APPENDIX 4.14 ENGINEER'S MEMORANDUM

Peter Waugh, consulting engineer with the Environmental Justice Coalition for Water, in collaboration with the Project Team and the Technical Advisory Committee, prepared this memorandum. It consists of four main sections, which inform the project proposals and the CECorps Final Design Reports.

1. Estimating Water Demand
2. Estimating Monthly Water Rates Per Household
3. Estimating Operator Cost
4. Estimating Wellhead Nitrate Treatment and Offsite Waste Disposal Cost

Estimating Water Demand

The purpose of this memorandum is to present a consistent methodology that can be used for estimating the water demand for the preliminary level analysis for each of the community water systems included in the Salinas Valley Disadvantaged Community Plan process. This methodology is based upon the assumption that there is no site-specific demand data available for the subject community. Secondly, this provides a conservative demand appropriate for preliminary level analysis useful for analyzing and comparing alternatives but should not be used for a final level of design.

Summary of Standard Methodology for Calculating Water Demand

The standard methodology for calculating demand is as follows:

A. If the water system has 2, 3 or 4 connections, provide water supply/storage facilities sufficient to supply 3 gpm per connection.
B. If the water system is a state small system (between 5 and 14 connections) provide water supply/storage facilities sufficient to supply 3 gpm per connection for 24 hours.
C. If the water system has 15 or more connections, use an average daily demand of 100 gallons per capita per day and a maximum daily demand of 225 GCPD. These unit demand values are multiplied by the number of residents to get the total daily demand at the site. The peak hour demand is calculated by dividing the maximum daily demand by 24 hours and multiplying by 1.5. This is equivalent to 14 gallons per hour times the number of residents in the community.
D. Determine the fire flow requirements for any system by contacting the local fire marshal. This is likely to be about 1000 gpm for 2 hours.

Basis of Standard Methodology

A summary and comparison of average daily water demand values for systems greater than 15 connections is provided in Table 1 below.

Table 1 Average Daily Demand Values

Reference	Demand (GCPD)	Comment
Cal Water	104	June 2013
	68	June 2015 after conservation efforts
	61	January 2013
	46	January 2016 after conservation efforts
USGS	77	State of California, publicly supplied
	51	State of California, self-supplied
Jeff Bensch	100	Rule of thumb of Technical Advisory Committee member

The maximum daily demand and peak hour demand values were calculated as follows:

Maximum daily demand = average daily demand * 2.25 = 100 *2.25 = 225 GCPD

Peak hour demand = maximum daily demand / 24 hours * 1.5 * number of residents = 225/24*1.5* number of residents = 14 * number of residents (gallons per hour)

References

Email from Brenda Granillo of Cal Water to Heather Lukacs of EJCW dated May 23, 2016 provided per capita water demand based upon measurements from local Cal Water systems. The demand data are: June 2013 = 104 GCPD, June 2015 = 68 GCPD, January 2013 = 61 GCPD, January 2016.

United States Geological Survey (May 3, 2016). Estimated Use of Water in the United States County-Level Data for 2010. Retrieved November 18, 2016 from http://water.usgs.gov/watuse/data/2010. DO-PSPCp = 77 Domestic, publicly supplied per capita use, in gallons/day DO-SSPCp = 51 Domestic self-supplied per capita use, in gallons/day

TAC Member Rule of Thumb Jeff Bensch of the TAC is a highly experienced water resources engineer who often works with water systems in California. He suggests a rule of thumb of 100 GCPD for domestic and landscape irrigation uses.

Summary of California Code of Regulations 64554 provides a methodology for determining maximum daily demand (MDD) and peak hourly demand (PHD). Portions of the regulation that are relevant to the Salinas Valley Disadvantaged Community systems include:

> (a)(2): "For systems with less than 1,000 service connections, the system shall have storage capacity equal to or greater than MDD, unless the system can demonstrate that it has an additional source of supply or has an emergency source connection that can meet the MDD requirement."
>
> Since there are no water demand data available for the subject water systems, use section (b)(4): "If no water usage data are available, utilize records from a system that is similar in size,

elevation, climate, demography, residential property size, and metering to determine the average water usage per service connection. From the average water usage per service connection, calculate the average daily demand and follow the steps in paragraph (3) to calculate the MDD and PHD."

