APPENDIX 4.11

CECorps Design Report for Middlefield Road

March 2017

APPENDIX 4.11 MIDDLEFIELD ROAD DESIGN REPORT

This addendum summarizes the results of the design report prepared by Community Engineering Corps (CECorps) team from San Jose State University dated March 9, 2017 as well as additions to the original report prepared by Peter Waugh, consulting engineer, and the Salinas Valley Water and Wastewater Planning Project Team. Table 1 and Table 2 summarize the results of the combined work with the intent of providing important cost information for the property owner and residents at Middlefield Road.

Table 1: Summary of Capital Construction and O/M Costs for the five houses served by Middlefield Rd. Water System #4

	Alt 1a: Consolidation with Cal Water	**Alt 1b: Consolidation with Gabilan**	**Alt 2: New Well**	**Alt 3: Wellhead Treatment**
Source of Information	CECorps	CECorps	CECorps	Project Team
Capital Cost	$290,972	$127,328	$33,233	$35,314
Annual O&M Cost	$4,135[1]	$2,700[1]	$3,527	$17,400
Net Present Value	$362,972	$174,328	$95,233	$305,000
Estimated average monthly cost/home	$69[2]	$45[3]	$59	$290

Notes:

[1] The operation and maintenance cost was calculated by multiplying the estimated annual water cost per home by the number of homes.

[2] Based upon 4 residents using 100 gallons per day and Cal Water rates posted on 4.15.17 for the Monterey Region Tariff Area. Assumes 5/8" water meter charge.

[3] Based on a flat rate of $45 per household.

Table 2: Summary of Capital Construction and O/M Costs for Cal Water extension to Middlefield Road

	Alternative 1a WS #4	**Alternative 1a -2 WS #4 and WS #3**	**Alternative 1a-3 WS #4, WS #3 and WS #2**
Source of Information	CECorps	Project Team	Project Team
Number of Households	5	12	26
Capital Cost	$290,972	$464,141	$824,521
Estimated average monthly cost/home	$69[2]	$69[2]	$69[2]

[2] Based upon 4 residents using 100 gallons per day and Cal Water rates posted on 4.15.17 for the Monterey Region Tariff Area. Assumes 5/8" water meter charge.

Summary of CECorps Design Report

The Livingston Mutual Water System (LMWS) serves a disadvantaged community of five adjacent homes on Middlefield Road in the Salinas Valley. It has a supply well located at 742 Middlefield Road and a small distribution system to the five homes. The well water has nitrate levels that exceed the maximum contaminant level (MCL). Two alternative solutions are considered for bringing the water supply into compliance with applicable water quality standards: 1) drill a new supply well and 2) consolidate with a

nearby water system. The preferred alternative is consolidation with a larger water system in the area, either Cal Water-Salinas or Gabilan Water Company.

Additions/Revisions to the Original Design Report

a) Addition of Neighboring Small Water Systems

The original CECorps Design Report included one water system (termed WS #4 in this memorandum) serving five homes at 740, 742, 746, 748 and 750 Middlefield Road. There are two additional state small water systems that could also be included in the consolidation. One (WS #3) serves seven homes at 718, 720, 722, 724, 732, 736 and 738 Middlefield Road. The second additional state water system that is a potential consolidation partner (system WS #2) serves 14 homes at 12 and 22 Lagunita Road and 679, 680, 681, 682, 683, 686, 696, 698, 702, 706, 708 and 712 Middlefield Road. WS #2 also has nitrate levels that exceed the MCL. WS #3 has had repeat bacteria violations according to Monterey County data. The general locations of the three water systems are shown in Figure 1.

Figure 1. Proposed Middlefield Road Water Line and State Small Water Systems

Alternative 1a which entails consolidation of the five homes in water system WS #4 with a nearby Cal Water system would require tying into the existing Cal Water distribution system at the intersection of San Juan Grade Road and Hebert Road and installing approximately 1400 feet of new water system piping in the right of way of Hebert Road and Middlefield Road. This alternative is described on pages 19 – 22 of the original report.

Alternative 1a -2 includes consolidation of WS #4 as described above plus the additional 7 homes of water system WS #3. This alternative would require all the new infrastructure described for Alternative 2a above and would require an additional 600 feet of piping in Middlefield Road (for a total of 2200 feet of piping).

Finally, Alternative 1a-3 includes consolidation of systems WS #3 and WS #4 as detailed above plus an additional 14 homes from WS #2. In this case, the new piping would form a loop with connections to the Cal Water system in San Juan Grade Road at both Lagunita Road and Hebert Road. A total of 3840 feet of piping would be required.

The construction cost from the original report is expanded to include the two new alternatives. See Table 3. While the cost increases for alternative 1a-2 and 1a-3, the cost per home served decreases.

Table 3. Capital Construction Costs for Middlefield Road Water Systems to Connect with Cal Water-Salinas System

Item	Unit	Unit Cost[4]	Quantity			Cost		
			WS #4[1]	WS #4 & WS #3[2]	WS #4, WS #3 & WS #2[3]	WS #4	WS #4 & WS #3	WS #4, WS #3 and WS #2
8" pipe	ft	110	1400	2200	3840	$154,000	$242,000	$422,400
Service lines	each	2200	5	12	26	$11,000	$26,400	$57,200
Backflow prevention	each	1000	5	12	26	$5,000	$12,000	$26,000
Fire hydrants	each	8869	1	1	2	$8,869	$8,869	$17,738
Surveying and engineering	hrs	125	280	420	700	$35,000	$52,500	$87,500
Construction and contract management	hrs	125	100	150	250	$12,500	$18,750	$31,250
Grant administration	hrs	125	80	120	200	$10,000	$15,000	$25,000
Subtotal						**$236,369**	**$375,519**	**$667,088**
Contingency	%	20%				$47,274	$75,104	$133,418
Price Escalation	%	3%				$8,509	$13,519	$24,015
Total Initial						**$292,152**	**$464,141**	**$824,521**
Total Cost per home						**$58,430**	**$38,678**	**$31,712**

Notes:
[1] Quantities for WS #4 are taken directly from Table 4 of *546 Design Report for Community Engineering Corps Projects Middlefield Rd.*
[2] Quantities for WS #4 and WS #3 are consistent with the WS #4 quantities with the following differences: a) an additional 600 feet of water line is needed to reach the new homes, b) there is a service line and backflow preventer at each home (12 total), c) one fire hydrant will still be sufficient for the homes in this alternative, d) engineering, construction management, etc. costs are increased by a factor of 1.5 to account for the additional homes.

