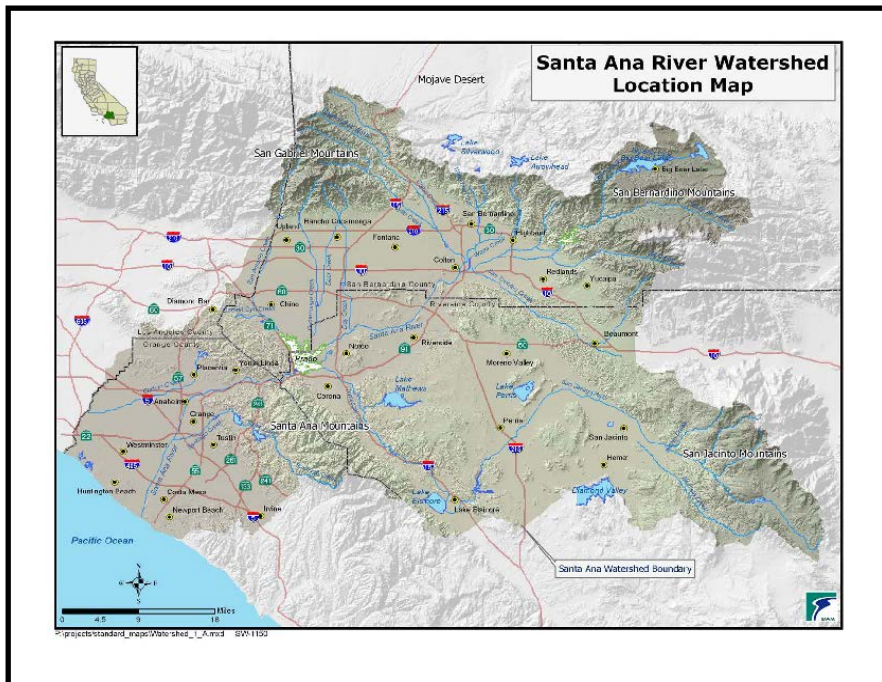


RECLAMATION

Managing Water in the West

SANTA ANA WATERSHED BASIN STUDY

**INLAND EMPIRE INTERCEPTOR APPRAISAL ANALYSIS
TECHNICAL MEMORANDUM NO. 4
SUMMARY OF COSTS AND RECOMMENDED OPTIONS
MARCH 2013 (FINAL – MAY 2013)**



U.S. Department of the Interior
Bureau of Reclamation



Santa Ana Watershed
Project Authority

PROJECT INFORMATION

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Inland Empire Interceptor Appraisal Analysis

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LIST OF ACRONYMS & ABBREVIATIONS

ORGANIZATIONS:

CDM	Camp, Dresser & McKee
CVWD	Coachella Valley Water District
EMWD	Eastern Municipal Water District
EPA	US Environmental Protection Agency
ESO	Bureau of Reclamation Engineering Services Office
IEUA	Inland Empire Utilities Agency
OCS	Orange County Sanitation District
Reclamation	Bureau of Reclamation
CRWQCB	California Regional Water Quality Control Board, Colorado River Basin Region
SAWPA	Santa Ana Watershed Project Authority
SBVMWD	San Bernardino Valley Municipal Water District
SCAO	Bureau of Reclamation Southern California Area Office
WMWD	Western Municipal Water District

DOCUMENTS:

Appraisal Analysis	Inland Empire Interceptor Appraisal Analysis
Basin Plan	Water Quality Control Plan: Colorado River Basin - Region 7
Basin Study	Santa Ana Watershed Basin Study
OWOW	One Water One Watershed
Porter-Cologne	California Porter-Cologne Water Quality Control Act
SAWPA Investigation	Inland Empire Brine Line Disposal Option Concept Investigation
TM	Technical Memorandum

FACILITIES and PROCESSES:

Brine Line	Inland Empire Brine Line
CVSC	Coachella Valley Storm Water Channel
CW	Constructed Wetland
EPF	Evaporation Pond Facility
FTP	Facultative Treatment Pond
FWS	Free Water Surface
IEI	Inland Empire Interceptor

IEBL	Inland Empire Brine Line
SARI	Santa Ana Regional Interceptor
TF	Treatment Facility

PARAMETERS and UNITS of MEASURE:

AFY	Acre-Feet per Year
cfs	Cubic Feet per Second
ft	Feet
in	Inches
HGL	Hydraulic Grade Line
BOD	Biochemical Oxygen Demand
gpm	Gallons per Minute
MGD	Million Gallons per Day
mg/L	Milligrams per Liter
PRF	Peak Rate Factor
psi	Pounds per Square Inch
TDS	Total Dissolved Solids
TSS	Total Suspended Solids

REFERENCES

- [1] *Santa Ana Watershed Salinity Management Program, Phase 2 SARI Planning Technical Memorandum*, Camp, Dresser & McKee (CDM), et al for Santa Ana Watershed Project Authority, May 2010.
- [2] *Santa Ana Watershed Salinity Management Program, Summary Report*, CDM, et al for Santa Ana Watershed Project Authority, July 2010.
- [3] *Inland Empire Brine Line Disposal Option Concept Investigation (Draft)*, Santa Ana Watershed Project Authority, October 2011.
- [4] *Manual: Constructed Wetlands Treatment of Municipal Wastewaters*, U.S. Environmental Protection Agency, 1999.
- [5] *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers*, U.S. Environmental Protection Agency, 2001.
- [6] *Evaporation Pond Sizing with Water Balance and Make-up Water Calculations*, Idaho National Engineering and Environmental Laboratory, Engineering Design File, 2001.
- [7] *Desert Aqueduct Project Development Plan Phase 1 Report (Draft)*, GEI/Bookman-Edmonston, et al for Coachella Valley Water District, et al, August 2007.
- [8] *RSMeans Facilities Construction Cost Data, 2011, 26th Annual Edition*, RSMeans, a division of Reed Construction Data, 2010.
- [9] *Reclamation Manual, Directives and Standards, FAC 09-01, Cost Estimating & 09-02, Construction Cost Estimates and Project Cost Estimates*, Bureau of Reclamation, October 2007.
- [10] *Water Quality Control Plan: Colorado River Basin - Region 7*, Colorado River Basin Regional Water Quality Control Board, 2006.

INTRODUCTION

Santa Ana Watershed Project Authority

The Santa Ana Watershed Project Authority (SAWPA) is a joint powers authority comprised of five member water districts that serve the vast majority of the Santa Ana Watershed. The area served by SAWPA is located within Orange, Riverside and San Bernardino Counties of California, bounded by the Pacific Ocean on the west, the San Bernardino Mountains to the north, and the San Jacinto Mountains to the east.

The five SAWPA Member Agencies are

- Eastern Municipal Water District (EMWD),
- Western Municipal Water District (WMWD),
- Inland Empire Utilities Agency (IEUA),
- San Bernardino Valley Municipal Water District (SBVMWD), and
- Orange County Water District (OCWD).

Inland Empire Brine Line

SAWPA's mission is to protect water quality and enhance the water supply within the Santa Ana River Watershed. For these purposes, SAWPA developed the Inland Empire Brine Line (Brine Line), which is also known as the Santa Ana Regional Interceptor (SARI), for the purpose of exporting salt from the Santa Ana Watershed. The Brine Line includes approximately 72 miles of pipeline in multiple branches which converge in the vicinity of Prado Dam near the City of Corona. It has a planned capacity of approximately 32.5 MGD and was planned for collection and exportation of approximately 271,000 tons of salt per year from the upper Santa Ana Watershed, east of the Santa Ana Mountains. Currently (2010 & 2011), average system flows are approximately 11.7 MGD and over 75,000 tons of salt are exported per year.

An additional 21 miles of pipeline convey the combined flows to Orange County Sanitation District (OCSD) facilities for treatment and disposal by discharge to the Pacific Ocean. This pipeline has a nominal capacity of 30 MGD. The planned capacity of the Brine Line system (32.5 MGD) exceeds the hydraulic capacity of the pipeline from the Brine Line convergence near Prado Dam to the OCSD facilities. Furthermore, the agreement between SAWPA and OCSD allows Brine Line flows to the OCSD system up to only 17.0 MGD, with a contractual right to purchase up to 30.0 MGD capacity.

Project Background

The One Water One Watershed (OWOW) Plan is the integrated water management plan for the Santa Ana Watershed and is administered by SAWPA. The Bureau of Reclamation (Reclamation) Southern California Area Office (SCAO) and SAWPA submitted a proposal in June 2010 for funding of a Santa Ana Watershed Basin Study (Basin Study) in support of the OWOW Plan update, known as One Water One Watershed 2.0. In August 2010, this Basin Study was selected by Reclamation for funding. This Inland Empire Interceptor Appraisal Analysis (Appraisal Analysis) is one component of the Basin Study.

A study entitled *Santa Ana Watershed Salinity Management Program* [1] [2] (Salinity Management Program) was completed in 2010 by a team of consultants led by Camp, Dresser & McKee (CDM), which addressed the Brine Line capacity limitations. The Salinity Management Program identified and evaluated several alternatives for system configuration changes to address the capacity limitations. The *Phase 2 Technical Memorandum* [2] included estimated costs for each of these strategies, which were indexed to Year 2010.

One of the alternatives considered is a proposed new Brine Line outfall to the Salton Sea, identified as Option 4 in the Salinity Management Program. The Salinity Management Program did not include a comprehensive review of Option 4, which would replace the existing outfall from the Brine Line system convergence near Prado Dam in western Riverside County near the Orange County boundary to the OCSD system. Option 4 is the subject of this Appraisal Analysis and is identified herein as the Inland Empire Interceptor (IEI).

The discussion of Option 4 in the Salinity Management Program identified a need for treatment of Brine Line flows prior to discharge to the Salton Sea. However, the estimated costs presented for Option 4 include only those associated with the pipeline itself and estimated costs for treatment of Brine Line flows for Option 4 were not included.

Appraisal Analysis Objectives

Reclamation criteria for appraisal analyses are set forth in *Reclamation Manual, Directives and Standards, FAC 09-01, Cost Estimating* [9]. Appraisal analyses “are intended to be used as an aid in selecting the most economical plan by comparing alternative features”. Several alternative conceptual designs for the proposed Inland Empire Interceptor (IEI) have been developed and evaluated for this Appraisal Analysis for the purpose of comparison.

Reclamation Manual FAC 09-01 also states that appraisal analyses are to be prepared “using the available site-specific data.” A literature review of previous studies and other available site-specific data was addressed in Technical Memorandum No. 1 (TM1). Various additional sources of available information have been identified in TM2, TM3 and this TM4.

System flows and brine characteristics were addressed in TM2. The route of the proposed IEI represents an opportunity for SAWPA to expand the Brine Line service area to include the San Gorgonio Pass and Coachella Valley areas; and TM2 also addressed this opportunity and the associated additional flows.

Conceptual designs for each alternative under consideration for the proposed IEI were addressed in TM3. These alternatives begin at a common point in western Riverside County near Prado Dam in upper Santa Ana Watershed, running generally eastward to a common point in San Gorgonio Pass. Two alternatives continue eastward from the common point in San Gorgonio Pass and through Coachella Valley to a common end point near the north edge of the Salton Sea in eastern Riverside County.

This TM4 presents estimated costs associated with the alternative conceptual designs for the proposed IEI presented in TM3 of this Appraisal Analysis. Suggested strategies for implementation of the proposed IEI are also presented in this TM4.

These Technical Memoranda will be summarized in a final report.

Technical Memorandum No. 4 – Estimated Costs

This TM4 presents estimated capital construction costs and operation and maintenance costs for alternative IEI conceptual designs described in TM3 of this Appraisal Analysis. These estimated costs are indexed to Year 2010 to facilitate comparison with the estimated costs presented for the various Options considered in the *Salinity Management Program Phase 2 Technical Memorandum* [2].

COST ESTIMATING CRITERIA

Background

As noted above, the Salinity Management Program identified and evaluated several alternatives for Brine Line system configuration changes to address anticipated capacity limitations. Salinity Management Program Technical Memorandum 2 included estimated costs for each of these strategies. One of the alternatives considered is a proposed new Brine Line outfall to the Salton Sea, which was identified as Option 4 in the Salinity Management Program. This Option 4 would replace the existing outfall from the Brine Line system convergence near Prado Dam in western Riverside County near the Orange County boundary to the OCSD system.

The investigation of Option 4 in the Salinity Management Program was less comprehensive than the investigations of the other Options considered. For example, the Salinity Management Program discussion of Option 4 identified a need for treatment of Brine Line flows prior to discharge to the Salton Sea; but the estimated costs presented for Option 4 did not consider the cost of treatment.

Option 4 is the subject of this Appraisal Analysis and is identified herein as the Inland Empire Interceptor (IEI). As also noted above, appraisal analyses “are intended to be used as an aid in selecting the most economical and viable plan by comparing alternative features”. Various alternatives have been developed for the purpose of this comparative analysis and are presented in TM3 of this Appraisal Analysis.

Construction Cost Estimating Criteria

The criteria used for developing the estimated construction costs for the various alternatives under consideration in this Appraisal Analysis are summarized in **Table 1** on the following page. Discussions of these criteria follow **Table 1**.

The estimated unit costs are indexed to Year 2010 to facilitate comparison with the estimated costs presented for the various Options considered in the *Salinity Management Program Phase 2 Technical Memorandum* [2] and with those presented in the *Inland Empire Brine Line Disposal Option Concept Investigation* [3]. Unit cost data from locations outside of southern California and/or from years other than Year 2010 were adjusted using Historical and Location Indexes published by *RS Means* [8].

Table 1 – Construction Costs Estimating Criteria

COMPONENT	ESTIMATING CRITERIA
Pipeline Base Unit Costs:	
Pressure Class 150 psi	\$12.00 per inch diameter per LF
Pressure Class 200 psi	Class 150 Pipeline Base Unit Cost + \$1.00 per in dia. per LF
Pressure Class 250 psi	Class 150 Pipeline Base Unit Cost + \$2.00 per in dia. per LF
Pressure Class 400 psi	Class 150 Pipeline Base Unit Cost + \$4.00 per in dia. per LF
Pipeline Location Cost Adjustment Factors:	
Open Country	0.74 * Pipeline Base Unit Cost
Rural Road	1.00 * Pipeline Base Unit Cost
Commercial / Residential	1.19 * Pipeline Base Unit Cost
Busy City Street	1.32 * Pipeline Base Unit Cost
Additional Pipeline Costs:	
Manholes	\$14,000 or \$17,000 Each.
Tunneling, Jacking & Boring	\$17.50 per inch diameter (casing) per LF.
Environmental Mitigation	\$14.00 per LF.
Existing Pipeline Abandonment Costs	\$9.00 per inch diameter per LF
Land Costs:	
Easements & Rights-of-Way	\$57.00 per LF.
Land Parcels	\$56,000 per Acre.
Pump Station & Turbine Gen. Station Costs:	
Pump Stations	\$ = 1.0 * 64,661 * Pump HP ^{0.6652}
Turbine Generator Stations	\$ = 1.7 * 400,510 * Q ^{0.7461} , Q in cfs
Electrical Service	\$570,000 per Station.
Power Transmission Lines	\$340,000 per Mile.
Water Quality Treatment Facility Costs:	
Clearing & Grubbing	\$4,400 per acre
Earthwork	\$16,000 per acre
Liner	\$47,500 per acre
Plants & Planting	\$7,600 per acre
Control Structures	\$35,000 per acre
Plumbing & Fencing	\$15,000 per acre
Distributive Costs	25%
Contingencies	25%

Pipeline Base Unit Costs

The estimated Pipeline Base Unit Costs presented in **Table 1** above are based on average construction costs for large diameter pipeline projects in the southwestern US for Class 150 pipe with average trench depth of 15 to 20 feet and site conditions characteristic of a Rural Road location category (described below). The estimated Pipeline Base Unit Costs include typical appurtenances for large diameter pipelines such as fittings, cathodic corrosion protection, air relief valves and blow-offs.

