APPENDIX

APPENDIX A – ADDITIONAL INFORMATION ON WATER UTILITY PROJECTS

- **Alco Water Service (PG&E):**

County Well and Hemingway Booster Pump Station

Description: This project is applicable to the county well pump station and the Hemingway booster pump station. Alco proposes to use a high-efficiency motor associated with a variable frequency drive to run a pump at its best efficiency point. The use of VFDs offers a cost-effective method to match driver speed to load demands and represent a state-of-the-art opportunity to reduce operating costs, improve overall productivity and operate the system at optimum efficiency. At the county well, Alco intends to acquire a VFD, a 300HP motor with high power factor and a new pump that has a preferred operation region (POR) that is between 70% and 120% of the Best Efficiency Point (within this region, the service life of the pump will not be significantly affected by hydraulic loads, vibration, or flow separation).

At its Hemingway facility, Alco intends to acquire a VFD, a new pump and a 30HP motor. Water level sensing devices will be used to monitor water level and generate a speed reference signal, which increases or decreases the pump speed and allows the start and stop levels to be selected. This will result in the motors running on optimum duty (optimum speed range for energy efficient operation of the pumps) and will replace simple on/off control of the motors, with the level monitored with a mechanical float. Pressure transducers, flow meters and energy monitoring devices are essential equipment to provide us with the necessary parameters to accurately calculate the energy efficiency of our plant.

In order to determine a baseline for further analysis of efficiency, it will be necessary to install a SCADA system that will continuously record flow, pressure, kW input and other necessary parameters which will allow us to determine the plant's efficiency. With the data collected from the SCADA system, further analysis will be conducted to determine what additional efficiency improvements can be made to optimize the pumping energy required for each gallon the well produces. As the demand for water changes over time, the SCADA system makes sure that pumps at the most cost-effective wells are turned on first and turned off last.

The total projected cost is $194,000 for the well pump and $53,000 for the booster pump as detailed below.

Cost detail:

Well Pump		**Alco Water Service**
Motor	*Specs*	300 HP
	Price	$20,000
Pump	*Price*	$65,000
VFD	*Price*	$65,000
Differential water level sensing system	*Price*	$2,500
Pressure Transducer	*Price*	$2,500
Flow meter	*Specs*	10" MagMeter
	Price	$6,000
Energy monitoring equipment (kWs/kWhs/power factor, Volts & Amps)	*Price*	$6,000
Programmable Logic Controllers	*Price*	$2,000
Wiring & enclosures	*Price*	$4,000
SCADA programming	*Price*	$2,000
Equipment installation	*Price*	$10,000
Engineering	*Price*	$4,000
Contingency	*Price*	$5,000

Total projected cost: 194,000

Booster Pump		**Alco Water Service**
Motor	*Specs*	30 HP
	Price	$5,000
Pump	*Price*	$4,000
VFD	*Price*	$16,000
Differential water level sensing system	*Price*	$2,500
Pressure Transducer	*Price*	$1,500
Flow meter	*Specs*	10" MagMeter
	Price	$4,000
Energy monitoring equipment (kWs/kWhs/power factor, Volts & Amps)	*Price*	$6,000
Programmable Logic Controllers	*Price*	$2,000
Wiring & enclosures	*Price*	$2,500
SCADA programming	*Price*	$2,000
Equipment installation	*Price*	$3,500
Engineering	*Price*	$2,000
Contingency	*Price*	$2,000

Total projected cost: 53,000

- **Del Oro Water Company (PG&E):**

VFD Installation at the Pines District No. 2 Booster

Description: Install a variable-frequency drive (VFD), with a PLC, on Booster 2 of the DOWC Pines system. The PLC in conjunction with the VFD will make the pump efficient, by adjusting motor speed to run the pump at the optimum efficiency point, saving about 45,000 kWh annually, compared to a single speed pump. The project cost is $100,000 with a breakdown provided below.