[3] Quantities for WS #4, WS #3 and WS #2 are consistent with the WS #4 quantities with the following differences: a) the new water line will be a looped system from San Juan Grade Road tie-in along Lagunita Road, Middlefield Road and Hebert Road, b) there is a service line and backflow preventer at each home 26 total), c) two fire hydrants, d) engineering, construction management, etc. costs are increased by a factor of 2.5 to account for the additional homes.
[4] Unit Costs are taken directly from Table 4 of *546 Design Report for Community Engineering Corps Projects San Jose State University Student Chapter Salinas, CA Middlefield Rd.*

b) Standardized Water Demand

A standard method for calculating water demand has been developed for use in the water supply system analysis for each community. This method is summarized in Appendix 4.14 Engineer's Memorandum. Table 4 shows the water demand for each Middlefield Rd. alternative.

Table 4: Water Demand for Middlefield Road

Alternative	Design Water Demand[2, 3]
Alternative 1 – Consolidation for five homes (WS #4)	ADD = 2,000 gpd, MDD = 4,500 gpd, PHD = 281gph
Alternative 1 (modified) – consolidation for 7 homes (WS #3)	ADD = 2,800 gpd, MDD = 6,300 gpd, PHD = 394 gph
Alternative 1 (modified) – consolidation for 14 homes (WS #2)	ADD = 5,600 gpd, MDD = 12,600 gpd, PHD = 788 gph
Alternative 1 – Drill new well	15 gallons per minute (gpm)

Notes:
[1] ADD = average daily demand, MDD = maximum daily demand, PHD = peak hour demand, gpd = gallons per day, gph = gallons per hour.
[2] Note that consolidation water demand may be modified by the consolidation partner if they have historic water demand data to support using a different value.
[3] The design water demands for alternative 2 are additive. For example, if systems WS #4 and WS #3 consolidate with Cal Water, the ADD = 2,000 + 2,800 = 4,800 gpd.

c) Wellhead Treatment

An additional alternative of wellhead treatment is considered for three scenarios – five homes (WS #4), seven homes (WS #3), and 14 homes (WS #2). The systems would continue using the existing water supply well and distribution system at each of the three distinct communities. Each system would then install an ion exchange treatment facility, a small shed to house the facility, and a 3,000-gallon plastic storage tank to accept the waste brine prior to hauling the brine to a treatment facility. The operation and maintenance costs include weekly visits by an operator, hauling the waste stream to a treatment facility and disposal at the treatment facility. Additional information about this scenario is included in Appendix 4.14 Engineer's Memorandum. A summary of treatment costs in provided in Table 5 below. This includes the capital construction cost as well as the monthly operation and maintenance cost.

Table 5 Capital Construction Cost and Operation/Maintenance Cost for Middlefield Water Systems

Community	No. of Homes	Capital Construction Cost	Monthly O/M Cost	Annual O/M Cost
Middlefield #4	5	$35,314	$1,450	$17,400
Middlefield #3	7	$36,917	$1,630	$19,560
Middlefield #2	14	$42,313	$2,260	$27,120

d) Net Present Value and Monthly Cost Per Household

The economic evaluation for Middlefield Road in Table 1 was updated to include net present value and projected monthly cost per household using the Johnson Road CECorps team's methodology. Page 20 of Appendix 4.2 Johnson Road CECorps Design Report describes this methodology:

> "The economic evaluation also includes a comparison of the Net Present Value (NPV) of each alternative, which assumes an O&M inflation rate of 1.9% and annual discount rate of 3.1% over a 20 year term. The costs presented in this evaluation are in 2016 dollars, and the backup for these cost estimates can be found in Appendix F... To evaluate each alternative's cost impact on the community members, the estimated annual O&M costs were divided to show the amount that would be paid by each household on a monthly basis."

546 – Design Report for Community Engineering Corps Projects

PROJECT TEAM: San Jose State University

STATE: California

COMMUNITY: Salinas River Valley

PROJECT: Middlefield Rd.

PROJECT NUMBER

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SUBMITTAL DATE: 2/16/2017
Revision Date: 3/9/2017

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San Jose State University Student Chapter
Salinas, CA
Middlefield Rd. (Project Number)

Part 1 – Administrative Information

1.0 Contact Information

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2.0 Project Disciplines

Water Supply
____ Source Development
____ Water Storage
__X_ Water Distribution
__X_ Water Treatment
__X_ Water Pump

Civil Works
____ Roads
____ Drainage
____ Dams

Agriculture
____ Irrigation Pump
____ Irrigation Line
____ Water Storage
____ Soil Improvement
____ Fish Farm
____ Crop Processing Equipment

Sanitation
____ Latrine
____ Gray Water System
____ Black Water System

Structures
____ Bridge
____ Building

Energy
____ Fuel
____ Electricity

Information Systems
____ Computer Service

3.0 Project Location

Latitude: 36.756483
Longitude: -121.614317

4.0 Purpose of Report

____ Report Prepared for Review by Regulatory Authority
Name of Regulatory Authority:_____

__X_ Design Submittal for Partner Community

546 Design Report for Community Engineering Corps Projects
San Jose State University Student Chapter
Salinas, CA
Middlefield Rd. (Project Number)

Part 2 – Technical Information

1.0 INTRODUCTION

Project Background

The Environmental Justice Coalition for Water (EJCW), in collaboration with the Community Engineering Corps (CECorps), has requested the San Jose State University Student Chapter of Engineers Without Borders (EWB SJSU) to conduct a feasibility study for the Livingston Mutual Water System (LMWS), which is experiencing a domestic well nitrate contamination problem. The EJCW and CECorps have identified LMWS as a disadvantaged community comprised of five residences within Salinas Valley. The community is served by a domestic well at 742 Middlefield Road that exceeds the maximum contaminant level (MCL) for nitrate concentration. The project calls for a feasible solution to address the treatment, storage, and distribution of the water serving LMWS.

This report identifies and evaluates three alternative solutions on the basis of water quality, system maintenance, fire code compliance, and cost. The report also recommends an alternative based on this evaluation. Figure 1 shows the location of the LMWS and the well.

