

*Irvine Ranch Water District*

# **Energy and GHG Master Plan**

*Summary Report*

July 24, 2012



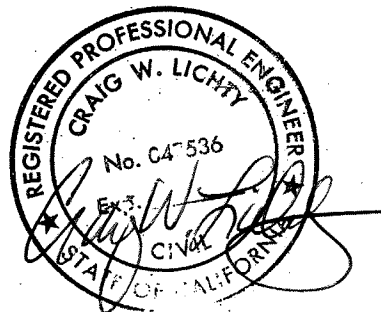
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## IRWD Energy & GHG Master Plan

24 July 2012



Prepared for

**Irvine Ranch Water District**  
15600 Sand Canyon Avenue  
Irvine, California 92619

K/J Project No. 1083047\*00



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Alan Zelenka  
Project Manager



# ***Irvine Ranch Water District Energy and GHG Master Plan - Summary Report***

## **Section 1: Master Plan Goal**

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As a recognized industry leader with a history of implementing innovative and cutting-edge practices and cost-effective programs, the Irvine Ranch Water District (IRWD or District) seeks to further improve, optimize and reduce its energy consumption and greenhouse gas (GHG) emissions by developing an Energy and GHG Master Plan (Master Plan). The planning effort was initiated in November 2010 with the direct involvement of IRWD's management team. The goal was to identify a portfolio of cost-effective projects to reduce the District's existing and future energy usage and costs, and as required under future regulatory conditions, reduce GHG emissions.

## **Section 2: Process Description**

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There were five steps in the development of the Master Plan:

1. Develop Supporting Materials
2. Perform Project Assessments
3. Evaluate and Rank the Projects
4. Perform Portfolio and Scenario Analyses
5. Create the Master Plan Report



Each step is summarized in the following sections.

## **Section 3: Develop Supporting Materials**

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### **3.1 Baseline & Forecast**

The primary supporting documents prepared for the Master Plan were the Baseline Forecast and 20-year Forecast of IRWD's electricity, natural gas, and fleet fuel usage and the associated GHG emissions. Baseline data was developed using operating and billing data for the 2009 calendar year.

Data for 14 existing facilities was analyzed to ascertain the current energy use by IRWD facilities. Energy data was also collected for 11 planned and authorized projects, which are currently under construction, contract, or pre-construction. By using the total energy use data from these 14 facilities and 11 projects, a baseline of current energy use at facilities was created that represents current energy use. This provided a "snap-shot" or starting point for the forecast.

By starting with the baseline energy usage and applying acceptable escalation rates, a forecast of energy use over a 20-year period was developed. This is referred to as the Baseline Forecast.

IRWD also identified an additional eight projects that are currently being planned or considered for the future. Expected energy use from these projects was used to model their impact on future energy use and GHG emissions. This second forecast is referred to as the Baseline Plus Planned Projects (BPPP) Forecast and represents IRWD's total energy use over a 20-year period, assuming the additional eight projects are completed. Tables 1, 2 and 3 provide a list of the facilities and projects included in the Baseline and BPPP Forecasts.

**TABLE 1: EXISTING FACILITIES INCLUDED IN THE BASELINE FORECAST**

Facility Number	Facility Name	Year Planned to be On-Line	Baseline		
			Electricity Use (kWh/Yr)	Natural Gas Use (Therms/Yr)	GHG Emissions (MT CO <sub>2</sub> e/Yr)
1	IRWD HQ	--	1,170,195	24,629	850
2	IRWD Ops	--	1,990,902	29,168	1,113
3	Dyer Road Well Field	--	19,696,444	0	6,769
4	DATS	--	9,330,862	0	5,429
5	Irvine Desalter Plant	--	13,757,566	0	4,927
6	MWD Imports	--	0	0	20,723
7	Recycled	--	2,829,539	18,328	1,201
8	Other Water Supply	--	16,033,291	5,588	5,747
9	Michelson WRP	--	17,696,908	72,066	7,742
10	Los Alisos WRP	--	7,605,361	552	5,584
11	Other Waste Water	--	670,526	0	246
12	Vehicles	--	0	0	1,348
13	San Joaquin Marsh	--	2,433,325	0	886
14	Manning Treatment Plant	--	101,130	0	30
<b>TOTAL for Baseline</b>			<b>93,316,049</b>	<b>150,331</b>	<b>62,595</b>

Baseline data is from actual billing data for CY 2009

**TABLE 2: PLANNED/AUTHORIZED FACILITIES INCLUDED IN THE BASELINE FORECAST**

Facility Number	Facility Name	Year Planned to be On-Line	Baseline		
			Electricity Use (kWh/Yr)	Natural Gas Use (Therms/Yr)	GHG Emissions (MT CO <sub>2</sub> e/Yr)
15	Dept. 50 Storage Building	2012	36,600	0	11
16	Strand Ranch	2012	0	0	0
17	Baker Treatment Plant	2013	5,805,000	0	1,714
18	Michelson Phase 2 Upgrade	2012	32,060,000	79,800	10,209
19	Class B Biosolids Handling - with FOG	2015	19,219,200	20,600	5,834
20	Syphon Reservoir (500 AF)	2012	76,000	0	22
21	East Reservoir #3 Photovoltaic *	2011	-340,000	0	-99
22	Jackson Ranch	2011	0	0	0
23	Wells 21 and 22	2012	5,154,600	0	1,523
24	Tustin Legacy Well 1A (aka Well 52)	2013	2,105,400	0	622
25	Lake Forest Well #2	2014	306,000	0	105
<b>TOTAL for Baseline Forecast</b>			<b>64,422,800</b>	<b>100,400</b>	<b>19,941</b>

\*Photovoltaic facility at East Reservoir #2 will generate a surplus of 340,000 kWh of electricity; creating a reduction of 99 MT CO<sub>2</sub>e/Yr.



**TABLE 3: FUTURE PLANNED FACILITIES INCLUDED IN THE BASELINE PLUS PLANNED PROJECTS FORECAST**

Facility Number	Facility Name	Year Planned to be On-Line	Baseline		
			Electricity Use (kWh/Yr)	Natural Gas Use (Therms/Yr)	GHG Emissions (MT CO <sub>2</sub> e/Yr)
26	Michelson Phase 3 Upgrade	2020	4,127,000	7,400	1,284
27	Syphon Reservoir (5,000 AF)	2018	8,750,000	0	2,558
28	Class A Biosolids Handling – Dryer	2015	21,515,800	964,800	16,425
29	Class A Biosolids Handling – Microturbine *	2015	-7,683,300	0	-2,246
30	Well 106	2012	1,980,800	0	709
31	Well 53	2012	2,042,100	0	702
32	Future OPA Wells	2016	3,369,500	0	1,158
33	Well 51	2015	2,739,500	0	1,594
<b>TOTAL for BPPP Forecast</b>			<b>36,841,400</b>	<b>972,200</b>	<b>22,184</b>

\* Microturbine facility for biosolids handling will generate a surplus of 7,683,300 kWh of electricity; creating a reduction of 2,246 MT CO<sub>2</sub>e/Yr.

Tables 4 and 5 present IRWD’s energy use, energy cost, and GHG emissions summarized in five-year increments through 2030 under the BPPP Forecast. Figures 1 and 2 present the forecast of IRWD’s electricity use and electricity costs by year for the Baseline Forecast (the use by existing and authorized facilities) and the BPPP Forecast (includes the planned facilities). For the purposes of the Master Plan, the BPPP Forecast represents the most likely future energy use by IRWD. Potential future projects identified in this plan will either add to or subtract from the totals in the BPPP Forecast.

Tables 4 and 5 show a significant jump in the projected use and cost of electricity and natural gas between the baseline year (2009) and 2015. This is due to numerous new IRWD projects coming on-line during this period, including: the Michelson Plant Phase 2 Upgrade, Biosolids Handling Projects, Baker Treatment Plant and several local groundwater well projects. The drop in electricity use in 2017 is due to the Irvine Desalter losing its groundwater pumping exemption. The data below also shows that energy use and GHG emissions are fairly flat from 2015 until 2030.

Table 4 shows that annual increases in GHG emissions during the baseline year to 2015 are at a much lower rate than increases of electricity and natural gas use. This occurs because the GHG emissions associated with new IRWD projects coming on-line are offset by a reduction in the emissions associated with importing water from MWD and treating biosolids at Orange County Sanitation District (OCSD).



**TABLE 4: TOTAL ANNUAL ENERGY USE AND GHG EMISSIONS – BPPP FORECAST**

Year	Total Annual Electricity Use (kWh/Yr)	Total Annual Natural Gas Use (Therms/Yr)	Total Annual Fleet Fuel Consumption (Gallons/Yr)	Total Annual GHG Emissions (MT CO <sub>2</sub> e/Yr)
<b>Baseline Year</b>	93,316,049	150,331	164,912	62,565
<b>2015</b>	149,394,800	1,143,800	179,400	75,900
<b>2020</b>	155,774,800	1,183,900	195,700	90,300
<b>2025</b>	162,771,600	1,218,700	208,100	95,700
<b>2030</b>	164,086,800	1,221,300	209,700	95,700

**FIGURE 1: IRWD ELECTRICITY USE FORECAST**

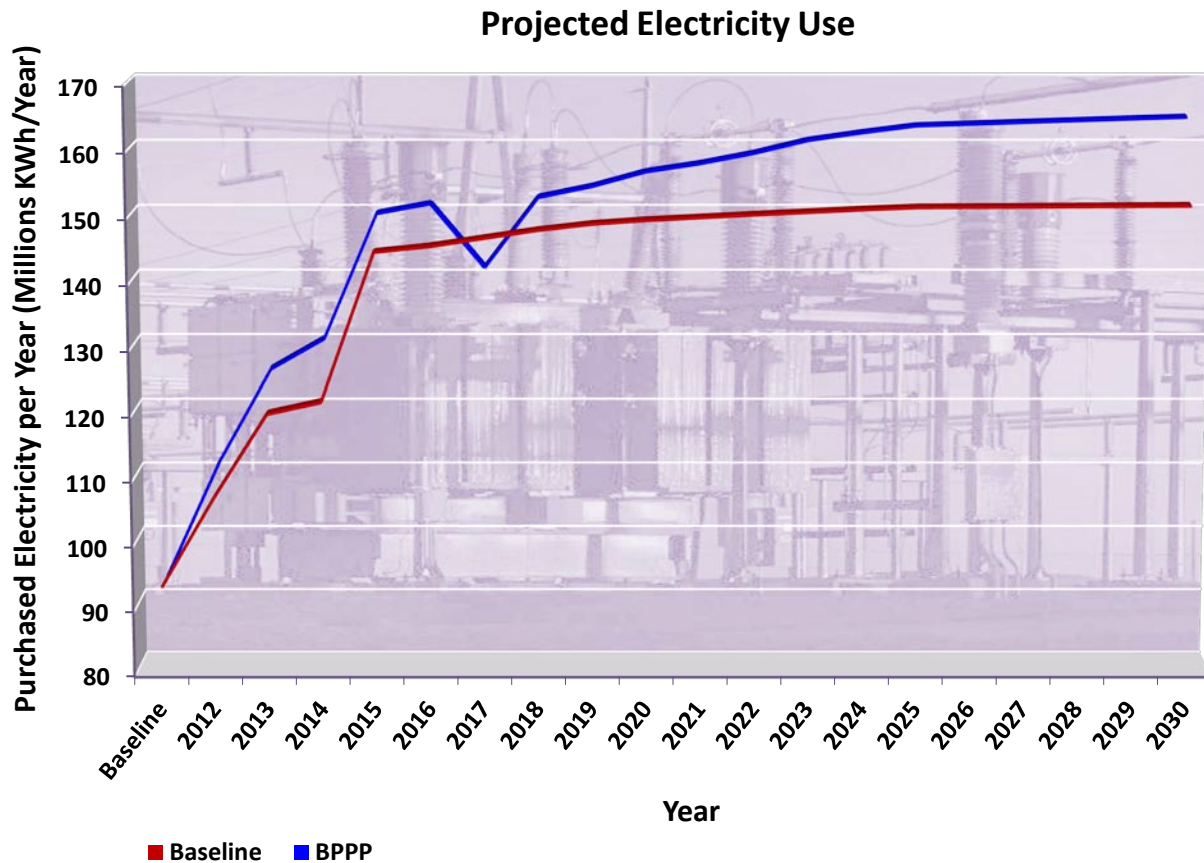


Table 5 depicts the increases in electricity, natural gas and fleet fuel costs based on acceptable utility escalation rates. The shift from MWD imports to pumping local groundwater supplies requires more direct electricity use by IRWD, and is the major reason for the increased electricity costs. Natural gas purchases increase because the sludge dryers in the Biosolids Project come on-line in 2015. Total annual energy costs nearly double in the period from the baseline year up to 2015 (from \$10 million to \$18 million), and rise to nearly \$27 million per year by 2030. The expected cost increases, however, will be largely offset by the savings from no longer sending biosolids to OCSD and avoiding purchases of imported water from MWD.