Use the annual data from a neighboring system to determine MDD and PHD using section (3): "If only annual water usage data are available: (A) Identify the year with the highest water usage during at least the most recent ten years of operation or, if the system has been operating for less than ten years, during its years of operation; (B) To calculate the average daily use, divide the total annual water usage for the year with the highest use by 365 days; and (C) To calculate the MDD, multiply the average daily usage by a peaking factor of 2.25. (D) To calculate the PHD, determine the average hourly flow during MDD and multiply by a peaking factor that is a minimum of 1.5."

California Code of Regulations 64215 states: "Prior to receiving permit approval, a state small water system which was not in existence on November 12, 1991 shall demonstrate to the local health officer that sufficient water is available from the water system's sources and distribution storage facilities to supply a minimum of three gallons per minute for at least 24 hours for each service connection served by the system." Assuming 4 residents per connection, this is equivalent to 1080 GCPD (calculated as 3 gpm * 60 minutes * 24 hours/4 residents per connection). This is applicable to water systems defined as follows: "State Small Water System – A State Small Water System is a system which provides piped water to the public for human consumption that serves 5 to 14 service connections and does not serve more than an average 25 people for more than 60 days of the year."

Monterey County Code 15.04.140 - Quantity of water supply states the following:

a. Every domestic water system shall provide sufficient water from the water sources and storage facilities to adequately, reliably and safely meet the maximum water demand at all times.

b. Water sources shall demonstrate reliability and capability of a long term sustained yield in accordance with the requirements of Chapter 16 of Title 22 of the California Code of Regulations. In addition, water sources for local small water systems shall supply sufficient water quantity in accordance with the minimum capacity expressed in gallons per minute set forth in the Table 2.

Table 2. Minimum Capacity for Local Small Water Systems in Monterey County

Number of Service Connections	Number of Gallons Per Minute
2	*6
3	9
4	12

* When the second service connection is on the first parcel under one ownership, the quantity of water required will be at the Director's discretion.

Fire Flow can be determined by contacting the fire marshal. The fire flow requirement for small communities can be significantly higher than the requirement for domestic uses. For example, the fire flow rate requirement for the Johnson Road community is 1000 gpm for two hours.

Estimating Monthly Water Rates Per Household

For all communities, we assumed a 5/8" meter charge, as this is the most common size meter currently in use, and an estimate of 100 gallons per person per day of water use. We assume 4 people per household in Middlefield Rd, Johnson Rd, Hudson Landing Rd, Schoch Rd, and Santa Teresa. In Walnut Ave, we increased the number of people per household to 6 based upon the CEC teams estimates. These assumptions results in an estimated water use per month per household of 12,000 gallons which is equivalent to approximately 16 CCF or 120 CGL. With 6 people per household and the same usage per person (100 gallons per day), this amounts to a total of 18,000 gallons per month for Walnut Ave.

Cal Water- Salinas District (near Johnson Rd, Schoch Rd, and Middlefield Rd.)

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge[(1)] (Monthly)	$	$19	1	$18.6
Usage Rate Tier 1, 0-6 CCF (Monthly)	CCF	$3.03	6	$18.2
Usage Rate Tier 2 7-17 CCF (Monthly)	CCF	$3.20	10	$32.1
Estimated Total Monthly Water Use and Cost Per Household				***$69***

[(1)] Qualifying homes will receive a discounted service charge due to Low Income Ratepayer Assistance (LIRA) program. This LIRA discount was not included in this calculation.

