Generation of Solar Power at Garthe and West Pump Station Facilities Project

WaterSMART: Water and Energy Efficiency Grants for FY2022 R22AS00023 Funding Group I

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SECTION 1: TECHNICAL PROPOSAL

A. Executive Summary

Date: November 3, 2021	**Applicant Name**: City of Santa Ana
City: Santa Ana	**Project Length of Time:** 10 Months (Construction)
County: Orange	**Estimated Completion Date:** Dec. 2023
State: California	**Located on a Federal Facility:** No

The City of Santa Ana is a Category A applicant.

Project Summary

The City of Santa Ana Public Works Agency (the City) purchases 18,000,000 kilowatt hours (kWh) of electrical power each year to operate well pumps and booster pumps to deliver potable water to 44,565 customer meters. The proposed Solar Power Generation at the Garthe and West Pump Stations Project ("Project") will create a renewable energy system at two of the City's pump station/reservoir facilities to offset some of the electric load, reduce the associated greenhouse gas (GHG) emissions and lower the City's electric bill. This solar power will be generated by mounting photovoltaic (PV) modules on top of water storage reservoirs at the Garthe and West Pump Station facilities. The Project is expected to generate an estimated additional 1,316,942 kWh annually, reducing the associated Greenhouse Gas emissions and demonstrating significant progress toward achieving the 2015 City of Santa Ana Climate Action Plan (Appendix A) goal to reduce carbon dioxide equivalent (CO_2e) 30% by the year 2020 and 40% by 2035, relative to the 2008 baseline. This renewable energy source is expected to result in an annual savings of approximately $77,945, which will be used by the City to invest in future solar/energy efficiency projects (such as battery storage) at City facilities. The Project is also expected to enhance water reliability and improve water conservation management by reducing the amount of water consumed during energy production, saving an estimated 101.4 acre feet per year (AFY) of water.

B. Project Location

The proposed Project is located in City of Santa Ana in Orange County, California, approximately 30 miles southeast of Los Angeles. The City of Santa Ana is bounded on the north by the Cities of Garden Grove and Orange, on the east by the Cities of Tustin and Irvine, on the south by the City of Costa Mesa, and on the west by the Cities of Westminster and Fountain Valley. The Garthe Pumping station is located at 2401 N. Bristol Ave, Santa Ana, CA 92706 and has a latitude of 33° 46' 6.477"N and a longitude of -117° 53' 3.1668"W. The West Pump Station is located at 201 S. Mountain View Ave., Santa Ana, CA 92704 and has a latitude of 33° 44' 36.8406"N and longitude of -117° 55' 36.8862"W, as shown on Figure 1 (below).

Figure 1. Garthe and West Pump Station Facilities Location Map

C. Technical Project Description

The City of Santa Ana (City) currently purchases 18 million kilowatt hours (kWh) of electricity each year to operate water well pumps and booster pumps to deliver potable water to its customers. In February 2019, the City approved a "Water Systems Alternative Energy Feasibility Study" ("NAM Study") prepared by Newcomb Anderson McCormick (NAM), a Willdan Company (Appendix B). This Study included an evaluation of installing on-site renewable energy systems to offset some of the City's electrical load, lower electric bills, and reduce the associated greenhouse gas (GHG) emissions. The renewable energy resources that were evaluated included installing solar photovoltaic (PV) modules at six locations, including the Garthe and West pump station/reservoir facilities.

Preliminary designs were undertaken to determine the anticipated rate tariff, total system size, annual performance projections, and relative load offset for each. The designs were simulated using HelioScope, an industry standard PV simulation program that uses a local weather data file and calculates the hourly performance of the system based on the angle of insolation, air temperature, wind speed, intensity of clouds, etc. The hourly PV output is subtracted from the hourly electric load profile data from SCE to determine the hourly

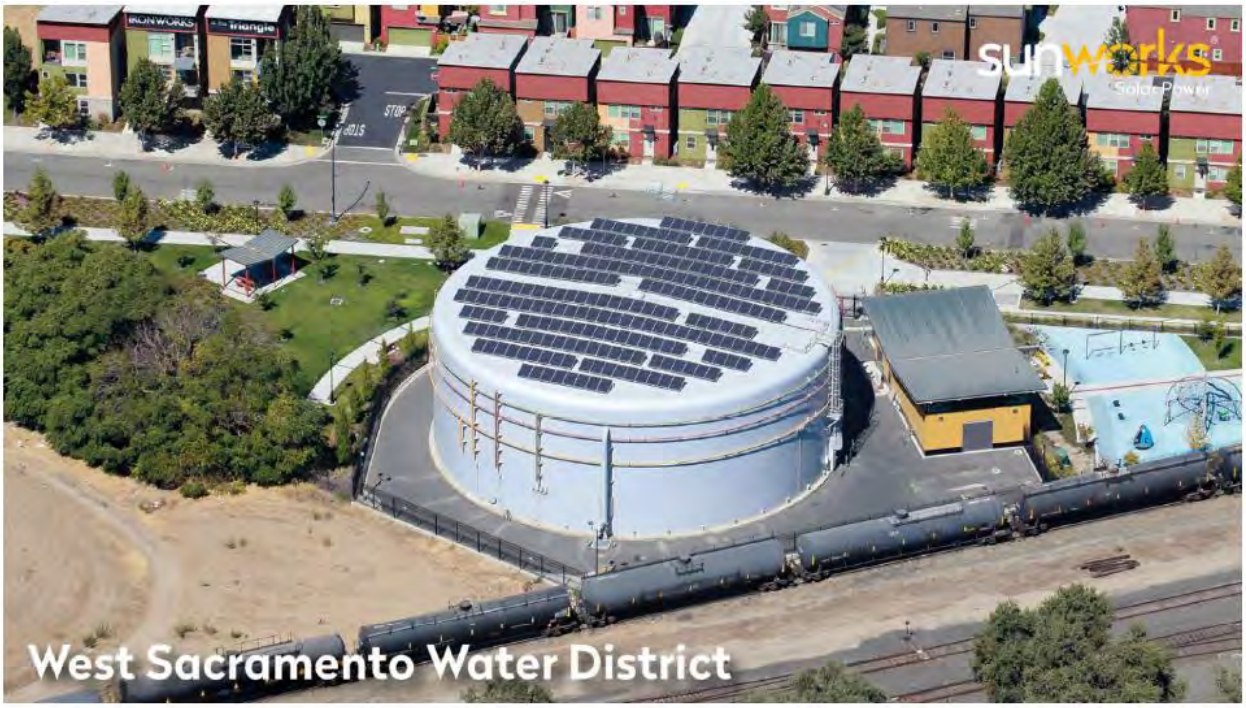
energy use with PV in place.

The electric cost was then calculated with consideration of how these kWh fall into the On-Peak, Part-Peak, and other categories. Twelve (12) monthly bills were calculated for the sites with and without solar. A lifecycle cost analysis was performed, then the implementation cost and energy savings at each of the proposed sites were tabulated. The results of this evaluation indicated that the greatest solar benefit was for the Garthe and West sites, as follows:

West Site:	Year -1 Electricity Savings:	422,617 kWh
	Year -1 Energy Cost Savings:	$39,780
Garthe Site:	Year -1 Electricity Savings	894,325 kWh
	Year -1 Energy Cost Savings:	$38,165

Following installation, each site would be interconnected to the local electric utility (Southern California Edison or "SCE"), through their net energy metering (NEM) program. NEM allows systems to export to the grid during times when the site load is less than the solar PV generation, receiving a credit worth nearly the full retail rate of the energy being exported. It is assumed that Project sites would utilize either a ballasted mounting system, or a direct attachment. An example of a solar system installed on top of a municipal water reservoir is shown below.

Figure 2. West Sacramento Water District Solar Project Example



D. Evaluation Criteria

D.1. Evaluation Criterion A — Quantifiable Water Savings

Describe the amount of estimated water savings. For projects that conserve water, please state the estimated amount of water expected to be conserved (in acre-feet per year) as a direct result of this project. Describe the support/documentation of estimated water savings.

This Project will save 101.4 acre feet per year (AFY) of water based on reduced water use for energy production. According to researchers at the Virginia Water Resources Research Center, in Blacksburg, Virginia; fossil-fuel-fired thermoelectric power plants consume more than 132 billion gallons of fresh water per day (2008) in the United States alone, which translates to an average of 25 gallons of water to produce 1 kilowatt-hour (kWh) of electricity. IEEE Spectrum, by Willie Jones, April 1, 2008.

The City currently purchases energy from SCE which receives energy from a variety of sources. The main energy generation facilities for SCE are located in SCE's service area of Southern California. Although the City does not provide water directly to SCE power generation facilities, SCE's power generation facilities are located Southern California, which is a region currently experiencing severe impacts to its water supplies due to the ongoing drought. The City cannot guarantee that the Project will result in water savings in City's service area; however, water savings will occur since the Project is shifting the Garthe and West Pump Stations from fossil fuel fired thermoelectric power to solar power, which requires no water in the electricity generation process.

Describe current losses Please explain where the water that will be conserved is currently going and how it is being used. Consider the following:

a. Explain where current losses are going (e.g., back to the stream, spilled at the end of the ditch, seeping into the ground)?

The estimated 101.4 AFY of water is currently being used to generate the energy needed for operation of the water system.

b. If known, please explain how current losses are being used. For example, are current losses returning to the system for use by others? Are current losses entering an impaired groundwater table becoming unsuitable for future use?

Currently 101.4 AFY of treated water is being used to produce the energy needed to power the Garthe and West Pump Stations. Implementation of the proposed Project could help recover the drinking water currently being used for energy production that could be used for other needs.

c. Are there any known benefits associated with where the current losses are going? For example, is seepage water providing additional habitat for fish or animal species?

There are currently no known benefits associated with current losses due to leaks in the City water system.

d. Describe the support/documentation of estimated water savings. Please provide sufficient detail supporting how the estimate was determined, including all supporting calculations.

According to researchers at the Virginia Water Resources Research Center, in Blacksburg, Virginia; fossil-fuel-fired thermoelectric power plants consume more than 132 billion gallons of fresh water per day (2008) in the United States alone, which translates to an average of 25 gallons of water to produce 1 kilowatt-hour (kWh) of electricity. IEEE Spectrum, by Willie Jones, April 1, 2008.

D.2. Evaluation Criterion B—Renewable Energy

D.2.1. Subcriterion No. B.1: Implementing Renewable Energy Projects Related to Water Management and Delivery

Describe the amount of energy capacity. *For projects that implement renewable energy systems, state the estimated amount of capacity (in kilowatts) of the system. Please provide sufficient detail supporting the stated estimate, including all calculations in support of the estimate.*

In February 2019, the City approved a "Water Systems Alternative Energy Feasibility Study" prepared by Newcomb Anderson McCormick (NAM), a Willdan Company ("NAM Study"). This study included an evaluation of the potential to install on-site renewable energy systems to offset some of the electrical load, lower electric bills, and reduce the associated greenhouse gas (GHG) emissions. The renewable energy resources that were evaluated included installing solar PV modules on the roofs of the storage tanks at five of the pump stations, including Garthe and West. This study is posted in Appendix B.

The results of the NAM Study determined that the estimated annual amount of energy that would be generated would be 894,325 kWh at the Garth site and 422,617 kWh for the West site, for a total of 1,316,942 kWh annually. Given that there are 8,760 total hours in a year, a simple calculation reveals that this equates to a capacity of approximately 150 kW per year.

Describe the amount of energy generated. *For projects that implement renewable energy systems, state the estimated amount of energy that the system will generate (in kilowatt hours per year). Please provide sufficient detail supporting the stated estimate, including all*

calculations in support of the estimate. Please explain how the power generated as a result of this project will be used, including any existing or planned agreements and infrastructure.

As described in great detail above, pursuant to the calculations provided in the February 2019 NAM Study, the estimated amount of energy (in kWh) generated was determined: 894,325 kWh annually for the Garth site and 422,617 kWh for the West site, for a total of 1,316,942 kWh annually.

The power generated as a result of this Project would typically supply the local electric utility (SCE) grid, resulting in a cost savings to the City of Santa Ana. Each of these systems would be interconnected to SCE through their Net Energy Metering program (NEM). NEM allows systems to export to the grid during times when the site load is less than the solar PV generation, receiving a credit or nearly the full retail rate of the energy being exported.

Describe the status of a mothballed hydro plant.
This question is not related to the proposed Project.

Describe any other benefits of the renewable energy project. *Please describe and provide sufficient detail on any additional benefits expected to result from the renewable energy project, including:*

- *How the system will combat/offset the impacts of climate change, including an expected reduction in greenhouse gas emissions*

As explained above, according to the NAM Study, the proposed Project is expected to generate an estimated 1,316,942 kWh annually. The Table on page 1 of the NAM Study shows a total of nine (9) proposed projects. The NAM study states that collectively (i.e., all 9 sites), "the implementation of these projects would reduce the Water Resources Division's purchase of electricity by 25% compared to 2016. This would also reduce the GHG emissions of 1330 metric tons of CO2 equivalent by a similar percentage from 2016."

According to this chart, the Garthe and West projects together represent approximately 28% of this total (all 9 sites) energy savings (i.e., 1,316,942 kWh divided by 4,648,554 kWh). Therefore, **the proposed Project is expected to combat/offset the impacts of climate change by reducing the City Water Resources Division's entire annual greenhouse gas emissions by over 7%** (i.e. 28.3% of the total 25%).

According to EPA Climate Change Indicators, greenhouse gases from human activities are the most significant driver of observed climate change causing global warming.

According to EPA Greenhouse Gas Equivalencies Calculator, this amount translates to 933 Metric Tons of carbon dioxide equivalent of greenhouse gas. To Offset this amount, it will require 1,143 acres of USA forests in one year or 15,432 tree seedlings grown for 10 years.

The proposed Project is a more effective and sustainable solution than these options for GHG reduction.

- *Expected environmental benefits of the renewable energy system*

The proposed Project is expected to generate 1,316,942 kWh on an annual basis, resulting in an expected water supply savings of over 101.4 AFY. (Refer to above Section Quantifiable Water Savings for calculation.) The expected energy and water savings from the installation of this renewable energy system will benefit the overall environment, including the following:

- Reduced greenhouse gas emissions reducing the global warming trend
- Enhanced water reliability and water quality
- Improved air quality
- Wildlife preservation
- Fewer extreme weather events and therefore, Improved fire protection
- Improved forests and rural landscapes
- Improved water conservation management
- Health benefits for humans and all living things

Additionally, by implementing a local renewable energy source, water savings of 101.4 AFY will be realized due to reduced reliance on fossil fuel energy. Electricity production is among the biggest uses of water in the United States. Energy production by thermoelectric power plants account for the largest share of freshwater withdrawals in United States. This is followed by 37% for irrigation and only 13% for drinking water accounts. Renewable energy sources like solar and wind can mitigate our drought issue and set us on a better path to conserving this precious resource that is vital to all life on earth.

Coal-fired power plants can use up to 1,100 gallons of water per megawatt-hour for cooling and operations. Nuclear power plants use roughly 800 gallons of water per megawatt-hour heating water to create steam to turn turbines and produce power, and natural gas can use 300 gallons of water per megawatt-hour for extraction and electricity generation. Fracking for natural gas also contaminates water. Solar energy on the other hand requires no water to generate power.

- *Any expected reduction in the use of energy currently supplied through a Reclamation project.*

As mentioned previously, the City receives its energy from SCE who generates and purchases energy from a variety of sources and transmits the energy to its customers. One source of energy that SCE is reliant upon is the Hoover Dam, which generates up to 4 billion kWh per year and is owned and operated by the Bureau of Reclamation. Any

reduction in energy consumption in the City will result in reduced energy purchased from SCE, which will ultimately create more energy in the western energy grid.

- *Anticipated benefits to other sectors/entities.*

  By eliminating the Garthe and West Pump Stations' need to purchase energy from SCE, there will be an additional 1,316,942 kWh per year of energy conserved on the western grid. As with all energy conservation efforts, the proposed Project will benefit municipal, industrial, environmental and recreation sectors, making more energy available to these sectors that are not yet able to produce renewable energy onsite. The project will benefit the overall environment by reducing greenhouse gas emissions, enhancing water reliability, and improving water management.

- *Expected water needs, if any, of the system.*

  The proposed Project will not generate any water needs. In fact, the Project is expected to save in excess of 101.4 AFY of water on an annual basis by reducing reliance on fossil fuel consumptive energy.

D.2.2. Subcriterion No. B.2: Increasing Energy Efficiency in Water Management*.*
Describe any energy efficiencies that are expected to result from implementation of the water conservation or water efficiency project (e.g., reduced pumping).

- *If quantifiable energy savings is expected to result from the project, please provide sufficient details and supporting calculations. If quantifying energy savings, please state the estimated amount in kilowatt hours per year.*

  As described in detail above, the results of the NAM Study determined that the estimated annual amount of energy that would be generated would be 894,325 kWh at the Garth site and 422,617 kWh for the West site, for a total of 1,316,942 kWh per year.

- *How will the energy efficiency improvement combat/offset the impacts of climate change, including an expected reduction in greenhouse gas emissions.*

  By generating an estimated 1,316,942 kWh annually, the project is expected to reduce greenhouse gas emissions by the associated amount, thereby improving/offsetting the impacts of climate change in doing so.

- *If the project will result in reduced pumping, please describe the current pumping requirements and the types of pumps (e.g., size) currently being used. How would the proposed project impact the current pumping requirements and energy usage?*

  By generating over 101.4 AFY of water savings, the need for pumping an equivalent

amount of water will be reduced.

- *Please indicate whether your energy savings estimate originates from the point of diversion, or whether the estimate is based upon an alternate site of origin.*

  The expected energy savings originates from the point of origin.

- *Does the calculation include any energy required to treat the water, if applicable?*
  Not applicable.

- *Will the project result in reduced vehicle miles driven, in turn reducing greenhouse gas emissions? Please provide supporting details and calculations.*
  Not applicable.

- *Describe any renewable energy components that will result in minimal energy savings/production (e.g., installing small-scale solar as part of a SCADA system).*

  The proposed Project will create a renewable energy system at two of the City's pump station facilities, to offset some of the electric load and reduce the associated greenhouse gas (GHG) emissions. This renewable solar power will be generated by mounting PV modules on top of water storage tanks at the Garthe and West pump station facilities and is expected to generate an estimated additional 1,316,942 kWh annually between the two project sites.

D.3. Evaluation Criterion C—Sustainability Benefits

Enhancing drought resiliency. In addition to the separate WaterSMART Environmental Water Resources Projects NOFO, this NOFO places a priority on projects that enhance drought resiliency, through this section and other sections above, consistent with the SECURE Water Act. Please provide information regarding how the project will enhance drought resilience by benefitting the water supply and ecosystem, including the following:

- *Does the project seek to improve ecological resiliency to climate change?*

Climate change is an issue that has many effects on our environment. For example, climate is expected to perpetuate the duration and frequency of droughts, which threatens a number of ecosystems throughout the Western United States that rely on water to survive. As indicated in multiple reports, climate change is being perpetuated by the burning of fossil fuels and the subsequent greenhouse gases emitted from this process. By shifting to a renewable energy source, the City will be reducing its carbon emissions, thereby combatting climate change and the threat it poses to a number of ecosystems throughout the western United States.

Specifically, the Project is intended to help provide ecological resilience to climate change

by:

- Generating 1,316,942 kWh annually that will reduce the release of 933 tons of carbon dioxide per year
- Saving of over 101.4 AFY of water annually, making these additional water supplies available to other users such as various ecosystems throughout the western United States.

Above alterations will result in benefits to the environment, agriculture, wildlife, forestry and air and water quality, thereby improving ecological resilience.

- *Will water remain in the system for longer periods of time? If so, provide details on current/future durations and any expected resulting benefits (e.g., maintaining water temperatures or water levels).*
  Currently the City acquires approximately 25-30% of its water supply from Metropolitan Water District of Southern California's (MWD) imported water connections that receive water from the Colorado River and the State Water Project (SWP) from San Francisco Bay-Delta (the Delta), which are directly influenced by climate conditions the Colorado River Basin and in northern California, respectively. Both regions have been suffering from multi-year drought conditions, which directly impact water supplies to southern California.

  The City's ability to reduce water intake from SWP and Colorado River, will allow an equivalent amount of water to remain at these sources, which will help prevent potential increase in salinity and algal production, reduced oxygen levels, and higher temperatures that are detrimental to wildlife production.

- *Will the project benefit species (e.g., federally threatened or endangered, a federally recognized candidate species, a state listed species, or a species of particular recreational, or economic importance)? Please describe the relationship of the species to the water supply, and whether the species is adversely affected by a Reclamation project or is subject to a recovery plan or conservation plan under the Endangered Species Act (ESA).*
  Greenhouse gas emissions and their effect on global warming are directly responsible for abnormal changes in wildlife habitat. Biologists are becoming more and more concerned that global climate change will drastically reduce biodiversity. Some biologists estimate that 35% of animals and plants could become extinct in the wild by 2050 due to global climate change. According to the National Parks Service: "If we can sufficiently reduce greenhouse gas emissions, many of them will still have a chance to survive and recover".

  Increased GHG emissions are directly responsible for the increase in drought conditions observed in California. The impact of the recent drought conditions on the wildlife

habitat has been tremendous. According to the Pacific Institute, many of the State's environmental flows went unmet during the drought period, affecting aquatic ecosystems and decreased protections for endangered species. The recent drought has caused losses or destruction of fish and wildlife habitat, loss of wetlands, more wildfires and lower water levels in reservoirs, lakes, and ponds. Dry creeks and rivers led **18 fish species to diminish to near extinction**.

Implementation of this project will not only reduce an equivalent amount of 933 tons of carbon dioxide, it will allow for water savings of over 101.4 AFY to remain at source, and provide an incremental increase to the over drafted river supplies.

- *Please describe any other ecosystem benefits as a direct result of the project.*

As mentioned above, various ecosystems are likely to benefit including forestry, rangeland, riparian, and other ecosystems that rely on air and water quality as a direct result of the project.

- *Will the project directly result in more efficient management of the water supply? For example, will the project provide greater flexibility to water managers, resulting in a more efficient use of water supplies?*

On an annual basis, the Project is expected to save an average of over 101.4 AFY of water and over 1,014 AFY in 10 years throughout the western United States, allowing these additional water supplies to be more efficiently managed by water managers, with greater flexibility to benefit multiple users.

Addressing a specific water and/or energy sustainability concern(s). Will the project address a specific sustainability concern? Please address the following:

- *Explain and provide detail of the specific issue(s) in the area that is impacting water sustainability, such as shortages due to drought and/or climate change, increased demand, or reduced deliveries.*

Yes, the proposed Project will address two important sustainability concerns: energy sustainability and water sustainability; both are being experienced in the Project area, the state of California, and throughout the western United States.

Water:
The Project addresses the water sustainability concerns by saving over 101.4 AFY of water, making these additional water supplies available to other users.

Water sustainability in the project area and throughout western United States is a very serious concern. According to the U.S Drought Monitor, the Project area is currently

experiencing a D2 "Severe Drought" status, much like it as has endured for the vast majority of the past nine years. See Figure 3 below for a map of Southern California and Figure 4 of the western United States.

Figure 3. Orange County Drought Map

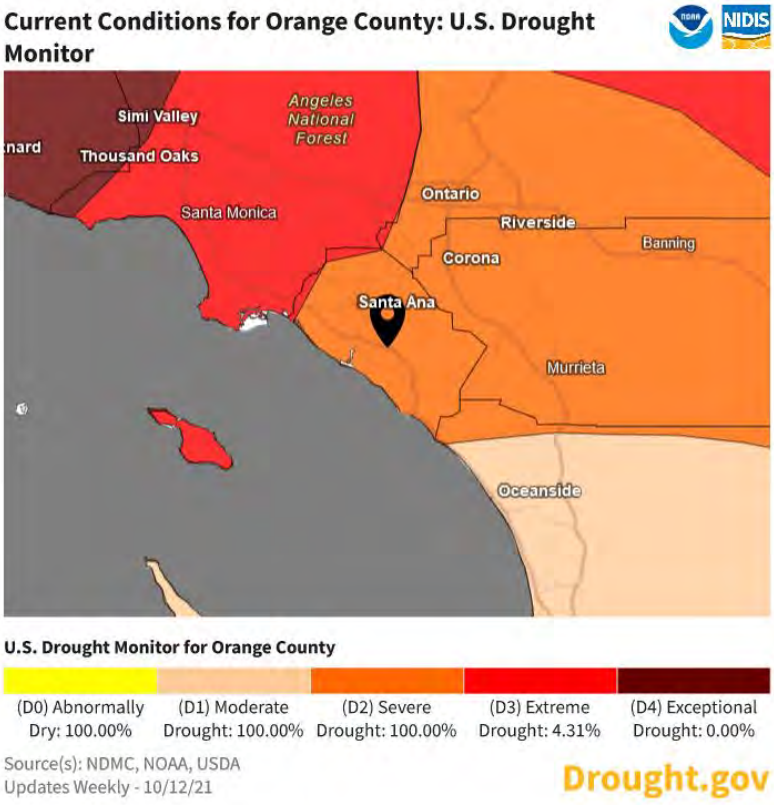
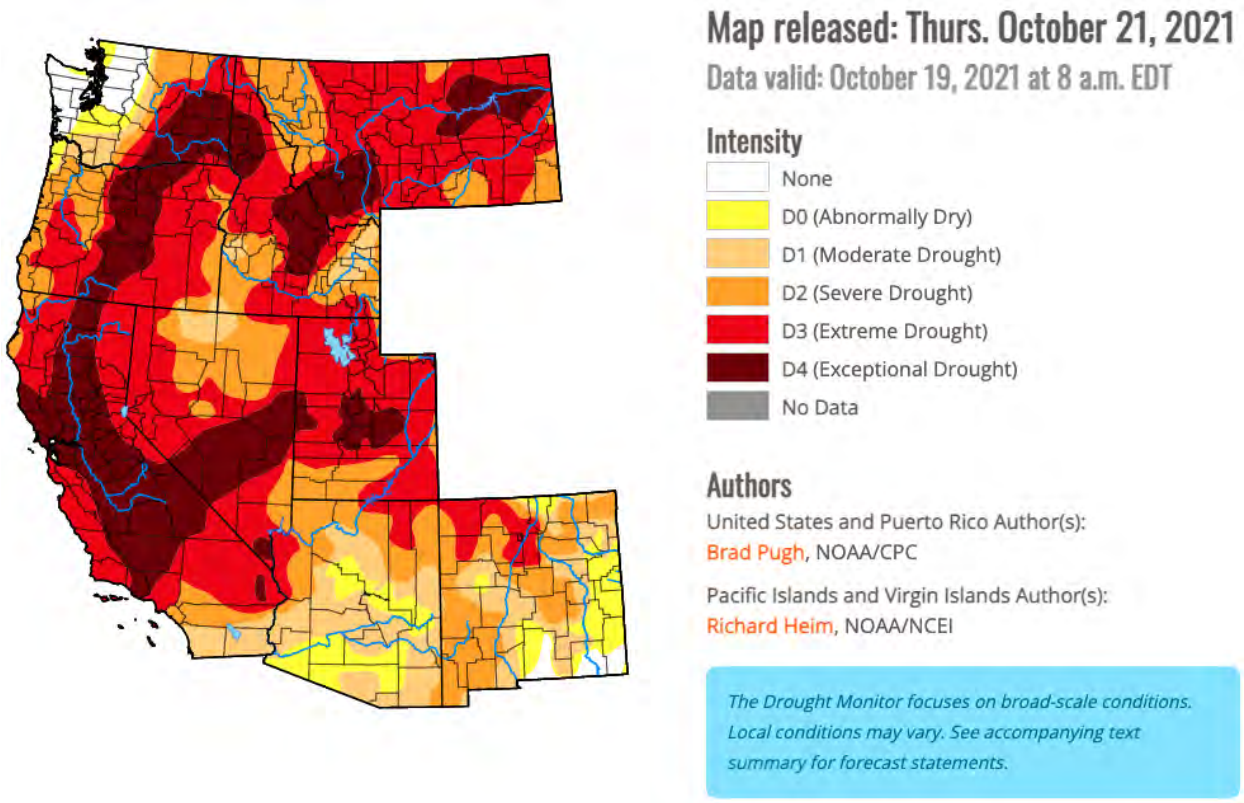


Figure 4. Western United States U.S. Drought Monitor Map



The years 2012- 2015 marked the driest four-year period in 120 years of historical records, along with historic high temperatures according to the California Department of Water Resources. "Severe Drought Area" is characterized as widespread water shortages or restrictions; "very high" fire risk; widespread crop and pasture losses; shortages of water supply in reservoirs, streams and wells.