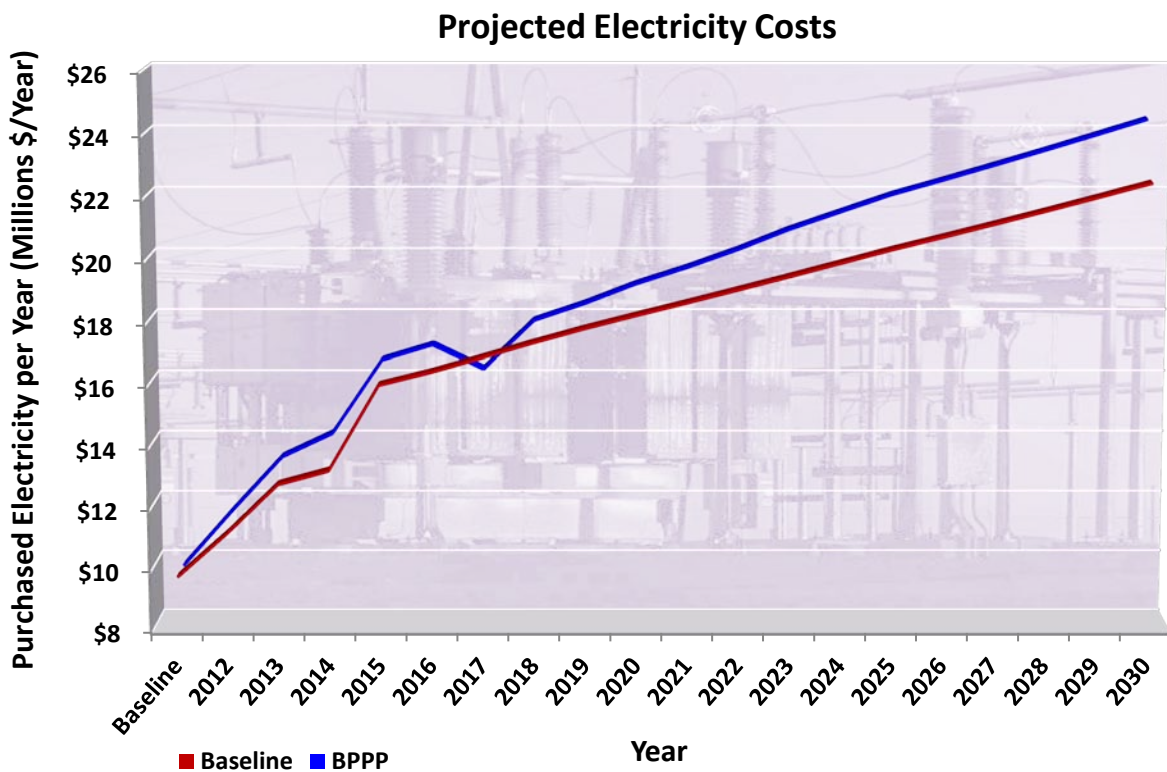




**TABLE 5: TOTAL ANNUAL ENERGY COST – BPPP FORECAST**

Year	Total Annual Electricity Costs (\$)	Total Annual Natural Gas Costs (\$)	Total Annual Fleet Fuel Consumption Costs (\$)	Total Costs (\$)
Annual Utility Escalation Rates (%)	<b>1.97%</b>	<b>3.00%</b>	<b>2.60%</b>	-
<b>Baseline Year</b>	\$9,732,864	\$112,266	\$376,716	\$10,221,900
<b>2015</b>	\$16,521,000	\$986,700	\$467,100	\$17,974,800
<b>2020</b>	\$18,991,000	\$1,183,900	\$579,300	\$20,754,800
<b>2025</b>	\$21,877,800	\$1,412,800	\$700,300	\$23,990,900
<b>2030</b>	\$24,314,300	\$1,641,300	\$802,300	\$26,757,900

**FIGURE 2: IRWD ELECTRICITY COST FORECAST**



In addition to the Baseline and BPPP Forecasts, other supporting documents developed for this Master Plan include summaries of regulatory constraints, potential project funding sources, energy equipment audits, the process energy audit, and a review of the OCSD GHG Inventory assumptions (refer to the full report).

## Section 4: Project Assessments



### 4.1 Initial Screening of Projects

Once the supporting documents were completed, potential energy savings and GHG reduction projects were identified. Prior to Workshop #1, IRWD management staff and Kennedy/Jenks staff brainstormed prospective projects and compiled an initial list of 61 potential projects. During Workshop #1, IRWD management staff and Kennedy/Jenks staff used a voting and ranking process to pare the list of potential projects from 61 down to 20. These 20 projects were more fully assessed in the next phase of the process, and are summarized in Table 6 below.



**TABLE 6: TOP 20 POTENTIAL PROJECTS**

Project Number	Project Title	Project Description
1	Water Supply Pump Optimization Program	Evaluate energy optimization software, such as Derceto's AQUADAPT, that would optimize water supply pumps to save energy, minimize cost, and maximize reliability.
2	GHG Reductions from Biosolids	Evaluate the potential GHG reductions caused by the District's Class A biosolids project.
3	Accelerate Local Groundwater Supply Projects	Evaluate the acceleration of planned local groundwater supply projects; thereby reducing imported water purchases from MWD (assuming current groundwater basin management rules are changed).
4	Automate Dissolved Oxygen Control at LAWRP	Evaluate changing existing Dissolved Oxygen (DO) controls at LAWRP from a manual system to an automated system.
5	Microhydro	Screen sites (based on head and flow characteristics) between water supply pressure zones to evaluate the feasibility of installing microhydro systems (<100 kW) in place of pressure relief valves.
6	San Joaquin Marsh Pumping Optimization	Evaluate not pumping in the winter during peak hours (noon- 6 p.m.) to reduce energy use.
7	Reservoir Pumped Storage	Evaluate building a pumped storage small hydro project between the upper Irvine Lake Reservoir and the lower Peters Canyon Reservoir. Water would be pumped up during the lower-cost off-peak hours and released to generate electricity during the higher-cost on-peak hours.
8	Food-Waste to Energy	Evaluate the collection and use of pre-processed and liquefied food waste to increase digester gas production to be used to generate electricity. Equipment would include a food waste receiving station and microturbine generators.



Project Number	Project Title	Project Description
9	Pump Efficiency Improvement Program	Evaluate accelerating and expanding the existing program to evaluate all pumps, install all cost-effective pump retrofits within three years, and develop an IRWD pump specification requiring premium efficiency pumps.
10	Energy Efficiency Measures (EEMs)	Evaluate the EEMs from: 1) the new energy audits of the Sand Canyon Headquarters Building and the MWRP Operations Building; 2) the EEMs that were not implemented from the October 2009 energy audit, and; 3) an Energy Management System (EMS) for the MWRP. An EMS is a stand-alone software system that is used to monitor and control the operations and maintenance of the MWRP in order to optimize energy use and thereby minimize GHG emissions.
11	Motor Replacement Program	Evaluate an accelerated three-year program to install cost-effective motor retrofits, and develop an IRWD motor specification requiring premium efficiency motors.
12	Solar PV Projects	Evaluate the potential for solar PV projects, and various purchase structures including: IRWD own & operate, power purchase agreement (PPA), and a land lease to a solar PV developer at Jackson Ranch.
13	Well Efficiency Testing & Rehabilitation (WETR)	Evaluate the WETR program including: testing to identify wells that have seen a drop in specific capacity, rehabilitation of those wells with subpar performance through mechanical or chemical means, and installation of right-sized pumps/motors for new hydraulic conditions.
14	Michelson Phase 2 Process Optimization	Evaluate optimizing energy use at the MWRP by diverting some of the flow away from the new energy intensive Membrane Bio Reactor (MBR) to the existing less energy intensive Activated Sludge (AS) system.
15	Process Energy Audit	Evaluate plant equipment and processes at MWRP and LAWRP to determine if control measures could be added in order to reduce energy use.
16	Syphon Reservoir Small Hydro	Evaluate the potential electricity generation from the planned outfall at the Syphon Reservoir through the existing 16-inch pipeline during the summer months.
17	Renewables Purchase	Evaluate the purchase of renewable energy through three purchase structures: equity purchase, Power Purchase Agreement (PPA), and Renewable Energy Credits (RECs).
18	Fleet Fuel Consumption & GHG Policy	Evaluate opportunities to change the composition of IRWD's vehicle and equipment fleet, the use of alternative fuels, and other fuel-saving strategies.
19	Forestry Offset Program	Evaluate the potential GHG reductions caused by carbon sequestration from an expansion of IRWD's Shadetree Partnership Nursery Project.
20	Additional Water Conservation Activities	Evaluate additional water conservation activities above and beyond existing IRWD programs, including: Joint Energy and Water Commercial Audit Pilot Program, Commercial Industrial and Institutional Water Use Efficiency Incentive Program, and UC Irvine Water Use Efficiency Incentive Program.



## 4.2 Project Assessments and Cost Templates

A concept-level Project Assessment and Cost Template analysis was prepared for each of the Top 20 Projects. The purpose of the Project Assessments was to create sufficient understanding about each project in order to score and rank them. The Project Assessments and Cost Templates are not intended to be a “Go/No Go” level analysis, and their accuracy is typical of a planning study. Most of the projects included in the final short-list of projects will need additional in-depth analysis before final approval and implementation.

In order to promote an equitable comparison of the projects in the evaluation, scoring and ranking phases of the process, the Project Assessments used a common template approach for all 20 projects. Each Project Assessment included the following elements:

- Project Description
- History
- Vendors
- Technical Maturity
- Energy Production, Energy Savings and GHG Reductions
- Environmental Impacts
- Operational Impacts
- Summary of Advantages and Disadvantages

Project costs were also calculated using a common template approach. The Cost Template used for each project included the following elements:

- Size (KW per unit)
- Equipment Life
- Annual kWh Saved or Generated
- Total Capital Cost and Annual Debt Service
- O&M Costs
- Incentives and Benefits (including rebates and the value of avoided electricity costs)
- Annual Net Cost or Savings
- Net Present Value (NPV) of Annual Net Costs or Savings
- Energy and GHG Lifecycle Costs (\$/kWh and \$/MTCO<sub>2</sub> respectively)

During the conceptual-level evaluations it became apparent that several of the Top 20 Projects had multiple implementation options, and therefore 32 project options were identified. For example, for Project #5 – Microhydro alone there were eight different options identified.

Each Project Assessment and Cost Template is included in the full report, as well as a section on how to read the assessments and templates.

## 4.3 Projects Removed from Further Consideration

Two of the Top 20 Projects were removed from further consideration in the process:

- **Project #2 - GHG Reductions from Biosolids** was removed because after it was selected the project ended up being included in the Baseline Plus Planned Projects and was therefore no longer a valid new incremental project.



- **Project #11- Motor Replacement Program** was removed because the energy savings and GHG reductions associated with this program were already included in Project #9 – Pump Efficiency Improvements Program and in Project #13 – Well Efficiency Testing Program, making it redundant.

## Section 5: Project Evaluation and Ranking



### 5.1 Project Evaluation Criteria and Weighting

In order to score and rank the projects, an evaluation criteria and a weighting system was developed during Workshop #2. The workshop was attended by IRWD management staff and facilitated by Kennedy/Jenks. The evaluation criteria were based on decision factors commonly used by IRWD. The consensus evaluation criteria and weighting are described in Table 7, and were applied to the 32 projects by Kennedy/Jenks.

**TABLE 7: CONSENSUS EVALUATION CRITERIA AND WEIGHTING**

Evaluation Criteria	Description	Weighting
<b>Cost/Cost-Effectiveness</b>	How does this project cost compare to the other projects?	40
<b>Operational Impacts</b>	How do the adverse or beneficial impacts of the project on the operations of the plant compare to the other projects and to continued purchases of electricity? Impacts include the general operations & maintenance complexity and risk, and the amount of additional staff required.	20
<b>Risk &amp; Uncertainty</b>	What is the financial risk that the capital cost or O&M costs of the project will be higher than the estimated costs in the project assessment? What is the regulatory risk of additional required permits or approvals? What is the need for additional political action by IRWD to implement the project? Will the local community support or accept the project? Decision Autonomy — To what degree can IRWD act on its own rather than rely on additional agencies or regulators to also approve the project?	20
<b>GHG Impacts</b>	How do the reductions in GHG compare to the other projects and to continued purchases of electricity?	10
<b>Environmental Impacts</b>	How do the air, land, water, noise, visual and waste by-products impacts of the project compare to the other projects?	10

A more detailed description of the evaluation criteria and sub-criteria is found in the full report.

## 5.2 Scoring and Ranking

The goal of the scoring and ranking process was to differentiate the 32 projects based on the weighted evaluation criteria. The scored projects can then be ranked and a short-list of projects developed. The short-list of projects will be used to develop several portfolios of projects that will be analyzed in the next step (Step 4: Portfolio Analysis) of the planning process.

A project's score was calculated by applying the evaluation criteria in Table 7 to each project. However, there were both quantitative and qualitative criteria, each of which was handled in a slightly different fashion. Quantitative criteria ("Cost/Cost-Effectiveness" and "GHG Impacts") had calculated costs or reduction amounts in the Cost Template that could be compared. Applying the quantitative criteria involved a statistical sorting from best to worst of the projects based on costs or GHG emission reduction amounts. The best project is given a score of 10 and the worst project is given a score of 1.

Qualitative criteria ("Operational Impacts," "Risk and Uncertainty" and "Environmental Impacts") do not have numerical comparisons, but have written evaluations from the Project Assessments. To apply the qualitative evaluation criteria to the projects, a "low-moderate-high" scale was used to assign scores from 1 to 10. A spreadsheet was used to calculate the final cumulative score of each project. Table 8 and Figure 3 show the results of the scoring process.

