CITY OF LAS CRUCES

EAST MESA WATER RECLAMATION FACILITY – SOLAR PHOTOVOLTAIC FEASIBILITY STUDY

PRELIMINARY ENGINEERING REPORT

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The technical material and data contained in this Report were prepared under the supervision and direction of the undersigned, whose seal as a Professional Engineer, licensed to practice in the State of New Mexico, is affixed below.

12-23-13

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All questions about the meaning or intent of this document shall be submitted only to the Engineer of Record, stated above, in writing.

CITY OF LAS CRUCES, NEW MEXICO

EAST MESA WATER RECLAMATION FACILITY – SOLAR PHOTOVOLTAIC FEASIBILITY STUDY
PRELIMINARY ENGINEERING REPORT

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EXECUTIVE SUMMARY

The purpose of this Preliminary Engineering Report (PER) was to evaluate and recommend an alternative for a Solar (Photovoltaic, PV) System intended to provide power for the operation of the East Mesa Water Reclamation Facility (EMWRF) in the City of Las Cruces. Two alternatives were identified as feasible for implementation of the Solar project. Both would use the same type of equipment, with the main difference being the size or capacity of the system. Alternative 2 – 100kW Solar PV System (nominal size) consisted of two rows of solar PV panels, each sized to produce 50kW. This system size would be equivalent in size to the one currently installed at City Hall. Alternative 3 – 300kW Solar PV System (nominal size) consisted of six rows of 50kW solar PV panels. This system size was evaluated because it would offset both usage and demand charges over a year.

Table ES-1 shows a summary of the costs estimated for each of the two viable alternatives. The total project cost was estimated at $882,900 for Alternative 2 – 100kW Solar PV System, and $2,061,500 for Alternative 3 – 300kW Solar PV System.

TABLE ES-1
SUMMARY OF PROJECT COSTS AND PRESENT WORTH

Alternative	Construction Cost	Non-Construction Cost	Total Project Cost	Present Worth
Alternative 2 – 100kW Solar PV System	$ 746,300	$ 136,600	$ 882,900	$ 916,400
Alternative 3 – 300kW Solar PV System	$ 1,742,600	$ 318,900	$ 2,061,500	$ 2,128,400

Based on the results of an overall comparison which included cost and non-cost factors, **the recommended project is Alternative 3 – 300 kW Solar PV System.** The main advantages of this alternative are: easily expandable to up to 500 kW; maximizes Renewable Energy Certificate (REC) Credits cost-benefit; all power requirements for existing equipment at the EMWRF would be provided by solar; and greater positive environmental impact because all power needed to operate the facility would be supplied by “green” energy. The main

disadvantages of this selected alternative, compared to the other, are: more land requirements, and higher capital and present worth costs.

REC Credits for the proposed system size are estimated at $5,430.81 annually. EPE dependency is estimated to be reduced by approximately 9,165kWh for an estimated savings of $31,803.47.

1.0 PROJECT PLANNING

1.1 Location

The City of Las Cruces is located in the Mesilla Valley in southern New Mexico at the junction of Interstate 10 (I-10) and the southern terminus of Interstate 25 (I-25). The City is about 45 miles north of El Paso, TX, 225 miles south of Albuquerque, NM, and 275 miles east of Tucson, AZ.

The East Mesa Water Reclamation Facility (EMWRF) is located at 5150 E. Lohman Avenue, City of Las Cruces, Doña Ana County, New Mexico, on an approximately 10-acre tract, in State Lands. The land is leased to the City by the New Mexico State Land Office (NMSLO), under a 25-year contract in effect since July 2006. The facility collects wastewater from interceptors serving the East Mesa area south of US70. The effluent discharge (Outfall 001) is located at latitude 32°19'40" North and longitude 106°43'26" West. The purpose of this facility is to provide treatment to the sewage received and to produce Class 1A Reclaimed Wastewater for landscape irrigation of facilities such as golf courses, City parks, and large landscape areas located east of Interstate 25 (I-25). Figure 1-1 shows the project location.

1.2 Environmental Resources Present

An Environmental Information Document (EID) for the proposed project will be provided under separate cover.

1.3 Population Trends

For consistency purposes, and per the City's approval, the population projections included in this PER correspond to the ones included in the "Water and Wastewater Impact Fee Land Use Assumptions and Capital Improvements Plan 2011-2016" prepared by Duncan and Associates, 2012. For the reader's convenience, a copy of the data included in the reference document is provided in Appendix A of this Report. Table 1-1 shows the historical population growth from 2000 to 2010 for the City of Las Cruces and Doña Ana County. The population projection used in

the document prepared by Duncan and Associates is a linear trend in the midrange of the growth projection series presented in the *Vision 2040 Draft Regional Planning Document*. The City's population was projected to grow by 2,024 annually from 2011 to 2021. However, to cover the minimum 20-year period typically used for PERs, the projection has been expanded to year 2034, assuming the same linear trend and annual growth rate of 1.87%, as shown in Table 1-2.

TABLE 1-1

HISTORICAL POPULATION GROWTH 2000-2010

Year	City of Las Cruces		Doña Ana County
	CDD	US Census	
2000	73,539	73,539	174,682
2001	75,016	75,230	176,460
2002	76,352	76,697	178,473
2003	78,204	79,056	182,147
2004	81,057	81,252	184,935
2005	83,649	84,610	189,265
2006	87,697	87,744	193,779
2007	91,730	90,060	198,205
2008	93,910	91,865	201,428
2009	95,128	93,570	206,419
2010	96,994	97,618	209,233
Average	**2.81%**	**2.87%**	**1.82%**

Source: Duncan and Associates, 2012 (Table 5).

TABLE 1-2

POPULATION GROWTH 2011-2034

Year	Population	Year	Population
2011	99,443	2023	124,202
2012	101,303	2024	126,525
2013	103,197	2025	128,891
2014	105,127	2026	131,301
2015	107,093	2027	133,757
2016	109,095	2028	136,258
2017	111,135	2029	138,806
2018	113,214	2030	141,402
2019	115,331	2031	144,046
2020	117,487	2032	146,739
2021	119,684	2033	149,483
2022	121,922	2034	152,279

1.4 Community Engagement

In general, public perception about water conservation and reuse of high-quality treated wastewater is well-accepted in the community of Las Cruces due, among other reasons, to the scarcity of this resource in the arid Southwest. As part of the effort to preserve natural resources, the City constructed the EMWRF to substitute the use of potable water with reclaimed effluent mainly for irrigation of golf courses, parks, and other large water consumers. Currently, one of the largest costumers, the Sonoma Ranch Golf Courses, has been able to significantly decrease their irrigation well usage by utilizing EMWRF water.

The Solar Photovoltaic Study PER is intended to evaluate the alternatives to further pursue the application of environmentally-friendly technologies in the City. This project is not focused on water, but on alternative ("green") energy to substitute as much as possible the traditional electricity power supply needed for operation of the EMWRF. This project is also expected to be well-accepted by the community.

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East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

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Project Location Map

Figure 1-1

2.0 EXISTING FACILITIES

2.1 Location Map

Figure 2-1 provides a picture of the general project planning area and shows the location of the EMWRF, where the proposed Solar Photovoltaic Study would be located.

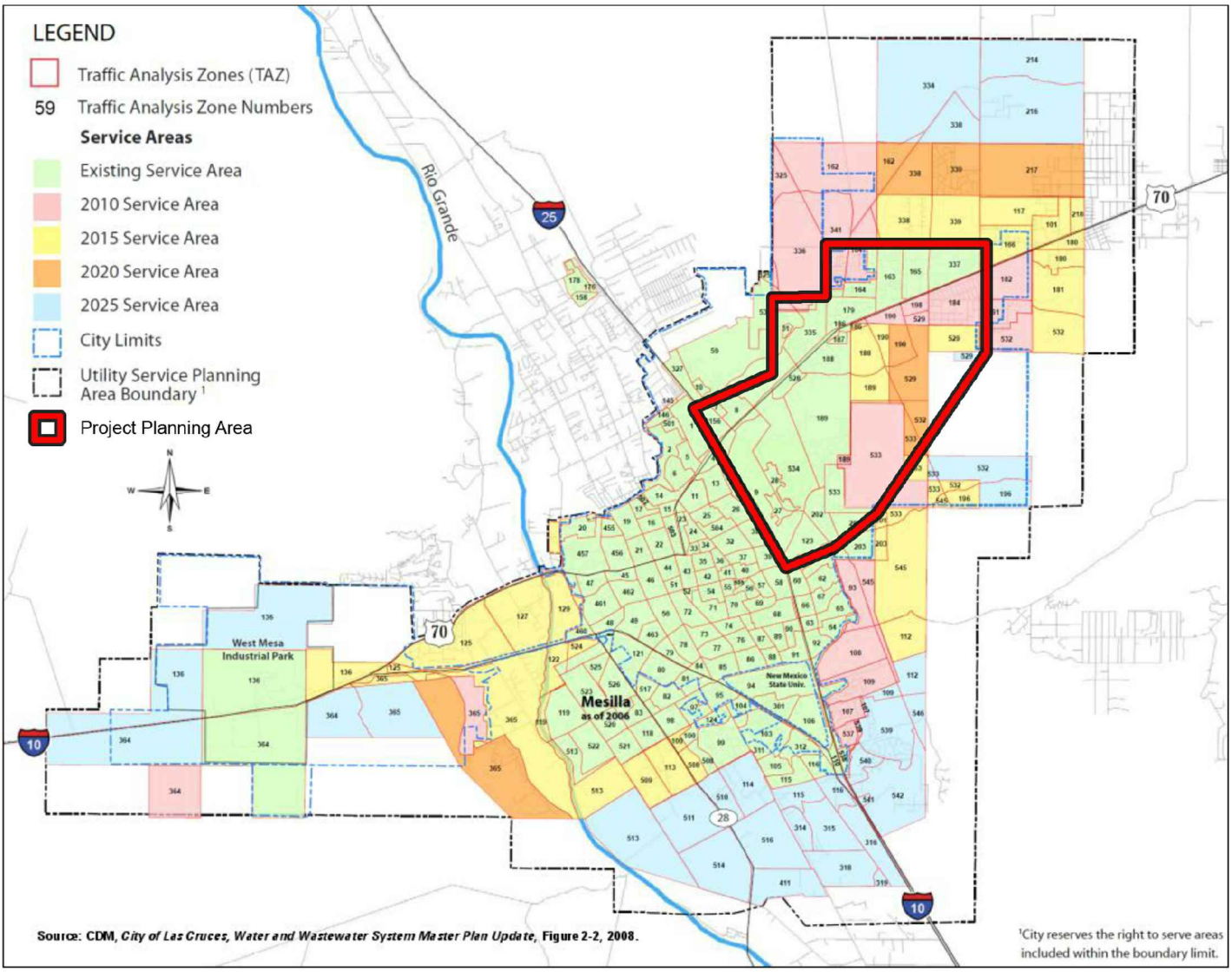
2.2 History

The East Mesa Water Reclamation Facility has a design flow capacity of 1.0 million gallons per day (MGD) and is classified as a major municipal discharger under the federal Clean Water Act, Section 402, of the National Pollutant Discharge Elimination System (NPDES) permit program. It is assigned NPDES permit number NM0030872, which regulates discharge of treated wastewater from Outfall 001. The City of Las Cruces also has a Ground Water Discharge Permit (GWDP) issued by the New Mexico Environment Department (NMED) for reuse of the treated effluent (reclaimed wastewater) for irrigation at City parks and other City facilities under NMED (NMED GWQB DP-1536). Other locations (i.e., golf course, restoration project behind the Las Cruces Dam), construction, and dust control utilize reuse under a different permit.

Construction of the facility was completed in December of 2009; it started operations in 2010 and was under warranty until April 2011. Prior to construction of this facility, wastewater from the east mesa side of Las Cruces was treated at the City's Jacob A. Hands Wastewater Treatment Facility (NPDES Permit No. NM0023311).

2.3 Condition of Existing Facilities

Conveyance of raw sewage to the EMWRF is through the sanitary sewer collection systems by both gravity flow and a forcemain. However, the collection system still allows wastewater to be diverted to the Jacob A. Hands Wastewater Treatment Plant, if needed. The EMWRF design capacity is 1.0 MGD, but it is currently receiving about 0.70 MGD. The layout of the existing facilities is shown in Figure 2-2.



East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

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Planning Area
Figure 2-1

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East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

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Existing Facilities
Figure 2-2

The treatment process at the new facility is marketed by Aero-Mod, under the commercial name of Sequox, which is a biological nutrient removal process for wastewater. Raw sewage is received at the entrance works, where it first passes through a mechanical drum screen with a 1/4-inch opening. An automatic spray system washes the screen with treated effluent (washwater). Screenings are collected in a dumpster for disposal at the landfill after passing the paint filter test.

The plant has two parallel treatment trains identified as east and west. Following pre-treatment and large solids removal, sewage flows to the anaerobic selector basin, where the wastewater can be directed to either of the two trains. After the selector, sewage flows to the first stage aeration basin, where nitrification occurs. The aeration tank is operated to control wastewater flow to the second stage basin for aerobic and anoxic cycles, where denitrification takes place. The mixed liquor suspended solids (MLSS) are maintained at a solids concentration between 1,300 to 1,500 mg/L. The solids, also known as sludge, are wasted (waste activated sludge, WAS) from the bottom of both the first and second stage basins to the sludge holding basin, which is referred to as an "aerobic digester" by the system manufacturer. Following the second stage basin, wastewater flows through an inlet screen to a rectangular clarifier basin.

The aeration and sludge holding basins have wall-mounted aerators supplied by a total of five air compressors/blowers. However, because of the current low flow condition, two blowers in operation are sufficient to run one treatment train. The blowers are alternated and rested on a regular cycle. Air lift pumps move the return activated sludge (RAS) to a trough that allows it to gravity flow back to the head of the biological process. Following the clarifier, flows are collected below the water's surface and through a regulating weir and orifice to a fine mesh disc filter unit contained in a separate enclosed basin. The clarifiers have "skimmers" that draw off floating solids, sending them back to the head of the plant. The operators also use net skimmers to pull off excess floating grease and solids. After filtration, the effluent passes over six pipe weirs and then to an enclosed channel to an ultraviolet (UV) disinfection system. A portable chlorine tablet system is available for disinfection purposes as a backup in the event that the UV

system fails. After disinfection, the flow is split into two trains: the two-million gallon (MG) tank for storage of reclaimed effluent, or to the NPDES-permitted Outfall 001 at the arroyo.

At the plant, there are two effluent flow meters: one for the discharge to the first side of the split to the holding tank/golf course pond, and one for the discharge to Outfall 001. Effluent that goes directly to the golf course and not into the storage tank is also measured further down the line. Storage of treated effluent is provided by the Sonoma Ranch Golf Course pond or by the storage tank located at the reclamation facility site. Any surplus reclaimed wastewater is discharged onto an adjacent natural drainage feature.

Since odor is a very sensitive issue with respect to the location of the facility, solids (WAS) are not processed at this site. Wasted sludge from the sludge holding basin is transported to the Jacob A. Hands WWTP in a 6,000 gallon truck. The solids from the two WWTPs are combined for processing. This combined sludge is then sent to the City of Las Cruces West Mesa Compost facility. The compost is made available to area residents for use. Odor control for the plant emissions has been implemented for the entrance works and the sludge holding basin.

The power needed to operate the equipment is currently supplied by El Paso Electric (EPE) Company. A diesel generator is used for backup power and is exercised once a week. Plant operations are monitored by the supervisory control and data acquisition (SCADA) system. The SCADA has a call-out alarm system, and it can also be monitored at the Jacob A. Hands WWTP, which has 24-hour staff coverage. Because this Solar Farm PER is intended to determine the size and best technology to supply solar power to the equipment used at the EMWRF, a summary description of the equipment using electricity is provided in Table 2-1.