The proposed Project is intended to help provide energy resilience and drought resilience to the Project area and western United States. Without action like this, we can expect impacts similar to those the Project area actually experienced during the 2012-17 drought, due to reduced supplies. Those impacts were severe, and included detrimental impacts to energy, the environment, agriculture, wildlife, forestry, economics, health, air quality and recreation.

Energy:

The Project addresses the energy sustainability concerns by generating an estimated 1,316,942 kWh annually of renewable energy.

Energy sustainability is also a very serious concern in the City of Santa Ana and throughout the state of California. According to an August 2021 Reuters article, the state of California "faces a potential supply shortfall of up to 3,500 megawatts during

peak demand hours in the coming weeks". Nichola Groom, Reuters, August 11, 2021. According to a recent article from Bloomberg Energy, these supply shortages are on the rise in California. There were 25,281 blackout events in 2019, a 23% increase from 20,598 in 2018. The number of utility customers affected jumped to 28.4 million in 2019, up 50% from 19 million in 2018. This year in California, extreme drought has slashed 1,000 MW of hydroelectric power capacity; wildfires threaten transmission lines that bring in power from other states; and a fire at a San Francisco-area gas plant knocked out 300 MW of supply, state agencies said.

Energy supply shortfalls throughout the state, including in the Project area, have been increasing in recent years, even worse than anticipated. The proposed Project will help to alleviate these shortfalls and mitigate the resulting detrimental effects.

- *Explain and provide detail of the specific issue(s) in the area that is impacting energy sustainability, such as reliance on fossil fuels, pollution, or interruptions in service. Please describe how the project will directly address the concern(s) stated above. For example, if experiencing shortages due to drought or climate change, how will the project directly address and confront the shortages?*

Energy sustainability worldwide, and in the Project area in particular, is becoming more difficult due to society's reliance on fossil fuels. The result of this reliance is decreasing supplies and increasing energy shortages, which result in interruptions in service, as well as increased air pollution and other negative environmental impacts. Climate change has increased our reliance on these fossil fuels for uses in all areas of our society, including the production of water for firefighting and public use, as well as increased creature comforts such as air conditioning increases due to the rising temperatures associated with climate change. In recent years, this reliance has been increasing as demand increases.

According to a July 2014 publication from U.S. Department of Energy, titled, "*Water Energy Nexus Executive Summary,*" present day water and energy systems are interdependent. Water is used in all phases of energy production and electricity generation. Recent developments have focused national attention on the connections between water and energy infrastructure. When severe drought affected more than a third of the United States in 2012, limited water availability constrained the operation of some power plants and other energy production activities. Several current trends are further increasing the urgency to address the water-energy nexus in an integrated and proactive way.

According to researchers at the Virginia Water Resources Research Center, in Blacksburg, Virginia; fossil-fuel-fired thermoelectric power plants consume more than 132 billion gallons of fresh water per day (2008) in the United States alone, which

translates to an average of 25 gallons of water to produce 1 kilowatt-hour (kWh) of electricity. IEEE Spectrum, by Willie Jones, April 1, 2008.

To address these shortages with respect to energy sustainability; the Project is expected to generate 1,316,942 kWh on an annual basis. With respect to water shortages and sustainability, the proposed Project is expected to strengthen supply reliability by saving over 101.4 AFY on an annual basis.

- *Please address where any conserved water as a result of the project will go and how it will be used, including whether the conserved water will be used to offset groundwater pumping, used to reduce diversions, used to address shortages that impact diversions or reduce deliveries, made available for transfer, left in the river system, or used to meet another intended use.*

  The City relies on MWD for approximately 25-30% of its water supply and coordinates its long-term and water-shortage planning with MWD and Orange County Water District (OCWD). Water conservation management efforts such as the proposed Project will supplement the groundwater, increasing the City's water supply reliability and making these supplies available to other users.

- *Provide a description of the mechanism that will be used, if necessary, to put the conserved water to the intended use.*

  The City relies on approximately 70-75 percent local groundwater from the Orange County Groundwater Basin (OC Basin). The Orange County Water District (OCWD) is responsible for managing the OC Basin, including water quality and groundwater replenishment. The OC Basin is not adjudicated and as such, pumping from the OC Basin is managed through a process that uses financial incentives to encourage groundwater producers to pump a sustainable amount of water. No additional mechanisms will be necessary to allocate the conserved water for its intended use. The conserved water will be used to supplement the groundwater supply.

- *Indicate the quantity of conserved water that will be used for the intended purpose(s).*

  The proposed Project is expected to generate 1,316,942 kWh on an annual basis, resulting in an expected water supply savings of over 101.4 AFY annually. The project will benefit the overall environment by enhancing water reliability, conserving valuable water, reducing greenhouse gas emissions, and improving water conservation management.

Other project benefits. *Please provide a detailed explanation of the project benefits and their significance. These benefits may include, but are not limited to, the following:*

1. *Combating the Climate Crisis: E.O. 14008: Tackling the Climate Crisis at Home and Abroad, focuses on increasing resilience to climate change and supporting climate resilient development. For additional information on the impacts of climate change throughout the western United States, see: https://www.usbr.gov/climate/secure/docs/2021secure/2021SECUREReport.pdf. Please describe how the project will address climate change, including the following:*

- *Please provide specific details and examples on how the project will address the impacts of climate change and help combat the climate crisis.*

  By generating an estimated 1,316,942 kWh annually, the project is expected to reduce greenhouse gas emissions by the associated amount, thereby addressing and improving/offsetting the impacts of climate change.

- *Does this proposed project strengthen water supply sustainability to increase resilience to climate change?*

  Yes; the proposed Project will strengthen water supply sustainability to increase resilience to climate change. According to researchers at the Virginia Water Resources Research Center, in Blacksburg, Virginia; fossil-fuel-fired thermoelectric power plants consume more than 132 billion gallons of fresh water per day (2008) in the United States alone, which translates to an average of 25 gallons of water to produce 1 kilowatt-hour (kWh) of electricity. IEEE Spectrum, by Willie Jones, April 1, 2008. Therefore, because the project is expected to generate 1,316,942 kWh on an annual basis, a simple mathematical calculation reveals that the expected water supply savings is 32,923,550 gallons annually or 101.4 AFY. **The proposed Project is expected to strengthen water supply sustainability by over 101.4 AFY on an annual basis.**

- *Will the proposed project establish and utilize a renewable energy source?*

  The Project will establish and utilize a renewable energy source by generating solar power at two of the City's pump station sites, generating an estimated additional 1,316,942 kWh annually.

- *Will the project result in lower greenhouse gas emissions?*

  Yes, as mentioned above, by replacing an estimated 1,316,942 KW of fossil fuel energy with renewable solar energy the project will result in lower greenhouse gas emissions.

2. *Disadvantaged or Underserved Communities: E.O. 14008 and E.O. 13985 support environmental and economic justice by investing in underserved and disadvantaged communities and addressing the climate-related impacts to these communities,*

including impacts to public health, safety, and economic opportunities. Please describe how the project supports these Executive Orders, including:

a. *Does the proposed project directly serve and/or benefit a disadvantaged or historically underserved community? Benefits can include, but are not limited to, public health and safety through water quality improvements, new water supplies, new renewable energy sources, or economic growth opportunities.*

Yes, the proposed Project will provide benefits to a disadvantaged community, including expanding on renewable energy source, increasing electrical power reliability, enhancing public health and generating economic savings.

b. *If the proposed project is providing benefits to a disadvantaged community, provide sufficient information to demonstrate that the community meets the disadvantaged community definition in Section 1015 of the Cooperative Watershed Act, which is defined as a community with an annual median household income that is less than 100 percent of the statewide annual median household income for the State, or the applicable state criteria for determining disadvantaged status.*

According to the 2020 U.S. Census, the annual median household income for the state of California is $75,235, and the median household income (in 2019 dollars) between 2015-2019 was $66,145 for the City of Santa Ana, California. Since a disadvantaged community is defined as "a community with an annual median household income that is less than 100 percent of the statewide annual median household income for the state" by definition, Santa Ana is a disadvantaged community, and will benefit by the proposed Project. Please see below for a map of the City of Santa Ana and the Disadvantages Communities (DACs) and Severely Disadvantaged Communities (SDACs). DACs are defined by having MHI between $42,737 and $56,982 per year and SDACs are defined by having a MHI less than $42,737 per year.

c. *If the proposed project is providing benefits to an underserved community, provide sufficient information to demonstrate that the community meets the underserved definition in E.O. 13985, which includes populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life.*

EO 13985 states, *"…the term underserved communities refers to populations sharing a particular characteristic, as well as geographic communities, who have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life…… In the context of the Federal workforce, this term includes individuals who belong to communities of color, such as Black and African American, Hispanic and Latino…….individuals with limited English proficiency….."* According to the 2020

US Census, 76.8% of the City of Santa ana's total population are Latino and 80.3% speak a language other than English at home (persons above 5 years old). The proposed project is providing benefits to this underserved community in Santa Ana.

3. *Tribal Benefits: The Department of the Interior is committed to strengthening tribal sovereignty and the fulfillment of Federal Tribal trust responsibilities. The President's memorandum "Tribal Consultation and Strengthening Nation-to-Nation Relationships" asserts the importance of honoring the Federal government's commitments to Tribal Nations. Please address the following, if applicable:*
   a. *Does the proposed project directly serve and/or benefit a Tribe? Will the project increase water supply sustainability for an Indian Tribe? Will the project provide renewable energy for an Indian Tribe?*

      There are no tribal communities living in the City of Santa Ana, however, the City's reduced dependence on electrical power and water savings will allow other users to benefit, including tribal communities.

   b. *Does the proposed project directly support tribal resilience to climate change and drought impacts or provide other tribal benefits such as improved public health and safety through water quality improvements, new water supplies, or economic growth opportunities?*

      The proposed Project will reduce the city's reliance on limited electrical power and water supplies, making it more resilient to climate changes and drought impacts. In doing so, additional supplies will be made available to other users. These other users, including tribal communities, will also benefit by increased resilience to climate change and drought impacts, improved public health and new water supplies.

4. *Other Benefits: Will the project address water and/or energy sustainability in other ways not described above? For example:*
   a. *Will the project assist States and water users in complying with interstate compacts?*

      MWD supplies water to 26 member agencies (including the city of Santa Ana) Since 1941, sources included Colorado river supplies from outside the state of California. Implementation of the proposed project will help ensure the City serves as a responsible member by reducing its dependence on the finite MWD interstate supplies, thereby supporting water supply reliability and assisting States and water users during times of drought.

      The project will decrease dependence on both the state water project and the Colorado aqueduct projects, which means less water will be pulled from these

projects' source basins.

b. *Will the project benefit multiple sectors and/or users (e.g., agriculture, municipal and industrial, environmental, recreation, or others)?*

Generation of 1,316,942 kWh of renewable energy annually, and an anticipated annual savings of over 101.4 AFY of water will benefit municipal, industrial, and environmental, recreation sectors; making more energy and water more readily available to these sectors in times of reduced supplies. The project will benefit the overall environment by enhancing water and energy reliability, conserving valuable water, reducing greenhouse gas emissions, and improving water conservation management.

In addition, energy savings gained from implementation of this project will reduce the grid load, increase energy storage, and lower production costs for the SCE customers in Southern California.

c. *Will the project benefit a larger initiative to address sustainability?*

Yes. The Project is consistent with the City's Climate Action Plan (Appendix A) which targets a 15% reduction (over 2008 levels) in greenhouse gas emissions by 2020 and a 30% reduction by 2035. This also benefits a larger initiative by the State of California to reduce statewide greenhouse gas emissions to 1990 levels, and 80% below 1990 levels by 2050.

The project also benefits a larger federal initiative. In fact, on Oct. 15, 2021; President Biden's administration unveiled a government-wide plan to address the systemic threat climate change poses to all sectors of the economy. This plan is part of the White House's longer-term agenda to cut domestic greenhouse gas emissions nearly in half by 2030 and transition to a net-zero emissions economy by mid-century while mitigating the impact of climate change on the economy. (The target more than doubles the country's prior commitment under the 2015 Paris climate agreement.)

d. *Will the project help to prevent a water-related crisis or conflict? Is there frequently tension or litigation over water in the basin?*

The proposed project is estimated to result in an annual savings of 101.4 AFY of water, in a time of severe drought crisis where literally, every drop helps. In times such as these, there is frequently tension and/or litigation over available water supplies. In fact, Northern California agencies are filing a lawsuit against the State

Water Resources Control Board over an emergency drought order issued in August 2021 to curtail water diversions.

The City of Santa Ana is one of MWD's 26 member-agencies (including 14 cities, 11 municipal water districts, and one county water authority). Implementation of the proposed project will help ensure the City serves as a responsible member by reducing its dependence on the finite supply from MWD, thereby supporting water supply reliability during times of drought. Project implementation will also help prepare for projected increases in water demands, making water available for multiple beneficial uses and help to resolve or prevent water related conflicts in the region.

D.4. Evaluation Criterion D—On-Farm Irrigation Improvements

Not applicable.

D.5. Evaluation Criterion E—Planning and Implementation

Up to 8 points may be awarded for these subcriteria.

D.5.1 Subcriterion D.1— Project Planning

Does the applicant have a Water Conservation Plan and/or System Optimization Review (SOR) in place? Does the project address an adaptation strategy identified in a completed WaterSMART Basin Study? Please self-certify or provide copies of these plans where appropriate to verify that such a plan is in place. Including a specific excerpt or a link to the planning document may also be considered where appropriate.

The City of Santa Ana maintains a Water Shortage Contingency Plan (WSCP) (Appendix C) which identifies a number of water conservation methods to be instated in response to water shortages. By implementing solar power generation at the Garthe and West Pump Station facilities, the City will be able to provide reliable water supplies even in the event of a water shortage, which would threaten water and energy resources.

The City of Santa Ana has a Climate Action Plan (Appendix A). The Project does address an adaptation strategy identified in the September 2013, U.S. Department of Interior Bureau of Reclamation Summary Report for the Santa Ana Watershed Basin Study, which includes the City of Santa Ana. One of the adaptation strategies identified was AB 32 compliance: "….identify additional opportunities for reducing carbon emissions." (Section 4.6 states that climate adaptation strategies were developed through a consultative process involving reclamation and SAWPA staff.) The proposed Project will generate renewable (solar) energy in lieu of electrical power, thus reducing the carbon emissions. In doing so, the Project addresses this adaptation strategy specifically identified in the completed Watersmart Basin Study.

Provide the following information regarding project planning:

1. *Identify any district-wide, or system-wide, planning that provides support for the proposed project. This could include a Water Conservation Plan, SOR, Drought Contingency Plan or other planning efforts done to determine the priority of this project in relation to other potential projects.*

The City of Santa Ana is deeply committed to saving the City's precious water resources, and has participated in and developed numerous planning documents that address water shortages and conservation alternatives including the NAM Study, as well as the following:

- City of Santa Ana Permanent Water Conservation requirements (Municipal Code section 39-106)
- City of Santa Ana Strategic Plan – Community Facilities and Infrastructure
- City of Santa Ana Climate Action Plan (Appendix A)
- City of Santa Ana Climate Emergency Resolution
- City of Santa Ana Drought Action Plan (Appendix D)
- City of Santa Ana Water Master Plan (2017) (Appendix E)
- Urban Water Management Plan (2020) (Appendix F)
- Water Systems Alternative Energy Feasibility Study (Appendix B)
- Metropolitan Water District Water Surplus and Drought Management Plan
- Metropolitan Water District Integrated Water Resources Plan

These efforts each lend support to the proposed Project; a few of the many examples are described below.

Section 7 of the 2017 Santa Ana Water Master Plan identifies "the installation of solar panels at the Garth and West reservoir facilities which will provide the city with sustainable energy."

In September 2021, the City of Santa Ana became only the fourth city in the United States to endorse the Fossil Fuel Non-Proliferation Treaty by approving a Climate Emergency Resolution. The resolution commits Santa Ana to "…developing policies as well as courses of action that ….restrict expansion of fossil fuel combustion…." The proposed Project is consistent with and supported by this Treaty.

In May 2014, the Santa Ana City Council approved greenhouse gas emissions reduction targets for inclusion in the city's Climate Action Plan (Appendix A), and in December 2015 adopted a resolution to approve the Climate Action Plan that included these targets. The proposed Project will reduce greenhouse gas emissions consistent with this action and the city's Climate Action Plan. This action helped to accomplish Goal 5 of the Santa Ana Strategic Plan, which also meets the state of California objective of reducing statewide greenhouse gas emissions to 1990 levels by 2020 and are on track to achieve the statewide

goal of 80% below 1990 levels by 2050.

2. *Describe how the project conforms to and meets the goals of any applicable planning efforts and identify any aspect of the project that implements a feature of an existing water plan(s).*

   The Climate Action Plan is one of the City of Santa Ana's significant planning documents. One of the major goals of the City's Climate Action Plan is to reduce carbon dioxide equivalent (CO_2) 30% by the year 2020 and 40% by 2035, relative to the 2008 baseline. With the solar power it will generate, the proposed Project will generate an estimated additional 1,316,942 kWh annually, thus reducing the corresponding greenhouse gas emissions. As stated on page 1 of the NAM Study, the project is a "good step in implementing the Climate Action Plan"

   The proposed Project conforms to Section 7 of the 2017 Santa Ana Water Master Plan, which identifies "the installation of solar panels at the Garth and West reservoir facilities which will provide the city with sustainable energy."

   In addition, in August 1999; Metropolitan Water District adopted a "Water Surplus and Drought Management Plan", and in 1996 adopted an evolving long-term water strategy known as the "Integrated Water Resources Plan", or IRP. The IRP was updated in 2004, 2010, 2015 and 2020, and "looks to local solutions to close any potential gap between supply and demand," representing a refinement — not an overhaul — of Southern California's water management strategy. The proposed project does exactly that, by promising to provide an estimated additional 101.4 AFY to the City's groundwater, thereby helping to close the gap.

3. *If applicable, provide a detailed description of how a project is addressing an adaptation strategy specifically identified in a completed WaterSMART Basin Study or Water Management Options Pilot (e.g., a strategy to mitigate the impacts of water shortages resulting from climate change, drought, increased demands, or other causes)*
   For more information on Basin Studies, including a list of completed basin studies and reports, please visit: www.usbr.gov/WaterSMART/bsp.

   In September 2013, the U.S. Department of Interior Bureau of Reclamation issued a Summary Report for the WaterSmart Santa Ana Watershed Basin Study, which includes the City of Santa Ana. One of the adaptation strategies identified was AB 32 compliance: "….identify additional opportunities for reducing carbon emissions." (Section 4.6 states that climate adaptation strategies were developed through a consultative process involving reclamation and SAWPA staff.) The proposed Project will generate renewable (solar) energy in lieu of electricity, thus reducing the carbon

emissions. In doing so, the Project addresses this adaptation strategy specifically identified in the completed Watersmart Basin Study.

D.5.2. Subcriterion D.2— Readiness to Proceed

- *Identify and provide a summary description of the major tasks necessary to complete the project. Note: please do not repeat the more detailed technical project description provided in Section D.2.2.4.; this section should focus on a summary of the major tasks to be accomplished as part of the project.*

1. City of Santa Ana Building Dept. to issue appropriate building permits.
2. Southern California Edison (SCE) to approve plans and issue permit.
3. City staff to implement Public Bid process to determine the lowest responsible bidder, in compliance with State of California Public Contracts Code.
4. Santa Ana City Council to award construction contract (to the lowest responsible bidder).
5. City will manage the project during construction phase.
6. Grant Compliance: The City of Santa Ana has professional grant consultants on contract that will utilize to assure all the Bureau of Reclamation requirements are met in a timely manner.

- *Describe any permits that will be required, along with the process for obtaining such permits.*

Following permits will be required:

- City of Santa Ana Building Department permit
- SCE permit

- *Identify and describe any engineering or design work performed specifically in support of the proposed project.*

Newcomb Anderson McCormick (NAM), a Willan Company prepared a "Water Systems Alternative Energy Feasibility Study" which the City approved in February 2019. This study included an evaluation of the potential to install on-site renewable energy systems to offset some of the City's electrical load, lower electric bills, and reduce the associated greenhouse gas (GHG) emissions. The renewable energy resources that were evaluated included installing solar PV modules on the roofs of the storage tanks at the Garthe and West pump stations and included some preliminary designs. These designs were simulated using HelioScope, an industry standard PV simulation program. This program uses a local weather data file and calculates the hourly performance of the system based on the angle of insolation, air temperature, wind speed, intensity of clouds, etc.

- *Describe any new policies or administrative actions required to implement the project.*

No new policies or administrative actions are required to implement the Project.

- *Please also include an estimated project schedule that shows the stages and duration of the proposed work, including major tasks, milestones, and dates. Milestones may include, but are not limited to, the following: complete environmental and cultural compliance; mobilization; begin construction/installation; construction/installation (50% complete); and construction/installation (100% complete)*

Table 1. Project Schedule

Estimated Project Schedule			
No.	Task/Milestone	Start Date	Completion Date
1	Issue RFP to prepare design documents	January 2022	March 2022
2	Award contract for preparation of design documents	April 2022	April 2022
3	Design Phase	May 2022	November 2022
4	for construction bids	November 2022	December 2022
5	Award Construction Contract	Jan 2023	Jan 2023
6	Construction Period (9 mos.)	March 2023	November 2023
7	Complete Project		December 2023

D.6. Evaluation Criterion F—Collaboration

- *Please describe how the project promotes and encourages collaboration. Consider the following:*
- *Is there widespread support for the project? Please provide specific details regarding any support and/or partners involved in the project. What is the extent of their involvement in the process?*

As described D.5.1.1 above, the proposed Project is consistent with numerous planning documents that the City was involved with and/or a part of. Many of these planning documents, such as the City's 2020 Urban Water Management Plan (UWMP) were prepared with widespread support and integration from the public, as well as numerous local and regional agencies identified in Section 2.2.1 of this document.

The City of Santa Ana has started communication with Southern California Edison (SCE) who are very supportive of this project and have been collaborating with the City on this project. City of Santa Ana has been one of the leaders in conservation in the region and

will communicate the results of this project to other member agencies so that it may be duplicated by others.

- *What is the significance of the collaboration/support?*

The City of Santa Ana has been working with SCE on implementation of a Hydropower efficiency project that was also funded by the Reclamation in 2019. City will continue its collaborate with SCE on implementation of this project that will allow a streamlined process to complete the project within time and budget. This is the first time, there has been a grant opportunity for the City to apply for and implementation of this Project will enable the City to share its experience with other MWD member agencies. The shared experience and lessons learned will be a valuable tool for other agencies to implement such as project in their service areas.

Will this project increase the possibility/likelihood of future water conservation improvements by other water users?

The proposed project will install solar PV systems to generate an alternative renewable energy supply that will result in future water conservation improvements. According to page 59 of the Santa Ana Climate Action Plan (Appendix A) regarding Municipal Operations Energy Measures, "Solar PV systems are another way for the city to reduce energy costs and emissions, and to set an example **to encourage installation of renewable energy by businesses and residents in the community**.(emphasis added) Likewise, the resulting new renewable energy improvements by other water users will result in additional future water conservation improvements.

- *Please attach any relevant supporting documents (e.g., letters of support or memorandum of understanding).*

There was not enough time to solicit letters of support as the decision to submit this application was not finalized till very close to the grant deadline. However, as noted in the planning section, this project has the full support of the City management and would have been able to present strong support letters.

D.7. Evaluation Criterion G— Additional Non-Federal Funding

Table 2. Non- Federal Funding Summary

Percentage of Non Federal Funding		
Non-Federal Funding Amount	**Total Project Cost**	**Non-Federal Funding Percentage**
$2,435,408	$2,935,408	83.0%

D.8. Evaluation Criterion H— Nexus to Reclamation

Describe the nexus between the proposed project and a Reclamation project or Reclamation activity. Please consider the following:

- *Does the applicant have a water service, repayment, or O&M contract with Reclamation?*

No, the City does not have a water service, repayment or O&M contract with Reclamation.

- *If the applicant is not a Reclamation contractor, does the applicant receive Reclamation water through a Reclamation contractor or by any other contractual means?*

Yes, the City of Santa Ana is a member agency of MWD who imports water from the Colorado River and Delta via the SWP and Colorado River Aqueduct (CRA), respectively. The CRA diverts water from the Colorado River at Lake Havasu which is operated by Reclamation.

- *Will the proposed work benefit a Reclamation project area or activity?* No.
- *Is the applicant a Tribe?* No.

E. PERFORMANCE MEASURES

The City of Santa Ana proposes to use the following performance measures to quantify the benefits upon completion of the proposed project:

Performance Measure No. 1: Energy Generated
The measure of performance will be the actual amount of energy generated (kWh) resulting from the construction of the Project. It is expected that the project will generate up to 1,316,942 kWh per year. After construction, and for two years following, the City will provide energy reports for the kWh generated.