Pipe pressure classes greater than Class 150 were used for those portions of the proposed IEI for which the hydraulic analyses indicate that system operating pressures would exceed 100 psi. These portions typically occur immediately downstream of pump stations and immediately upstream of turbine generator stations. The estimated unit costs for pipe pressure classes other than Class 150 were determined using available relative pipe materials costs.

Pipeline Location Cost Adjustment Factors

Pipeline Cost Adjustment Factors are applied to the estimated Pipeline Base Unit Costs to address conditions along various segments of the alignments that vary from the assumed typical Rural Road site conditions described above and may significantly influence construction costs. These Pipeline Cost Adjustment Factors were used in the *Desert Aqueduct Project Development Plan Phase 1 Report (Draft)* [7] and are based on the “cultural modifiers” or difficulty factors developed by the EPA as part of the sanitary sewer needs assessment in the 1970’s to address anticipated terrain and installation conditions. The Pipeline Cost Adjustment Factors used in this TM4 are presented in **Table 1** above.

Site conditions associated with the Rural Road category are characteristic of a two-lane rural highway or street with low traffic volumes and minor existing utilities congestion. As noted above, this category represents baseline conditions. Site conditions associated with the Open Country category include minimal existing utilities congestion and surface restoration requirements. The Commercial / Residential category is characteristic of somewhat congested urban business and residential areas and is typically applied to arterial streets. The Busy City Street category is characteristic of dense urban areas typical of town centers, downtown areas, business districts and congested commercial areas with significant existing utilities congestion and surface restoration requirements.

Additional Pipeline Costs

Certain aspects of construction are not necessarily accounted for in the estimated Pipeline Base Unit Costs or in the Pipeline Cost Adjustment Factors described above. These include manholes on the gravity portions of the proposed IEI, tunneling or jacking & boring at crossings of other existing major facilities (such as freeways and railroads), and mitigation for possible adverse environmental impacts along the alignments. These are included in the estimated costs presented in this TM4 for specific segments of the various alignments, as applicable. The estimated unit costs for these Additional Pipeline Costs used in this TM4 are presented in **Table 1**.

Existing Pipeline Abandonment Costs

The existing Brine Line system includes 21 miles of pipeline that convey the flows from the point of convergence in the vicinity of Prado Dam to Orange County Sanitation District (OCSD) treatment facilities. The *Phase 2 Technical Memorandum* [2] reported that this portion of the system is owned and operated by OCSD. Implementation of the proposed IEI would involve abandonment of this system outfall pipeline or conversion to some other beneficial use. The estimated unit cost used in this TM4 for abandonment of the existing pipeline is presented in **Table 1**.

Land Costs

The Land Costs presented in this TM4 are included among the estimated costs for the various major components of the project. The pipeline alignments considered in this Appraisal Analysis are generally proposed to be located in or adjoining existing transportation, drainage and/or (public or private) utility corridors wherever possible in an effort to minimize the costs of acquisition of easements or rights-of-way. However, it is likely that some portions of the IEI would be located outside of those existing easements and rights-of-way and that acquisition of additional easements and/or rights-of-way would be necessary.

Land costs for acquisition of easements and rights-of-way necessary for the pipeline are based on a typical easement (or right-of-way) width of 100 feet at a cost of approximately \$25,000 per acre, or approximately \$57.00 per linear foot (LF). These costs were based on information presented in *Desert Aqueduct Project Development Plan Phase 1 Report (Draft)* [7], indexed to Year 2010. These costs were applied to segments for which existence of easements and/or rights-of-way was not readily indicated by available mapping and acquisition of easement rights may be necessary.

It would also be necessary to acquire land on which to locate the planned IEI Pump Stations, Turbine Generator Stations (Energy Recovery Facilities) and Water Quality Treatment Facility. Similarly, if the Evaporation Pond Facility were necessary for implementation of the proposed IEI, then it would also be necessary to acquire land on which to locate that facility. The cost of acquisition of parcels necessary for the Pump Stations and Turbine Generator Stations are based on a typical parcel size of approximately three (3) acres at a cost of approximately \$56,000 per acre, or approximately \$168,000 per station.

It is likely that the Water Quality Treatment Facility (TF) and the Evaporation Pond Facility (EPF) would be located in rural areas near the shore of the Salton Sea. It is also likely that the land costs (per acre) for these facilities would be lower than for Pump Stations and Turbine Generator Stations. However, due to the limited information readily available regarding land costs in the vicinity of the Salton Sea, the unit cost used to calculate the estimated land cost for the TF and EPF is the same as that used for Pump Stations and Turbine Generator Stations, approximately \$56,000 per acre.

Pump Station and Turbine Generator Station Costs

The estimated costs presented in this TM4 for Pump Stations are based on a trend analysis of the estimated costs for Pump Stations included in the draft *Inland Empire Brine Line Disposal Option Concept Investigation* [3] for which estimated costs were based on Year 2010. The estimated costs presented for Turbine Generator Stations (Energy Recovery Facilities) are based on a trend analysis of the costs for similar facilities presented in *Desert Aqueduct Project Development Plan Phase 1 Report (Draft)* [7], indexed to Year 2010.

The estimated cost of electrical service to each of the Pump Stations and Turbine Generator Stations includes a base capital cost of \$570,000 per station. The estimated cost of electrical service to the stations would also vary with proximity to existing electrical transmission and distribution facilities. A unit cost of \$340,000 per mile was used to calculate the cost of the estimated length of new electric transmission line necessary for each station.

Water Quality Treatment Facility Costs

Conceptual designs are presented in TM3 of this Appraisal Analysis for the proposed Inland Empire Interceptor Water Quality Treatment Facility (TF) to reduce Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD) concentrations in the proposed IEI flows. Among the alternative designs

considered, the two alternatives that would require the least land area for a given design flow (TF Alternatives 3 and 5) both use wastewater treatment ponds followed by constructed wetlands in the treatment process. It is anticipated for this analysis that the TF would be located in a rural area near the shore of the Salton Sea with relatively low land costs.

The EPA publications *Manual: Constructed Wetlands Treatment of Municipal Wastewaters* [4] and *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers* [5] were used to develop the conceptual designs described in TM3. Similarly, the cost data presented in *Constructed Wetlands Treatment of Municipal Wastewaters* [4], indexed to Year 2010, were used to develop the estimated costs for the TF presented in this TM4.

Distributive Costs

Distributive Costs are described in *Reclamation Manual, Directives and Standards, FAC 09-01, Cost Estimating & 09-02, Construction Cost Estimates and Project Cost Estimates* [9]. FAC 09-01 describes Distributive Costs as costs “of such a broad non-specific nature that they can only be attributed to the project as a whole.” FAC 09-02 lists examples of Distributive Costs, which include, but are not limited to, such costs as administrative, facilitating services, planning (investigations), design and specifications, construction management, environmental compliance, archeological considerations, O&M during construction and project start-up and training.

The estimated Distributive Costs presented in this TM4 were calculated as a percentage of the estimated construction costs for the proposed IEL. The component parts of the estimated Distributive Costs used in this TM4 are presented in **Table 2** below.

Table 2 – Estimated Distributive Costs

COMPONENT	ESTIMATED RANGE	PERCENTAGE USED
Administrative, Planning & Design	8% to 17% of Est. Const. Cost	13.0%
Permits & Fees	1% to 2% of Est. Const. Cost	1.5%
Legal & Financial	1.5% to 3% of Est. Const. Cost	2.5%
Construction Management	5.5% to 9% of Est. Const. Cost	7.0%
Start-up and Training	0.5% to 1% of Est. Const. Cost	1.0%
Total Distributive Costs		25.0%

Contingencies

Contingencies are described in *Reclamation Manual, Directives and Standards, FAC 09-01, Cost Estimating & 09-02, Construction Cost Estimates and Project Cost Estimates* [9]. This category in a project cost estimate is an allowance to cover “uncertainties inherent as a project advances from the planning stage through construction that may directly affect the estimated cost of a project.” The allowances for Contingencies are typically calculated as a percentage of the estimated costs for the project.

FAC 09-01 lists categories of Design Contingencies, including unlisted items, design and scope changes, and cost estimating refinements. FAC 09-01 lists examples of Construction Contingencies including an allowance “to cover minor differences in actual and estimated quantities, unforeseeable difficulties at the site, changed site conditions, possible minor changes in plans and other uncertainties.” The allowance is intended to take into consideration such factors as “reliability of the data, adequacy of the estimated quantities and general knowledge of the site conditions.”

The allowance for Contingencies presented in this TM4 was calculated as 25% of the estimated construction costs for the proposed IEI and includes both Design Contingencies and Construction Contingencies.

Operation and Maintenance Costs

The estimated annual Operation and Maintenance (O&M) Costs presented in this TM4 were calculated as a percentage of the estimated construction costs for the related components of the project. The percentages used in this TM4 to estimate the annual O&M Costs are presented in **Table 3** below.

Table 3 – Annual Operation and Maintenance Costs Estimating Criteria

COMPONENT	ESTIMATING CRITERIA
Pipeline	1.5% of Pipeline Estimated Construction Cost
Abandoned Pipeline	0% of Est. Pipeline Abandonment Cost
Pump Stations & Turbine Gen. Stations	2.0% of Estimated Station Construction Cost
Electrical Power Use (Cost)	\$0.10 per kWh
Electrical Power Produced (Credit)	\$0.04 per kWh
Water Quality Treatment Facility	1.5% of Est. Construction Cost
Evaporation Pond Facility	1.5% of Est. Construction Cost

The estimated annual cost of electrical power used by each Pump Station was added to the estimated annual O&M costs for that station. The estimated annual credit for the electrical power produced by each Turbine Generator Station was deducted from the estimated annual O&M costs for that station.

Present Worth Analysis of Estimated Costs

The *Santa Ana Watershed Salinity Management Program, Phase 2 SARI Planning Technical Memorandum* [2] included a Present Worth analysis of the estimated costs for each of the options considered to facilitate comparison. The increasing net present worth of each option was reported for the 30-year period from Year 2010 to Year 2040. The present worth analysis was performed for two assumed future inflation rates for purchase of capacity in the OCSD system, 4.95% and 17.6%.

The data and methodology used in the present worth analysis for the Phase 2 Technical Memorandum [2] were reproduced for use in this Appraisal Analysis. These were used to prepare a present worth analysis for the combination of alignment alternatives with the lowest estimated cost, which can be used for comparison with the present worth analyses presented in the Phase 2 Technical Memorandum [2].

The present worth analyses for the combination of least-cost alternatives that would serve the proposed Expanded Service Area are presented in **Table 21** and **Table 22** in **Appendix A** of this TM4. The alternatives used in the present worth analyses are Santa Ana Watershed (SAW) Alternative 2, Coachella Valley (CV) Alternative B-1, and Water Quality Treatment Facility (TF) Alternative 5-1. CV Alternative B-1 and TF Alternative 5-1 accommodate projected flows from the San Geronio Pass and Coachella Valley areas, as described in TM3. The estimated costs for the Evaporation Pond Facility are **not** included in the present worth analyses presented in this TM4.

INLAND EMPIRE INTERCEPTOR ALTERNATIVES in SANTA ANA WATERSHED

General Description

The SAWPA Investigation described four alternative conceptual designs for the portion of the IEI in the upper Santa Ana Watershed. Three of these (identified herein as SAW Alternatives 1, 2 and 4) were selected for consideration in TM3 of this Appraisal Analysis. (SAW Alternative 3 was not selected in TM3 for further consideration.) The specific alignments are generally the same as those developed for the SAWPA Investigation.

Alignments

The SAW Alternatives are based upon two primary alignments, which are identified as the Gas Main Alignment and the North Alignment. These are complemented by various combinations of secondary alignments, which are identified as the IEBL Alignment, the EMWD North Alignment, and the IEUA Alignment.

The primary alignment of SAW Alternatives 1 and 2 is the Gas Main Alignment. A portion of the IEBL Alignment (Segments IEBL-1a through IEBL-1d) and the EMWD North Alignment connect to the Gas Main Alignment to comprise SAW Alternative 1. SAW Alternative 2 is comprised of only a portion of the IEBL Alignment (Segments IEBL-1a through IEBL-1d) connected to the Gas Main Alignment.

The primary alignment SAW Alternative 4 is the North Alignment. The IEBL Alignment (Segments IEBL-1a through IEBL-2) and the IEUA Alignment connect to the North Alignment.

Alternatives Considered & Design Flows

Projections of average flows in the proposed IEI are addressed in TM2 of this Appraisal Analysis. A Peak Rate Factor (PRF) of 1.16 was applied to the average flows to calculate the peak flows used to develop the conceptual design for the three SAW Alternatives presented in TM3 (SAW Alternatives 1, 2 and 4). The projected average and peak flows used in this Appraisal Analysis match those developed by SAWPA staff in the *Inland Empire Brine Line Disposal Option Concept Investigation* [3].

The primary and secondary alignments that make up SAW Alternatives 1 and 2 are summarized in **Table 4** below, along with the associated peak flows and pipe sizes from the conceptual designs presented in TM3.

Table 4 – SAW Alternatives 1 & 2 Alignments, Peak Flows & Pipe Sizes

Alignment / Segment	End Station	Segment Length (Feet)	SAW Alternative 1		SAW Alternative 2	
			Peak Flow	Pipe Dia.	Peak Flow	Pipe Dia.
			(gpm)	(in)	(gpm)	(in)
Primary Alignment - Gas Main:						
G-1	650 + 05	52,421	15,312	42	25,937	54
G-2	947 + 74	29,769	15,312	42	25,937	54
G-3	1100 + 00	15,226	15,312	42	25,937	54
G-4a – G-4d	1750 + 80	65,080	15,312	42	25,937	54
G-4e	1911 + 42	16,062	25,937	54	25,937	54
G-5	2070 + 00	15,858	25,937	54	25,937	54
G-6	2412 + 38	34,238	25,937	54	25,937	54
Secondary Alignments:						
IEBL:						
BL-1	125 + 84	12,584	15,312	42	25,937	54
EMWD North:						
EN-1	440 + 00	44,000	8,650	30	N.A.	N.A.
EN-2	941 + 01	50,101	8,650	30	N.A.	N.A.

The primary and secondary alignments that make up SAW Alternative 4 are summarized in **Table 5** below, along with the associated peak flows and pipe sizes from the conceptual designs presented in TM3.

Table 5 – SAW Alternative 4 Alignments, Peak Flows & Pipe Sizes

Alignment / Segment	End Station	Segment Length (Feet)	SAW Alternative 4	
			Peak Flow (gpm)	Pipe Dia. (in)
Primary Alignment - North:				
N-1a	54 + 34	5,434	1,736	16
N-1b	60 + 20	586	17,326	42
N-1c	580 + 00	51,980	18,715	42
N-1d – N-2a	715 + 00	13,500	20,798	42
N-2b – N-2d	1020 + 00	30,500	21,145	42
N-2e – N-3a	1424 + 00	40,400	23,437	42
N-3b – N-4a	2020 + 00	59,600	25,937	42
N-4b - N-7	2789 + 24	76,924	25,937	54
Secondary Alignments:				
IEBL:				
BL-1a	125 + 84	12,584	15,590	42
BL-1b	365 + 47	23,963	15,590	42
IEUA	89 + 99	8,999	347	16

Modifications to the Existing Brine Line System

If the proposed IEI were implemented, the existing 21 miles of pipeline that convey the Brine Line flows from the point of convergence in the vicinity of Prado Dam to Orange County Sanitation District (OCSD) facilities would need to be abandoned or converted to some other beneficial use. Any costs associated with abandonment or conversion of this outfall pipeline would be common to each of the three SAW Alternatives (SAW Alternatives 1, 2 and 4) under consideration in this Appraisal Analysis. Therefore, these costs are included in the estimate costs for each of the SAW Alternatives. The unit cost used to develop the estimate costs of abandonment is based on an assumed typical pipeline size of 54 inches.

