EXHIBIT 3-C

SPI Comments on VE Study

1 Introduction

A Value Engineering (VE) study, sponsored by the Monterey Peninsula Regional Water Authority and facilitated by Value Management Strategies, Inc. (VMS), was conducted for the Desalination Plant portion of the Monterey Peninsula Water Supply Project. The study was conducted at the offices of California American Water in Monterey, California July 7 through 11, 2014.

This report prepared by Separation Processes, Inc. (SPI) reviews the report prepared by VMS. Costs are presented for any changes recommended by SPI.

The items are identified by the format (numbering system) used in the report. Cost estimates are given for each change made to the VE study.

Some of the results contained in the study are acceptable to SPI and are not discussed herein.

2 Purpose of this Report

The intent of this report is to review the results obtained by the VE team and comment upon them where appropriate and propose changes were needed.

3 Report Assumptions

Certain assumptions had to be made in order to present the costs given herein. These are as follows:

- Year of Construction, 2014
- Service life, 30 years
- Interest, 8%
- Electricity cost, $0.10/kWh
- Chemical costs at present day rates

4 VE Alternative Number and Description: BD-1: Revise layout of RO and Admin building: create one building with overlook, improved sight lines and a reduced courtyard

4.1 VE Description of Baseline Concept: The plan layout of the SWRO Building and Admin Building indicates two buildings separated by a 50-foot-wide open Garden space.

4.2 VE Description of Alternative Concept: The alternate concept attaches the Admin Building to the SWRO building in order to provide visual and direct physical connectivity from the Control Room, located inside the Admin Building, into the SWRO Building. The Control Room can either be one or two stories depending on whether or not visual connection is desired from a higher vantage point.

4.3 SPI Comment: This revision has merit, but will impact the schedule by more than the one month as mentioned in the VE study and add to the project costs. The added costs will not only include the construction costs but also the revisions required to the architectural drawings followed by revisions to the 30% design. In particular revisions will have to be made not only to the building design/arrangement but also to the piping and layout drawings.

This alternative proposal has been given a cost of $250,000.00, but does not include the cost for re-design. The cost for re-design is estimated to be approximately $100,000.00. Thus, the total cost extra for this item amounts to $350,000.00. There is no savings in the life cycle cost.

4.4 SPI Schedule Impacts: The redesign effort will require an additional approximately 3-months.

4.5 SPI Risk Impacts: This change will increase the project costs due to the additional architectural and engineering time required to complete the revisions.

4.6 SPI Conclusion: The cost estimate given for this change is estimated to be $250,000.00, which cost only includes the administration portion of the building. SPI's review of the cost estimate given in the VE study does not appear to include the additional architectural and engineering fees associated with this change. It is therefore considered to be low. When these are added this cost extra becomes approximately $350,000.00.

Thus, it is SPI's conclusion that this alternative not be chosen.

5 VE Alternative Number and Description: BD-2: Eliminate fire protection of the buildings where not required by code

5.1 VE Description of Baseline Concept: The 30% design submittal does not specify areas within the plant receiving fire sprinkler coverage. Per Mike Zafer of CDM Smith on 7/9/14, the SWRO Building, the Admin Building and the Filter Building are all fully sprinkled in the current baseline concept.

5.2 Description of Alternative Concept: This recommendation simply proposes the project team should confirm whether fire sprinkler coverage is required in (1) the Filter building, and delete if not, and (2) if the RO room within the SWRO building can change to non-sprinkled.

5.3 SPI Comment: SPI agrees with this change.

5.4 SPI Schedule Impacts: SPI sees no schedule impacts due to this change.

5.5 SPI Risk Impacts: SPI sees no risk impact due to this change.

5.6 SPI Conclusion: SPI agrees with the costs presented by the VE team for this item and can recommend acceptance.

6 VE Alternative Number and Description: BD-3: Increase occupancy categories of process structures (category IV for the process-critical facilities)

6.1 VE Description of Baseline Concept: Table 19-7 Risk Categories of the BODR calls for Facility Risk Category of IV for the finished water storage tanks and related equipment, and Facility Risk Category of III for other structure.

6.2 Description of Alternative Concept: The VE team recommends that a closer look should be given to the facilities where higher Occupancy Category maybe needed for some structures and a lower one for the rest; for example, SWRO might be IV, and Admin Building might be II.

6.3 SPI Comment: SPI agrees with this change.

6.4 SPI Schedule Impacts: SPI sees no schedule impacts due to this change.

6.5 SPI Risk Impacts: SPI sees no risk impact due to this change.

6.6 SPI Conclusion: SPI agrees with the costs presented by the VE team for this item and can recommend that this item be accepted.

7 VE Alternative Number and Description: BD-4: Shift site layouts to avoid collapsible soils

7.1 VE Description of Baseline Concept: The baseline concept calls for constructing the facility in an area that is generally comprised of loose to very loose sand, which according to the BODR is considered unsuitable. The project geotechnical engineer estimates 2 to 3 inches of seismically-induced settlement during a design earthquake event, as compared to the 0.5 to 1 inches of seismically induced settlement reported in the Baseline Geotechnical Report (URS).

The BODR proses to re-densify the soil below the proposed building pads in order to provide uniform and adequate bearing capacity for the foundation systems. The proposed design considers over excavation and compaction, in addition to one of the following alternatives to address the differential settlement:

- Structures supported by mat foundations
- Geopiers beneath the structures
- Dynamic compaction beneath the structures

7.2 VE Description of Alternative Concept: It was communicated to the VE team that the site area is roughly 43 acres. Therefore, this alternative recommends considering one of the two following options:

- Shift the entire location of the facility within the site to an area where more suitable foundation material is located
- Shift location of facilities in relation to each other within the same area (i.e., interchange the Brine Equalization Basin with Admin and SWOR Treatment Buildings)

7.3 SPI Comment: This alternate makes good sense and would be recommended by SPI. However, the costs needed to perform this work need to be corrected.

7.4 SPI Schedule Impacts: The schedule will be impacted by the time required to complete the new soils boing tests and geotechnical work. This work will delay the project by one month.

7.5 SPI Risk Impacts: This alternative will decrease the risks.

7.6 SPI Conclusion: The cost savings given in the VE study are $42,000.00. However, this cost excludes the work of additional soils borings and geotechnical tasks which is estimated to cost approximately $100,000.00. This will more than off-set the cost savings given in the VE study as $42,000.00.

It is SPI's conclusion that this item be accepted, but the costs updated to show this additional cost $142,000.00.

8 VE Alternative Number and Description: BD-5: Use a geogrid-reinforced soil mat in lieu of dynamic soil compaction

8.1 VE Description of Baseline Concept: The Baseline design is considering over- excavation and compaction combined with one of a three alternatives below to address the 2 to 3 inches of estimated differential settlement:

- Structures supported by mat foundations
- Geopiers beneath the structures
- Compaction beneath the structures

8.2 VE Description of Alternative Concept: This alternative calls for a geosynthetic-reinforced soil mat to be placed under the SWRO and Admin buildings that have conventional footings. The purpose of the soil mat would be to limit differential settlement across the building footprint in event of seismically induced settlement as opposed to other proposed measure.