**TABLE 8: PROJECT SCORING AND RANKING**

Rank	Project No.	Project Name	Score
1	20	Additional Water Conservation - Combined Program	80
2	9	Pump Efficiency Improvement Program	77
3	10	Energy Efficiency Measures	75
4	17b	Renewables Purchase - REC	74
5	12b	Solar PV Program - Land Lease Jackson Ranch	73
6	14b	MWRP Phase 2 Optimization - 38% Flow Diversion	71
7	14a	MWRP Phase 2 Optimization - 25% Flow Diversion	71
8	15	Process Energy Audit	71
9	6	San Joaquin Marsh Pumping Optimization	71
10	4	LAWRP Automated DO Control	70
11	18	Fleet Fuel Reduction - Alternative Vehicles	66
12	3	Accelerated Local GW Supplies	66
13	8	Food Waste-to-Energy	64
14	12c	Solar PV Program - PPA	60
15	1b	Pump Optimization (4% savings)	54
16	13	Well Efficiency Testing and Rehabilitation	52
17	7c	Reservoir Water Pumped Storage: Hydro Only	52
18	17a	Renewables Purchase - Direct Access PPA	51
19	12a	Solar PV Program - Own & Operate	51
20	5a	Microhydro - Sand Canyon & Oak Canyon 3-2 PRV	48
20	5c	Microhydro - Portola Springs Zn 4-4R PRV (P1)	48
20	5d	Microhydro - Portola Springs Zn 4-4R PRV (P2)	48



Rank	Project No.	Project Name	Score
20	5e	Microhydro - PA6 Zn 6-5 PRV (P3)	48
20	5f	Microhydro - PA6 Zn 6-5 PRV (P4)	48
20	5g	Microhydro - Spectrum 8 Zn 3-3R PRV (P3)	48
20	5h	Microhydro - Trabaco Zn 3-3R PRV (P7)	48
27	5b	Microhydro - Sand Canyon & Alton Pkwy 3-2 PRV	47
28	1a	Pump Optimization (2% savings)	46
29	16	Syphon Reservoir Small Hydro	46
29	7a	Reservoir Water Pumped Storage: Net Metering	46
29	7b	Reservoir Water Pumped Storage: Feed in Tariff	46
32	19	Forestry Offset	45

## Project Ranking

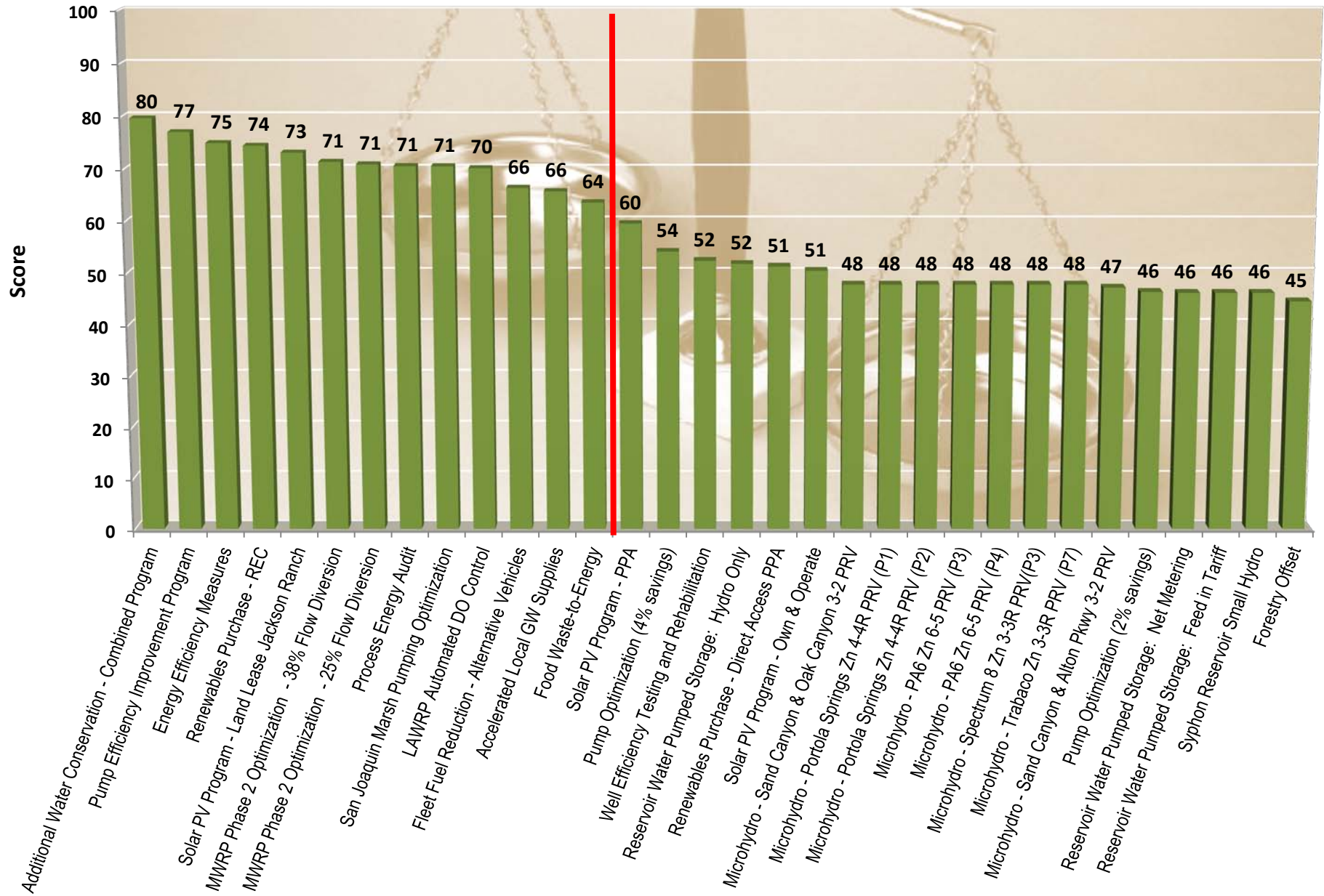


FIGURE 3: PROJECT SCORING AND RANKING





### 5.3 Short-List of Projects Subject to Additional Analysis

The red line in Figure 3 indicates a natural break-point in the project scoring between 64 and 60 points. Projects to the left of this break-point represent the short-list of projects that would be subject to additional analysis and roughly demark the cost-effective from the non-cost-effective projects included in the scoring and ranking process. It is these cost-effective projects that are used in the next phase of the process to create portfolios of projects for final evaluation. While there are 13 projects identified in Figure 3 above; two of the projects (14a and 14b) are variations of the same project, and are thus mutually exclusive. Only one of these projects can be included on the short-list; therefore Project 14b, which has a higher NPV and value to IRWD, was included in the short-list of 12 projects. Three of the 12 projects merit further discussion:

**Project #3 - Accelerated Local Groundwater Supplies:** The NPV of Project #3, with an annual net savings of \$141 million, represents the largest benefit to the District from any single project. In and of itself, Project #3 represents nearly 90% of the total benefit to IRWD of all the projects combined, and its benefits are 10 times greater than the next largest project. The sheer size of Project #3 makes it difficult to analyze it concurrently with the rest of the short-listed projects.

In addition, Project #3 requires a change in the current basin groundwater management policy, which merits careful and serious consideration by IRWD. Given these two factors, it was decided that Project #3 should be analyzed separately from the other 11 projects on the short-list. Therefore, the portfolio and scenario analysis in Section 6 is performed first on the short-list of 11 projects, and then separately on Project #3.

**Project #17b – Renewables Purchase from Renewable Energy Credits (RECs):** Project #17b is the only project on the short-list that has a cost to IRWD and no electricity savings. The reason it is on the short-list of projects is it potentially provides a cost-effective method to reduce GHG emissions under future regulatory conditions, and because it scored very highly with respect to the evaluation criteria. Should IRWD be subject to future GHG regulations and need to reduce its GHG emissions beyond the reductions identified in the Master Plan, RECs are a cost-effective, no-capital-cost option to achieve those reductions. Regarding Project #17b's relatively high score and ranking, while it scored low on the NPV criterion, it does not have any capital costs and thus scored fairly high on the overall Cost/Cost-Effectiveness criterion. As for the other criteria, since a REC is a contractual relationship it has very little operational risk, complexity or staffing requirement; and therefore scored at the top of the Operational Impacts criterion. Since it is a contractual transaction, its financial and regulatory risks are also very low. Its political/local acceptability is high, and it does not require any other body to approve the project, meaning decision autonomy ranks high. Therefore it scored at the top of the Risk and Uncertainty criterion. Since the project utilizes renewable energy, it also scored high for GHG impacts and Environmental Impacts criteria. Overall it ranked fourth in scoring.

**Project #18 – Fleet Fuel Reduction – Alternative Vehicles:** This project identifies the energy and GHG reduction associated with changing the composition of IRWD's vehicle and equipment fleet to use alternative fuels. Quantifying the potential benefit associated with changing IRWD's vehicle fleet requires a detailed analysis of future technology, fuel costs and maintenance requirements by equipment type; but this type of detailed analysis is inappropriate for a feasibility level study such as this. The analysis done for this project did attempt to estimate the fuel savings and GHG reductions, and IRWD staff estimated the capital cost of the alternative vehicles over 20 years. The results of that analysis show that this project would result in an estimated NPV of savings of \$1.9 million over 20 years; which is why this project is on the short-list. However, no fueling infrastructure costs or O&M cost & benefits were included in this analysis. IRWD staff believes a new CNG fueling station would be required in order to provide normal and emergency operations. This facility would cost about \$2.3 million and makes the Fleet Fuel Reduction project no longer cost-effective. Whether this refueling station is necessary, or if necessary, whether the capital cost could be significantly reduced by using a regional facility has not been fully analyzed. Therefore, the Fleet Fuel Reduction project has been evaluated without the cost of a CNG fueling station and several portfolios that do not include the Fleet Fuel Reduction project have been included in the portfolio analysis in the next section. If the Fleet Fuel Reduction project were to be added to the final preferred portfolio at a later date, it is recommended that additional analysis of the CNG fueling station under both normal and emergency operations, as well as the potential for regional partnerships be explored.

Table 9 shows, in ranked order, the 12 short-listed projects that are subject to additional analysis. The total of all 12 projects presented in Table 9 represents the sum of each project for its estimated project life. Subsequent sections combine the projects into portfolios and analyze them for only the study period through the year 2030.



**TABLE 9: SHORT-LIST OF PROJECTS SUBJECT TO ADDITIONAL ANALYSIS**

Rank	Project No.	Life	Project Name	Capital Cost Less Incentives (\$)	NPV of Annual Net Savings (\$) <sup>1</sup>	Average Annual Net Savings (\$/Year)	Average Annual Electricity Saved (kWh)	Average Annual GHG Reduction (MT/yr)	Average Annual Natural Gas Saved (Therms)	Average Annual Fleet Fuel Saved (Gal/Year)
1	20	20	Additional Water Conservation - Combined Program	\$1,132,200	\$13,235,700	\$894,300	743,800	1,067	0	0
2	9	15	Pump Efficiency Improvement Program	\$1,127,100	\$1,760,600	\$152,900	2,188,800	637	0	0
3	10	5-20	Energy Efficiency Measures	\$241,200	\$684,500	\$44,100	513,300	149	0	0
4	17b	20	Renewables Purchase - REC	\$0	(\$293,100)	(\$20,400)	0	1,274	0	0
5	12b	20	Solar PV Program - Land Lease Jackson Ranch	\$0	\$763,200	\$51,400	0	0	0	0
6	14b	7	MWRP Phase 2 Optimization - 38% Flow Diversion	\$0	\$807,100	\$128,400	1,148,700	465	0	0
7	15	20	Process Energy Audit	\$5,500	\$319,100	\$22,100	185,000	54	0	0
8	6	10	San Joaquin Marsh Pumping Optimization	\$0	\$219,800	\$26,000	405,500	118	0	0
9	4	5	LAWRP Automated DO Control	\$309,800	\$58,100	\$12,800	835,700	243	0	0
10	18	20	Fleet Fuel Reduction - Alternative Vehicles	\$1,509,600 <sup>2</sup>	\$1,929,600	\$161,400	(12,100)	389	(527,000) <sup>3</sup>	73,600 <sup>4</sup>
11	3	20	Accelerated Local GW Supplies	\$24,822,200	\$141,474,200	\$10,921,500	(10,637,600)	4,049	0	0
12	8	15	Food Waste-to-Energy	\$4,260,200	\$768,800	\$45,800	3,153,600	917	0	0
<b>Total All 12 Projects</b>				<b>\$33,407,000</b>	<b>\$161,727,600</b>	<b>\$12,440,300</b>	<b>(1,475,200)</b>	<b>9,362</b>	<b>(527,000)</b>	<b>73.600</b>

<sup>1</sup> The NPV calculations in this table are calculated using the useful life of the project which in some cases goes beyond the study period of 2030. The analysis here is not strictly limited to the years 2012 to 2030.

<sup>2</sup> As per IRWD staff analysis, NPV of the 20 year cumulative capital costs, the 1<sup>st</sup> year incremental capital cost would be \$230,000, declining to zero over 20 years. This calculation does not include the estimated \$2.3 million for a CNG Fueling Station.

<sup>3</sup> Measured in 1,000 scf

<sup>4</sup> Combined gallons of gasoline and diesel

Table 9 shows the key economic, energy, and GHG results of the project evaluations for each of the 12 short-listed projects. The project life was, in general, 20 years unless the alternative has a limited window of opportunity. The sixth column from the left in Table 9 shows the Net Present Value (NPV) of the Annual Net Savings of the short-listed projects. The NPV calculation includes all of the project costs (i.e. – capital cost, debt service, O&M cost, and fuel costs), less any benefits and incentives over the life of the project. It is an estimate of the project’s full costs and benefits. Therefore, the calculated NPV best represents the estimated value of the project to IRWD. The NPV calculation eliminates the time-value of money and shows the cost or benefit of a project in current dollars (2012\$) so they can be more readily compared. A project with a positive NPV (black numbers) is a benefit to IRWD, and a project with a negative NPV (red numbers) is a cost to IRWD. Only Project #17b creates a cost to IRWD. Also, while nearly all of the projects save electricity, two projects (#18 and #3) actually increase the amount of electricity IRWD will need to purchase.

## Section 6: Portfolio and Scenario Analysis



### 6.1 Portfolio Analysis without Project #3

The Master Plan’s goal is to identify a portfolio of cost-effective projects to reduce the District's existing and future energy costs with corresponding reductions in GHG emissions. The Master Plan also recommends low-cost projects that can further reduce GHG emissions in response to future regulatory conditions. The portfolio that best meets this goal is the most appropriate portfolio for IRWD.