Source: Cal Water Salinas District 2017 Rate Sheet for Residential Metered Connections. Accessed Oct. 14, 2017 https://www.calwater.com/docs/rates/rates_tariffs/mor/20170415-Residential_Metered_Service_MOR.pdf

Gabilan Water Company (near Middlefield Rd.)

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge[(1)] (Monthly)	$	$45	1	$45.0
Estimated Total Monthly Cost Per Household				***$45***

[(1)] In 2017, Gabilan Water Company raised their rates to $45 per household.

Source: Community members shared information about their water bill in October 2017.

Pajaro Sunny Mesa Community Service District (near Hudson Landing Road)

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge (Monthly)	$	$15.29	1	$15.3
Usage Rate Tier 1, 0-6 CCF (Monthly)	CCF	$5.13	16	$82.3
Estimated Total Monthly Water Use and Cost Per Household			***16***	***$98***

Source: PSMCSD's 2018 Rate Schedule. Accessed Oct. 14, 2017. http://pajarosunnymesa.com/uploads/2018%20Rate%20Schedule.pdf

Santa Teresa - City of Soledad

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge (Monthly)	$	$13.55	1	$13.6
Usage Rate Tier 1, 0-7 CCF (Monthly)	CCF	$1.48	7	$10.4
Usage Rate Tier 2, 7.01-23 CCF (Monthly)	CCF	$1.82	9	$16.5
Estimated Total Monthly Water Use and Cost Per Household			***16***	***$40***

Source: City of Soledad Water Rate Schedule for Jan 1, 2018. Accessed Oct. 14, 2017. http://ci.soledad.ca.us/documentcenter/view/1393

Walnut Ave - City of Greenfield

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge (Monthly)	$	$13.42	1	$13.4
Usage Rate Tier 1, 0-8,000 gallons (Monthly)	1,000 gallons	$1.17	8	$9.4
Usage Rate Tier 2, 8,000-15,000 gallons (Monthly)	1,000 gallons	$1.75	7	$12.3
Usage Rate Tier 3, >15,000 (Monthly)	1,000 gallons	$3.35	3	$10.1
Estimated Total Monthly Water Use and Cost Per Household			***18***	***$45***

Source: City of Greenfield 2017 Water Rate Schedule (effective Aug 1, 2016). Accessed Oct. 14, 2017. http://ci.greenfield.ca.us/158/Utility-Billing

California American Water - Ralph Lane (near Schoch Rd)

Item Description	Units	Unit Cost	Quantity	Total Cost
Service and Usage Costs				
Service Charge[(1)] (Monthly)	$	$6.24	1	$6.2
Usage Rate Tier 1, 0-59.8 CGL (Monthly)	CGL (100 gallons)	$0.40	59.8	$23.9
Usage Rate Tier 2, next 164.5 CGL (Monthly)	CGL (100 gallons)	$0.48	60.2	$28.9
Estimated Total Monthly Water Use and Cost Per Household			***120***	***$59***

[(1)] Qualifying homes will receive a discounted service charge due to Low Income Ratepayer Assistance (LIRA) program. This LIRA discount was not included in this calculation.

Source: Cal Am's Amber Park, Ralph Lane, Chualar Rate Schedules, effective Feb 2017. Accessed Oct. 14, 2017. https://amwater.com/caaw/customer-service-billing/billing-payment-info/water-rates/monterey-district

Estimating Operator Cost

In this section, the Consulting Engineer and Project Team present estimated costs for a contract water system operator to carry out necessary water quality testing and reporting for small systems typical in the Salinas Valley Disadvantaged Community Project. This will allow a more accurate comparison of costs for the alternatives of the various projects. The operator cost was developed through discussions with two individuals who act as contract water system operators for small water systems: Miles Farmer of Cyprus Water Services and Mike Christensen. Additional input was provided by TAC members Jeff Bensch and Ed Waggoner.

The cost presented is general in nature and is meant to be used for a preliminary level of analysis when comparing alternatives. It should not be used for final design.