8.3 SPI Comment: SPI agrees with this change and recommends acceptance.

8.4 SPI Schedule Impacts: SPI sees no schedule impacts due to this change.

8.5 SPI Risk Impacts: SPI sees no risk impact due to this change.

8.6 SPI Conclusion: SPI agrees with this alternative and can recommend acceptance.

9 VE Alternative Number and Description: BD-6: Connect the 4160 to 480 transformers directly to the 21kV switchgear

9.1 VE Description of Baseline Concept: The existing electrical distribution system has the 21kv to 4160 volt (5000 kva) transformer and the 4160 volt to 480 volt (2500 kva) transformer connected in series. The power for the 2500 kva transformer goes through the 5000 kva transformer. The configuration is typical for two transformers, circuits MDS-2A and MCS-2B. All four transformers are pad mounted, oil filled transformers.

9.2 VE Description of Alternative Concept: Change the 2500 transformers from "4160 volt to 480 volt" to "21kv to 480 volt" and connect to the 21 kV switchgear. The change would require the cables be installed from the 21 kV switchgear instead of the 4160 volt switchgear. Two additional fused switches would be added to the 21 kV switchgear and two circuit breakers would be deleted from the 4160 volt switchgear.

9.3 SPI Comment: SPI agrees with this change.

9.4 SPI Schedule Impacts: SPI sees no schedule impacts due to this change.

9.5 SPI Risk Impacts: The system requires an analysis prior to acceptance.

9.6 SPI Conclusion: Assuming that the analysis indicates there will be no effect on the downstream equipment, this alternative can be accepted.

10 VE Alternative Number and Description: BD-7: Simplify landscaping using xeriscaping principles and eliminate irrigation

10.1 VE Description of Baseline Concept: The landscape design in the 30% submittal includes indigenous plants that only require irrigation until their roots are established - as reported by Joni Janecki, Landscape Architect on 7/7/14. The 30% design is not yet detailed enough to show how this initial irrigation period concept will be implemented.

The Basis of Design Draft Report (BODR) dated 4/14/14 indicates only "A drip irrigation system will be designed and implemented". The design also includes vegetables planted in raised beds to create an "agricultural education garden" per the BODR. As reported on 7/8/14, the gardens will be irrigated with rainwater (and possibly water from the desalination facility) that will be captured then stored within an aboveground cistern tank. Ms. Janecki reported that the cistern's capacity can provide up to 50% of the water necessary to irrigate the garden vegetables throughout a given year.

10.2 VE Description of Alternative Concept: Explore and design a means to eliminate the use of potable water entirely for the irrigation of plants. Scale back plant materials and irrigation as much as possible.

10.3 SPI Comment: SPI agrees with this change and can recommend its acceptance.

10.4 SPI Schedule Impacts: SPI sees no schedule impacts due to this change.

10.5 SPI Risk Impacts: SPI sees no risk impact due to this change.

10.6 SPI Conclusion: SPI agrees with this alternative and can recommend its acceptance.

11 VE Alternative Number and Description: E-1: Revise configuration of RO trains to accommodate flat foot foundation

11.1 VE Description of Baseline Concept: Currently the desalination plant building is designed to include a two-level configuration of the foundations. The upper level houses all equipment and the lower level (pipe galleries) house most of the interconnecting piping.

11.2 VE Description of Alternative Concept: This recommendation proposes to reconfigure the Interconnecting piping and equipment layout such that the building foundation is simplified to a flatfoot foundation.

11.3 SPI Comment: By making the change recommended in the VE study will result in a much larger building (footprint area). This increase in area will result in a redesign of the building, equipment and piping arrangements.

The equipment arrangement given in the 30% design is not unusual and has been accomplished on a number of different projects.

The cost savings for this alternative are given as $400,000.00. However, SPI's estimate shows that the cost of the flat foot arrangement is actually higher. This results from the apparent use of the same unit cost for building construction. In the case of using the two-story RO arrangement with the equipment located in a floor below the RO process equipment has a unit cost greater than the flat-floor arrangement as shown in SPI's cost figures. Thus, the result is a slightly higher cost.

11.4 SPI Schedule Impacts: This alternative will impact the schedule.

11.5 SPI Risk Impacts: No risks are found.

11.6 SPI Cost Estimate: The VE study gives a cost estimate savings of $400,000.00. The cost is calculated on the basis that the unit cost per square foot for the 2-level arrangement is $250.00 per square foot (as given in VE # BD-3) for the RO building base case. The base case RO building has the RO trains on one floor and the equipment mounted below. Thus, for this arrangement the VE team used a unit cost of $250.00 per square foot. For the flat foot arrangement proposed in this item then, the unit cost per square foot has to be lower. SPI used a unit cost of $200.00 per square foot. The area of the building will increase by at least 50% to a total of about 41,400 square feet.

The figures generated from the calculation result in an initial cost extra of $780,000.00 and an additional life-cycle cost increase and an increase in life cycle costs of $69,264.00.

11.6.1 Capital Cost

The capital cost for this alternative is given in the following table.

E-1 - Capital Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
Foundation		1	2,100,000.00	2,100,000.00	1		1,500,000.00
RO Building	sf	27,600.00	250	6,900,000.00	41,400.00	200	8,280,000
SUB-TOTAL							
PROJECT MARK-UPS				0.00		0.00	
TOTAL				9,000,000.00			9,780,000
						SAVINGS	780,000.00

11.6.2 Life Cycle Cost

The life cycle cost for this alternative is given in the following table.

E-1 - Life Cycle Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
Foundation		1	186,480.00	186,480.00	1		133,200.00
RO Building	sf	27,600.00	250	612,720.00	41,400.00	200	735,264
SUB-TOTAL							
PROJECT MARK-UPS				0.00		0.00	
TOTAL				799,200.00			868,464
						SAVINGS	69,264.00

11.78 SPI Conclusion: SPI does not recommend acceptance of this alternative.

12 VE Alternative Number and Description: E-2: Use radially split case pumps in lieu of segmental pumps

12.1 VE Description of Baseline Concept: The baseline concept includes the use of segmental-ring high pressure pumps designed to operate at 82% efficiency. Figures are provided on the following page to illustrate the type of pumps.

12.2 VE Description of Alternative Concept: The alternative concept proposes to replace the segmental-ring pumps with radially split case pumps. Further, consider the use of one radially split case pump to feed two RO trains in order to increase the high pressure pump size and obtain pump efficiency of 87% (instead of 82%) and to achieve capital cost savings. This concept proposes the use of 4 radially split case pumps instead of 7 segmental-ring pumps.