Project Summary:

Estimated Energy Savings with VFD: 45,000 kWh per year
Anticipated Operational Date: 09/01/08
Estimated Project Cost: $100,000

Cost Detail:

New 100 HP VFD-rated motor:	$15,000
VFD, PLC for SCADA interface & RLL-programming	$35,000
Wiring, materials & enclosure:	$10,000
New horizontal-centrifugal pump:	$15,000
Electrician labor:	$5,000
Engr/Admin/Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$100,000**

- **California Water Service (PG&E):**

VFD Installation at Bakersfield Station 176

Description: Install a variable-frequency drive (VFD) on booster E of California Water Service Company's Bakersfield district station 176, a booster pumping facility. This pump has a single-speed 125 HP vertical top drive electric motor. The unit pumps directly into the distribution system at 1700 GPM and experiences a pressure fluctuation of 20 psig from day to night. The VFD will make the pump highly-efficient, by adjusting motor speed to run the pump at the optimum efficiency point of 82%, saving about 50 MWH annually, compared to a single speed pump. The project cost is $95,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, CWSC hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 50 MWH/YR
Anticipated Operational Date: 06/01/09
Estimated Project Cost: $95,000

Cost Detail:

New 125 HP VFD-rated motor:	$10,000
VFD, PLC for SCADA interface, RLL-programming & well level transducer:	$30,000
Wiring, materials & enclosure:	$10,000
New turbine pump:	$15,000
Electrician labor:	$10,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$95,000**

VFD Installation at Chico Station 64

Description: Install a variable-frequency drive (VFD) on Well 64 of California Water Service Company's Chico district, a groundwater production facility. This pump has a single-speed 75 HP vertical top drive electric motor. The unit pumps directly into the distribution system at 850 GPM and experiences a pressure fluctuation of 30 psig from day to night. The VFD will make the pump highly-efficient, by adjusting motor speed to run the pump at the optimum efficiency point of 82%, saving about 50 MWH annually, compared to a single speed pump. The project cost is $110,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, CWSC hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 50 MWH/YR
Anticipated Operational Date: 06/01/09
Estimated Project Cost: $110,000

Cost Detail:

New 75 HP VFD-rated motor:	$10,000
VFD, PLC for SCADA interface, RLL-programming & well level transducer:	$30,000
Wiring, materials & enclosure:	$10,000
New turbine pump:	$30,000
Electrician labor:	$10,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$110,000**

- **Golden State Water Company (PG&E):**

VFD Installation – Settled Water Booster Pump
Hill Street Water Treatment Plant

Description: Install a variable-frequency drive (VFD) on Booster B at Golden State Water Company's Hill Street Surface Water Treatment Plant (Hill Street Plant) in Bay Point California. This vertical turbine pump has a 1,800 rpm single-speed 75 HP electric motor. This unit is designed to pump 1,100 gpm of settled water through three horizontal dual-media pressure filters and convey filtered water into the clearwell located 80 feet above the filters. Control of flow rates through each filter is provided through the operation of a flow meter working in conjunction with an automated control valve. The desired flow rate for each filter is 'set' by the plant operator and the individual filter inlet control systems (meter & butterfly valve) modulate to achieve the desired flow rate. Typically this results in the butterfly valves being partially closed or 'pinched' to reduce the flow rate. The settled water booster pumps operate at full speed (1,800 rpm) and when a lower rate of flow is required the filter valves are pinched to reduce the rate of flow, causing the pumping head to increase resulting in wasted energy. By installing a VFD on one of the four settled water booster pumps, the rates of flow can be adjusted to more closely meet the desired flow rate through the filters, resulting in an energy savings. The Hill Street Plant is operated through automation and SCADA controls and the addition of the VFD will greatly increase the operational (energy) efficiency of the Hill Street Plant. It is estimated the VFD, by allowing adjustment of motor speed, will result in an annual savings 100 MWH, compared to a single speed pump. The project cost is $100,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, GSWC hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 100 MWH/YR
Anticipated Operational Date: 04/01/09
Estimated Project Cost: $100,000