If that pipeline could be converted to another use, the cost of abandonment may be reduced or eliminated.

Cost Estimates for SAW Alternatives 1, 2 and 4

The estimated costs for the conceptual designs developed in TM3 of this Appraisal Analysis for the three SAW Alternatives under consideration (SAW Alternatives 1, 2 and 4) are summarized in **Table 10** of the section of this TM4 entitled “Cost Estimate – Least Cost Alternative”. The estimated construction costs for SAW Alternative 2 are lower than the estimated construction costs for both SAW Alternative 1 and SAW Alternative 4.

INLAND EMPIRE INTERCEPTOR ALTERNATIVES in SAN GORGONIO PASS & COACHELLA VALLEY

General Description

Two alternative alignments are described in TM3 of this Appraisal Analysis for the portion of the proposed IEI through the San Gorgonio Pass and Coachella Valley areas. TM3 also describes three alternative conceptual designs developed for each of the two alignments under consideration in this Appraisal Analysis. Two of the three alternatives utilize energy recovery facilities to optimize the hydraulic characteristics of the system. The third alternative for each alignment (without flow controls) had unacceptable hydraulic characteristics. Therefore, estimated costs are presented in this TM4 only for the two alternatives (for each alignment) utilizing energy recovery facilities.

Alignments

The two alignments developed for the portion of the proposed IEI through the San Gorgonio Pass and Coachella Valley areas are identified in this Appraisal Analysis as CV Alignment A and CV Alignment B. CV Alignment A generally follows an existing gas main easement through the San Gorgonio Pass area and follows Coachella Canal for a substantial portion of the length through Coachella Valley. CV Alignment B generally follows the abandoned pavement of the US highway 60 / 70 / 99 alignment through much of the San Gorgonio Pass area. This abandoned pavement is located between the I-10 and UPRR rights-of-way. CV Alignment B follows the Whitewater River / Coachella Valley Storm Water Channel (CVSC) through Coachella Valley.

Alternatives Considered & Design Flows

Projections of average flows in the proposed IEI are addressed in TM2 of this Appraisal Analysis. Alternative flow projections are presented, with and without projected flows from the potential service area expansion in the San Gorgonio Pass and Coachella Valley areas. A Peak Rate Factor (PRF) of 1.16 was applied to the Average Flows tabulated above to calculate the Peak Flows used to develop the conceptual design for each of the CV Alternatives and to perform the hydraulic analysis of each. This PRF is the same as that used in the Salinity Management Program and SAWPA Investigation reports.

For purpose of comparison, conceptual designs were developed for each of the CV Alignments using both sets of peak flow projections. Energy Recovery Facilities were included in the alternative conceptual designs to maintain full pipe flow.

The peak flows and pipe sizes for the various segments of CV Alignment A from the conceptual designs presented in TM3 for the two alternatives with Energy Recovery Facilities are presented in **Table 6** below.

Table 6 – CV Alignment A Segments, Peak Flows & Pipe Sizes

Segment End Station	Segment Length	CV Alternative A-1 (Flows from Expanded Service Area)		CV Alternative A-2 (Flows from Existing Service Area)	
		Peak Flow	Pipe Dia.	Peak Flow	Pipe Dia.
	(Feet)	(gpm)	(in)	(gpm)	(in)
1258 + 60	125,860	25,937	36	25,937	36
1320 + 00	6,140	25,937	48	25,937	36
1982 + 55	66,255	39,428	48	25,937	36
3193 + 17	121,062	39,428	48	25,937	42
4060 + 00	86,683	42,509	54	25,937	42
4410 + 50	35,050	54,625	54	25,937	42
4480 + 00	6,950	60,636	60	25,937	42

The peak flows and pipe sizes for the various segments of CV Alignment B from the conceptual designs presented in TM3 for the two alternatives with Energy Recovery Facilities are presented in **Table 7** below.

Table 7 – CV Alignment B Segments, Peak Flows & Pipe Sizes

Segment End Station	Segment Length	CV Alternative B-1 (Flows from Expanded Service Area)		CV Alternative B-2 (Flows from Existing Service Area)	
		Peak Flow	Pipe Dia.	Peak Flow	Pipe Dia.
	(Feet)	(gpm)	(in)	(gpm)	(in)
1110 + 00	111,000	25,937	36	25,937	36
1725 + 33	61,533	39,428	48	25,937	36
2860 + 00	113,467	39,428	48	25,937	42
3380 + 50	52,050	42,509	54	25,937	42
3690 + 00	30,950	54,625	54	25,937	42
3775 + 97	8,000	60,636	60	25,937	42

Cost Estimates for CV Alignments A and B

The conceptual designs and the associated estimated costs for the two alternative CV Alignments (A and B) should be compared for the same projected flows. Therefore, CV Alternatives A-1 and B-1 should be paired for comparison and analysis, since both were designed for projected flows from the potential service area expansion in the San Gorgonio Pass and Coachella Valley areas. Similarly, CV Alternative A-2 should be paired with CV Alternative B-2, since both were designed for flows from only the existing SAWPA service area.

The estimated construction costs for CV Alternatives A-1 and B-1 are summarized in **Table 11** of the section of this TM4 entitled “Cost Estimate – Least Cost Alternative”. The estimated construction costs for CV Alternative B-1 are lower than the estimated construction costs for CV Alternative A-1.

The estimated construction costs for CV Alternatives A-2 and B-2 are summarized in **Table 13** of the section of this TM4 entitled “Cost Estimate – Least Cost Alternative”. The estimated construction costs for CV Alternative B-2 are lower than the estimated construction costs for CV Alternative A-2.

Energy Recovery Facilities Costs

The estimated costs of the proposed energy recovery facilities have a significant influence on the total estimated costs for all four CV Alternatives considered. The large costs associated with the proposed Turbine Generator Stations and the associated electric transmission facilities and higher pressure classes of pipe in relation to the value of the electrical energy produced annually indicate that the time period necessary to recover the investment in those facilities would be long.

As discussed in TM3 of this Appraisal Analysis, these energy recovery facilities were incorporated into the conceptual designs as a means of extracting surplus energy from the flows in the proposed IEI. However, this design goal could be accomplished by other means. For example, low-head in-line turbine generators could be used to capture that surplus energy without need for higher pressure classes of pipe. This approach would eliminate the added costs of higher pressure classes of pipe necessary to accommodate the energy recovery facilities as proposed in this Appraisal Analysis; but the costs associated with these low-head in-line turbine generators and the associated electric transmission facilities would likely be similar to the costs of the proposed energy recovery facilities considered in this Appraisal Analysis.

Alternatively, the surplus energy could be dissipated using flow control devices in the pipeline, the cost of which would certainly be substantially less than the cost of either the energy recovery facilities proposed in this Appraisal Analysis or the low-head in-line turbine generator alternative. However, there would be no accompanying energy recovery or credit for electricity produced to help offset costs.

WATER QUALITY TREATMENT FACILITY

Background

The water quality issues in the Salton Sea and the potential impacts of the proposed IEI on the Salton Sea are discussed in TM3 of this Appraisal Analysis. Various combinations of wastewater treatment ponds and constructed wetlands, collectively identified herein as the Inland Empire Interceptor Treatment Facility (TF), are considered for treatment of the IEI flows for TSS and BOD. Estimated costs are presented in this section of this TM4 for each of two alternative designs for the proposed TF.

The large land area necessary for the TF suggests a location in a rural area with relatively low land costs. The proposed location of the TF at the downstream end of the IEI near the shore of the Salton Sea fits this criterion and would facilitate gravity flow.

As discussed in TM3 of this Appraisal Analysis, water treatment processes used to reduce TSS and BOD concentrations are not effective at significantly reducing TDS concentrations. Therefore, if removal of salt from IEI flows were deemed necessary to reduce or mitigate for accumulation of salts from the IEI in the Salton Sea, then this treatment could best be accomplished using a separate process. A conceptual design for an Evaporation Pond Facility is presented in Appendix C of TM3 as an alternative approach for removal of salts from the Salton Sea attributable to the IEI flows. Estimated costs associated with an Evaporation Pond Facility sized for the projected IEI flows are addressed in **Appendix B** of this TM4.

Treatment Facility Conceptual Designs

The US Environmental Protection Agency (EPA) publications entitled *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers* [5] (WTP Manual) and *Manual: Constructed Wetlands Treatment of Municipal Wastewaters* [4] (CW Manual) were used for conceptual design(s) for the Inland Empire Interceptor Treatment Facility (TF) described in TM3. The WTP Manual also provides information useful for development of estimated construction costs and O&M costs for constructed wetlands.

Alternatives Considered & Design Flows

Alternative conceptual designs for the TF are presented in TM3. Two of these alternatives are considered in this TM4.

TF Alternative 3 would provide TSS and BOD removal using a Facultative Wastewater Treatment Pond (FTP) to pre-treat flows prior to treatment in a Free Water Surface Constructed Wetland (FWS CW). TF Alternative 3 would produce discharges to the Salton Sea with TSS and BOD concentrations that meet or exceed EPA effluent standards (30 mg/L for both TSS and BOD).

TF Alternative 5 would also provide TSS and BOD removal using a Facultative Wastewater Treatment Pond (FTP) to pre-treat flows prior to treatment in a Free Water Surface Constructed Wetland (FWS CW). TF Alternative 5 would treat only a portion of the IEI flows. The effluent would then be blended with the balance of the IEI flows to produce discharges to the Salton Sea with average TSS concentration of approximately 200 mg/L.

Projections of average flows in the proposed IEI are addressed in TM2 of this Appraisal Analysis. Alternative flow projections are presented, with and without projected flows from the potential service area expansion in the San Geronio Pass and Coachella Valley areas. Alternative conceptual designs were developed for the TF using both sets of average flow projections.

The minimum surface areas for the FTP and the FWS CW of TF Alternative 3 and the total area of the facility are summarized for both projected flows in **Table 8** below.

Table 8 – Treatment Facility Alternative 3 Average Flows and Areas

	Avg. Flow (2060)	Minimum Surface Area			Minimum Total Area
		FTP	FWS CW	Subtotal	
	(MGD)	(Acres)	(Acres)	(Acres)	(Acres)
Existing SAWPA Service Area (Alt. 3-2)	32.1	1,391	1,039	2,430	3,159
Expanded Service Area (Alt. 3-1)	75.1	2,411	1,800	4,211	5,474

The minimum surface areas for the FTP and the FWS CW of TF Alternative 5 and the total area of the facility are summarized for both projected flows in **Table 9** below.

Table 9 – Treatment Facility Alternative 5 Average Flows and Areas

	Avg. Flow (2060)	Minimum Surface Area			Minimum Total Area
		FTP	FWS CW	Subtotal	
	(MGD)	(Acres)	(Acres)	(Acres)	(Acres)
Existing SAWPA Service Area (Alt. 5-2)	32.1	927	693	1,620	2,106
Expanded Service Area (Alt. 5-1)	75.1	1,434	1,071	2,505	3,257

Treatment Facility Cost Estimates

The conceptual designs and associated estimated costs for the two alternative TF designs (TF Alternatives 3 and 5) should be compared for the same projected flows. Therefore, TF Alternatives 3-1 and 5-1 should be paired for comparison and analysis, since both were designed for projected flows from the potential service area expansion in the San Gorgonio Pass and Coachella Valley areas. Similarly, TF Alternative 3-2 should be paired with TF Alternative 5-2, since both were designed for flows from only the existing SAWPA service area.

The estimated construction costs for TF Alternatives 3-1 and 5-1 are summarized in **Table 12** of the section of this TM4 entitled “Cost Estimate – Least Cost Alternative”. The estimated costs of TF Alternative 5-1 are lower than those of TF Alternative 3-1.

The estimated construction costs for TF Alternatives 3-2 and 5-2 are summarized in **Table 14** of the section of this TM4 entitled “Cost Estimate – Least Cost Alternative”. The estimated costs of TF Alternative 5-2 are lower than the estimated costs of TF Alternative 3-2.

The estimated costs of the proposed Water Quality Treatment Facility represent a substantial portion of the estimated costs for the overall project. Therefore, if implementation of the proposed IEI receives further consideration, the need for the TF and the applicable design criteria warrants careful scrutiny.

For example, the item with the largest estimated construction cost for both TF Alternatives is the impermeable liner. A clay or synthetic membrane liner is recommended in the CW Manual [4] under a constructed wetland if the permeability of the soil is greater than approximately 10^{-6} cm/sec (0.0014 in/hr). Available soil survey data from the USDA Natural Resources Conservation Service (formerly the Soil Conservation Service) for the Salton Sea area indicate that the permeability of the soils in the area is much greater than this recommended maximum. Due to the permeability of the soils in the area, the cost of the liner has been included in the estimated construction costs for both TF Alternatives. The magnitude of the cost of the liner suggests that investigation of alternatives would be warranted.

Alternatives could include site-specific soil investigations to determine actual soil permeability and soil treatment with clay (e.g. bentonite) to reduce soil permeability to acceptable levels. Also, the CW Manual [4] acknowledges that a “leaky wetland,’ which may take advantage of natural processes to purify wastewater as it moves downward through soil to recharge groundwater, may be a potential benefit in certain areas.” Investigation of the suitability of a “leaky wetland” for this TF may also warrant investigation.

COST ESTIMATE – LEAST COST ALTERNATIVE

Summaries of Cost Estimates for Santa Ana Watershed Alternatives

The estimated costs for the three SAW Alternatives (SAW Alternatives 1, 2 and 4) are summarized in **Table 10** below. The estimated costs for the least cost SAW Alternative (SAW Alternative 2) are presented in detail in **Table 18** in **Appendix A** of this TM4.

Table 10 – Summary of Costs of SAW Alternatives

Description	SAW Alternative		
	1	2	4
Construction Costs	\$344,029,200	\$337,680,902	\$368,539,425
Distributive Costs (25%)	\$86,007,300	\$84,420,226	\$92,134,856
Contingencies (25%)	\$86,007,300	\$84,420,226	\$92,134,856
Total Construction Costs	\$516,043,800	\$506,521,354	\$552,809,138
Annual O&M Costs	\$18,069,608	\$20,249,464	\$21,090,154

The estimated costs for SAW Alternative 2 are lower than the estimated costs for SAW Alternatives 1 and 4. Therefore, SAW Alternative 2 is the least-cost alternative for this portion of the proposed IEI.

Summaries of Cost Estimates for Coachella Valley Alternatives

The estimated costs for the two CV Alternatives designed to serve the proposed expanded service area (CV Alternatives A-1 and B-1) are summarized in **Table 11** on the next page. The estimated costs for the least cost of these alternatives (CV Alternative B-1) are presented in detail in **Table 19** in **Appendix A** of this TM4.

Table 11 – Summary of Costs of CV Alternatives (Expanded Service Area)

Description	CV Alternative	
	A-1	B-1
Construction Costs	\$396,307,228	\$309,420,966
Distributive Costs (25%)	\$99,076,807	\$77,355,241
Contingencies (25%)	\$99,076,807	\$77,355,241
Total Construction Costs	\$594,460,842	\$464,131,449
Annual O&M Costs	\$6,536,048	\$4,661,725

The estimated costs for CV Alternative B-1 are lower than the estimated costs for CV Alternative A-1. Therefore, CV Alternative B-1 is the least-cost alternative for this portion of the proposed IEI serving the proposed expanded service area.

The estimated costs for the two TF Alternatives designed to serve the proposed expanded service area (TF Alternatives 3-1 and 5-1) are summarized in **Table 12** below. The estimated costs for the least cost of these alternatives (TF Alternative 5-1) are presented in detail in **Table 20** in **Appendix A** of this TM4.