Performance Measure No. 2: Water Saved (Conserved)
The measure of performance will be the actual amount of water consumption reduced after implementation of the Project, quantified as follows:
After project implementation, the City will monitor its energy savings as noted above and will use the latest energy consumption of water data to estimate the amount of water conserved as a result of reducing dependence on fossil fuel energy.

SECTION 2: PROJECT BUDGET

A. Standard Form 424 Budget Information

This document is included in the separate submission with all of the City's completed Standard Form 424 copies.

B. Funding Plan and Letters of Commitment

Describe how the non-Federal share of project costs will be obtained. Reclamation will use this information in making a determination of financial capability.

The City of Santa Ana has allocated the matching funds required for the Project to be carried to completion. The sources of the cost share are from the City's Water Enterprise Fund. As shown by the City of Santa Ana City Council draft resolution, the City is committed to providing the remaining matching fund to complete the Project effective immediately.

Commitment letters from third-party funding sources should be submitted with your application. If commitment letters are not available at the time of the application submission, please provide a timeline for submission of all commitment letters.

The City of Santa Ana will be providing the matching funding from its own budget. Therefore, no third party funding is included.

Table 3. Total Project Costs by Source

SOURCE	AMOUNT	Percentage
Costs to be reimbursed with the requested Federal funding	$ 500,000	17.0%
Costs to be paid by the applicant	$ 2,435,408	83.0%
Value of third-party contributions	$ 0	-%
Totals	**$ 2,935,408**	**100%**

Table 4. Summary of Non-Federal and Federal Funding Sources

FUNDING SOURCES	AMOUNT	%
Non-Federal Entities		
City of Santa Ana	$ 2,435,408	83%
Non-Federal Subtotal	**$ 2,435,408**	**83%**
Other Federal Entities		
None	$0	**-%**
Other Federal Subtotal	**$0**	**-%**
REQUESTED RECLAMATION FUNDING	**$ 500,000**	**17%**

C. Budget Proposal

Table 5. Project Budget

BUDGET ITEM DESCRIPTION	COMPUTATION		QUANTITY TYPE	TOTAL COST
	$/Unit	Quantity		
Salaries and Wages				**$ 20,007**
Project Manager	$ 69.47	288	Hours	$ 20,007
Fringe Benefits				**$ 9,184**
Project Manager	$ 31.89	288	Hours	$ 9,184
Travel				**$ -**
N/A				
Equipment				**$ -**
N/A				
Supplies/Materials				**$ -**
N/A				
Contractual/Construction				**$ 2,905,216**
Design				
Design phase	$ 376,909	1	LS	$ 376,909
Construction				
Equipment - Garthe Pump Station	$ 824,400	1	LS	$ 824,400
Equipment - West Pump Station	$ 424,764	1	LS	$ 424,764
Installation - Garthe Pump Station	$ 561,600	1	LS	$ 561,600
Installation - West Pump Station	$ 283,176	1	LS	$ 283,176
Contingency (10%)	$ 247,085	1	LS	$ 247,085
Construction Management				
Construction Management (8%)	$ 197,668	1	LS	$ 187,282
Environmental				**$ 1,000**
BOR Environmental Review	$ 1,000	1	LS	$ 1,000
Other				$ -
N/A				$ -
TOTAL DIRECT COSTS				**$ 2,935,408**
Indirect Costs				**$ -**
N/A				$ -
TOTAL ESTIMATED PROJECT COSTS				**$ 2,935,408**

D. Budget Narrative

Salaries and Wages

The salaries and wages are the City's Project Manager who is estimated to spend ~2 hours per week for the duration of the Project.

Fringe Benefits
The fringe benefits represent the City's Project Manager's fringe benefits and it is estimated that they will spend ~2 hours per week for the duration of the Project.

Travel
Not applicable.

Equipment
All equipment costs are included in the Contractual/Construction.

Materials and Supplies
All material and supplies costs are included in the Contractual/Construction.

Contractual/Construction
Through a competitive bid process in compliance with all applicable state and federal requirements, a qualified Contractor will be selected to construct the Project. The construction contract will include all relevant equipment, supplies and materials, construction, labor, and management needed to construct the project (as detailed in Table 5) at both Garth and West Pump Stations.

Third-Party In-Kind Contributions
Not applicable.

Environmental and Regulatory Compliance Costs
The cost to prepare the environmental documents will be part of the design component of the Project. The $1,000 cost allocated here is for BOR to complete its environmental review.

Other Expenses
Not applicable.

Indirect Costs
Not applicable.

Total Costs
The total cost of the Project is expected to be $2,935,408.

SECTION 3: ENVIRONMENTAL AND CULTURAL RESOURCES COMPLIANCE

Will the proposed project impact the surrounding environment (e.g., soil [dust], air, water [quality and quantity], animal habitat)? Please briefly describe all earth-disturbing work and any work that will affect the air, water, or animal habitat in the project area. Please also explain the impacts of such work on the surrounding environment and any steps that could be taken to minimize the impacts.

The proposed Project falls under Categorical Exemption for CEQA as identified by the State Resources Agency. (CEQA Guidelines 14 CCR Section 15300-15331). The scope of work on this project requires installation of solar equipment on the roof of existing reservoir structures; therefore, there will be no earth- disturbing work or work that affects the air, water, or animal habitat in the project area. Any incidental impacts from the construction phase of the project will be limited in nature and temporary. To minimize any impacts, the construction period will be limited to city ordinance requirements for noise and traffic.

Are you aware of any species listed or proposed to be listed as a Federal threatened or endangered species, or designated critical habitat in the project area? If so, would they be affected by any activities associated with the proposed project?

The Project area includes no known species listed or proposed-to-be-listed as a Federal threatened or endangered species nor designated critical habitat.

Are there wetlands or other surface waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States?" If so, please describe and estimate any impacts the proposed project may have.

There are no known wetland or surfaced waters inside the project boundaries that potentially fall under CWA jurisdiction as "Waters of the United States".

When was the water delivery system constructed?

For many years, the City of Santa Ana was a ranching community with some farming. To serve this growing agricultural and domestic community, a municipal water system was formed in 1886.

Will the proposed project result in any modification of or effects to, individual features of an irrigation system (e.g., headgates, canals, or flumes)? If so, state when those features were constructed and describe the nature and timing of any extensive alterations or modifications to those features completed previously.

The Project will be constructed on the roof of two City water storage tanks and will not impact features of the overall irrigation system such as head gates, canals, or flumes.

Are any buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places? A cultural resources specialist at your local Reclamation office or the State Historic Preservation Office can assist in answering this question.

No; the proposed project area has no buildings, structures, or features in the irrigation district listed or eligible for listing on the National Register of Historic Places.

Are there any known archeological sites in the proposed project area?

No; the proposed project area includes no known archeological sites.

Will the proposed project have a disproportionately high and adverse effect on low income or minority populations?

No; the proposed project will NOT have a disproportionately high and adverse effect on low income or minority populations. In fact, the proposed project will have a POSITIVE effect on the local population, including low income and minority populations. Historically, Santa Ana has had one of the lowest per capita incomes in all of Orange County. The local population (of which more than 78 percent identified as Hispanic or Latino in 2010) will benefit from the efficiency and economic savings that the proposed project implementation will bring.

Will the proposed project limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands?

No; the proposed project will not limit access to and ceremonial use of Indian sacred sites or result in other impacts on tribal lands

Will the proposed project contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area?

No; the proposed project will NOT contribute to the introduction, continued existence, or spread of noxious weeds or non-native invasive species known to occur in the area.

SECTION 4: REQUIRED PERMITS OR APPROVALS

1. Electrical permit will be issued by the City of Santa Ana Building Department.
2. SCE permit will be sought by the City.

SECTION 5: LETTERS OF SUPPORT

There was not enough time to solicit letters of support as the decision to submit this application was not finalized till very close to the grant deadline. However, as noted in the planning section, this project has the full support of the City management and would have been able to present strong support letters.

SECTION 6: OFFICIAL RESOLUTION

Below is the draft resolution that will be approved by the City Council on December 7th, 2021.

RESOLUTION NO. 2021-XXX

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF SANTA ANA AUTHORIZING AN APPLICATION FOR GRANT FUNDING BY THE BUREAU OF RECLAMATION'S WATERSMART WATER ENERGY AND EFFICIENCY GRANT PROGRAM FOR THE SOLAR POWER GENERATION AT GARTHE AND WEST PUMP STATION FACILITIES PROJECT

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF SANTA ANA AS FOLLOWS:

Section 1. The City Council of the City of Santa Ana hereby finds, determines and declares as follows:

A. The City of Santa Ana (the City) currently purchases energy from Southern California Edison to deliver potable water to its customers.

B. The City adopted a Climate Action Plan that provides guidelines and goals for the City to reduce its carbon emissions by 35% in 2035 based on the 2008 carbon emission baseline.

C. The City is in the planning stages of a Solar Power Generation at Garthe and West Pump Station Facilities Project (the Project). The proposed Project involves, among other things, installing photovoltaic modules on top of water storage tanks at the Garthe and West Pump Station facilities and connecting the solar power to power the City's water distribution system.

D. By installing solar power at the Garthe and West Pump Station Facilities, the City will generate up to 1,316,942 kWh of renewable energy that offset's the City's consumption of energy derived from fossil fuel combustion, reduce the City's greenhouse gas emissions, and reduce the City's annual electricity bill.

E. The United States Department of the Interior offers financial assistance in the form of grant funding through its Bureau of Reclamation's WaterSMART (Sustain and Manage America's Resources for Tomorrow) Water Energy and Efficiency Grant Program for this type of project. The program provides up to a maximum of $2,000,000 in grant funding, but not to exceed 50% of the total project cost.

F. The City desires to fund part of the cost of the Project with grant funding from the WaterSMART Water Energy and Efficiency Grant Program.

Section 2. The City Council of the City of Santa Ana hereby authorizes and directs the Executive Director of Public Works, or his or her designee, to sign and submit, for and on behalf of the City of Santa Ana, a grant application from the Bureau of

Reclamation's WaterSMART Water Energy and Efficiency Grant Program for the AMI Project up to the amount of $2,000,000.

Section 3. The Executive Director of Public Works, or his or her designee, is designated to provide the assurances, certifications, and commitments required for the grant application, including executing a financial assistance or similar agreement with the Bureau of Reclamation within established deadlines and any amendments or changes thereto.

Section 4. The Executive Director of Public Works, or his or her designee, is designated to represent the City of Santa Ana in carrying out the City's responsibilities under the grant agreement, including certifying disbursement requests on behalf of the City and compliance with applicable state and federal laws.

Section 5. If a grant award is made by the Bureau of Reclamation, the City of Santa Ana commits to providing up to $2,000,000 in matching funds for the Project plus any remaining balance.

Section 6. This Resolution shall take effect immediately upon its adoption by the City Council, and the Clerk of the Council shall attest to and certify the vote adopting this Resolution.

ADOPTED this ____ day of _____, 2021.

_____
Miguel A. Pulido
Mayor

APPROVED AS TO FORM:
Sonia R. Carvalho, City Attorney

By:_____
John M. Funk
Assistant City Attorney

AYES: Councilmembers _____

NOES: Councilmembers _____

ABSTAIN: Councilmembers _____

NOT PRESENT: Councilmembers _____

CERTIFICATE OF ATTESTATION AND ORIGINALITY

I, Maria D. Huizar, Clerk of the Council, do hereby certify the attached Resolution No. 2021 -_____ to be the original resolution adopted by the City Council of the City of Santa Ana on _____, 2021.

Date: _____

_____
Clerk of the Council
City of Santa Ana

SECTION 7: UNIQUE ENTITY IDENTIFIER AND SYSTEM FOR AWARD MANAGEMENT

REGISTRATION STATUS: ACTIVE

PAYMENTS FOR CONTRACTS & GRANTS WILL NOT BE AWARDED OR PROCESSED AFTER:

02-12-2022

SANTA ANA, CITY OF

Renew Registration Now

Sarah Ro

Legal Business Name: SANTA ANA, CITY OF

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APPENDICES

Appendix A: Santa Ana Climate Action Plan
Appendix B: Water Systems Alternative Energy Feasibility Study
Appendix C: Santa Ana Water Shortage Contingency Plan
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Appendix A: Santa Ana Climate Action Plan

Please see this link.

Appendix B: Water Systems Alternative Energy Feasibility Study

Please see Attachment 2 in the "Attachments" section of this grants.gov submittal.

Appendix C: Santa Ana Water Shortage Contingency Plan

Please see this link.

Appendix D: Santa Ana Drought Action Plan

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Appendix E: Santa Ana Water Master Plan

Please see this link.

Appendix F: Santa Ana 2020 Urban Water Management Plan

Please see this link.

City of Santa Ana
Public Works Agency
Water Resources Division

Water Systems Alternative Energy Feasibility Study

Project Number: 2669.01
February 2019

Newcomb|Anderson|McCormick
A WILLDAN COMPANY
201 Mission Street, Suite 2000, San Francisco, CA 94105
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Foreword

The City of Santa Ana Public Works Agency, Water Resources Division, hired Newcomb Anderson McCormick (NAM), a Willdan company, to evaluate the potential to offset some of their electricity purchases with renewable energy. The Agency uses electricity from Southern California Edison (SCE) at about 30 sites around the city for pumping out of wells and pressurizing the distribution system. NAM evaluated past records of pumping operations and electricity use; visited the prospective sites; and reviewed the 2017 Master Water Plan from the Agency.

NAM also evaluated the potential to generate electricity from solar power by covering the water storage tanks with solar collectors and by recovering head from the water delivered directly from the Metropolitan Water District. This evaluation assumes that the hydro turbine at SA-1 would continue to generate renewable electricity at its current reduced capacity as a baseline. The savings in this report are the marginal additional savings that would be generated by a new turbine.

NAM created cost estimates for constructing these projects and calculated the potential monetary savings by utilizing the new proposed SCE rate schedules, as opposed to the current rates. In addition, a life cycle cost analysis for each option was performed.

NAM would like to thank the assistance in performing this project that was provided by Water Resources Manager, Nabil Saba and Assistant Engineer II, Brian Ige.

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SECTION 1:
EXECUTIVE SUMMARY

The City of Santa Ana Public Works Agency purchases 18,000,000 kWh per year to operate well pumps and booster pumps to deliver potable water to 45,000 customer meters. This report evaluates the potential to install on-site renewable energy systems to offset some of this electric load, lowering electric bills and reducing the associated greenhouse gas (GHG) emissions.

The renewable energy resources evaluated include placing solar PV modules on the roofs of the storage tanks at five pump stations (Cambridge, East, Garthe, South and West), as well as at the City Yard; and recovering head from water that is delivered directly to the city from the Metropolitan Water District at a pressure that is higher than the city uses (SA-1 replacement, SA-3, SA-6).

The implementation cost and energy savings have been calculated for these projects and a life cycle cost analysis has been performed for the anticipated 25-year life of the equipment. The following table shows the anticipated overall cost and benefit projected for the city. [1,2,3]

Project	Site Name	Total Installed Cost	Year 1 Electricity Savings (kWh)	Year 1 Energy Cost Savings	25 year Net Benefit	Electric Savings Rate ($/kWh)
Turbine	SA-1	($638,763)	425,299	$38,441	$858,509	$0.090
Turbine	SA-3	($835,988)	536,973	$31,965	$409,035	$0.060
Turbine	SA-6	($1,072,174)	845,901	$55,131	$1,075,182	$0.065
Solar	Garthe Station	($1,404,000)	894,325	$38,165	($148,834)	$0.043
Solar	South Station	($194,832)	75,170	$3,492	($77,488)	$0.046
Solar	West Station	($707,940)	422,617	$39,780	$635,398	$0.094
Solar	East Station	($677,160)	393,985	$19,080	($43,018)	$0.048
Solar	Cambridge Station	($334,800)	184,480	$8,332	($67,435)	$0.045
Solar	City Yard	($1,890,767)	869,805	$46,325	($298,129)	$0.053
Total	**Total**	**($7,756,424)**	**4,648,554**	**$280,711**	**$2,343,220**	**$0.060**

The net effect of all these project is an investment of almost $8 million with 25 years of savings that will exceed the investment by about $2 million. This is not a great financial investment, but it is a good step in implementing the Climate Action Plan with a project that pays for itself.

The implementation of these projects would reduce the Water Resources Divisions purchase of electricity by 25% compared to 2016. This would also reduce the GHG emissions of 1,330 Metric tons of CO_2 equivalent by a similar percentage from 2016. As the SCE fuel mix changes to less GHG from year to year, the GHG savings will

shift accordingly.

The City of Santa Ana Climate Action Plan from 2015 indicates that the goal for municipal operations is a CO_2e reduction of 30% by the year 2020 and 40% by 2035, relative to the 2008 baseline. It is recommended that the City consider investment in these projects to help achieve the GHG goals, while saving money over the life of the project.

The summary table shows the effective cost per kWh at which electricity is being saved. Some of the savings are valued at less than the City currently pays for the electricity due to reasons described in this report. These include anticipated new SCE rates that will shift summer on peak hours later, so little solar power will be generated when it is most highly valued. In other cases where there is not a large existing load (such as SA-3 and SA-6) the power must be wheeled to other meters, which lowers its value. Substituting NEMA wheeling of this power for RES-BCT (described in the report) is a way to significantly increase the value of the electricity for these sites, but SCE would need to approve the arrangement.

1. The Total Installed Cost for the turbine projects includes the anticipated construction contract (labor, materials, tax, overhead and profit), contingency, engineering, and project management, minus a potential incentive for SA-1. See Appendix G.

2. The Total Installed Cost for the solar projects includes the anticipated construction contract, contingency, engineering, project management, and an upfront payment for a performance guarantee. The life cycle numbers include an annual maintenance agreement as well. See Appendix H.

3. The economic analysis assumes that electric rates will escalate at 3.5% per year and that the PV performance will degrade at 0.5% per year. The Net Present Value is calculated with a Discount Rate of 3%. See Appendix H.

SECTION 2:
INTRODUCTION

The City of Santa Ana Public Works Agency operates a water distribution system to deliver potable water to 45,000 meters throughout the city, using a series of pipes, pumps, tanks and wells. The Agency delivers an average of 33.5 million gallons per day (MGD) of water, purchasing 18,000,000 kWh of electricity annually to operate the pumps and other loads. The Agency's average electric load is a little over 2 megawatts. This electricity is purchased from Southern California Edison through meters at pump stations and wells on several different rate schedules. The GHG released in the generation of this electricity, based on the average Southern California Edison (SCE) rates used in the Santa Ana Climate Action Plan, is 0.286 metric tons of CO_2 equivalent per Megawatt hour (MWh), or a total of 5,148 metric tons per year.

This report evaluates the potential to generate renewable electricity to offset some of the cost of this pumping power and to reduce the GHG impact of this electricity use.

The two local renewable resources evaluated in this report are the generation of solar power with photovoltaic (PV) modules mounted on storage tanks and carports at the City Yard, and the recovery of head from water delivered to the city system by the Metropolitan Water District.

SECTION 3:

DESCRIPTION OF SANTA ANA POTABLE WATER DISTRIBUTION SYSTEM

The following information comes from discussions with the Agency engineers, observations at a number of pump stations, and a review of the 2017 Santa Ana Water Masterplan.

3.1 ZONES

The city is divided into two zones for potable water supply, the small upper or north zone (northeast of Interstate 5), and the lower or main zone covering the rest of the city. The upper zone is kept at a pressure of about 100 psig, while the main zone was observed to have a pressure of about 70 psig as water leaves the booster pumps, with a lower pressure as it flows through the distribution system.

3.2 TANKS

The City of Santa Ana Public Works Agency stores its water in grade level atmospheric tanks, or reservoirs, located around the city, with a total capacity of about 49 million gallons. The tanks are typically from 17 to 35 feet high, with water kept within several feet of the top. This is enough water to serve the city's typical load for more than a day, although it is important to keep the tanks relatively full to meet potential emergency requirements.

3.3 BOOSTER PUMPS

Booster pumps (totaling a capacity of 105 million gallons per day and 3,975 hp motor capacity) at each of the tanks pressurize this water from about 6 to 12 psig in the tank to approximately 70 psig for distribution to customers in most of the city, or 100 psig in the upper zone.

3.4 WELL PUMPS

Most water is supplied to these tanks by well pumps distributed around the city (21 pumps totaling 5,300 hp in motor capacity). These wells have the capacity to deliver 74 million gallons per day, pumping from a depth of 100 to 300 feet. Fourteen of these well pumps deliver water to the tanks, pumping to 6 to 12 psig. Seven well pumps feed directly into the higher distribution pressure, corresponding to the distribution pressure in that zone. Groundwater in this aquifer is managed by the Orange County Water District in coordination with Metropolitan Water District (MWD).

3.5 MWD CONNECTION POINTS

About 25 to 30% of the City's water is delivered directly by MWD to the city's pressurized distribution system through 7 connection points around the city. The connection points use pressure reducing valves (PRVs) to drop the pressure from approximately 160 to 190 psig in the MWD pipes to the city pressure of approximately 70 psig, or 100 psig in the case of SA-6, the one connection in the upper zone.

One Connection Point, SA-1, has a hydro turbine to generate electricity with some of this pressure differential. Its operation will be discussed later in the report. The design capacity of these 7 connections is 87 million gallons per day, but they are typically operated at lower flow rates.

3.6 ELEVATIONS

The city has relatively little change in elevation and the water is maintained in one distribution system for the main zone, more or less at the same pressure and elevation throughout most of the city. The analysis will assume that the small differences in elevation do not affect the performance of the systems.

3.7 WASTEWATER

The Agency also operates two wastewater lift stations to deliver it to the regional treatment plant, although these are a small fraction of the annual electrical use.

SECTION 4:

HISTORICAL WATER DELIVERY

Per the 2017 Master Water Plan, the City of Santa Ana delivers an average potable water flow of 33.5 MGD, with a maximum daily flow of 45.2 MGD. This total water use is about 12 billion gallons per year, with a peak flow rate of 45,000 gallons per minute (gpm) and an average flow rate of 23,000 gpm.

The projection for growth in the Master Plan is fairly moderate, with an anticipated Near-Term average daily load rising to 34.9 MGD, and the full buildout (2040) average load rising to 35.5 MGD, 6% higher than today's load. This analysis will not evaluate the potential effects of increasing loads in the future, because the growth rate is expected to be quite low.

SECTION 5:
HISTORICAL ELECTRICITY USE AND RATE SCHEDULES

The Agency purchased 18,284,786 kWh in calendar year 2016. This implies an average use of 2,087 kW throughout the year. Note that the Agency used somewhat more electricity than this, but a portion of this use was offset by the existing hydro generator.

There are 31 main Southern California Edison (SCE) electric meters throughout the city serving the water system. Some of these just serve one well pump or one pressure reducing valve. Other meters serve multiple booster pumps and well pumps at a given pump station.

5.1 RATE SCHEDULES

The largest electric loads are served by TOU-8-B rate schedules. Smaller pumping loads are served by TOU-PA-3 and TOU-PA-2 rate schedules. Other meters that just serve a pressure reducing valve (instrumentation, light, ventilation) are served by the TOU-GS-1 rate schedule.

These are all Time of Use rate schedules. The most expensive electricity is sold during the summer On Peak period, which occurs from noon to 6 pm on weekdays during June, July, August and September.

SCE announced in 2017 its intention to change the hours which are billed as On Peak, reflecting the amount of solar energy on their grid during the middle of the day. The proposed On Peak hours are 4 pm to 9 pm on weekdays, representing the new grid peak demand when loads are high and are not offset by solar generation.

The proposal is currently under negotiation with the California Public Utilities Commission. The final outcome is uncertain, but the consensus is that the new On Peak period will be as requested by SCE, or within an hour of the request.

Projects in this report will be evaluated based on the SCE proposed rate schedule. Even though it is not finalized, the proposed rate schedule should give a more accurate picture of the likely savings from these projects. The new time of use periods will not have a significant impact on the hydro turbine project because the turbines will typically operate the same during the afternoons as they do during the evenings.

The new time of use periods, however, will adversely impact the value of solar energy. Under the current rate schedule most of the solar energy generated offsets the more expensive electricity of the On Peak and Mid Peak periods. Under the proposed rate schedule most solar energy will offset the less expensive Off Peak electricity during the summer and Super Off Peak electricity during the winter.

The solar savings are calculated by calculating the performance of the solar system for every hour of the year, based on a Typical Meteorological Year, and applying the energy and demand costs for that hour to assemble a bill for every month of the year.

5.2 NET ENERGY METERING

Net Energy Metering is an arrangement with SCE to give near-full retail value for renewable electricity to the customer who generates it. If the customer is generating more renewable electricity than the site is using, the net electricity is taken by SCE and credited to the customer for the retail value at the time the power is delivered. The solar projects will take advantage of this around noon at their peak output. They may be generating more power than the site is using, but they get compensated at the retail rate in effect whenever the power is exported. Solar projects attempting to offset a significant portion of the site load often export power during the middle of the day and import it the rest of the day. Without Net Energy Metering any excess electricity exported to SCE would be compensated at a few pennies a kWh.

5.3 NET ENERGY METERING AGGREGATION

Net Energy Metering Aggregation (NEMA) is an arrangement with the utility to allow a site that generates more electricity than it uses over the course of the year to use the excess electricity to offset load on adjacent sites owned by the city. For example, if a renewable system were installed on one parcel and it generated more electricity than the loads on that parcel used in a year, the excess electricity could be used to offset electricity use at an adjacent parcel at retail rates. If Lot 1 had a renewable power source and it touched Lot 2 but not Lot 3, but Lot 2 touched Lot 3, then the Lot 1 power can be used to offset the Lot 3 load. A chain of contiguous sites can be used to pass power from one end to the other, even if it is not used by the middle sites.

There are several sites that we anticipate will generate more electricity than they use. These include the hydro turbines at SA-3 and SA-6. The two turbine sites are offsetting very small loads at each site, as opposed to SA-1 which has a large pump load at the site to offset.

One can make the argument that the SA-3 and SA-6 parcels are contiguous to the parcel the street is on, and all are owned by the city. That parcel is likely contiguous with all other parcels that hold streets and all are owned by the city. If this is the case, the power from one site, say the South Station, could be used at any city parcel contiguous with a street to offset electricity loads at retail rates. We have not seen this done before, but it is worth an attempt to maximize the value of the electricity.

We raised the question with SCE NEM Customer Interconnection Services and they responded as follows:

> *For the purpose of NEM Aggregation, Schedule NEM-ST, Special Condition 5 speaks to the eligibility requirements in great detail and addresses a few of your questions about parcel contiguity and eligibility, so I would recommend giving that a thorough read (a section touches on public thoroughfares/streets).*
>
> *From what you describe below, it sounds as though this may qualify for NEM-A, assuming there are no parcel adjacency/contiguity issues or other eligibility concerns mentioned in Schedule NEM-ST.*
>
> *Best Regards,*
>
> *NR*
> *NEM Customer Interconnection Services*
> *Southern California Edison*
> *Customer.Generation@sce.com*
> (866) 600-6290

This is the preferred rate schedule to use with this project, but if it is not available, rate schedule RES-BCT will work.