TABLE 2-1

EXISTING FACILITIES AND EQUIPMENT AT THE EMWRF

Unit Operation or Equipment	Equipment Manufacturer	Motor Size or Power Requirements	Design Criteria	Comments
Rotary Drum Screens And Screenings Compactor	Rotary drum screens & washer compactor Model LFS-366 Liqui-Fuge Rotary Drum Screens and Model EWP-250/800 Washing Press manufactured by Vulcan Industries Inc.	Rotary drum screen motor 1 HP	– Two (2) screens; one (1) Washer/Compactor 1 – Sewage flow rate 4 mgd (2.7 mgd required) – Compactor capacity 99 cf/hr, (continuous operation)	– Rotary drum screens are used to screen raw pumped domestic sewage. The system consists of two rotary drum screens and a washer/compactor. – Each drum consists of a headbox, rotating drum cylinder, a 5-mm wedge wire screen, internal and external spray bar systems, and segmented flights for conveying screenings to an enclosed discharge chute, where the screenings exit into a washer/compactor.
Biological Nutrient Removal Process	Packaged biological nutrient removal (BNR) system by Aeromod. Blowers: three (3) Kaeser FB440C positive displacement.	Blowers: Two 60-HP positive displacement; a third blower kept on standby.	– The BNR system is designed to accept screened wastewater at an average daily flow of 1.0 mgd. – Design influent wastewater concentrations are: 5-day biochemical oxygen demand (BOD_5) 250 mg/l; total suspended solids (TSS) 320 mg/l, and ammonia nitrogen (NH_3-N) 50 mg/l. – At a mixed-liquor temp. of 15°C, the BNR process treats to BOD5, TSS, and NH_3-N to no more than 10 mg/l, 15 mg/l, and 1 mg/l, respectively. Effluent nitrate nitrogen (NO_3-N) does not exceed 6 mg/l.	– All internal pumping, including return activated sludge and waste-activated sludge pumping, is done by airlift pumps, with the process blowers supplying the air. – Blowers: Two blowers are sufficient to supply all air required for aeration, digestion, and airlift pumping, assuming an ambient air temperature of 100°F, and a site elevation of 4,200 ft MSL.

Unit Operation or Equipment	Equipment Manufacturer	Motor Size or Power Requirements	Design Criteria	Comments
Automatic Backwash Disk Filter	Hydrotech/ Kruger	Drive Motor (1 per unit) 1.5 HP, 460v, 3 phase Backwash Pump (1 per unit) 10 HP, 460v, 3 phase	– Initial Peak Flowrate, MGD 1.4 – Initial Avg. Flowrate, MGD 0.5 – Future Peak Flowrate, MGD 2.7 – Future Avg. Flowrate, MGD 1.0 – Max. Influent TSS*, mg/L 20 – Avg. Influent TSS*, mg/L 15 – Avg. Effluent TSS*, mg/L ≤3 – Max. Influent Turbidity*, NTU 9 – Avg. Effluent Turbidity*, NTU ≤2 – Filter Pore Size, µm 10 – Filter Cloth Material Woven Polyester – Backwash Pressure, psi 110 – Backwash Flowrate, gpm 55	– Automatic backwash filter system. – Each disk filter consists of a central drum onto which the disks with filter media are mounted. – The system is used for filtering domestic wastewater after secondary treatment and clarification. Each filter is designed to operate on a continuous basis and to operate while receiving varying flows. – Within the past year, five more discs have been added, bringing the system to full capacity.
UV Disinfection Equipment	GLOW-VCS-HO system manufactured by Glasco UV	Power requirement 230 volt, 3-phase, 3-wires, 60 hertz, 125.0 Amps	– Water Temperature Range: 60 to 85°F – Microorganism of interest: Fecal coliform bacteria – Flow Rate to 5-Bank System (with one on standby): Min. 0.01 mgd; Avg. 0.5 mgd; Peak 1.4 mgd – Flow Rate to future 7-Bank System (with one on standby): Min. 0.01 mgd; Avg. 1.0 mgd; Peak 2.7 mgd	– This system uses a total of four UV banks, with one on stand-by, to disinfect 1.4 MGD of influent. – The future addition of no more than two (2) identical banks to the same channel, will enable disinfection of 2.7 mgd.
Water Booster Pump	Grundfos Model CR 45-2-2	Pump motor 15 HP	– The packaged booster pump system uses constant speed pumps to maintain a pressure of 65 psig at 226 gpm when suction pressure is 0 psig. – The maximum duty point of each pump is 280 gpm @ 100’ TDH.	– The yard hydrant and drum screen booster pump package system pump treated water from the 2 MG storage tank to the plant yard hydrant system and drum screens. – Boosters added for additional capacity.

Unit Operation or Equipment	Equipment Manufacturer	Motor Size or Power Requirements	Design Criteria	Comments
Submersible Booster Pumps (Reclaimed Water Pumps)	Flygt Model NP-3153	Motor: 20 HP Motor Type: Submersible	– Location: Reclaimed Water Booster Station – Two (2) submersible, mounted on rails – Design capacity and head: 910 gpm @ 55' TDH. – Minimum hydraulic efficiency at design capacity: 80.8 % – Pump speed at design capacity (Max.): 1755 rpm	– The pumps are used to pump reclaimed water (plant effluent) from the UV system to the storage tank and from the storage tank to the distribution system as washwater.
Sludge Pumps (Digester Sludge Pumps)	Flygt Model NP-3085	Motor: 3 HP Motor Type: Submersible	– Location: Aerobic Digesters – Two (2) Submersible, mounted on rails. – Design capacity and head: 180 gpm @ 26' TDH – Pump speed at design capacity (Max.): 1710 rpm	– This pump is used for digested sludge.
Submersible Dewatering Pump (Discfilter Sump Pump)	Flygt Model SX-2	Motor: 0.33 HP Motor Type: Submersible	– Location: Discfilter – One (1) submersible – Design capacity and head: 57 gpm @ 33' TDH – Pump speed at design capacity (Max.): 3450 rpm	– This pump is used to pump backwash waste from the discfilter backwash sump to the aeration basins – ¼ hp motor replaced with 1/3 hp motor
Diesel Engine Driven Generator	Cummins No. DFEK, Caterpillar No. 500eKW	625 kVA (at 80% lagging power factor), 500 kW	– The engine generator has a standby power rating of 625 kVA at 80 percent lagging power factor, 500 kW, with 480 VAC/3□/60Hz, 4-wire, wye connected, solidly grounded, alternating current generator	– Skid mounted, diesel fuel fired, reciprocating engine driven generator set equipped with a sub-base fuel tank, sound attenuating weather-protective enclosure, and supporting systems.
Biofilter Motor	New York Blowers	1.3 hp	– Air handling of entrance works up to 5 air exchanges per hour	– Odor Control for Entrance Works
Control Process Compressors	Ingersoll Rand	Motor: 5 hp, qty: 2	– Maintenance of variable pressure for air handling	– Operate control valves for aeration in the Aeromod unit

Unit Operation or Equipment	Equipment Manufacturer	Motor Size or Power Requirements	Design Criteria	Comments
UV Compressor	Black & Decker	3 hp motor	– Wipes UV Lamps to remove buildup	– Original compressor replaced with unit from local home improvement store

2.3.1 Compliance with Current Permits

The existing facilities and equipment have been in operation only for about three (3) years and their operational condition is good. Between January 2012 and the present, the EMWRF facility has had only one (1) permit violation; this was with the state DP-1536. The violation for total nitrogen (TN) exceedance (permit limit is 10 mg/l) occurred on July 31, 2012 and was confirmed on August 13, 2012. It was the result of faulty dissolved oxygen measuring equipment and was corrected immediately. The first sample yielded a TN concentration of 10.5 mg/l, and the confirmation was 13.7mg/l. No violations have occurred with the NPDES permit.

2.3.2 Wastewater Flows

Figure 2-3 shows influent flows to the EMWRF for the period July 2012 to October 2013. The data shown are the average and maximum recorded in each month. The increase in flow is notable after June 2013, when it rose from about 0.26 MGD average day to a little over 0.66 MGD.

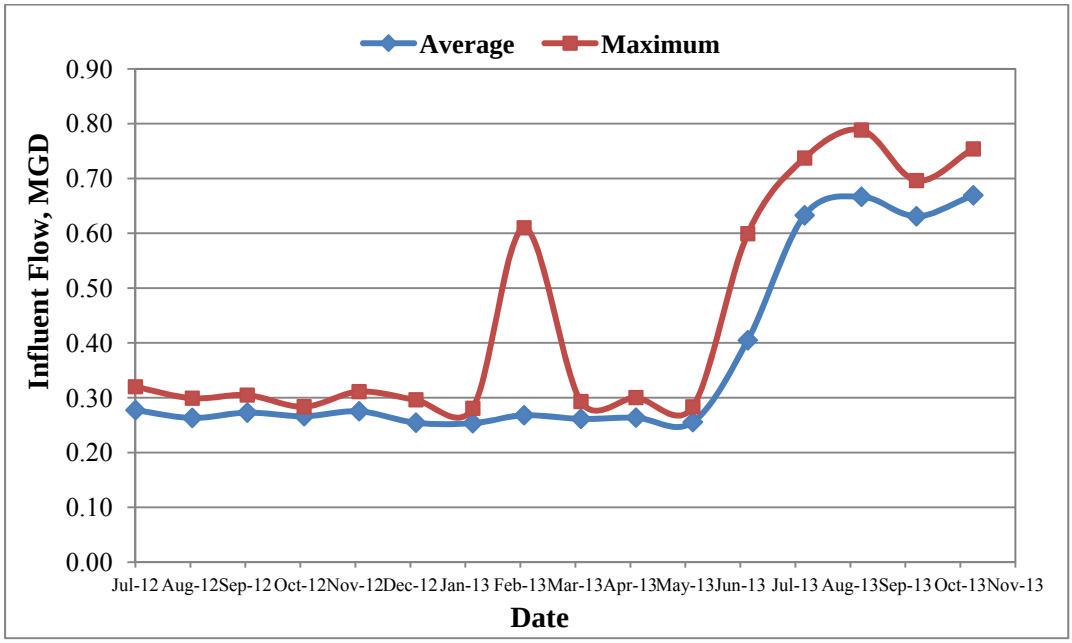

FIGURE 2-3

MONTHLY AVERAGE AND MAXIMUM INFLUENT FLOW

2.3.3 EMWRF Power Usage

Figure 2-4 shows the historical power usage at the EMWRF for the period April 2012 to September 2013. The average monthly usage is about 60,000 kilowatt-hours (kWh), the minimum 42,000 kWh, and the maximum 93,000 kWh.

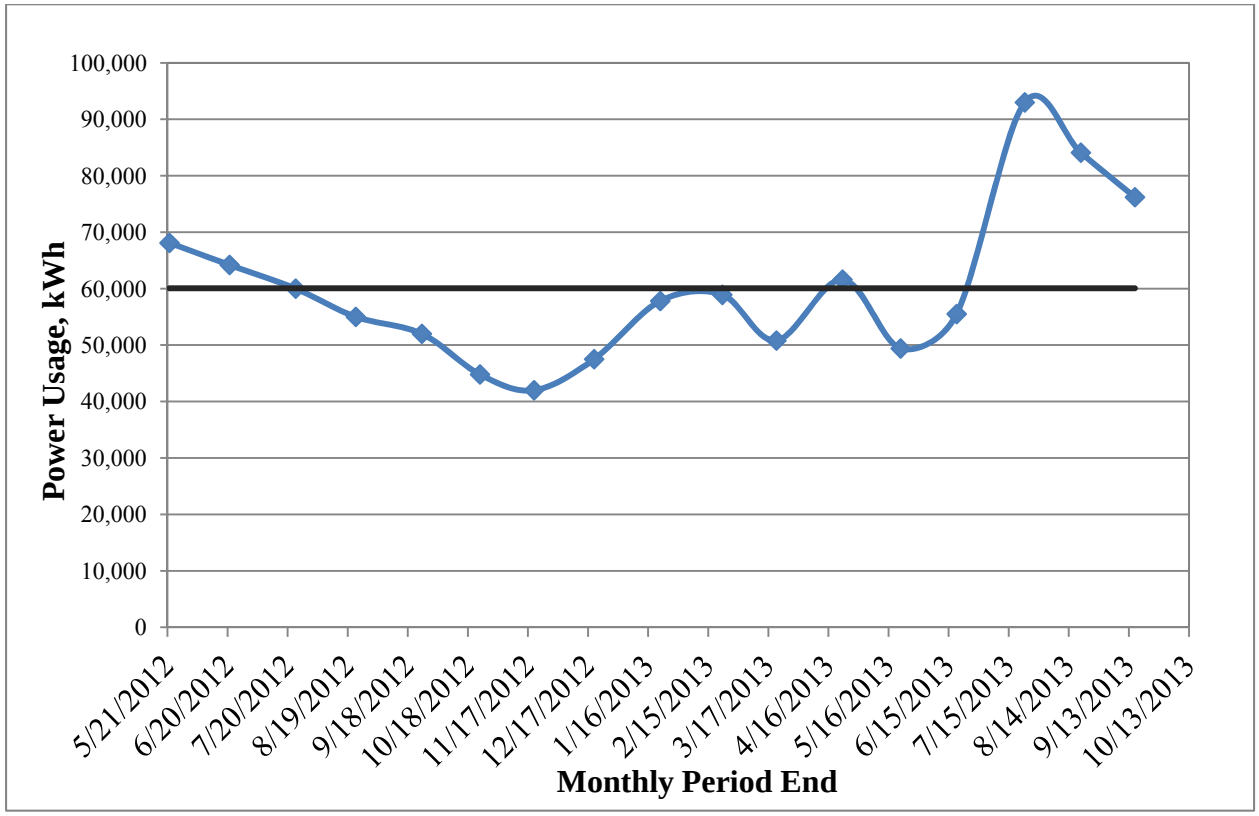

FIGURE 2-4

HISTORICAL MONTHLY POWER USAGE AT THE EMWRF

2.3.4 Wastewater Flows and Energy Consumption

A summary of monthly power usage (billing cycles vary), total influent flow to the EMWRF during the same period, and calculated power consumed per million gallon (MG) of influent treated is presented in Table 2-2. Based on the 14 months of data provided, the average power consumption per MG of influent treated at the facility is about 6,000 kWh. Figure 2-5 shows the relationship between influent flow and power usage at the EMWRF. The chart clearly shows that

as flow to the plant increases, power usage also increases. This trend is very likely related to having more blowers in service when flow increases to supply the oxygen needed for the biological treatment process.