Table 12 – Summary of Costs of TF Alternatives (Expanded Service Area)

Description	TF Alternative	
	3-1	5-1
Construction Costs	\$745,972,900	\$443,759,100
Distributive Costs (25%)	\$186,493,225	\$110,939,775
Contingencies (25%)	\$186,493,225	\$110,939,775
Total Construction Costs	\$1,118,959,350	\$665,638,650
Annual O&M Costs	\$16,784,390	\$9,984,580

The estimated costs for TF Alternative 5-1 are lower than the estimated costs for TF Alternative 3-1. Therefore, TF Alternative 5-1 is the least-cost alternative for this portion of the proposed IEI serving the proposed expanded service area.

The estimated costs for the two CV Alternatives designed to convey flows from only the existing SAWPA service area (CV Alternatives A-2 and B-2) are summarized in **Table 13** below.

Table 13 – Summary of Costs of CV Alternatives (Existing Service Area)

Description	CV Alternative	
	A-2	B-2
Construction Costs	\$341,365,243	\$250,100,820
Distributive Costs (25%)	\$85,341,311	\$62,525,205
Contingencies (25%)	\$85,341,311	\$62,525,205
Total Construction Costs	\$512,047,864	\$375,151,230
Annual O&M Costs	\$6,350,856	\$3,756,286

The estimated costs for CV Alternative B-2 are lower than the estimated costs for CV Alternative A-2. Therefore, CV Alternative B-2 is the least-cost alternative for this portion of the proposed IEI serving only the existing SAWPA service area.

The estimated costs for the two TF Alternatives designed to treat flows from only the existing SAWPA service area (TF Alternatives 3-2 and 5-2) are summarized in **Table 14** below.

Table 14 – Summary of Costs of TF Alternatives (Existing Service Area)

Description	TF Alternative	
	3-2	5-2
Construction Costs	\$430,473,400	\$286,984,800
Distributive Costs (25%)	\$107,618,350	\$71,746,200
Contingencies (25%)	\$107,618,350	\$71,746,200
Total Construction Costs	\$645,710,100	\$430,477,200
Annual O&M Costs	\$9,685,652	\$6,457,158

The estimated costs for TF Alternative 5-2 are lower than the estimated costs for TF Alternative 3-1. Therefore, TF Alternative 5-2 is the least-cost alternative for this portion of the proposed IEI serving the existing SAWPA service area.

Least Cost Alternatives

The total estimated cost for the proposed IEI to serve the proposed expanded service area is the combined estimated costs of SAW Alternative 2, CV Alternative B-1 and TF Alternative 5-1, the least-cost alternatives identified above. Therefore, the total estimated cost for the proposed IEI to serve the proposed expanded service area is summarized in **Table 15** below.

Table 15 – Summary of Least Cost Alternatives (Expanded Service Area)

Description	Alternative			
	SAW Alt. 2	CV Alt. B-1	TF Alt. 5-1	TOTALS
Construction Costs	\$337,680,902	\$309,420,966	\$443,759,100	\$1,090,860,968
Distributive Costs (25%)	\$84,420,226	\$77,355,241	\$110,939,775	\$272,715,242
Contingencies (25%)	\$84,420,226	\$77,355,241	\$110,939,775	\$272,715,242
Total Construction Costs	\$506,521,354	\$464,131,449	\$665,638,650	\$1,636,291,452
Annual O&M Costs	\$20,249,464	\$4,661,725	\$9,984,580	\$34,895,769

The total estimated cost for the proposed IEI to serve the existing SAWPA service area is the combined estimated costs of SAW Alternative 2, CV Alternative B-2, and TF Alternative 5-2, which are the least-cost alternatives identified above. Therefore, the total estimated cost for the proposed IEI to serve the existing SAWPA service area is summarized in **Table 16** on the next page.

Table 16 – Summary of Least Cost Alternatives (Existing SAWPA Service Area)

Description	Alternative			TOTALS
	SAW Alt. 2	CV Alt. B-2	TF Alt. 5-2	
Construction Costs	\$337,680,902	\$250,100,820	\$286,984,800	\$874,766,522
Distributive Costs (25%)	\$84,420,226	\$62,525,205	\$71,746,200	\$218,691,631
Contingencies (25%)	\$84,420,226	\$62,525,205	\$71,746,200	\$218,691,631
Total Construction Costs	\$506,521,354	\$375,151,230	\$430,477,200	\$1,312,149,783
Annual O&M Costs	\$20,249,464	\$3,756,286	\$6,457,158	\$30,462,908

Present Worth Analysis

Present worth analyses were presented in the Phase 2 Technical Memorandum [2] of the estimated costs for each of the options considered in that study to facilitate comparison. The methodology used in the Phase 2 Technical Memorandum present worth analyses were reproduced for use in this Appraisal Analysis to prepare a present worth analysis for the combined estimated costs of SAW Alternative 2, CV Alternative B-1, and TF Alternative 5-1, which are the least-cost alternatives identified above to serve the proposed Expanded Service Area.

The increasing net present worth of this combination of alternatives is reported for the 30-year period from Year 2010 to Year 2040. The present worth analysis was performed for the two assumed future inflation rates for purchase of capacity in the OCS D system used in the Phase 2 Technical Memorandum present worth analyses, 4.95% and 17.6%. This present worth analysis was performed to facilitate comparison of the proposed IEI with the present worth analyses of the options considered in the Phase 2 Technical Memorandum [2].

Present worth analyses for the combination of least cost alternatives that would serve the proposed Expanded Service Area (SAW Alternative 2, CV Alternative B-1 and TF Alternative 5-1) are presented in **Table 21** and **Table 22** in **Appendix A** of this TM4.

OPPORTUNITIES and OPTIMIZATION STRATEGIES

General Description

The present worth analysis presented in this TM4 evaluates the combination of alignment alternatives that would serve the proposed Expanded Service Area with the lowest estimated cost. This analysis was prepared for the purpose of comparison with the present worth analyses presented in the *Salinity Management Program Phase 2 Technical Memorandum* [2]. A simple comparison of the results of these present worth analyses indicates that the present worth of the estimated costs of the proposed IEI are greater than the costs of other options considered in the Salinity Management Program.

However, various aspects of the proposed IEI distinguish this option from the other options considered in the Salinity Management Program. For example, as discussed in TM3 of this Appraisal Analysis, the proposed IEI has great potential as a tool for economic development in the San Gorgonio Pass and Coachella Valley areas along the route, making brine management infrastructure available to prospective employers in the area. This Economic Development Opportunity is unique to the proposed IEI among all the options considered and may significantly influence the benefits associated with this option, which may help to offset the estimated costs.

Furthermore, significant Opportunities are available for refinement of the conceptual designs for the proposed IEI presented in this Appraisal Analysis. Any of these Opportunities could result in reduction or elimination of certain costs included in the estimates presented in this TM4. For example, uncertainties related to appropriate water quality standards for discharges to the Salton Sea and to implementation of a restoration plan for the Sea help make the design criteria for the Water Quality Treatment Facility (TF) similarly uncertain. Reducing the scope of those uncertainties would help to verify the need for the TF, to determine appropriate TF design criteria, and to reduce the multiplier for contingencies. The estimated costs for the TF are a substantial portion of the total estimated costs for the proposed IEI; so reducing the scope of any uncertainties could significantly influence the total estimated costs for the proposed IEI.

Evaluation of Opportunities for refinement of the scope, design, estimated costs and anticipated benefits of a project is an incremental process. Each incremental step in this process often includes identification of appropriate “next steps” in the process. For the proposed IEI, the appropriate next steps are identified in this TM4 as Optimization Strategies. Suggested Optimization Strategies include performing further investigation of the Opportunities identified. Priority rankings are assigned to those Optimization

Strategies; but these priority rankings are subjective and loosely based on the potential influence on the estimated project costs and/or the value of anticipated benefits.

The Opportunities and the associated Optimization Strategies identified in this Appraisal Analysis are discussed on the following pages and summarized in **Table 17** located at the end of this section of this TM4. The suggested priorities for each Opportunity and for the associated Optimization Strategies are also identified in **Table 17**.

Economic Development Opportunities

As noted in TM3 of this Appraisal Analysis, the economic development potential associated with the proposed IEI is significant. The history of economic development in the Santa Ana Watershed demonstrates that brine management infrastructure is a valuable tool for economic development. Industrial facilities in the upper Santa Ana Watershed are major contributors of flow to the existing Brine Line. That history suggests that the proposed IEI, if implemented, would make similar brine management infrastructure available to prospective employers located in the San Gorgonio Pass and Coachella Valley areas.

Similarly, the proposed Gas Main Alignment traverses portions of the existing SAWPA service area that are not currently served by the existing Brine Line. The Gas Main Alignment is the primary alignment for SAW Alternative 2, which is identified in this TM4 as the least cost alternative for the Santa Ana Watershed portion of the proposed IEI.

Economic development in San Gorgonio Pass and Coachella Valley encouraged by availability of brine disposal infrastructure could also serve to facilitate efforts to restore the Salton Sea.

The other options considered in the Salinity Management Program would not significantly expand the SAWPA service area, nor extend infrastructure to provide service to areas within the existing SAWPA service area where it is not currently available. Nor would those other options influence efforts to restore the Salton Sea. Therefore, Economic Development Opportunities associated with the proposed IEI are unique to this option. Successful pursuit of those Economic Development Opportunities could offset some portion of the estimated costs of the proposed IEI, which could significantly alter the comparison of the IEI estimated costs with those of the other options considered in the Salinity Management Program.

The suggested Optimization Strategy for the Economic Development Opportunities is to perform an economic impact analysis for the proposed IEI. This economic impact analysis should be used to quantify the economic development benefits of the proposed IEI and used to refine the IEI estimated costs for comparison with the estimated costs of the other options considered in the Salinity Management Program.

Net Impact

If implemented, the proposed IEI would impact the Salton Sea in various ways, some of which may be considered beneficial and others negative. For example, the projected flows in the proposed IEI could provide a reliable new source of water to the Salton Sea. Though the projected IEI flows are small in comparison to the loss of water from the Sea to evaporation, they could offset a portion of the imbalance in the Salton Sea water budget.

The beneficial impacts from the increased supply of water to the Sea may offset or exceed the detrimental impacts from the increased salt load conveyed by the IEI flows. If so, the net impact of the proposed IEI flows on Salton Sea salinity would be beneficial. Conversely, if it were determined that the proposed IEI flows would have a net detrimental impact on salinity in the Salton Sea, appropriate measures should be incorporated into the IEI design to offset or mitigate for that impact (e.g. the EPF).

The suggested Optimization Strategy associated with the Net Impact of the proposed IEI is to perform a more detailed investigation of both beneficial and detrimental impacts of the proposed IEI on the Salton Sea. This investigation may include:

- Development or refinement of a water budget for the Salton Sea,
- Development or refinement of models for salinity and water quality in the Salton Sea,
- Modeling of the impact of the proposed IEI flows on salinity and water quality in the Salton Sea, and
- Evaluation of the influence of Salton Sea salinity and water quality regulatory requirements on the design and estimated costs of various components of the proposed IEI.

Salton Sea Restoration

As discussed in TM3 of this Appraisal Analysis, the Salton Sea is a terminal water body and, as such, no outlet is available for the salts, nutrients and other contaminants conveyed by water flowing into the Sea. It

is typical of such terminal water bodies in a desert environment that concentrations of these salts, nutrients and other contaminants accumulate are dynamic, increasing over time. Several plans have been proposed in recent years for restoration of the Salton Sea in response to both the deteriorating water budget imbalance and the deteriorating water quality. Implementation of any of these restoration plans has been impeded by the estimated costs, which contributes to significant uncertainties regarding salinity and water quality aspects of the proposed IEI. A clear understanding of how the low-salinity flows conveyed by the proposed IEI would influence TDS concentrations and other water quality parameters in the Salton Sea or in affected components of a Salton Sea restoration plan would help to reduce those uncertainties.

Similarly, resolution of uncertainties regarding specific components of Salton Sea restoration could facilitate design and construction of the proposed IEI in collaboration with corresponding components of the Salton Sea restoration plan. For example, the TF presented in this Appraisal Analysis for treatment of the IEI flows, if needed, could be developed in combination with the “habitat complex” included in proposed Salton Sea restoration plans as part of a hybrid facility. In this case, the proposed IEI flows could provide a reliable water supply to the habitat complex.

The suggested Optimization Strategy for the Opportunities associated with efforts to restore the Salton Sea is to investigate the likely impacts of implementation of restoration on planning and design development for the proposed IEI. This investigation would likely overlap with the Optimization Strategy for Net Impact discussed above and may include:

- Development or refinement of a water budget for the Salton Sea,
- Development or refinement of models for salinity and water quality in the Salton Sea,
- Modeling of the impact of the proposed IEI flows on salinity and water quality in the affected components of the Salton Sea restoration, and
- Evaluation of the influence of Salton Sea Restoration efforts on the design and estimated costs of various components of the proposed IEI.

Basin Plan

Similar to the uncertainties regarding Salton Sea restoration efforts, Salton Sea salinity and water quality regulatory requirements add to the uncertainties regarding the associated components of the proposed IEI. As discussed in TM3 of this Appraisal Analysis, evaluation of the impacts of the proposed IEI would be

based largely on standards established in the Colorado River Basin Region Basin Plan (Basin Plan). Approval of a Basin Plan Amendment will be required for implementation of the proposed IEI.

The suggested Optimization Strategy associated with the Basin Plan is to perform a more detailed investigation of the process and technical requirements for the necessary Basin Plan Amendment.

As also discussed in TM3 of this Appraisal Analysis, it should be noted that in an arid climate like that of the area tributary to the Salton Sea, water treated to Basin Plan standards would be a highly valued resource with many potential uses. The cost of treating water to those standards is significant, as demonstrated by the estimated costs for the TF and the EPF presented in this TM4. It is difficult to justify those costs for water intended for discharge to a surface water body with much higher salinity and poor water quality from which that water cannot be recovered for some other use. Any water supplies that comply with the requirements of the Basin Plan would certainly have greater value for potential uses other than discharge to the Sea. Therefore, the water quality standards established in the Basin Plan are a deterrent to any potential new sources of water to the Salton Sea and contribute to the uncertainties noted above regarding salinity and water quality aspects of the proposed IEI and the associated costs.

If new sources of water supply to the Salton Sea are to be encouraged in support of restoration efforts, then a change to the regulatory approach to Salton Sea salinity and water quality standards warrants serious consideration. Broad-based community support would certainly be necessary for such a change.

Stakeholder Partnering

The objective of the change suggested in this Appraisal Analysis to the regulatory approach to Salton Sea salinity and water quality standards is to reduce obstacles to potential new sources of water supply to the Salton Sea in support of restoration efforts. The influence of any such change would extend well beyond the scope of any single project; and community-based support for the change would enhance the likelihood of adoption. This circumstance represents an Opportunity for SAWPA to partner with other Salton Sea stakeholders.

The suggested Optimization Strategy associated with this Stakeholder Partnering Opportunity is to identify Salton Sea stakeholders and investigate opportunities for partnerships with those stakeholders. These Partnerships could help to develop specific proposals for the suggested regulatory changes, identify the benefits of the changes, and communicate those changes and benefits to the broader community. Potential

partners would likely include other organizations serving the San Gorgonio Pass, Coachella Valley areas, and/or other areas tributary to the Salton Sea, such as:

- Economic development organizations,
- Electric and other dry utilities providers,
- Irrigation districts,
- Other major water users or suppliers,
- Salton Sea stakeholders,
- Tribes,
- Water utilities,

Salton Sea Salinity

Though the projected TDS concentrations in the IEI flows (up to 6,800mg/L) are much lower than existing TDS concentrations in the Sea (approximately 48,000 mg/L). The salts in the IEI flows would add to the existing rate of accumulation of salts in the Sea. Whether the salts in the IEI flows would cause the TDS concentrations in the Sea to increase will depend on factors beyond the scope of this Appraisal Analysis, such as the magnitude of the Salton Sea water budget imbalance over time and progress toward implementation of a Salton Sea restoration plan.