Eight portfolios were identified for analysis, and these were compared against each other to determine the best portfolio. Since a separate analysis is being done on Project #3, Portfolio 1 was comprised of the remainder of the 11 short-listed projects. The next three portfolios each removed a project that was the subject of discussion among IRWD staff at the workshop as to whether or not it should be included in the short-list. The RECs project was removed because of its positive NPV; the Fleet Changes project was removed because of its uncertain capital cost, and the Food-Waste-To-Energy project was removed because of the uncertainty about the type and amount of food waste that would be available to IRWD. Portfolio 5 removed the RECs and Fleet Changes projects from the portfolio. Portfolio 6 focused exclusively on energy efficiency projects, and included only projects in the portfolio that save electricity. Portfolio 7 included only those projects that could be done without any up-front capital cost. Finally, Portfolio 8 did not delete any projects, but added back the project that just missed the initial short-list cut-off - Project #12c Solar PV project using a Power Purchase Agreement (PPA). For the portfolio analysis only the cost and benefits within the study period up to 2030 are included. In summary, the eight portfolios are:

**Portfolio 1** - Short-Listed Projects minus Project #3: Accelerated Local GW Supplies

**Portfolio 2** - Short-Listed Projects minus Project #17b: RECs

**Portfolio 3** - Short-Listed Projects minus Project #18: Fleet Changes

**Portfolio 4** - Short-Listed Projects minus Project #8: Food-Waste-To-Energy

**Portfolio 5** - Short-Listed Projects minus Project #17b and #18

**Portfolio 6** - Only Energy Efficiency projects (projects #20, #9, #10, #15, #14b, #6 and #4)

**Portfolio 7**: Only projects without Capital Costs (projects #6, #12b, #14b, #17b, & #15)

**Portfolio 8** - Short-Listed Projects plus Project #12c – Solar PPA

None of the portfolios contain Project #3 – Accelerated Local Groundwater Supplies, because it was analyzed separately.

Five types of analysis were performed on the eight portfolios in order to compare them and select the best portfolio. Data was used directly from the project Cost Templates to create an annual portfolio cost or savings for

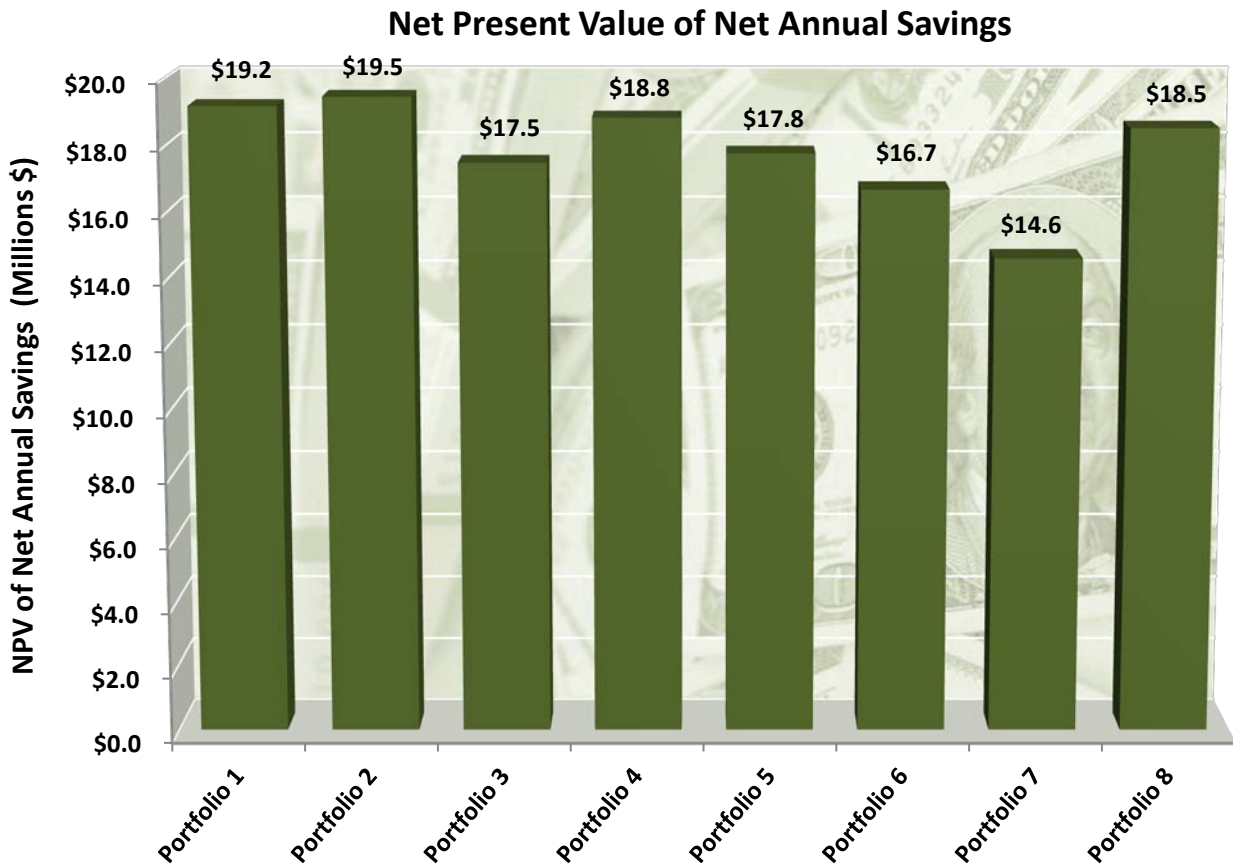


each of the eight portfolios. The annual portfolio cost or savings enables the calculation of the NPV of Net Annual Savings, the Capital Cost, and the Average Annual Electricity Cost of each portfolio.

The five types of analysis performed to compare the portfolios are:

1. Net Present Value (NPV) of the Net Annual Savings (\$)
2. Cumulative Capital Costs (\$)
3. Average Annual Electricity Cost (\$/Year)
4. Average Annual Electricity Purchases (kWh/Year)
5. Average Annual GHG Emissions Reductions (Metric Tons of CO<sub>2</sub>/Year)

**FIGURE 4: NPV OF NET ANNUAL SAVINGS - COMPARISON OF PORTFOLIOS**

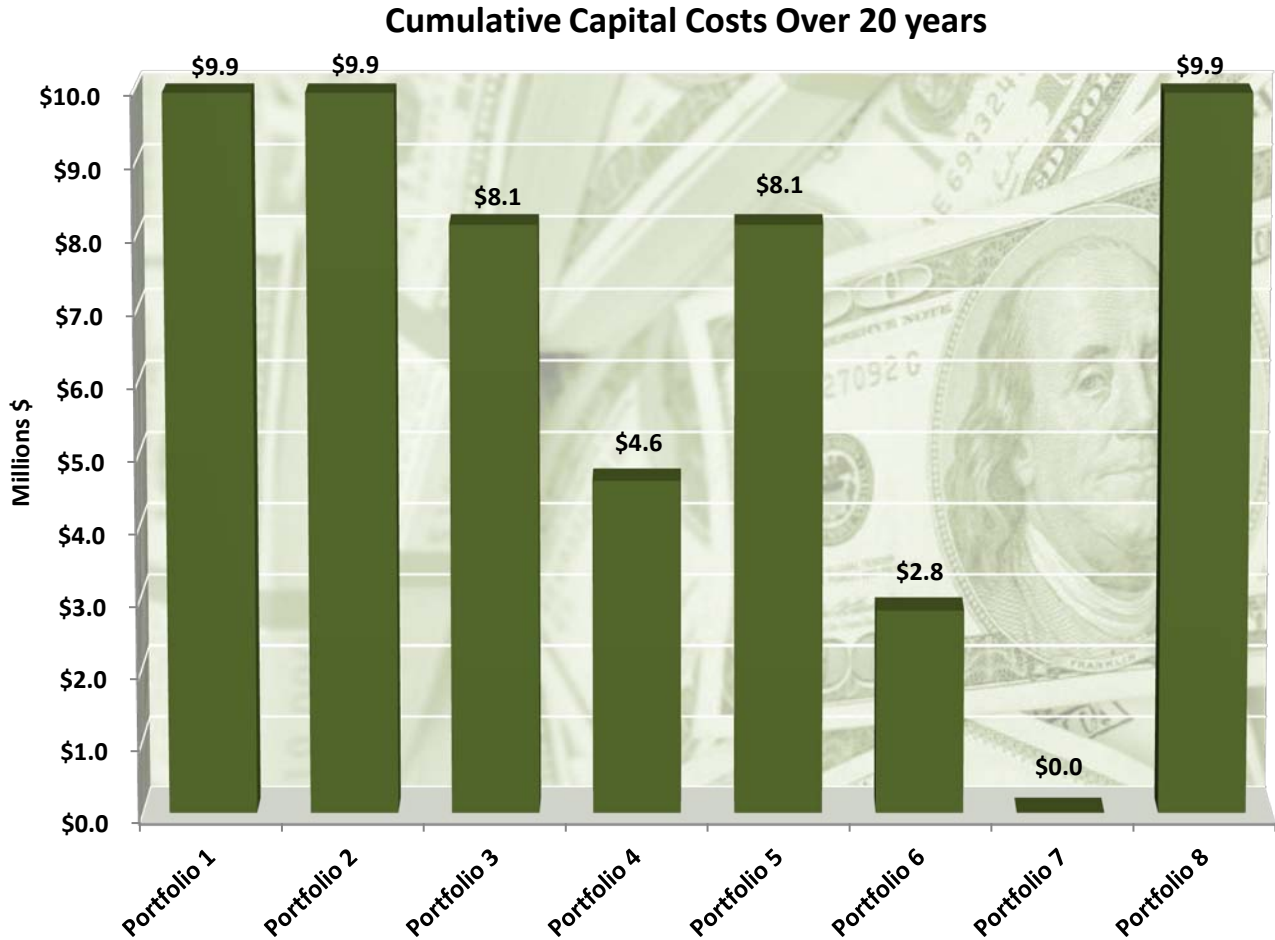


The above figure compares the NPV of Net Annual Savings for each portfolio compared to the BPPP. The NPV shows the value of the savings associated with the portfolio compared to the cost of the BPPP Forecast, which is represented by the x-axis (\$0) and includes IRWD's cost, energy use or GHG emissions. Portfolio 2 creates the largest savings to the District. None of the portfolios create a cost to IRWD; all of them create financial savings for IRWD.