Cost Detail:

New 75 HP VFD-rated motor:	$10,000
VFD & PLC Interface:	$25,000
Programming & Integration:	$15,000
Wiring, materials & enclosure:	$10,000
New vertical-turbine pump:	$15,000
Electrician labor:	$5,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$100,000**

- **San Jose Water Company (PG&E):**

VFD Installation at Grant Street Station

Description: Install a variable-frequency drive (VFD) on Well #2 of San Jose Water Company's Grant Street Station, a groundwater production facility. This pump has a single-speed 200 HP vertical hollow shaft (VHS) top drive electric motor. The unit pumps directly into the distribution system at 1,500 GPM and experiences a pressure fluctuation of 20 psig from day to night. The VFD will make the pump highly-efficient, by adjusting motor speed to run the pump at the optimum efficiency point of 84%, saving about 100 MWH annually, compared to a single speed pump. The project cost is $95,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, SJW hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 100 MWH/YR
Anticipated Operational Date: 06/01/09
Estimated Project Cost: $95,000

Cost Detail:

New 200 HP VFD-rated motor:	$15,000
VFD, PLC for SCADA interface, RLL-programming & well level transducer:	$40,000
Wiring, materials & enclosure:	$5,000
New 4-stage turbine pump:	$10,000
Electrician labor:	$5,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$95,000**

VFD Installation at Seventeenth Street Station

Description: Install a variable-frequency drive (VFD) on Booster 2 of San Jose Water Company's Seventeenth Street Station, a groundwater production facility. This horizontal-centrifugal pump has a single-speed 100 HP electric motor. The unit pumps directly into the distribution system at 2,500 GPM and experiences a pressure fluctuation of 20 psig from day to night. The VFD will make the pump highly-efficient, by adjusting motor speed to run the pump at the optimum efficiency point, saving about 50 MWH annually, compared to a single speed pump. The project cost is $100,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years.

Since the existing equipment has not reached the end of its useful life, SJW hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 50 MWH/YR
Anticipated Operational Date: 06/01/09
Estimated Project Cost: $100,000

Cost Detail:

New 100 HP VFD-rated motor:	$15,000
VFD, PLC for SCADA interface & RLL-programming	$35,000
Wiring, materials & enclosure:	$10,000
New horizontal-centrifugal pump:	$15,000
Electrician labor:	$5,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$100,000**

- **California Water Service Company (SCE):**

VFD Installation at Visalia Station 79

Description: Install a variable-frequency drive (VFD) on Well 79 of California Water Service Compnay's Visalia district, a groundwater production facility. This pump has a single-speed 100 HP vertical top drive electric motor. The unit pumps directly into the distribution system at 1,200 GPM and experiences a pressure fluctuation of 30 psig from day to night. The VFD will make the pump highly-efficient, by adjusting motor speed to run the pump at the optimum efficiency point of 75%, saving about 65 MWH annually, compared to a single speed pump. The project cost is $110,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, CWSC hereby requests PG&E to provide 100% funding for this pilot project.

Project Summary:

Estimated Energy Savings with VFD: 65 MWH/YR
Anticipated Operational Date: 06/01/09
Estimated Project Cost: $110,000

Cost Detail:

New 100 HP VFD-rated motor:	$10,000
VFD, PLC for SCADA interface, RLL-programming & well level transducer:	$30,000
Wiring, materials & enclosure:	$10,000
New turbine pump:	$30,000
Electrician labor:	$10,000
Pump Contractor Labor:	$15,000
Contingency:	$5,000
TOTAL	**$110,000**