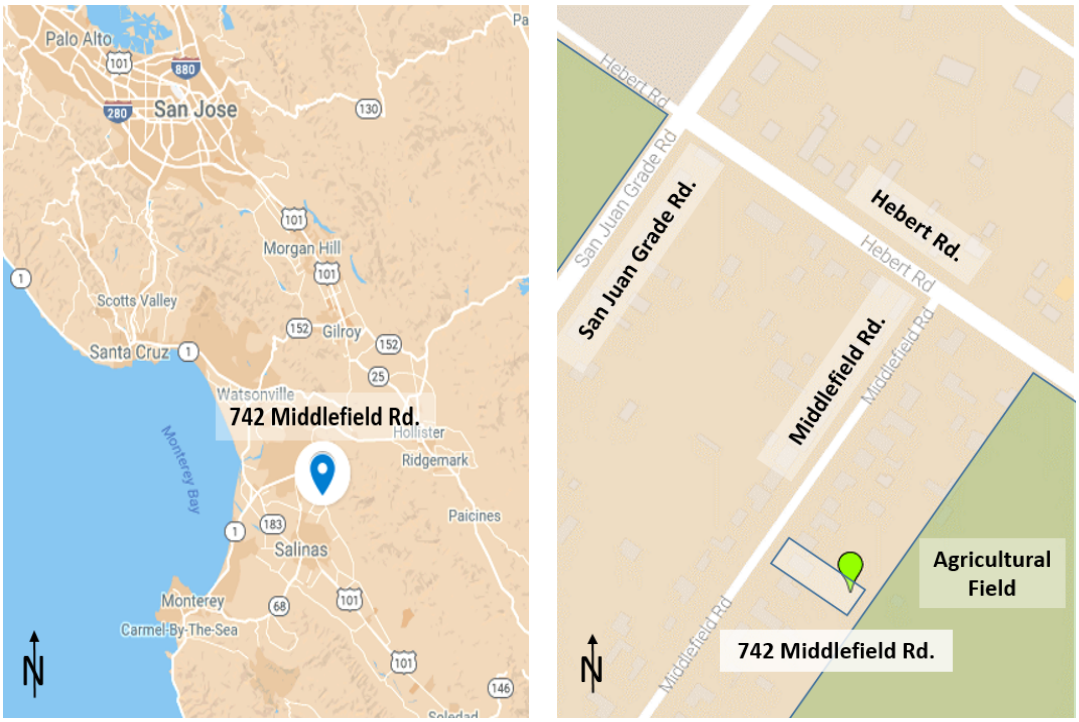
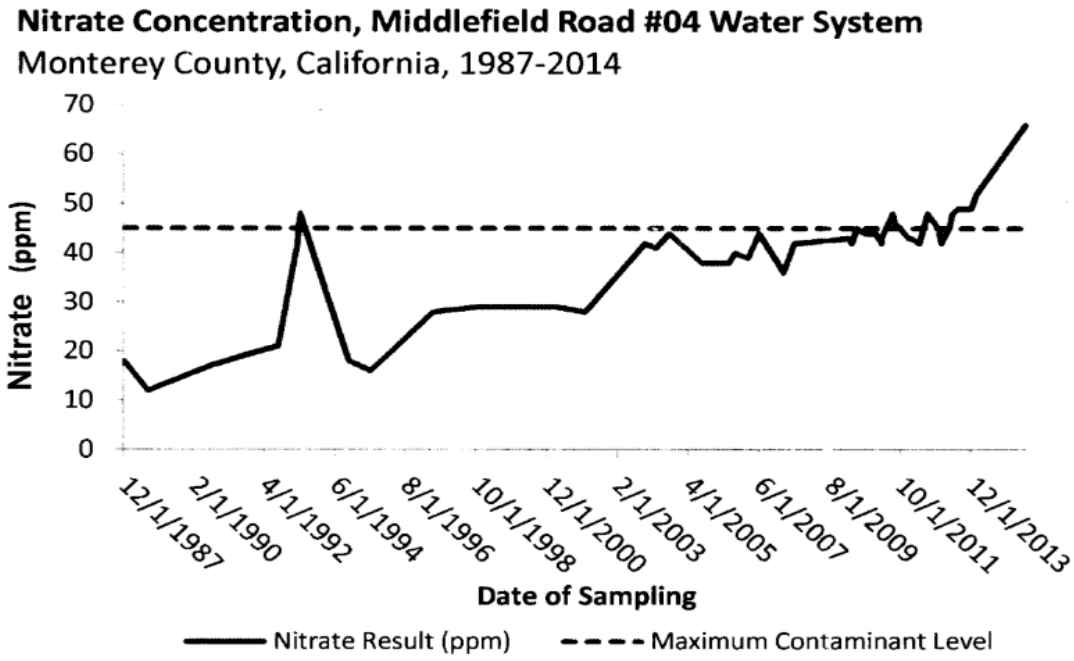


Figure 1 *– Site Location*

Problem Definition

In recent years, the domestic well serving the LMWS has experienced increasing levels of nitrate contamination that have forced residents to use bottled water for drinking and cooking purposes. The Environmental Protection Agency (EPA) and State Water Resources Control Board have defined the state MCL for nitrate (NO_3) as 45 mg/L (or ppm) (*Nitrate Fact Sheet)*. As shown in Figure 2, the well has exceeded the MCL consistently since 2009. The noticeable spike in nitrate levels in 1992 was due to surface contamination from a damaged well casing. The homeowner resolved the issue by repairing the casing.

Figure 2 - Nitrate Contamination for LMWS



LMWS System Properties

Specifications of the existing well were determined from a site visit. The well, pump, and storage is located at 742 Middlefield Road and provides service to five homes located on 740-750 Middlefield Road shown in Figure 3. The property owner dates its construction to pre-1940. The maximum flow rate is 23 gallons per minute (gpm); the well is thus classified as a domestic well because it produces less than 1,000 gpm. The well casing is 233 feet deep, with a pumping water

level of 172 feet below ground surface.

The well system is automatically operated by a programmable logic controller. A pressure sensor controls the pump, activating it when water pressure reaches a lower limit and shutting it off when pressure reaches an upper limit. The water is pumped to three hydropneumatic surge tanks using a 15-HP pump. The water is distributed to customers through a system of PVC pipes.

Figure 3 *- Pump, Pumphouse, three storage tanks from the assessment trip. Located in the backyard of 742 Middlefield Rd.*

LMWS charges shareholders a monthly rate of $35 for up to two people residing in a household. There is a pro-rated charge of $10 per adult and $5 per child under 16 per month for people residing or visiting in addition to the $35 minimum for two people. In 2015, USGS estimated 51 gallons per day of "domestic self-supplied per capita use in Monterey County." The current water demand is not expected to increase due to new customers or developments. Currently, the homeowners of the Middlefield Road community manage LMWS with one appointed well manager. The management of LMWS includes monthly billing and receiving payment from residents, managing monthly payments to PG&E for electricity for the well pump, scheduling and overseeing periodic and emergency well maintenance and repair.