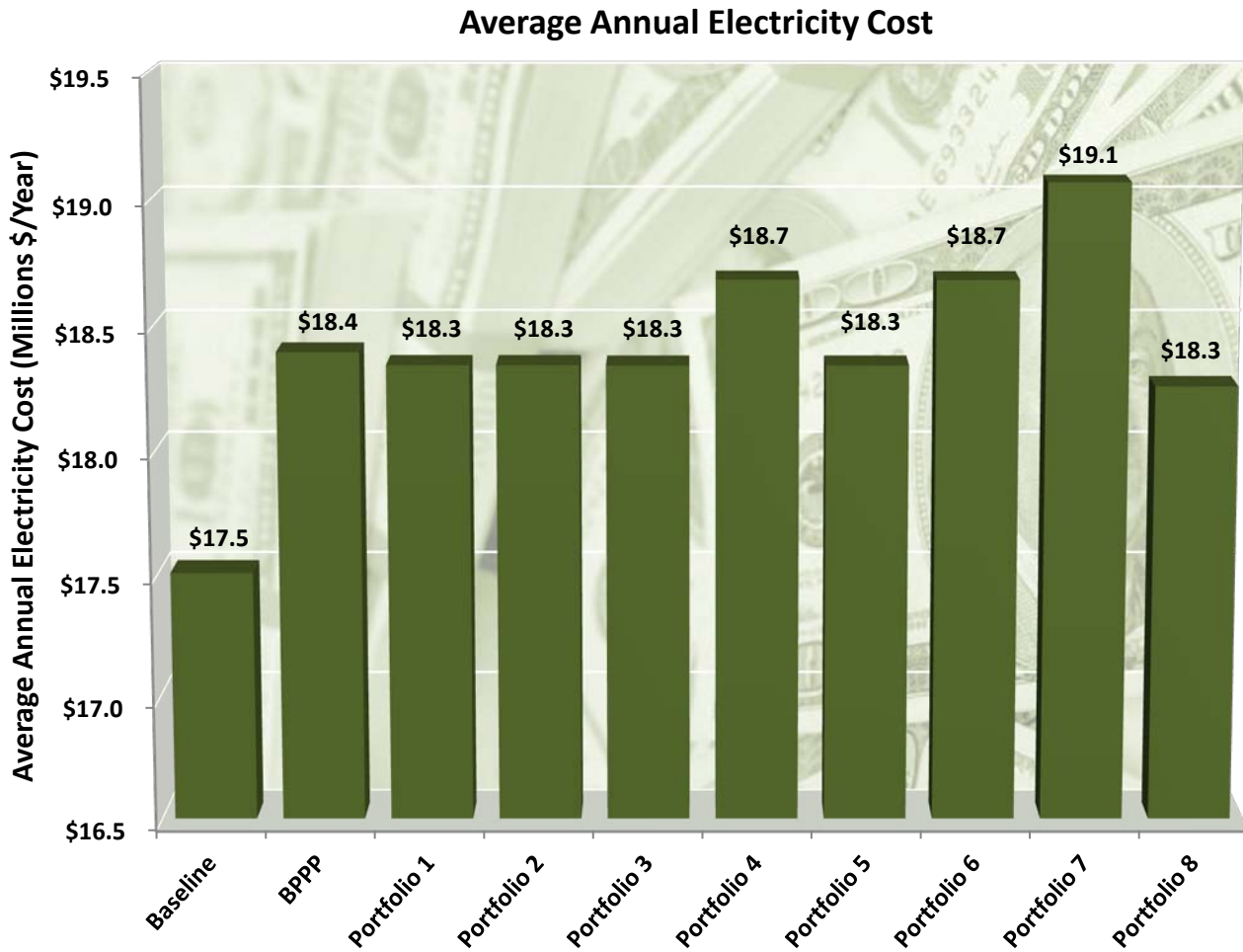


FIGURE 5: CUMULATIVE CAPITAL COSTS - COMPARISON OF PORTFOLIOS



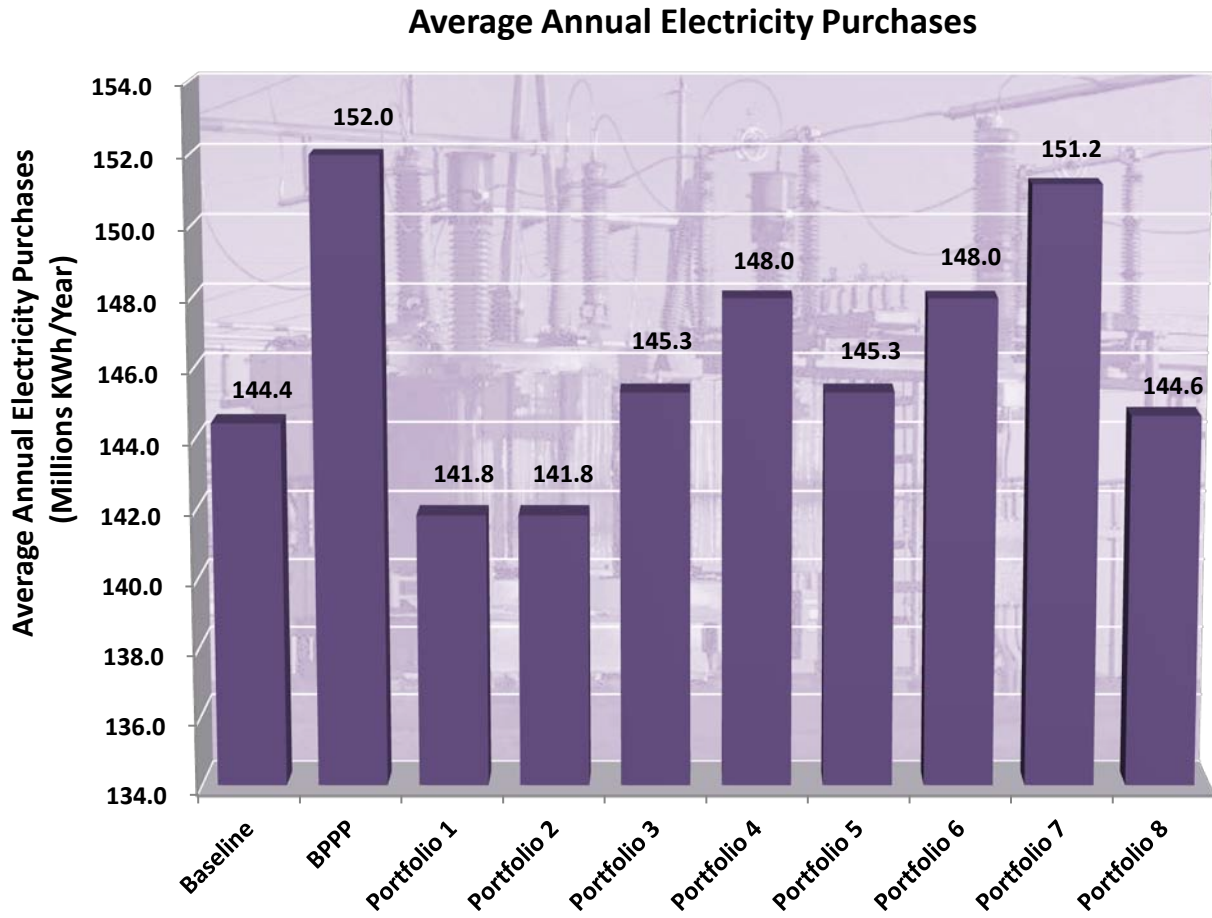
The figure above compares the cumulative capital cost required over 20 years for each of the eight portfolios. Portfolio 7, which is comprised of projects without any up-front capital costs, obviously has the lowest cumulative capital costs. Portfolios 4 & 6 do not include the capital cost of Project #8 the Food-Waste-To-Energy project, which has a capital cost of \$4.26 million. Portfolios 1, 2, and 8 have the same capital cost; and Portfolios 3 and 5 have the same capital cost because neither includes Project #18 Fleet Changes.

**FIGURE 6: AVERAGE ANNUAL ELECTRICITY - COST COMPARISON OF PORTFOLIOS**



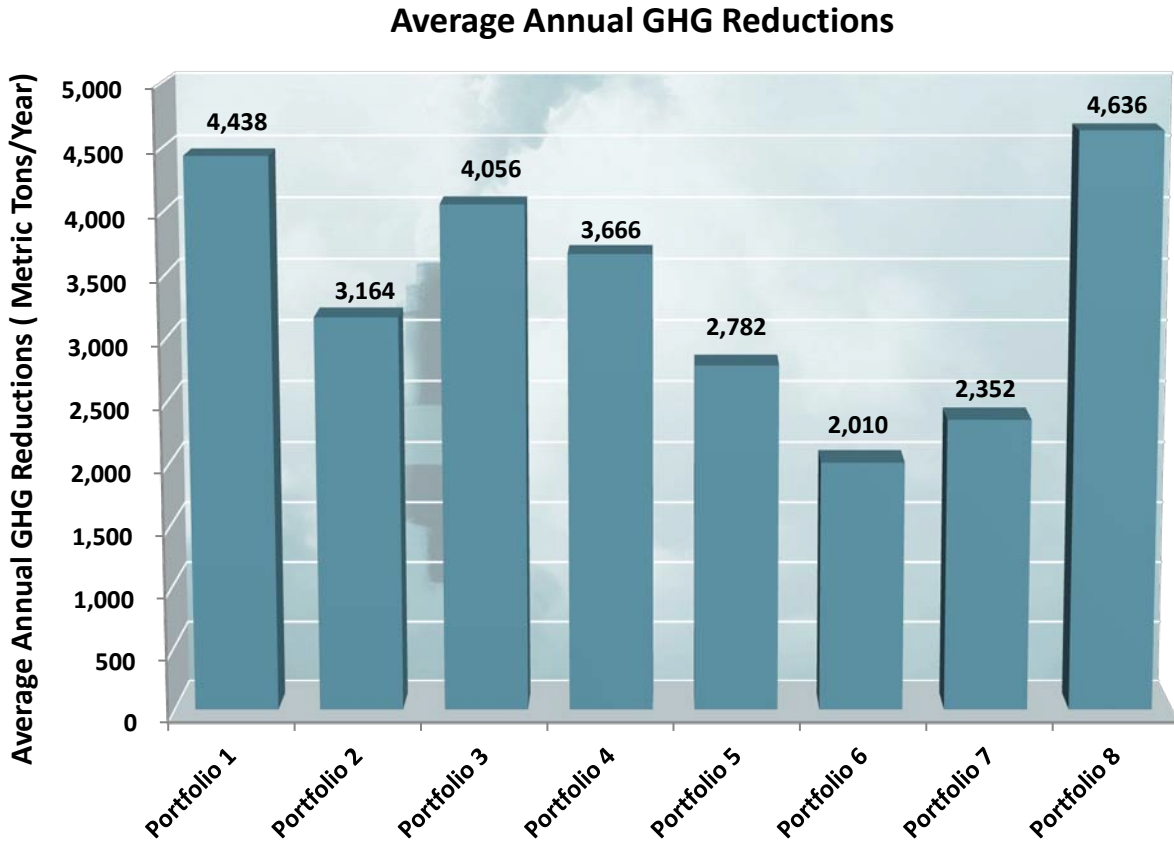
The figure above compares IRWD’s average annual cost for electricity for each of the eight portfolios, the Baseline and the BPPP, through the year 2030. A portion of the expected increase in cost from the Baseline will be offset by reduced payments to Orange County Sanitation District to treat wastewater and biosolids. Portfolios 1, 2, 3, 5 and 8 have the lowest average annual costs; and they are about 0.5% lower than the BPPP average annual cost.

FIGURE 7: AVERAGE ANNUAL ELECTRICITY USAGE - COMPARISON OF PORTFOLIOS



All of the portfolios reduce IRWD's electric consumption compared to the BPPP electricity use. Portfolios 1 & 2 have substantially lower levels of average annual electricity purchases than the BPPP, followed by Portfolios 3, 5 & 8.

FIGURE 8: AVERAGE ANNUAL GHG REDUCTIONS - COMPARISON OF PORTFOLIOS



The figure above compares the GHG emission reductions of each portfolio compared to the BPPP level of GHG emissions (represented by 0 on the x-axis). Portfolios 1 & 8 have the highest amount of GHG emission reductions.

### 6.2 Portfolio Comparison without Project #3

Considering the analysis and figures above, the two overall consistently best performing portfolios are Portfolio 1 and Portfolio 2. However, since project #17b - Purchases of RECs will only be needed should IRWD be subject to future GHG regulations and need to reduce its GHG emissions beyond the reductions identified in this Master Plan, it is not appropriate to include it in the final preferred portfolio. Should that future regulatory requirement occur project #17b can be added back into the mix of projects. In addition, because of the uncertainty surrounding the capital cost of the CNG fueling station in project #18 – Fleet Changes; it also not included in the preferred portfolio of projects. Once this uncertainty is resolved and if the project’s benefit is confirmed it could be added back into the mix of projects.

Removing projects #17b and #18 eliminates portfolios 1, 2, 3, 4 and 8. Of the remaining portfolios Portfolio 5 most cost-effectively lowers both energy cost and GHG emissions, and best meets IRWD’s goals.



### 6.3 Benefits of Preferred Portfolio (Portfolio 5)

Portfolio 5, the preferred portfolio, is comprised of the following 9 projects in ranked order:

1. Project #20 – Additional Water Conservation Programs – Combined Program
2. Project #9 – Pump Efficiency Improvement Program
3. Project #10 – Energy Efficiency Measures
4. Project #12b – Solar PV Program Jackson Ranch Land Lease
5. Project #14b – MWRP Phase 2 Optimization with 38% Flow Diversion
6. Project #15 – Process Energy Audit
7. Project #6 – San Joaquin Marsh Pumping Optimization
8. Project #4 – LAWRP Automated DO Control
9. Project #8 Food-Waste-to-Energy

The following three tables illustrate the financial savings, electricity savings, and GHG reduction benefits that the Preferred Portfolio 5 could have for IRWD during the study period of the Master Plan (through 2030):

**TABLE 10: FINANCIAL BENEFITS OF PORTFOLIO 5**

<b>Average Annual Net Savings</b>	<b>\$1,378,000</b>
<b>Net Present Value (NPV) of Annual Net Savings</b>	<b>\$17.8 Million</b>
<b>Cumulative Total Net Savings by 2030</b>	<b>\$23.7 Million</b>

**TABLE 11: ELECTRICITY SAVINGS OF PORTFOLIO 5**

<b>Annual Electricity Purchase Savings</b>	<b>6.7 Million kWh/Year</b>
<b>Total Electricity Purchase Savings by 2030</b>	<b>127 Million kWh</b>

**TABLE 12: GHG REDUCTIONS OF PORTFOLIO 5**

<b>Annual Reduction in GHG Emissions</b>	<b>2,782 MTCO<sub>2</sub>/Year</b>
<b>Total Reductions in GHG Emissions by 2030</b>	<b>52,858 MTCO<sub>2</sub></b>

### 6.4: Project #3 - Accelerated Local Groundwater Supplies

During 2009 IRWD imported 28% (16,000 acre-feet) of its total annual potable water demand (57,400 acre-feet). According to the IRWD's 2009 Greenhouse Gas Inventory, roughly one-third of IRWD's total (direct and indirect) GHG emissions were related to imported water from the Metropolitan Water District (MWD).

The IRWD planning and engineering staff has developed a Groundwater (GW) Work Plan spreadsheet to model the expansion of IRWD's groundwater supply capacity to meet future demands and reduce the dependence on imported water supply. The GW Work Plan takes into account numerous factors and constraints, such as the water demand forecast, the Orange County Water District's (OCWD) Basin Protection Plan, and potential annexations. The GW Work Plan identified a number of potential future groundwater projects and prioritized them based on cost-effectiveness, schedule, and operational impacts. The GW Work Plan also created a schedule for implementing the priority groundwater projects.

Project #3 - Accelerated Local Groundwater Supplies can only occur if the current basin groundwater management policy is changed. Project #3 assumes the District would develop slightly more than half of the planned Joint Anaheim Well Field project capacity by 2015, and fast-track the completion of Well 51 from 2015 to 2012. Also, there will be a more aggressive use of four existing wells: expanded OPA well pumping, Well 106,

Well 53, and Well 52. The completion of these operational changes and additional projects will result in a reduction of imported water required from MWD to meet projected water demands. However, the District will still need to rely on imported water to meet water demands, especially following the loss of the Basin Protection Plan exemption status of the DATS and Wells 21 & 22. The table below lists the differences in operations, as well as the timing of the development of additional wells, between the District's current plans and the Accelerated Local Groundwater Supply alternative envisioned in Project #3.

**TABLE 13: COMPARISON OF CHANGES TO OPERATIONS AND ON-LINE DATES FOR BPPP VS. ACCELERATED LOCAL GROUNDWATER SUPPLY ALTERNATIVE**

Well	BPPP (currently planned)	Accelerated Local Groundwater Supply
Expanded OPA Well Pumping		<ul style="list-style-type: none"> <li>No change in on-line year</li> <li>More aggressive use in years 2017 to 2022</li> </ul>
Well 106	<ul style="list-style-type: none"> <li>In 2017 use drops from full capacity to only 27% and ramps up to full capacity in 2024</li> </ul>	<ul style="list-style-type: none"> <li>No change in on-line year</li> <li>More aggressive use in years 2017 to 2023 at full capacity</li> </ul>
Well 53	<ul style="list-style-type: none"> <li>Use is only 88% in 2012</li> <li>Use drops to zero in 2017 to 2024 where it is used at roughly 20% capacity ramping up to roughly 50% capacity by 2030</li> </ul>	<ul style="list-style-type: none"> <li>No change in on-line year</li> <li>More aggressive use in years 2012 to 2023 at full capacity</li> </ul>
Well TL-1a (52)	<ul style="list-style-type: none"> <li>Use is only 36% in 2012</li> <li>Use drops to zero in 2017 to 2030</li> </ul>	<ul style="list-style-type: none"> <li>No change in on-line year</li> <li>More aggressive use in years 2013 to 2023 at full capacity</li> </ul>
Well 51	<ul style="list-style-type: none"> <li>Use is only 10% in 2015 and 22% in 2016</li> <li>No use from 2017 to 2030</li> </ul>	<ul style="list-style-type: none"> <li>On-line year accelerates from 2015 to 2012</li> <li>More aggressive use in years 2012 to 2023 mostly at full capacity</li> </ul>
Joint Anaheim Well Field	<ul style="list-style-type: none"> <li>Project <b><i>not</i></b> brought on-line or used from 2012 to 2030</li> </ul>	<ul style="list-style-type: none"> <li>On-line year is accelerated to 2015, but only 50% of the project is built</li> <li>More aggressive use in years 2015 and 2016</li> <li>No use from 2017 to 2021</li> <li>Use in 2021 starts at 1% and ramps up to roughly 25% by 2025 and stays there until 2030</li> </ul>

### 6.5: Benefits of Project #3

Under the Accelerated Local Groundwater Supply alternative, MWD imports would decrease about 36% by 2030 and imported water costs would decrease about 38% when compared to the BPPP. Conversely, electricity purchases would increase by 15% by 2030 to operate the new wells, and electricity costs would increase by about 12%. Because the electricity needed to import water from MWD does not show up as part of IRWD's electricity purchases, adding new IRWD wells and pumps will *increase* the amount of electricity consumed by the District.