The cost provided is based upon the following scenario: a water system with one well serving between 15 and 50 connections with an ion exchange water treatment system to remove elevated levels of nitrate and a chlorine based water disinfection system. The operator will visit the site once per week for sampling and general maintenance activities such as observations and identification of problems in the water supply, treatment and distribution system, reading water meters and maintaining records. Daily monitoring for nitrate will be carried out by the water system manager. The operator will prepare the annual report and consumer confidence report. There are 6 hours of operator effort per quarter allotted to maintenance. The budgeting level cost for this type of operator service is $1,000 per month. Scenarios that differ significantly from this type of system may require a different level of effort on behalf of the operator. In this case, use $75 per hour unit operator costs with a level of effort estimated by a local contract operator.

Estimating Wellhead Nitrate Treatment and Offsite Waste Disposal Cost

In this section, we present estimated costs for the wellhead treatment option of the Santa Teresa, Middlefield Road, and Hudson Landing Road projects. The design criteria for the systems are provided in Table 3. These criteria were provided to Tim Bushman of Culligan QWE Commercial systems. Mr. Bushman provided an estimate for the capital construction cost for each of the five systems shown in the last column of the table. Mr. Bushman's estimate is included as page 9 of this memorandum. The treatment system for each is an ion exchange system. As per the price quote, the cost includes "freight, sales tax, and estimated installation costs." The price quote assumes no other pretreatment (such as iron removal, manganese removal, etc.).

Table 3. Design parameters for water treatment

Community Name	No. of Homes	Design Flow (gpm) [1]	Contamination[3]	Capital Construction Cost of Treatment Equipment
Santa Teresa	10	30	Nitrate 10.6 mg/l	$10,631
Middlefield Rd.	5	15	Nitrate 13.6 mg/l	$7,543
Hudson Landing Road[2]	2	6	Nitrate 40.5 mg/l Chromium VI 11ug/l	$5,931
	2	6	Nitrate 17.6 mg/l	$4,783
	13	39	Chromium VI 20 ug/l	$40,380

Notes:

[1] Use 3 gpm per connection for systems with fewer than 15 connections as per CCR 64215.

[2] There are approximately 50 wells servicing 80 homes. The three different systems listed for Hudson Landing Road are intended to give the range of possible design parameters for the wells at the site.

[3] Nitrate values are NO_3-N with MCL = 10 mg/l.

Additional assumptions for the capital construction cost of nitrate removal systems include: a) no additional electric infrastructure is needed for any of the systems, b) there is sufficient space at each location to install the treatment system, c) there is adequate access to the site that they can be maintained without doing any additional work for access to the site.

Additional items that are needed for a complete treatment system include the following:

- 8 foot by 8 foot by 8 foot high (nominal dimensions) storage shed for protection of the equipment costed at $3,000
- 3000 gallon above-grade plastic storage tank for on-site brine storage before it is hauled away to disposal at Monterey One Water facility (formerly Monterey Regional Water Pollution Control Agency) using a cost of $5,000 as per TAC member Jeff Bensch
- 50 gpm pump that will be used to pump from the on-site storage tank into the brine hauling truck using a cost of $3,000 as per TAC member Jeff Bensch
- Initial analysis of the brine for disposal at Monterey One Water at an estimated cost of $5,000
- 25% added for engineering, permitting, etc.
- 25% added for a contingency

The operation and maintenance tasks include:

- The brine in the 3000-gallon storage tank must be hauled to a disposal site when the tank is full. The frequency of hauling is dependent on the size of the tank. For example, it must be hauled on a monthly basis for the Santa Teresa community. The hauling cost is based upon paying $185 per hour for four hours for the hauling truck as per Keith Potter at the Don Chapin Company. $185 per hour * 4 hours/3000 gallons = $0.25 per gallon. The volume of brine produced is included as **Table 5**.
- The disposal fee as per Monterey One Water is $0.05 per gallon.
- The operator required for the treatment system is costed at $1,000 per month.