TABLE 2-2

POWER USAGE, INFLUENT FLOW AND POWER CONSUMPTION PER VOLUME TREATED

Power Meter		Power Usage, kWh	Total Flow to WWTP, MG	kWh/MG Treated
Start Date	Stop Date			
7/25/2012	8/23/2012	55,000	8.68	6,333
8/24/2012	9/25/2012	52,000	9.09	5,722
9/26/2012	10/24/2012	44,800	7.87	5,694
10/25/2012	11/20/2012	42,000	7.45	5,635
11/21/2012	12/20/2012	47,500	7.83	6,064
12/21/2012	1/22/2013	57,800	8.18	7,070
1/23/2013	2/22/2013	58,900	8.29	7,105
2/23/2013	3/21/2013	50,800	7.13	7,123
3/22/2013	4/23/2013	61,600	8.59	7,168
4/24/2013	5/22/2013	49,400	7.37	6,706
5/23/2013	6/19/2013	55,500	8.83	6,285
6/20/2013	7/23/2013	93,000	19.87	4,680
7/24/2013	8/20/2013	84,100	19.02	4,421
8/21/2013	9/16/2013	76,200	17.04	4,471
	Minimum	42,000	7.13	4,421
	Maximum	93,000	19.87	7,168
	Average	60,053	10.37	6,034

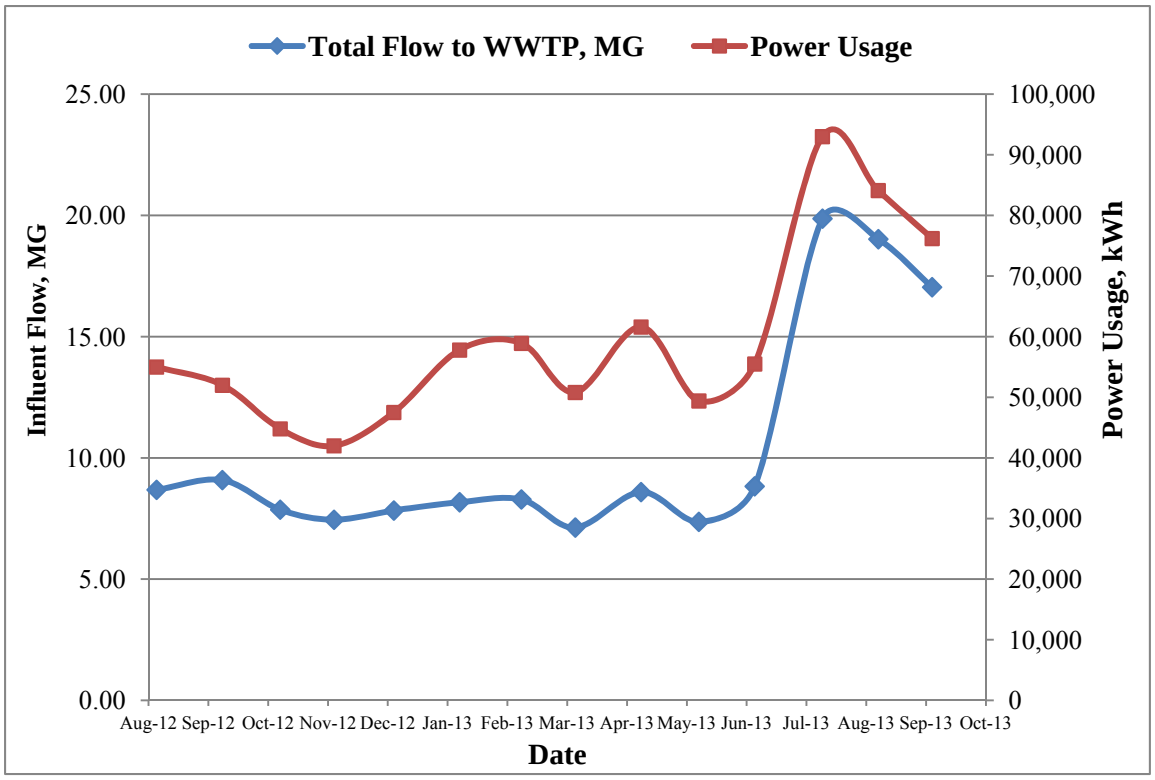

FIGURE 2-5

MONTHLY VOLUME TREATED AND CORRESPONDING POWER USAGE

2.4 Financial Status of Any Existing Facilities

The most recent available financial status information was provided by the City of Las Cruces as shown in Tables 2-3 and 2-4.

TABLE 2-3

FINANCIAL STATUS OF FACILITIES FUND 5420

FUND: Wastewater Water Reclamation Project Fund 5420	DIVISION: Utilities		
	FY 2011/12	FY 2012/2013	FY 2013/2014
RESOURCES			
Beginning Balance	$ 470,044	412,479	220,386
Revenues			
Miscellaneous Revenues	19,834	(19,087)	5,000
Operating Transfers In	832,855	884,248	873,170
Total Revenue	**$ 852,689**	**865,161**	**878,170**
Total Resources	**$ 1,322,733**	**1,277,640**	**1,098,556**
EXPENDITURES			
East Mesa Wastewater Reclam. Plant	356,002	262,363	545,429
Bond/Note Principal	166,251	170,777	170,147
Bond/Note Interest	376,259	353,432	364,725
Operating Transfers Out	0	0	0
Total Expenditures	**$ 898,512**	**786,572**	**1,080,301**
Accrual Adjustments	11,742	28,930	0
ENDING BALANCE	**$ 412.479**	**462,138**	**18,255**

*FY 2011/12: These are audited actuals.
*FY 2012/13: These are preliminary, unaudited actuals.
*FY 2013/14: This is our Revised Budget for the current Fiscal Year.

TABLE 2-4

FINANCIAL STATUS OF FACILITIES FUND 5450

FUND: Wastewater Capital Improvement Fund 5450	DIVISION: Utilities		
	FY 2011/12	**FY 2012/2013**	**FY 2013/2014**
RESOURCES Beginning Balance	$ 3,401,877	4,116,513	5,540,692
Revenues			
Miscellaneous Revenues	154,898	(195,963)	105,000
Federal Grants	0	0	321,000
Operating Transfers In	1,716,524	2,616,524	1,616,524
Total Revenue	**$ 1,871,422**	**2,420,561**	**2,042,524**
Total Resources	**$ 5,273,299**	**6,537,074**	**7,583,216**
EXPENDITURES			
Wastewater Administrative Services	14,150	222	52,305
WW J. Hands Treatment Plant Operations	70,666	46,435	100,000
Laboratory	0	0	0
WW Proj. & Grants – Water Recl. Booster	0	23,695	357,035
WW Proj. & Grants – Lab Bldg.	0	0	10,879
Wastewater Line Maintenance	41,340	46,273	0
840A0 – WW Septic Systems	76,660	106,572	267,800
84020 – WW Street Utility Rehab	594,538	725,118	1,500,000
84030 – WW Replace Lines and Manholes	35,829	82,699	310,000
84070 – WW Line Rehab Extension	100,000	37,810	103,000
84080 – WW Public Works Reimb. Cost	(20,563)	61,605	117,385
840J0 – WW Syst Ctrl & Data Acquisition	18,051	9,960	10,000
84063 – WW Treat. Plant Rehabilitation	120,646	233,476	3,073,815
84066 – WW Treat. Plant Odor Control	0	0	250,000
840G0 – WW Water Reclam. Project	105,468	470,000	221,094
84092 – WW Forcemain Rehab	0	0	235,000
840A1 – WW Septic Systems NMED	0	0	321,000
Operating Transfers Out	0	0	0
Total Expenditures	**$ 1,156,786**	**1,843,865**	**6,929,313**
Accrual Adjustments	0	0	0
ENDING BALANCE	**$ 4,116,513**	**4,693,209**	**653,903**

*FY 2011/12. These are audited actua1s.
*FY 2012/13: These are preliminary, unaudited actuals.
*FY 2013/14: This is our Revised Budget for the current Fiscal Year.

2.5 Water/Energy/Waste Audits

No audits have been performed at that EMWRF.

3.0 NEED FOR PROJECT

3.1 Health, Sanitation, and Security

Currently, all wastewater treatment facilities in the City of Las Cruces are operated with electrical power supplied by the company El Paso Electric (EPE). However, as the City is moving forward in the implementation of environmentally-friendly and more sustainable projects, such as water conservation and use of reclaimed wastewater for irrigation, evaluation of alternative energy sources is the next natural step. As a result, the purpose of this project is to evaluate and recommend an alternative for a Solar Photovoltaic Array intended to provide power for the operation of the East Mesa Water Reclamation Facility (EMWRF).

3.2 Aging Infrastructure

The EMWRF started operations in 2010. As such, the existing facilities and equipment are relatively new and in good operational condition. The EMWRF has an emergency generator on site to operate critical equipment during power outages.

The City is evaluating an alternative energy source to offset the power needed for the operation of the EMWRF not only for sustainability purposes, but because of the volatility of power rates that is expected to continue, or increase in the future, as fossil fuel resources are depleted. Solar power is considered to be the most reliable renewable energy source in the area, even during winter season. This renewable energy source will be evaluated to offset the current power consumption. The emergency generator will continue to be part of the existing facilities as a backup resource.

3.3 Reasonable Growth

Population projections are presented in Section 1.3. Figure 2-5, included in Section 2.0 of this PER, shows the relationship between the monthly volume of wastewater treated at the EMWRF and power usage. This PER will evaluate several solar photovoltaic array sizes for various load

reduction capabilities for the existing design capacity of the facility (1.0 MGD) and associated equipment.

4.0 ALTERNATIVES CONSIDERED

It is the City of Las Cruces' intention to install a solar photovoltaic (PV) system to interconnect to an El Paso Electric (EPE) Company grid system and to receive Renewable Energy Certificates (REC) credits for the electricity generated by the solar PV system at the East Mesa Water Reclamation Facility (EMWRF). Currently, the City has an Agreement with EPE for the purchase of REC credits for the power generated by the solar PV system installed at City Hall, which are estimated to be $16,900 per year. The City has initiated conversations with EPE for the purchase of RECs at $0.01/kWh. The REC rates are regulated by the Public Regulation Commission (PRC) and were established to encourage the use of alternative energy sources to reduce the demand on local utility power grids. The REC credits that the City will receive for the EMWRF will be dependent on the size (capacity) selected. Therefore, the objective of this Section of the PER will be to evaluate several facility sizes for various load reductions capabilities. Conversations and meetings between the City's representatives, the Consulting Engineer (Molzen Corbin) preparing the Preliminary Engineering Report (PER), and the Environmental Consultant (Terracon) preparing the Environmental Information Document (EID) have concluded that the best location for installation of the solar power facilities is within the existing property limits at the EMWRF site.

- **Power Demand and Facility Sizes**

  The existing Agreement with EPE Company at City Hall is for a 100 kW system. As such, one of the alternatives to be evaluated in this PER will be for the same capacity, 100 kW (nominal size). The other alternative to be evaluated was determined after reviewing the last 17 months of EPE electric bills for the EMWRF. This system size was selected to offset both usage and demand charges over a year and corresponds to a 300kW system (nominal size).

- **Solar Photovoltaic (PV) System Selection**

  The City of Las Cruces already has a solar PV system in operation, which provides power to City Hall. The PV Car Port Mount system was selected by the City among other reasons because of the following advantages:

- Local Support
- Local Representation
- Cost effectiveness of the system
- Reputable and long-standing equipment manufacturers

Even though there are several technologies and products available on the market, it is the City's desire to utilize the same solar panel and inverter products which have already been evaluated and are currently in use. Because the same electrical staff provides maintenance services for both City Hall and the EMWRF, this will facilitate maintenance by having the same manufacturer installed at both facilities; thus, reducing the learning curve for maintenance and operations.

- **Alternatives**

  The alternatives to be evaluated for the EMWRF Solar Photovoltaic Feasibility Study are:

  - Alternative 1 – No Action
  - Alternative 2 – 100 kW Solar PV System (Nominal Size)
  - Alternative 3 – 300 kW Solar PV System (Nominal Size)

4.1 Alternative 1 – No Action

Under this alternative, the EMWRF and related equipment would continue to be operated with electrical power supplied by EPE Company. However, due to potential future unknown rate increases by EPE Company and anticipated current and future interest in sustainable projects and implementation of "green energy" projects for operation of City facilities, Alternative 1 – No Action is not considered a viable option, and further analysis is not provided.

4.2 Alternative 2 – 100 kW Solar PV System (Nominal Size)

4.2.1 Description

This alternative consists of the installation of a solar PV array at a nominal 112 kW (DC) and 108 kW (AC). This system size would be comparable to the one currently installed at City Hall. Table 4-1 shows the estimated power produced, power usage, demand, and REC credits. **REC Credits are estimated at $1,815.84 annually.**

TABLE 4-1

POWER ESTIMATES
ALTERNATIVE 2 – 100kW SOLAR PV SYSTEM

	Module Count (333W each)	kW(DC)	Inverter Efficiency	kW(AC)
	336	112	96.0%	108

Month	kWH Produced	EPE Cost Usage	EPE Cost Demand	REC Credits
Jan	13,627	$ (2,443.38)	$ (1,406.50)	$ 136.27
Feb	13,654	$ (2,004.77)	$ (1,377.50)	$ 136.54
Mar	16,027	$ (2,459.57)	$ (1,464.50)	$ 160.27
Apr	16,498	$ (2,702.86)	$ (1,897.50)	$ 164.98
May	17,096	$ (2,734.97)	$ (2,070.00)	$ 170.96
Jun	15,469	$ (3,904.15)	$ (2,061.38)	$ 154.69
Jul	15,990	$ (3,426.23)	$ (2,087.25)	$ 159.90
Aug	15,887	$ (3,084.19)	$ (1,975.13)	$ 158.87
Sep	14,826	$ (1,617.70)	$ (1,218.00)	$ 148.26
Oct	15,615	$ (1,424.00)	$ (1,174.50)	$ 156.15
Nov	13,726	$ (1,822.78)	$ (1,218.00)	$ 137.26
Dec	13,169	$ (2,408.74)	$ (1,392.00)	$ 131.69
Yearly Totals		**$ (30,033.35)**	**$ (19,342.25)**	**$ 1,815.84**

4.2.2 Design Criteria

To maximize the production capability, calculations were performed at a 35-degree pitch and a 180-degree azimuth. Installation costs have been reduced by minimizing the grading required, utilization of aluminum conductors, and using a pile-driven ground-mounted system.

4.2.3 Map

Taking into consideration land requirements for future process expansion of the EMWRF, the land available immediately north of the existing basins will not be considered for installation of the solar PV system, as it is being reserved for construction of future wastewater treatment basins. Because of shadowing concerns due to the reclaimed effluent storage tank located to the

east side of the treatment plant, the land available just north of it has also been eliminated from consideration for installation of solar panels.

The sites that have been identified as adequate for installation of the 100 kW (nominal size) solar PV system are located east of the storage tank, which are the two rows shown in blue in Figure 4-1. Due to the small footprint of the 100 kW system, there will be plenty of space for installation of additional panels, if desired. Future pads available for expansion of the solar PV system are labeled as "Future Pad" in Figure 4-1. Each pad would have a nominal capacity of 50 kW.

4.2.4 Environmental Impacts

As previously mentioned, the solar PV system will be installed within the EMWRF property limits currently leased to the NMSLO. An Environmental Information Document (EID) was prepared for the entire facility site in December 2005. However, an updated EID will be prepared for the Solar Photovoltaic Feasibility Study and will be provided under separate cover. It is worth mentioning that during the preparation of this PER all potential environmental impacts have been discussed with the City's representatives and the Consultant preparing the EID, and these discussions have been taken into consideration for site selections.

4.2.5 Land Requirements

Land (footprint) requirements are one of the main factors driving the evaluation of potential sites available for installation of the solar PV system. As previously mentioned in Section 4.2.3, some locations have been identified as not suitable or available for this project for different reasons. With regard to Alternative 2 – 100 kW Solar PV System (Nominal Size), it has been determined that the best location for construction is east of the reclaimed water storage tank, as shown in Figure 4-1. The site dimensions required for installation of the 100 kW solar PV system are approximately 75 ft wide by 225 ft long, occupying an estimated area of 16,900 square feet. The land where the solar panels will be installed is leased by the City of Las Cruces to the NMSLO under a 25-year contract which expires in July 2031.