The suggested Optimization Strategy for the Opportunities associated with Salton Sea Salinity is to investigate the likely influence of the proposed IEI flows on TDS concentrations in the Salton Sea. This investigation would likely overlap with the Optimization Strategies described for Net Impact and Salton Sea Restoration discussed above and for Salton Sea Water Quality discussed below and may include:

- Development or refinement of a water budget for the Salton Sea,
- Development or refinement of models for salinity and water quality in the Salton Sea,
- Modeling of the impact of the proposed IEI flows on salinity in the Salton Sea, and
- Evaluation of the influence of Salton Sea salinity regulatory requirements on the design and estimated costs of various components of the proposed IEI.

Salton Sea Water Quality

The Basin Plan is less specific about limitations on concentrations of TSS and BOD than it is for limits on TDS concentrations, but cites the EPA effluent standard for discharge of wastewater effluent to surface water for both TSS and BOD (30 mg/L). These parameters (TSS and BOD) correlate with or influence other water quality parameters for which specific standards are identified in the Basin Plan, including concentrations of turbidity, dissolved oxygen, and bacteria. As with TDS in the IEI flows discussed above, whether the TSS and/or BOD in the IEI flows would cause adverse impacts on the water quality in the Sea will depend on factors beyond the scope of this Appraisal Analysis, such as the magnitude of the Salton Sea water budget imbalance over time and progress toward implementation of a Salton Sea restoration plan.

The suggested Optimization Strategy for the Opportunities associated with Salton Sea Water Quality is to investigate the likely influence of the proposed IEI flows on TSS and BOD concentrations in the Salton Sea. This investigation would likely overlap with the Optimization Strategies described for Net Impact, Salton Sea Restoration, and Salton Sea Salinity discussed above and may include:

- Development or refinement of a water budget for the Salton Sea,
- Development or refinement of models for salinity and water quality in the Salton Sea,
- Modeling of the impact of the proposed IEI flows on water quality in the Salton Sea, and
- Evaluation of the influence of Salton Sea water quality regulatory requirements on the design and estimated costs of various components of the proposed IEI.

Brine Pre-treatment and Treatment Strategies

Six strategies for managing flows in the Brine Line system were addressed by CDM in the Salinity Management Program [2]. Four of those Options (2a, 2b, 3a and 3b) involve changes to the method and/or degree of treatment of Brine Line flows; and two of those Options (3a and 3b) involve pre-treatment of brine to reduce BOD loads prior to discharge to the Brine Line system.

Potential strategies for centralized treatment of the Brine Line (IEI) flows are presented in TM3 of this Appraisal Analysis as alternatives to the brine pre-treatment strategies discussed in the Salinity Management Program [2]. The Treatment Facility (TF) would use wastewater treatment ponds and constructed wetlands as a centralized treatment mechanism to reduce TSS and BOD concentrations in the flows prior to discharge to the Salton Sea.

The suggested Optimization Strategy for the Opportunities associated with Brine Pre-treatment and Treatment is to develop and evaluate alternative strategies for treatment of the IEI flows, based on results of Optimization Strategy for other Opportunities discussed above. This Optimization Strategy may include development of hybrid conceptual designs incorporating Salinity Management Program brine pre-treatment strategies in combination with alternative configurations of the wastewater treatment ponds and/or constructed wetlands that comprise the TF considered in this Appraisal Analysis.

Management of Surplus Energy

As discussed previously in this TM4, the estimated costs of the proposed energy recovery facilities have a significant influence on the estimated for all four CV Alternatives considered. The large costs associated with the proposed Turbine Generator Stations and the associated electric transmission facilities and higher pressure classes of pipe suggest that the time period necessary to recover the investment in those facilities would be long. The costs associated with removal of surplus energy from the flows in the proposed IEI could be reduced using an alternative approach (e.g. low-head in-line turbine generators or flow control devices). However, the benefits of the accompanying energy recovery or credit for the value of electricity produced would also be reduced or eliminated.

The suggested Optimization Strategy for the Opportunities associated with Management of Surplus Energy is to develop alternative conceptual designs using alternative approaches. This Optimization Strategy should include evaluation of estimated costs and associated credits and/or benefits (if any) of these alternative conceptual designs.

Other Opportunities

Other Opportunities exist to refine, reduce and/or eliminate costs identified in this TM4 for the proposed IEI. Examples of Other Opportunities and the suggested Optimization Strategy for each example include but are not limited to the following:

- **Synthetic Membrane Liners:** The synthetic membrane liner at the Water Quality Treatment Facility (and at the Evaporation Pond Facility) represents an Opportunity to reduce costs through investigation of alternatives as discussed in the section of this TM4 entitled “Water Quality Treatment Facility”.
- **Tunneling:** Alternative approaches to pipeline design and construction in selected areas (e.g. tunneling in lieu of direct bury through the Badlands west of the City of Beaumont along the Gas

Main Alignment) represents an Opportunity to refine costs through investigation of those alternatives. Tunneling in lieu of direct bury in an area like the Badlands could add construction cost but may reduce impacts associated with the project.

- **Phasing:** Phasing of project components (e.g. use of dual pipelines in Coachella Valley) represents an Opportunity to defer costs until warranted by the flows in the system. Identification of opportunities for phasing of project components and Present Worth analyses of the phased costs may lead to reduced total costs for the project.

Summary

As noted in the discussions on the pages above, some of the suggested Optimization Strategies overlap among some of the Opportunities identified. Therefore, the Opportunities and associated Optimization Strategies are summarized in **Table 17** on the next page.

Table 17 – Summary of Opportunities and Optimization Strategies

OPPORTUNITIES	PRIORITY	OPTIMIZATION STRATEGIES													
		Economic Impact Analysis	Salton Sea Water Budget	Salton Sea Salinity & Water Quality Model	IEI Influence on Salton Sea Salinity	IEI Influence on Salton Sea Water Quality	Influence on of Salton Sea on IEI Design	Basin Plan Amendment Process	Salton Sea Regulatory Approach	Identify, Investigate, & Initiate Partnerships	Hybrid Strategies for Brine Treatment	Alternative Conceptual Designs & Est. Costs	Investigate Alternative Liner Materials	Investigate Tunneling in Lieu of Direct Bury	Investigate Phasing of Improvements
		1	2	2	2	2	2	3	3	4	5	6	7a	7b	7c
Economic Development Opportunities	1	X													
Net Impact	2		X	X	X	X	X								
Salton Sea Restoration	2		X	X	X	X	X								
Basin Plan	3							X	X						
Stakeholder Partnering	4									X					
Salton Sea Salinity	2		X	X	X		X								
Salton Sea Water Quality	2		X	X		X	X								
Brine Pre-treatment and Treatment	5										X				
Management of Surplus Energy	6											X			
Other Opportunities	7												X	X	X

APPENDIX A – COST ESTIMATES

Santa Ana Watershed Alternatives

As discussed in the “Inland Empire Interceptor Alternatives in Santa Ana Watershed” section of this TM4, the estimated costs for each of the SAW Alternatives considered in this Appraisal Analysis are presented in **Table 18** on the pages that follow in this **Appendix A**.

Table 18 – Cost Estimate for Santa Ana Watershed Alternative 2
 (Sheet 1 of 4)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
PIPELINE BASE COST:						
Class 150 Pipe						
54" Diameter Conc Pipe Class 150 Pipe	186,874	LF	\$648.00	1.13	\$735.39	\$137,425,118
Subtotal, Class 150 Pipe	186,874	LF				\$137,425,118
Class 200 Pipe						
54" Diameter Conc Pipe Class 200 Pipe	33,800	LF	\$702.00	1.13	\$796.67	\$26,927,315
Subtotal, Class 200 Pipe	33,800	LF				\$26,927,315
Class 250 Pipe						
54" Diameter Conc Pipe Class 250 Pipe	16,818	LF	\$756.00	1.13	\$857.95	\$14,429,478
Subtotal, Class 250 Pipe	16,818	LF				\$14,429,478
Class 400 Pipe						
54" Diameter Conc Pipe Class 400 Pipe	3,746	LF	\$864.00	1.13	\$980.52	\$3,672,951
Subtotal, Class 400 Pipe	3,746	LF				\$3,672,951
SUBTOTAL, PIPELINE BASE COST	241,238	LF				\$182,454,862
ADDITIONAL PIPELINE COSTS:						
Easements & Rights-of-Way Acquisition						
Per LF of 100' Esmnt.	35,451	LF			\$57.00	\$2,020,707
Tunneling / Jack & Bore						
Jack and Bore 78" Diameter Steel Casing (54" Carrier Pipe)	2,900	LF			\$1,365.00	\$3,958,500
Subtotal, Micro-Tunneling / Jack & Bore	2,900	LF				\$3,958,500.00
Environmental Mitigation Areas						
Pipeline	14,100	LF			\$14.00	\$197,400
Parcels		Ac			\$6,000	\$0
Subtotal, Environmental Mitigation Areas						\$197,400.00
SUBTOTAL, ADDITIONAL PIPELINE COSTS						\$6,176,607
EXISTING PIPELINE ABANDONMENT COSTS:						
Existing 54-inch Pipeline Abandonment	110,880	LF			\$486.00	\$53,887,680

Table 18 – Cost Estimate for Santa Ana Watershed Alternative 2
 (Sheet 2 of 4)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
PUMP STATIONS:						
Pump Station 1-BL @ 1228 HP						
Pump Station	1,228	HP			\$7,337,991	\$7,337,991
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 1-BL						\$8,415,991
Pump Station 1-G @ 1228 HP						
Pump Station	1,228	HP			\$7,337,991	\$7,337,991
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 1-G						\$8,415,991
Pump Station 2-G @ 3193 HP						
Pump Station	3,193	HP			\$13,855,925	\$13,855,925
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 2-G						\$14,933,925
Pump Station 3-G @ 2292 HP						
Pump Station	2,292	HP			\$11,113,662	\$11,113,662
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	2	Mi			\$340,000	\$680,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 3-G						\$12,531,662
Pump Station 4-G @ 3029 HP						
Pump Station	3,029	HP			\$13,378,354	\$13,378,354
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	5	Mi			\$340,000	\$1,700,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 4-G						\$15,816,354

Table 18 – Cost Estimate for Santa Ana Watershed Alternative 2
 (Sheet 3 of 4)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
Pump Station 5-G @ 2784 HP						
Pump Station	2,784	HP			\$12,648,423	\$12,648,423
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	2	Mi			\$340,000	\$680,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 5-G						\$14,066,423
Pump Station 6-G @ 5363 HP						
Pump Station	5,363	HP			\$19,563,407	\$19,563,407
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	2	Mi			\$340,000	\$680,000
Pump Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal, Pump Station 6-G						\$20,981,407
SUBTOTAL, PUMP STATIONS	7	Ea				\$95,161,753
SUMMARY OF CONSTRUCTION COSTS:						
SUBTOTAL, PIPELINE BASE UNIT COST	241,238	LF				\$182,454,862
SUBTOTAL, ADDITIONAL PIPELINE COSTS						\$6,176,607
SUBTOTAL, EXISTING PIPELINE ABANDONMENT COSTS:	110,880	LF				\$53,887,680
SUBTOTAL, PUMP STATIONS	7	Ea				\$95,161,753
SUBTOTAL						\$337,680,902
DISTRIBUTIVE COSTS:					25%	\$84,420,226
CONTINGENCIES:					25%	\$84,420,226
TOTAL CONSTRUCTION COSTS						\$506,521,354

Table 18 – Cost Estimate for Santa Ana Watershed Alternative 2
 (Sheet 4 of 4)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
ANNUAL OPERATION & MAINTENANCE COSTS:						
Annual Pipeline O & M					1.50%	\$4,244,208
Annual Pump Station O & M					2.00%	\$2,854,853
Annual Pumping Power Cost						
Power Cost (per kWh)					\$0.10	
Motor Efficiency (typ.)					0.95	
Pump Station 1-BL @ 1228 HP						\$844,730
Pump Station 1-G @ 1228 HP						\$844,730
Pump Station 2-G @ 3193 HP						\$2,196,434
Pump Station 3-G @ 2292 HP						\$1,576,645
Pump Station 4-G @ 3029 HP						\$2,083,620
Pump Station 5-G @ 2784 HP						\$1,915,087
Pump Station 6-G @ 5363 HP						\$3,689,157
Subtotal						\$13,150,403
TOTAL OPERATION & MAINTENANCE COSTS						\$20,249,464

Coachella Valley Alternatives

As discussed in the “Inland Empire Interceptor Alternatives in San Gorgonio Pass & Coachella Valley” section of this TM4, the estimated costs for the CV Alternative B-1, which would serve the Expanded Service Area, are presented in **Table 19** on the pages that follow in this **Appendix A**.

Table 19 – Cost Estimate for CV Alternative B-1 (Expanded Service Area)
 (Sheet 1 of 5)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
PIPELINE BASE COSTS:						
Class 150 Pipe						
36" Diameter Conc Pipe Class 150 Pipe	77,021	LF	\$432.00	1.10	\$477.27	\$36,760,342
48" Diameter Conc Pipe Class 150 Pipe	165,640	LF	\$504.00	0.97	\$487.13	\$80,688,524
54" Diameter Conc Pipe Class 150 Pipe	83,000	LF	\$648.00	0.74	\$479.52	\$39,800,160
60" Diameter Conc Pipe Class 150 Pipe	8,597	LF	\$720.00	0.74	\$532.80	\$4,580,482
Subtotal, Class 150 Pipe	334,259	LF				\$161,829,507
Class 200 Pipe						
36" Diameter Conc Pipe Class 200 Pipe	9,376	LF	\$468.00	1.10	\$517.05	\$4,847,851
48" Diameter Conc Pipe Class 200 Pipe	9,360	LF	\$546.00	0.97	\$527.72	\$4,939,297
54" Diameter Conc Pipe Class 200 Pipe	0	LF	\$702.00	0.74	\$519.48	\$0
60" Diameter Conc Pipe Class 200 Pipe	0	LF	\$780.00	0.74	\$577.20	\$0
Subtotal, Class 200 Pipe	18,736	LF				\$9,787,148
Class 250 Pipe						
36" Diameter Conc Pipe Class 250 Pipe	9,376	LF	\$504.00	1.10	\$556.82	\$5,220,762
48" Diameter Conc Pipe Class 250 Pipe	0	LF	\$588.00	0.97	\$568.32	\$0
54" Diameter Conc Pipe Class 250 Pipe	0	LF	\$756.00	0.74	\$559.44	\$0
60" Diameter Conc Pipe Class 250 Pipe	0	LF	\$840.00	0.74	\$621.60	\$0
Subtotal, Class 250 Pipe	9,376	LF				\$5,220,762
Class 400 Pipe						
36" Diameter Conc Pipe Class 400 Pipe	15,227	LF	\$576.00	1.10	\$636.37	\$9,689,735
48" Diameter Conc Pipe Class 400 Pipe	0	LF	\$672.00	0.97	\$649.51	\$0
54" Diameter Conc Pipe Class 400 Pipe	0	LF	\$864.00	0.74	\$639.36	\$0
60" Diameter Conc Pipe Class 400 Pipe	0	LF	\$960.00	0.74	\$710.40	\$0
Subtotal, Class 400 Pipe	15,227	LF				\$9,689,735
SUBTOTAL, PIPELINE BASE COST	377,597	LF				\$186,527,152
ADDITIONAL PIPELINE COSTS:						
Easements & Rights-of-Way Acquisition						
Per LF of 100' Esmnt.	78,309	LF			\$57.00	\$4,463,613