Measure of Effectiveness

The team has identified four measures of effectiveness, or criteria, to assess the advantages and disadvantages of each proposed alternative. In addition to cost and water quality, the maintenance of the system is considered a measure of effectiveness. This decision was based on direct feedback from the community. The current well operator for LMWS, Laura Gomez,

expressed concern about managing the system and the challenges of finding sustainable solutions to well contamination.

The fire code compliance criterion acknowledges the local fire code regulations and the safety requirements mandated by the fire marshal in Monterey County. All proposed alternatives must undergo consideration of the current fire code regulations set by the local fire marshal.

The California Fire Code, **Appendix A - Fire-Flow Requirements for Buildings**, requires 1,000 gpm of water supplied for two hours for rural residential buildings. The fire marshal has the ability to lower or increase the requirement based on the type of water utility system that is connected to the community. The requirements are also based on the overall feasibility of full fire-flow requirements for buildings in rural areas or small communities [See **B103.1**].

The criteria are summarized below:

1. **Water quality** – Compliance with California drinking water MCLs for nitrate and other contaminants
2. **System maintenance –** Assessment of the system's ease of management and operation
3. **Fire code compliance** – Ability to comply with fire flow requirements established by California Fire Code - Appendix A and Monterey Regional Fire Department Fire Marshal.
4. **Costs** – Initial and operational costs over the lifetime of the system

2.0 PROJECT ALTERNATIVE

The following alternatives were selected for evaluation to meet the system criteria.

Alternative 1. Drill a new well near the existing site

Alternative 2. Consolidation with a nearby water utility company

A final recommendation is made by assessing the pros and cons of each alternative based on the measures of effectiveness.

3.0 ALTERNATIVE 1: New Well

A new well would be drilled to provide a new source of water that meets the nitrate MCL. The new well must be located at an uncontaminated site at an accessible distance to the existing pumphouse such that the current storage and pump facilities can be used. The new well must also be drilled to an appropriate depth.

Design Criteria and Assumptions

A proper location for drilling a new well must be determined per Monterey County requirements and provide adequate separation from existing water and wastewater infrastructure as well as animal enclosures. Well drilling requires the community to hire a contractor for construction of the new well and demolition of the existing well. The appropriate well drilling permits from Monterey County must also be obtained. The final design and sizing of the proposed well is not within the scope of this feasibility report.

The design flow and storage are assumed to stay the same because there is no projected increase in water usage from the community in the future. A new well would be able to reuse the existing pump, pumphouse, and storage tanks. The distribution system would need an extension to connect the community with the new wellhead location.

It is assumed the existing pump could be used for the new well because of the similar static head, as seen in **Figure 4.** The static water level is independent of the well depth. In addition, newly installed screens for the new well will increase pumping efficiency for the current pump by decreasing drawdown.

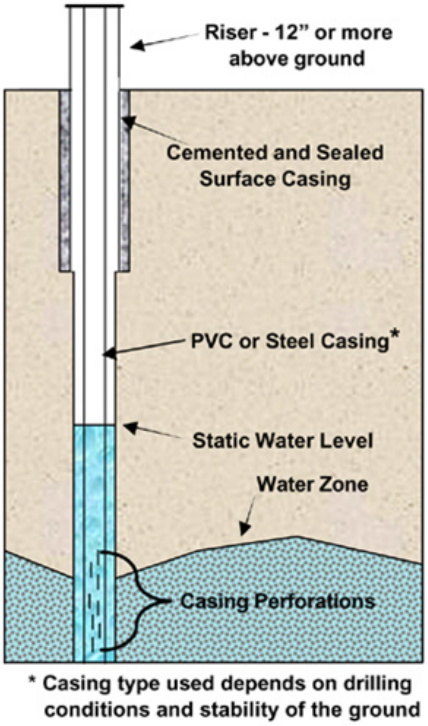


Figure 4 *- Example diagram of a new well design (Well Permit Application Review)*

Water Quality

Drilling a new well could provide a new source of water that meets the MCL criteria for nitrate concentrations. However, the probability of locating a site that meets the nitrate MCL within an accessible distance of the LMWS is low. There is a high likelihood of nitrate contamination based on a report by the California Department of Water Resources (DWR) (*Salinas Groundwater Basin, Eastside Aquifer Subbasin*). The new well would be located in the same geographic region as the existing well, known as the East Side Aquifer sub-basin of the Salinas groundwater basin **(Figure 5),** where there is a high likelihood of nitrate contamination according to a report by the California Department of Water Resources (DWR). The report states that the Salinas Valley's groundwater quality issues are due to agricultural production and that the region has an "extensive nonpoint source nitrate problem" (*Salinas Groundwater Basin, Eastside Aquifer Subbasin*). Thus, there is likely no single source of contamination that can be addressed
directly.