12.3 SPI Comment: A better choice for cost effective pumps for high pressure (HP) service to the RO process are the multiple stage horizontal centrifugal type. These have become the standard in for SWRO service. The advantage in using this type of pump in lieu of the pumps provided in the base case is its higher efficiency. The pumps provided in the base case have an efficiency of 82% and those proposed for the alternate have an efficiency of 84% - 87%. Therefore, the electrical draw for the proposed pumps will be significantly lower therefore off-setting the higher costs.

The VE recommendation is to also change the number of pumps from 7 to 4. This change will result in reducing the capital cost because of a reduction in the number of pumps and the reduction in piping and valves required.

12.4 SPI Schedule Impacts: Delivery times for these pumps can normally be obtained in a shorter time period. Thus, this may assist in having no appreciable impact on the project schedule.

12.5 SPI Risk Impacts: This type of pump has been used for a number of years in SWRO systems. Thus, there is no risk introduced for this project.

12.6 SPI Cost Estimate:

12.6.1 Capital Cost Estimate

The capital cost estimate for these pumps is given in the following table.

E-2 - Capital Cost

CONSTRUCTION ELEMENT		BASLINE CONCEPT			ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
Radial Split		7	286,000.00	2,002,000.00	7		
Horizontal				0.00	4.00	365,000.00	1,460,000
SUB-TOTAL							
PROJECT MARK-UPS				0.00		0.00	
TOTAL				2,002,000.00			1,460,000
						SAVINGS	-542,000.00

12.6.2 Life Cycle Cost

The life cycle cost for this alternative is given in the following table.

E-2 - Life Cycle Cost

CONSTRUCTION ELEMENT		BASLINE CONCEPT			ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
Radial Split			5,605,377.60	0.00			0.00
Horizontal				0.00	5,242,648	200	5,242,648
SUB-TOTAL							
PROJECT MARK-UPS				0.00		0.00	0
TOTAL				0.00			5,242,648
		PW	63,116,552	0.00		**PW**	59,032,216
						SAVINGS	-4,084,335.30

12.7 SPI Conclusion: SPI finds merit to this proposal, but also understands the inherent process implications from reducing the number of pumps. Cal-Am intends to operate standby units to boost capacity on a short term basis and insure annual delivery targets are achieved. In reducing the number pumps, the capacity of each pump is increased—leading to a larger flow demand of the associated standby pump. This larger flow would have a correspondingly higher raw water demand and increase the number of supply wells required. With this in mind we do not see the proposal as beneficial on a net basis.

13 VE Alternative Number and Description: E-3: Install acceptance testing connections as permanent

13.1 VE Description of Baseline Concept: The baseline concept at 30% stage does not contemplate any special provisions or connections to recirculate water during the startup and commissioning phase. Also, it does not contain any provisions to recirculate flow to the head of the plant to keep the plant running during short periods, instead of shutting the plant down.

13.2 VE Description of Alternative Concept: Install a permanent connection between the treated water line and the raw water line at the desalination plant during the initial construction. This will assist in startup/commissioning as well as allowing the plant to recycle flow under abnormal condition (instead of having to shut down).

13.3 SPI Comment: SPI finds no fault in this recommendation and would agree with this alternative.

13.4 SPI Schedule Impacts: SPI sees no impact on the schedule, since this line can be installed during site construction.

13.5 SPI Risk Impacts: SPI sees no impact due to risk factors with this recommendation.

13.6 SPI Conclusion: SPI agrees with this alternative and can recommend its acceptance.

14 VE Alternative Number and Description: E-4: Construct the filtered water storage tanks out of concrete and construct as rectangular

14.1 VE Description of Baseline Concept: The baseline concept includes two 750,000 gallon pre-stressed concrete finished water storage tanks (approximate dimensions: 70' diameter by 27' tall).

14.2 VE Description of Alternative Concept: This alternative proposes replacing two tanks with a single two cell reinforced concrete storage tank.

14.3 SPI Comment: Concrete tanks are often used for the purpose intended for this case.

The savings, (i.e., $73,000.00) however, do no warrant making this change. This results because; the new configuration does not improve operation or maintenance.

In any event SPI recommends that these tanks be deleted (refer to our comments in item M-1, below).

14.4 SPI Schedule Impacts: SPI sees no impact on the schedule.

14.5 SPI Risk Impacts: SPI sees no impact due to risk factors with this recommendation.

14.6 SPI Conclusion: The additional $73,000.00 does appear to be warranted.

15 VE Alternative Number and Description: E-5: Use fiberglass for the granular pretreatment filters in lieu of steel

15.1 VE Description of Baseline Concept: The baseline concept includes 10 steel rubber-lined pressure filter tanks that are 10-feet in diameter by 40 feet long (~24,000 gallons).

15.2 VE Description of Alternative Concept: This alternative proposes to replace the steel tanks with fiberglass tanks.

15.3 SPI Comment: The water quality from the well is expected to have a low SDI. This is true of all well supplies whether used for brackish water or sea water RO processes. It is expected that because of the very low SDI, filters will not be required. However, since the well has not been developed it is best to err on the side of caution and include these filters in the design of the plant.

Should it be found that the well supply will be low in SDI (i.e., high in quality), the filters can easily be removed from the design.

An additional benefit offered by the removal of the filters is the removal of the backwash system and backwash ponds as well.

15.4 SPI Schedule Impacts: No schedule impacts are expected.

15.5 SPI Risk Impacts: The risk associated with these filters is significantly reduced since their inclusion only brings a safeguard.

15.6 SPI Cost Estimate:

15.6.1 Capital Cost

In the event these filters can be removed, the cost savings are significant.

E-5 - Capital Cost

CONSTRUCTION ELEMENT			BASLINE CONCEPT		ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
Media Filters		10	60,000.00	600,000.00	0		0.00
Brine Ponds		2	500,000.00	1,000,000.00	0		0.00
Backwash		2	300,000.00	600,000.00	0		0.00
Pump & Piping Cost		2	92,000.00	184,000.00	0		0.00
SUB-TOTAL				2,384,000.00			0.00
PROJECT MARK-UPS				0.00		0.00	
TOTAL				2,384,000			0.00
						SAVINGS	-2,384,000.00

15.6.2 Life Cycle Cost

The life cycle cost for this alternative is given in the following table.

CONSTRUCTION ELEMENT			BASLINE CONCEPT		ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
Filter Amortization		10	5,328.00	53,280.00	0.00		0.00
Brine Ponds Amortization		2	44,400.00	88,800.00	0.00		0.00
Backwash Amortization		2	26,640.00	53,280.00			
Backwash Elec.		2	47,000.00	94,000.00			
Pump & Piping Cost		2	8,169.60	16,339.20	0.00		0.00
Pump Elec.		2	38,300.00	38,300.00			
SUB-TOTAL				343,999.20			0.00
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				343,999.20			0.00
			PW	3,873,430.99		PW	0.00
						SAVINGS	-3,873,430.99

15.7 SPI Conclusion: SPI recommends that these filters be included as presently designed, until the feed water quality is known. Regarding vessel material, we agree that FRP may have benefits over lined steel in terms of corrosion protection; but may not be available commercially and domestically in the size required.