**TABLE 14: ELECTRICITY INCREASE OF PROJECT #3**

<b>Annual Increased Electricity Purchases</b>	<b>10.6 Million kWh/Year</b>
Total Increased Electricity Purchases by 2030	<b>202 Million kWh</b>

However, since the GHG emissions associated with the delivery of an acre-foot of imported water from MWD are much higher than the GHG emissions for an acre-foot of locally produced groundwater by IRWD, the overall GHG emissions for IRWD for the same amount of water supplied would decrease by 9% by 2030.

**TABLE 15: GHG REDUCTIONS OF PROJECT #3**

<b>Annual Reduction in GHG Emissions</b>	<b>4,049 MT CO<sub>2</sub>/Year</b>
Total Reductions in GHG Emissions by 2030	<b>76,928 MT CO<sub>2</sub></b>

The capital cost for the development of Project #3 - Accelerated Local Groundwater Supplies would be approximately \$24.8 million. However this investment could create substantial financial savings for the District.

**TABLE 16: FINANCIAL SAVINGS OF PROJECT #3**

<b>Average Annual Net Savings</b>	<b>up to \$10.9 Million</b>
<b>Net Present Value (NPV) of Annual Net Savings</b>	<b>up to \$141 Million</b>
Cumulative Total Net Savings by 2030	<b>up to \$208 Million</b>

## 6.6 Benefits of Portfolio 5 and Project #3

Over the 20-year study period of the Master Plan (through 2030) the 10 projects (the 9 projects in Portfolio 5 and Project #3) could have a cumulative net savings of \$231 million and reduce GHG emissions by 129,785 MTCO<sub>2</sub>. The tables below include annual and cumulative totals of the benefits to IRWD.

**TABLE 17: FINANCIAL BENEFITS OF PORTFOLIO 5 AND PROJECT #3**

<b>Average Annual Net Savings</b>	<b>\$12.2 Million</b>
<b>Net Present Value (NPV) of Annual Net Savings</b>	<b>\$159 Million</b>
<b>Cumulative Total Net Savings by 2030</b>	<b>\$231 Million</b>

**TABLE 18: GHG REDUCTIONS OF PORTFOLIO 5 AND PROJECT #3**

<b>Annual Reduction in GHG Emissions</b>	<b>6,831 MT CO<sub>2</sub>/Year</b>
<b>Total Reductions in GHG Emissions by 2030</b>	<b>129,785 MT CO<sub>2</sub></b>

However, the short-list of project would increase the amount of overall electricity purchased by the District to pump the local groundwater.

**TABLE 19: ELECTRICITY INCREASE OF PORTFOLIO 5 AND PROJECT #3**

<b>Annual Increased Electricity Purchases</b>	<b>4.0 Million kWh/Year</b>
<b>Total Increased Electricity Purchases by 2030</b>	<b>75 Million kWh</b>

## Section 7: Scenario Analysis on the Preferred Portfolio 5

In order to anticipate and plan for future changes, a scenario analysis was performed to illuminate potential impacts on the Master Plan, and to provide guidance to IRWD in responding to potential future changes. The definition of a future scenario is a change in the regulatory, economic or political environment that would precipitate a modification of the projects in Portfolio 5. For instance, if a future scenario were to become a reality, it could require the addition or deletion of a specific project within Portfolio 5. In essence, this is a sensitivity analysis based on potential future scenarios. For the scenario analysis only the cost and benefits within the study period up to 2030 are included.

In Workshop #2, IRWD management staff discussed and approved the following set of five future scenarios to be applied to Portfolio 5:

1. More stringent air quality constraints.
2. More stringent GHG regulations and a market price on GHG emissions (\$/MT).
3. More stringent water quality constraints.
4. Higher electricity prices.
5. Revised Evaluation Criteria that eliminates GHG Impacts and Environmental Impacts.

For each scenario three items are discussed:

- 1) The **project impact** on the Master Plan and specifically on any particular short-listed project;
- 2) The **financial impacts** on the portfolio (i.e. – the change in NPV of Net Annual Savings), and
- 3) Any specific suggested **guidance** for IRWD to mitigate the impacts of the scenario.

The scenario analysis is first applied to Portfolio 5 and then to Project #3.



## 7.1 Air Quality Scenario

**Project Impact:** Under the more stringent air quality constraints scenario IRWD could be prohibited from creating additional air pollution from generating resources such as a microturbine. Therefore Project #8, which includes a food waste receiving station to convert pre-processed and liquid food waste to biogas that is used to power a microturbine, would be deleted and not implemented.

**Financial Impact:** The NPV of Portfolio 5 would decrease about \$350,000 (-2%) because the District would lose the value added from Project #8 Food-Waste-To-Energy (see Figure 9).

FIGURE 9: NPV IMPACT OF THE AIR QUALITY SCENARIO ON PORTFOLIO 5



**Guidance:** IRWD should work with regulators to ensure microturbines continue to be permitted. The risk of this scenario happening is quite low. However, should the microturbine permitting be questioned, it could be argued that because this project actually decreases GHG by using biogas from the digesters, it should be treated differently than other fossil fuel-fired generators.

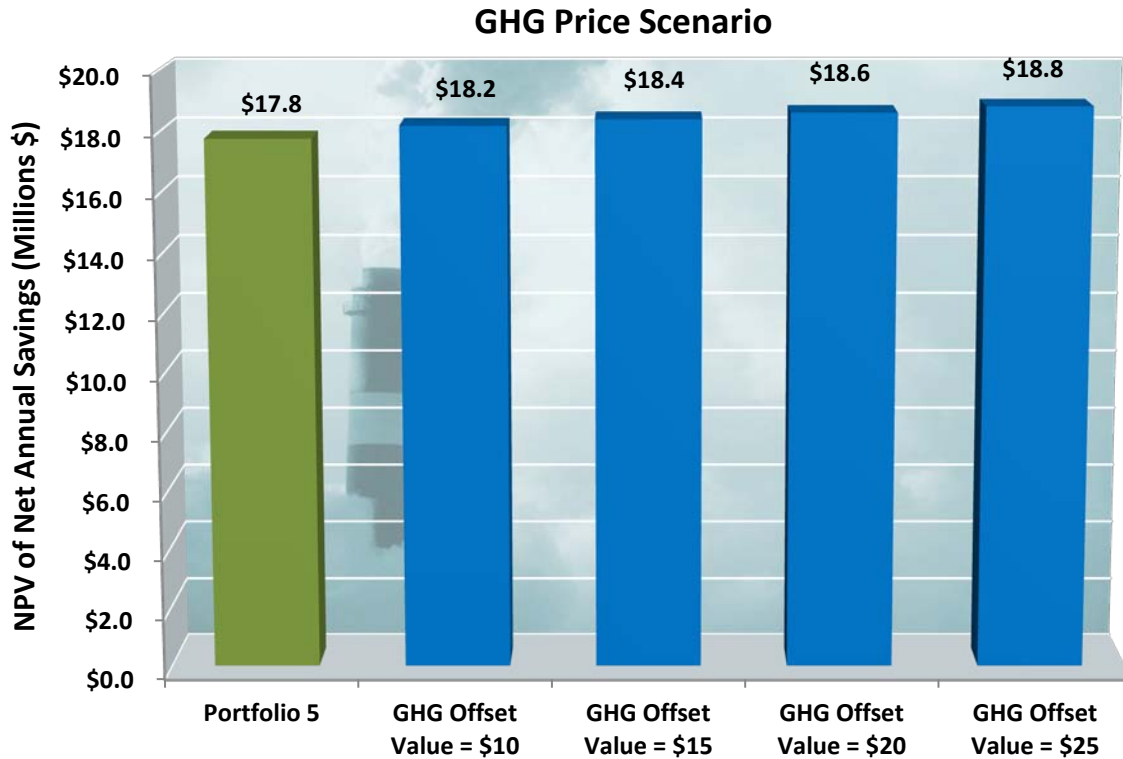
## 7.2 GHG Regulation & Price

**Project Impact:** Under more stringent GHG regulations, such as a lowering of the mandatory GHG reporting threshold or the lowering of Cap & Trade emissions participation threshold, IRWD may be required to reduce its overall GHG emissions. In addition, a future regulatory environment that creates a market price for GHG emissions (\$/MT) could have a positive financial impact on Portfolio 5.

**Financial Impact:** As the market price of GHG emissions increases so does the NPV of Portfolio 5. The figure below shows the increase in the NPV of Portfolio 5 at different GHG prices ranging from \$10 to \$25 per MT CO<sub>2</sub>. Portfolio 5 increases in value by 2% at \$10/MT and up to 6% at \$25/MT.



**FIGURE 10: NPV IMPACT OF THE GHG PRICE SCENARIO ON PORTFOLIO 5**



**Guidance:** IRWD should monitor the GHG market prices and position itself to be able to potentially sell some of its GHG emission offsets into a future market, thereby creating a revenue stream for the District. If IRWD should have to reduce its GHG emissions, the market price would allow the District to quantify the value of those reductions.

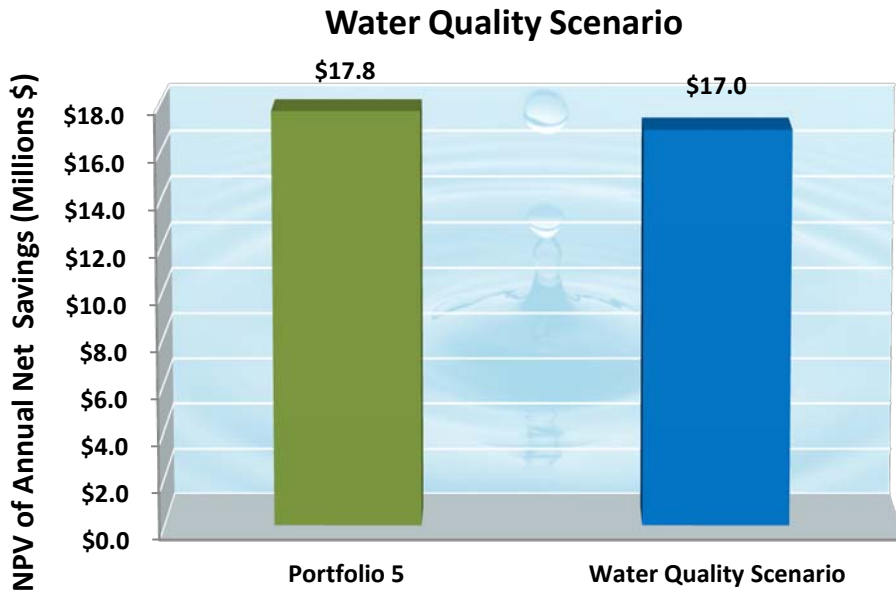
### 7.3 Water Quality Scenario

**Project Impact:** More stringent water quality constraints may require IRWD to maximize the quality of the effluent from the MWRP. Since diverting flows from the membrane plant to the activated sludge plant could decrease the overall effluent quality from MWRP, this may not be allowed. This would mean Project #14 Michelson 38% Flow Diversion Project could not be implemented and the project would be deleted.

**Financial Impact:** Not implementing Project #14 would decrease the NPV of Portfolio 5 by about \$790,000 or 4% (see Figure 11).



**FIGURE 11: NPV IMPACT OF THE WATER QUALITY SCENARIO ON PORTFOLIO 5**



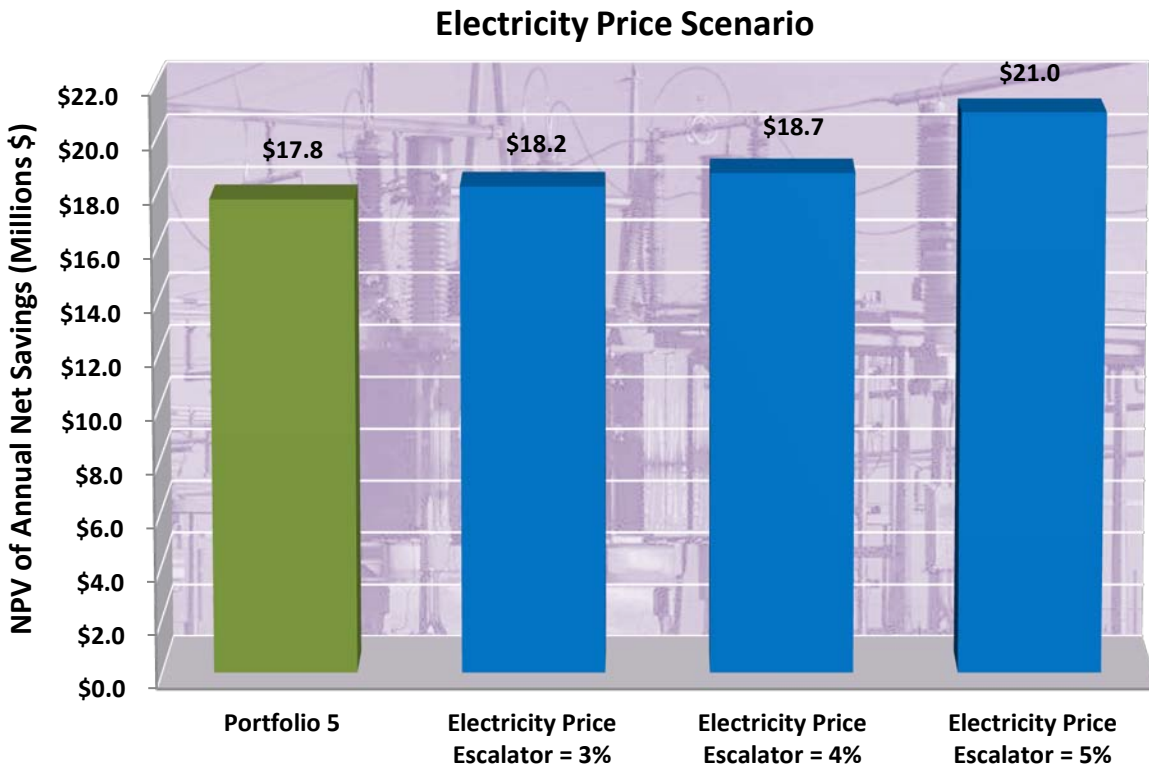
**Guidance:** IRWD should work with regulators over the next seven years, while this project is viable, to ensure IRWD can operate the MWRP system by balancing flows between the membrane plant and the activated sludge plant, while still meeting water quality standards for outflows from MWRP.