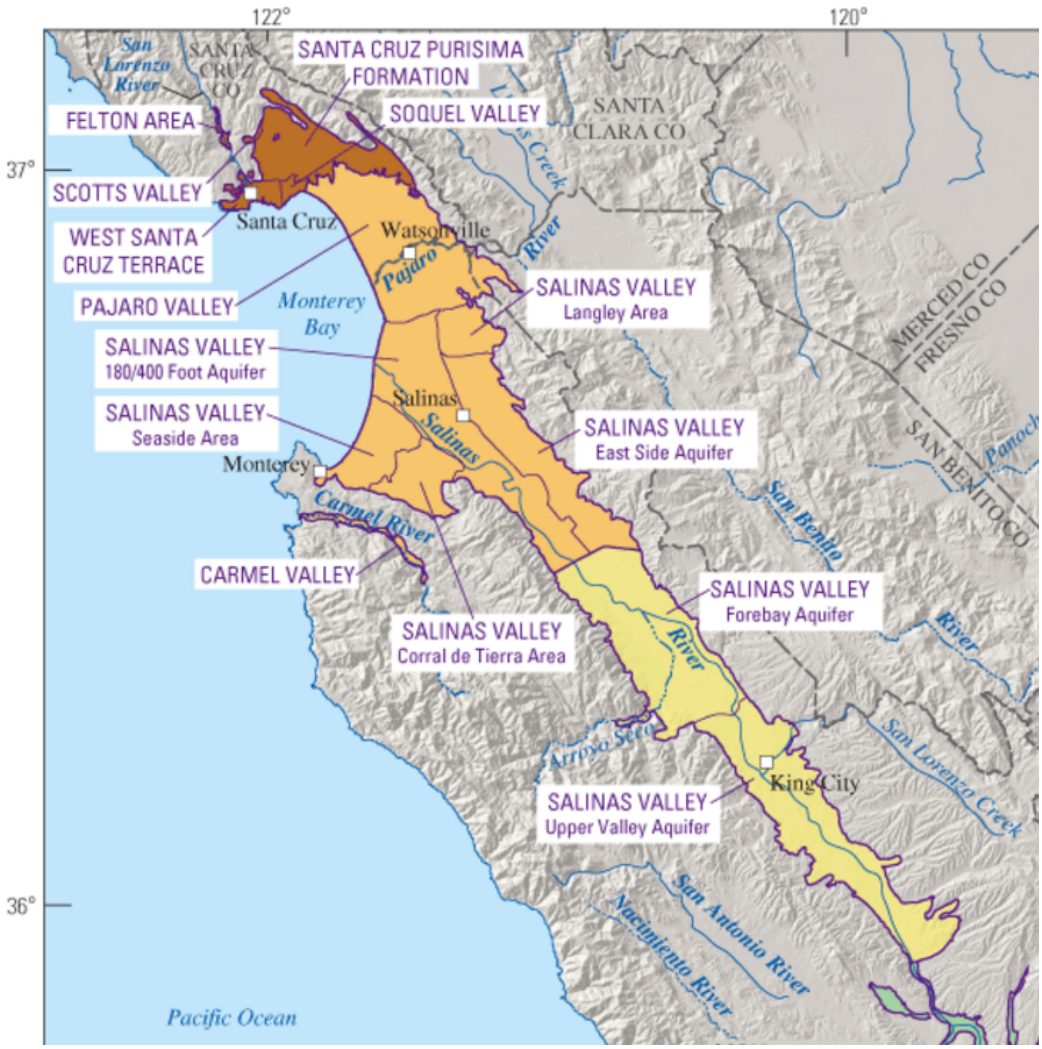


Figure 5 *- East Side Aquifer Sub-Basin located within the Salinas Groundwater Basin (Source: USGS)*

Even if a newly drilled well is found to meet nitrate MCLs, there is still a risk of future contamination due to the agricultural runoff in this region.

Costs

Costs associated with well drilling include capital construction costs, permitting fees required by Monterey County, and operational costs.

The new well system would reuse the existing storage facilities and pump which will reduce installation and material costs. The cost to extend piping from the new well location to the existing distribution system must also be considered in the final estimate after the location of the new well site is finalized.

Well-drilling estimates shown in **Table 1** were provided by local well-drilling contractors and are based on a new domestic well with a depth of 600 feet (at less than 1,000 gpm). The assumed depth is deeper than the existing well depth of 233 feet and is based on a reasonable average of nearby well depths that are in compliance with the nitrate MCL. Note that costs may vary based on well depth. In California, price escalation during drought conditions has caused well-drilling costs to vary significantly.

Table 1 *- Well-Drilling Estimates*

Contractor	Description	Estimate
Maggioria Brothers Drilling, Inc.	See Appendix C.	$43,839
Arthur & Orum Well Drilling, Inc.	$45/ft	$27,000
Eaton Pumps & Drilling	$85/ft	$51,000

Other costs associated with the new well system are due to Monterey County regulations and permitting requirements. The Monterey County Water Resources Agency (MCWRA) issues all permits to construct, repair, or demolish a well in Monterey County. The MCWRA charges additional fees for water well permit applications. Well permitting fees are summarized in **Table 2.** A permit must be also obtained for the demolition of the existing well.

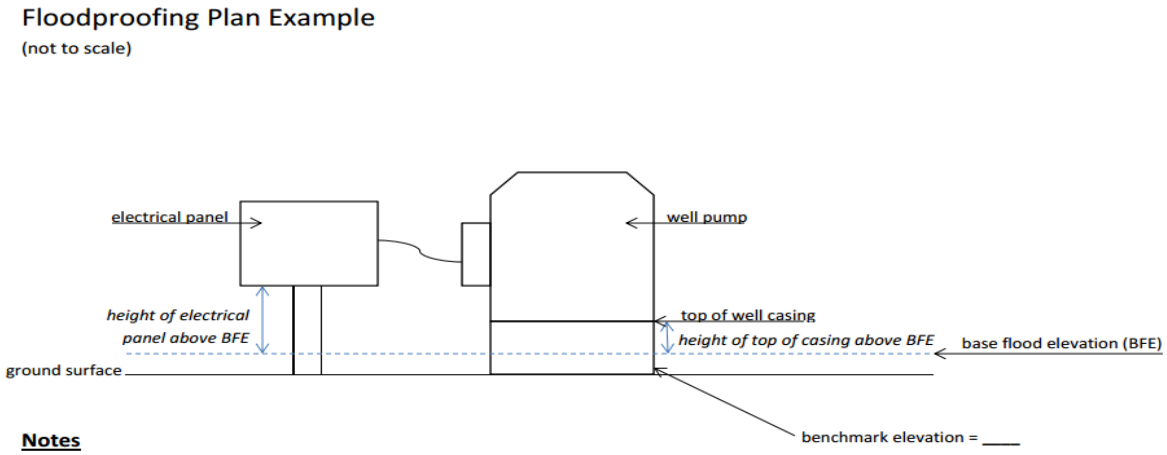
Table 2 *- Well Permitting Fees*

Item	Cost
Construction Permit - Under 5 acre-feet/year (<1,000 gpm) Domestic	$2,108
Destruction Permit	$1,274
Borehole Fees (4 or less)	$542
Monitoring Well Fees (4 or less)	$1,213
Well Construction Fee for New Domestic Well	$121
Well Reconstruction/Destruction Fees	$365
Well Construction Fees for Wells Producing over 5 Acre-Feet per Year	$610
Total	**$6,233**

(*Well Permit Application Review)*

MCWRA also requires a floodproofing plan before well construction can begin. A sample floodproofing plan is provided by the county (**Figure 6**). The floodproofing plan is required to demonstrate mitigation against flood damage and requires official documentation from a licensed surveyor or civil engineer.

Figure 6 *- Sample Floodproofing Plan*



An impact assessment is required for new wells according to the 2010 Monterey County General Plan (Policy PS-3.3 for domestic wells) to determine any adverse impacts to existing well systems. Impact assessment fees are also charged by the MCWRA.

Operational costs due to the new well are assumed to be the same as the existing well. LMWS charges a monthly rate of $35 per household. Equivalent uniform annual cost (EUAC) can be used to evaluate the average annual cost of owning, operating, and maintaining a system over the course of its lifetime. It is used in this report to compare options that have different life spans and different maintenance requirements. The total EUAC over a 40-year analysis period is $4,965. See Appendix G for assumptions and cost calculations.