5.4 RENEWABLE ENERGY SELF-GENERATION – BILL CREDIT TRANSFER (RES-BCT)

A more conventional approach to using excess renewable generation at one site to offset electricity use at another site is RES-BCT. This approach requires that the sites have the same owner, but they do not need to be contiguous. One Generating Account can deliver power to up to 50 Benefitting Accounts. This could assure that excess power at the South Station and the two hydro turbines could always be used to offset energy use at various pump loads.

The disadvantage to RES-BCT is that the full retail value of the electricity does not get transferred to the other meter. The Generation portion of the rate transfers, but the Delivery Service (Transmission and Distribution) does not transfer. Under the Schedule TOU-GS-1-B likely to be used, this excludes a portion of the monetary savings.

These projects are evaluated in this report using the RES-BCT rate, which is the likely default. They will also be evaluated using the NEMA rate, which is more beneficial to the City, but not guaranteed to be accepted, should it be pursued with SCE.

SECTION 6:

POTENTIAL FOR HEAD RECOVERY AT MWD CONNECTIONS

6.1 METROPOLITAN WATER DISTRICT CONNECTIONS

The Santa Ana water system has seven connection points with the Metropolitan Water District, SA-1 through SA-7. Each station contains a pressure reduction controller to convert from MWD pressure to city water pressure. MWD pressure typically ranges from 160 to 190 psig, per logs of plant operation. City water is typically controlled at 63 to 75 psig. There are one to three pressure reducing valves at each station to regulate pressure, sized for different flow rates. Flow at a station is typically manually set at a given rate for weeks or months at a time, counting on the booster pumps to automatically cycle or change speed, to fine tune pressure in the distribution system. A number of these pumps operate with Variable Frequency Drive controls to more closely match the loads.

The flow through each of these connection points is shown in the following table, derived from the city's Monthly Production Reports. This is monthly data for calendar year 2017 and is taken to be representative of flows in typical years.

Cubic Feet	SA 1	SA 2	SA 3	SA 4	SA 5	SA 6	SA 7	Total
Jan-17	400	-	500	-	-	2,410,100	2,402,400	**4,813,400**
Feb-17	4,511,700	-	2,399,600	-	-	13,949,500	8,302,400	**29,163,200**
Mar-17	5,350,500	-	5,739,400	-	-	16,551,800	-	**27,641,700**
Apr-17	19,539,100	-	6,567,100	-	-	25,336,200	3,395,800	**54,838,200**
May-17	20,903,300	-	9,248,200	-	-	21,477,600	-	**51,629,100**
Jun-17	14,247,700	-	9,197,300	-	-	21,670,300	4,672,800	**49,788,100**
Jul-17	21,471,100	-	10,073,800	-	-	21,487,200	-	**53,032,100**
Aug-17	21,467,200	-	7,686,100	8,629,900	-	26,616,400	-	**64,399,600**
Sep-17	20,771,300	-	9,723,300	16,652,200	-	31,517,800	143,900	**78,808,500**
Oct-17	21,131,000	-	17,444,100	11,249,200	-	32,394,700	308,300	**82,527,300**
Nov-17	20,539,500	-	19,375,700	-	-	20,765,900	-	**60,681,100**
Dec-17	21,451,800	-	19,702,700	-	-	21,367,300	-	**62,521,800**
2017 Cubic Feet per Year	**191,384,600**	**-**	**117,157,800**	**36,531,300**	**-**	**255,544,800**	**19,225,600**	**619,844,100**

Total water delivered by MWD peaks in the fall months and is close to zero during January. Note that some interconnection points were not used at all in 2017, and some were used minimally. (SA-5 was out of service, per the 2017 Water Master Plan.)

The following table shows the Normal Operating Capacity for each MWD connection, as listed in the 2017 Water Masterplan, and its equivalent in CFS.

MWD Connection	Normal Operating Capacity (MGD)	Normal Operating Capacity (CFS)
SA-1 Bristol	5.17	8.0
SA-2 First	5.17	8.0
SA-3 McFadden	5.17	8.0
SA-4 Warner	4.85	7.5
SA-5 Alton	4.85	7.5
SA-6 Santa Clara	7.76	12.0
SA-7 Red Hill	4.85	7.5
Total	**37.82**	**58.5**

One can see in the monthly water meter readings that station SA-1 delivered an almost constant flow from April through December, illustrating that the valves are sometimes fully opened for a month or more. This monthly flow of about 21 million cubic feet is equivalent to 8 CFS, the Normal Operating Capacity listed for this station. Similarly, station SA-3 operated at close to 8 CFS for all the hours of November and December. SA-6 operated at 12 CFS for all the hours of September and October.

The following table shows the calculated percent operating time for each station by month in 2017.

Percent of Normal Operating Capacity by Month and MWD Connection

Normal Operating Capacity (CFS)	8.0	8.0	8.0	7.5	7.5	12.0	7.5
MWD Connection	**SA-1**	**SA-2**	**SA-3**	**SA-4**	**SA-5**	**SA-6**	**SA-7**
Jan-17	0%	0%	0%	0%	0%	7%	12%
Feb-17	23%	0%	12%	0%	0%	48%	46%
Mar-17	25%	0%	27%	0%	0%	51%	0%
Apr-17	94%	0%	32%	0%	0%	81%	17%
May-17	98%	0%	43%	0%	0%	67%	0%
Jun-17	69%	0%	44%	0%	0%	70%	24%
Jul-17	100%	0%	47%	0%	0%	67%	0%
Aug-17	100%	0%	36%	43%	0%	83%	0%
Sep-17	100%	0%	47%	86%	0%	101%	1%
Oct-17	99%	0%	81%	56%	0%	101%	2%
Nov-17	99%	0%	93%	0%	0%	67%	0%
Dec-17	100%	0%	92%	0%	0%	66%	0%

It is understood that the MWD connections are typically operated fully open or fully closed. During months when the flow is less than this capacity, it is assumed that during some hours of the month this full rate is used and during the other hours of the month the flow is zero.

In the evaluation of hydro turbines to make electricity from the excess pressure, this suggests that the efficiency at this design flow is important, but the partial flow efficiency is not critical.

The monetary benefits for this project will be calculated according to the SCE rate schedules that are used for each account. When a unit operated, say 23% of the hours in a month, it will be assumed that this implies it operates 23% of the On Peak hours, 23% of the Mid Peak hours and 23% of the Off Peak hours. A demand savings for a given month is only be included if the unit operates at least 95% of the hours that month to keep the savings fairly conservative.

The historical flow data is converted into anticipated full load operating hours per month for each MWD connection in the following table.

Calculated Operating Hours per Month at Normal Operating Capacity								
MWD Connection	**SA-1**	**SA-2**	**SA-3**	**SA-4**	**SA-5**	**SA-6**	**SA-7**	**Total**
Jan-17	0	-	0	-	-	56	89	**145**
Feb-17	157	-	83	-	-	323	307	**870**
Mar-17	186	-	199	-	-	383	-	**768**
Apr-17	678	-	228	-	-	586	126	**1,619**
May-17	726	-	321	-	-	497	-	**1,544**
Jun-17	495	-	319	-	-	502	173	**1,489**
Jul-17	746	-	350	-	-	497	-	**1,593**
Aug-17	745	-	267	320	-	616	-	**1,948**
Sep-17	721	-	338	617	-	730	5	**2,410**
Oct-17	734	-	606	417	-	750	11	**2,517**
Nov-17	713	-	673	-	-	481	-	**1,867**
Dec-17	745	-	684	-	-	495	-	**1,924**
Total	**6,645**	**-**	**4,068**	**1,353**	**-**	**5,915**	**712**	

The following table shows the total water flow in 2017 by connection point. Note that three connection points, SA-1, SA-3 and SA-6 represent 91% of all the MWD flow for the year. These three stations will be investigated for the potential to generate power from this water flow.

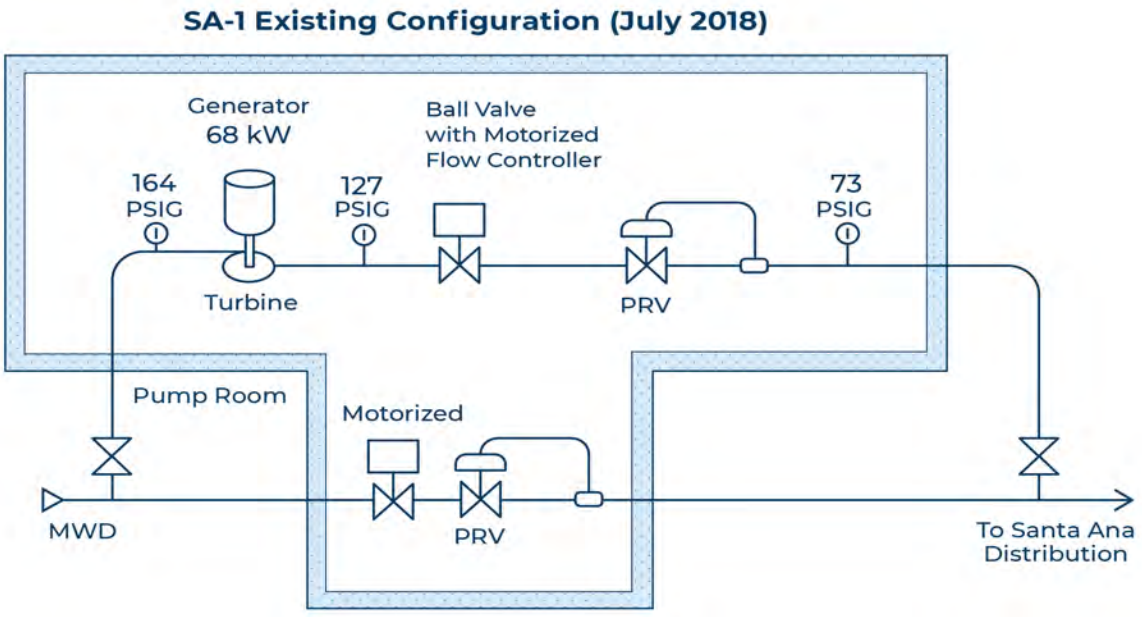
MWD Connection	2017 Cubic Feet per Year	Percent of MWD Flow
SA-1	191,384,600	31%
SA-2	-	0%
SA-3	117,157,800	19%
SA-4	36,531,300	6%
SA-5	-	0%
SA-6	255,544,800	41%
SA-7	19,225,600	3%
Total	**619,844,100**	**100%**

6.2 MWD STATION SA-1

Station SA-1 is the only MWD connection point where electricity is currently generated. The generator is in a pump building at the Garthe Pumping Station. MWD water is fed through a Byron Jackson two stage hydro turbine, which drives a 200 hp Siemens Allis generator to offset purchases of electricity for the wells and booster pumps at this site. The address of this station is 2401 N. Bristol Street. The SCE Service Account number is 3-001-3273-57 and the Rate Schedule is TOU-PA-3-B-S.

The configuration of this turbine installation is shown in *Figure 1*. After the discharge of the turbine there is a manual control valve (fully open during the site visit) and a pressure regulating valve to drop the pressure as needed to match the City pressure. The MWD pressure observed at SA-1 during July 2018 was 164 psig, while the City system pressure was observed to be 73 psig.

Figure 1.



The pressure after the turbine and before the PRV was observed to be 127 psig per the local meter. This means a pressure drop of 37 psi, or 85 feet through the turbine. The flow at this time was 8.2 CFS and the turbine was metered at 68 kW of electrical power.

Note that the theoretical power can be calculated from flow and pressure drop as follows. This calculation assumes a turbine mechanical efficiency of 70%. This low pressure drop puts the turbine outside its normal operating range, so the efficiency is only an assumption.

$$\frac{8.2\ ft^3}{sec} \times 85\ ft \times \frac{hp\ sec}{550\ ft\ lbs} \times \frac{62.4\ lbs}{ft^3} \times 70\%\ mech.eff. \times 95\%\ elect.eff \times \frac{0.746\ kW}{hp} = 39\ kW$$

The theoretical power production under these conditions is estimated at 39 kW, while the electric meter reads 68 kW. We will assume that the electric meter is reading correctly here, as that gives more conservative results

for the project. This would mean that perhaps the intermediate pressure meter was not reading accurately.

The original design submittal for the turbine showed a selection point at 8.0 CFS and 200 feet. Note, there are two stages of the turbine in series, so the pressure-drop for each stage (100 feet) is added together to get the total pressure drop of 200 feet.

Historical logs available for 2006 and earlier indicate the following typical operation points:

- MWD pressure at 165 to 190 psig. (average 177 psig)
- Mid pressure at 68 to 75 psig. (average 71 psig)
- System pressure at 60 to 69 psig. (average 64 psig)
- This corresponds to the generator putting out 130 to 165 kW of power output. (average 147 kW)

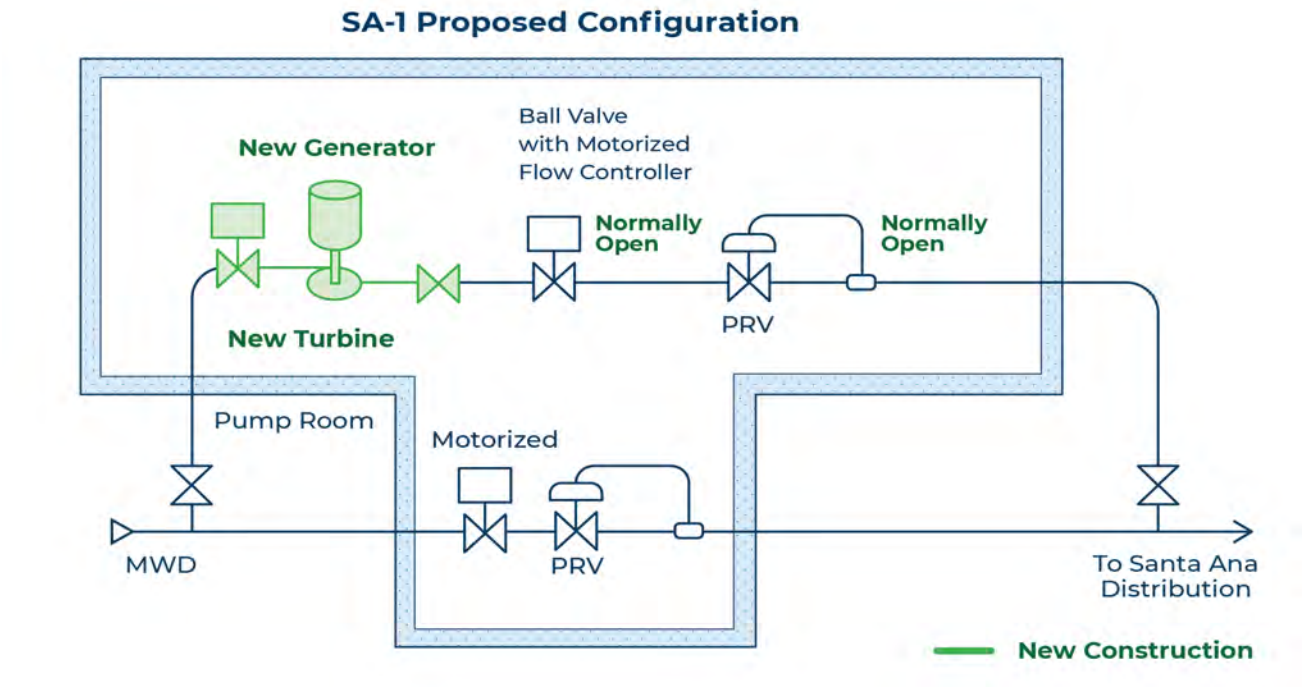
The pressure-drop in previous years averaged 106 psi through the turbine, or 244 feet of water, closer to its design drop of 200 feet. This leads us to the conclusion that the head recovery system is not currently working properly, as less head is dropped through the turbine than shown in the design or shown in historical operation records.

It is assumed for this report that the observed operations represent the actual baseline operations for this unit. The unit is about 32 years old and was rebuilt about 14 years ago. It is assumed that the inefficiencies in the current operations represent the typical operating conditions due to the condition of the turbine, or its controls, or the PRV's controls, and that this can be considered the baseline operation of the system. If the Agency has a quick-fix and can lower the discharge pressure of the turbine back to about 71 psig, that can then be treated as the baseline of operations for this project.

6.3 POTENTIAL PROJECT AT SA-1

The proposed project for SA-1 is to replace the hydro-generator with a new unit, as illustrated in *Figure 2*. The new unit would be designed around the parameters the original unit was built for. The original operation was called out for a flowrate of 8 CFS. This is the flowrate that the unit is typically controlled to.

Figure 2



The original pressure drop was designed for 200 feet, or 87 psi. The actual pressure drop appears to range from 217 to 275 feet, or 94 to 119 psi. A turbine should be selected that operates well over this pressure range. For the purposes of this analysis, a single operating pressure differential will be used. The midpoint of the observed pressure ranges is 245 feet, or 106 psi.

One potential turbine that could be used in place of the Byron Jackson turbine is a Canyon Hydro In-Line Turbine ILT12-33-9.0. This turbine has a 12-inch supply and discharge pipes in the same configuration as the current turbine, with a vertical axis and the generator mounted above the turbine. A proposal for this turbine generator package is contained in the Appendix. Another proposal is presented for a turbine with a horizontal axis manufactured by Gilkes. In this case the Canyon turbine is less expensive and matches the geometry of the existing installation.

The Canyon Hydro turbine curve indicates a mechanical efficiency of 83.5% at the design point of 8 CFS and 245 feet. This implies an electrical output calculated as follows:

$$\frac{8.0\ ft^3}{sec} \times 245\ ft \times \frac{hp\ sec}{550\ ft\ lbs} \times \frac{62.4\ lbs}{ft^3} \times 83.5\%\ mech.eff. \times 95\%\ elect.eff \times \frac{0.746\ kW}{hp} = 132\ kW$$

Through the installation of a new hydro-turbine and generator at SA-1, the output of the generator will increase from 68 kW to 132 kW. This will happen for the 6,645 hours per year that this connection is in use, for an electrical savings of 425,280 kWh per year. Note, the existing turbine is calculated to generate 68 kW x 6,645 hours per year, or 425,299 kWh per year of renewable electricity.

When this savings is applied to the appropriate hours for each month with the rate schedule in use at the site, the monetary savings for one year is projected to be $38,441. The electricity saved through this rate schedule is worth approximately $0.09 per kWh on rate TOU-PA-3-E.

The projected cost to purchase and install the new hydro turbine is $718,000. This involves removing the existing turbine/generator and installing a new, similar unit and connecting it to the electrical and control systems. Interconnection with SCE is required for this project, but since the turbine is small relative to the site load, and since a turbine generator has been tied to SCE in the past, a large effort is not projected.

The Pressure Reduction Turbine project at SA-1 is likely eligible for an SCE incentive through the statewide Self Generation Incentive Program. This is currently offering $600 per kW for this type of installation. This incentive of $79,200 would lower the capital cost of the project to $638,763.

Note that half of this incentive is likely to be payable upfront, while the other half is payable over the first five years of operation. For simplicity's sake it is all being treated as an upfront incentive.

Only the SA-1 is eligible for an incentive under the SGIP program. This turbine will offset electricity already used at the site. Since the turbines at SA-3 and SA-6 will primarily export power to other sites, as they have no significant power use onsite to offset, they likely do not qualify for the SGIP incentive. Also, SGIP incentives for solar power generation were fully expended a number of years ago.

In this application, the demolition of the existing unit is expected to include the removal of the generator, turbine shaft, impellers and upper housing. The existing turbine has a large bell set in concrete to house the impellers which hang down from the frame. This bell can likely be filled with rebar and concrete to form the foundation for the new turbine, whose impeller does not hang lower than the inlet and outlet pipes.

The typical design of a head recovery turbine puts it in parallel with the existing PRV. Water flow through the turbine is the first loading order, controlled to a setpoint such as 8 CFS by the turbine wicket gates. If the resulting flow does not meet the pressure requirements of the plant discharge, the parallel PRV can open to maintain the desired pressure setpoint. In this case, the parallel PRV is installed in a room at a lower elevation than the existing turbine. However, it is expected that the turbine alone would operate normally when the 8 CFS flow is desired.

In the new scenario, the manual valve and PRV installed in series with the turbine not necessary. A new automated valve will be installed upstream of the turbine to provide a remote shut off for water flow through the turbine. The existing manual valve and PRV in series with the turbines can be opened fully or removed to create a smaller pressure drop.

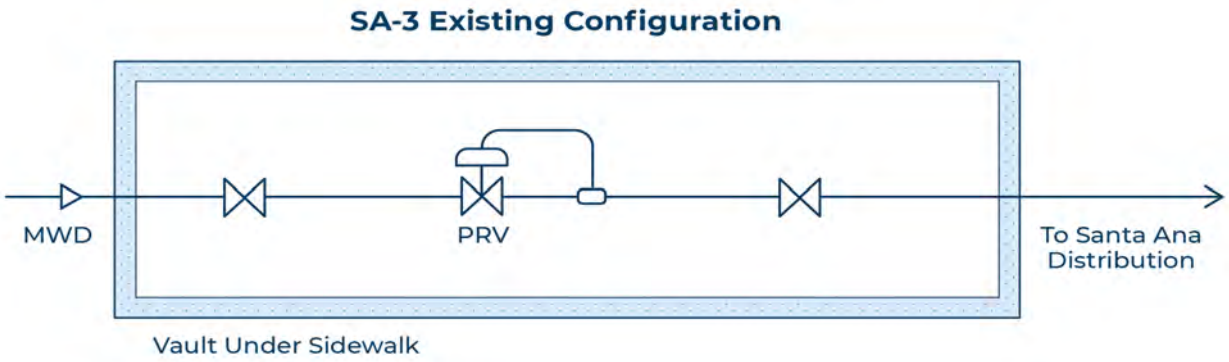
The existing turbine generator is 32 years old, presumably approaching the end of its useful life. Should the turbine fail the baseline generation would be zero kWh per year. In that case the installation of the new turbine would increase net-generation by 877,140 kWh per year. When this savings is applied to the appropriate hours each month the monetary savings for one year is projected to be about $90,000. Note that these savings assume that the rate schedule remains unchanged for the meter that serves the whole site.

6.4 MWD STATION SA-3

The pressure reducing station SA-3 is installed in a vault under the sidewalk at the south east corner of Bristol Street and McFadden Avenue. The configuration is shown in *Figure 3*, with one PRV and two isolation valves, approximately eight feet below the sidewalk. The SCADA monitoring and associated electrical meter are installed in small cabinets mounted nearby on the sidewalk. The SCE Service Account is 3-035-8796-80 and the Rate Schedule is TOU-GS-1-A.

The PRV flow rate is typically controlled to 8 CFS when in use. The observed pressure drop was from 172 to 85 psig, according to the installed pressure gages.

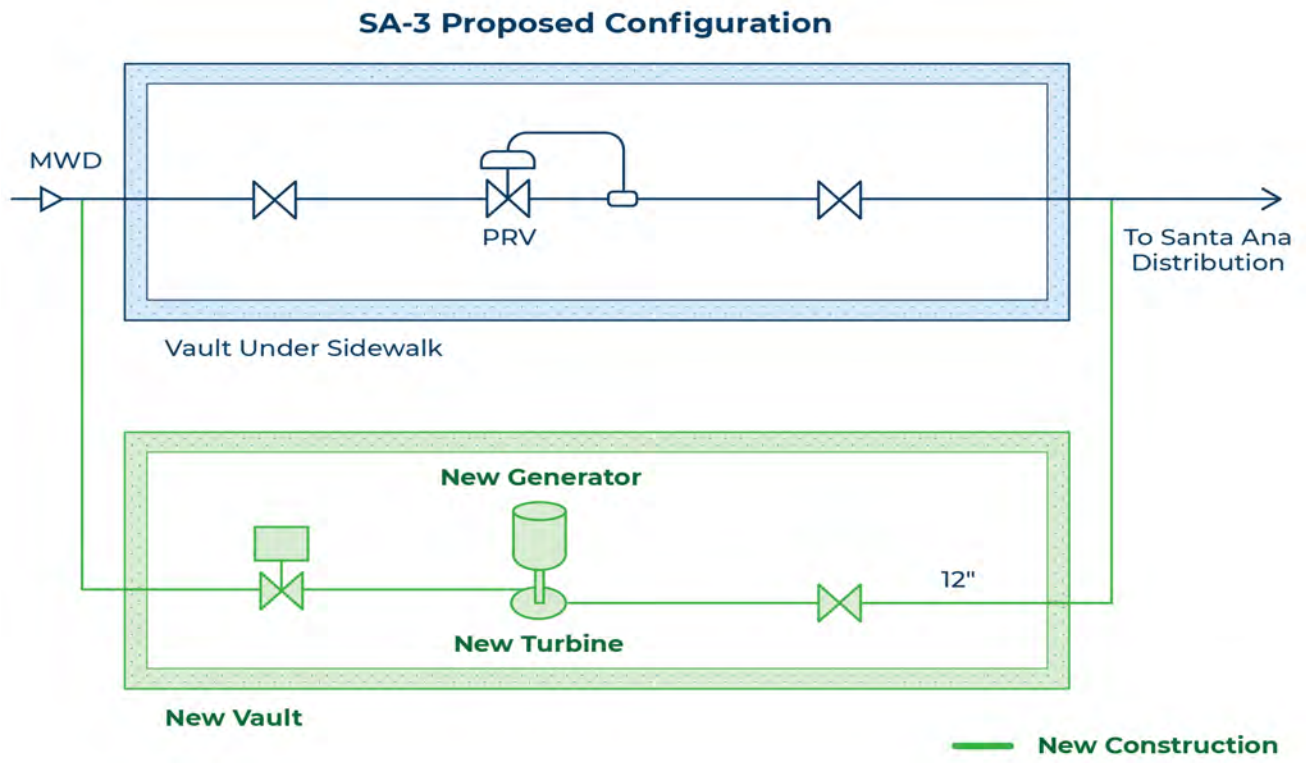
Figure 3



6.5 POTENTIAL PROJECT AT SA-3

The proposed project at SA-3 is to install a new hydro-turbine generator in parallel with the existing Pressure Reducing Valve. There is no room in the existing vault, so a new vault would be required side by side with the existing vault. This is illustrated in *Figure 4*. The new vault would contain the new hydro-turbine and generator, a remotely controlled valve on the inlet of the turbine and an isolation valve on the discharge, an electrical panel to control the turbine and take power from it, a new metered connection to deliver the power to SCE, and some additional SCADA points.