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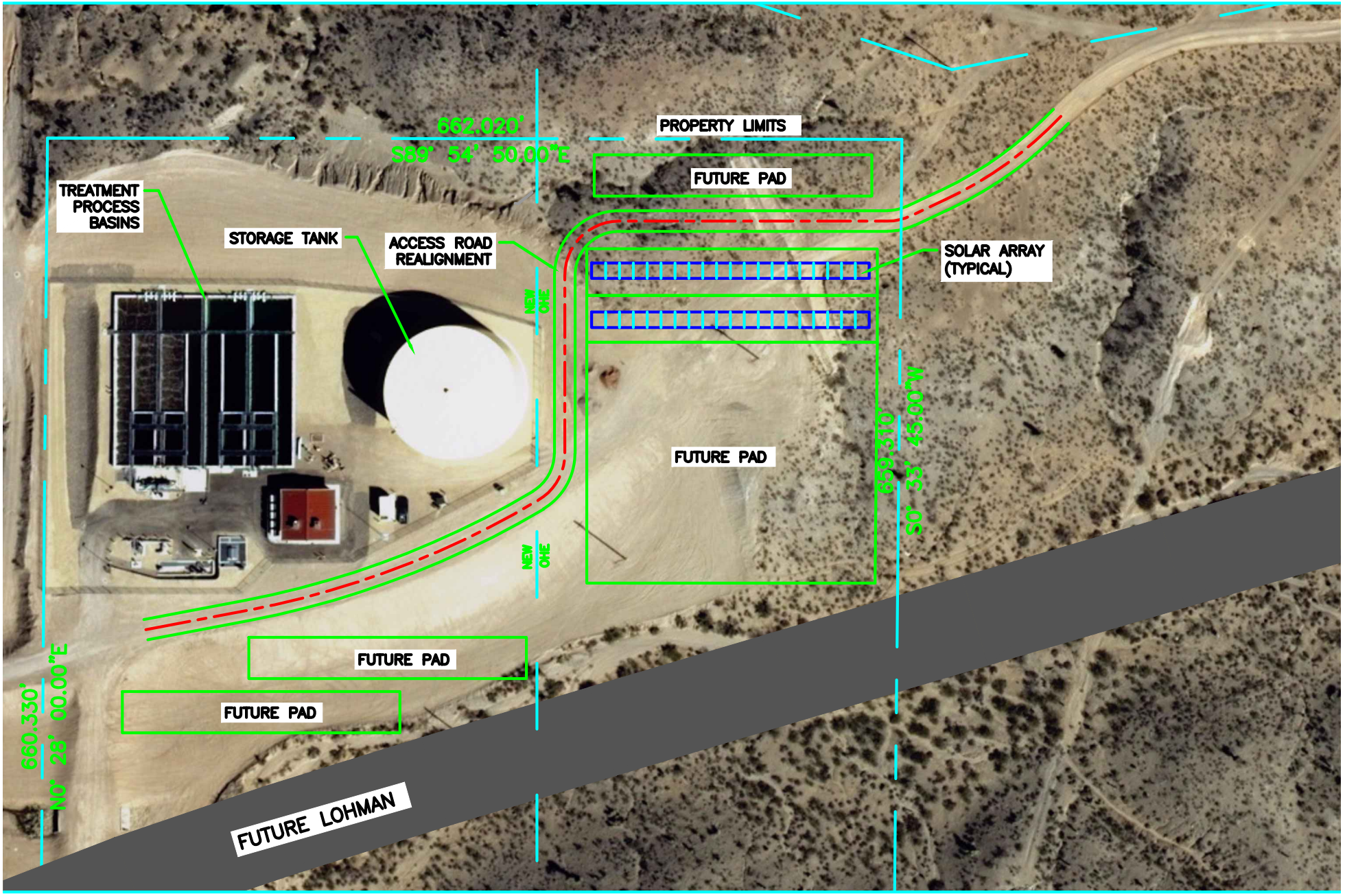

East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

MOLZENCORBIN

Figure 4-1 Alternative 2 - 100kW Solar PV System (Nominal Size)

4.2.6 Potential Construction Problems

In addition to the limited land available for this project, there are several other factors to take into consideration: 1) potential flooding, 2) arroyo crossing through the property, 3) future extension of Lohman Avenue, 4) topography of the remaining land available within the site, and 5) relocation of existing electrical utilities.

- **Potential flooding:** The site is not located within a FEMA designated flood zone. There is a flood zone north of the site, but it will not impact the EMWRF or the proposed solar PV system project. For more details, refer to the figure provided in Appendix B of this Report.
- **Arroyo crossing through the property:** There are minor localized arroyo flows through the site, south of the site where the solar PV would be installed. However, slope stabilization will be included to make sure pad sites do not encroach on the flow path of the arroyo.
- **Future extension of Lohman Avenue:** This will indeed affect the location for the solar PV system project because this route is planned to pass through the EMWRF site. Therefore, the system will be arranged to be installed on the north side of future Lohman Avenue. For more details regarding the extension of Lohman Avenue, please refer to the figure provided in Appendix B of this Report.

  Realignment of the existing access road will also be necessary for implementation of the solar PV system, as shown in Figure 4-1.
- **Topography:** With the exception of where the existing EMWRF is constructed and where future treatment facilities would be built (north of existing basins), the remaining land available for installation of the solar PV panels is slightly hilly. However, for the type of system proposed for this project, flat land is not strictly necessary. Earthwork will be included in the cost estimates.
- **Relocation of existing electrical utilities:** Current electrical lines include overhead and underground lines. A figure which shows existing lines is provided in Appendix C of this Report as a reference.

The overhead lines run diagonally from southwest to northeast of the plant, and they connect to the lines running east to west, below and above the site. The plan for the lines will be to intersect the lines south and north of the plant and run a new overhead line directly northwest, parallel to the storage tank.

The underground lines (which feed the EMWRF) run through the site, from east to west. The new overhead lines will be in closer proximity to the plant and will allow for the existing underground conductors to potentially be reutilized by EPE Company.

EPE Company requires a minimum 10-foot easement for both the overhead and underground lines, in addition to a 30-foot clearance on one side for service vehicles. This service clearance will be used for the rerouting of the service access road to the EPE Company substation, which currently runs adjacent to the existing power poles.

Storm Water Management Plan for City Departments

The City's design standards require that all construction plans comply with the requirements of Las Cruces Municipal Code Chapter 34-Drainage and Flood Control, Article III – Storm Water Management.

4.2.7 Sustainability Considerations

The EMWRF was designed to produce high-quality effluent, which is currently being used for irrigation of a golf course and other facilities, thus reducing potable water uses for irrigation. The solar PV system – the subject of this study – is another effort towards sustainability which the City of Las Cruces is interested in implementing. It is intended to generate "green" energy from a renewable source for operation of the equipment currently installed at the EMWRF. Alternative 2 – 100 kW Solar PV System (Nominal Size) would be capable of producing enough power to operate approximately one-third of the facilities equipment on average and would offset the yearly power usage and demand charge by approximately one-fourth.

4.2.8 Cost Estimates

Table 4-2 presents the Engineer's Opinion of Cost for Alternative 2 – 100 kW Solar PV System (Nominal Size). The total construction cost is estimated at $739,800, including contingencies at 20% and New Mexico Gross Receipts Taxes (NMGRT). Non-construction costs, including Professional Engineering Services (design), permitting assistance, inspection, surveying services, and NMGRT are estimated at $127,000. The estimated total project cost for this alternative is $882,900 in today's dollars. A detailed cost estimate is provided in Appendix D of this Report. Table 4-3 shows an estimate of the annual operation and maintenance (O&M) cost for this alternative. The annual O&M cost is estimated to be $1,817.

TABLE 4-2

ENGINEER'S OPINION OF COST
ALTERNATIVE 2 – 100kW SOLAR PV SYSTEM

Item	Amount
General Civil Work	$112,500
Electrical (Incl. PV panels, panel rack, cables, conduit, etc.)	$381,000
Site Improvements (5%)	$24,700
Relocation of EPE Utilities	$35,000
Electrical Service Allowance	$10,000
Testing Laboratory Service	$15,000
Subtotal	**$578,200**
Construction Contingencies @ 20%	$115,600
Subtotal	$693,800
NMGRT @ 7.5625%	$52,500
Total Construction Costs	**$746,300**
Professional Engineering Services (8.3%)	$57,600
Permitting, Inspection, Surveying Services (10%)	$69,400
Subtotal	$127,000
NMGRT @ 7.5625%	$9,600
Total Professional Engineering Services	**$136,600**
TOTAL PROJECT COST	**$882,900**

TABLE 4-3

ENGINEER'S OPINION OF ANNUAL O&M COST
ALTERNATIVE 2 – 100kW SOLAR PV SYSTEM

Item	Estimated Cost
Visual Inspection (Twice per year)	$ 1,392
Array Cleaning	$ 425
Total Annual O&M Cost	**$ 1,817**

Table 4-4 shows a summary of yearly charges by EPE Company without and with a 100 kW solar PV system in service, which are estimated to be -$56,697.59 and -$47,559.76, respectively. Adding the $1,817 annual O&M for the PV system to the charges incurred when the system is in operation, the difference in EPE charges, or in other words, **the savings in EPE usage, are calculated at $7,320.83.**

TABLE 4-4

EPE COMPANY CHARGES WITHOUT AND WITH IMPLEMENTATION OF ALTERNATIVE 2 – 100kW SOLAR PV SYSTEM

Month	EPE Charges Without PV System	EPE Charges With PV System (including RECs)
Jan	$ 4,585.33	$ 3,713.61
Feb	$ 4,119.18	$ 3,245.73
Mar	$ 4,789.05	$ 3,763.80
Apr	$ 5,068.24	$ 4,435.38
May	$ 5,300.10	$ 4,634.01
Jun	$ 6,190.08	$ 5,810.84
Jul	$ 5,840.86	$ 5,353.58
Aug	$ 5,434.60	$ 4,900.44
Sep	$ 3,635.86	$ 2,687.44
Oct	$ 3,441.24	$ 2,442.35
Nov	$ 3,781.58	$ 2,903.52
Dec	$ 4,511.47	$ 3,669.05
Yearly Totals	**$ 56,697.59**	**$ 47,559.76**

4.3 Alternative 3 – 300 kW Solar PV System (Nominal Size)

4.3.1 Description

This alternative consists of the installation of a solar PV system large enough to produce approximately 300 kW (nominal size), which has been estimated to be sufficient to power existing equipment needed for operation of the EMWRF at design capacity (1.0 MGD).

Table 4-5 shows the estimated power produced, power usage, demand, REC credits, and net operating electrical cost. **REC Credits are estimated at $5,430.81 annually.**

TABLE 4-5

POWER ESTIMATES
ALTERNATIVE 3 – 300kW SOLAR PV SYSTEM

	Module Count (333W)	kW(DC)	Inverter Efficiency	kW(AC)
	1008	336	96.0%	323
	kWH	EPE Cost		REC Credits
Month	Produced	Usage	Demand	
Jan	40,757	$ (979.18)	$ (1,406.50)	$ 407.57
Feb	40,837	$ (537.70)	$ (1,377.50)	$ 408.37
Mar	47,933	$ (737.61)	$ (1,464.50)	$ 479.33
Apr	49,343	$ (601.77)	$ (1,897.50)	$ 493.43
May	51,130	$ (557.82)	$ (2,070.00)	$ 511.30
Jun	46,265	$ (1,934.13)	$ (2,061.38)	$ 462.65
Jul	47,823	$ (1,389.88)	$ (2,087.25)	$ 478.23
Aug	47,513	$ (1,061.07)	$ (1,975.13)	$ 475.13
Sep	44,343	$ (24.66)	$ (1,218.00)	$ 443.43
Oct	46,700	$ -	$ (1,174.50)	$ 467.00
Nov	41,052	$ (348.00)	$ (1,218.00)	$ 410.52
Dec	39,385	$ (993.86)	$ (1,392.00)	$ 393.85
Yearly Totals		**$ (9,165.67)**	**$ (19,342.25)**	**$ 5,430.81**

4.3.2 Design Criteria

To maximize the production capability, calculations were performed at a 35-degree pitch and a 180-degree azimuth. Installation costs have been reduced by minimizing the grading required, utilization of aluminum conductors, and a pile-driven ground-mounted system.

4.3.3 Map

The location of the 300 kW solar PV system in 50 kW arrangements is shown in Figure 4-2. As with Alternative 2 – 100 kW Solar PV System (Nominal Size), the land available immediately north of the existing basins will not be considered for installation of the 300 kW solar PV system, as it is being reserved for future process basins. Also, because of shadowing concerns due to the reclaimed effluent storage tank located to the east side of the treatment plant, the land

available just north of it has also been eliminated from consideration for installation of solar panels.

The sites that have been identified as adequate for installation of the 300 kW capacity solar PV system are located east of the storage tank, which are the six rows shown in blue in Figure 4-2. Space for installation of additional solar panels would be available at the northeast corner of the property (one small site north and one south of the proposed 300 kW panels, each for about 50 kW) and south of the process basins and storage tank (two small sites, north of future Lohman Avenue, 50 kW each). Future pads available for expansion of the solar PV system are labeled as "Future Pad" in Figure 4-2.

4.3.4 Environmental Impacts

The solar PV system will be installed within the EMWRF property limits. An EID was prepared for the entire facility's site in December 2005. An EID has been prepared for the Solar Photovoltaic Feasibility Study and is provided under separate cover. However, it is worth mentioning that during the preparation of this PER all potential environmental impacts have been discussed with City's representatives and the Consultant preparing the EID, and those discussions have been taken into consideration for site selections.

4.3.5 Land Requirements

As previously mentioned in Section 4.3.3, some locations have been identified as not suitable or available for installation of the solar PV system at the EMWRF. With regards to Alternative 3 – 300 kW Solar PV System (Nominal Size), it has been determined that the best location is to the east of the existing storage tank. The site dimensions required for installation of the 300 kW capacity solar PV system are approximately 220 feet wide by 225 feet long, occupying an estimated area of 49,500 square feet. The land where the solar panels will be installed is leased by the City of Las Cruces to the NMSLO under a 25-year contract which expires in July 2031.