System Maintenance

This alternative does not provide any improvements for the ease of operation and managerial burden. This alternative maintains the status quo in terms of managerial efforts of LMWS.

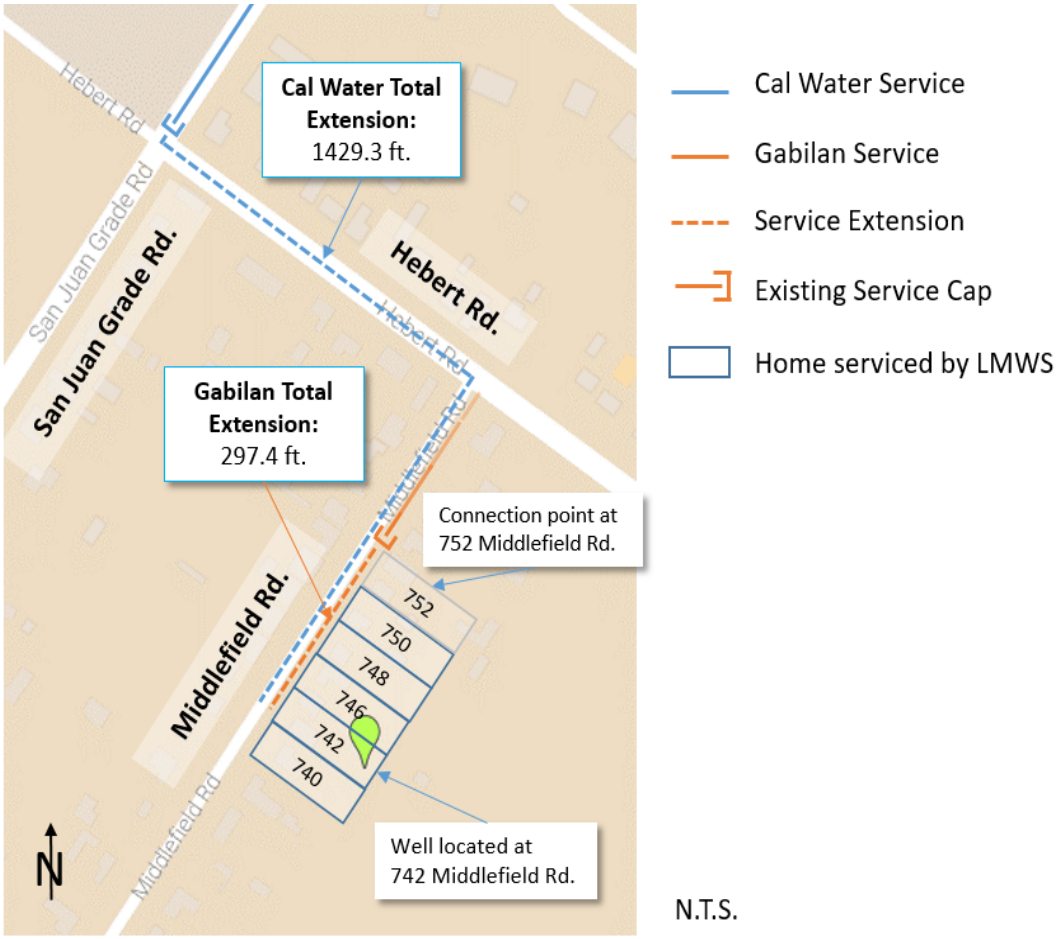
Fire Code Compliance

The Monterey County Regional Fire District requires this area to provide 1000 gpm for 1 hour at 20 psi. Notes from a related project in Monterey County indicated that fire flow requirements cannot be deferred due to the Public Utilities Commission (PUC) regulation: General Order 103.

4.0 ALTERNATIVE 2: Consolidation

Consolidation entails selecting a nearby water utility company to extend potable water service to LMWS, removing the managerial burden from the community. Gabilan Water Utility (Gabilan) and California Water Service (CWS) are the two nearest water utilities in consideration for consolidation. The closest Gabilan connection is located on the northeast corner of 752 Middlefield Road facing northwest as shown in **Figure 7**. The closest CWS connection is located at the intersection of San Juan Grade Road and Hebert Road.

***Figure** 7 - Possible connections to the two nearest local water utilities: Gabilan and CWS*



Gabilan Water Utility

Design Criteria and Assumptions

The closest Gabilan connection is approximately 298 feet from LMWS (**Figure 7**). The state certified distribution system operator for Gabilan, Mike Christensen, provided the following description of the water system:

1. Gabilan has 162 connections and operates two wells capable of pumping 150 gpm each. Both well pumps fill one storage tank of about 30,000 gallons and another of 40,000 gallons. As required by water utility regulations, the Gabilan distribution system has a bypass valve, which allows the system to move water back and forth between its two water distribution zones in the event that a well goes out of service. The storage tanks are drawn by a 15HP pump. The current system has about 70,000 gallons of total storage. Gabilan uses 4-inch PVC pipes as mains in their distribution system.
2. Monterey County confirmed that Gabilan needs to demonstrate that it has source capacity according to Title 22 §64554 (New and Existing Source Capacity) prior to extending service to new customers. Gabilan recently underwent an unexpected staff transition and many of its records were lost so a maximum demand scenario could not be calculated; however, Mike Christensen described a recent well pump failure in the zone that serves the Middlefield Rd area where the system bypass was utilized and all connections were served for three weeks by the remaining well and storage tank. The future design team would need to verify the source capacity per methods described in Title 22 §64554. Gabilan would also need to demonstrate that one of the two wells could supply maximum daily demand for all customers in case one of the wells goes out of service. If the supply cannot meet the demand, then additional storage would need to be provided by Gabilan or LMWS would consolidate with CWS.
3. Per the latest quarterly nitrate tests, the nitrate concentration in Well #1 is 12-14 mg/l and 1-2 mg/l in Well #2, well below the MCL. Gabilan's 2014 Consumer Confidence Report can be found in Appendix D.
4. Laura Gomez has attempted consolidation with Gabilan in the past but Gabilan insisted that LMWS pay for professional engineering design services and build additional storage capacity for the Gabilan system. At that time, LMWS did not have the means to hire a civil engineer or pay for the project expenses, so they stopped pursuing consolidation.

Water Quality

Gabilan meets all state water quality standards. Consumer confidence reports for Gabilan can be found in Appendix D. One advantage of consolidation is that regular water quality monitoring and maintenance would be conducted by the water service to ensure consistent water quality. There are no negative impacts on water quality due to consolidation.