- **Golden State Water Company (SCE):**

VFD Installation –Jeffries Well # 4 Pump

Description: Install a variable-frequency drive (VFD) on Well 4 at Golden State Water Company's Jeffries Plant in Arcadia California. This well has a single-speed 200 HP vertical hollow shaft (VHS) top drive electric motor. This unit is designed to pump 1600 gpm of water to the Main Zone of the South Arcadia System. The Main Zone of the South Arcadia System is a closed zone with widely fluctuating demands. Under the current operation, Jeffries Well 4 pumps continuously through a pressure reducing valve (PRV) to the zone. The PRV modulates to maintain a near constant discharge pressure to the zone. The well, however, is frequently pumping through a pinched PRV, causing a significant energy loss. By installing a VFD on Well # 4, its production can be adjusted to more closely match demands in the zone. The South Arcadia System is operated through automation and SCADA controls and the addition of the VFD will greatly increase the operational (energy) efficiency of the Jeffries Plant. It is estimated the VFD, by allowing adjustment of motor speed, will result in an annual savings 100 MWH, compared to a single speed pump. The project cost is $100,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, GSWC hereby requests SCE to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 100 MWH/YR
Anticipated Operational Date: 04/01/09
Estimated Project Cost: $100,000

Cost Detail:

New 200 HP VFD-rated motor:	$20,000
VFD & PLC Interface:	$50,000
Programming & Integration:	$10,000
Wiring, materials & enclosure:	$10,000
Electrician labor:	$5,000
Contingency:	$5,000
TOTAL	**$100,000**

VFD Installation –Booster Pump
Mojave Manor Plant

Description: Install a variable-frequency drive (VFD) on Booster B at Golden State Water Company's Mojave Manor Plant in Barstow California. This horizontal end suction pump has a 3,500 rpm single-speed 25 HP electric motor. This unit is designed to pump 400 gpm of water to the Mojave Manor Booster Zone. The Mojave Manor Booster Zone is a closed zone with widely fluctuating demands. Under the current operation, Booster B pumps continuously through a pressure reducing valve (PRV) to the zone. The PRV modulates to maintain a near constant discharge pressure to the zone. The booster, however, is frequently pumping through a pinched PRV, causing a significant energy loss. By installing a VFD on Booster B, its production can be adjusted to more closely match demands in the zone. The Barstow System is operated through automation and SCADA controls and the addition of the VFD will greatly increase the operational (energy) efficiency of the Mojave Manor Plant. It is estimated the VFD, by allowing adjustment of motor speed, will result in an annual savings 30 MWH, compared to a single speed pump. The project cost is $60,000 with a breakdown provided below. Anticipated life expectancy of the equipment is ten years. Since the existing equipment has not reached the end of its useful life, GSWC hereby requests SCE to provide 100% funding for this pilot project.

Project Summary:
Estimated Energy Savings with VFD: 30 MWH/YR
Anticipated Operational Date: 04/01/09
Estimated Project Cost: $60,000

Cost Detail:

New 25 HP VFD-rated motor:	$5,000
VFD & PLC Interface:	$25,000
Programming & Integration:	$10,000
Wiring, materials & enclosure:	$10,000
Electrician labor:	$5,000
Contingency:	$5,000
TOTAL	$60,000

- **East Pasadena Water Company (SCE):**

Estimated Project Costs for Booster and Well Pumps, VFDs & Monitoring Equipment at Mountain View Plant

Booster Pump # 3

VFD unit, Piping & Booster pump (assuming 50 hp.) = $62,000
Engineering = $2,500
SCADA connection & programming = $1,500
8" Flow meter with transducer = $2,750
PSI Transducers = $1,300
Kwh transducer = $1,000
PLC (1 Shared by both boosters and well) 50% = $2,200
Labor to install efficiency measuring equipment = $1,500
Total Estimated Cost = **$74,750**

Well Pump # 8

Service column pipes, shafts and install new pump bowls for VFD operation = $100,000
VFD unit & Motor Control Center = $28,000
Engineering = $2,500
SCADA connection & programming = $1,500
Well water level monitoring device = $1,500
PSI Transducers = $1,300
Kwh transducer = $1,000
PLC (1 Shared by both booster and well) 50% = $2,200
Labor to install efficiency measuring equipment = $1,500
Total Estimated Cost = **$139,500**