Table 19 – Cost Estimate for CV Alternative B-1 (Expanded Service Area)
 (Sheet 2 of 5)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
Manholes						
60 in. Sq. Manhole for 36" Diameter Pipe	155	Ea			\$14,000	\$2,170,000
60 in. Sq. Manhole for 48" Diameter Pipe	333	Ea			\$14,000	\$4,662,000
60 in. Sq. Manhole for 54" Diameter Pipe	166	Ea			\$14,000	\$2,324,000
72 in. Sq. Manhole for 60" Diameter Pipe	17	Ea			\$17,000	\$289,000
	671	Ea				\$9,445,000
Tunneling / Jack & Bore						
Jack and Bore 60" Diameter Steel Casing (36" Carrier Pipe)	700	LF			\$1,050.00	\$735,000
Jack and Bore 72" Diameter Steel Casing (48" Carrier Pipe)	0	LF			\$1,155.00	\$0
Jack and Bore 78" Diameter Steel Casing (54" Carrier Pipe)	0	LF			\$1,365.00	\$0
Jack and Bore 84" Diameter Steel Casing (60" Carrier Pipe)	0	LF			\$1,470.00	\$0
Subtotal, Micro-Tunneling / Jack & Bore	700	LF				\$735,000
Environmental Mitigation Areas						
Pipeline	95,397	LF			\$14.00	\$1,335,558
Parcels		Ac			\$6,000	\$0
Subtotal, Environmental Mitigation Areas						\$1,335,558
SUBTOTAL, ADDITIONAL PIPELINE COSTS						\$15,979,171
TURBINE GENERATOR STATIONS:						
Turbine Generator Station 1-B @ 57.8 CFS & 70 FT of Head						
Turbine Generator Station	70	Ft			\$14,007,397	\$14,007,397
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$15,085,397

Table 19 – Cost Estimate for CV Alternative B-1 (Expanded Service Area)
 (Sheet 3 of 5)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
Turbine Generator Station 2-B @ 57.8 CFS & 640 FT of Head						
Turbine Generator Station	640	Ft			\$14,007,397	\$14,007,397
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$15,085,397
Turbine Generator Station 3-B @ 57.8 CFS & 220 FT of Head						
Turbine Generator Station	220	Ft			\$14,007,397	\$14,007,397
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	2	Mi			\$340,000	\$680,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$15,425,397
Turbine Generator Station 4-B @ 87.8 CFS & 355 FT of Head						
Turbine Generator Station	355	Ft			\$19,134,818	\$19,134,818
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$20,212,818
Turbine Generator Station 5-B @ 87.8 CFS & 140 FT of Head						
Turbine Generator Station	140	Ft			\$19,134,818	\$19,134,818
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	1	Mi			\$340,000	\$340,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$20,212,818

Table 19 – Cost Estimate for CV Alternative B-1 (Expanded Service Area)
 (Sheet 4 of 5)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
Turbine Generator Station 6-B @ 87.8 CFS & 145 FT of Head						
Turbine Generator Station	145	Ft			\$19,134,818	\$19,134,818
Electrical Service	1	Ea			\$570,000	\$570,000
Transmission Line	3	Mi			\$340,000	\$1,020,000
Turbine Generator Station Parcel	3.0	Ac			\$56,000	\$168,000
Subtotal						\$20,892,818
SUBTOTAL, TURBINE GENERATOR STATIONS	6	Ea				\$106,914,643
SUMMARY OF CONSTRUCTION COSTS:						
SUBTOTAL, PIPELINE BASE UNIT COST	377,597	LF				\$186,527,152
SUBTOTAL, ADDITIONAL PIPELINE COSTS						\$15,979,171
SUBTOTAL, TURBINE GENERATOR STATIONS	6	Ea				\$106,914,643
SUBTOTAL						\$309,420,966
DISTRIBUTIVE COSTS:					25%	\$77,355,241
CONTINGENCIES:					25%	\$77,355,241
TOTAL CONSTRUCTION COSTS						\$464,131,449

Table 19 – Cost Estimate for CV Alternative B-1 (Expanded Service Area)
 (Sheet 5 of 5)

Description	Quantity	Units	Pipeline Base Unit Cost	Weighted Location Cost Adj. Factor	Adjusted Unit Cost /Unit Price	Estimated Cost
ANNUAL OPERATION & MAINTENANCE COSTS:						
Annual Pipeline O & M					1.50%	\$4,556,392
Annual Turbine Generator Station O & M					2.00%	\$3,207,439
Annual Power Generation Credit						
Power Generation Credit (per kWh)					\$0.04	
Motor Efficiency (typ.)					0.95	
Turbine Generator Station 1-B @ 57.8 CFS & 70 FT of Head	70	Ft				\$114,114
Turbine Generator Station 2-B @ 57.8 CFS & 640 FT of Head	640	Ft				\$1,043,332
Turbine Generator Station 3-B @ 57.8 CFS & 220 FT of Head	220	Ft				\$358,645
Turbine Generator Station 4-B @ 87.8 CFS & 355 FT of Head	355	Ft				\$879,743
Turbine Generator Station 5-B @ 87.8 CFS & 140 FT of Head	140	Ft				\$346,941
Turbine Generator Station 6-B @ 87.8 CFS & 145 FT of Head	145	Ft				\$359,332
Subtotal						\$3,102,107
TOTAL O&M COSTS						\$4,661,725

Water Quality Treatment Facility Alternatives

As discussed in the “Water Quality Treatment Facility” section of this TM4, the estimated costs for TF Alternative 5-1, which would serve the Expanded Service Area, are presented in **Table 20** on the next page in this **Appendix A**.

Table 20 – Cost Estimate for Treatment Facility Alternative 5-1 (Expanded Service Area)

Description	Quantity	Units	Adjusted Unit Cost /Unit Price	Estimated Cost
WATER QUALITY TREATMENT FACILITY COSTS:				
Facultative Treatment Ponds				
Clear & Grub	1,434	Ac	\$4,400	\$6,309,600
Earthwork	1,434	Ac	\$16,000	\$22,944,000
50 mil Liner	1,434	Ac	\$47,500	\$68,115,000
Control Structures	1,434	Ac	\$35,000	\$50,190,000
Plumbing & Fencing	1,434	Ac	\$15,000	\$21,510,000
Water Quality Treatment Facility Land Cost	1,434	Ac	\$56,000	\$80,304,000
Subtotal, Facultative Treatment Ponds	1,434	Ac		\$249,372,600
Constructed Wetlands				
Clear & Grub	1,071	Ac	\$4,400	\$4,712,400
Earthwork	1,071	Ac	\$16,000	\$17,136,000
50 mil Liner	1,071	Ac	\$47,500	\$50,872,500
Plants & Planting	1,071	Ac	\$7,600	\$8,139,600
Control Structures	1,071	Ac	\$35,000	\$37,485,000
Plumbing & Fencing	1,071	Ac	\$15,000	\$16,065,000
Water Quality Treatment Facility Land Cost	1,071	Ac	\$56,000	\$59,976,000
Subtotal, Constructed Wetlands	1,071	Ac		\$194,386,500
SUMMARY OF CONSTRUCTION COSTS:				
Subtotal, Facultative Treatment Ponds	1,434	Ac		\$249,372,600
Subtotal, Constructed Wetlands	1,071	Ac		\$194,386,500
SUBTOTAL				\$443,759,100
DISTRIBUTIVE COSTS:			25%	\$110,939,775
CONTINGENCIES:			25%	\$110,939,775
TOTAL CONSTRUCTION COSTS				\$665,638,650
ANNUAL OPERATION & MAINTENANCE COSTS:				
Water Quality Treatment Facility O & M			1.50%	\$9,984,580
TOTAL OPERATION & MAINTENANCE COSTS				\$9,984,580

Present Worth Analysis

Present worth analyses for the combination of least cost alternatives that would serve the Expanded Service Area (Santa Ana Watershed (SAW) Alternative 2, Coachella Valley (CV) Alternative B-1 and TF Alternative 5-1) are presented in **Table 21** and **Table 22**, respectively, on the pages that follow in this **Appendix A**.

Table 21 – Present Worth Analysis for Least Cost Alternative (4.95% Inflation Rate)
 (Part 1 of 2, Sheet 1 of 4)

OCSD Rates (per SAW Salinity Management Plan)			
Description	Rate	Description	Rate
O&M Inflation Rate 1 (IR1):		O&M Inflation Rate 2 (IR2):	6.00%
Rate up to 2013 (IR12013)	10.00%	O&M Inflation Rate 3 (IR3):	3.00%
Rate at 2014(IR12014)	8.00%	Capital Inflation Rate 1 (CIR1):	4.95%
Rate at 2015(IR12015)	7.00%	Capital Inflation Rate 2 (CIR2):	10.00%
Rate up to 2020(IR12020)	5.40%	Interest Rate 1 (INTR1):	6.00%
Costs unchanged after 2020	0.00%	Interest Rate 2 (INTR2, est'd.):	6.25%

Calendar Year	2010 (n)	Flow (mgd)	OCSD CIP Sinking Fund	OCSD Treatment Capacity Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Treatment Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Maintenance Cost		2010 Present Worth (P/F, INTR1, n)	Capital + O&M Costs Per Year	2010 Capital + O&M Present Worth	2010 Cumulative Present Worth
				2010 Dollars	Inflated Cost (F/P, CIR1, n)		2010 Dollars	Inflated Cost (F/P, IR1, n)		2010 Dollars	Inflated Cost (F/P, IR2, n)				
2010	0	14.74	\$1,696,607	\$0	\$0	\$0	\$7,914,842	\$7,914,800	\$7,914,800	\$140,290	\$140,290	\$140,290	\$9,751,697	\$9,751,697	\$9,751,697
2011	1	15.09	\$1,696,607	\$0	\$0	\$0	\$8,103,853	\$8,914,200	\$8,409,623	\$140,290	\$148,707	\$140,290	\$10,759,514	\$10,246,520	\$19,998,217
2012	2	15.44	\$1,696,607	\$0	\$0	\$0	\$8,292,864	\$10,034,400	\$8,930,580	\$140,290	\$157,630	\$140,290	\$11,888,637	\$10,767,477	\$30,765,694
2013	3	15.80	\$1,696,607	\$0	\$0	\$0	\$8,481,875	\$11,289,400	\$9,478,798	\$140,290	\$167,088	\$140,290	\$13,153,095	\$11,315,695	\$42,081,389
2014	4	16.15	\$1,696,607	\$0	\$0	\$0	\$8,670,887	\$11,796,600	\$9,344,012	\$140,290	\$177,113	\$140,290	\$13,670,320	\$11,180,909	\$53,262,298
2015	5	16.50	\$1,696,607	\$0	\$0	\$0	\$8,859,898	\$12,426,500	\$9,285,804	\$140,290	\$187,740	\$140,290	\$14,310,847	\$11,122,701	\$64,384,999
2016	6	18.12	\$1,696,607	\$18,346,508	\$24,515,913	\$17,282,751	\$9,729,242	\$13,339,000	\$9,403,469	\$140,290	\$199,004	\$140,290	\$39,750,524	\$28,523,117	\$92,908,116
2017	7	19.74	\$1,696,607	\$18,346,508	\$25,729,451	\$17,111,554	\$10,598,586	\$15,315,500	\$10,185,682	\$140,290	\$210,944	\$140,290	\$42,952,502	\$29,134,133	\$122,042,249
2018	8	21.36	\$1,696,607	\$18,346,508	\$27,003,059	\$16,942,053	\$11,467,929	\$17,466,700	\$10,958,824	\$140,290	\$223,601	\$140,290	\$46,389,966	\$29,737,774	\$151,780,023
2019	9	22.98	\$1,696,607	\$18,346,508	\$28,339,710	\$16,774,231	\$12,337,273	\$19,805,400	\$11,722,786	\$140,290	\$237,017	\$140,290	\$50,078,734	\$30,333,914	\$182,113,936
2020	10	24.60	\$1,696,607	\$18,346,508	\$29,742,526	\$16,608,071	\$13,206,617	\$22,345,900	\$12,477,834	\$140,290	\$251,238	\$140,290	\$54,036,271	\$30,922,802	\$213,036,738
2021	11	26.21	\$1,696,607	\$18,346,508	\$31,214,781	\$16,443,557	\$14,075,961	\$22,345,900	\$11,771,541	\$140,290	\$266,312	\$140,290	\$55,523,600	\$30,051,995	\$243,088,733
2022	12	27.83	\$1,696,607	\$18,346,508	\$32,759,912	\$16,280,673	\$14,945,305	\$23,816,800	\$11,836,220	\$140,290	\$282,291	\$140,290	\$58,555,610	\$29,953,790	\$273,042,523
2023	13	29.45	\$1,696,607	\$18,346,508	\$34,381,528	\$16,119,402	\$15,814,649	\$25,287,800	\$11,855,907	\$140,290	\$299,229	\$140,290	\$61,665,163	\$29,812,206	\$302,854,730
2024	14	31.07	\$1,696,607	\$18,346,508	\$36,083,414	\$15,959,729	\$16,683,993	\$26,758,700	\$11,835,399	\$140,290	\$317,182	\$140,290	\$64,855,903	\$29,632,024	\$332,486,754
2025	15	32.69	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2026	16	32.81	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2027	17	32.93	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2028	18	33.05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2029	19	33.17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754

Table 21 – Present Worth Analysis for Least Cost Alternative (4.95% Inflation Rate)
 (Part 1 of 2, Sheet 2 of 4)

Calendar Year	2010 (n)	Flow (mgd)	OCSD CIP Sinking Fund	OCSD Treatment Capacity Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Treatment Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Maintenance Cost		2010 Present Worth (P/F, INTR1, n)	Capital + O&M Costs Per Year	2010 Capital + O&M Present Worth	2010 Cumulative Present Worth
				2010 Dollars	Inflated Cost (F/P, CIR1, n)		2010 Dollars	Inflated Cost (F/P, IR1, n)		2010 Dollars	Inflated Cost (F/P, IR2, n)				
2030	20	33.28	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2031	21	33.40	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2032	22	33.52	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2033	23	33.64	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2034	24	33.76	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2035	25	33.88	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2036	26	34.00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2037	27	34.12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2038	28	34.24	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2039	29	34.35	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2040	30	34.47	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2041	31	34.59	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2042	32	34.71	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2043	33	34.83	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2044	34	34.95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2045	35	35.07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2046	36	35.19	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2047	37	35.30	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2048	38	35.42	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2049	39	35.54	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2050	40	35.66	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2051	41	35.78	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2052	42	35.90	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2053	43	36.02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2054	44	36.14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2055	45	36.26	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2056	46	36.37	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2057	47	36.49	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2058	48	36.61	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2059	49	36.73	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754
2060	50	36.85	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$332,486,754

Table 21 – Present Worth Analysis for Least Cost Alternative (4.95% Inflation Rate)
 (Part 2 of 2, Sheet 3 of 4)

IEI Construction Cost Estimate =	\$1,636,291,452
Annual Const. Cost over 5 years =	\$327,258,290
O&M Cost Estimate =	\$34,895,769

One-time Sellback	Salton Sea Discharge
2010	\$370,443,080
2013	\$542,365,713
2014	\$585,754,971
2015	\$626,757,818
2020	\$815,272,540
2025	\$815,272,540

Average Flow	32.69 MGD
2010 Dollars	\$370,443,080
Inflation at 2025	\$815,272,540
2010 Present Worth	\$360,595,800