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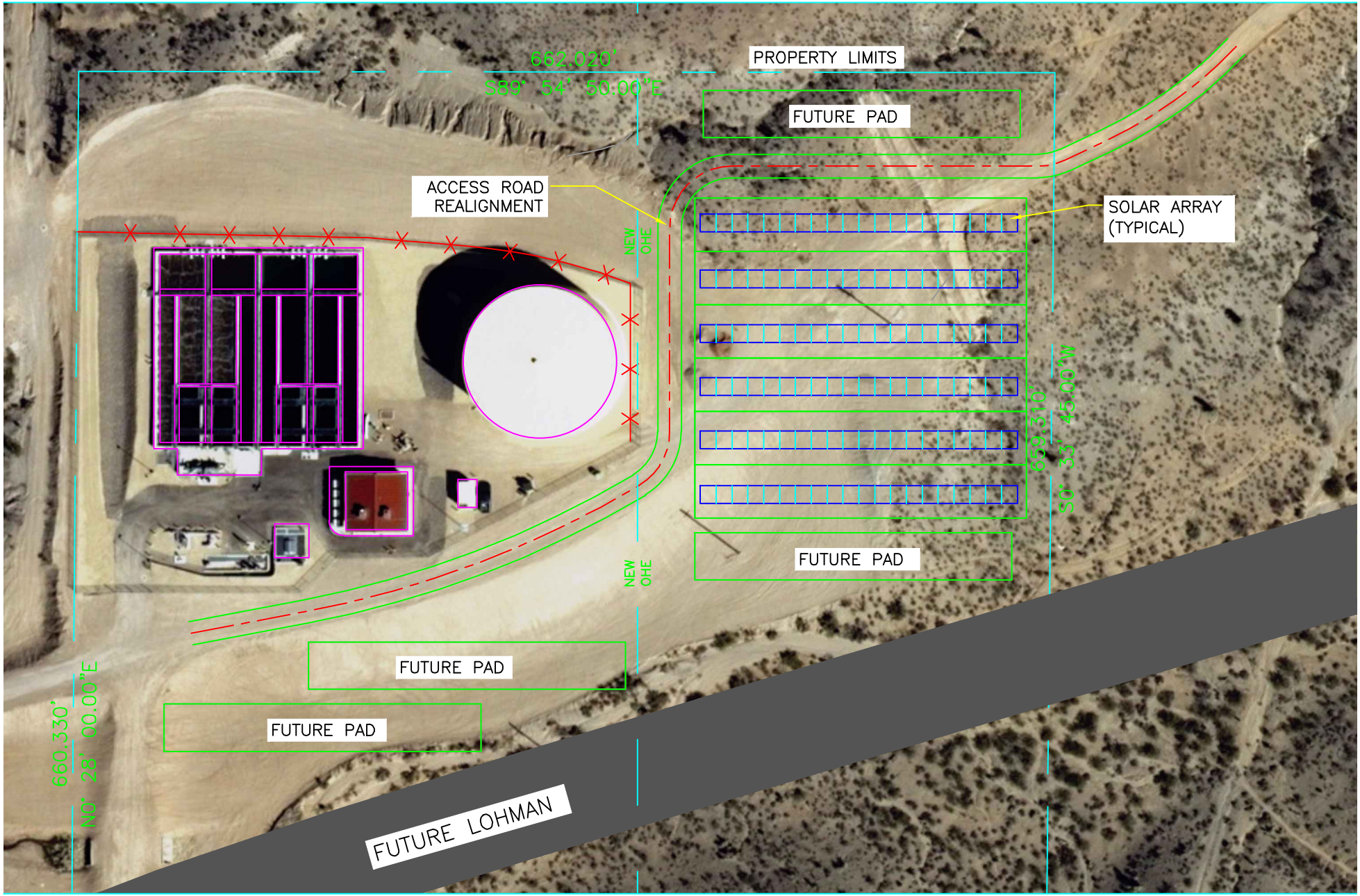


East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

MOLZENCORBIN

Figure 4-2 Alternative 3 - 300kW Solar PV System (Nominal Size)

4.3.6 Potential Construction Problems

In addition to the limited land available for this project, there are several other factors to take into consideration: 1) potential flooding, 2) arroyo crossing through the property, 3) future extension of Lohman Avenue, 4) topography of the remaining land available within the site, and 5) relocation of existing power supply facilities.

- **Potential flooding:** The site is not located within a FEMA designated flood zone. There is a flood zone north of the site, but it will not impact the EMWRF or the proposed solar PV system project. For more details, refer to the figure provided in Appendix B of this Report.
- **Arroyo crossing through the property:** There are minor localized arroyo flows through the site, south of the site where the solar PV would be installed. However, slope stabilization will be included to make sure pad sites do not encroach on the flow path of the arroyo.
- **Future extension of Lohman Avenue:** This will indeed affect the location for the solar PV system project because this route is planned to pass through the EMWRF site. Therefore, the system will be arranged to be installed on the north side of future Lohman Avenue. For more details regarding extension of Lohman Avenue, please refer to the figure provided in Appendix B of this Report.

  Realignment of the existing access road will also be necessary for implementation of the solar PV system, as shown in Figure 4-1.
- **Topography:** With the exception of where the existing EMWRF is constructed and where future treatment facilities would be built, the remaining land available for installation of the solar PV panels is hilly. However, for the type of system proposed for this project, flat land is not strictly necessary. Earthwork will be included in the cost estimates.
- **Relocation of existing electrical utilities:** Current electrical lines include overhead and underground lines. A figure which shows existing lines is provided in Appendix C of this Report as a reference.

The overhead lines run diagonally from southwest to northeast of the plant, and they connect to the lines running east to west, below and above the site. The plan for the lines will be to intersect the lines south and north of the plant and run a new overhead line directly northwest, parallel to the storage tank.

The underground lines (which feed the EMWRF) run through the site, from east to west. The new overhead lines will be in closer proximity to the plant and will allow for the existing underground conductors to potentially be reutilized by EPE Company.

EPE Company requires a minimum 10-foot easement for both the overhead and underground lines in addition to 30-foot clearance on one side for service vehicles. This service clearance will be used for the rerouting of the service access road to the EPE Company substation which currently runs adjacent to the existing power poles.

Storm Water Management Plan for City Departments

The City's design standards require that all construction plans comply with the requirements of Las Cruces Municipal Code Chapter 34-Drainage and Flood Control, Article III – Storm Water Management.

4.3.7 Sustainability Considerations

The EMWRF was designed to produce high-quality effluent, which is currently being used for irrigation of a golf course and other facilities, thus reducing potable water uses for irrigation. The solar PV system – the subject of this study – is another effort towards sustainability the City of Las Cruces is interested in implementing. It is intended to generate "green" energy from a renewable source for operation of the equipment currently installed at the EMWRF.

Alternative 3 – 300 kW Solar PV System (Nominal Size) would be capable of producing enough power to offset the EMWRF's yearly usage and demand charges.

4.3.8 Cost Estimates

Table 4-6 presents the Engineer's Opinion of Cost for Alternative 3 – 300 kW Solar PV System (Nominal Size). The total construction cost is estimated at $1,742,600, including contingencies at 20%. Non-construction costs, including Professional Engineering Services (design), permitting assistance, inspection, surveying services, and NMGRT are estimated at $318,900. The estimated total project cost for this alternative is $2,061,500 in today's dollars. A detailed cost estimate is provided in Appendix E of this Report. Table 4-7 shows an estimate of the annual O&M cost for this alternative. The annual O&M cost is estimated at $3,634.

TABLE 4-6
ENGINEER'S OPINION OF COST
ALTERNATIVE 3 – 300kW SOLAR PV SYSTEM

Item	Amount
General Civil Work	$188,300
Electrical (Incl. PV panels, panel rack, cables, conduit, etc.)	$1,040,400
Site Improvements (5%)	$61,400
Relocation of EPE Utilities	$35,000
Electrical Service Allowance	$10,000
Testing Laboratory Service	$15,000
Subtotal	**$1,350,100**
Construction Contingencies @ 20%	$270,000
Subtotal	$1,620,100
NMGRT @ 7.5625%	$122,500
Total Construction Costs	**$1,742,600**
Professional Engineering Services (8.3%)	$134,000
Permitting, Inspection, Surveying Services (10%)	$162,000
Subtotal	$296,500
NMGRT @ 7.5625%	$22,400
Total Professional Engineering Services	**$318,900**
TOTAL PROJECT COST	**$2,061,500**

TABLE 4-7

ENGINEER'S OPINION OF ANNUAL O&M COST
ALTERNATIVE 3 – 300kW SOLAR PV SYSTEM

Item	Estimated Cost
Visual Inspection (Twice per year)	$ 2,784
Array Cleaning	$ 850
Total Annual O&M Cost	**$ 3,634**

Table 4-8 shows a summary of yearly charges by EPE Company without and with a 300 kW solar PV system in service, which are estimated to be -$56,697.59 and -$23,077.11, respectively. Adding the $3,634 annual O&M cost for the PV system to the charges incurred when the system is in operation, the difference in EPE charges, or in other words, **the savings in EPE usage, are calculated at $29,986.48. REC Credits for the proposed system size are estimated at $5,430.81 annually. EPE dependency is estimated to be reduced by approximately 9,165kWh for an estimated savings of $31,803.47.**

TABLE 4-8

EPE COMPANY CHARGES WITHOUT AND WITH IMPLEMENTATION OF ALTERNATIVE 3 – 300kW SOLAR PV SYSTEM

Month	EPE Charges Without PV System	EPE Charges With PV System (including RECs)
Jan	$ 4,585.33	$ 1,978.11
Feb	$ 4,119.18	$ 1,506.83
Mar	$ 4,789.05	$ 1,722.78
Apr	$ 5,068.24	$ 2,005.84
May	$ 5,300.10	$ 2,116.52
Jun	$ 6,190.08	$ 3,532.86
Jul	$ 5,840.86	$ 2,998.90
Aug	$ 5,434.60	$ 2,561.07
Sep	$ 3,635.86	$ 799.23
Oct	$ 3,441.24	$ 707.50
Nov	$ 3,781.58	$ 1,155.48
Dec	$ 4,511.47	$ 1,992.01
Yearly Totals	**$ 56,697.59**	**$ 23,077.11**

5.0 SELECTION OF AN ALTERNATIVE

Two alternatives have been identified as feasible for implementation of a Solar Photovoltaic (PV) System intended to provide power for operation of the East Mesa Water Reclamation Facility (EMWRF). Both alternatives would use the same type of equipment, with the main difference being the size or capacity of the system. Alternative 2 – 100 kW Solar PV System (nominal size) consists of two rows of PV panels, each sized to produce 50 kW. This system size is equal to the one currently installed at the City of Las Cruces City Hall. Alternative 3 – 300 kW Solar PV System (nominal size) consists of six rows of PV panels. This system size was selected to optimize the size of the PV system while minimizing the level of earthwork required. **REC Credits for Alternative 2 are estimated at $1,825.84 annually; for Alternative 3 are estimated at $5,340.81.** This section of the PER will present the present worth analysis and overall comparison of alternatives.

5.1 Life Cycle Cost Analysis

Table 5-1 shows a summary of estimated costs for each of the two feasible alternatives. The total project cost for Alternative 2 – 100 kW Solar PV System is estimated at $882,900, and the estimate for Alternative 3 – 300 kW Solar PV System is $2,061,500.

TABLE 5-1

SUMMARY OF PROJECTS COST

Alternative	Construction Cost	Non-Construction Cost	Total Project Cost
Alternative 2 – 100 kW Solar PV System	$ 746,300	$ 136,600	$ 882,900
Alternative 3 – 300 kW Solar PV System	$ 1,742,600	$ 318,900	$ 2,061,500

The present worth of cost is a combination of capital and operating cost, presented as an overall cost. Using interest rates over a 20-year period, operating costs are translated to an equivalent

lump sum that is combined with the capital cost to yield the present worth. An interest rate of 0.8% will be used to calculate the present worth for the alternatives being evaluated. That is the "real" discount rate taken from Appendix C of *OMB Circular A-94*, revised in December 2012 and currently in effect (refer to copy provided in Appendix F of this Report).

Table 5-2 shows the total project cost and the annual O&M cost, as well as the present worth for the two alternatives being evaluated. It should be noted that the O&M cost is a gain to the City, given that they are producing power in lieu of purchasing power from EPE Company and they are also getting paid by EPE Company for the power produced through the REC program. The present worth for Alternative 2 – 100 kW Solar PV System is $916,400 and for Alternative 3 – 300 kW Solar PV System it is $2,128,400. It is important to mention that, because of the significant difference in capital cost and the very minimal O&M associated with the solar PV systems, regardless of their size, the governing condition for comparison purposes is the total project cost, which as shown in Table 5-2 is very close to the calculated present worth.

TABLE 5-2

PRESENT WORTH FOR THE EMWRF SOLAR PV SYSTEM

Alternative	Total Project Cost	Annual O&M Cost	Present Worth
Alternative 2 – 100 kW Solar PV System	$ 882,900	$ 1,817	$ 916,400
Alternative 3 – 300 kW Solar PV System	$ 2,061,500	$ 3,634	$ 2,128,400

5.2 Non-Monetary Factors

The advantages and disadvantages of each alternative are summarized in Table 5-3. A summary of the comparison between the two feasible alternatives in terms of cost and non-cost factors is shown in Table 5-4. For comparison purposes, each process is given three (3) points for the most favorable, two (2) points for neutral, and one (1) point for the least favorable. The alternative with the highest score will be recommended for implementation.

TABLE 5-3

ALTERNATIVES ADVANTAGES AND DISADVANTAGES

Alternative	Advantages	Disadvantages
Alternative 2 – 100 kW Solar PV System	– Less land requirements – Lower capital cost and present worth – Easily expandable to up to 500kW	– Does not maximize the benefit of the REC Credits – A significant portion of power requirements would be supplied by electrical (EPE Company) – Lesser positive environmental impact because a conventional energy source would still provide the majority of the plant's power – Longer payback period
Alternative 3 – 300 kW Solar PV System	– Easily expandable to up to 500 kW – Maximizes usage of REC Credits – All power consumed by the EMWRF would be offset by the solar array – Greater positive environmental impact because all power needed to operate the facility would be provided by "green" energy – Shortest system payback	– More land requirements – Higher capital cost and present worth

TABLE 5-4

COMPARISON AND RANKING OF ALTERNATIVES

Alternative	Capital Cost & Present Worth	RECs Credit Benefit	Environmental & Sustainability Impact	Implementation Problems	TOTAL SCORE
Alternative 2 – 100 kW Solar PV System	3	1	1	2	**7**
Alternative 3 – 300 kW Solar PV System	1	3	3	2	**9**

Alternative 2 – 100 kW Solar PV System had a total score of seven (7) points and Alternative 3 – 300 kW Solar PV System had nine (9) points. Therefore, based on the results of the overall comparison of the two feasible alternatives, **the recommended project for implementation is Alternative 3 – 300 kW Solar PV System.**

6.0 PROPOSED PROJECT (RECOMMENDED ALTERNATIVE)

Based on the results of an overall comparison taken into account cost and non-cost factors, **the recommended project** to provide power for operation of the East Mesa Water Reclamation Facility (EMWRF) **is Alternative 3 – 300 kW Solar Photovoltaic (PV) System.**

6.1 Preliminary Project Design

It has been determined that six (6) arrays of solar panels will be needed for implementation of Alternative 3 – 300 kW Solar PV System (Nominal Size). The sites that have been identified as adequate for installation of the solar PV system are located east of the storage tank, which are the six (6) rows shown in blue in Figure 6-1. Space for expansion of the system to generate up to 500 kW will be available at the northeast corner of the property (one small site north and one south of the proposed system, each 50 kW) and south of the process basins and storage tank (two small sites, north of future Lohman Avenue, 50 kW each). Sites available for expansion of the solar PV system are labeled as "Future Pad" in Figure 6-1. The site dimensions required for installation of the 300 kW capacity solar PV system are approximately 220 feet wide by 225 feet long, occupying an estimated area of 49,500 square feet. The land where the solar panels will be installed is leased by the City of Las Cruces to the NMSLO under a 25-year contract which expires in July 2031.