16 VE Alternative Number and Description: E-6: Relocate VFDs for RO feed water high pressure pumps to filter effluent transfer pumps

16.1 VE Description of Baseline Concept: In the baseline concept, VFDs are proposed to be installed on both the high pressure pumps and on one of the filter effluent transfer pumps.

16.2 VE Description of Alternative Concept: This concept proposes to install VFDs on all filter effluent transfer pumps and eliminate the VFDs on the high pressure pumps.

16.3 SPI Comment: At this point in time this alternative makes technical sense and would be recommended by SPI. In the event the filters can be removed, the VFD's can be moved to the well supply pumps.

16.4 SPI Schedule Impacts: No schedule impacts are noted.

16.5 SPI Risk Impacts: No project risks result from this change.

16.6 SPI Cost Estimate:

1**5.6.1 Capital Cost**

In the event the filters can be eliminated, the following cost savings result:

E-6 - Capital Cost

CONSTRUCTION ELEMENT			**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**	
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
VFD at HP Pumps		7	85,000.00	595,000.00			0.00
VFD at Wells				0.00	7	22,000.00	154,000.00
				0.00	0		0.00
				0.00	0		0.00
SUB-TOTAL				595,000.00			154,000.00
PROJECT MARK-UPS				0.00		0.00	
TOTAL				595,000			308,000.00
						SAVINGS	-287,000.00

16.6.2 Life Cycle Cost

The life cycle cost for this alternative is given in the following table.

E-6 - Life Cycle Cost

CONSTRUCTION ELEMENT			**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**	
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
VFD at HP Pumps		7	52,836.00	369,852.00	0.00		0.00
VFD at Well Pumps				0.00	7.00	13,675.20	95,726.40
				0.00			
				0.00			
				0.00	0.00		0.00
				0.00			
SUB-TOTAL				369,852.00			95,726.40
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				369,852.00			95,726.40
			PW	4,164,533.52		PW	1,077,879.26
						SAVINGS	-3,873,430.99

16.7 SPI Conclusion: As presently designed, SPI can recommend the inclusion of this alternative.

17 VE Alternative Number and Description: E-7: Use above-ground FRP piping in lieu of below-grade HDPE

17.1 VE Description of Baseline Concept: Permeate and Raw/Saline Water pipes are specified as below grade high-density polyethylene (HDPE) and fiber-reinforced plastic (FRP) above-grade pipes in the baseline concept.

17.2 VE Description of Alternative Concept: This alternative proposes to substitute below-grade HDPE piping with above-grade FRP piping.

17.3 SPI Comment: Above grade FRP piping is often used for reverse osmosis systems and can be employed for this project. This piping however, suffers from degradation from the effects of sunlight. Therefore, they must be painted or protected in a similar manner.

17.4 SPI Schedule Impacts: No project schedule impacts are considered for this alternative.

17.5 SPI Risk Impacts: No project risks result from this change.

16.6 SPI Conclusion: SPI agrees with this alternative and can recommend its acceptance for the project.

18 VE Alternative Number and Description: M-1: Increase size of the filtered water storage tanks

18.1 VE Description of Baseline Concept: The baseline concept includes two 300,000-gallon covered, glass-lined tanks, with a total volume of approximately 600,000 gallons. Assuming a 5-foot minimum operating level, the effective volume is approximately 440,000 gallons.

18.2 VE Description of Alternative Concept: This alternative proposes the installation of two 500,000-gallon covered, glass-lined tanks, resulting in a total volume of approximately 1,000,000 gallons. Assuming a 5-foot minimum operating level, effective volume is approximately 770,000 gallons.

18.3 SPI Comment: Any tanks placed to hold sea water is to be avoided. This is because the sea water will contain microbes that will grow within these tanks and therefore enter the SWRO membranes. This will create increased fouling and increase the frequency of membrane cleaning operations. Increasing the cleaning frequency, results in lowering the membrane life, therefore increasing the cost of operation.

There exists no technical reason for these tanks.

SPI recommends that in lieu of increasing the size of these tanks, they be eliminated.

18.4 SPI Schedule Impacts: The elimination of these tanks will result in reducing the construction schedule.

18.5 SPI Risk Impacts: Elimination of these tanks reduces risk from contamination of the membranes due to bio-fouling.

18.6 SPI Cost Estimate:

18.6.1 Capital Costs

The savings in capital costs are given in the following table.

M-1 - Capital Cost

CONSTRUCTION ELEMENT	BASLINE CONCEPT				ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total]
Filter Storage Tanks		2	354,000.00	708,000.00	0		0.00
SUB-TOTAL				708,000.00			
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				708,000			0
						SAVINGS	-708,000.00

18.6.2 Life Cycle Costs

The life cycle cost for this alternative is given in the following table.

M-1 - Life Cycle Cost

CONSTRUCTION ELEMENT	BASLINE CONCEPT				ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total]
Filter Storage Tanks Amortization		2	31,435.20	62,870.40	0		0.00
SUB-TOTAL				62,870.40			
PROJECT MARK-UPS				0.00		0.00	
TOTAL				62,870			0
						SAVINGS	-62,870.40

18.7 SPI Conclusion: SPI recommends the removal of these tanks.

19 VE Alternative Number and Description: M-2: Provide lifts to move heavy equipment

19.1 VE Description of Baseline Concept: The baseline 30% design does not include provision for moving or removing the large equipment in the RO building. It is assumed that the equipment would be removed using a portable crane.

19.2 VE Description of Alternative Concept: In the RO Building, the installation of a permanent overhead bridge crane is recommended to be able to move, remove and install large pieces of equipment (pumps, motors) and new membrane skids. This crane would have a 5-ton capacity.

19.3 SPI Comment: SPI agrees with the VE teams approach for this alternative.

19.4 SPI Schedule Impacts: This change will affect the design schedule slightly, but not in a manner that will create schedule delays.

19.5 SPI Risk Impacts: No project risks are envisioned.

19.6 SPI Conclusion: SPI agrees with this alternative and can recommend its acceptance.

20 VE Alternative Number and Description: M-3: Eliminate pumps in chemical storage sumps

20.1 VE Description of Baseline Concept: The existing design shows sump pumps in chemical storage sumps. The pumps would operate on a manual-enable switch and shut off by float switch activation. At present, pumps are connected to the sanitary sewer.

20.2 VE Description of Alternative Concept: This concept proposes to provide portable sump pumps and receptacles for power connection. The operators would put the sump pumps in the sumps when sumps are full. Pumps would be connected to receptacles on the outside of the building such that chemicals could be loaded into a truck or container for disposal.