Calculations for the capital construction cost is included in **Table 6**. The operation and maintenance cost calculations are included in **Table 7**. A summary of the costs is provided in **Table 4** below.

Table 4. Summary of Capital and Operation/Maintenance Costs for Wellhead Treatment

Community	Capital Construction Cost	Monthly Operation and Maintenance Cost
Santa Teresa	$39,947	$1,900
Middlefield Road #4	$35,315	$1,450
Middlefield Road #3	$36,917	$1,630
Middlefield Road #2	$42,314	$2,260
Hudson Landing Road	$32,897	$1,090
Hudson Landing Road	$31,175	$1,090
Hudson Landing Road	$84,570	$1,073

Table 5. Ion Exchange Waste Storage and Hauling

Community	Number of Residents	Daily Water Use (gallons)	Waste (gallons)[1]			
			Daily	Weekly	Monthly	Yearly
Santa Teresa	40	4000	100	700	3000	36500
Hudson Landing Road	4	400	10	70	300	3650
Hudson Landing Road	52	5200	32.5	228	975	11863
Middlefield road #4	20	2000	50	350	1500	18250
Middlefield road #3	28	2800	70	490	2100	25550
Middlefield road #2	56	5600	140	980	4200	51100

Note:

[1] Waste = 100 gallons for every 4000 gallons processed for nitrate removal, 25 gallons for every 4000 gallons processed for chromium removal

Table 6 Capital Construction Costs for Nitrate Removal

Item	Units	Santa Teresa	Middlefield WS #4	Middlefield WS #3	Middlefield WS #2	Hudson Valley Rd Example System #1	Hudson Valley Rd Example System #2	Hudson Valley Rd Example System #3
Treatment System (Culligan QWE)	lump sum	$10,631	$7,543	$8,611	$12,209	$5,931	$4,783	$40,380
Shed Housing	lump sum	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Brine Storage	lump sum	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Pump	lump sum	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000	$3,000
Lab Analysis	lump sum	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000	$5,000
Sub-Total		$26,631	$23,543	$24,611	$28,209	$21,931	$20,783	$56,380
Engineering	25%	$6,658	$5,886	$6,153	$7,052	$5,483	$5,196	$14,095
Contingency	25%	$6,658	$5,886	$6,153	$7,052	$5,483	$5,196	$14,095
Grand total		$39,947	$35,315	$36,917	$42,314	$32,897	$31,175	$84,570

Notes:

Hudson Valley Road Example System #1, 2 homes, 6 gpm, Nitrate (as NO3) = 179 mg/l, Chromium VI @ 11 ug/l