Figure 4



When the Agency needs 8 CFS through this station it would open flow through the turbine, using a combination of the automated valve and the wicket gates to minimize sudden pressure changes. The existing PRV could be kept at a higher setpoint so that it does not typically operate unless there were an unusual demand for water at this point. The control valve and wicket gates would be remotely operated to shut down flow in the turbine when appropriate as well.

The electricity generated by the hydro turbine at this location cannot offset an adjacent City of Santa Ana load, as the only electric load at this location is instrumentation and lighting. It is anticipated that the generated electricity will be used to off-set another city meter through the Renewable Energy Self-generation Bill Credit Transfer mechanism know as RES BCT. This allows the value of electricity generated by the turbine to be metered by SCE on a TOU-GS-1 rate schedule. The dollar value of this electricity can be used to offset the generation component at one or more city electric meters.

The anticipated generation of electricity from this turbine at 8 CFS and the standard pressure drop means it will generate the same average electric output as the SA-1 installation, 132 kW. In the case of SA-3, the anticipated full load hours of operation are expected to be 4,068 hours per year, so the anticipated energy generation is 536,976 kWh per year.

The monetary value for this savings based on the RES-BCT Generation portion of the TOU-GS-1-LG rate schedule is $31,965 per year. The electricity is worth about $0.06 per kWh through the RES-BCT program.

If this project were approved by SCE as a NEMA project, the value of the electricity generated at the TOU-GS-1-E rate schedule would be approximately $0.14 per kWh, more than doubling the monetary savings.

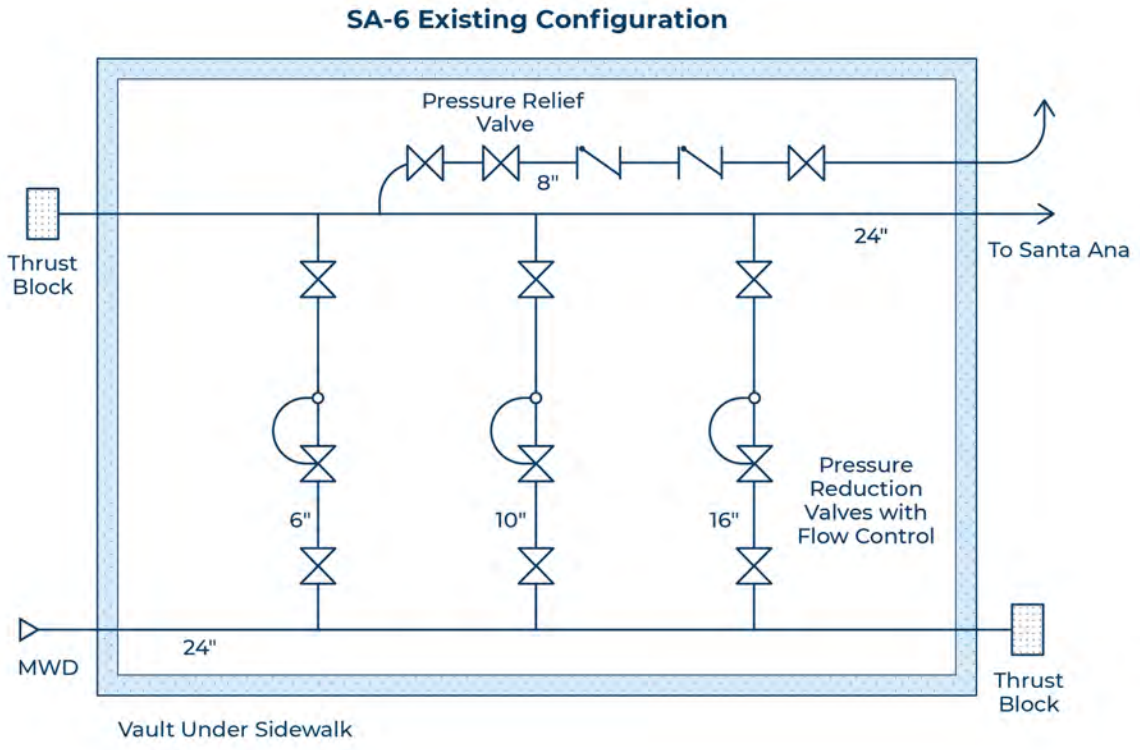
The projected cost to purchase and install the new hydro turbine is $835,988. This involves the purchase of the new turbine generator set with electrical panel and controls, the construction of a new vault below the sidewalk to house the turbine and switchgear, the connection with SCE including a new transformer to accept the power, and integration with the existing SCADA controls.

6.6 MWD STATION SA-6

The pressure reducing station SA-6 is installed in a vault under the sidewalk at the northeast corner of E. Santa Clara Avenue and Tustin Avenue. The configuration is shown in *Figure 5*, with three PRVs and six isolation valves, approximately eight feet below the sidewalk. The SCADA monitoring and associated electrical meter are installed in small cabinets mounted nearby on the sidewalk. The SCE Service Account number and rate schedule is not known.

The three PRVs are installed in parallel at different sizes, 6-inch, 10-inch and 16-inch. The combined operation of these PRVs is typically controlled at 12 CFS. The typical pressure drop through this station is assumed to be the typical MWD pressure (177 psig) reduced to the upper zone pressure of 100 psig, for a pressure difference of 77 psig (or 178 feet).

Figure 5

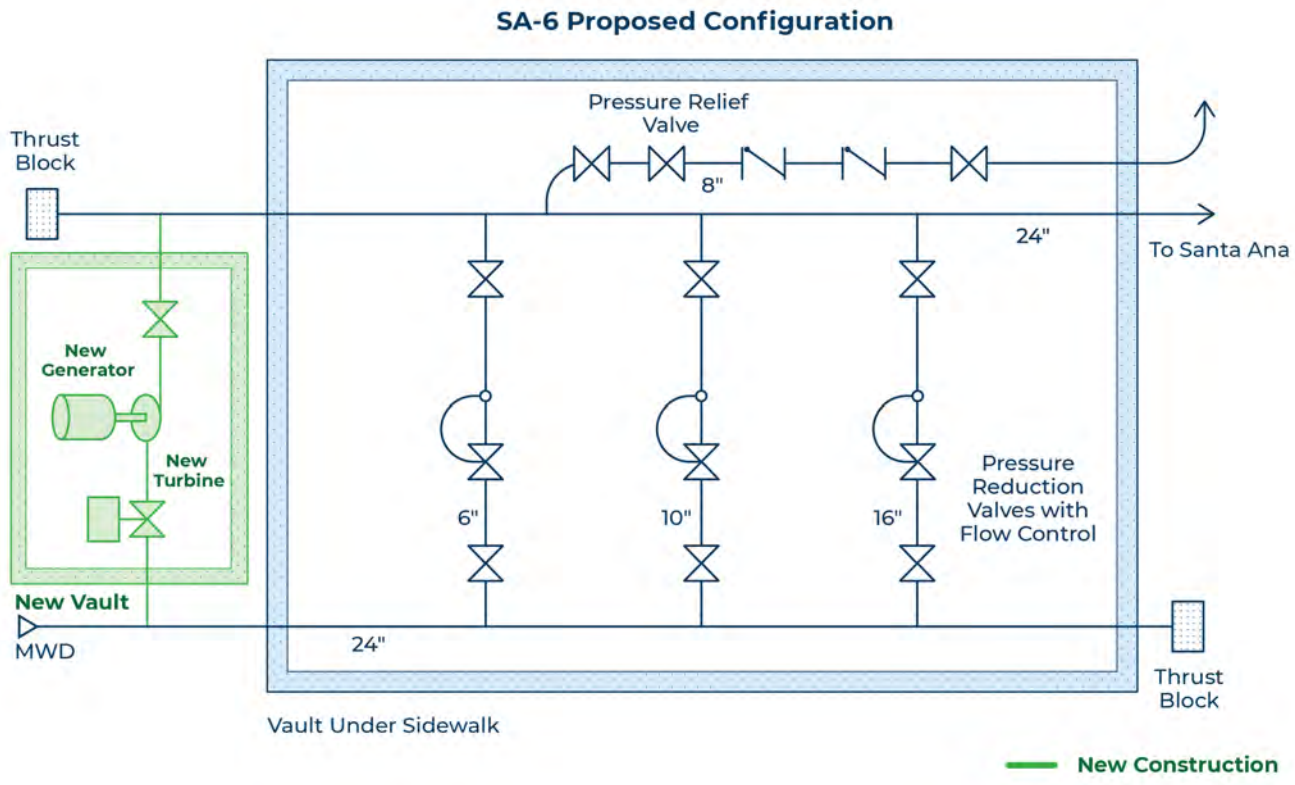


6.7 POTENTIAL PROJECT AT SA-6

The proposed project at SA-6 is to install a new hydro turbine generator in parallel with the existing Pressure Reducing Valves. There is no room in the existing vault, so a new vault would be required, potentially on the north side of the existing vault. This is illustrated in *Figure 6*. The new vault would contain the new hydro

turbine and generator, a remotely controlled valve on the inlet of the turbine and an isolation valve on the discharge, an electrical panel to control the turbine and take power from it, a new metered connection to deliver the power to SCE, and some additional SCADA points.

Figure 6



When the Agency needs 12 CFS through this station it would open flow through the turbine, using a combination of the automated valve and the wicket gates to minimize sudden pressure changes. The PRV could be kept at a higher setpoint so that it does not typically operate unless there were an unusual demand for water at this point. The control valve and wicket gates would be remotely operated to shut down flow in the turbine when appropriate, as well.

The electricity generated by the hydro-turbine at this location cannot offset an adjacent City of Santa Ana load, as the only electric load at this location is instrumentation and lighting. It is anticipated that the generated electricity will be used to off-set another city meter through the Renewable Energy Self-generation Bill Credit Transfer mechanism know as RES BCT. This allows the value of electricity generated by the turbine to be metered by SCE on a TOU-GS-1-C rate schedule. The dollar value of this electricity can be used to offset the generation component at one or more city electric meters.

The power produced by this flow and pressure difference is calculated here. The pressure drop is lower than for the other turbines, because the discharge of the turbine goes to the higher-pressure zone in the city, so the typical pressure drop is from 177 to 100 psig.

$$\frac{12\ ft^3}{sec} \times 178\ ft \times \frac{hp\ sec}{550\ ft\ lbs} \times \frac{62.4\ lbs}{ft^3} \times 83.5\%\ mech.eff. \times 95\%\ elect.eff \times \frac{0.746\ kW}{hp} = 143\ kW$$

This assumes the same mechanical efficiency as found for the 12-inch turbine for the 8 CFS flow rate. This turbine is likely to be a 14 or 16-inch unit.

In the case of SA-6, the anticipated full load hours of operation are expected to be 5,915 hours per year, so the anticipated energy generation is 845,901 kWh per year.

The monetary value for this electricity based on the RES-BCT arrangement with the Generation portion of TOU-GS-1-LG rate schedule is $55,131 per year. The value of the generated electricity is approximately $0.065 per kWh.

Should the City sign up with SCE through the NEMA program, the electricity would be worth approximately $0.145 per kWh, more than double the RES-BCT savings. The City would need to enter discussions with SCE and possibly apply for an interconnection to determine which rate will apply to this project.

The projected cost to purchase and install the new hydro-turbine is $1,072,174. This involves the purchase of the new turbine generator set with electrical panel and controls, the construction of a new vault below the sidewalk to house the turbine and switchgear, the connection with SCE including a new transformer to accept the power, and integration with the existing SCADA controls.

SECTION 7:

POTENTIAL FOR SOLAR POWER GENERATION AT PUMP STATIONS AND CITY YARD

There are several city-owned and operated locations that have the potential for the addition of solar PV. These sites include Garthe station, South station, West station, East station, Cambridge station, and the City Yard. The following table lists the existing conditions of these locations.

Site Name	Annual kWh Usage	Existing Rate Schedule
Garthe Station	1,530,219	TOU-PA-3-B
South Station	77,362	TOU-PA-2-B
West Station	2,861,684	TOU-8-B
East Station	802,416	TOU-PA-3-A
Cambridge Station	526,805	TOU-PA-3-B
City Yard	884,323	TOU-GS-3-B

After completing site-walks to get a close inspection of solar installation potential, preliminary designs were made to determine the anticipated rate tariff, total system size, annual performance projections, and relative load off-set for each site. A summary of this information can be seen in the following table.

Site Name	Anticipated Rate Tariff	Solar System Size (kW)	Annual Energy Generation (kWh)	Relative Load Off Set (%)
Garthe Station	TOU-PA-3-E	500	894,325	58%
South Station	TOU-PA-2-D	44	75,170	97%
West Station	TOU-8-E	230	422,617	15%
East Station	TOU-PA-3-E	220	393,985	49%
Cambridge Station	TOU-PA-3-D	100	184,480	35%
City Yard	TOU-GS-3-D	523	869,805	98%

Each project would be interconnected to the local electric utility (SCE) through their Net Energy Metering (NEM) program. NEM allows systems to export to the grid during times when the site load is less than the solar PV generation, receiving a credit worth nearly the full retail rate of the energy being exported. The NEM policy does not allow for systems to be installed that would generate more than the site's annual load.

It is assumed that the water tank sites would utilize either a ballasted mounting system, or a direct attachment, as there are different types of roofs on the reservoirs.

An example of a solar system installed atop a municipal water reservoir is shown here from West Sacramento. (This photograph is from the Sunworks website.)

In the case of the City Yard, a series of carports would be used to reach the desired solar PV output. Note, the designs compiled in this proposal are preliminary, and are not intended for construction; a structural engineer would need to evaluate the site specifics for each design to ensure the safety and security of the systems. During the site walk, some trees were identified as allowable for removal, while others, such as those on adjacent properties, were not allowed to be removed; the preliminary designs have accounted for this information.

After evaluating the site's load and solar PV potential, examining the current and expected future rate tariff, the NAM team was able to calculate the financial benefit of these projects, independently and as a portfolio. Although a simple loan and a power purchase agreement were both evaluated, for the purposes of this summary report, the NAM team has focused on the results of the cash-purchase option, since it is the most financially advantageous.

The following table shows the sites under consideration for PV, the current and recommended SCE rate schedule to provide the lowest rate with solar power, the size of the proposed system in DC kW (based on the nominal DC rating of the proposed solar modules, and the anticipated construction cost per DC Watt of system capacity. The cost per Watt varies according to the size of the system and the complexity of installation, with a higher cost for parking lot shade structures because of the extra construction materials involved.

Site	Meter	Utility	Original Utility Rate Tariff	Proposed Utility Rate Tariff	System Size (kW DC)	Construction Costs Metric ($/W)
Garthe	V349N-000040	SCE	TOU-PA-3-D	TOU-PA-3-E	500	$2.50
South	259000-065622	SCE	TOU-PA-2-D	TOU-PA-2-D	44	$4.00

West	V349N-017847	SCE	TOU-8-D	TOU-8-E	230	$2.75
East	V345R-006147	SCE	TOU-PA-3-E	TOU-PA-3-E	220	$2.75
Cambridge	V345N-001335	SCE	TOU-PA-3-D	TOU-PA-3-D	100	$3.00
City Yard	V349N-014832	SCE	TOU-GS-3-D	TOU-GS-3-D	523	$3.25

These designs were simulated using HelioScope, and industry standard PV simulation program. This program uses a local weather data file and calculates the hourly performance of the system based on the angle of insolation, the air temperature, the wind speed, the intensity of clouds, and so on. The hourly PV output is subtracted from the hourly electric load profile data from SCE to determine the hourly energy use with PV in place. The electric bill is calculated based on how these kWh fall into the On-Peak, Part-Peak, and other bins to calculate 12 monthly bills for the site with and without solar.

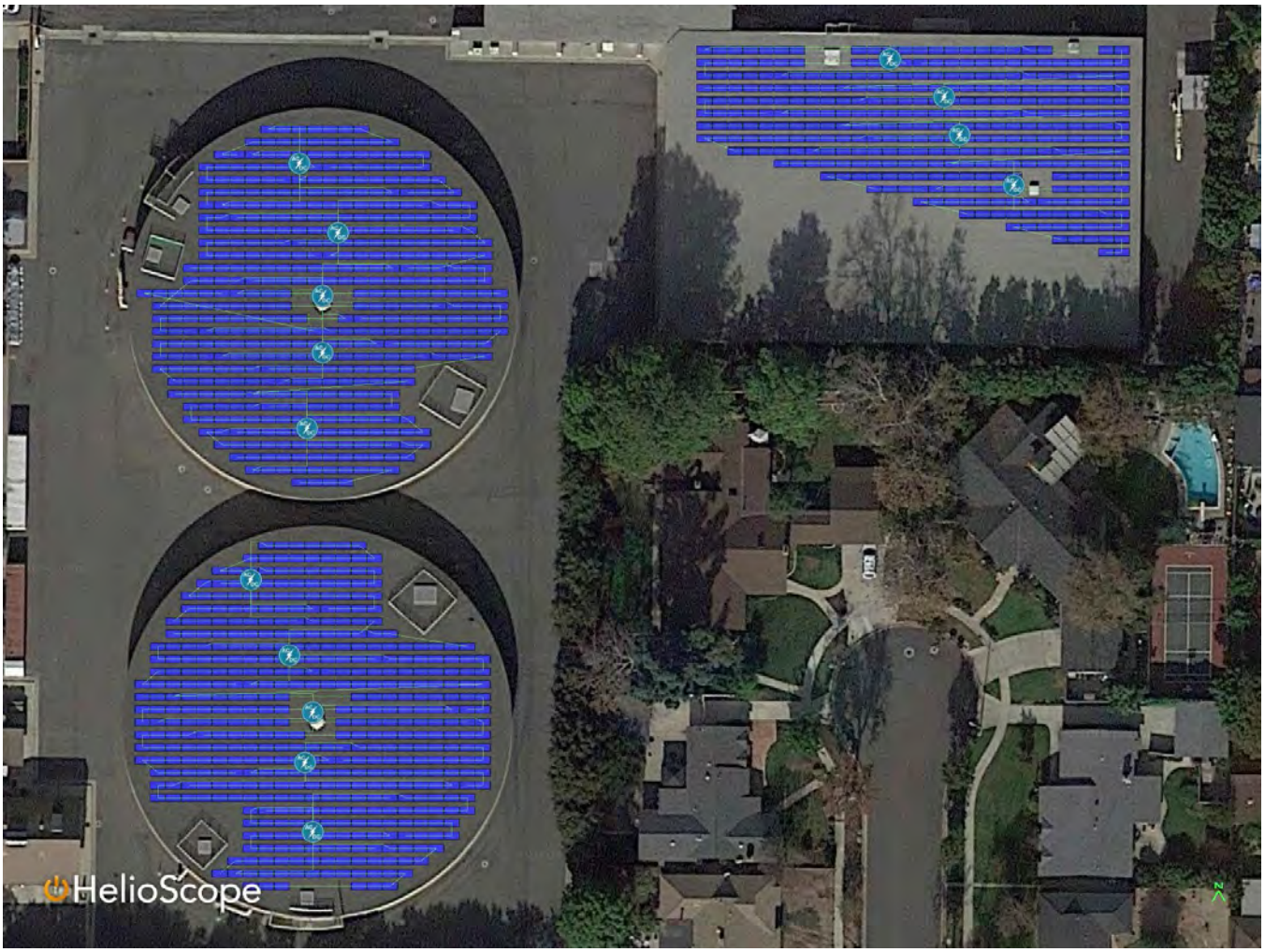
Site	Generation (kWh/yr)	Annual kWh AC per DC kW Installed
Garthe	894,325	1,789
South	75,170	1,708
West	422,617	1,837
East	393,985	1,791
Cambridge	184,480	1,845
City Yard	869,805	1,664

The annual bill savings are included with the system capital cost to evaluate the lifecycle vale of the project and its energy savings. The parameters included in this analysis are listed in the Appendices. The following table summarizes the outcomes of the financial evaluation.

Site Name	Total Installed Cost	Year 1 Energy Cost Savings	25 year Net Benefit
Garthe Station	($1,404,000)	$38,165	($148,834)
South Station	($194,832)	$3,492	($77,488)
West Station	($707,940)	$39,780	$635,398
East Station	($677,160)	$19,080	($43,018)
Cambridge Station	($334,800)	$8,332	($67,435)
City Yard	($1,890,767)	$46,325	($298,129)
Total	($5,209,499)	$155,174	$494

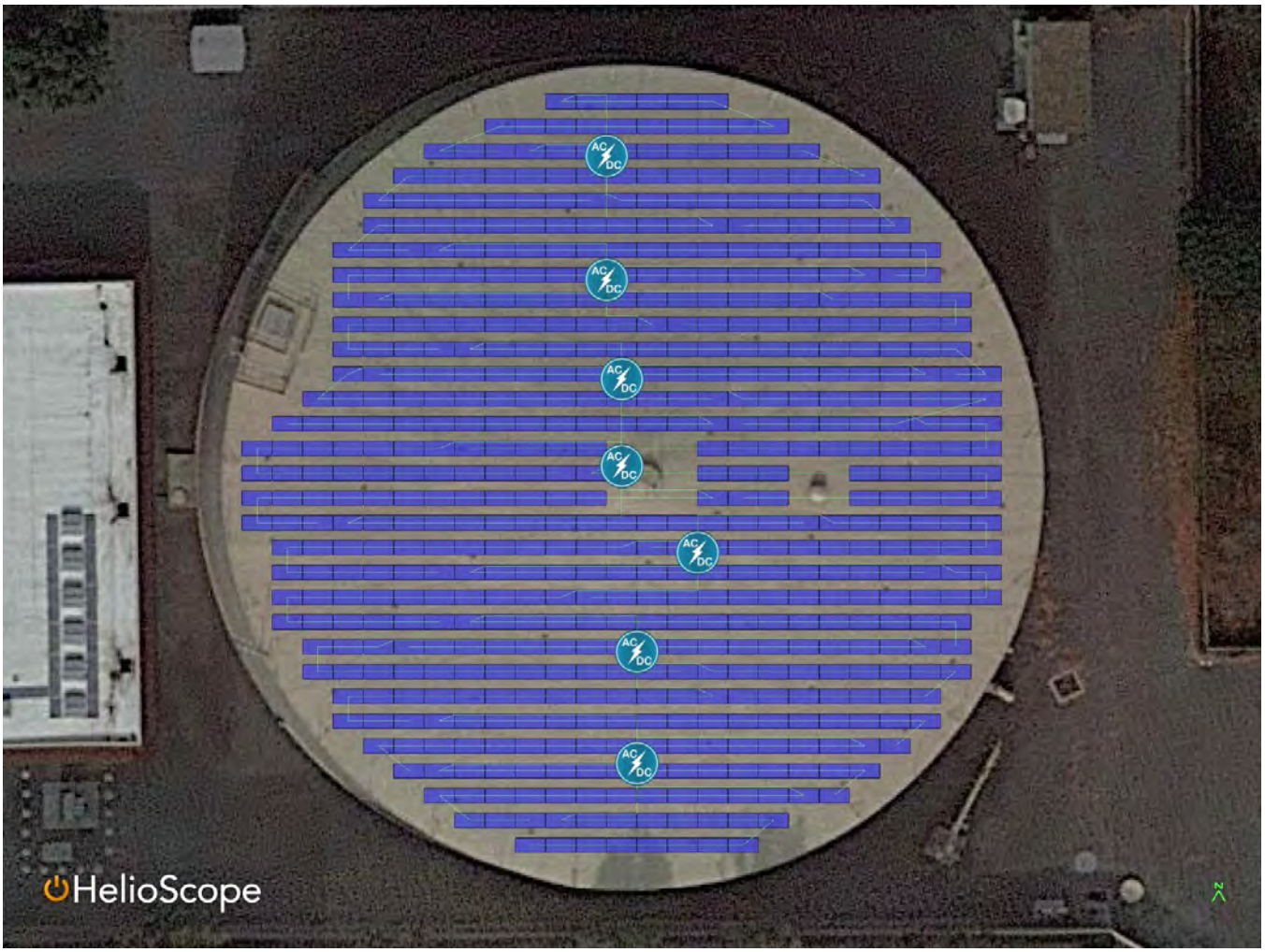
The sum of all the solar projects has a positive net-benefit over 25 years. However, it is only the Garthe Station and the West Station that have positive net-benefits as individual sites. Further, it is only the West Station that has a significantly positive net-benefit.

The following figures show the preliminary solar layouts at each site, with some initial commentary on some of the challenges that might arise with each design.

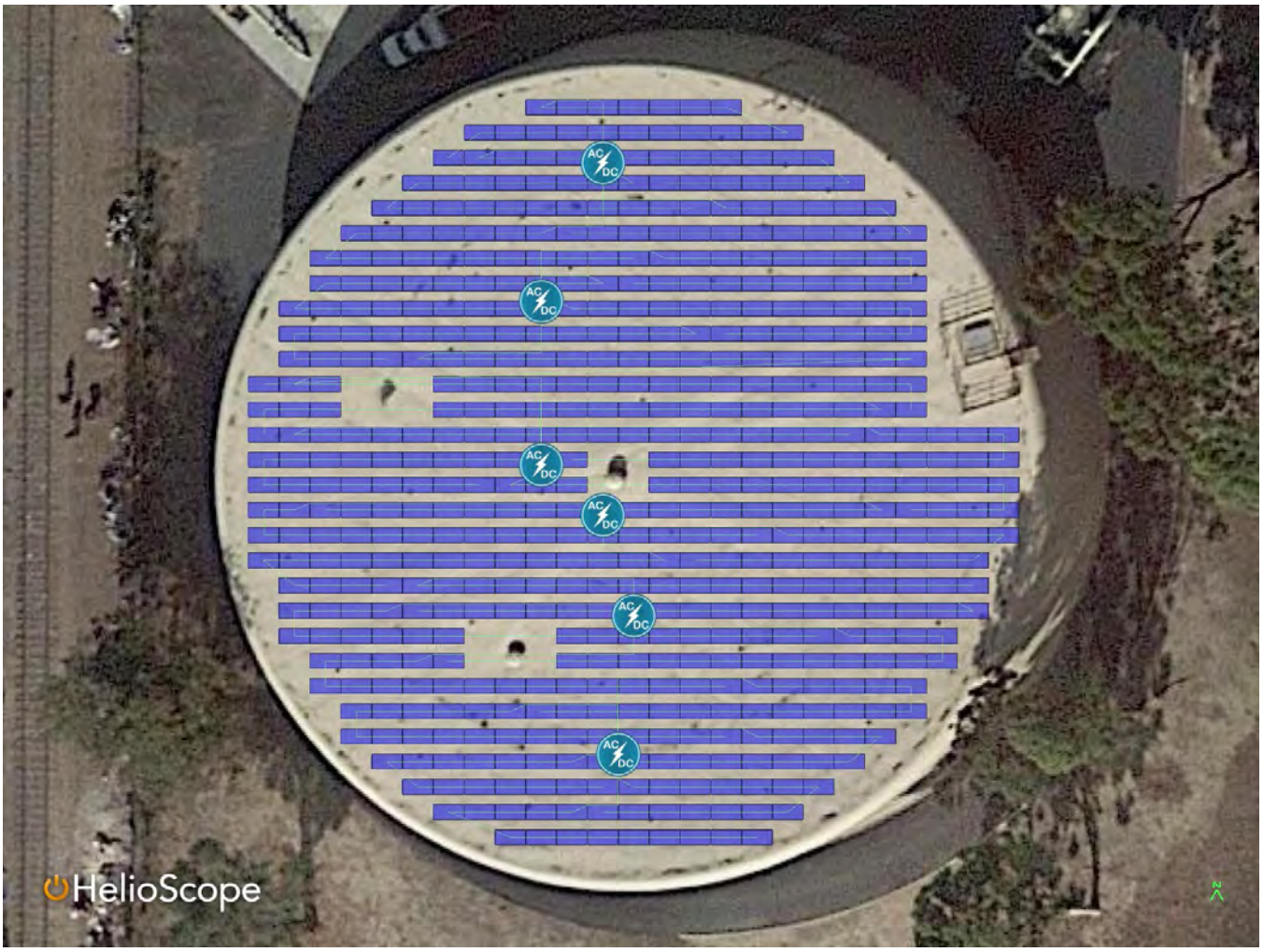


Garthe Station – This array utilizes the roof space of both circular storage tanks, as well as the roof surface of the rectangular reservoir to the northeast. Shading concerns from trees to the south of the building have reduced the amount of available roof space. Since these trees are not on the city's property, they will be difficult to remove. All surfaces account for existing equipment that limit the available space for the installation of solar PV modules. These arrays would likely utilize a ballast mounted system, pending an in-depth structural analysis.