20.3 SPI Comment: SPI has no opinion or this matter.

20.4 SPI Schedule Impacts: No schedule impacts are seen.

20.5 SPI Risk Impacts: No risks are envisioned.

20.6 SPI Conclusion: SPI agrees with this alternative and can recommend its acceptance.

21 VE Alternative Number and Description: M-4: Split the $C0_2$ tank to share 120-ton requirement between two tanks

21.1 VE Description of Baseline Concept: One CO_2 120-ton storage tank is provided in the baseline concept. (Drawing sheet M45 and M46).

21.2 VE Description of Alternative Concept: To provide for redundancy during tank maintenance, this alternative recommends utilize two storage tanks to provide the same amount of storage.

21.3 SPI Comment: SPI recommends that this system be removed and all carbon dioxide be obtained from the acid pre-treatment system. This will save a significant amount in life-cycle costs as shown and discussed in item TP-4.

21.4 SPI Schedule Impacts: None are foreseen.

21.5 SPI Risk Impacts: No added risks are expected.

21.6 SPI Conclusion: SPI recommends that the Water Authority utilize the alternative given above.

22 VE Alternative Number and Description: RS-1: Refine the design to meet test well data water quality information

22.1 VE Description of Baseline Concept: The project has been designed around many assumptions relative to the quality and quantity of raw water that will be delivered to the plant from the intake wells. Key assumptions include equipment sizing, chemical treatment processes, and storage quantities. The reported intent is to not significantly revise the design when the information from the test well is available. The assumption is that the design will be robust enough to account for any water quality or quantity issues. Currently, the design team has been contractually limited relative to their engineering design fees. The full amount of engineering design fees will not be authorized until the project receives certain regulatory approvals in order to proceed.

22.2 VE Description of Alternative Concept: Perform a design analysis of the treatment processes, Equipment sizing, and storage capacities once water quality and quantity information is available from the seawater intake test well. If the information indicates that the plant is overdesigned for certain aspects, entertain revisions to the design sufficient to "right size" and optimize the design per the test information.

22.3 SPI Comment: The design of any SWRO process always begins with an analysis of the water to be treated. There is no reason that the water from the proposed well will not deliver normal sea water at the expected quality. Thus, the design of the process at this time has minimal risk, since the performance of the plant can be projected from membrane manufacturer's computer programs. The well will supply sea water that is considered to be in the normal range of Total Dissolved Solids (TDS) concentration of 34,500 mg/L. Further the well supply will deliver a water quality of significantly low Silt Density Index (SDI). This value can be expected to be 1.0 or less. A value of this SDI level is not unusual for a water supply from a well.

The only refinement in design would be accomplished after the feed water quality from the wells has been determined. This refinement is expected to be the removal of the pretreatment filters.

22.4 SPI Schedule Impacts: No schedule impacts are expected.

22.5 SPI Risk Impacts: This approach has minimal risk.

22.6 SPI Conclusion: The VE cost study gives a potential savings of $5,227,000.00. This appears reasonable and in fact could be lowed further as discussed above.

23 VE Alternative Number and Description: RS-2: Revise construction schedule using multiple crews per discipline to accelerate project completion

23.1 VE Description of Baseline Concept: The CDM Smith proposed schedule indicates a sequentially phased construction schedule, likely using one crew per discipline type that moves around the project site.

23.2 VE Description of Alternative Concept: This alternative proposes to start construction of all facilities as soon as possible after underground infrastructure is complete, and consider multiple crews per discipline to accelerate the schedule and complete construction sooner.

23.3 SPI Comment: SPI agrees with this concept.

23.4 SPI Schedule Impacts: This item will reduce schedule impacts.

23.5 SPI Risk Impacts: No risk would result from this approach.

23.6 SPI Conclusion: SPI agrees with the alternative presented above and can recommend its acceptance.

24 **VE Alternative Number and Description: TP-1:** Consider assuming a higher recovery rate on the RO to 50% on the first pass and 90% on the second pass (48% total recovery)

24.1 VE Description of Baseline Concept: The existing design is based on 45% recovery rate of the first pass SWRO system and 90% recovery rate of the second pass. The total plant recovery rate is approximately 43%.

24.2 VE Description of Alternative Concept: This alternative proposes to design the desalination plant such that the recovery of the first (SWRO) pass is 50% instead of 45%. By definition, recovery is the percentage of raw (source) water converted into desalinated water. The higher the design RO system recovery, the less source water is needed to be collected, pretreated and desalinated to produce the same volume of fresh water. Increase of the SWRO system recovery from 45% to 50% will result in 11% (50% / 45 % = 1.11) lower intake, pretreatment system, and SWRO system. A figure widely used for plants with intake wells is 50% recovery.

24.3 SPI Comment: SPI agrees with this revision, because it reduces the cost of the well system, feed piping, pumping equipment and other associated equipment, which contribute significantly to the capital and operating costs. However, at a recovery of 50%, and assuming normal sea water concentration of 34,400 mg/L the brine concentration will exceed the required maximum about 62,500 mg/L. At 50% recovery, the brine will have a concentration of about 68,650 mg/L. Thus, this item cannot be addressed until the well supply has been developed and the final water quality has been determined.

Regarding the electrical requirement for the HP pump, the electrical requirement is about 3-5% higher energy usage for the 50% case as compared with the 45% case. However, this additional cost will be more than off-set by the reduction in well supply electricity usage and lower capital costs for the well and associated piping and valves feeding the process.

For the higher recovery, there may exist a problem obtaining the required boron content in the final permeate, which will require further study. This will depend upon the membrane used. For example the boron concentration can be met using the DOW membrane, but not with the Hyrdanautics membrane. These conclusions were reached using the manufacturer’s projection programs and should be verified.

The design of the SWRO process has to include a flux as well as a recovery optimization in order to determine the optimized design. The optimization of flux is required because as with the recovery, as the flux changes, the operating pressure changes as well.

Confirmation of the optimized design cannot be performed at this time due to the fact that the feed water quality is not known.

24.4 SPI Schedule Impacts: This alternative will result in impacting the project schedule; due to the revision in design.

24.5 SPI Risk Impacts: The risk associated with this alternative is not considered to be a significant factor.

24.6 SPI Conclusion: SPI cannot recommend this alternative until the final feed water quality is known.

25 VE Alternative Number and Description: TP-2: Install a plug on the main permeates line after the second or third membrane and uses all of the same elements

25.1 VE Description of Baseline Concept: At present, the SWRO system vessel configuration has an internally staged design where two different types of membranes (SWC5-LD and SWC6-LD) elements are used. See the baseline concept figure on the following page.