Hudson Valley Road Example System #2, 2 homes, 6 gpm, Nitrate (as NO3) = 78 mg/l

Hudson Valley Road Example System #3, 13 homes, 39 gpm, Chromium = 20 ug/l

Table 7: Operation and Maintenance Cost for Wellhead Treatment

Item	Units	Unit Cost	Brine Quantity	Monthly Cost	Yearly Cost
Santa Teresa - 10 homes, 4 residents per home					
Disposal Cost	gallons per month	$0.05	3000	$150.00	$1,800.00
Hauling Cost	gallons per month	$0.25	3000	$750.00	$9,000.00
Operator cost	monthly cost	$1,000.00	12	$1,000.00	$12,000.00
Total				$1,900.00	$22,800.00
Middlefield Road #4 - 5 homes, 4 residents per home					
Disposal Cost	gallons per month	$0.05	1500	$75.00	$900.00
Hauling Cost	gallons per month	$0.25	1500	$375.00	$4,500.00
Operator cost	monthly cost	$1,000.00	12	$1,000.00	$12,000.00
Total				$1,450.00	$17,400.00
Middlefield Road #3 - 7 homes, 4 residents per home					
Disposal Cost	gallons per month	$0.05	2100	$105.00	$1,260.00
Hauling Cost	gallons per month	$0.25	2100	$525.00	$6,300.00
Operator cost	monthly cost	$2,000.00	12	$1,000.00	$12,000.00
Total				$1,630.00	$19,560.00
Middlefield Road #2 - 14 homes, 4 residents per home					
Disposal Cost	gallons per month	$0.05	4200	$210.00	$2,520.00
Hauling Cost	gallons per month	$0.25	4200	$1,050.00	$12,600.00
Operator cost	monthly cost	$3,000.00	12	$1,000.00	$12,000.00
Total				$2,260.00	$27,120.00
Hudson Valley Road Example System #1 - 2 homes, 4 residents per home, 6 gpm, Nitrate (as NO3) = 179 mg/l, Chromium VI @ 11 ug/l					
Disposal Cost	gallons per month	$0.05	300	$15.00	$180.00
Hauling Cost	gallons per month	$0.25	300	$75.00	$900.00
Operator cost	monthly cost	$500.00	12	$1,000.00	$12,000.00
Total				$1,090.00	$13,080.00
Hudson Valley Road Example System #2, 2 homes, 4 residents per home, 6 gpm, Nitrate (as NO3) = 78 mg/l					
Disposal Cost	gallons per month	$0.05	300	$15.00	$180.00
Hauling Cost	gallons per month	$0.25	300	$75.00	$900.00
Operator cost	monthly cost	$500.00	12	$1,000.00	$12,000.00
Total				$1,090.00	$13,080.00
Hudson Valley Road - Example System #3, 13 homes, 39 gpm, Chromium = 20 ug/l					
Disposal Cost	gallons per month	$0.05	243.75	$12.19	$146.25
Hauling Cost	gallons per month	$0.25	243.75	$60.94	$731.25
Operator cost	monthly cost	$1,000.00	12	$1,000.00	$12,000.00
Total				$1,073.13	$12,877.50

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8.25.17

Peter Waugh
Heather Lukacs
The Environmental Justice Coalition for Water

Re: Budgetary equipment pricing

Dear Peter and Heather,
Below are budgetary equipment pricing based on the provided contaminant levels and flow rates.
Pricing includes freight, sales tax, and estimated installation costs.
These prices assume no other pretreatment is necessary, ie. iron removal, manganese removal, etc.)

The Nitrate systems presented are all twin alternating meter initiated systems.
The Cr6 Systems, due to the tremendous capacity (about 1,000,000 gallons per cubic foot) are exchanged when the media is depleted. The smaller system is a single tank configuration, whereas #5 is a lead –lag two tank configuration. The Cr6 systems include a water meter to track water throughput.

1. 10 homes, 30 gpm, Nitrate @ 47 mg/l (as NO3): $10,631.00
(HE120-T, 7 cub ft twin alt Nitrate exchanger)

2. 5 homes, 15 gpm, Nitrate @ 60 mg/l (as NO3): $7,543.00
(HE150-T 5 cubic ft twin alt Nitrate exchanger)

3. 2 homes, 6 gpm, Nitrate @179 mg/l (as NO3), Chromium VI @ 11 ug/l: $5,931.00
(HE 60 Twin) 2 Cub ft twin alt Nitrate exchanger- single 2 cub ft Cr6 exchanger)

4. 2 home, 6 gpm, Nitrate @ 78 mg/l (as NO3): $4,783.00
(HE 60 Twin) 2 Cub ft twin alt Nitrate exchanger

5. 5. 13 homes, 39 gpm, Chromium VI @ 20 ug/l.: $40,380.00
(two (2) - 30"- 10 cub ft Cr6 Exchangers in lead lag configuration with valving for stage positioning)

Hope this helps, let me know if there is anything else I can provide at this point.

Respectfully,

Tim Bushman MWS, CI
WQA Certified Water Specialist
Culligan QWE Commercial Systems
Direct: 831.801.6523