Calendar Year	2010 (n)	Capital Cost of IEI			IEI O&M Costs			Baseline Analysis Capital + O&M 2010 Present Worth	Capital + O&M 2010 Present Worth	Capital + O&M Cumulative Present Worth
		2010 Dollars	Inflated Cost (F/P, CIR2, n)	2010 Present Worth (P/F, INTR1, n)	2.0% of Const. Cost in 2010 Dollars	Inflated Cost (F/P, IR2, n)	2010 Present Worth (P/F, INTR2, n)			
2010	0	\$0	\$0	\$0	\$0	\$0	\$0	\$9,751,697	\$9,751,697	\$9,751,697
2011	1	\$0	\$0	\$0	\$0	\$0	\$0	\$10,246,520	\$10,246,520	\$19,998,217
2012	2	\$0	\$0	\$0	\$0	\$0	\$0	\$10,767,477	\$10,767,477	\$30,765,694
2013	3	\$0	\$0	\$0	\$0	\$0	\$0	\$11,315,695	\$11,315,695	\$42,081,389
2014	4	\$0	\$0	\$0	\$0	\$0	\$0	\$11,180,909	\$11,180,909	\$53,262,298
2015	5	\$0	\$0	\$0	\$0	\$0	\$0	\$11,122,701	\$11,122,701	\$64,384,999
2016	6	\$0	\$0	\$0	\$0	\$0	\$0	\$28,523,117	\$28,523,117	\$92,908,116
2017	7	\$0	\$0	\$0	\$0	\$0	\$0	\$29,134,133	\$29,134,133	\$122,042,249
2018	8	\$0	\$0	\$0	\$0	\$0	\$0	\$29,737,774	\$29,737,774	\$151,780,023
2019	9	\$0	\$0	\$0	\$0	\$0	\$0	\$30,333,914	\$30,333,914	\$182,113,936
2020	10	\$327,258,290	\$848,823,723	\$473,978,734	\$0	\$0	\$0	\$30,922,802	\$504,901,535	\$687,015,472
2021	11	\$327,258,290	\$933,706,096	\$491,864,724	\$0	\$0	\$0	\$30,051,995	\$521,916,719	\$1,208,932,191
2022	12	\$327,258,290	\$1,027,076,705	\$510,425,657	\$0	\$0	\$0	\$29,953,790	\$540,379,446	\$1,749,311,637
2023	13	\$327,258,290	\$1,129,784,376	\$529,687,002	\$0	\$0	\$0	\$29,812,206	\$559,499,208	\$2,308,810,845
2024	14	\$327,258,290	\$1,242,762,813	\$549,675,191	\$0	\$0	\$0	\$29,632,024	\$579,307,215	\$2,888,118,061
2025	15	\$0	\$0	\$0	\$34,895,769	\$54,366,470	\$21,897,627	\$0	(\$338,698,173)	\$2,549,419,888
2026	16	\$0	\$0	\$0	\$34,895,769	\$55,997,464	\$21,227,817	\$0	\$21,227,817	\$2,570,647,705
2027	17	\$0	\$0	\$0	\$34,895,769	\$57,677,388	\$20,578,496	\$0	\$20,578,496	\$2,591,226,201
2028	18	\$0	\$0	\$0	\$34,895,769	\$59,407,710	\$19,949,036	\$0	\$19,949,036	\$2,611,175,237
2029	19	\$0	\$0	\$0	\$34,895,769	\$61,189,941	\$19,338,830	\$0	\$19,338,830	\$2,630,514,068

Table 21 – Present Worth Analysis for Least Cost Alternative (4.95% Inflation Rate)
 (Part 2 of 2, Sheet 4 of 4)

Calendar Year	2010 (n)	Capital Cost of IEI			IEI O&M Costs			Baseline Analysis Capital + O&M 2010 Present Worth	Capital + O&M 2010 Present Worth	Capital + O&M Cumulative Present Worth
		2010 Dollars	Inflated Cost (F/P, CIR2, n)	2010 Present Worth (P/F, INTR1, n)	2.0% of Const. Cost in 2010 Dollars	Inflated Cost (F/P, IR2, n)	2010 Present Worth (P/F, INTR2, n)			
2030	20	\$0	\$0	\$0	\$34,895,769	\$63,025,640	\$18,747,290	\$0	\$18,747,290	\$2,649,261,357
2031	21	\$0	\$0	\$0	\$34,895,769	\$64,916,409	\$18,173,843	\$0	\$18,173,843	\$2,667,435,200
2032	22	\$0	\$0	\$0	\$34,895,769	\$66,863,901	\$17,617,937	\$0	\$17,617,937	\$2,685,053,138
2033	23	\$0	\$0	\$0	\$34,895,769	\$68,869,818	\$17,079,036	\$0	\$17,079,036	\$2,702,132,173
2034	24	\$0	\$0	\$0	\$34,895,769	\$70,935,913	\$16,556,618	\$0	\$16,556,618	\$2,718,688,791
2035	25	\$0	\$0	\$0	\$34,895,769	\$73,063,990	\$16,050,180	\$0	\$16,050,180	\$2,734,738,972
2036	26	\$0	\$0	\$0	\$34,895,769	\$75,255,910	\$15,559,234	\$0	\$15,559,234	\$2,750,298,205
2037	27	\$0	\$0	\$0	\$34,895,769	\$77,513,587	\$15,083,304	\$0	\$15,083,304	\$2,765,381,510
2038	28	\$0	\$0	\$0	\$34,895,769	\$79,838,995	\$14,621,933	\$0	\$14,621,933	\$2,780,003,442
2039	29	\$0	\$0	\$0	\$34,895,769	\$82,234,164	\$14,174,673	\$0	\$14,174,673	\$2,794,178,115
2040	30	\$0	\$0	\$0	\$34,895,769	\$84,701,189	\$13,741,095	\$0	\$13,741,095	\$2,807,919,211
2041	31	\$0	\$0	\$0	\$34,895,769	\$87,242,225	\$13,320,779	\$0	\$13,320,779	\$2,821,239,990
2042	32	\$0	\$0	\$0	\$34,895,769	\$89,859,492	\$12,913,320	\$0	\$12,913,320	\$2,834,153,310
2043	33	\$0	\$0	\$0	\$34,895,769	\$92,555,277	\$12,518,325	\$0	\$12,518,325	\$2,846,671,635
2044	34	\$0	\$0	\$0	\$34,895,769	\$95,331,935	\$12,135,411	\$0	\$12,135,411	\$2,858,807,046
2045	35	\$0	\$0	\$0	\$34,895,769	\$98,191,893	\$11,764,210	\$0	\$11,764,210	\$2,870,571,256
2046	36	\$0	\$0	\$0	\$34,895,769	\$101,137,650	\$11,404,364	\$0	\$11,404,364	\$2,881,975,620
2047	37	\$0	\$0	\$0	\$34,895,769	\$104,171,779	\$11,055,524	\$0	\$11,055,524	\$2,893,031,144
2048	38	\$0	\$0	\$0	\$34,895,769	\$107,296,933	\$10,717,355	\$0	\$10,717,355	\$2,903,748,500
2049	39	\$0	\$0	\$0	\$34,895,769	\$110,515,841	\$10,389,530	\$0	\$10,389,530	\$2,914,138,030
2050	40	\$0	\$0	\$0	\$34,895,769	\$113,831,316	\$10,071,733	\$0	\$10,071,733	\$2,924,209,763
2051	41	\$0	\$0	\$0	\$34,895,769	\$117,246,255	\$9,763,657	\$0	\$9,763,657	\$2,933,973,420
2052	42	\$0	\$0	\$0	\$34,895,769	\$120,763,643	\$9,465,004	\$0	\$9,465,004	\$2,943,438,423
2053	43	\$0	\$0	\$0	\$34,895,769	\$124,386,552	\$9,175,486	\$0	\$9,175,486	\$2,952,613,909
2054	44	\$0	\$0	\$0	\$34,895,769	\$128,118,149	\$8,894,824	\$0	\$8,894,824	\$2,961,508,733
2055	45	\$0	\$0	\$0	\$34,895,769	\$131,961,693	\$8,622,747	\$0	\$8,622,747	\$2,970,131,480
2056	46	\$0	\$0	\$0	\$34,895,769	\$135,920,544	\$8,358,992	\$0	\$8,358,992	\$2,978,490,472
2057	47	\$0	\$0	\$0	\$34,895,769	\$139,998,160	\$8,103,305	\$0	\$8,103,305	\$2,986,593,777
2058	48	\$0	\$0	\$0	\$34,895,769	\$144,198,105	\$7,855,440	\$0	\$7,855,440	\$2,994,449,217
2059	49	\$0	\$0	\$0	\$34,895,769	\$148,524,048	\$7,615,156	\$0	\$7,615,156	\$3,002,064,373
2060	50	\$0	\$0	\$0	\$34,895,769	\$152,979,770	\$7,382,221	\$0	\$7,382,221	\$3,009,446,594

Table 22 – Present Worth Analysis for Least Cost Alternative (17.6% Inflation Rate)
 (Part 1 of 2, Sheet 1 of 4)

OCSD Rates (per SAW Salinity Management Plan)			
Description	Rate	Description	Rate
O&M Inflation Rate 1 (IR1):		O&M Inflation Rate 2 (IR2):	6.00%
Rate up to 2013 (IR12013)	10.00%	O&M Inflation Rate 3 (IR3):	3.00%
Rate at 2014(IR12014)	8.00%	Capital Inflation Rate 1 (CIR1):	17.6%
Rate at 2015(IR12015)	7.00%	Capital Inflation Rate 2 (CIR2):	10.00%
Rate up to 2020(IR12020)	5.40%	Interest Rate 1 (INTR1):	6.00%
Costs unchanged after 2020	0.00%	Interest Rate 2 (INTR2, est'd.):	6.25%

Calendar Year	2010 (n)	Flow (mgd)	OCSD CIP Sinking Fund	OCSD Treatment Capacity Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Treatment Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Maintenance Cost		2010 Present Worth (P/F, INTR1, n)	Capital + O&M Costs Per Year	2010 Capital + O&M Present Worth	2010 Cumulative Present Worth
				2010 Dollars	Inflated Cost (F/P, CIR1, n)		2010 Dollars	Inflated Cost (F/P, IR1, n)		2010 Dollars	Inflated Cost (F/P, IR2, n)				
2010	0	14.74	\$1,696,607	\$0	\$0	\$0	\$7,914,842	\$7,914,800	\$7,914,800	\$140,290	\$140,290	\$140,290	\$9,751,697	\$9,751,697	\$9,751,697
2011	1	15.09	\$1,696,607	\$0	\$0	\$0	\$8,103,853	\$8,914,200	\$8,409,623	\$140,290	\$148,707	\$140,290	\$10,759,514	\$10,246,520	\$19,998,217
2012	2	15.44	\$1,696,607	\$0	\$0	\$0	\$8,292,864	\$10,034,400	\$8,930,580	\$140,290	\$157,630	\$140,290	\$11,888,637	\$10,767,477	\$30,765,694
2013	3	15.80	\$1,696,607	\$0	\$0	\$0	\$8,481,875	\$11,289,400	\$9,478,798	\$140,290	\$167,088	\$140,290	\$13,153,095	\$11,315,695	\$42,081,389
2014	4	16.15	\$1,696,607	\$0	\$0	\$0	\$8,670,887	\$11,796,600	\$9,344,012	\$140,290	\$177,113	\$140,290	\$13,670,320	\$11,180,909	\$53,262,298
2015	5	16.50	\$1,696,607	\$0	\$0	\$0	\$8,859,898	\$12,426,500	\$9,285,804	\$140,290	\$187,740	\$140,290	\$14,310,847	\$11,122,701	\$64,384,999
2016	6	18.12	\$1,696,607	\$18,346,508	\$48,528,553	\$34,210,715	\$9,729,242	\$13,339,000	\$9,403,469	\$140,290	\$199,004	\$140,290	\$63,763,164	\$45,451,081	\$109,836,079
2017	7	19.74	\$1,696,607	\$18,346,508	\$57,069,579	\$37,954,529	\$10,598,586	\$15,315,500	\$10,185,682	\$140,290	\$210,944	\$140,290	\$74,292,630	\$49,977,109	\$159,813,188
2018	8	21.36	\$1,696,607	\$18,346,508	\$67,113,825	\$42,108,044	\$11,467,929	\$17,466,700	\$10,958,824	\$140,290	\$223,601	\$140,290	\$86,500,733	\$54,903,765	\$214,716,953
2019	9	22.98	\$1,696,607	\$18,346,508	\$78,925,858	\$46,716,094	\$12,337,273	\$19,805,400	\$11,722,786	\$140,290	\$237,017	\$140,290	\$100,664,882	\$60,275,777	\$274,992,729
2020	10	24.60	\$1,696,607	\$18,346,508	\$92,816,809	\$51,828,421	\$13,206,617	\$22,345,900	\$12,477,834	\$140,290	\$251,238	\$140,290	\$117,110,554	\$66,143,152	\$341,135,881
2021	11	26.21	\$1,696,607	\$18,346,508	\$109,152,567	\$57,500,211	\$14,075,961	\$22,345,900	\$11,771,541	\$140,290	\$266,312	\$140,290	\$133,461,386	\$71,108,649	\$412,244,530
2022	12	27.83	\$1,696,607	\$18,346,508	\$128,363,419	\$63,792,687	\$14,945,305	\$23,816,800	\$11,836,220	\$140,290	\$282,291	\$140,290	\$154,159,117	\$77,465,803	\$489,710,334
2023	13	29.45	\$1,696,607	\$18,346,508	\$150,955,381	\$70,773,773	\$15,814,649	\$25,287,800	\$11,855,907	\$140,290	\$299,229	\$140,290	\$178,239,016	\$84,466,577	\$574,176,911
2024	14	31.07	\$1,696,607	\$18,346,508	\$177,523,527	\$78,518,827	\$16,683,993	\$26,758,700	\$11,835,399	\$140,290	\$317,182	\$140,290	\$206,296,017	\$92,191,123	\$666,368,034
2025	15	32.69	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2026	16	32.81	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2027	17	32.93	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2028	18	33.05	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2029	19	33.17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034

Table 22 – Present Worth Analysis for Least Cost Alternative (17.6% Inflation Rate)
 (Part 1 of 2, Sheet 2 of 4)

Calendar Year	2010 (n)	Flow (mgd)	OCSD CIP Sinking Fund	OCSD Treatment Capacity Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Treatment Cost		2010 Present Worth (P/F, INTR1, n)	OCSD O&M Maintenance Cost		2010 Present Worth (P/F, INTR1, n)	Capital + O&M Costs Per Year	2010 Capital + O&M Present Worth	2010 Cumulative Present Worth
				2010 Dollars	Inflated Cost (F/P, CIR1, n)		2010 Dollars	Inflated Cost (F/P, IR1, n)		2010 Dollars	Inflated Cost (F/P, IR2, n)				
2030	20	33.28	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2031	21	33.40	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2032	22	33.52	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2033	23	33.64	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2034	24	33.76	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2035	25	33.88	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2036	26	34.00	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2037	27	34.12	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2038	28	34.24	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2039	29	34.35	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2040	30	34.47	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2041	31	34.59	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2042	32	34.71	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2043	33	34.83	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2044	34	34.95	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2045	35	35.07	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2046	36	35.19	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2047	37	35.30	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2048	38	35.42	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2049	39	35.54	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2050	40	35.66	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2051	41	35.78	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2052	42	35.90	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2053	43	36.02	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2054	44	36.14	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2055	45	36.26	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2056	46	36.37	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2057	47	36.49	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2058	48	36.61	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2059	49	36.73	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034
2060	50	36.85	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$666,368,034

Table 22 – Present Worth Analysis for Least Cost Alternative (17.6% Inflation Rate)
 (Part 2 of 2, Sheet 3 of 4)

IEI Construction Cost Estimate =	\$1,636,291,452
Annual Const. Cost over 5 years =	\$327,258,290
O&M Cost Estimate =	\$34,895,769

One-time Sellback	Salton Sea Discharge
2010	\$370,443,080
2013	\$542,365,713
2014	\$585,754,971
2015	\$626,757,818
2020	\$815,272,540
2025	\$815,272,540

Average Flow	32.69 MGD
2010 Dollars	\$370,443,080
Inflation at 2025	\$815,272,540
2010 Present Worth	\$360,595,800