The design includes a split-permeate configuration where a portion of the permeate water produced from the front 3 elements is removed from the front of the vessels rather than allowed to mix with the permeate water from the remainder of the elements within the vessel. Two different types of elements are used in order to maximize the benefit of collecting high quality water from the front end of the vessels. If the same elements are used, the permeate water collected from the front of the vessels will not be of as high of quality because permeate from the back and front membranes in the vessel will mix and back elements always produce worse quality permeate than front elements. SWC5-LD is a higher salt rejection, lower productivity element than SWC6-LD.

25.2 VE Description of Alternative Concept: This alternative proposes to use the same RO elements for the entire vessel – for example SWC5 or SWC5+ elements (or other non-Hydranautics elements with the same or higher productivity) and install a plug in the permeate tube between the 3rd and 4th elements in the vessels. Use of the same RO elements within the vessels will simplify plant operation (i.e., membrane rotation and procurement) and lower membrane replacement costs.

25.3 SPI Comment: SPI supports this idea. Use of this system will result in improved water quality without sacrificing technical aspects or costs.

This design has been accomplished in many SWRO installations and will result in obtaining a better permeate water quality because the permeate water is taken from the lead elements which produce the lowest TDS. SPI finds that no problems will result if this alternative is chosen.

This alternative will also result in the reduction of electrical consumption in the HP pump of the next stage. This reduction carries a present worth of $142,000.00.

There appears no benefit of increasing the number of elements from 7 to 8. Doing this, would reduce the water quality coming from the lead elements (i.e., higher TDS) and increase the TDS of the permeate water from the lower membranes. This would increase the electrical usage due to the higher operating pressure. Therefore, eliminating any advantage offered by using 8-elements per pressure vessel.

25.4 SPI Schedule Impacts: No schedule impacts are expected.

25.5 SPI Risk Impacts: There is no risk for using 7-membranes but an increased risk of higher cost of water for using 8-elements per pressure vessel.

25.6 SPI Conclusion: This alternative cannot be evaluated until the final feed water quality is known.

26 VE Alternative Number and Description: TP-3: Install a second pass brackish RO train on the split stream to improve water quality and reduce energy use

26.1 VE Description of Baseline Concept: Install a second pass brackish RO train on the split stream to improve water quality and reduce energy use.

26.2 VE Description of Alternative Concept: The alternative concept proposes to install a brackish water RO treatment system for the permeate collected from the front of the SWRO vessels in order to use the energy in this stream to produce better quality front permeate water and reduce the size of the second pass. Because the permeate carries energy adequate to retreat it through a second pass, no additional pumping will be needed. The recovery of the front-end permeate will be 95% and the water quality will be of 20 mg/L TDS or less, as compared to the TDS of the front end permeate which will be 80 to 120 mg/L.

26.3 SPI Comment: This concept will result in increasing energy usage, because pressure is, of course necessary in order to produce water in this new stage. During operation the membranes will foul, increasing the pressure requirement of the first pass HP pump for water production. As this occurs, two operating scenarios can be taken, the first would be to maintain the pressure of the first pass in a constant condition and in the second case, and the pressure can be increased. Both of these operating scenarios are not recommended, because in the case of maintaining constant pressure, the production from the first pass will decrease. In the second case to maintain production, the increase in pressure leads to an increase in electrical usage.

In addition, there is no need to improve the water quality from the process.

For these reasons, SPI does not support the use of this alternative.

26.4 SPI Schedule Impacts: The implementation of this additional pass will result in changes in design of the process, also affecting the layout and arrangement drawings. It is estimated that this change would require an additional month for re-design, specification, ordering of equipment and site construction time. A t5ime extension of one month can be expected.

26.5 SPI Risk Impacts: This is a new proposal. That it is not normally used in a conventional SWRO process. Thus, it is not fully proven.

26.6 SPI Conclusion: SPI recommends that this alternative not be included in the final design.

27 VE Alternative Number and Description: TP-4: Eliminate sulfuric acid addition from process

27.1 VE Description of Baseline Concept: Sulfuric acid is included in the baseline concept as a tool for controlling the formation of calcium carbonate on the membranes.

27.2 VE Description of Alternative Concept: The alternative concept proposes to eliminate sulfuric acid equipment based on the fact that the production water is anticipated to be nearly 100% seawater, where magnesium carbonate is the driver.

27.3 SPI Comment: If the acid is used for pre-treatment, it produces carbon dioxide as it mixes with the sea water supply. This carbon dioxide can be recovered in a decarbonator and used for the post treatment step. This eliminates the need for purchasing carbon dioxide and can reduce operating costs.

The collection of carbon dioxide for use in the post treatment step is not a new idea. It is carried out in many plants in the Middle East area.

27.4 SPI Schedule Impacts: No design revisions are required.

27.5 SPI Risk Impacts: No risks result from this revision.

27.6 SPI Cost Estimate:

27.6.1 Capital Cost

The capital costs are given in the following table:

TP-4 - Capital Cost

CONSTRUCTION ELEMENT		BASLINE CONCEPT			ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	COST/UNIT	Total	QTY	COST/UNIT	Total
Decarbonator		1	0.00	0.00	1		475,000.00
Carbon Dioxide							
SUB-TOTAL							
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				0			475,000
						SAVINGS	475,000.00

27.6.2 Life Cycle Costs

The life cycle costs are given in the following table:

TP-4 - Life Cycle Cost

CONSTRUCTION ELEMENT		BASLINE CONCEPT			ALTERNATIVE CONCEPT		
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
Decarbonator Blower	Kw	7.5		0.00	1	6,200.00	6,200.00
Decarb, Amortization					1	42,180.00	42,180.00
Carbon Dioxide Usage	mg/L	15	96,000.00	302,500.00		0.00	0.00
Acid Usage	mg/L	49.5	475,000.00	475,000.00	49.5	475,000.00	475,000.00
SUB-TOTAL				777,500.00			523,380.00
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				777,500.00		523,380.00	523,380.00
			PW	8,754,650.00		PW	5,893,259
						SAVINGS	-2,861,391.2

27.7 SPI Conclusion: The cost savings resulting from this change shows the significant benefit offered. SPI recommends that the sulfuric acid treatment in the present design be used and the resulting formation of carbon dioxide be collected for use in post treatment.

28 VE Alternative Number and Description: TP-5: Provide a spare chemical injection function to Desal Plant

28.1 VE Description of Baseline Concept: The baseline concept project does not include additional space or equipment to accommodate chemical injection beyond the currently assumed water treatment

28.2 VE Description of Alternative Concept: This alternative proposes to construct an outbuilding separate from the RO building sufficient to house enough chemical storage tanks and equipment to support future chemical injection into the water after the RO membranes.

28.3 SPI Comment: Additional chemical treatment facilities can always be provided at the future time when additional capacity is added. The provision of this facility should be based on the future expansion requirements, which are not known at this time.