South Station – This array utilizes the roof space of both storage tanks. All surfaces account for existing equipment that limit the available space for the installation of solar PV modules. These arrays would likely utilize a ballast mounted system, pending a structural analysis.



West – This array utilizes the roof space of the single storage tank, while taking into account existing equipment that limits the available space for the installation of solar PV modules. This array would likely utilize a ballast mounted system, pending a structural analysis.



East – This array utilizes the roof space of the single storage tank, while taking into account existing equipment that limits the available space for the installation of solar PV modules. This array would likely utilize a ballast mounted system, pending an in-depth structural analysis.

Cambridge – This array utilizes the roof space of the single storage tank, while taking into account existing equipment that limits the available space for the installation of solar PV modules. It is assumed that the trees causing shading from the south west will be removed by the city to increase the available space. This array would likely utilize a ballast mounted system, pending an in-depth structural analysis.

City Yard Caption – This array utilizes available parking lot space using solar carport structures. It is assumed that any trees causing shading will be removed by the city to increase the available space. Since this array would utilize a series of carport structures, a soils analysis will be required.

APPENDICES

APPENDIX A – HISTORICAL ELECTRICITY PURCHASES
APPENDIX B – 2017 MASTER WATER PLAN
APPENDIX C – EXISTING BYRON JACKSON HYDRO TURBINE
APPENDIX D – TURBINE PROPOSALS
APPENDIX E – PLANT OPERATING RECORDS
APPENDIX F – MONTHLY PRODUCTION REPORTS
APPENDIX G – TURBINE COST ESTIMATES
APPENDIX H – SOLAR MODEL PARAMETERS

APPENDIX A
HISTORICAL ELECTRICITY PURCHASES

City of Santa Ana - Public Works Agency - Water Resources Division
Monthly Electricity Consumption by Service Account (kWh)

			Period												
Site	**Service Account**	**Location**	**Jan-16**	**Feb-16**	**Mar-16**	**Apr-16**	**May-16**	**Jun-16**	**Jul-16**	**Aug-16**	**Sep-16**	**Oct-16**	**Nov-16**	**Dec-16**	**CY 2016**
Well 32	3-000-2923-73	2801 N Westwood	431	721	314	289	292	272	325	626	262	283	290	326	4,432
Well 36	3-000-5824-85	2415 N Bristol St	62,138	97,286	93,266	63,910	82,547	63,714	109,470	114,798	97,827	111,705	78,106	107,946	1,082,713
Well 34	3-000-6323-10	1727 W Alton Ave	3,101	7,668	15,525	16,049	13,168	14,951	4,223	9,387	18,725	4,343	5,604	7,473	120,217
SA 7	3-000-6921-16	2215 Ritchey St	86	75	81	76	79	71	69	70	70	77	77	86	916
Well 29	3-000-8776-20	101 S Flower	163	857	1,034	1,246	1,400	816	870	645	35	37	0	-	7,104
Well 31	3-001-3269-95	1815 E Chestnut Ave	87,658	106,106	114,551	118,236	107,881	125,902	92,420	66,534	638	667	569	35,048	856,209
Cambridge Reservoir	3-001-3273-34	2736 N Cambridge St	289	747	879	842	337	465	988	831	811	839	813	832	8,674
Crooke PS & Well 27 & 28	3-001-3273-42	730 W Memory Ln	111,676	152,136	164,386	160,119	157,476	173,238	160,596	138,168	142,579	249,731	265,474	435,254	2,310,832
SA 4	3-001-3273-52	1206 3/4 W Warner Ave	303	173	80	81	84	82	86	86	83	85	76	73	1,292
Maxine Sewage Lift Sta.	3-001-3273-68	5321 1/2 W Mcfadden	1,324	1,168	1,239	1,175	1,226	1,142	1,158	1,146	1,135	1,222	1,224	1,337	14,496
West PS & Wells 20,21,30	3-001-3274-13	209 S Mountain View St	221,714	243,111	261,478	292,531	251,432	253,595	312,232	267,811	257,022	266,721	299,800	263,027	3,190,475
East PS & Well 26	3-001-3274-19	1730 S Santa Fe St	52,130	73,738	57,100	82,430	59,342	68,958	67,737	63,450	60,188	102,877	138,457	97,552	923,960
Well 24	3-001-3274-37	1800 W 22nd St	51,553	16,290	25,495	38,133	14,151	34,359	3,715	745	712	7,698	44,214	27,650	264,716
Garthe PS, Well 18	3-001-3274-45	2401 N Bristol St	199,709	172,958	186,060	172,318	89,330	127,436	67,034	71,287	54,643	116,583	184,461	209,439	1,651,257
Elevated Tank Lights	3-001-3276-00	14th/Poinsettia	1,378	1,236	1,081	838	976	861	942	1,078	1,192	1,366	1,386	1,515	13,848
Well 33	3-001-3276-18	917 W Walnut St	68,633	49,488	60,194	50,481	85,769	96,796	89,303	96,573	83,580	104,704	270	295	786,086
Segerstrom Sewage Lift Sta.	3-002-3158-73	2903 S Bristol St	5,425	4,961	5,376	5,287	5,423	5,436	5,671	5,453	4,597	4,728	4,334	3,202	59,893
South PS	3-008-2244-21	1727 Alton Pkwy	2,378	6,005	14,702	14,774	9,735	12,003	3,682	5,647	16,893	2,153	2,434	4,995	95,402
Well 35	3-010-7630-01	1718 N Sydney	33,647	93,625	102,143	103,461	81,780	109,945	101,037	110,978	116,381	102,754	106,782	132,658	1,195,191
Well 37	3-010-7672-94	2007 W Mcfadden Ave	72,480	101,600	111,513	120,135	113,155	123,417	134,056	140,016	139,131	123,433	115,084	93,911	1,387,931
Cambridge PS	3-011-0573-83	2736 N Cambridge St	53,508	133,421	136,246	34,312	8,510	119,151	42,790	115,677	132,161	144,622	134,400	7,504	1,062,303
PRV 1	3-020-4700-93	501 3/4 W Memory Ln	29	27	29	28	29	28	29	29	28	29	28	29	342
SA-1	3-021-7437-93	2315 N Bristol St	117,877	37,696	56,244	87,601	32,458	84,117	956	736	577	16,535	93,088	65,067	592,952
PRV 2	3-022-4131-75	399 3/4 E 17th St	139	155	167	160	166	159	164	70	34	35	34	35	1,317
PRV 3	3-022-5443-14	1345 3/4 N Grand Ave	173	197	209	202	209	201	206	207	197	185	148	152	2,287
Walnut PS	3-025-3286-49	723 W Walnut	48,512	39,606	44,833	38,075	58,785	80,242	85,599	82,115	67,570	88,375	1,511	-	635,223
Well 40	3-029-7986-40	1301 N Mabury St	171,499	21,899	1,179	667	821	725	761	931	1,071	260	153	272	200,238
Well 41	3-029-9837-84	907 3/4 N Flower St	107,828	126,789	120,923	137,015	123,797	115,587	139,479	155,820	161,039	100,093	131,017	126,066	1,545,452
Well 16	3-030-3976-48	650 N Flower St A	33,588	15,260	25,962	20,600	19,117	17,759	15,313	17,423	25,150	25,829	26,528	21,764	264,293
SA-3	3-035-8796-80	1101 3/4 S Bristol St	61	59	63	60	60	61	65	63	61	62	59	60	733
	Total		1,509,899	1,505,413	1,602,740	1,561,496	1,319,801	1,631,792	1,441,289	1,468,711	1,384,698	1,578,365	1,636,703	1,643,878	**18,284,786**

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

P.O. Box 300
Rosemead, CA
91772-0001
www.sce.com

For billing and service inquiries call 1-800-990-7788,

For emergency services call 24 hrs a day, 7 days a week

Date bill prepared: Aug 9 '16

Customer account 2-24-876-4649

220 S DAISY AVE
SANTA ANA, CA 92703-4334

CHARGE: 060176400 - 62003

FY15/16 : $42,621.34

FY 16/17 : $139,505.32

Your account summary

Previous Balance	$217,421.81
Wire credit adjustment	-$217,421.81
Balance forward	$0.00
Your new charges	$182,126.66
Total amount you owe by Aug 29 '16	**$182,126.66**

APPROVED FOR PAYMENT
BY _____
Nabil Saba
DATE 8/16/16

Summary of your billing detail

Service account	Service address	Billing period	Your rate	New charges
3-021-7437-93	2315 N BRISTOL ST SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-PA-3-A	$355.67
3-025-3286-49	723 W WALNUT SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-PA-3-B	$14,200.79
3-029-9837-84	907 3/4 N FLOWER ST MET01 SANTA ANA, CA	Jun 17 '16 to Jul 19 '16	TOU-PA-3-B	$11,004.52
3-035-8796-80	1101 3/4 S BRISTOL ST SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-GS-1-A	$34.01
CAMBRIDGE PS 3-011-0573-83	2736 N CAMBRIDGE ST SANTA ANA, CA	Jul 1 '16 to Aug 2 '16	TOU-PA-3-B	$8,364.64
CAMBRIDGE RESERVOIR SITE LIGHT 3-001-3273-34	2736 N CAMBRIDGE ST SANTA ANA, CA	Jul 1 '16 to Aug 2 '16	TOU-GS-1-A	$177.83
CROOKE PS & WELL 27 & 28 3-001-3273-42	730 W MEMORY LN SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-8-B	$26,717.13
EAST PS & WELL 26 3-001-3274-19	1730 S SANTA FE ST SANTA ANA, CA	Jun 13 '16 to Jul 13 '16	TOU-PA-3-A	$8,879.63

(Continued on next page)

(14-574) Tear here

Please return the payment stub below with your payment and make your check payable to Southern California Edison.
If you want to pay in person, call 1-800-747-8908 for locations, or you can pay online at www.sce.com.

Tear here

SOUTHERN CALIFORNIA EDISON®
An EDISON INTERNATIONAL® Company

Customer account 2-24-876-4649
Please write this number on your check. Make your check payable to Southern California Edison.

Amount due by Aug 29 '16 **$182,126.66**

Amount enclosed $ 182,126.66

STMT 08092016 P4

SANTA ANA, CITY OF
ATTENTION NABIL SABA
220 S DAISY AVE
SANTA ANA, CA 92703-4334

P.O. BOX 300
ROSEMEAD, CA 91772-0001

24 876 4649 00000050 0000000000182126601821266

Contact Information

Customer service numbers

General Services (U.S. & Canada)	1-800-655-4555
Account Balance & Extensions	1-800-950-2356
Emergency Services & Outages	1-800-611-1911
California Alternate Rates for Energy (CARE)	1-800-447-6620
Electric Industry Restructuring	1-800-799-4723
Energy Theft Hotline	1-800-227-3901
Hearing & Speech Impaired (TTY)	1-800-352-8580

Multicultural services

Cambodian / ខ្មែរ	1-800-843-1309
Chinese / 中文	1-800-843-8343
Korean / 한국어	1-800-628-3061
Vietnamese / Tiếng Việt	1-800-327-3031
Spanish / Espanol	1-800-441-2233

Correspondence: Southern California Edison (SCE)
P. O. Box 6400, Rancho Cucamonga, CA 91729-6400

Important information

Rotating outages

A rotating outage is a controlled electric outage that lasts approximately one hour for a group of circuits, which is used during electric system emergency conditions to avoid widespread or uncontrolled blackouts. Each SCE customer is assigned a rotating outage group, shown on the upper part of the SCE bill. If your rotating outage group begins with the letters A, M, R, S, or X, you are subject to rotating outages. If it begins with N or Exempt, you are not. Your rotating outage group may change at any time. For more information, and to see which rotating outage groups are likely to be called in the event of a system emergency, visit www.sce.com or call 1-800-655-4555.

Options for paying your bill

On-line	www.sce.com or Electronic Fund Transfer	
Mail-in	Check or Money order	
In Person	Authorized payment locations	1-800-747-8908
Phone	QuickCheck	1-800-950-2356
	Credit Card-Visa/MasterCard*	1-800-254-4123
	Debit Card-ACCEL/NYCE/Pulse/Star*	1-800-254-4123

*The Credit/Debit card payment options are not available for payment of commercial services or security deposits for commercial services.

You may call us for electronic payment options, to make payment arrangements, or for information on agencies to assist you in bill payment. If service has been disconnected, on the day of the service reconnection, be sure all appliances and other electric devices are turned off. For additional home safety tips, visit www.sce.com/safety or you may call SCE Customer Service at 1-800-655-4555.

Past due bills

Your bill was prepared on August 9, 2016. Your bill is due when you receive it and becomes past due 19 days after the date the bill was prepared. You will have 15 days at your new address to pay a bill from a prior address before your service will be terminated. SCE does not terminate residential service for non-payment of bills for other classes of service. Termination of electric service requires a Service Connection charge. If you are a residential customer, and claim an inability to pay and payment arrangements have not been extended to you by SCE pursuant to SCE's filed tariffs, you may contact the California Public Utilities Commission (CPUC).

Rules and rates

SCE's rules and rates are available in full at www.sce.com or upon request.

Late Payment Charge (LPC)

A late payment charge of 0.8% will be applied to the total unpaid balance on your account if full payment is not received by the due date on this bill (except for CARE and state agency accounts).

Disputed bills

If you think your bill is incorrect, call us and speak with a customer service representative, or if necessary, with a manager. If you feel unsatisfied with the result of such discussion(s), contact the CPUC, Consumer Affairs Branch by mail at: 505 Van Ness, Room 2003, San Francisco, CA 94102; or at: www.cpuc.ca.gov, 1-800-649-7570, TTY: 1-800-229-6846. Include a copy of your bill, why you believe SCE did not follow its rules and rates, and a check or money order made out to the CPUC for the disputed amount. You must pay the disputed amount, or send it to the CPUC, before the past-due date to avoid disconnection. The CPUC accepts payment only for matters relating directly to bill accuracy. While the CPUC is investigating your complaint, you must pay any new SCE bills that become due.

Electronic Fund Transfers (EFT)

When you provide a check as payment, you authorize us either to use information from your check to make a one-time electronic fund transfer from your account or to process the payment as a check transaction. When we use information from your check to make an electronic fund transfer, funds may be withdrawn from your account as soon as the same day we receive your payment. You will not receive your check back from your financial institution, but the transaction will appear on your financial institution statement. If you do not wish to authorize an electronic fund transfer, please call the 800 number on the front of your bill.

Definitions

- DWR Bond Charge: Bonds issued by the Department of Water Resources (DWR) to cover the cost of buying power for customers during the energy crisis are being repaid through this charge.
- SCE Generation: These charges recover energy procurement and generation costs for that portion of your energy provided by SCE. Beginning April 11, 2010, pursuant to CPUC Decision 10-03-022, Direct Access (DA) is again open to all non-residential customers, subject to annual limits during a four year phase-in period, and absolute limits following the phase-in. All residential customers currently returning to Bundled Service may not elect to return to DA service.
- CA Climate Credit: Credit from state effort to fight climate change. Applied monthly to eligible businesses and semi-annually to residents.

To change your contact information or enroll in SCE's payment option, complete the form below and return it in the enclosed envelope.

Change of mailing address: 2-24-876-4649

STREET#	STREET NAME	APARTMENT #
CITY	STATE	ZIP CODE
TELEPHONE #	E-MAIL ADDRESS	

Direct Payment (Automatic Debit) Enrollment: 2-24-876-4649

I hereby authorize SCE and my financial institution to automatically deduct my monthly payment from the checking account as shown on my enclosed check, ten calendar days after my bill is mailed.

Signature _____ Date _____

To change your checking account information or to be removed from the Direct Payment program please call SCE at 1-800-655-4555.

Energy Assistance Fund (EAF): I want to help people pay their energy bill through EAF. For info visit www.sce.com/eaf or call (800) 205-8596.

Round-up my bill to next whole dollar amount for EAF

☐ Every Month ☐ One Month only

Add this amount for EAF $ _____

☐ Every Month ☐ One Month only

Select one box only and sign below for EAF:

_____

Summary of your billing detail (continued)

Service account	Service address	Billing period	Your rate	New charges
ELEVATED TANK LIGHTS 3-001-3276-00	14TH/POINSETTA STWA SANTA ANA, CA	Jun 29 '16 to Jul 29 '16	TOU-GS-1-A	$152.36
FIRST STREET UNDER PASS 3-001-3273-57	N/S 1ST AT SANTA FE SANTA ANA, CA	Jul 6 '16 to Aug 4 '16	TOU-GS-1-A	$68.62
GARTHE PS & SA 1 3-001-3274-45	2401 N BRISTOL ST SANTA ANA, CA	Jul 1 '16 to Aug 1 '16	TOU-PA-3-B-S	$8,598.06
GARTHE PS & SA 1 3-001-3274-45	2401 N BRISTOL ST SANTA ANA, CA	Jul 1 '16 to Aug 1 '16	TOU-PA-3-B-S	$60.00
MAXINE SEWAGE LIFT STATION 3-001-3273-68	5321 1/2 W MCFADDEN PMP SANTA ANA, CA	Jul 7 '16 to Aug 5 '16	TOU-PA-2-B	$156.30
PRV 1 3-020-4700-93	501 3/4 W MEMORY PED SANTA ANA, CA	Jun 27 '16 to Jul 27 '16	TOU-GS-1-A	$27.95
PRV-2 3-022-4131-75	399 3/4 E 17TH ST SANTA ANA, CA	Jun 8 '16 to Jul 8 '16	TOU-GS-1-A	$47.77
PRV-2 3-022-4131-75	399 3/4 E 17TH ST SANTA ANA, CA	Jul 8 '16 to Aug 8 '16	TOU-GS-1-A	$49.09
PRV-3 3-022-5443-14	1345 3/4 N GRAND AVE SANTA ANA, CA	Jul 6 '16 to Aug 4 '16	TOU-GS-1-A	$52.31
SA 4 3-001-3273-52	1206 3/4 W WARNER AVE SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-GS-1-A	$35.25
SA 7 3-000-6921-16	2215 RITCHEY ST SANTA ANA, CA	Jun 9 '16 to Jul 11 '16	TOU-GS-1-A	$36.39
SEGRSRTROM SEWAGE LIFT STATION 3-002-3158-73	2903 S BRISTOL ST SANTA ANA, CA	Jun 23 '16 to Jul 25 '16	TOU-PA-2-B	$664.41
SOUTH PS 3-008-2244-21	1727 ALTON PKWY WP SANTA ANA, CA	Jun 17 '16 to Jul 19 '16	TOU-PA-2-B	$1,598.50
WATER WELL 3-029-7986-40	1301 N MABURY ST SANTA ANA, CA	Jun 17 '16 to Jul 19 '16	TOU-PA-3-B	$2,569.11
WELL 16 3-001-3274-64	650 W FLOWER B SANTA ANA, CA	Jun 13 '16 to Jul 13 '16	TOU-PA-2-A	$2,346.58
WELL 24 3-001-3274-37	1800 W 22ND ST SANTA ANA, CA	Jun 13 '16 to Jul 13 '16	TOU-PA-2-A	$2,635.39
WELL 29 3-000-8776-20	101 S FLOWER PMP SANTA ANA, CA	Jun 15 '16 to Jul 15 '16	TOU-PA-2-A	$150.71
WELL 31 3-001-3269-95	1815 E CHESTNUT AVE SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-PA-3-B	$10,825.53
WELL 32 3-000-2923-73	2801 N WESTWOOD SANTA ANA, CA	Jul 1 '16 to Aug 2 '16	TOU-GS-1-A	$79.73
WELL 33 3-001-3276-18	917 W WALNUT ST SANTA ANA, CA	Jul 7 '16 to Aug 5 '16	TOU-PA-3-A	$7,889.17
WELL 34 3-000-6323-10	1727 W ALTON AVE SANTA ANA, CA	Jun 17 '16 to Jul 19 '16	TOU-PA-2-A	$3,393.77
WELL 35 3-010-7630-01	1718 N SYDNEY WELL SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-PA-3-B	$10,873.35
WELL 36 3-000-5824-85	2415 N BRISTOL ST SANTA ANA, CA	Jun 30 '16 to Aug 1 '16	TOU-PA-2-B	$9,064.10
WELL 37 3-010-7672-94	2007 W MCFADDEN AVE WELL SANTA ANA, CA	Jul 5 '16 to Aug 3 '16	TOU-PA-3-B	$13,073.27
WELL 39 3-015-9839-54	2401 N BRISTOL ST SANTA ANA, CA	Jul 1 '16 to Aug 1 '16	MISC-CHARGES	$14.47
WEST PS & WELLS 20, 21, 30 3-001-3274-13	209 S MOUNTAIN VIEW ST SANTA ANA, CA	Jun 9 '16 to Jul 11 '16	TOU-8-B	$37,930.25
				$182,126.66

APPENDIX B
2017 MASTER WATER PLAN

City of Santa Ana
2017 Water Master Plan

Table 4 - Summary of Demands and Peaking Factors

NAM >>>

Time Horizon	Average Day Demand (million gal/day)	Maximum Day Demand (million gal/day)	Peak Hour Demand (million gal/day)	Annual Use (gal/yr)	Average Flow (gal/hr)	Average Flow (gal/min)	Peak Hour Flow (gal/hr)	Peak Hour Flow (gal/min)
Existing	33.5	45.2	65.3	12,227,500,000	1,395,833	23,264	2,720,833	45,347
Near Term	34.9	47.1	68	12,738,500,000	1,454,167	24,236	2,833,333	47,222
Buildout (2040)	35.5	47.9	69.1	12,957,500,000	1,479,167	24,653	2,879,167	47,986

365

33,500,000 gallon/day

33.5 MGD

City of Santa Ana
2017 Water Master Plan

Table 6 - Groundwater Well Summary

Well No.	Well Pumps To	Power (hp)	Static Depth (ft)	Pumping Depth (ft)	Capacity (mgd)	Design Head (ft)	Design Capacity (gpm)
16	Walnut	150	83	108	2.16	228	2,000
18	John Garthe	150	-	-	3.29	212	2,000
20	West	150	92	115	4.35	161	3,000
21	West	150	93	113	4.16	160	3,000
24	John Garthe	150	127	203	1.85	279	1,800
26	East	125	127	-	3.00	246	2,500
27	Crooke	300	189	298	3.97	370	2,500
28	System	350	180	264	3.62	400	2,500
29	Walnut	200	152	218	3.65	246	2,500
30	John Garthe	150	91	118	4.35	165	3,000
31	System	350	177	246	3.98	408	3,000
32	John Garthe	300	126	-	3.22	315	2,775
33	Walnut	250	148	227	4.10	280	2,800
34	south	125	115	194	2.18	425	2,500
35	System	350	130	165	3.17	305	3,000
36	John Garthe	250	155	194	5.18	210	3,600
37	System	350	119	137	3.31	330	3,000
38	System	350	221	322	2.16	425	2,500
39	John Garthe	250	153	194	4.32	250	3,000
40	System	400	192	278	3.71	200	2,575
41	System	450	155	201	4.32	350	3,000
TOTAL		**5,300**			**74.05**		**56,550**
				=	51,424 gpm	=	81 mgd

Table 11 - Metropolitan Water District Connections

MWD Connection	Name	Normal Operating Capacity (mgd)	Design Capacity (mgd)	Number of Valves	Valve Type	Notes
SA-1	Bristol	5.17	6.46	2	FCV	Has hydro. Needs work.
SA-2	First	5.17	9.69	1	FCV	
SA-3	McFadden	5.17	6.46	1	FCV	
SA-4	Warner	4.85	6.46	1	FCV	
SA-5	Alton	4.85	12.93	1	Out of Service	Being Upgraded
SA-6	Santa Clara	7.76	12.93	3	FCV	
SA-7	Red Hill	4.85	32.31	2	FCV	Being moved by Caltrans
TOTAL		**37.82**	**87.24**			
	=	26,264 gpm	60,583 gpm			