Calendar Year	2010 (n)	Capital Cost of IEI			IEI O&M Costs			Baseline Analysis Capital + O&M 2010 Present Worth	Capital + O&M 2010 Present Worth	Capital + O&M Cumulative Present Worth
		2010 Dollars	Inflated Cost (F/P, CIR2, n)	2010 Present Worth (P/F, INTR1, n)	2.0% of Const. Cost in 2010 Dollars	Inflated Cost (F/P, IR2, n)	2010 Present Worth (P/F, INTR2, n)			
2010	0	\$0	\$0	\$0	\$0	\$0	\$0	\$9,751,697	\$9,751,697	\$9,751,697
2011	1	\$0	\$0	\$0	\$0	\$0	\$0	\$10,246,520	\$10,246,520	\$19,998,217
2012	2	\$0	\$0	\$0	\$0	\$0	\$0	\$10,767,477	\$10,767,477	\$30,765,694
2013	3	\$0	\$0	\$0	\$0	\$0	\$0	\$11,315,695	\$11,315,695	\$42,081,389
2014	4	\$0	\$0	\$0	\$0	\$0	\$0	\$11,180,909	\$11,180,909	\$53,262,298
2015	5	\$0	\$0	\$0	\$0	\$0	\$0	\$11,122,701	\$11,122,701	\$64,384,999
2016	6	\$0	\$0	\$0	\$0	\$0	\$0	\$45,451,081	\$45,451,081	\$109,836,079
2017	7	\$0	\$0	\$0	\$0	\$0	\$0	\$49,977,109	\$49,977,109	\$159,813,188
2018	8	\$0	\$0	\$0	\$0	\$0	\$0	\$54,903,765	\$54,903,765	\$214,716,953
2019	9	\$0	\$0	\$0	\$0	\$0	\$0	\$60,275,777	\$60,275,777	\$274,992,729
2020	10	\$327,258,290	\$848,823,723	\$473,978,734	\$0	\$0	\$0	\$66,143,152	\$540,121,886	\$815,114,615
2021	11	\$327,258,290	\$933,706,096	\$491,864,724	\$0	\$0	\$0	\$71,108,649	\$562,973,373	\$1,378,087,988
2022	12	\$327,258,290	\$1,027,076,705	\$510,425,657	\$0	\$0	\$0	\$77,465,803	\$587,891,460	\$1,965,979,448
2023	13	\$327,258,290	\$1,129,784,376	\$529,687,002	\$0	\$0	\$0	\$84,466,577	\$614,153,580	\$2,580,133,027
2024	14	\$327,258,290	\$1,242,762,813	\$549,675,191	\$0	\$0	\$0	\$92,191,123	\$641,866,314	\$3,221,999,341
2025	15	\$0	\$0	\$0	\$34,895,769	\$54,366,470	\$21,897,627	\$0	(\$338,698,173)	\$2,883,301,168
2026	16	\$0	\$0	\$0	\$34,895,769	\$55,997,464	\$21,227,817	\$0	\$21,227,817	\$2,904,528,986
2027	17	\$0	\$0	\$0	\$34,895,769	\$57,677,388	\$20,578,496	\$0	\$20,578,496	\$2,925,107,482
2028	18	\$0	\$0	\$0	\$34,895,769	\$59,407,710	\$19,949,036	\$0	\$19,949,036	\$2,945,056,518
2029	19	\$0	\$0	\$0	\$34,895,769	\$61,189,941	\$19,338,830	\$0	\$19,338,830	\$2,964,395,348

Table 22 – Present Worth Analysis for Least Cost Alternative (17.6% Inflation Rate)
 (Part 2 of 2, Sheet 4 of 4)

Calendar Year	2010 (n)	Capital Cost of IEI			IEI O&M Costs			Baseline Analysis Capital + O&M 2010 Present Worth	Capital + O&M 2010 Present Worth	Capital + O&M Cumulative Present Worth
		2010 Dollars	Inflated Cost (F/P, CIR2, n)	2010 Present Worth (P/F, INTR1, n)	2.0% of Const. Cost in 2010 Dollars	Inflated Cost (F/P, IR2, n)	2010 Present Worth (P/F, INTR2, n)			
2030	20	\$0	\$0	\$0	\$34,895,769	\$63,025,640	\$18,747,290	\$0	\$18,747,290	\$2,983,142,638
2031	21	\$0	\$0	\$0	\$34,895,769	\$64,916,409	\$18,173,843	\$0	\$18,173,843	\$3,001,316,481
2032	22	\$0	\$0	\$0	\$34,895,769	\$66,863,901	\$17,617,937	\$0	\$17,617,937	\$3,018,934,418
2033	23	\$0	\$0	\$0	\$34,895,769	\$68,869,818	\$17,079,036	\$0	\$17,079,036	\$3,036,013,454
2034	24	\$0	\$0	\$0	\$34,895,769	\$70,935,913	\$16,556,618	\$0	\$16,556,618	\$3,052,570,072
2035	25	\$0	\$0	\$0	\$34,895,769	\$73,063,990	\$16,050,180	\$0	\$16,050,180	\$3,068,620,252
2036	26	\$0	\$0	\$0	\$34,895,769	\$75,255,910	\$15,559,234	\$0	\$15,559,234	\$3,084,179,486
2037	27	\$0	\$0	\$0	\$34,895,769	\$77,513,587	\$15,083,304	\$0	\$15,083,304	\$3,099,262,790
2038	28	\$0	\$0	\$0	\$34,895,769	\$79,838,995	\$14,621,933	\$0	\$14,621,933	\$3,113,884,723
2039	29	\$0	\$0	\$0	\$34,895,769	\$82,234,164	\$14,174,673	\$0	\$14,174,673	\$3,128,059,396
2040	30	\$0	\$0	\$0	\$34,895,769	\$84,701,189	\$13,741,095	\$0	\$13,741,095	\$3,141,800,491
2041	31	\$0	\$0	\$0	\$34,895,769	\$87,242,225	\$13,320,779	\$0	\$13,320,779	\$3,155,121,270
2042	32	\$0	\$0	\$0	\$34,895,769	\$89,859,492	\$12,913,320	\$0	\$12,913,320	\$3,168,034,591
2043	33	\$0	\$0	\$0	\$34,895,769	\$92,555,277	\$12,518,325	\$0	\$12,518,325	\$3,180,552,915
2044	34	\$0	\$0	\$0	\$34,895,769	\$95,331,935	\$12,135,411	\$0	\$12,135,411	\$3,192,688,326
2045	35	\$0	\$0	\$0	\$34,895,769	\$98,191,893	\$11,764,210	\$0	\$11,764,210	\$3,204,452,536
2046	36	\$0	\$0	\$0	\$34,895,769	\$101,137,650	\$11,404,364	\$0	\$11,404,364	\$3,215,856,900
2047	37	\$0	\$0	\$0	\$34,895,769	\$104,171,779	\$11,055,524	\$0	\$11,055,524	\$3,226,912,425
2048	38	\$0	\$0	\$0	\$34,895,769	\$107,296,933	\$10,717,355	\$0	\$10,717,355	\$3,237,629,780
2049	39	\$0	\$0	\$0	\$34,895,769	\$110,515,841	\$10,389,530	\$0	\$10,389,530	\$3,248,019,311
2050	40	\$0	\$0	\$0	\$34,895,769	\$113,831,316	\$10,071,733	\$0	\$10,071,733	\$3,258,091,044
2051	41	\$0	\$0	\$0	\$34,895,769	\$117,246,255	\$9,763,657	\$0	\$9,763,657	\$3,267,854,700
2052	42	\$0	\$0	\$0	\$34,895,769	\$120,763,643	\$9,465,004	\$0	\$9,465,004	\$3,277,319,704
2053	43	\$0	\$0	\$0	\$34,895,769	\$124,386,552	\$9,175,486	\$0	\$9,175,486	\$3,286,495,189
2054	44	\$0	\$0	\$0	\$34,895,769	\$128,118,149	\$8,894,824	\$0	\$8,894,824	\$3,295,390,013
2055	45	\$0	\$0	\$0	\$34,895,769	\$131,961,693	\$8,622,747	\$0	\$8,622,747	\$3,304,012,760
2056	46	\$0	\$0	\$0	\$34,895,769	\$135,920,544	\$8,358,992	\$0	\$8,358,992	\$3,312,371,752
2057	47	\$0	\$0	\$0	\$34,895,769	\$139,998,160	\$8,103,305	\$0	\$8,103,305	\$3,320,475,058
2058	48	\$0	\$0	\$0	\$34,895,769	\$144,198,105	\$7,855,440	\$0	\$7,855,440	\$3,328,330,497
2059	49	\$0	\$0	\$0	\$34,895,769	\$148,524,048	\$7,615,156	\$0	\$7,615,156	\$3,335,945,653
2060	50	\$0	\$0	\$0	\$34,895,769	\$152,979,770	\$7,382,221	\$0	\$7,382,221	\$3,343,327,874

APPENDIX B – SALT REMOVAL (EVAPORATION PONDS)

Background

The Water Quality Treatment Facility (TF) described in TM3 of this Appraisal Analysis would not be effective at removing TDS (salt) from the flows. If implementation of the Brine Pool proposed in the various Salton Sea restoration plans discussed in TM3 does not occur, and if removal of salt associated with the proposed IEI flows were deemed necessary, then a separate process would be necessary. Therefore, a conceptual design for a Salt Evaporation Pond Facility (EPF) is presented in Appendix C of TM3 as an alternative to the Brine Pool.

The large land area necessary for the Salt Evaporation Pond Facility (EPF) and the associated pumping costs suggest a location near the shore of the Salton Sea in an area with low land costs. The costs of acquisition of land necessary for the proposed EPF are not included in the estimated costs presented in this TM4.

Evaporation Pond Facility Conceptual Design

The publication entitled *Evaporation Pond Sizing with Water Balance and Make-up Water Calculations* [6] (EP Manual) from the Idaho National Engineering and Environmental Laboratory was used for conceptual design for this Salt Evaporation Pond Facility (EPF) as discussed in TM3. This manual also addresses estimated costs for construction and for operation and maintenance for evaporation ponds.

Alternatives Considered & Design Flows

Projections of average flows in the proposed IEI are addressed in TM2 of this Appraisal Analysis. Alternative flow projections are presented, both with and without projected flows from the potential service area expansion in the San Gorgonio Pass and Coachella Valley areas. The conceptual design for the EPF was developed using both sets of average flow projections.

A multiplier of 1.30 was applied to the calculated EPF surface areas to account for necessary buffers, containment berms, access roads, etc. This multiplier was not developed to include extra trains that could provide EPF capacity greater than the design flows.

The minimum surface area and the total area of the EPF are summarized for the average flow projection for the existing service area and the expanded service area in **Table 23** below.

Table 23 – Evaporation Pond Facility Area

	Avg. Flow (2060)	Process Water (48,000 mg/L)	Minimum EPF Surface Area	Minimum Total Area
	(MGD)	(AFY)	(Acres)	(Acres)
Existing SAWPA Service Area	32.1	5,091	920	1,196
Expanded Service Area	75.1	9,915	1,792	2,330

Evaporation Pond Facility Estimated Costs

As discussed in TM3 of this Appraisal Analysis, the proposed IEI flows would add to the existing rate of accumulation of salts in the Sea. A brine pool has been proposed as part of various Salton Sea restoration plans, which if implemented, would offer a reasonable solution for the accumulation of salts in the Salton Sea. However, implementation of a Salton Sea restoration plan with a brine pool has been impeded by the estimated costs; so an Evaporation Pond Facility (EPF) was described in the Appendix of TM3. If needed, the EPF could serve in lieu of the brine pool to remove salts attributable to the IEI flows from the Salton Sea. It would likely be located in a rural area with relatively low land costs near the shore of the Salton Sea.

The estimated costs presented in this TM4 for the EPF are based on the criteria described in the Idaho National Engineering and Environmental Laboratory publication *Evaporation Pond Sizing with Water Balance and Make-up Water Calculations* [6], which was used in TM3 for conceptual design, and (for consistency) on the EPA publications used for the TF: *Manual: Constructed Wetlands Treatment of Municipal Wastewaters* [4] and *Principles of Design and Operations of Wastewater Treatment Pond Systems for Plant Operators, Engineers and Managers* [5]. The estimated cost for the pump station at the EPF is based on the cost estimating criteria for Pump Stations described above. The estimated EPF land cost is based on the Land Cost estimating criteria described above. Like the other estimated costs presented in this TM4, these costs have been indexed to Year 2010.

The criteria used for developing the estimated costs for the various EPF alternatives under consideration in this Appraisal Analysis are summarized in **Table 24** below.

Table 24 – Evaporation Pond Facility Construction Costs Estimating Criteria

COMPONENT	ESTIMATING CRITERIA
Evaporation Pond Facility:	
Clearing & Grubbing	\$4,400 per acre
Earthwork	\$16,000 per acre
Liner	\$47,500 per acre
Control Structures	\$35,000 per acre
Plumbing & Fencing	\$15,000 per acre

Cost Estimates

The estimated costs for the EPF designed to treat flows from the proposed expanded service area (EPF Alternative 1) and from only the existing SAWPA service area (EPF Alternative 2) are summarized in **Table 25** below.

Table 25 – Summary of Costs of EPF

Description	EPF Alternative	
	1 (Expanded S.A.)	2 (Existing S.A.)
Construction Costs	\$330,034,208	\$170,912,613
Distributive Costs (25%)	\$82,508,552	\$42,728,153
Contingencies (25%)	\$82,508,552	\$42,728,153
Total Construction Costs	\$495,051,312	\$256,368,919
Annual O&M Costs	\$7,829,388	\$4,050,666

The estimated costs for the conceptual design developed in TM3 of this Appraisal Analysis for the EPF designed to treat flows from the proposed expanded service area (EPF Alternative 1) are presented in detail in **Table 26** on the next page.

Table 26 – Cost Estimate - Evaporation Pond Facility (Expanded Service Area)

Description	Quantity	Units	Adjusted Unit Cost /Unit Price	Estimated Cost
EVAPORATION POND FACILITY COSTS:				
Evaporation Ponds:				
Clear & Grub	2,330	Ac	\$4,400	\$10,252,000
Earthwork	2,330	Ac	\$16,000	\$37,280,000
50 mil Liner	2,330	Ac	\$47,500	\$110,675,000
Plumbing & Fencing	2,330	Ac	\$15,000	\$34,950,000
Evaporation Pond Facility Land Cost	2,330	Ac	\$56,000	\$130,480,000
E.P.F. Pump Station @ 517 HP:				
Pump Station Q	54,625	GPM		
Pump Station Head	30	Ft		
Pump Station Size	517	HP		
Pump Station Cost	517	HP	\$4,127,208	
Electrical Service	1	Ea	\$570,000	
Transmission Line	5	Mi	\$1,700,000	
Subtotal, E.P.F. Pump Station			\$6,397,208	\$6,397,208
Subtotal, Evaporation Pond Facility	2,330	Ac		\$330,034,208
SUMMARY OF CONSTRUCTION COSTS:				
Subtotal, Evaporation Ponds	2,330	Ac		\$323,637,000
Subtotal, E.P.F. Pump Station	517	HP		\$6,397,208
SUBTOTAL				\$330,034,208
DISTRIBUTIVE COSTS:			25%	\$82,508,552
CONTINGENCIES:			25%	\$82,508,552
TOTAL CONSTRUCTION COSTS				\$495,051,312
ANNUAL OPERATION & MAINTENANCE COSTS:				
Evaporation Pond Facility O & M			1.50%	\$7,281,833
Annual Pump Station O & M			2.00%	\$191,916
Annual Pumping Power Cost				
Power Cost (per kWh)			\$0.10	
Motor Efficiency (typ.)			0.95	
E.P.F. Pump Station @ 517 HP:				\$355,639
TOTAL OPERATION & MAINTENANCE COSTS				\$7,829,388