28.4 SPI Schedule Impacts: This item will increase the design and construction periods of the facility.

28.5 SPI Risk Impacts: The risk incurred is based on the additional time and costs for this alternative.

28.6 SPI Conclusion: The costs given in the VE study assumed a specific additional plant capacity. However, at this time the additional capacity is not known, so the building provided may in fact be too large or not large enough. Since the addition of this building will incur re-design, additional architectural services and increased construction time, it is considered not practical at this time.

29 VE Alternative Number and Description: TP-6: Eliminate the UV treatment system

29.1 VE Description of Baseline Concept: In the baseline concept, the UV system is installed downstream of the RO membranes and upstream of the post-stabilization system. The purpose of the system is to provide a minimum 4-log inactivation of Giardia and Cryptosporidium. The system consists of 3 trains of reactors in a 2 + 1 configuration. The train consists of a flow meter (for flow documentation), reactor, and a flow valve. Each train will have a UPS to provide 10 minutes of ride through time upon power failure.

29.2 VE Description of Alternative Concept: This concept proposes to remove the UV system from the project. Different methods of obtaining the 4-log removal could be installed. These methods are described in VE Alternative TP-7 which suggests the use of either a coagulant chamber with flocculation or another type of pretreatment. The exact method is undefined and a rough cost estimate is given.

29.3 SPI Comment: SPI agrees with this alternative. Different systems could be employed and to determine which system to recommend would require further study.

29.4 SPI Schedule Impacts: Including this alternative will result in a reduction in construction time.

29.5 SPI Risk Impacts: No risks are identified.

28.6 SPI Conclusion: SPI recommends acceptance of this alternative provided disinfection credits can be achieved elsewhere in the process.

30 VE Alternative Number and Description: TP-7: Consider more efficient ways of meeting CT requirements (flocculation chamber, membrane pretreatment, etc.)

30.1 VE Description of Baseline Concept: Existing granular media pretreatment filters do not have flocculation/mixing chamber and coagulant addition, which does not allow them to be given Pathogen removal credits by the California Department of Public Health (CDPH).

30.2 VE Description of Alternative Concept: This alternative would install a flocculation/mixing chamber upstream of the existing filters to receive 2-log pathogen removal credit from the CDPH. Installing a mixing chamber will improve the oxidation of iron and manganese (if they are found in the water) and result in improved removal of these compounds as well. Install membrane pretreatment filters instead of granular media pretreatment filters to receive 4-log removal credit from the CDPH, and eliminate the need for cartridge filters and the UV disinfection system.

30.3 SPI Comment: Normal sea water does not contain manganese or iron. Thus, there is no need to remove these constituents. The installation of membrane filtration as a pretreatment step will increase the project costs and the cost of operation significantly.

Adding flocculation would require the addition of ferric chloride. The addition of this chemical (iron) will not be allowed to be discharged to the sea without treatment (removal). This treatment step is quite costly from both the capital and operating cost stand point.

In addition, the solids removed in this treatment step would have to be trucked to a land fill or similar facility.

30.4 SPI Schedule Impacts: The VE study states that the project schedule would be increased by one month for the commissioning of these membranes. It neglects to mention that this change would also require a revision to the design and construction periods of the facility.

This alternative will have a significant impact on the project costs and schedule and therefore is not recommended as a viable alternative.

30.5 SPI Risk Impacts: Increased capital and operating costs (see below).

30.6 SPI Cost Estimate:

30.6.1 Capital Costs

The capital costs are given in the following table:

TP-7 - Capital Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	COST	Total	QTY	COST	Total
Media Filters	10	60,000.00	600,000.00	600,000.00	10	600,000.00	600,000.00
Flocculation		0.00	0.00	0.00	10	5,000.00	50,000.00
Discharge Treatment		0.00	0.00	0.00	1	3,000,000.00	3,000,000.00
Ferric Chloride Capital		0.00	0.00	0.00	10	53,000.00	53,000.00
SUB-TOTAL							
PROJECT MARK-UPS				0.00		3,658,000.00	3,703,000.00
TOTAL				600,000			4,303,000
						SAVINGS	3,703,000.00

30.6.2 Life Cycle Costs

The life cycle costs are given in the following table:

TP-7 - Life Cycle Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
Media Filters	10		53,280.00	53,280.00		53,928.00	53,928.00
Flocculation	10					4,440.00	4,440.00
Discharge Treatment	1					266,400.00	266,400.00
Ferric Chloride Capital	10					4,706.40	4,706.40
Ferric Chloride Use	10					62,500.00	62,500.00
SUB-TOTAL				53,280.00		391,974.40	391,974.40
PROJECT MARK-UPS				0.00		0.00	0.00
TOTAL				53,280.00		391,974.40	391,974.40
			PW	599,932.80		PW	4,413,632
						SAVINGS	3,813,698.9

30.7 SPI Conclusion: SPI does not recommend inclusion of this alternative for the final design.

31 VE Alternative Number and Description: TP-8: Eliminate baffles in the treated water storage tanks; obtain CT points elsewhere

31.1 VE Description of Baseline Concept: The baseline concept includes two Hypalon baffle curtains per treated water storage tank to achieve a 0.5 baffling factor and provide 1 log inactivation of giardia.

31.2 VE Description of Alternative Concept: The baseline concept recommends deleting the baffles in treated water storage tanks. Required Contact Time (CT) points will be achieved elsewhere in the system.

31.3 SPI Comment: The elimination of these baffles would appear to be unwarranted at this time.

31.4 SPI Schedule Impacts: Elimination of the baffles could result in an increased risk of not obtaining the required final water quality.

31.5 SPI Risk Impacts: No increased risk was found

31.6 SPI Conclusion: SPI recommends that this alternative not be accepted.

32 VE Alternative Number and Description: TP-9: Optimize configuration from intake wells to RO membrane system

32.1 VE Description of Baseline Concept: The baseline concept includes the following steps for pumping water from the bay to the inlet of the RO high pressure pumps:

1. Slant wells with submersible pumps and motors pump water through the pressure filters and discharge to the filtered water tanks.
2. Filtered Water Pumps pump water through the cartridge filters and to the suction side of RO high pressure pumps.

32.2 VE Description of Alternative Concept: Several items are presented in this VE alternative that may result in a savings in construction cost or operational costs. This may be even more necessary if the pre-treatment process is changed in order to obtain more CT disinfection credit (See VE Alternative TP-7). The alternative concepts would include (as a minimum):

1. Changing the configuration of the filtered water tanks. For example, using concrete with common wall construction by making it rectangular
2. Using vertical turbine pumps as the filtered water pumps. This may result in more efficient pumps and more cost-effective construction
3. If it is feasible to have less than 600,000 gallons of filtered water tank storage, this would allow the project to reduce tank size and associated costs
4. If flocculation is used to increase the CT disinfection credits, then the entire pumping layout will have to be re-evaluated

32.3 SPI Comment:

Optimization of the configuration would be recommended for any process design. However, until the final feed water quality is known, it is only conjecture at this time. Thus, the optimization of the system would be completed after the well has been developed and the feed quality is known.