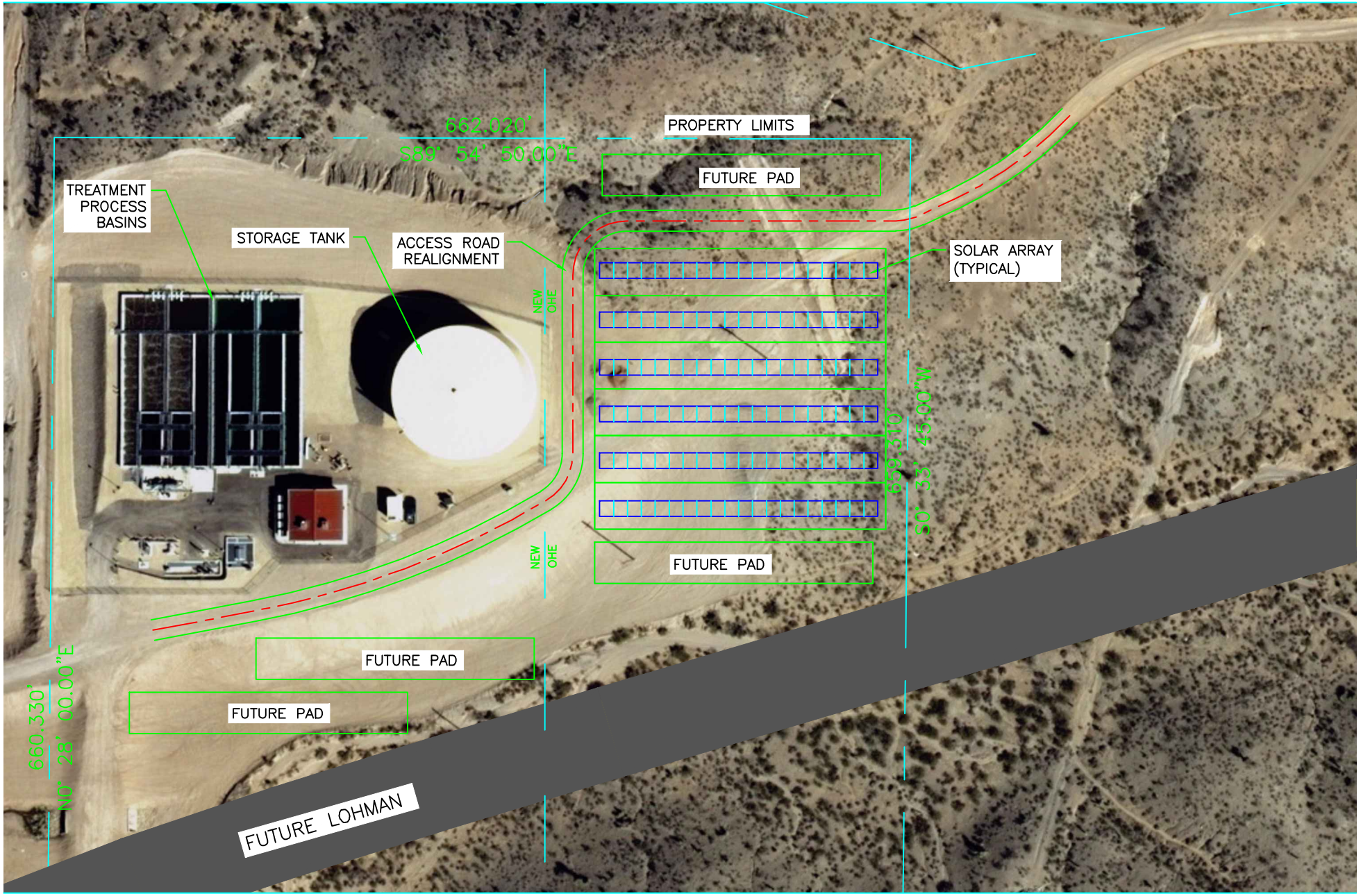
6.2 Project Schedule

Table 6-1 shows a tentative schedule for implementation of the proposed project.

TABLE 6-1
PROJECT SCHEDULE

Activity	Duration
Kickoff meeting and preliminary research	1 week
60% Preliminary design effort	7 weeks
Review by Owner	2 weeks
95% Final design effort	2 weeks
Funding agency review	4 weeks
Final design	2 weeks
Bid advertisement	3 weeks
Notice of award	2 weeks
Construction duration	14 weeks
TOTAL	**37 weeks**

LAST MODIFIED: Dec 20, 2013 - 4:04pm BY USER: kellison
DWG. LOCATION: M:\LASCRUCES\CLC E. Mesa Solar Farm\DWG\
DWG. NAME: eastprop-Alt3a.dwg



East Mesa Solar Photovoltaic Feasibility Study - Las Cruces, New Mexico

MOLZENCORBIN

Figure 6-1 300kW Solar PV System
Proposed Project

6.3 Permit Requirements

The land where the solar PV system will be installed is leased by the City of Las Cruces to the NMSLO under a 25-year contract which expires in July 2031. However, the contract (lease) may need to be modified to install the PV panels. A Construction Industries Division (CID) electrical permit will be necessary.

6.4 Sustainability Considerations

The proposed project, Alternative 3 – 300 kW Solar PV System, will be capable of reducing the usage charges for the EMWRF. REC Credits for the proposed system size are estimated at $5,430.81 annually. Additionally, it will be able to reduce EMWRF's dependency from EPE by 9,135 kWh per year.

6.5 Total Project Cost Estimate

A detailed cost estimate is provided in Appendix E of this Report, and a summary is provided in Table 6-2. The total project cost for the recommended alternative is $2,061,500.

TABLE 6-2
ENGINEER'S OPINION OF COST FOR THE PROPOSED PROJECT

Item	Amount
General Civil Work	$188,300
Electrical (Incl. PV panels, panel rack, cables, conduit, etc.)	$1,040,400
Site Improvements (5%)	$61,400
Relocation of EPE Utilities	$35,000
Electrical Service Allowance	$10,000
Testing Laboratory Service	$15,000
Subtotal	**$1,350,100**
Construction Contingencies @ 20%	$270,000
Subtotal	$1,620,100
NMGRT @ 7.5625%	$122,500
Total Construction Costs	**$1,742,600**
Professional Engineering Services (8.3%)	$134,000
Permitting, Inspection, Surveying Services (10%)	$162,000
Subtotal	$296,500
NMGRT @ 7.5625%	$22,400
Total Professional Engineering Services	**$318,900**
TOTAL PROJECT COST	**$2,061,500**

6.6 Annual Operating Budget

The annual operating budget and debt service schedule for the EMWRF is provided in Appendix G of this Report.

6.6.1 Income

The City's Wastewater Division is operated collectively as an enterprise fund, and is not subsidized by general City funds. The EMWRF is funded largely by Environmental Gross Receipts Tax (EGRT), although Wastewater Operations Funds (revenue from sewer bills) also contribute to the annual budget. Sewer rates for the City of Las Cruces are shown in Table 6-3.

TABLE 6 – 3
WASTEWATER SERVICE RATES

User Type	Access Charge, $/mo	Cost per 1,000 gallons, $	Additional Fees
Residential	$ 5.38	$1.30	$2.34 per 1,000 gallons exceeding 2,000 gallons
Small Commercial	$ 16.82	$ 1.16	
Large Commercial	$ 43.50	$ 1.71	
Large Multi-Unit	$ 43.50	$ 1.71	
Industrial Pretreatment	$ 545.00	$ 2.23	
Industrial Pretreatment - High Strength	$ 545.00	$ 5.44	Loading charges: BOD = $ 0.42/lb TSS = $ 0.18/lb
Mesilla	$ 1,565.03	$ 1.92	
County Villages	$ 2.74 per connection within County Village	$ 2.31	
Industrial (West Mesa Industrial Park)	$ 700.00	$ 3.50 to $8.83, depending on loading	Additional tiered charges for BOD/TSS, TDS, and N loading rates

Income and Expenditures for the EMWRF over the past two years (FY2011-2012 and FY2012-2013) were initially presented in Table 2-3 and are summarized again for convenience in Table 6-4. The anticipated budget for FY 2013-2014 is also included. As indicated in Table 6-4, the revenue for FY 2012-2013 exceeded the expenses incurred by operation of the facility; however, in the upcoming fiscal year, the anticipated revenue is not expected to cover expenses. The excess from previous years is expected to cover the additional expenditures for FY 2013-2014.

TABLE 6 – 4
EAST MESA WATER RECLAMATION FACILITY BUDGET FY 2013/2014

Fiscal Year	Beginning Balance	Revenue	Expenses	Adjustments	Ending Balance
2011/2012	$ 470,044	$ 852,689	$ 898,512	$ 11,742	$ 412,479
2012/2013	$ 412,479	$ 865,161	$ 786,572	$ 28,930	$ 462,138
2013/2014	$ 220,386	$ 878,170	$ 1,080,301	$ 0	$ 18,255

Revenue from reclaimed wastewater is not counted as income for the EMWRF. Although revenue is collected from the sale of effluent, the funds do not return to the Wastewater Division, but fall within the Water Services Division of the Utilities Department.

6.6.2 Annual O&M Costs

Table 6-5 shows the estimated annual O&M cost for the proposed project. The annual O&M cost is estimated at $3,634.

TABLE 6-5

ANNUAL O&M COST FOR THE PROPOSED PROJECT

Item	Estimated Cost
Visual Inspection (Twice per year)	$ 2,784
Array Cleaning	$ 850
Total Annual O&M Cost	**$ 3,634**

6.6.3 Debt Repayments

The reclamation facility carries approximately $12 million in debt as of the end of 2013. Initially, the facility obtained several separate loans from the New Mexico Finance Authority (NMFA) from 2003 to 2007. However, the loans were combined per Ordinance 2584 into one outstanding debt contract. The Schedule for repaying the Debt is presented in Table 6-6 (see Appendix G for the breakdown of principal and interest payments). The reclamation facility debt is expected to be paid in full in 2027.

TABLE 6 – 6
DEBT SERVICE SCHEDULE FOR THE EMWRF

Fiscal Year	Payment
2014	$ 374,209
2015	$ 372,104
2016	$ 370,701
2017	$ 993,035
2018	$ 994,968
2019	$ 992,428
2020	$ 989,319
2021	$ 989,433
2022	$ 990,760
2023	$ 991,238
2024	$ 992,926
2025	$ 971,995
2026	$ 975,180
2027	$ 967,370
Total Payments from 2014-2027	$ 11,965,666

In the year 2017, the annual payment will increase from roughly $370,000 to $990,000 – a factor of about 2.7. Per Section 6.6.1, revenues for 2013 amounted to less than $900,000. The loan payment in 2017 alone may exceed annual revenues, although revenue is expected to increase until the facility reaches capacity. The Solar Photovoltaic System at the EMWRF will increase the reclamation facility's debt by $2.1 M. Assuming the facility obtained a $2 M loan at an interest rate of 5 percent and a life cycle of 20 years, the annual loan payment would be $160,485. The total cost of the loan over the 20 year payback period would be $3.2 M.

It is anticipated that savings from decreased electricity consumption will enable rapid repayment of the loan. Energy generated by the Photovoltaic System will offset operating costs of the EMWRF, and net profit may be credited towards payment of the reclamation facility's debt.

6.6.4 Reserves

With the sale of 2010 Series Bonds, the City created a reserve account for net proceeds from the bonds, and deposited $2.48 M in the reserve account. Within this reserve, the EMWRF was allocated approximately $946,000.

If the City financed the project, they would likely be required to hold 10 percent of the loan amount in a reserve account; assuming the City obtained a $2,000,000 loan, $200,000 would need to be added to the existing reserve account.

7.0 CONCLUSIONS AND RECOMMENDATIONS

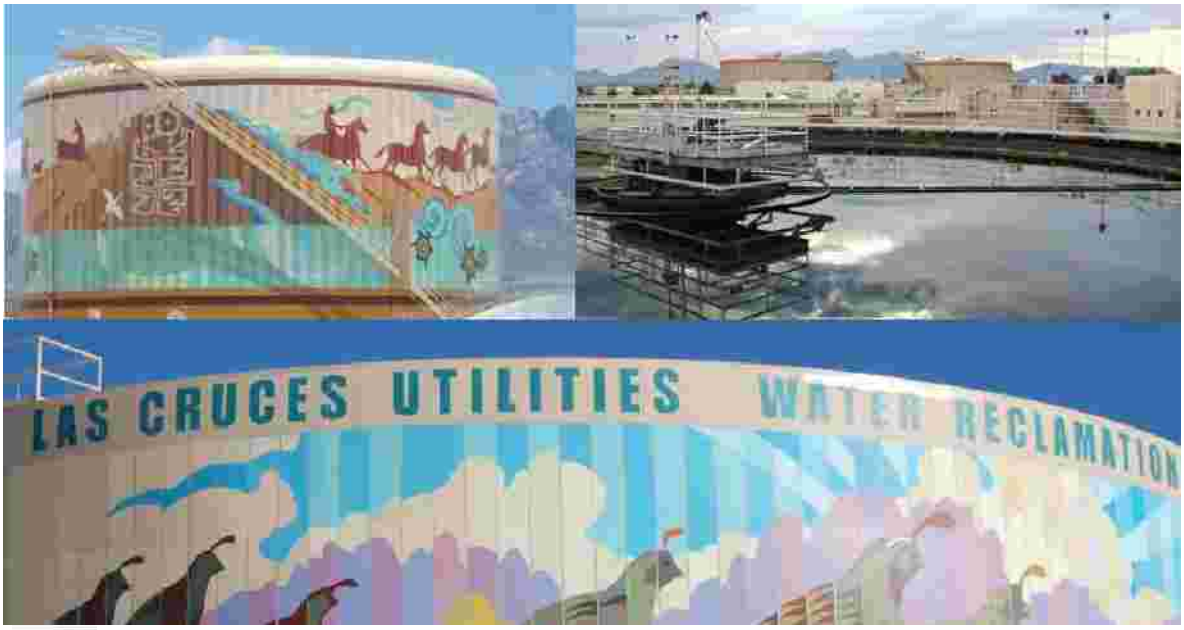
This Section of the East Mesa Water Reclamation Facility (EMWRF) Solar Photovoltaic Feasibility Study Preliminary Engineering Report (PER) summarizes the contents and results of Sections 1 to 6.

- The purpose of this project was to evaluate and recommend an alternative for a Solar PV System intended to provide power for the operation of the EMWRF at design capacity (1.0 MGD).
- The recommended facility size, Alternative 3 – 300 kW Solar PV System (Nominal Size), will be capable of optimizing the size of the PV system while minimizing the level of earthwork required.
- The total project cost for the recommended alternative is $2,061,500.
- REC Credits for the proposed system size are estimated at $5,430.81 annually.
- Reduce power dependency from EPE by 9,165 kWh per year
- The site dimensions required for installation of the 300 kW capacity solar PV system are approximately 220 feet wide by 225 feet long, occupying an estimated area of 49,500 square feet. It consists of six rows of PV panels, each 50 kW.
- The system can be expanded to produce up to 500 kW by installing additional solar PV panels.

APPENDIX A

Population Projections Data

Water and Wastewater Impact Fee
Land Use Assumptions and Capital Improvements Plan
2011-2016



Prepared for City of Las Cruces, New Mexico

duncan associates

July 2012

LAND USE ASSUMPTIONS

This chapter contains the land use assumption required by the *Development Fees Act* to document and update impact fees for water and wastewater facilities in Las Cruces. It provides a projection of land use change for a five-year (2011-2016) and ten-year (2011-2021) periods based on an analysis of recent growth and social and economic factors.

The location of Las Cruces and its proximity to various economic resources indicate that there are many local and regional influences that may affect growth in the city. These have the potential to increase both population and housing, and to affect the pattern and direction of growth. Local growth influences include economic development as evidenced by the Mesilla Valley Economic Development Association and the Arrowhead Research Center, potential new troop deployment to White Sands Missile Range (WSMR), the Las Cruces Convention Center and the growth of New Mexico State University (NMSU) student population and resultant increase in demand for accommodations. Regional growth influences include the planned Spaceport America and the addition of military personnel at Fort Bliss.

All of these factors, taken together, could potentially have the effect of maintaining or increasing demand for undeveloped land, and of maintaining or increasing the growth rate (especially the rate projected for the planning period covered by these land use assumptions). It is most important to specify a conservative growth projection for purposes of impact fee planning. Note also that the effect of the growth influences must be considered in context of the current, uncertain economic climate.

Population Growth Trends

As a result of annexations and new development, the City of Las Cruces has experienced consistent population growth over the past decade. As shown in Table 5, the City of Las Cruces has experienced average annual growth of approximately 2.9% based on the most recent U.S. Census data. The U.S. Census data is consistent with the growth estimates for 2000 through 2010. The City gher than the average growth rate in Dona Ana County during the same period.