City of Santa Ana
2017 Water Master Plan

Table 12 - Storage Reservoir Facilities

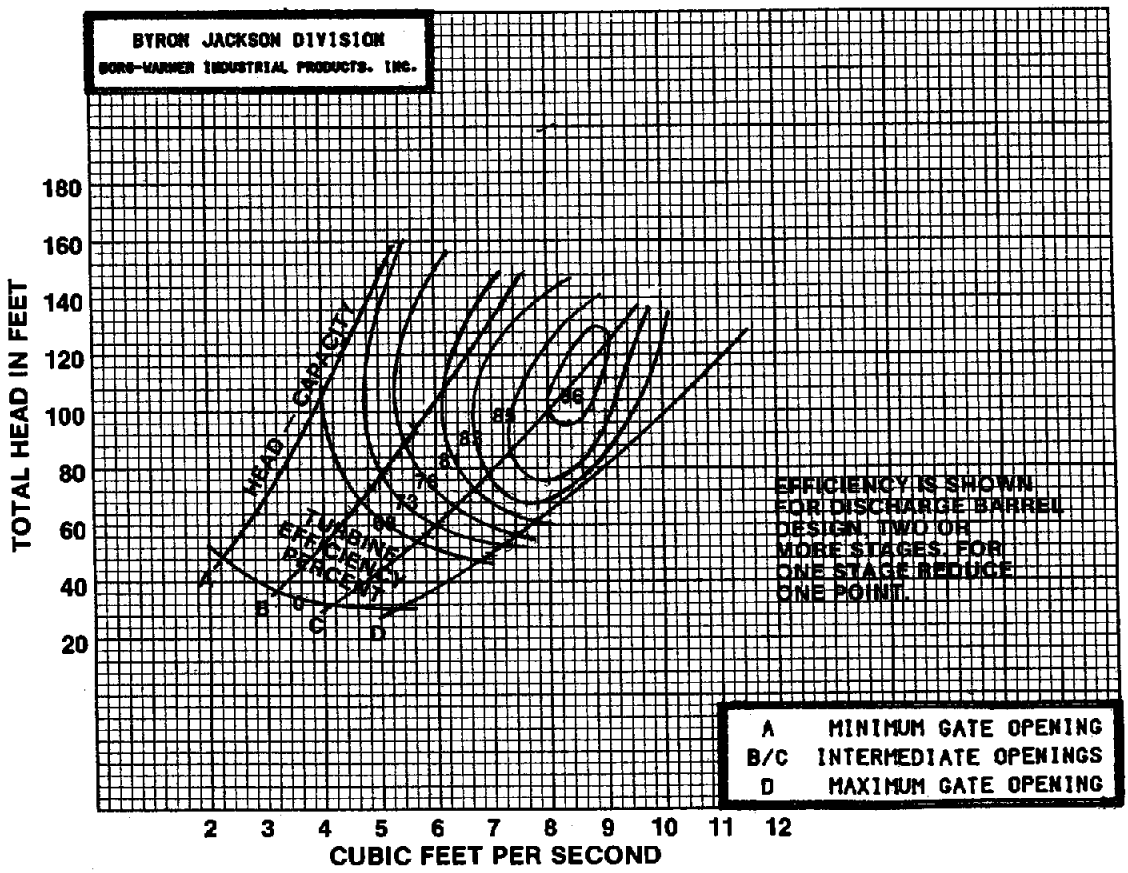
Reservoir Facility	Tank Type	Capacity (million gal)	Number of Tanks	Zone	Bottom Elevation (ft)	Diameter	Height	
Cambridge	Concrete	1.3	1	High	188.8	Variable	17.2	
Cooke	Concrete	6.0	1	High	157.6	Variable	21	
East	Steel	6.0	1	Low	76.2	180	31.5	
Elevated Tank	Steel	1.0	1	Low	NA	60	131	
John Garthe	Concrete	15.8	3	Low	100	277	35	Possible PV
South	Concrete	6.0	1	Low	35.7	219	22	
Walnut	Concrete	7.0	1	Low	79.8	Variable	22	
West	Steel	6.0	1	Low	66.9	180	32	Possible PV
TOTAL		49.1						

Table 16 - Booster Pump Summary

Station	Pump No.	Motor	Power (hp)	Average Capacity (gpm)	Design Head (ft)	Design Capacity (gpm)
Cambridge	1	Electric	75	1,481	150	1,650
Cambridge	2	Electric	75	1,436	150	1,650
Cambridge	3	Electric	75	1,526	150	1,650
Crooke	1	Electric	150	2,783	185	2,700
Crooke	2	Electric	150	2,693	185	2,700
Crooke	3	Electric	150	2,738	185	2,700
East	1	Electric	125	2,648	175	2,300
East	2	Electric	125	2,603	175	2,300
John Garthe	1	Electric	150	2,693	180	1,760
John Garthe	2	Electric	150	3,097	183	2,590
John Garthe	3	Electric	150	3,007	183	2,590
John Garthe	4	Electric	200	4,264	183	3,560
John Garthe	5	Electric	200	3,590	183	4,270
John Garthe	6	Gas	250	4,982		
South	1	Electric	125	2,244	212	2,000
South	2	Electric	125	2,244	212	2,000
Walnut	1	Electric	200	3,501	200	3,100
Walnut	2	Electric	200	3,501	200	3,100
Walnut	3	Electric	200	3,456	200	3,100
Walnut	4	Electric	150	2,738	200	2,400
Walnut	5	Electric	100	1,750	200	1,400
West	1	Electric	200	2,513	170	2,800
West	2	Electric	200	2,289	170	2,800
West	3	Electric	200	2,289	170	2,800
West	4	Electric	150	4,488	176	3,700
West	5	Electric	100	2,020	170	2,100
TOTAL			**3,975**	**72,574**		**63,720**

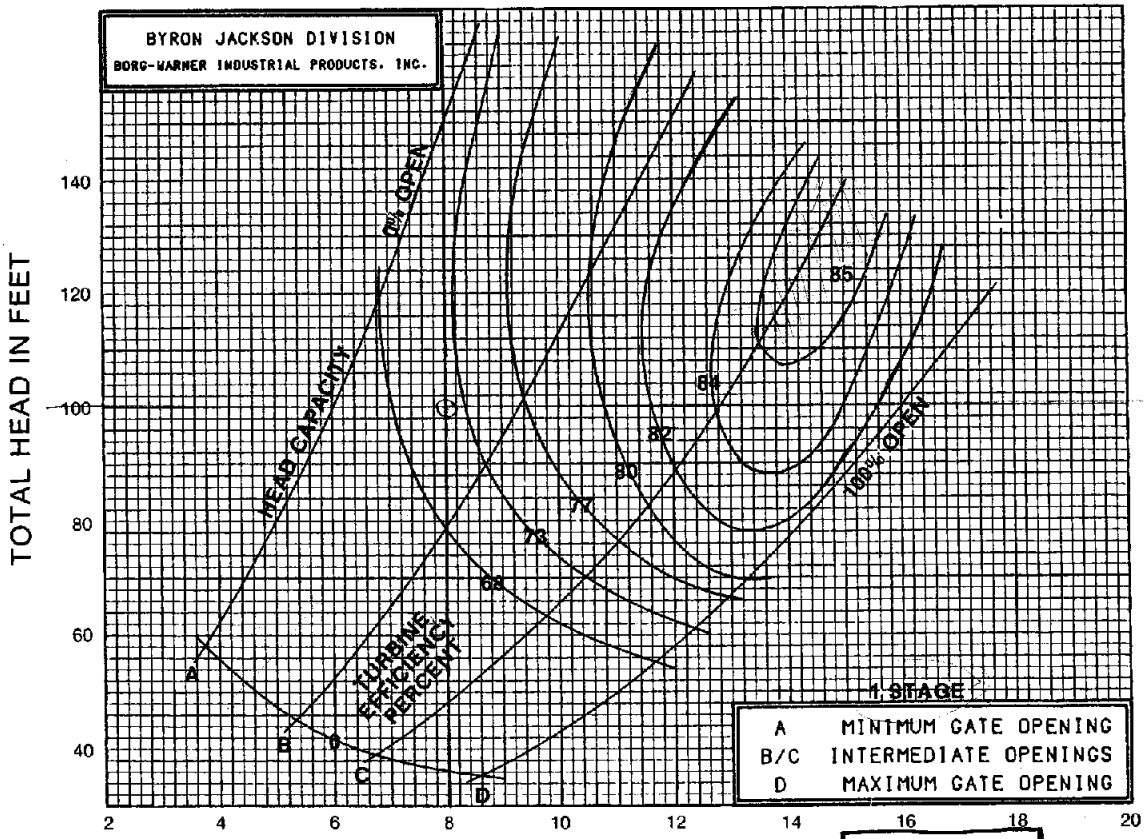
105 MGD

APPENDIX C
EXISTING BYRON JACKSON HYDRO TURBINE



8 RL TKW 1800 RPM

1 NOV 1984



8 M TKW 800 RPM

1 JUNE 84

TABLE 1, SHEET 2

Hydro turbines shall be furnished with the following metallurgy:

PART DESCRIPTION	ASTM NUMBER	COMMON TERMS
Inlet Elbow — Head	A-53 A-48	Fabricated Steel Cast Iron
Column	A-53	Fabricated Steel
Shaft — Main	A-582	400 Series Stainless Steel
Bearing — Column	B-271	Lead Bronze
Bearing — Main	B-271	Lead Bronze
Case — Main	A-48	Cast Iron
Wicket Gate	A-148 CA-958	Ni-Aluminum Bronze
Ring — Gate Operating	B-271 A-276	Bronze 400 Series Stainless Steel
Cover — Gate Mechanism	A-48	Cast Iron
Stem — Wicket Gate	A-582	400 Series Stainless Steel
Runner	B-148 CA-958/ A-743	Ni-Aluminum Bronze or 300 Series Stainless Steel
Case — Runner	B-148 CA-958 A-743	Ni-Aluminum Bronze or 300 Series Stainless Steel
Cone — Runner	B-148 CA-958	Ni-Aluminum Bronze
Split Ring — Runner	A-479	400 Series Stainless Steel
Key — Runner	A-276 A-582	300 Series Stainless Steel 400 Series Stainless Steel
Lever — Wicket Gate	A-743	400 Series Stainless Steel
Draft Tube	A-53	Fabricated Steel

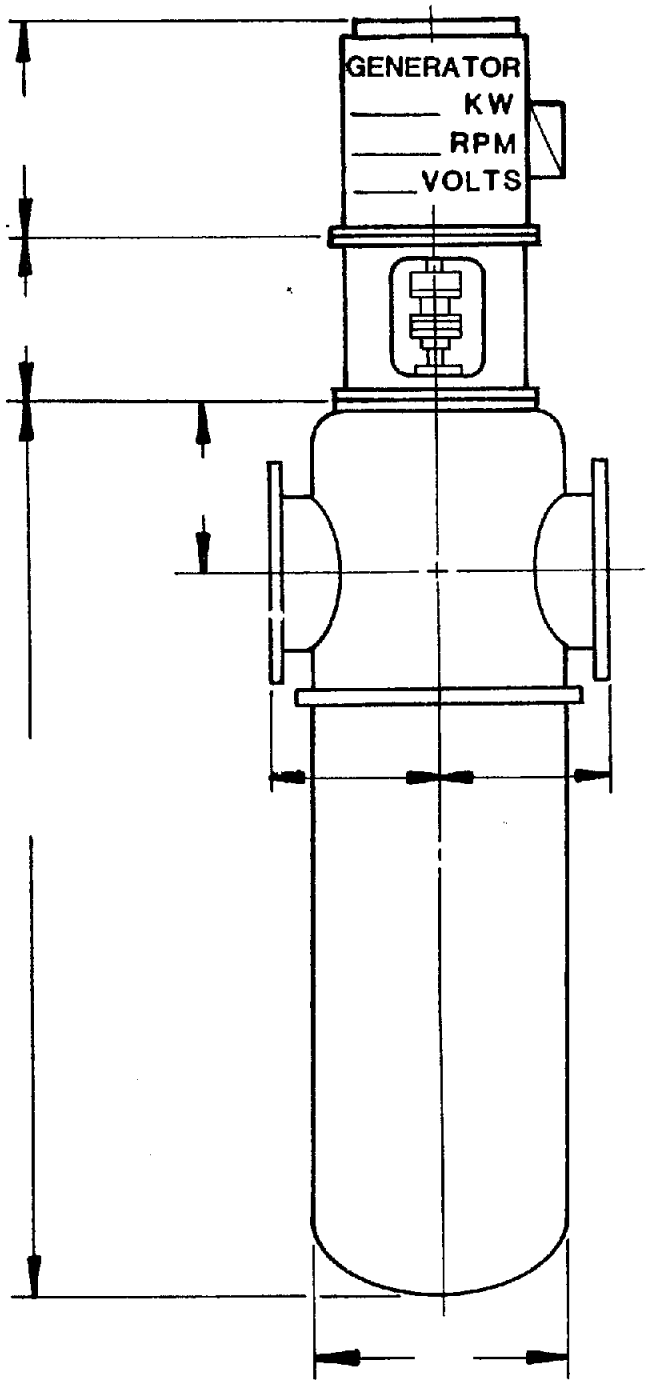
BW/IP International, Inc.
Pump Division

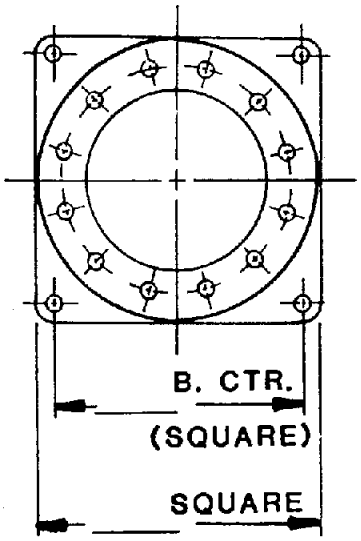
Byron Jackson® Products

Effective June 1986

BYRON JACKSON TKW HYDRO TURBINE

PRELIMINARY OUTLINE-BELOW GRADE PULL-OUT DESIGN





NOZZLES	
SIZE	
A.S.A. RATING	

RATED FLOW_____

NET HEAD-FT _____

K W OUTPUT _____

TURBINE RPM _____

TURBINE WT _____ LBS.

GENERATOR WT_____ LBS.

BARREL WT _____ LBS.

USER:	DRAWN BY	DATE	PROP. NO.
LOCATION:			
DRAWING TITLE:			

OUTLINE DIMENSIONS - INCHES

TURBINE SIZE	A	B	C	D	E	F[2]	G[1]		J[7]	L	M	N[5]	P	Q	V	W	X	Y	H[6]			
							1-STG COMP.	ADD PER STG.											K-DEGREES			
																			D	45	90	135
8 RL	35¼	31	33½	⅞	⅞	30	40	14	12	24	30	16	16	32	34	½	1⅛	⅞	24	17	12	5
8 M	41¼	37	39½	1	⅞	30	65	19	12	28	36	16	19	38	40	½	1⅛	⅞	24	19	12	5
8 H	41¼	37	39½	1	⅞	30	70	19	14	29	36	20	21	38	40	½	1⅛	⅞	28	23	16	5
10 H	66	66	54½	1¼	⅞	30	84	24	17½	37	48	26	25	52	54	¾	1⅛	⅞	35	27	17	6
12 H	72	72	60½	1¼	⅞	30	101	29	20	40	54	30	30	58	60	¾	1⅛	⅞	40	34	22	7
15 M	72	72	60½	1¼	⅞	30	115	33	20	40	54	30	30	58	60	¾	1⅛	⅞	40	34	22	7
15 H	79	79	70	1½	1⅛	30	120	33	23½	44	60	36	35	64	66	¾	1⅜	1⅛	47	38	26	9
17 H	94	94	83	1¾	1½	36	142	42	27	53	72	42	42	76	80	1	1¾	1⅜	54	46	31	11
21 H	108	108	97	1¾	1½	36	165	47	31½	60	84	50	49	90	92	1	1¾	1⅜	63	55	38	15
25 H	124	124	110	2	1¾	36	198	56	37½	67	96	60	59	102	104	1	2¼	1¾	74	66	46	17

NOZZLE ADAPTATION DIMENSIONS[3]

AA Min. = L + 5 (N-CA)
AB Min. = L + 3 (N-DA)
AE Min. = 6 (N-CA)
AF Min. = 4 (N-DA)

NOTES:

(1) Barrel length may be increased if necessary for extra-deep nozzle setting.

(2) "F" dimension is the typical minimum generator stand height. Applications requiring oversize turbine shafting or special wicket gate operators may require additional height.

(3) Standard barrel nozzles are sized for moderate fluid approach velocity to provide efficient and quiet operation. Where required, separate spool adapters or integral welded adapters may be specified.

(4) Specify "Byron Jackson To Supply" or "By Others".

(5) Standard nozzles have 150 lb. or 125 lb. standard A.S.A. raised face flanges..

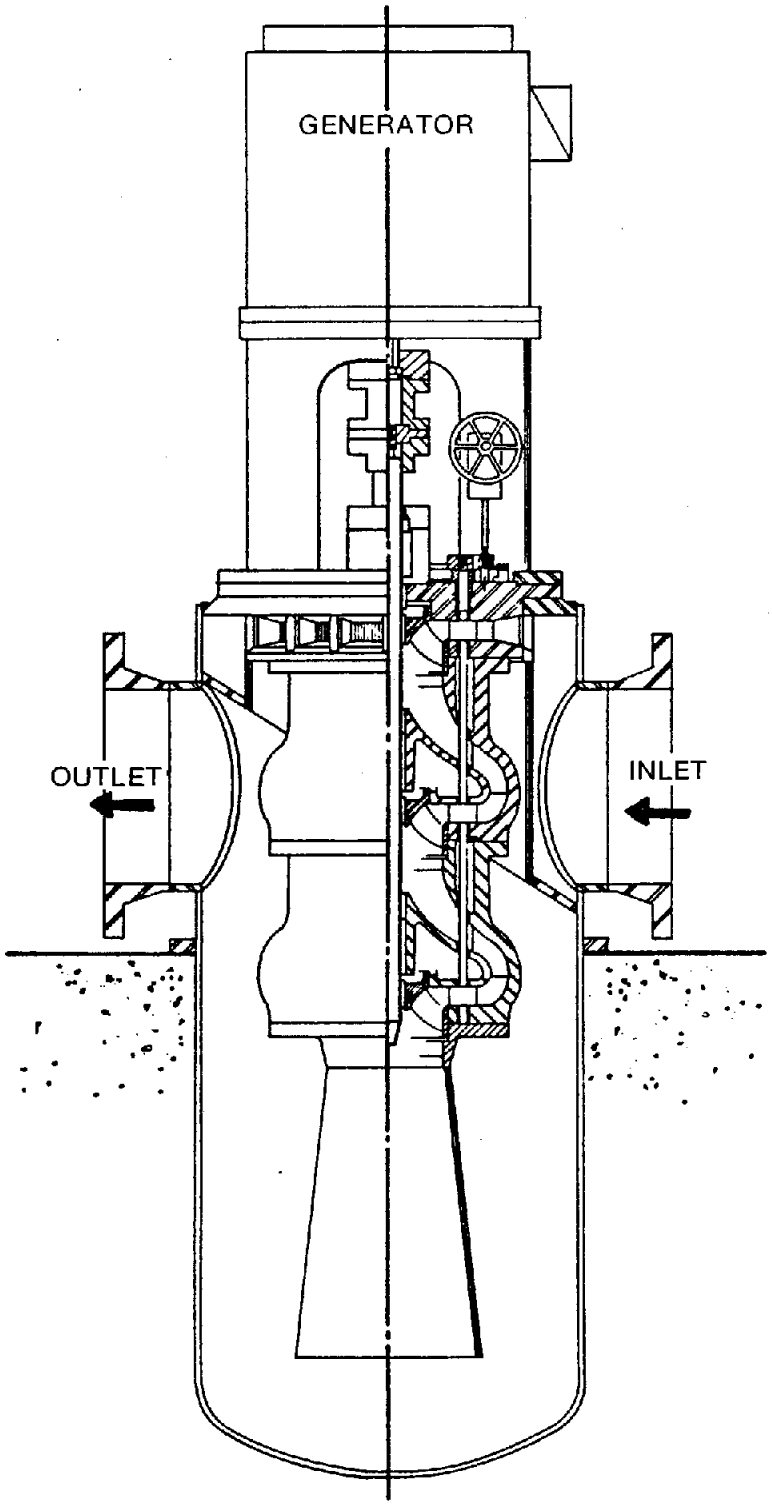
(6) Nozzles rated greater than 150 lb. may require greater elevation difference. Inlet nozzle elevation is always equal to or above discharge nozzle elevation.

(7) 250 lb. or 300 lb. nozzle flanges require additional base-to-nozzle clearance.

(8) Contact B.J. Engineering Department for special installation/mounting design.

BARREL INSTALLATION AND MOUNTING CONSIDERATIONS

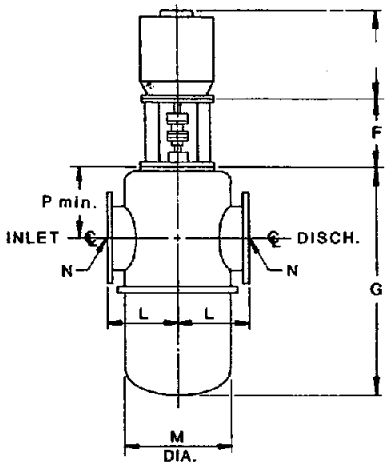
Pullout barrels can be permanently embedded in concrete, or they can be bolted to a baseplate. Each means of installation has certain advantages over the other. The embedded barrel will result in quieter operation due to the sound damping effect of the concrete and soil. For speed or ease of installation, the flange-mount barrel can be provided. A separate baseplate, anchor bolts, and flange mounting hardware will also be furnished. Installation of the baseplate will be performed by others. The baseplate and mounting flange mating surfaces are machined flat and after the baseplate has been properly levelled and grouted, the turbine barrel is simply lowered into place. With either type of pullout barrel installation, the barrel may be left in place, leaving the connected piping undisturbed, should it become necessary to remove the turbine for maintenance.



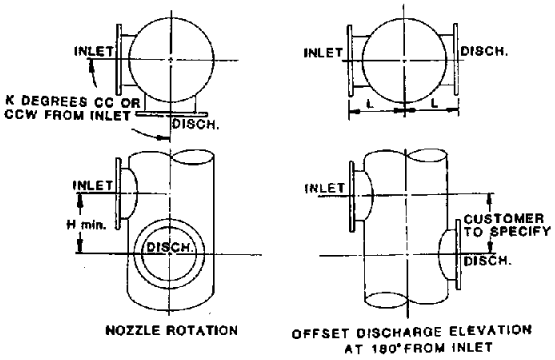
BYRON JACKSON HYDRO TURBINE STYLE DB
ABOVE GRADE PULL-OUT DESIGN

BYRON JACKSON TYPE TKW STYLE DB PULLOUT
PRELIMINARY OUTLINE DIMENSIONS

BASIC OUTLINE



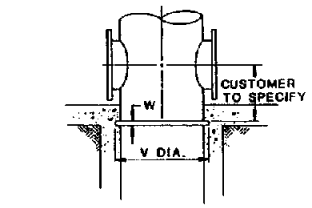
NOZZLE ORIENTATION



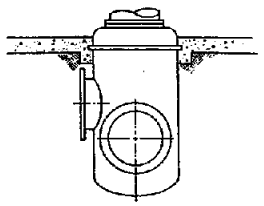
NOZZLE ROTATION

OFFSET DISCHARGE ELEVATION AT 180° FROM INLET

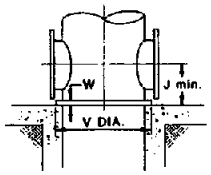
TYPICAL METHODS OF BARREL INSTALLATION



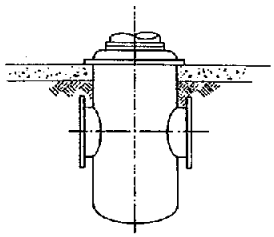
ABOVE BASE NOZZLES EMBEDDED BARREL AND ANCHOR RING



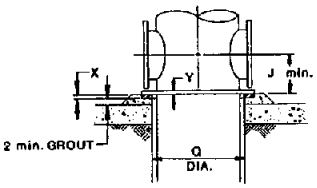
BELOW BASE NOZZLES EMBEDDED BARREL AND ANCHOR RING



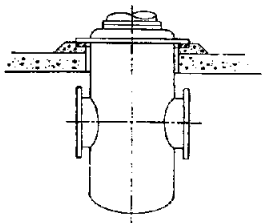
ABOVE BASE NOZZLES EMBEDDED BARREL



BELOW BASE NOZZLES EMBEDDED BARREL

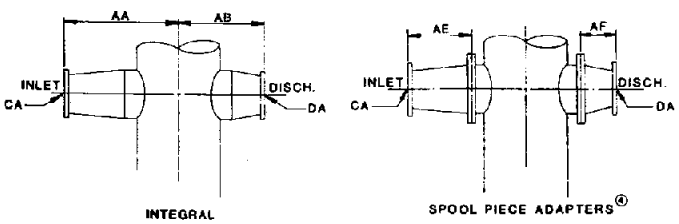


ABOVE BASE NOZZLES FLANGE-MOUNT BARREL



BELOW BASE NOZZLES ④ FLANGE-MOUNT BARREL

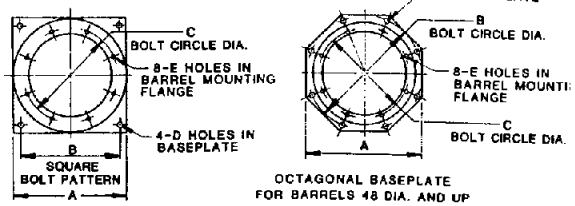
OPTIONAL PIPING/NOZZLE ADAPTATION



INTEGRAL

SPOOL PIECE ADAPTERS④

OPTIONAL BASEPLATE/MOUNTING FLANGE



SQUARE BASEPLATE FOR BARREL DIAMETERS THRU. 42 IN.

OCTAGONAL BASEPLATE FOR BARRELS 48 DIA. AND UP

APPENDIX D
TURBINE PROPOSALS

August 17, 2018

Michael KJ Anderson PE, VP
Newcomb | Anderson | McCormick
201 Mission Street, Suite 2000,
San Francisco, CA 94105

Dear Mr. Anderson,

Thank you for your correspondence regarding the hydroelectric projects you are evaluating in California at the SA-6 Santa Clara location. We appreciate the opportunity to work with you to offer the best possible Canyon Hydro equipment package for this site and application.

Based on your correspondence we are offering an equipment package utilizing an In-Line Turbine optimized to pass 12.0 CFS at 90-120 PSI net head. Under these conditions maximum expected system production will be 225 kW using the equipment package described below. The turbine will pass up to 18.7 CFS at 120 PSI net head with an expected maximum output of 351kW.

(1) Soar ILT16-33-11.25 Variable Flow Hydro Turbine, 1800 RPM, adjustable wicket gates
(1) US Motors Vertical Shaft, 500 HP, 1800 rpm, 480 VAC, 60 Hz, 3 ph., induction generator
(1) 16" Hydraulically Actuated Turbine Inlet Valve
(1) HPU to support wicket gate and inlet valve actuation with accumulator sized to close wicket gates and inlet valve in the event of power grid failure (double fail-safe)
(1) Switchgear and controls panels to parallel the generator with the local electrical utility grid and provide protective relays to utility grid standards for a project of this size. Specific utility requirements may change the scope of the switchgear/controls package offered and pricing may be affected. A one-line diagram and equipment list will be submitted for local electrical utility review and approval prior to proceeding with panel manufacture.

Budget estimate system price, as described……$541,000.00

The equipment package offered will be custom designed to meet the particular requirements of the site and project as explained through our discussions. As the project progresses and requirements are determined, we will be pleased to refine our budget estimate or offer a firm quotation. Budget estimates are offered for planning purposes only but are typically within 10% of a firm quotation for the same equipment package.