System Maintenance

Consolidation with Gabilan would remove the managerial burden of the community. LMWS would be dissolved and Gabilan would manage and maintain the system. Homes in the community would be individually metered and billed by Gabilan.

Fire Code Compliance

The fire marshal stated in an e-mail that a fire hydrant must be located within 1,000 feet of all homes within LMWS as the fire engine travels towards the house (Appendix E). Gabilan is a small public water system, which is not regulated by the Public Utilities Commission (PUC), nor is it constructed to the standards of General Order 103, and as such the deputy fire marshal has removed the requirement to provide 1,000 gpm for two hours at a residual pressure of 20 psi.

Costs

Initial costs including materials, services, and construction are summarized in **Table 3.** Operational costs are based on Gabilan's current billing schedule, which is $35 per month per household (Appendix F). Using this monthly operation and maintenance (O&M) cost, the EUAC of O&M for consolidation with Gabilan is $3,527 over a 40-year life cycle analysis. The total EUAC is $9,036. See Appendix G for calculation and assumptions.

Table 3 *- Gabilan Consolidation Cost Estimate*

Item	Quantity	Unit	Price/Unit	Basis of price	Total
4" PVC pipe SCH 80 (includes fittings, valves, installation, pavement, replacement, etc.)	298	ft.	$98.12	Assumes same price as 8" PVC less difference in cost of materials	$29,240
Services (1" service lines plus meters)	5	each	$2,200	King City San Antonio and Mildred contract	$11,000
Backflow prevention device	5	each	$1,000		$5,000
Fire Hydrants (includes piping, valve and installation)		each		BLANK Cost Catalog, 2015 GRC filing	$0
Surveying and Engineering Design	280	hrs.	$125	BLANK labor estimating tool, 2015 GRC filing	$35,000
Inspection Services		hrs.		MNS Engineers	$0
Construction and contract management	100	hrs.	$125		$12,500
Grant administration	80	hrs.	$125	Corona	$10,000
Design and Construction Contingency	20%		$104,189		$20,838
Price Escalation	3%		$125,027	Assumes project will be completed in 2017	$3,751
Total Initial					$127,328
Total O & M EUAC (40-yrs)					$3,527
TOTAL EUAC					$9,036

Consolidation with CWS

Design Criteria and Assumptions

The nearest connection is approximately 1,430 feet from LMWS (**Figure 7)**. The following statements were derived from meeting minutes where CWS discussed consolidation of a similar water system in the Salinas Valley with another CECorps project team. The process for consolidation is standard for CWS and can generally be assumed to be true for this project.

Process of Consolidation

1. "Request to Serve" letter from community to CWS with general description (e.g., disadvantaged community, homes, and population served).
2. CWS will reply with "Will Serve" letter. Valid for a limited timeframe.
3. The Community is to provide a basic engineering plan with a deposit ($1.71 per foot or $500, whichever is more) including details on the population size, number, location, and size of service connections.

Test and Material

1. To begin the project, pressure at the point of connection will be tested. An average static pressure of 40 psi is required. If pressure is below pressure standards, an inline booster pump will be added.
2. The main water line should be 6 to 8-inches and individual home connections can range from 1 to 2-inch pipes.

Schematics and Design

Five separate meters would be installed, and CWS would meter each house. The existing distribution system would not be used, which currently ties in the five homes using 2-inch PVC pipes that run through properties.

CWS Options:

1. CWS can design, install, and operate the entire system to each home.
2. CWS can design, and have someone else install the infrastructure following CWS's specifications (Appendix B).

Water Quality

CWS meets all state water quality standards. Consumer confidence reports for CWS can be found in Appendix D. The advantage of consolidation is that regular water quality monitoring and maintenance is conducted by the water service to ensure consistent water quality. There are no negative impacts on water quality due to consolidation.

Costs

Estimates from a similar CWS project were used as a guide to approximate the cost of trenching, laying pipe, and backfill for the new water line. A 6 to 8-inch pipe will be used depending on the size of the existing point of connection and will measure 1,430 feet in length. The itemized initial cost estimate is shown in **Table 4**. Operational costs are assumed to be comparable to Gabilan; therefore, an estimate of $35 per month per

household was used to calculate the EUAC of CWS O&M costs. The EUAC of O&M costs for consolidation with CWS is $3,527, and the total EUAC is $16,115 (Appendix G).

Table 4 *- CWS Consolidation Estimate*

Item	Quantity	Unit	Price/ Unit	Basis of price	Total
8" PVC pipe SCH 80 (includes fittings, valves, installation, pavement, replacement, etc.)	1,400	ft.	$110	King City Lone oak labor camp contract	$154,000
Services (1" service lines plus meters)	5	each	$2,200	King City San Antonio and Mildred contract	$11,000
Backflow prevention device	5	each	$1,000		$5,000
Fire Hydrants (includes piping, valve, and installation)	1	each	$8,869	BLANK Cost Catalog, 2015 GRC filing	$8,869
Surveying and Engineering Design	280	hrs.	$125	BLANK labor estimating tool, 2015 GRC filing	$35,000
Inspection Services		hrs.		MNS Engineers	$0
Construction and contract management	100	hrs.	$125		$12,500
Grant administration	80	hrs.	$125	Corona	$10,000
Design and Construction Contingency	20%		$231,369		$46,274
Price Escalation	3%		$277,643	Assumes project completed in 2017	$8,329
Total Initial					$290,972
Total O & M EUAC (40-yrs)					$3,527
TOTAL EUAC					$16,115

System and Maintenance

Consolidation with CWS would remove the managerial burden of the community. LMWS would be dissolved and CWS would manage and maintain the system. Homes in the community would be individually metered and billed by CWS.

Fire Code Compliance

CWS is a utility regulated by the PUC and as such, it is built to the standards of General Order 103. Consolidation with CWS requires CWS to provide a fire flow rate of 1,000

gpm at a residual pressure of 20 psi for a duration of two hours to a hydrant located within 1,000 feet of the homes. The fire marshal stated in an e-mail that a fire engine traveling towards a house within LMWS must have access to a fire hydrant no further than 1,000 feet away (Appendix E).

Alternative 2 – Options Summary

Both utilities can provide safe, clean water and meet regulations as established by the Monterey Regional Fire Department. Consolidation with Gabilan has a lower initial cost than with CWS because the point of connection is closer and the service line has a smaller diameter. Yet, consolidation with Gabilan is also more uncertain due to limited managerial capacity. As stakeholders, the LMWS community prefers consolidation with a larger water provider, expressing no preference between CWS and Gabilain Water Company.