32.4 SPI Schedule Impacts: Any schedule impacts cannot be determined at this time.

32.5 SPI Risk Impacts: Any risks are associated with the results of the final feed water quality.

32.6 SPI Conclusion: SPI recommends that this alternative not be pursued at this point.

33 VE Alternative Number and Description: TP-10: Consider sand removal process prior to pretreatment

33.1 VE Description of Baseline Concept: The baseline design anticipates production wells without a run to waste, and pumping directly to pressure filters at the desalination plant to capture sand/silt and particulate.

33.2 VE Description of Alternative Concept: This alternative proposes to install run-to-waste ability either at the desalination plant or at well heads when wells are first cycled.

33.3 SPI Comment: The run-to-waste system is normally provided for all SWRO systems, as the water is not sent to the RO process until it meets the SDI requirements of the membrane manufacturer.

The VE study expresses concern in this regard with elimination of sand before the pressure filters. However a properly designed and constructed well will not produce sand.

If it is found that the well has not been constructed properly and sand ingress becomes a problem, a strainer can be installed to eliminate this condition at that time.

33.4 SPI Schedule Impacts: A properly designed and constructed well, will not result in having sand in the supply. Well supply systems for SWRO systems are the preferred process due to the low amount of constituents in this type of supply.

33.5 SPI Risk Impacts: No risks are associated with this type of feed water supply system.

33.6 SPI Cost Estimate

33.6.1 Capital Cost

The capital costs are given in the following table:

TP-10 - Capital Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	COST	Total	QTY	COST	Total
Media/Sand Filters		10	60,000.00	600,000.00	2	50,000.00	100,000.00
Backwash		2	62,000.00	124,000.00			
Brine Ponds		2	550,000	1,100,000.00			
Pump & Piping Cost		2	92,000.00	184,000.00	2	50,000.00	100,000.00
TOTAL				2,008,000			200,000
						SAVINGS	-1,808,000.00

33.6.2 Life Cycle Costs

The life cycle costs are given in the following table:

TP-10 - Life Cycle Cost

CONSTRUCTION ELEMENT		**BASLINE CONCEPT**			**ALTERNATIVE CONCEPT**		
DESCRIPTION	UNIT	QTY	Annual Cost	Total	QTY	Annual Cost	Total
Media/Sande Filters			53,280.00	53,280.00		8,880.00	8,880.00
Backwash			11,011.20	11,011.20			0.00
Brine Ponds			97,680.00	97,680.00			0.00
Pump & Piping Cost			16,339.20	16,339.20		8,880.00	8,880.00
TOTAL				178,310.40		0.00	17,760.00
			PW	2,007,775.10	PW		199,978
						SAVINGS	-1,807,797.5

33.7 SPI Conclusion: This alternative cannot be technically evaluated until the well has been developed and the water quality is known. Therefore, SPI recommends that this alternative not be considered at this time.

34 VE Alternative Number and Description: TP-11: Eliminate the backwash treatment system and discharge directly to brine basin

34.1 VE Description of Baseline Concept: The existing configuration has the backwash waste going to two backwash ponds. The water is then settled and sent either to the front of the plant or to the outfall. The solids settle out and need to be removed periodically by plant staff, which dewater and dispose of the solids. The baseline concept also contains one large brine storage pond which is used to store brine before it is disposed of by pumping it to the outfall.

34.2 VE Description of Alternative Concept: The alternative concept proposes to eliminate the backwash ponds. The backwash waste and brine would be sent to the same ponds. The brine ponds would be reconfigured and enlarged into two separate ponds. The combination backwash waste/brine would be disposed of by pumping it to the outfall. The ponds would be configured to be dewatered and the sludge removed, dewatered, and disposed of off-site.

34.3 SPI Comment: There appears to be no drawbacks to employing this alternative.

34.4 SPI Schedule Impacts: No schedule impacts are expected.

34.5 SPI Risk Impacts: No risks have been identified.

34.6 SPI Conclusion: SPI sees a benefit in terms of capital facilities and operating costs at the desal facility. However, it would have impacts in terms of raw water supply and brine disposal that must be considered as well. The treatment of backwash waste conserves the amount of raw water pumped from the supply wells to the site; which would otherwise have to be made up with additonal or larger supply wells. Separately, comingly filter backwash residuals with waste brine may impact the securing of a disposal authorization to the MRWPCA ocean outfall. Given these concerns we do not see a net benefit with the proposal.

35 VE Alternative Number and Description: TP-12: Install system to blend the brine with raw water

35.1 VE Description of Baseline Concept: The baseline concept does not address how brine will be disposed of when there is no flow in the outfall from the MRWPCA wastewater plant. Modeling is still being performed to evaluate whether the outfall diffusers can provide sufficient dilution into the seawater when the brine is not combined with any treated wastewater effluent.

35.2 VE Description of Alternative Concept: If additional dilution is required during periods of no treated wastewater effluent availability, this solution could possibly provide sufficient dilution. The proposed alternative solution would use raw water from the slant wells to augment the brine flow to the outfall.

35.3 SPI Comment: The blending of the brine with raw water allows the plant to continue producing water when there is insufficient waste water to blend the brine with for disposal. This would prevent the shut-down of the plant or the storage of membranes in sterilized solution. Thus, it is recommended by SPI as a viable alternative.

35.4 SPI Schedule Impacts: There should be no schedule impacts due to this item.

35.5 SPI Risk Impacts: No increased risks are perceived.

35.6 SPI Conclusion: SPI recommends acceptance of this alternative.

36 VE Alternative Number and Description: TP-13: For 6.4 MGD plant option, eliminate brine pit and circulate the permeate and brine until discharge is allowed

36.1 VE Description of Baseline Concept: Brine concentrate flows from RO system to Brine discharge at MRWPCA outfall using excess pressure from RO process. When outfall capacity is exceeded, brine is directed to a 3 million gallon brine storage pond. A 6 MGD brine pump station is used to drawdown the brine storage pond when the outfall capacity is restored. Plant feed water overflow, as well as several other overflow sources, are also sent to the brine storage pond.

36.2 VE Description of Alternative Concept: This concept proposes to delete the Brine Storage Pond and Brine Pump Station and recirculate plant flow to head of plant when the MRWPCA outfall capacity is not available. The slant wells would need to be shut off when outfall capacity is not available. In order to recirculate the flow and keep the plant in ready standby, a 16 MGD recirculation pump station would be needed.

36.3 SPI Comment: This alternative does not address the 9.6 mgd case. In either event, the plant may have to be secured in the event the disposal of brine cannot be carried out. In that case it is recommended that the plant be put into intermittent operation (i.e., operation every 2-days for a period of 4-hours).

36.4 SPI Schedule Impacts: No schedule impacts result

35.5 SPI Risk Impacts: No risk impacts result.

36.6 SPI Conclusion: The costs given for this alternative do not appear to justify its use.