger Creek Regulating Reservoir

for the Central Amador Water Project (CAWP) system. Water from these reservoirs is treated in the Ione or Tanner Water Treatment Plants before being distributed throughout the AWS or treated in the Buckhorn Water Treatment Plant before distribution through the CAWP system. Additionally, some raw water is served to portions of the AWS for agricultural and industrial uses. The communities of Lake Camanche Village and La Mel Heights currently receive water drawn from groundwater wells. The following water and wastewater management processes are accounted for in the Agency's EI:

- Extract and Divert - Groundwater extraction from wells in Lake Camanche Village and La Mel Heights.
- Conveyance - Raw and treated water conveyance from Lake Tabeaud, the Tiger Creek Afterbay, and the Tiger Creek Regulating Reservoir to treatment plants or directly to customers if water is delivered raw.
- Treatment - Treatment of raw water to potable levels at the Ione, Tanner, and Buckhorn Water Treatment Plants.
- Distribution - Distribution of potable water through the AWS, CAWP, and Lake Camanche Village systems.

2.1.2 Data Collection and Analysis

Energy use data relating to the extraction, conveyance, treatment, and distribution of water in the Agency's water supply system was gathered from Pacific Gas & Electric (PG&E) meter data for calendar year 2015. In Appendix O of the 2015 UWMP Guidebook, DWR provides three reporting methods for EIs and associated tables.

- Water Supply Process Approach, Table O1-A – In this method, EI is reported by water management operation component (aggregated across all supply sources), including extraction, conveyance, placement into storage, treatment and distribution.
- Total Utility Approach, Table O1-B - In this method, EI is reported as a single EI for all water management operations.
- Multiple Water Delivery Products, Table O1-C - In this method, EI is reported by water management operation and water delivery product (Retail Potable, Retail Non-Potable, Wholesale Potable, Wholesale Non-Potable, Agricultural, Environmental, and Other Deliveries).

The Agency was able to identify which processes, but not which delivery product (i.e. if treated water conveyed from reservoirs goes to wholesale or retail customers), their energy meters track, so the Water Supply Process Approach was taken and Table O1-A completed. The Agency's water EI is 791.4 kWh/AF. Table 1, extracted from DWR's Appendix O – Energy Intensity Tables, summarizes the volume of water entering each process, the energy consumed, and total EI for the processes and entire water system. Treatment is the most energy intensive process in the Agency's water supply with an EI of 277.3 kWh/AF, while distribution is the lowest with an EI at 110.7 kWh/AF.

Table 1: Water Supply Process Approach Energy Intensity Calculations

	Extract and Divert[a]	Place into Storage	Conveyance[b]	Treatment[c]	Distribution[d]	Total Utility
Volume of Water Entering Process (AF)	*207*	*0*	*6,377.94*	*3,956.03*	*3,569.4*	*3,569.4*
Energy Consumed (kWh)	*48,748*	*0*	*1,283,863*	*1,097,094*	*395,040*	*2,824,745*
Energy Intensity (kWh/AF)	*235.5*	*0.0*	*201.3*	*277.3*	*110.7*	*791.4*

a) Extract and divert represents the volume of groundwater pumped in Lake Camanche Village and La Mel Heights.
b) Conveyance represents the volume of all raw water delivered to customers and to treatment plants.
c) Treatment represents the volume of water entering the treatment plant.
d) Distribution represents the volume of treated water delivered to customers. The volume of treated water delivered to customers is less than the volume of water treated due to system water losses.

2.1.3 Self-Generated Renewable Energy and Energy Use Reduction

While the Agency did not generate any renewable energy for use at its facilities during 2015, a 125 kW hydroelectric power generation station will be implemented in April 2016. This unit will generate electricity from water flowing through the Amador Transmission Line to offset the power used at the Tanner Water Treatment Plant as well as at the Ridge Pump Station, an administrative building, and other facilities in the treatment plant's vicinity.

Additionally, the Agency's Gravity Supply Line (GSL) was constructed in December 2015 to convey water to the Buckhorn Water Treatment Plant. This pipeline replaced the Tiger Creek and Silver Lake Pines Raw Water Pump Stations, and thus reduced overall operating costs for the CAWP wholesale system by approximately 20% due to the decrease in electricity use. The GSL eliminated over 80%, or approximately 1 million kWh, of the Agency's energy used for conveyance. Because the GSL was not in operation until December 2015, this energy use reduction was not captured in the Agency's water EI as documented herein.
Wastewater EI

The Agency operates eleven wastewater systems that collect approximately 8% of the wastewater generated within the Agency's service area. Of these eleven collection systems, eight systems discharge septic tank effluent wastewater through community subsurface infiltration systems, one system (Martell) conveys wastewater to the City of Sutter Creek Wastewater Treatment Plant (WWTP) where the wastewater is treated and recycled and two systems (Gayla Manor and Lake Camanche) treat the wastewater through secondary level treatment with disinfection before discharging the wastewater through land disposal. The remaining 92% of the wastewater generated within the service area is collected and treated by the Cities of Sutter Creek, Ione, Jackson, and Plymouth. This wastewater EI analysis only considers the wastewater collected, treated, and discharged by the Agency and not that by the Cities within its service area. Table 2 lists each of the Agency's wastewater systems and the volume of wastewater that each system collects, treats, and discharges.