6.0 ALTERNATIVES NOT CONSIDERED

The following options were excluded as feasible alternatives for this report:

Point-of-Entry and Point-of-Use Treatment

Regulation**:** Monterey County Code requires that nitrate treatment be installed at the entry to the distribution system (usually at the well), which means that wellhead treatment is the only current legal nitrate treatment option. However, the State Water Resources Control Board (SWRCB) allows public water systems to use Point-of-Use (POU) and Point-of-Entry (POE) treatment systems as an option for compliance for up to 3 years under emergency regulations (*California Health and Safety Code Section 116380*). Due to the implementation of the SWRCB POE/POU regulations, Monterey County is currently evaluating if the county ordinance should be amended to include POE/POU as an option for compliance. POU and POE are not a viable long-term option for LMWS. For this reason, POU and POE are considered only in this section but not in the recommendations section.

Modifications to the existing well - There is difficulty assessing the likelihood of meeting lower nitrate MCLs by modification of the current well, i.e. drilling at a deeper depth. The probability of meeting the nitrate MCL through this method is uncertain. County records for nearby wells show that some wells at deeper depths are also out of compliance with nitrate regulations.

Blending - Blending can be an option to meet compliance by blending a contaminated system with a different source that is below the MCL to dilute the contaminants. However, the process would require installing pipes to deliver water from a local source with low nitrates to LMWS. This alternative requires connection to a local water service, which is already encompassed by consolidation (Alternative 2). In addition, blending is not a viable option because of the difficulty

in monitoring proper dilution, the possibility of cross-contamination with nearby water systems, and liability concerns.

7.0 FINAL RECOMMENDATIONS

Cost Summary

Total costs for each alternative and their preferred options are listed in **Table 5**. The cost for the "do nothing" alternative is also included: this is what the cost to the community would be if they continue to buy bottled water for drinking and cooking purposes plus the current cost of the LMWS utility bill. The "do nothing" cost was based off an average of $7.86 per person per week that was reported through a survey of disadvantaged communities in Salinas Valley conducted by the EJCW and the $55 per month that LMWS currently charges each household. A life cycle of 40 years was chosen as the basis for the cost analysis for Alternatives 1 and 2, which is the life cycle typically used in analysis by CWS. The operational costs for Alternatives 1 and 2 assume the cost of a $35 per month utility bill (Appendix F).

Table 5 *- EUAC of each alternative*

Cost Type	"Do Nothing" Alternative: Bottled Water & Contaminated Well	Alternative 1: Well Drilling Arthur & Orum Well Drillers	Alternative 2a: Consolidation Gabilan	Alternative 2b: Consolidation CWS
Initial	$0	$33,233	$127,328	$290,972
Operational EUAC	$17,262	$3,527	$3,527	$3,527
Total EUAC	$17,262	$4,965	$9,036	$16,115

The advantages and disadvantages of each alternative and their preferred choices are summarized in **Table 6**, along with the overall costs.

Table 6 *- Summary of the Costs of Each Alternative and Their Advantages/Disadvantages*

Alternative	Advantages	Disadvantages	Initial cost	EUAC O&M costs	EUAC (Total)
Alternative 1: Drill New Well	-Allows for reuse of existing pump and storage	-High risk of nitrate contamination	$32,233	$3,527 (40-yr)	$4,036
Alternative 2a: Consolidation with Gabilan	-Long term sustainable solution -No maintenance required by community	-High estimated initial costs -Discontinues LMWS autonomy	$127,328	$3,527 (40-yr)	$9,036
Alternative 2b: Consolidation with CWS	-Long term sustainable solution -Provides fire protection -No maintenance required by community	-Highest estimated initial costs -Discontinues LMWS autonomy	$290,972	$3,527 (40-yr)	$16,115

To select the preferred alternative, the options were evaluated and scored based on the measures of effectiveness. For each criterion, the alternatives are given a corresponding point ranging from one (1) through five (5) and given a justification for the scoring.

The scoring ranges for water quality, system maintenance, fire code compliance, and costs are ranked according to **Table 7.**

***Table 7** - Criteria Ranking Values*

Criteria	Value	Description
Water Quality	5	Meets nitrate MCL, consistent water quality
	4	Meets nitrate MCL, slight risk of inconsistent water quality
	3	Meets nitrate MCL, moderate risk of inconsistent water quality
	2	Meets nitrate MCL, high risk of inconsistent water quality
	1	Does not meet nitrate MCL
System Maintenance	5	No system maintenance
	3	Some system maintenance
	1	Regular system maintenance
Fire Code Compliance	5	Compliant with fire code, has fire protection
	3	Compliant with fire code, has no fire protection
	1	Not compliant with fire code, has no fire protection
Costs	5	Very low cost
	4	Moderately low cost
	3	Average cost
	2	Moderately high cost
	1	Very high cost

The overall ranking of the three alternatives was determined by summing their total scores, as presented in the comparison matrix in **Table 8.**

Table 8 *- Point Summary Table*

Alternative	Criteria	Points	Justification	Total Score
Alt 1: Drill New Well	Water Quality	2	High risk of nitrate contamination for nearby wellhead locations	11
	System Maintenance	3	No change in system maintenance or managerial burden	
	Fire Code Compliance	3	Fire requirements were waived, homes still have no fire protection	
	Costs	3	Lowest cost of all alternatives	
Alt 2a: Consolidation with Gabilan	Water Quality	5	Water quality regularly monitored by water utility	16
	System Maintenance	5	No maintenance or management required by LMWS.	
	Fire Code Compliance	3	Fire requirements were waived, homes still have no fire protection	
	Costs	3	Second-highest cost of all alternatives	
Alt 2b: Consolidation with CWS	Water Quality	5	Water quality regularly monitored by water utility	16
	System Maintenance	53	No maintenance or management required by community	
	Fire Code Compliance	5	Provides fire protection for community	
	Costs	1	Highest cost of all alternatives	

Alternative 1 has the highest risk and is not recommended. There is no guarantee that a new, deeper well will not be contaminated with nitrate. If an uncontaminated well is found, it is possible that the well may become non-compliant in the future due to further non-point source contamination. The managerial burden on the community would remain the same as the current system.

Based on the summary presented in **Table 8**, this report recommends **Alternative 2** – Consolidation with a nearby water utility company. Consolidation with Gabilan has a lower cost compared to consolidation with CWS. Both Gabilan and CWS meet water quality requirements, and this option removes the managerial burden from the community. CWS offers professional management services.

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Alternative 2 - Consolidation with Gabilan and CWS

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