Table 5. Population Growth, 2000 to 2010

	City of Las Cruces		Dona Ana
Year	CDD	US Census	County
2000	73,539	73,539	174,682
2001	75,016	75,230	176,460
2002	76,352	76,697	178,473
2003	78,204	79,056	182,147
2004	81,057	81,252	184,935
2005	83,649	84,610	189,265
2006	87,697	87,744	193,779
2007	91,730	90,060	198,205
2008	93,910	91,865	201,428
2009	95,128	93,570	206,419
2010	96,994	97,618	209,233
Avg. Annual	2.81%	2.87%	1.82%

Source: City of Las Cruces Community Development Department, July 2010; U.S. Census, March 2010.

As shown in Table 6, the city population is projected to grow by 2,024 annually from 2011 to 2021. This projection is a linear trend based on the range of estimated population growth forecasts used by the City and County in the Vision 2040 draft regional planning project. The growth rates presented in the Vision 2040 plan were developed for the entire county based on several different regional growth models, with the c
the c The linear population growth model results in a projected annual population growth rate of approximately 1.9%, about two-thirds the growth rate experienced over the past ten years.

Table 6. Population Growth, 2011 to 2021

Year	Population
2010	97,618
2011	99,443
2012	101,303
2013	103,197
2014	105,127
2015	107,093
2016	109,096
2017	111,136
2018	113,214
2019	115,331
2020	117,488
2021	119,685
Avg. Annual % Change	1.87%
Avg. Annual Pop. Change	2,024

Source: 2010 population from Table 5; city-wide population projection is a linear trend for City of Las Cruces based on average projected growth trend from Peter J. Smith & Company, Inc., *Las Cruces and Dona Ana County Vision 2040 Regional Planning Project*, June 10, 2010 draft.

The *Water and Wastewater Master Plan* used population projections developed for the 40-year *Water Development Plan* in 2007 in developing the population growth projection. At the time, the City of Las Cruces was experiencing rapid development and high trend line growth rates. Since 2007, the rate of growth has slowed with the general national economic downturn. Of the four potential growth scenarios, the *Master Plan*
2.87% annually. As shown in Table 7, the 2020 growth projection used in the impact fee update has 12,795 fewer people than forecast in the *Water and Wastewater Master Plan*. Since the impact fee in the update will be based on the existing level of service rather than the list of planned improvements in the current *Master Plan*, the lower level of growth anticipated in this study will not affect the impact fee calculation. The lower growth rate used in the impact fee update will affect the timing and implementation of the *Master Plan* projects, which will be reflected in the list of planned capital improvements included in the IFCIP update.

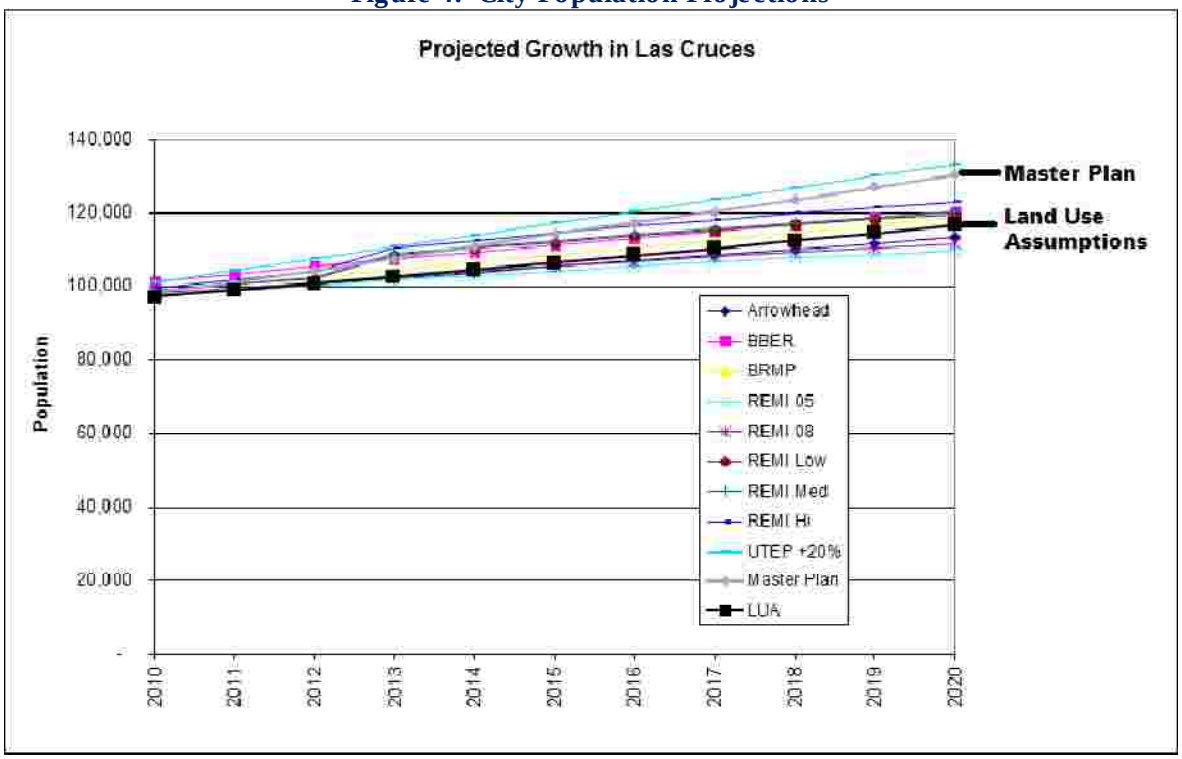
Table 7. Population Projection Comparison

Year	2008 Master Plan	Impact Fee LUA
2010	98,154	97,618
2015	114,219	107,093
2020	130,283	117,488
Annual Growth Rate, 2010-2020	2.87%	1.87%

Source: Master Plan growth from CDM Inc., *Water and Wastewater System Master Plan Update*, July 2008 (population model from table 2.1); land use assumption population projection from Table 6.

Figure 4 shows a comparison of population growth as projected in this analysis to the range of projections used in the regional planning project *Master Plan*. The population projection used in this study is in the midrange of the growth projection series presented in the Vision 2040 draft regional planning document.

Figure 4. City Population Projections



Future Land Use Trends

The residential and nonresidential water and wastewater customer growth rates are based on the population projections developed in the preceding section and are combined with local housing and nonresidential development trends. The forecast growth rates are used to calculate the growth in residential and commercial water and wastewater service units necessary to update the impact fee schedule calculated in the succeeding chapters of this report.

Historically, the growth rate in housing has exceeded the population growth rate. As shown in Table 8, the housing stock in the City of Las Cruces grew by 11,718 units from 2000 through 2010, increasing by an average of 3.2% annually.

Table 8. New Housing Units, City-Wide, 2000-2010

Total Units, 2000	31,652
Total Units, 2010	43,370
New Units, 2000-2010	11,718
Average Annual Increase	3.20%

Source: 2000 and 2010 U.S. Census.

The higher rate of increase in the number of housing units when compared to the overall increase in population 3.2% growth for housing units versus 2.9% for population is consistent with the historic pattern of declining household size. As shown in Table 9, the average number of persons per housing unit (all housing units, not just single-family) in the City of Las Cruces declined from 2.35 in 1990 to 2.25 in 2010. Current CDD estimates show a continued decline to 2.17 persons per unit by 2020.

Table 9. Persons per Unit, 1990-2020

Year	Persons Per Unit
1990	2.35
2000	2.28
2010	2.25
2020	2.17

Note: persons per unit is total population divided by total housing units

Source: 1990 and 2000 data from U.S. Census; 2010 data is ratio of 2010 population from Table 5 and housing units from Table 8.

The forecast growth in housing is based on the population growth rate developed in the preceding section and the trend toward fewer people per household. While housing stock growth has been about 3.2% per year during the last decade, growth over the next decade is projected to be significantly slower about 2.0% per year, as shown in Table 10. The lower growth rate projected for 2011-2021 reflects the current economic environment and need for the market to absorb the existing housing inventory. The projected residential growth rate corresponds with the growth rate currently being used by the City of Las Cruces Budget Department for residential building permits, which projects about 5,000 permits for the period 2010 to 2015. [3]

[3] Las *Cruces Fiscal Year 2010-11 Budget*, 2010

Table 10. Residential Growth, 2011 to 2021

Year	Housing Units
2010	43,370
2011	44,237
2012	45,122
2013	46,024
2014	46,944
2015	47,883
2016	48,841
2017	49,818
2018	50,814
2019	51,830
2020	52,867
2021	53,924
New Units, 2011-2021	9,687
Avg. Annual Change	950
Avg. Annual % Change	2.0%

Source: 2010 residential units from Table 8; growth rate based on analysis of residential growth trends from Duncan Associates, *City of Las Cruces 2010-2020 Impact Fee Land Use Assumptions for Major Roads, Drainage and Public Safety*, Table 7.

Growth in the nonresidential water and wastewater customer base is projected based on the residential growth rate. However, the nonresidential development growth rate is forecast to increase at an additional annual rate of 0.3%, in order to account for faster nonresidential development growth patterns. As shown in Table 11, total city-wide nonresidential square feet is expected to increase by 2.3% annually.

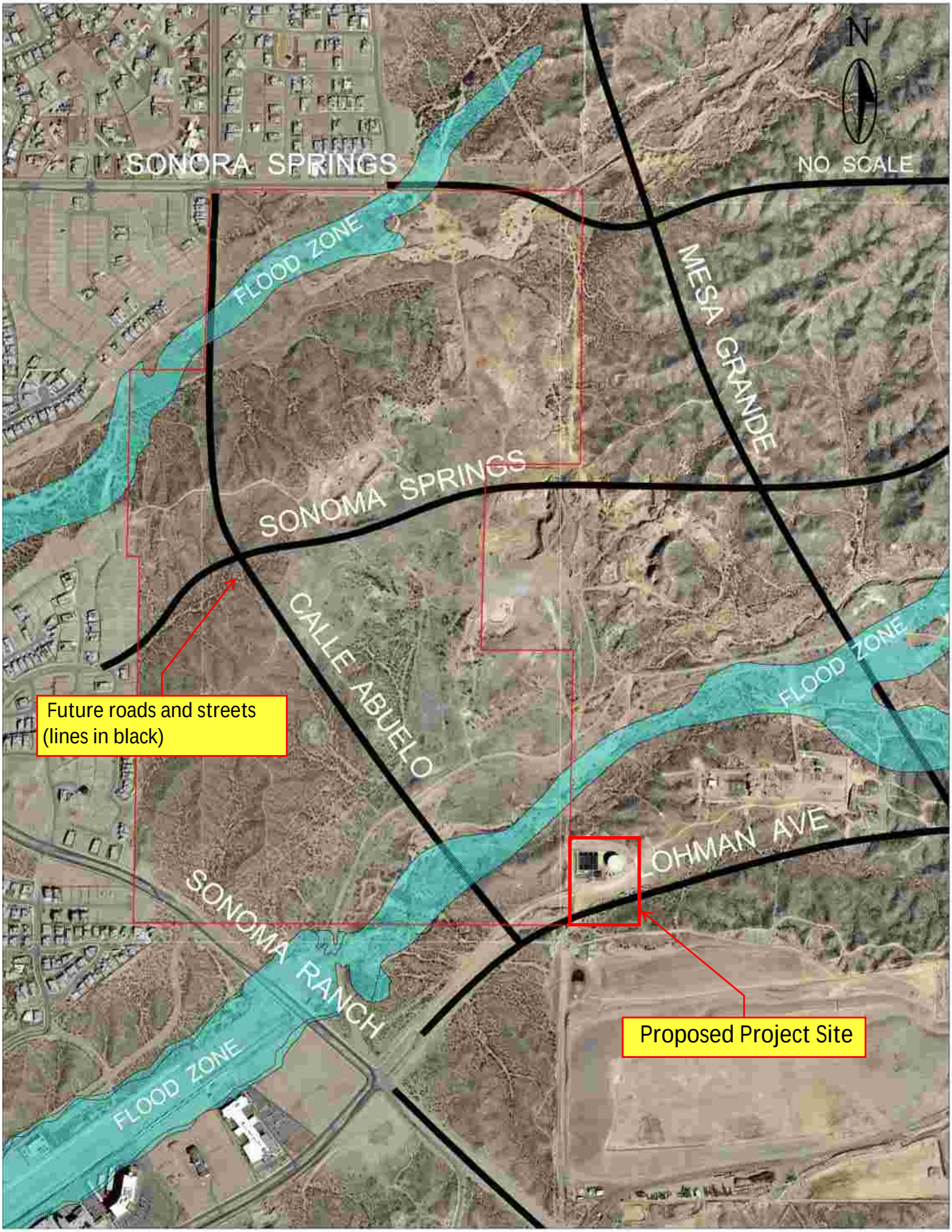
Table 11. Nonresidential Growth, 2011 to 2021

Year	Sq. Feet (1,000s)
2010	8,046
2011	8,231
2012	8,420
2013	8,614
2014	8,812
2015	9,015
2016	9,222
2017	9,434
2018	9,651
2019	9,873
2020	10,100
2021	10,332
New Sq. Ft. (1000s), 2011-2021	2,101
Avg. Annual Change	205
Avg. Annual % Change	2.3%

Source: 2010 nonresidential square feet from Duncan Associates and City of Las Cruces GIS Department analysis of Dona Ana County Assessor database for City of Las Cruces land uses, July 28, 2010; annual growth based on residential growth rate from Table 10 plus 0.3%.