Table 2: The Agency's Wastewater Systems

Wastewater System	Volume Collected (AF)	Volume Treated (AF)	Volume Discharged (AF)
Martell	*56.4*		
Eagles Nest	*2.0*		*2.0*
Fairway Pines & Mace Meadows[a]	*8.7*		*8.7*
Gayla Manor	*4.9*	*4.9*	*4.9*
Jackson Pines	*8.2*		*8.2*
Lake Camanche	*46.0*	*46.0*	*46.0*
Pine Grove	*9.5*		*9.5*
Surrey Junction	*1.0*		*1.0*
Tiger Creek Estates	*0.1*		*0.1*
Viewpoint	*0.4*		*0.4*
Wildwood Estates	*2.8*		*2.8*
Total	*140.0*	*50.9*	*83.6*

a) Fairway Pines and Mace Meadows share a collection system and discharge to two community leach fields.

Table 3 shows that treatment is the most energy intensive process.

Table 3: Wastewater Process Energy Intensity Calculations

	Collection / Conveyance[a]	Treatment[b]	Discharge / Distribution[c]	Total
Volume of Wastewater Entering Process (AF)	*140*	*50.9*	*83.6*	*140*
Wastewater Energy Consumed (kWh)	*78,986.5*	*82,821.63*	*51,193.02*	*213,001.15*
Wastewater Energy Intensity (kWh/AF)	*564.2*	*1,627.1*	*612.4*	*1,521.4*

a) Collection and Conveyance includes the wastewater collected by the 11 wastewater systems operated by the Agency.
b) Treatment includes the wastewater treated at the Agency within the Gayla Manor and Lake Camanche WWTPs.
c) Discharge and Distribution includes the wastewater discharged by 10 of the 11 wastewater systems operated by the Agency. The Martell system is excluded as it feeds into the Sutter Creek WWTP.

2.2 EI Summary

The most energy intensive water management process within the Agency's water system is treating raw Mokelumne River water to potable levels (277.3 kWh/AF), followed by extracting groundwater from the Lake Camanche Village and La Mel Heights wells (235.5 kWh/AF). Total energy use and volume of water entering the Agency's water system for calendar year 2015 were 2,824,745 kWh and 3,569 AFY, respectively, resulting in a total utility water EI of 791.4 kWh/AF.

The most energy intensive wastewater process in the Agency's wastewater system is treating wastewater through secondary treatment with disinfection. Total energy use and volume of wastewater processed through the Agency's wastewater system for calendar year 2015 were 213,001 kWh and 140 AFY, respectively, resulting in a total utility wastewater EI of 1,521.4 kWh/AF.

Table O1-A and Table O-2 were completed and are attached to this TM (Attachment A). Due to the recent installation of the Agency's Gravity Supply Line and a hydropower system, energy supplied by PG&E is expected to dramatically decrease in 2016, leading to a lower water EI for the Agency as it continues to work toward a more energy-efficient, sustainable future.

Attachment A: Table O1-A and Table O-2

Urban Water Supplier: *Amador Water Agency*

Water Delivery Product (If delivering more than one type of product use Table O-1C)

Retail Potable Deliveries

Table O-1A: Voluntary Energy Intensity - Water Supply Process Approach

Enter Start Date for Reporting Period 1/1/2015

End Date 12/31/2015

	Urban Water Supplier Operational Control							
	Water Management Process						Non-Consequential Hydropower (if applicable)	
	Extract and Divert	Place into Storage	Conveyance	Treatment	Distribution	Total Utility	Hydropower	Net Utility
Volume of Water Entering Process (AF)	*207*	*0*	*6377.94*	*3956.03*	*3569.4*	*3569.4*	*0*	*3569.4*
Energy Consumed (kWh)	*48748*	*0*	*1283863*	*1097094*	*395040*	*2824745*	*0*	*2824745*
Energy Intensity (kWh/AF)	*235.5*	*0.0*	*201.3*	*277.3*	*110.7*	*791.4*	*0.0*	*791.4*

Quantity of Self-Generated Renewable Energy

0 kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

Metered Data

Data Quality Narrative:

Water volume is metered by AWA and energy use is metered by PG&E, so data quality is high.

Narrative:

207 is volume pumped from wells
6,377 is total treated + total raw
3,956 is total treated
3,569 is total distributed

Urban Water Supplier: *Amador Water Agency*

Table O-2: Voluntary Energy Intensity - Wastewater & Recycled Water					
Enter Start Date for Reporting Period 1/1/2015 End Date 12/31/2015	Urban Water Supplier Operational Control				
	Water Management Process				
	Collection / Conveyance	Treatment	Discharge / Distribution	Total	
Volume of Wastewater Entering Process (AF)	*140*	*50.9*	*83.6*	*140*	
Wastewater Energy Consumed (kWh)	*78986.5*	*82821.63*	*51193.02*	*213001.15*	
Wastewater Energy Intensity (kWh/AF)	*564.2*	*1627.1*	*612.4*	*1521.4*	
Volume of Recycled Water Entering Process (AF)	*0*	*0*	*0*	*0*	
Recycled Water Energy Consumed (kWh)	*0*	*0*	*0*	*0*	
Recycled Water Energy Intensity (kWh/AF)	*0.0*	*0.0*	*0.0*	*0.0*	

Quantity of Self-Generated Renewable Energy related to recycled water and wastewater operations

0 kWh

Data Quality *(Estimate, Metered Data, Combination of Estimates and Metered Data)*

Metered Data

Data Quality Narrative:

Wastewater volume is metered by AWA and energy use is metered by PG&E, so data quality is high.

Narrative:

Collection/Conveyance includes all wastewater collection systems including Martell
Treatment includes only Gayla Manor and Camanche Village
Discharge/Distribution includes all wastewater collection systems excluding Martell