### 7.4 Electricity Prices Scenario

**Project Impact:** The anticipated annual escalation rate for electricity prices from Southern California Edison (SCE) in this Master Plan is about 2%. It is possible that SCE prices could escalate at a faster rate than anticipated. Fortunately, all of the projects in Portfolio 5 are less expensive than continuing purchases from SCE. If SCE rates increase faster than expected, the value of Portfolio 5 would increase, and therefore, none of the projects would be deleted from the portfolio. In addition, the solar PV program with a Power Purchase Agreement (Project #12c), which is first on the list of projects not to make the short-list, could be added, but only if the price escalation rates in the PPA were higher than currently expected.

**Financial Impact:** The amount of savings associated with Portfolio 5 is dependent on the rate of annual escalation of electricity prices. The figure below shows the additional value or savings associated with higher annual SCE escalation rates of 3%, 4%, and 5%. If SCE rates escalated at 3%, instead of the anticipated 2% rate, the NPV value of Portfolio 5 would increase about \$474,000 (3%); at a 4% escalation rate it would increase about \$978,000 (6%); and at a 5% escalation rate it would increase about \$3.2 million (18%).

FIGURE 12: NPV IMPACT OF THE ELECTRICITY PRICE SCENARIO ON PORTFOLIO 5



**Guidance:** IRWD should monitor the escalation rate of SCE electricity prices, and if they rise more than the anticipated 2% per year, the District should recalculate the additional benefit of Portfolio 5.

### 7.5 Revised Evaluation Criteria Scenario

**Project Impact:** This scenario would eliminate the GHG Impacts and Environmental Impacts evaluation criteria from the scoring analysis. The 20 total points allocated to these two criteria would be proportionally redistributed among the remaining evaluation criteria: Cost/Cost-Effectiveness, Operational Impacts, and Risk and Uncertainty. The elimination of these two criteria does not cause the removal of any of the projects on the short-list of projects; nor does it force any other marginal projects to move up onto the short-list. It does however cause the rank order of the short-listed projects to change.

**Financial Impact:** None.

**Guidance:** None.



## Section 8: Scenario Analysis on Project #3

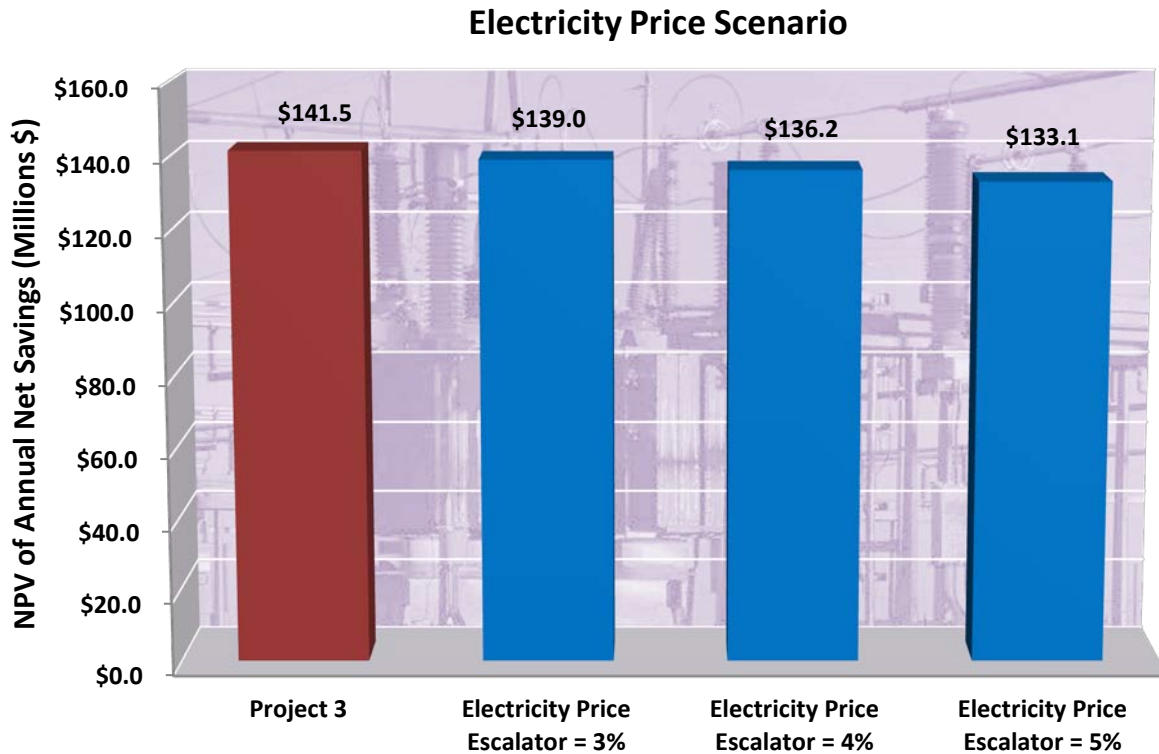
The same type of scenario analysis as in Section 7 above was applied to Project #3, but with a different set of potential future scenarios. For the scenario analysis only the cost and benefits within the study period up to 2030 are included. The four future scenarios applied to Project #3 are:

1. Higher electricity prices.
2. Lower imported water prices.
3. Orange County Groundwater Basin rules continue.
4. Higher capital cost for the accelerated local groundwater supply projects.

### 8.1 Electricity Prices Scenario

**Project Impact:** With the implementation of Project #3, IRWD's cost of electricity to run the new wells and pumps would increase.

**Financial Impact:** As the price of SCE electricity increases beyond the anticipated 2% per year, the value of this project decreases. Should SCE prices increase at 3% per year the NPV of Project #3 would decrease approximately \$2.5 million (2%), at a 4% annual rate of increase the NPV would decrease \$5.2 million (4%), and at a 5% escalation rate the NPV would decrease \$8.3 million (6%). However, in all scenarios Project #3 is still extremely cost-effective.



**FIGURE 13: NPV IMPACT OF THE ELECTRICITY PRICE SCENARIO ON PROJECT #3**

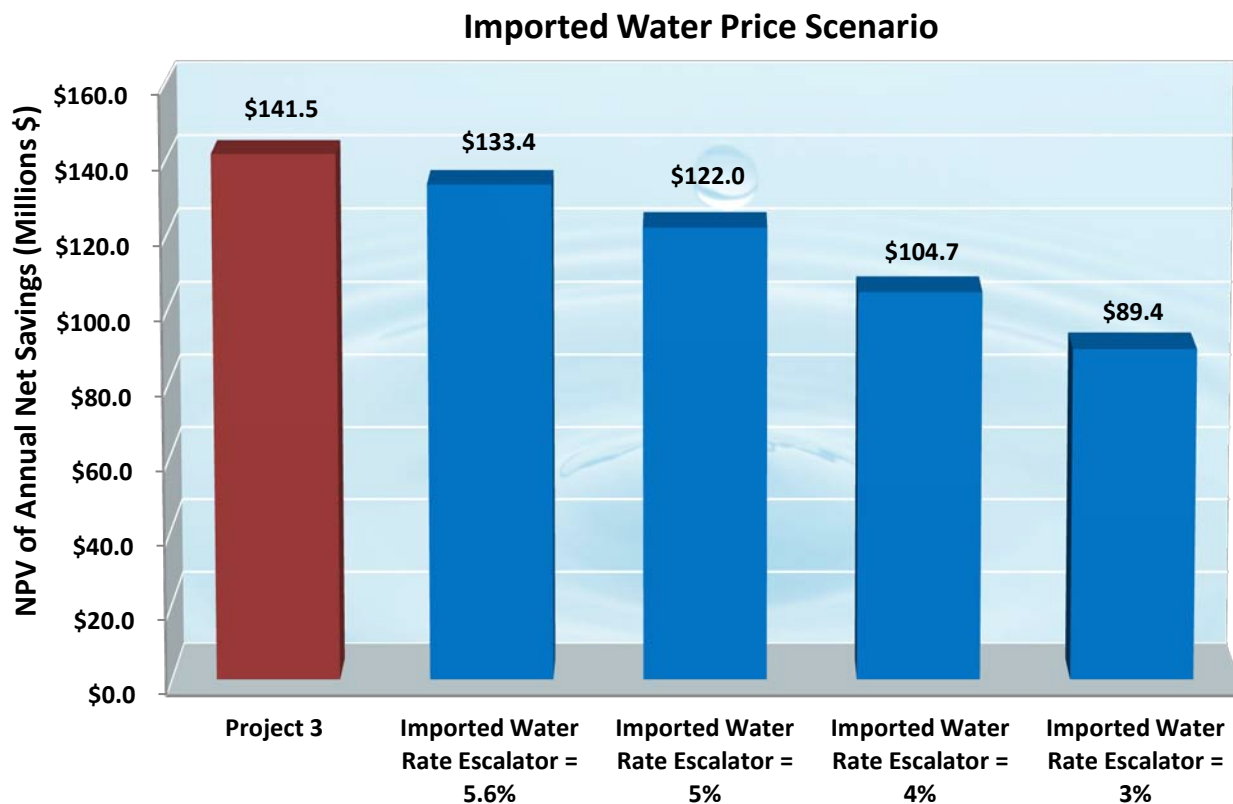
**Guidance:** The impacts of higher than anticipated electricity costs are relatively modest, and even at the highest escalation rate of 5% per year Project #3 is still cost-effective. IRWD should monitor the SCE rate increases and adjust the benefit of Project #3 accordingly.

## 8.2 Lower Imported Water Prices Scenario

**Project Impact:** The change in the price of imported water from MWD would have no physical impact on Project #3, but it would have a financial impact.

**Financial Impact:** The anticipated rate of escalation of the price of imported water from MWD is 6% per year in the Master Plan. Should the actual annual rate of increase for MWD imported water be lower than anticipated it would decrease the value of the project. If the annual rate of increase for MWD imported water were only 5.6% the NPV Project #3 would decline \$8.1 million (6%), if it were 5% it would decline \$19.5 million (14%), if it were 4% it would decline \$36.7 million (26%), and if the rate of increase were 3% it would decline about \$52 million (37%). However, in every scenario Project #3 is still extremely cost-effective.

**FIGURE 14: NPV IMPACT OF THE IMPORTED WATER PRICE SCENARIO ON PROJECT #3**



**Guidance:** The rate of increase of MWD prices can have a dramatic impact on the value of Project #3. However, even at the lowest rate of increase the project is still cost-effective. IRWD should closely monitor the increases in MWD imported water and adjust the benefit of Project #3 accordingly.

## 8.3 Orange County Basin Rules Continue Scenario

**Project Impact:** Should the current groundwater basin rules continue IRWD would not be able to implement Project #3.

**Financial Impact:** The inability to implement Project #3 would eliminate the entire value of the project. Partial implementation would result in a proportional decrease in the benefits or value of the project in the District.

**Guidance:** IRWD should continue to work toward expanding the use of local groundwater supplies.

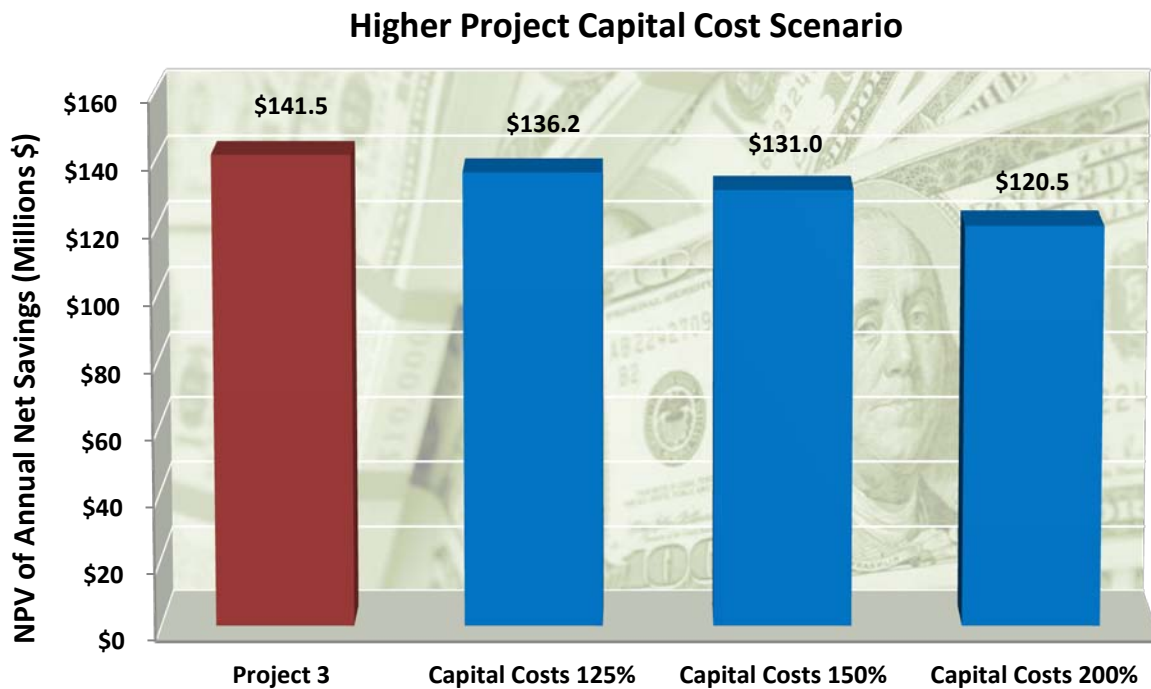


## 8.4 Higher Project Capital Cost Scenario

**Project Impact:** IRWD staff estimates the capital cost necessary for the construction of the entire Anaheim Well Field is approximately \$41 million, but this estimate has a degree of uncertainty. Project #3 envisions only building about half of the Anaheim Well Field requiring only about \$24.8 million for construction.