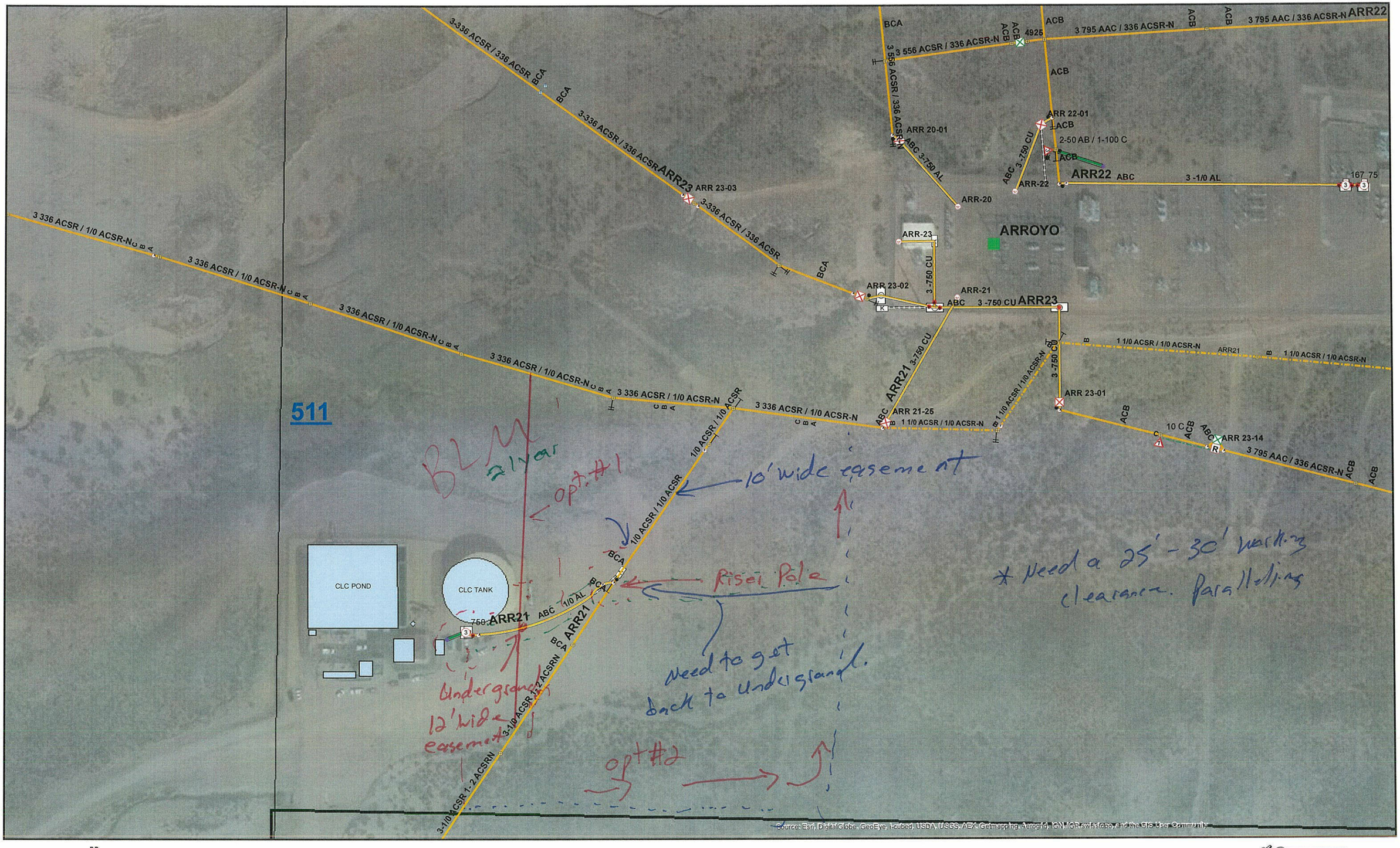
APPENDIX B

Floodplain and Future Roads


N
NO SCALE
SONORA SPRINGS
FLOOD ZONE
MESA GRANDE
SONOMA SPRINGS
CALLE ABUELO
Future roads and streets
(lines in black)
FLOOD ZONE
LOHMAN AVE
SONOMA RANCH
FLOOD ZONE
Proposed Project Site

APPENDIX C

El Paso Electric (EPE) Linework



1 inch = 142.358876 feet

Work Request # :	EPE Work Request Number
Work Order # :	EPE Work Order Number
Tax District :	EPE Tax District
Feeder :	Feeder Name

EPE Contact Name

EPE Job Location

EPE Legal Description

EPE Township/Range/Section

Planner :	EPE Planner
Planner Phone :	EPE Planner Phone
Planner Cell :	EPE Planner Cell
Customer :	EPE Contact Name
Customer Phone :	EPE Contact Phone

The Electric Company
EL PASO ELECTRIC

EPE Work Order Number
11/7/2013

APPENDIX D

Engineer's Opinion of Cost for Alternative 2 – 100kW Solar PV System

East Mesa Water Reclamation Facility - Solar Farm PER
Engineer's Opinion of Probable Cost
EMWRF - 100 kW Solar Farm Project

Construction Costs	**Amount**
General Civil Work	$112,500
Electrical (Incl. PV panels, panel rack, cables, conduit, etc.)	$381,000
Site Improvements (5%)	$24,700
Relocation of EPE Utilities	$35,000
Electrical Service Allowance	$10,000
Testing Laboratory Service	$15,000
Subtotal	**$578,200**
Construction Contingencies @ 20%	$115,600
Subtotal	$693,800
NMGRT @ 7.5625%	$52,500
Total Construction Costs	**$746,300**
Professional Engineering Services (8.3%)	$57,600
Permitting, Inspection, Surveying Services (10%)	$69,400
Subtotal	$127,000
NMGRT @ 7.5625%	$9,600
Total Professional Engineering Services	**$136,600**
Total Project Costs	**$882,900**

East Mesa Water Reclamation Facility - Solar Farm PER

Item A: Civil Work DATE: 11/23/13

EMWRF - 100 kW Solar Farm Project

ITEM		UNIT	QUANT	UNIT PRICE	COST ESTIMATE
Earthwork					
Borrow (fill material)		cy	3,820	$4.50	$17,190
Unclassified excavation (cut)		cy	3,250	$4.00	$13,000
Base course, 6"		sy	850	$7.00	$5,950
Drainage					
Drop inlet		ea	1	$5,000.00	$5,000
24" Culvert pipe		lf	70	$65.00	$4,550
24" Culvert pipe end section		ea	1	$375.00	$375
Rockslope		cy	350	$50.00	$17,500
Wire riprap		cy	190	$185.00	$35,150
SUBTOTAL					$98,700
Undefined Elements	8.00%				$7,900
General Conditions	2.00%				$2,000
Mobilization, Bonds, Shakedown	4.00%				$3,900
TOTAL					**$112,500**

East Mesa Water Reclamation Facility - Solar Farm PER

Item B: PV Panels and Ancillary Equipment for 100kW Solar Farm Facility DATE: 11/24/13

EMWRF - 100 kW Solar Farm Project

ITEM	UNIT	QUANT	UNIT PRICE	COST ESTIMATE
Panel Racks	$/Watt	111888	$ 0.42	$46,993
PV Panels	$/Watt	111888	$ 1.75	$195,804
PV Junction Box	EA	42	$ 125.00	$5,250
Cables from Panel to Combiner	LF	3500	$ 5.69	$19,915
Combiner Boxes	EA	2	$ 3,800.00	$7,600
Cables from Combiner to Inverter	LF	300	$ 17.95	$5,385
100kW Inverter	EA	1	$ 11,480.00	$11,480
AC Panelboard	EA	0	$ 8,325.00	$0
AC Conduit Run	LF	400	$ 33.30	$13,320
Connection to Existing Switchgear	LS	1	$ 8,500.00	$8,500
EPE Coordination	LS	1	$ 5,000.00	$5,000
Connection to WWTP control panel for power monitoring	LS	1	$ 15,000.00	$15,000
SUBTOTAL				$334,200
Undefined Elements 8.00%				$26,700
General Conditions 2.00%				$6,700
Mobilization, Bonds, Shakedown 4.00%				$13,400
TOTAL				**$381,000**

APPENDIX E

Engineer's Opinion of Cost for Alternative 3 – 300kW Solar PV System

East Mesa Water Reclamation Facility - Solar Farm PER
Engineer's Opinion of Probable Cost
EMWRF - 300 kW Solar Farm Project

Construction Costs	**Amount**
General Civil Work	$188,300
Electrical (Incl. PV panels, panel rack, cables, conduit, etc.)	$1,040,400
Site Improvements (5%)	$61,400
Relocation of EPE Utilities	$35,000
Electrical Service Allowance	$10,000
Testing Laboratory Service	$15,000
Subtotal	$1,350,100
Construction Contingencies @ 20%	$270,000
Subtotal	$1,620,100
NMGRT @ 7.5625%	$122,500
Total Construction Costs	**$1,742,600**
Professional Engineering Services (8.3%)	$134,500
Permitting, Inspection, Surveying Services (10%)	$162,000
Subtotal	$296,500
NMGRT @ 7.5625%	$22,400
Total Professional Engineering Services	**$318,900**
Total Project Costs	**$2,061,500**

East Mesa Water Reclamation Facility - Solar Farm PER

Item A: Civil Work DATE: 11/23/13

EMWRF - 300 kW Solar Farm Project

ITEM		UNIT	QUANT	UNIT PRICE	COST ESTIMATE
Earthwork					
Borrow (fill material)		cy	4,000	$4.50	$18,000
Unclassified excavation (cut)		cy	6,500	$4.00	$26,000
Base course, 6"		sy	850	$7.00	$5,950
Drainage					
Drop inlet		ea	1	$5,000.00	$5,000
24" Culvert pipe		lf	70	$65.00	$4,550
24" Culvert pipe end section		ea	1	$375.00	$375
Rockslope		cy	700	$50.00	$35,000
Wire riprap		cy	380	$185.00	$70,300
SUBTOTAL					$165,200
Undefined Elements	8.00%				$13,200
General Conditions	2.00%				$3,300
Mobilization, Bonds, Shakedown	4.00%				$6,600
TOTAL					**$188,300**

East Mesa Water Reclamation Facility - Solar Farm PER

Item B: PV Panels and Ancillary Equipment for 300kW Solar Farm Facility DATE: 11/24/13

EMWRF - 300 kW Solar Farm Project

ITEM	UNIT	QUANT	UNIT PRICE	COST ESTIMATE
Panel Racks	$/Watt	323000	$ 0.42	$135,660
PV Panels	$/Watt	323000	$ 1.75	$565,250
PV Junction Box	EA	126	$ 125.00	$15,750
Cables from Panel to Combiner	LF	10500	$ 5.69	$59,745
Combiner Boxes	EA	6	$ 3,800.00	$22,800
Cables from Combiner to Inverter	LF	900	$ 17.95	$16,155
100kW Inverter	EA	3	$ 11,480.00	$34,440
AC Panelboard	EA	1	$ 8,325.00	$8,325
AC Conduit Run	LF	450	$ 57.77	$25,997
Connection to Existing Switchgear	LS	1	$ 8,500.00	$8,500
EPE Coordination	LS	1	$ 5,000.00	$5,000
Connection to WWTP control panel for power monitoring	LS	1	$ 15,000.00	$15,000
SUBTOTAL				$912,600
Undefined Elements 8.00%				$73,000
General Conditions 2.00%				$18,300
Mobilization, Bonds, Shakedown 4.00%				$36,500
TOTAL				**$1,040,400**

APPENDIX F

Real Discount Rate

ABOUT
Leadership
OMB Organization Chart
Open Government Plan
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Agency Info
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Educational and Non-Profit Institutions
Federal Procurement
Federal Financial Management
Federal Information Resources / Data Collection
Other Special Purpose
Memoranda
Privacy Guidance
Reports
Federal Register
FOIA
NDA
No FEAR
OMB Locator

Circular A-94 Appendix C

Revised December 2012

OMB Circular No. A-94

Click here for PDF assistance

DISCOUNT RATES FOR COST-EFFECTIVENESS, LEASE PURCHASE, AND RELATED ANALYSES

Effective Dates. This appendix is updated annually. This version of the appendix is valid for calendar year 2013. A copy of the updated appendix can be obtained in electronic form through the OMB home page at http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c/ the text of the main body of the Circular is found at http://whitehouse.gov/omb/circulars_a094/ , and a table of past years rates is located at http://whitehouse.gov/sites/default/files/omb/assets/a94/dischist-2013.pdf . Updates of the appendix are also available upon request from OMB's Office of Economic Policy (202-395-3381).

Nominal Discount Rates. A forecast of nominal or market interest rates for 2013 based on the economic assumptions for the Fiscal Year 2014 Budget are presented below. These nominal rates are to be used for discounting nominal flows, which are often encountered in lease-purchase analysis.

Nominal Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
0.5	1.1	1.5	2.0	2.7	3.0

Real Discount Rates. A forecast of real interest rates from which the inflation premium has been removed and based on the economic assumptions from the 2014 Budget is presented below. These real rates are to be used for discounting constant-dollar flows, as is often required in cost-effectiveness analysis.

Real Interest Rates on Treasury Notes and Bonds of Specified Maturities (in percent)

3-Year	5-Year	7-Year	10-Year	20-Year	30-Year
-1.4	-0.8	-0.4	0.1	0.8	1.1

Analyses of programs with terms different from those presented above may use a linear interpolation. For example, a four-year project can be evaluated with a rate equal to the average of the three-year and five-year rates. Programs with durations longer than 30 years may use the 30-year interest rate.

Other Documents

Text of OMB Circular No. A-94 in HTML or PDF (22 pages, 78 kb)

Table of Past Years Discount Rates from Appendix C of OMB Circular No. A-94 (2 pages, 28 kb)

Memorandum M-13-04, 2013 Discount Rates for OMB Circular No. A-94 (2 pages, 790 kb)

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APPENDIX G

WW Operating Funds

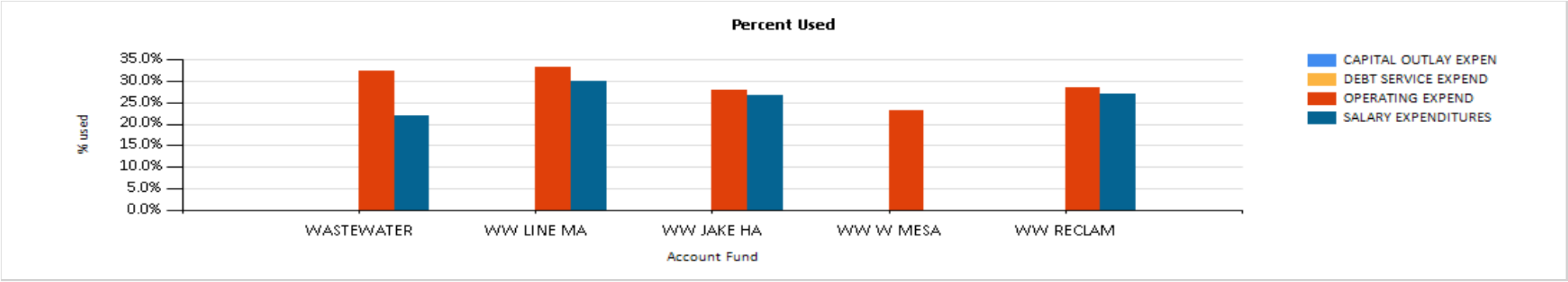
City of Las Cruces
PEOPLE HELPING PEOPLE

Wastewater Operations by Section

as of month end close 11/12/2013

	FY 2014 Revised Budget	YTD FY 2014 Actual	% Used	$ Avail	% Avail	Encumb	YTD FY 2013 Actual	YTD FY 2012 Actual	YTD FY 2011 Actual
Total Expenditures Wastewater Operations	$11,906,160	$3,565,003	30.0%	$8,336,064	70.0%	$403,647	$3,398,735	$2,887,325	$2,921,530
SALARY EXPENDITURES	$2,333,183	$647,411	27.7%	$1,685,772	72.3%	-	$584,441	$615,773	$709,687
OPERATING EXPEND	$9,500,709	$2,917,592	30.8%	$6,578,023	69.2%	$393,338	$2,814,294	$2,271,552	$2,211,844
DEBT SERVICE EXPEND	-	-	-	-	-	-	-	-	-
CAPITAL OUTLAY EXPEN	$72,268	-	0.0%	$72,268	100.0%	$10,309	-	-	-

	FY 2014 Revised Budget	YTD FY 2014 Actual	% Used	$ Avail	% Avail	Encumb	YTD FY 2013 Actual	YTD FY 2012 Actual	YTD FY 2011 Actual
54548010 - WASTEWATER A&G	$4,436,460	$1,421,917	32.1%	$3,014,543	67.9%	$396	$1,377,616	$930,718	$907,581
54548040 - WW LINE MAINTENANCE	$2,247,016	$720,503	32.1%	$1,524,743	67.9%	$27,268	$677,207	$718,756	$719,125
54548060 - WW JAKE HANDS TREAT PLANT OPER	$4,131,245	$1,139,348	27.7%	$2,988,574	72.3%	$333,199	$1,127,450	$936,318	$1,114,459
54548120 - WW W MESA TREATMENT PLANT OPER	$99,840	$23,187	23.2%	$76,653	76.8%	-	$21,072	$108,077	$9,946
54548440 - EAST MESA WW RECLAMATION PLANT	$991,599	$260,048	26.2%	$731,550	73.8%	$42,784	$195,391	$193,456	$170,419



Wastewater Operations by Section

as of month end close 11/12/2013