**Financial Impact:** If the capital cost should increase the value of the project would decrease. Should the actual capital cost be 125% of the estimated \$24.8 million, the NPV of Project #3 would decrease \$5.2 million (4%), if the capital cost was 150% of the estimate it would decrease \$10.5 million (7%), and if the capital cost were 200% of the estimate the NPV would decrease by \$21 million (15%). However, in all scenarios Project #3 remains cost-effective.

**FIGURE 15: NPV IMPACT OF THE HIGHER CAPITAL COST SCENARIO ON PROJECT #3**



**Guidance:** The value of Project #3 is only somewhat sensitive to the capital cost of the Anaheim Well Field. If the actual capital cost was higher than anticipated the value of the project would decrease, but the project would still be very cost-effective. IRWD should develop a more detailed estimate of the capital cost of the Anaheim Well Field before pursuing this project.

## Section 9: Items for Further Action

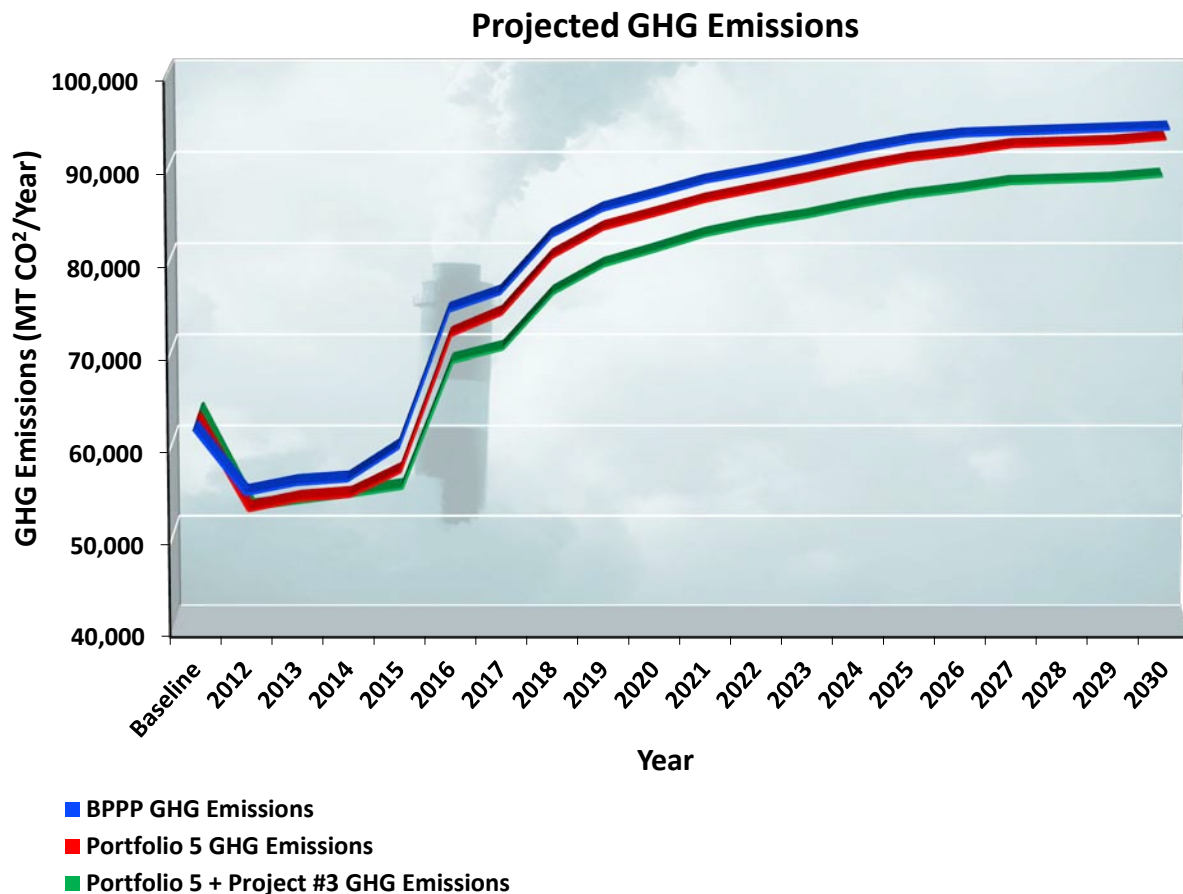
There are specific items recommended for further study in the short and long-term for each of the projects in the short-list of projects listed in the full report.

## Section 10: Conclusions

There are several conclusions that can be drawn from the analysis done for this Master Plan:

- Implementation of the Preferred Portfolio 5 can significantly reduce IRWD’s overall energy costs and GHG emissions. The estimated cumulative total net savings by 2030 from the Preferred Portfolio 5 is \$23.7 million, the estimated NPV of these savings is \$17.8 million, and the estimated average annual net savings is nearly \$1.4 million per year. The average annual estimated GHG emission reduction is 2,782 metric tons of CO<sub>2</sub> per year, and a total of nearly 53,000 metric tons by 2030.
- Project #3 - Accelerated Local Groundwater Supplies - can significantly reduce IRWD’s cost of water and reduce its GHG emissions. The estimated cumulative total net savings from Project #3 is up to an additional \$208 million, with an estimated NPV of these savings of approximately \$141 million. The average annual estimated GHG emission reduction would be up to 4,050 metric tons of CO<sub>2</sub> per year, and a total of up to 77,000 metric tons by 2030.
- The combined total of Preferred Portfolio 5 and Project #3 results in an estimated cumulative total net savings by 2030 of up to \$231 million, and the estimated NPV of these savings is \$159 million. The average annual estimated GHG emission reduction is 6,830 metric tons of CO<sub>2</sub> per year, and a total of 129,800 metric tons by 2030.
- Despite being controversial it could be very cost-effective for IRWD to continue to work toward expanding the use of local groundwater supplies.
- Overall IRWD GHG emissions are reduced from the BPPP Forecast as the result of implementing Portfolio 5, and are reduced further by the combination of Portfolio 5 and Project #3 (see Figure 16 below).

**FIGURE 16: COMPARISON OF GHG EMISSIONS PER YEAR**

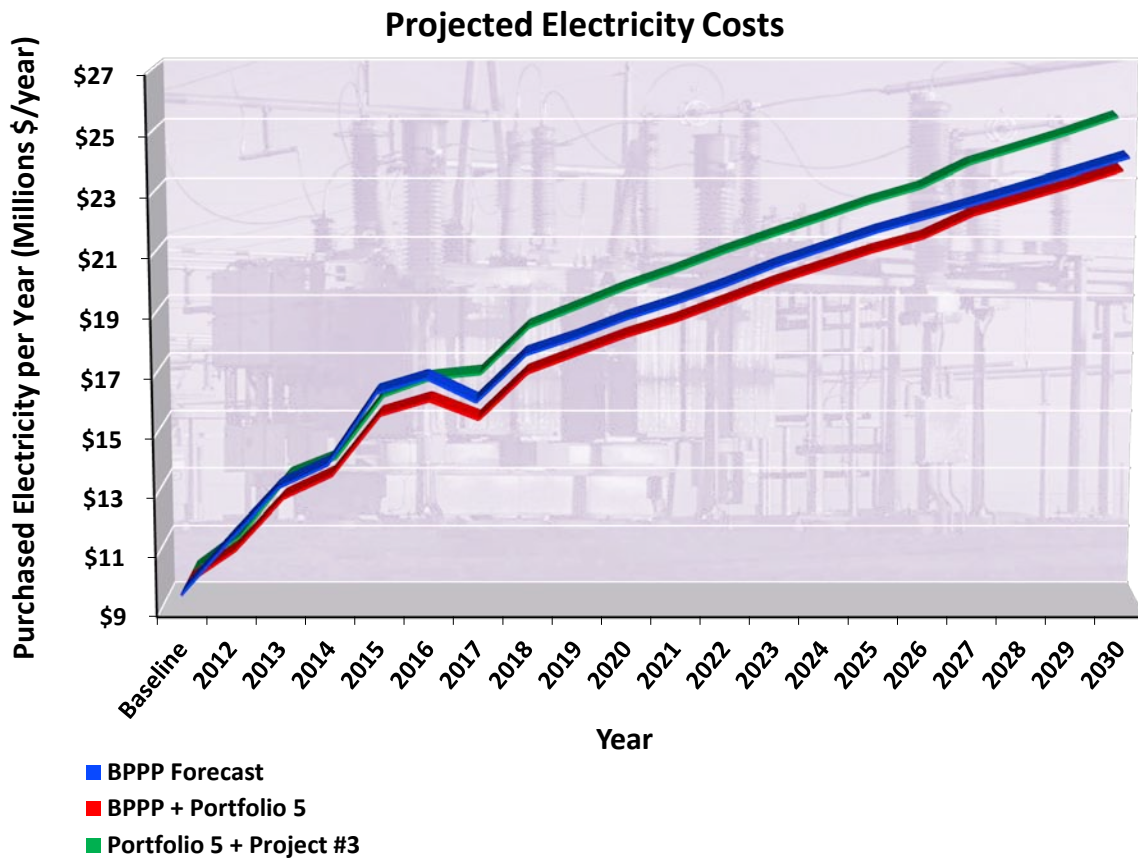






- While overall IRWD electricity costs are reduced by the implementation of only the Preferred Portfolio 5; adding Project #3 to Portfolio 5 increases electricity costs back above the BPPP Forecast because of additional local groundwater well pumping (see Figure 17 below). However, the expected increase in the cost of electricity for Portfolio 5 plus Project #3 is more than offset by reduced purchases of imported water from MWD.

**FIGURE 17: COMPARISON OF ELECTRICITY COST**



- Portfolio 5 and Project #3 remain cost-effective under all of the scenarios analyzed, indicating this is a robust Master Plan.
- The 10 projects in Portfolio 5 plus Project #3 create a road map for follow-up detailed analyses that should be pursued by the District.
- As the results of the follow-up analysis on each project become available, cost-effective projects should be fed into IRWD’s annual budget process.
- The projects in Portfolio 5, as well as Project #3, have different levels of effort required by IRWD to finalize the projects prior to implementation. As well, the projects have different levels of capital cost required to implement the projects. The projects should be separated into three groupings to reflect their priority for implementation by IRWD in their annual budget process (see Table 20 below).



**TABLE 20: PRIORITIZATION OF PROJECTS FOR IMPLEMENTATION**

Recommended Priority	Range of Capital Cost and Level of Effort to Finalize	Projects
1	Less than \$10,000 capital cost and relatively minor effort to refine benefits	# 6 San Joaquin Marsh # 12b Solar PV – Land Lease Jackson Ranch, # 14b MWRP Phase 2 Operation # 15 Process Energy Audit Measures
2	\$10,000 – \$500,000 capital cost and moderate effort to refine benefits	# 4 LAWRP Automated Dissolved Oxygen Control # 10 Energy Efficiency Measures
3	Greater than \$500,000 capital cost and significant effort to refine benefits	# 3 Accelerate Local GW Supplies # 8 Food Waste-to-Energy # 9 Pump Efficiency Improvement Program <sup>(1)</sup> # 20 Additional Water Conservation Activities

<sup>(1)</sup> Project #9 - Pump Efficiency Improvement Program could be broke into two phases: the first phase of the project could consist of replacing those pumps that have the highest usage and comparatively low efficiency and included in Priority Level 1, and the rest of the pumps could be included in Priority Level 2.

- IRWD should consider short-term implementation of the energy-efficiency projects that do not require up-front capital costs (i.e. – Project #15 Process Energy Audit, and Project #14b MWRP Phase 2 Optimization).
- In addition, Project #9 Pump Efficiency Improvement Program and Project #20 Additional Water Conservation programs, while both having capital costs of approximately \$1.1 million, are the highest ranking and most cost-effective projects identified in the Master Plan and should be considered for near-term implementation.
- Project #12b (Solar PV Program Land-Lease at Jackson Ranch) will help maximize the use of Jackson Ranch with a feasible and appropriate type of development. This project has the potential for additional revenue for the District, without any capital investment by the District, and with only minor risks. However, the necessary third-party negotiations will require more development time and will add some complexity to the negotiations. It is likely that IRWD will have only a limited window of opportunity to pursue this project due to the changing incentives for solar PV projects and fluctuations in the marketplace.
- The Master Plan should be updated every 3 to 5 years, or as conditions change.



**OFFICE LOCATIONS:**

**AUSTIN** ■ TEXAS

**BAKERSFIELD** ■ CALIFORNIA

**CHOTEAU** ■ MONTANA

**DENVER** ■ COLORADO

**EUGENE** ■ OREGON

**FEDERAL WAY** ■ WASHINGTON

**IRVINE** ■ CALIFORNIA

**KANSAS CITY** ■ KANSAS

**LAS VEGAS** ■ NEVADA

**LOS ANGELES** ■ CALIFORNIA

**PALO ALTO** ■ CALIFORNIA

**PORTLAND** ■ OREGON

**OAKLAND** ■ CALIFORNIA

**SACRAMENTO** ■ CALIFORNIA

**SAN DIEGO** ■ CALIFORNIA

**SAN FRANCISCO** ■ CALIFORNIA

**SEATTLE** ■ WASHINGTON

**TEMECULA** ■ CALIFORNIA

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