Normal Terms	15% to begin final design 30% to begin manufacture following final design approval 25% mid-project 20% upon notice of readiness to ship 10% upon successful start-up or 90 days from readiness, whichever is first
Normal Delivery	32-40 weeks from design approval and receipt of payments
Delivery FOB	Deming, Washington (crated for shipment)

In addition to equipment supply, Canyon Hydro also offers equipment installation services by our in-house field crews who are highly experienced with the unique requirements of hydroelectric equipment.

Commonly start-up, commissioning and training services are of value following installation. For a project of this type we can typically send a single technician who is capable of covering the mechanical and electrical portions of the equipment package. If start-up, commissioning and training assistance is of interest we suggest budgeting $8,000-$10,000 for a qualified Canyon Hydro technician.

I look forward to working with you to ensure our equipment package meets all the requirements of the site and project. Please contact me as questions arise or as additional project information becomes available.

Sincerely,

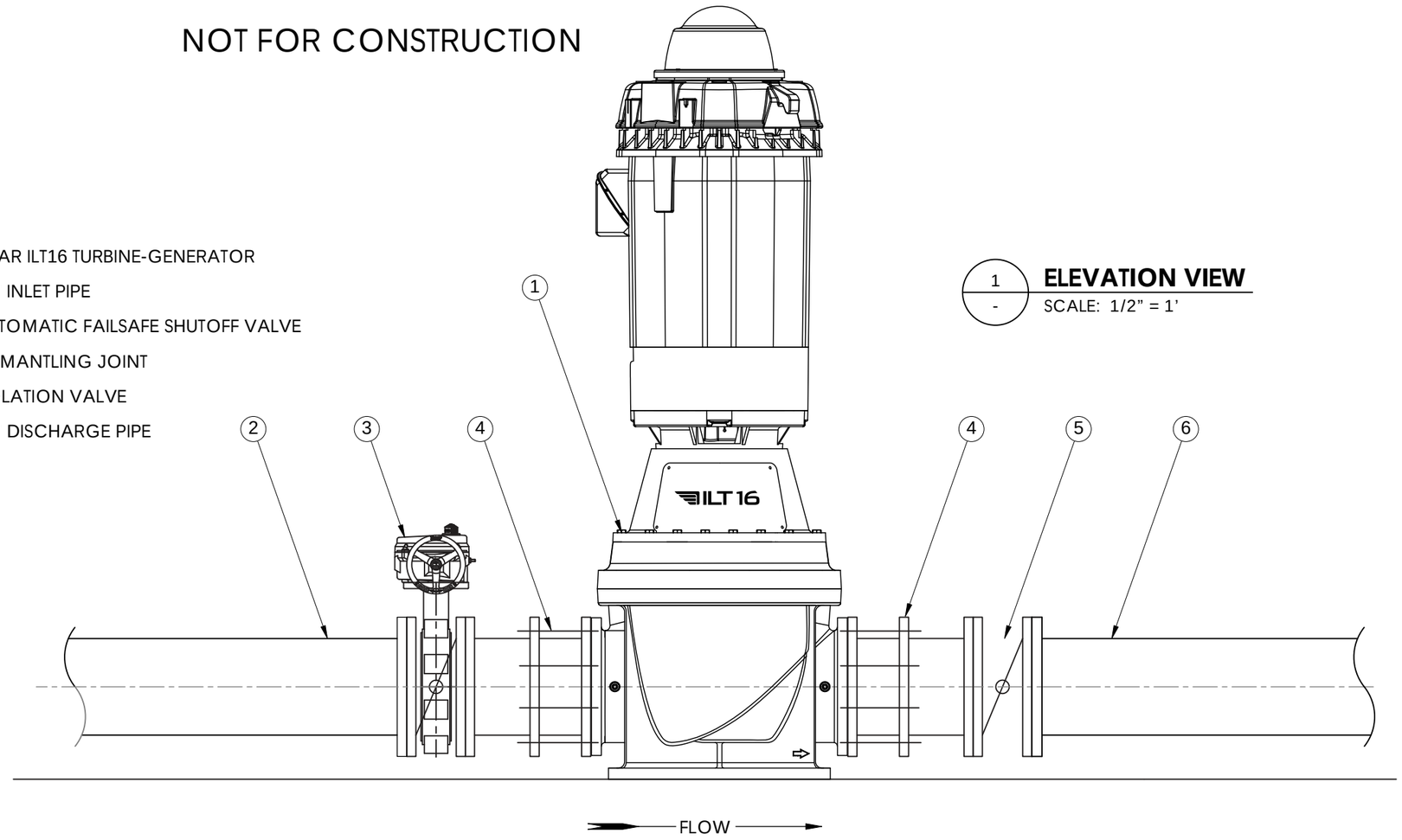
Ryan Maloney

Canyon Hydro– the water power division of Canyon Industries, Inc. • 5500 Blue Heron Lane • P.O. Box 36 • Deming WA 98244
360.592-5552 • Fax: 360.592.2235 • email: turbines@canyonhydro.com • www.canyonhydro.com

STANDARD INSTALLATION
CANYON ILT16 TURBINE-GENERATOR

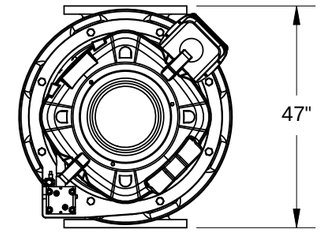
NOT FOR CONSTRUCTION

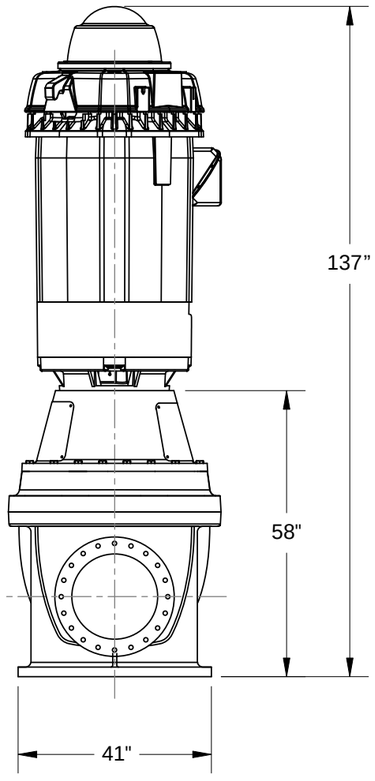
1. SOAR ILT16 TURBINE-GENERATOR
2. 16” INLET PIPE
3. AUTOMATIC FAILSAFE SHUTOFF VALVE
4. DISMANTLING JOINT
5. ISOLATION VALVE
6. 16” DISCHARGE PIPE



1 - **ELEVATION VIEW**
SCALE: 1/2” = 1’

2 - **ORTHOGRAPHIC VIEWS**
SCALE: 3/8” = 1’





Canyon Hydro

WWW.SOARHYDRO.COM
WWW.CANYONHYDRO.COM

Phone 1(360)592-2234
Fax 1(360)592-2235

5500 BLUE HERON LN
DEMING, WA 98244 USA

REVISIONS

NO.	DATE	BY
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THIRD ANGLE PROJECTION

SCALE = SHOWN

DO NOT SCALE		SIGNATURES ON FILE
DRAWN	RSM	7/20/2017
CHECKED	-	-

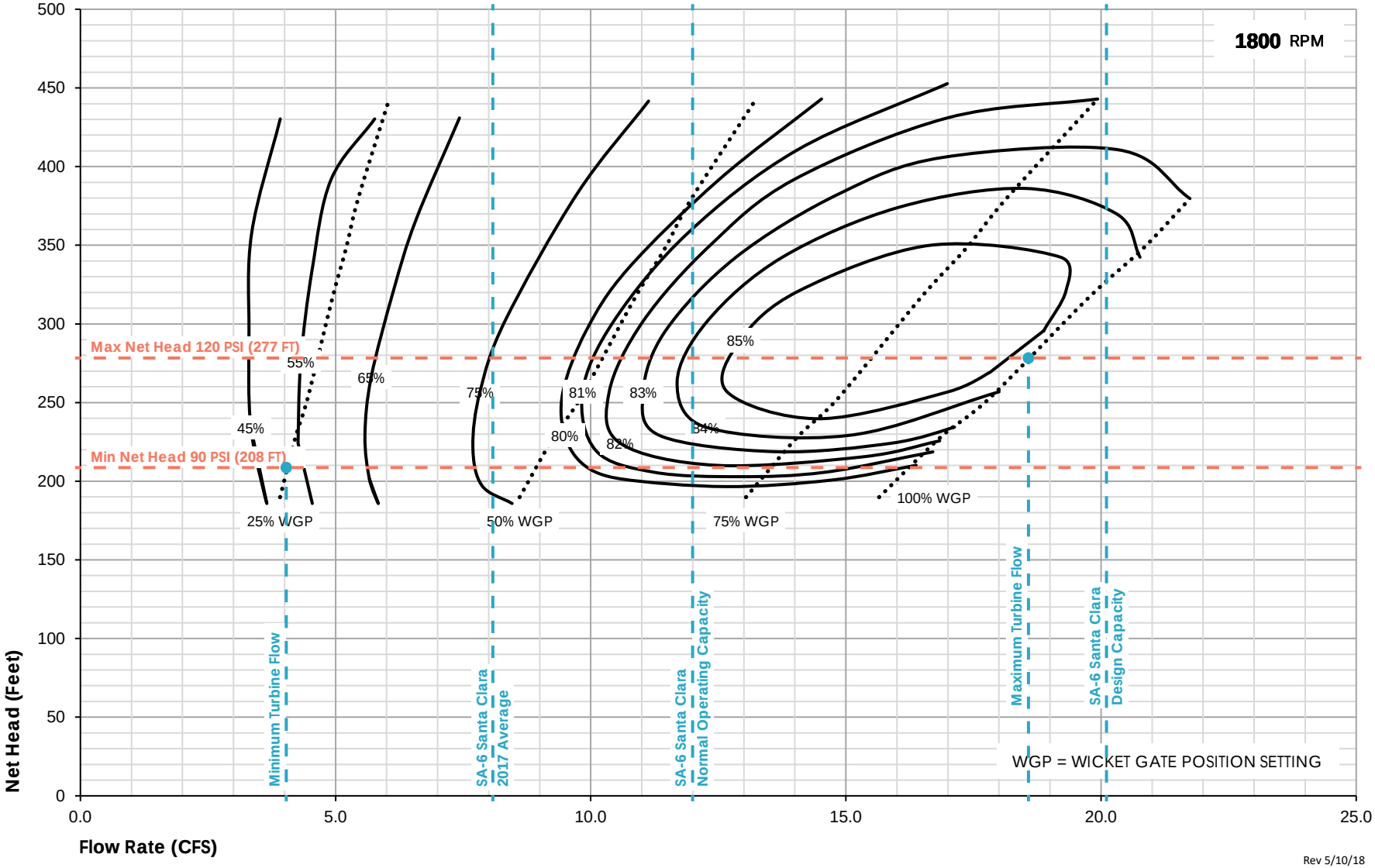
SOAR ILT16, 500 HP 1800 RPM
Turbine-Generator Assembly

ILT16 TURBINE STANDARD INSTALLATION DRAWING

SIZE	DRAWING NO.	SHEET	REV
B	170720-500	1 OF 1	A

ILT16-33-11.25

In-Line Turbine Performance Chart



Rev 5/10/18


Canyon
Hydro
SOAR

August 17, 2018

Michael KJ Anderson PE, VP
Newcomb | Anderson | McCormick
201 Mission Street, Suite 2000,
San Francisco, CA 94105

Dear Mr. Anderson,

Thank you for your correspondence regarding the hydroelectric projects you are evaluating in California at the SA-1 Bristol and SA-3 McFadden locations. We appreciate the opportunity to work with you to offer the best possible Canyon Hydro equipment package for this site and application.

Based on your correspondence we are offering an equipment package utilizing an In-Line Turbine optimized to pass 8.0 CFS at 90-120 PSI net head. Under these conditions maximum expected system production will be 145 kW using the equipment package described below. The turbine will pass your full specified design capacity of 10.0 CFS at 120 PSI net head with an expected maximum output of 183kW.

(1) Soar ILT12-33-9.0 Variable Flow Hydro Turbine, 1800 RPM, adjustable wicket gates
(1) US Motors Vertical Shaft, 250 HP, 1800 rpm, 480 VAC, 60 Hz, 3 ph., induction generator
(1) 12" Electrically Actuated Turbine Inlet Valve
(1) HPU to support wicket gate actuation with accumulator sized to close wicket gates in the event of power grid failure (fail-safe)
(1) Switchgear and controls panels to parallel the generator with the local electrical utility grid and provide protective relays to utility grid standards for a project of this size. Specific utility requirements may change the scope of the switchgear/controls package offered and pricing may be affected. A one-line diagram and equipment list will be submitted for local electrical utility review and approval prior to proceeding with panel manufacture.

Budget estimate system price, as described…….$261,000.00

The equipment package offered will be custom designed to meet the particular requirements of the site and project as explained through our discussions. As the project progresses and requirements are determined, we will be pleased to refine our budget estimate or offer a firm quotation. Budget estimates are offered for planning purposes only but are typically within 10% of a firm quotation for the same equipment package.

Normal Terms	15% to begin final design 30% to begin manufacture following final design approval 25% mid-project 20% upon notice of readiness to ship 10% upon successful start-up or 90 days from readiness, whichever is first
Normal Delivery	20-28 weeks from design approval and receipt of payments
Delivery FOB	Deming, Washington (crated for shipment)

In addition to equipment supply, Canyon Hydro also offers equipment installation services by our in-house field crews who are highly experienced with the unique requirements of hydroelectric equipment.

Commonly start-up, commissioning and training services are of value following installation. For a project of this type we can typically send a single technician who is capable of covering the mechanical and electrical portions of the equipment package. If start-up, commissioning and training assistance is of interest we suggest budgeting $8,000-$10,000 for a qualified Canyon Hydro technician.

I look forward to working with you to ensure our equipment package meets all the requirements of the site and project. Please contact me as questions arise or as additional project information becomes available.

Sincerely,

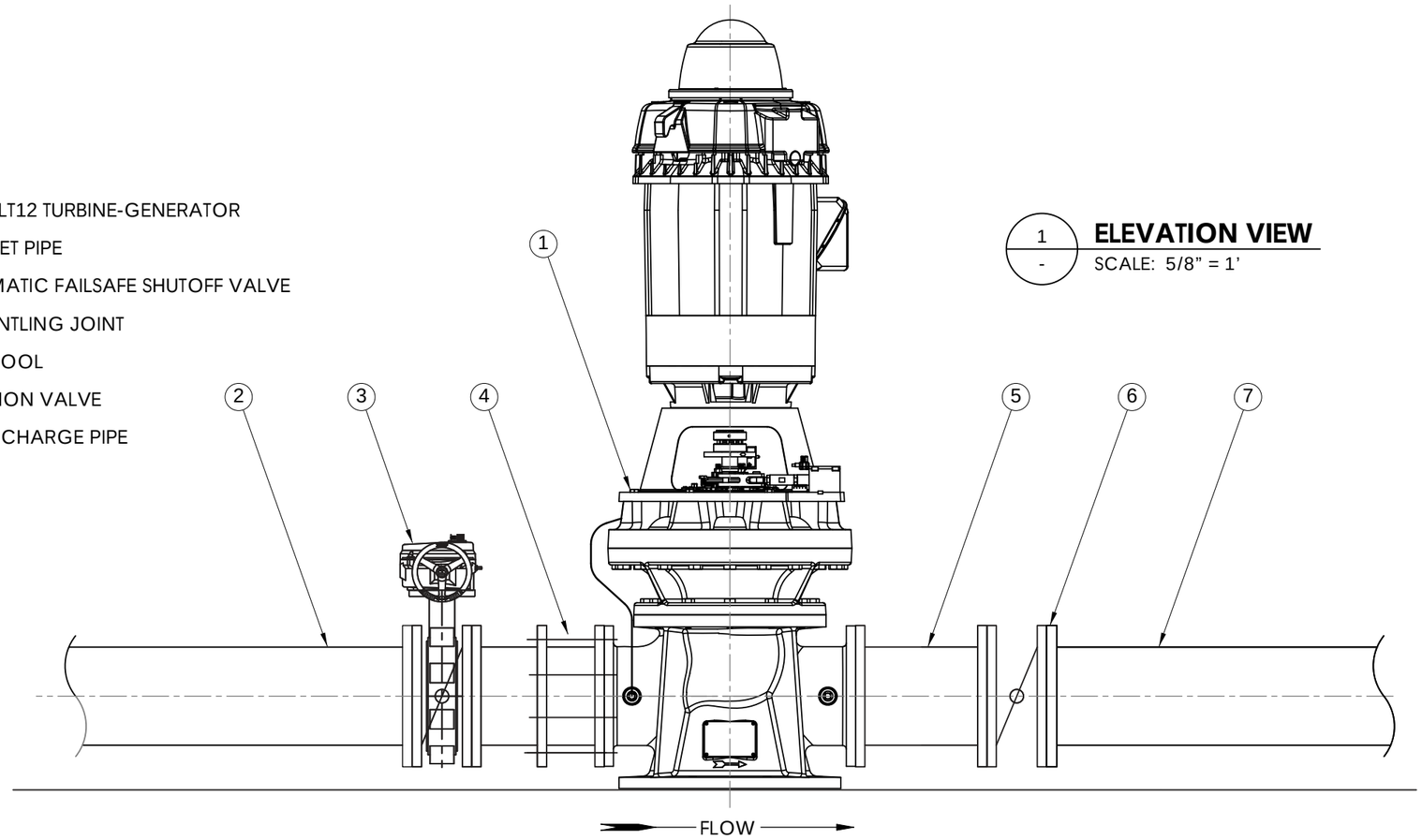
Ryan Maloney

Canyon Hydro– the water power division of Canyon Industries, Inc. • 5500 Blue Heron Lane • P.O. Box 36 • Deming WA 98244
360.592-5552 • Fax: 360.592.2235 • email: turbines@canyonhydro.com • www.canyonhydro.com

STANDARD INSTALLATION
SOAR ILT12 TURBINE-GENERATOR

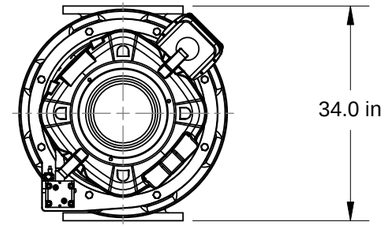
NOT FOR CONSTRUCTION

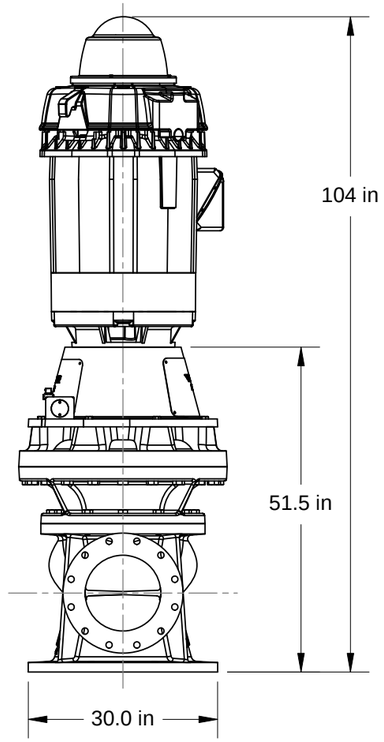
1. SOAR ILT12 TURBINE-GENERATOR
2. 12” INLET PIPE
3. AUTOMATIC FAILSAFE SHUTOFF VALVE
4. DISMANTLING JOINT
5. PIPE SPOOL
6. ISOLATION VALVE
7. 12” DISCHARGE PIPE



1 - **ELEVATION VIEW**
SCALE: 5/8” = 1’

2 - **ORTHOGRAPHIC VIEWS**
SCALE: 1/2” = 1’





Canyon Hydro

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WWW.CANYONHYDRO.COM

Phone 1(360)592-2234
Fax 1(360)592-2235

5500 BLUE HERON LN
DEMING, WA 98244 USA

REVISIONS

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THIRD ANGLE PROJECTION

SCALE = SHOWN

DO NOT SCALE | SIGNATURES ON FILE

DRAWN	RSM	3/16/2018
CHECKED	-	-

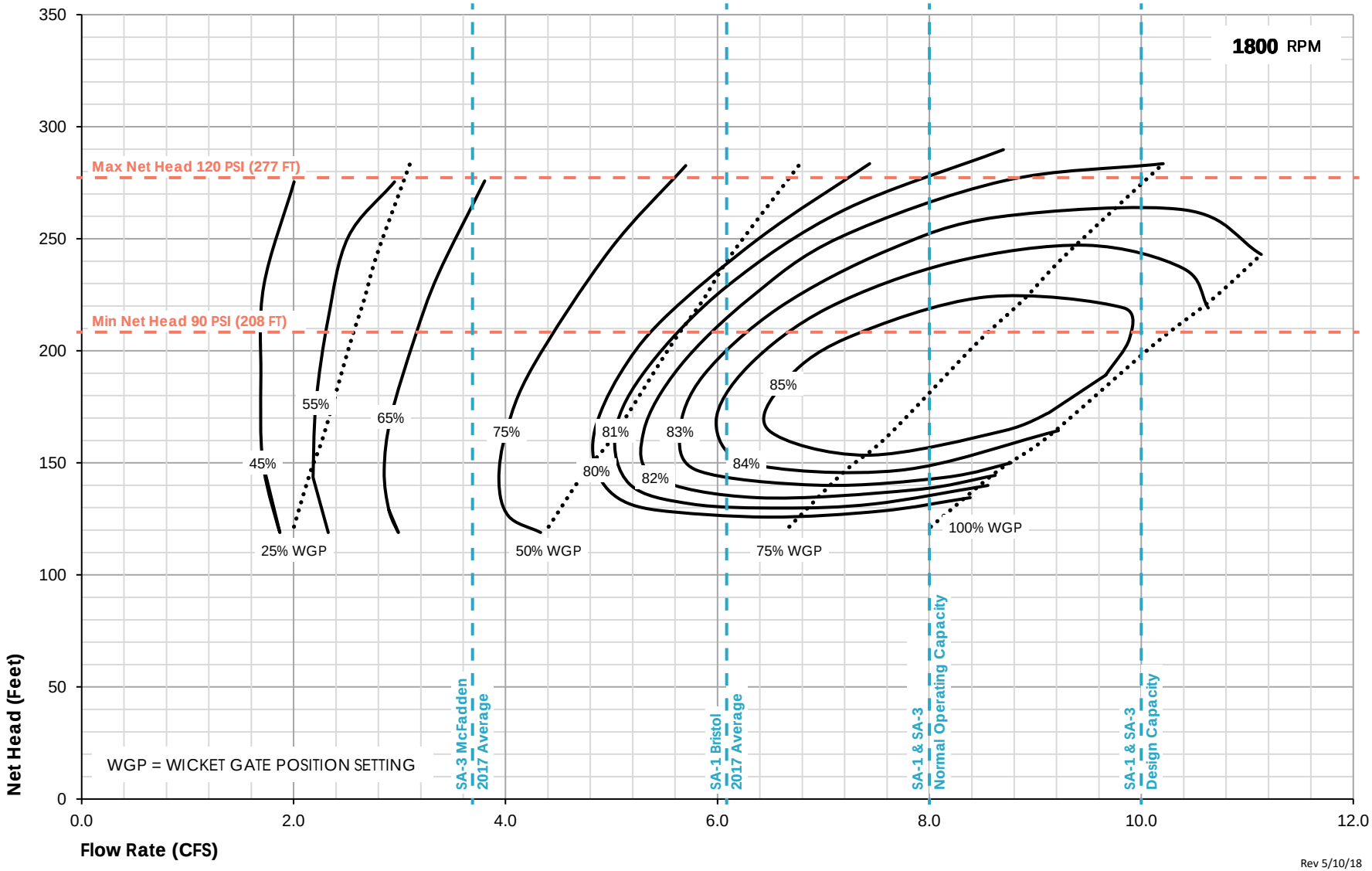
SOAR ILT12 - 250HP
Turbine-Generator Assembly

ILT12 TURBINE STANDARD INSTALLATION DRAWING

SIZE	DRAWING NO.	SHEET	REV
B	170928-250	1 OF 1	A

ILT12-33-9.0

In-Line Turbine Performance Chart



Rev 5/10/18


Canyon Hydro
US MOTORS

GILKES BUDGET OFFER FOR THE SUPPLY OF HYDRO ELECTRIC EQUIPMENT

Client:	Newcomb Anderson McCormick – Michael Anderson
Project Name:	California Pump/Vault Hydroelectric Project
Gilkes Reference No:	DW-MA-CAvault-Nov13-2018
Date:	Tuesday, 13 November 2018

GILKES

HYDROPOWER SYSTEMS

Gilbert Gilkes & Gordon Ltd
Canal Head North, Kendal, Cumbria
LA9 7BZ, England
North American contact details;
Darren Wager - d.wager@gilkes.com
Telephone: +1 604-603-7139

Attn: Michael Anderson

California Pump/Vault Hydroelectric Project

Dear Mike,

Thank you for your interest in the supply of Gilkes equipment. Please find herein our budget offer for the supply of hydroelectric equipment for the above project located in California.

Based on the head and flow data for the two turbines provided in your email of August 21st, 2018, we have arrived at the turbine offerings and project solution detailed in this budget quote.

We have included for a standard electrical controls and switchgear package that would be designed for a 480V system and would terminate at the LV side of the generator switchgear.

As this project develops further, we would be more than happy to provide you with a more comprehensive offer tailored to your specific requirements.

We trust you find this revised budget offer of interest. Should you have any questions or require any further information please do not hesitate to contact me and I will assist accordingly.

Yours Sincerely,

Darren Wager
Sales Director – Gilkes Hydro

Gilbert Gilkes & Gordon Ltd.
Mobile: +1 (253) - 318-0005
Email: d.wager@gilkes.com

The Gilkes Package

A Gilkes equipment package is comprehensive and exclusive of hidden extras;

- All factory assemblies which are stripped down for shipment are witness marked and colour coded to assist on site assembly.
- All major sub-contracted equipment is sourced from established suppliers from our approved supplier list. These sub-contractors have proved to be high quality, reliable suppliers with a technical appreciation and experience of small hydro generation projects.
- Gilkes packing methods are customised to suit the requirements dictated by the project location and access to the project site. Equipment can be packed for long periods of storage.
- Gilkes engineers provide expert on-site installation & commissioning services.
- Operating Manuals are included.
- A Gilkes project team is assigned to engineer the contract from start to finish and customer "single line" contact is organised through a contract engineer.
- The delivery schedule is handled by Gilkes Product Control Department and all sub-contractors are closely monitored to ensure "on time" delivery of all equipment.

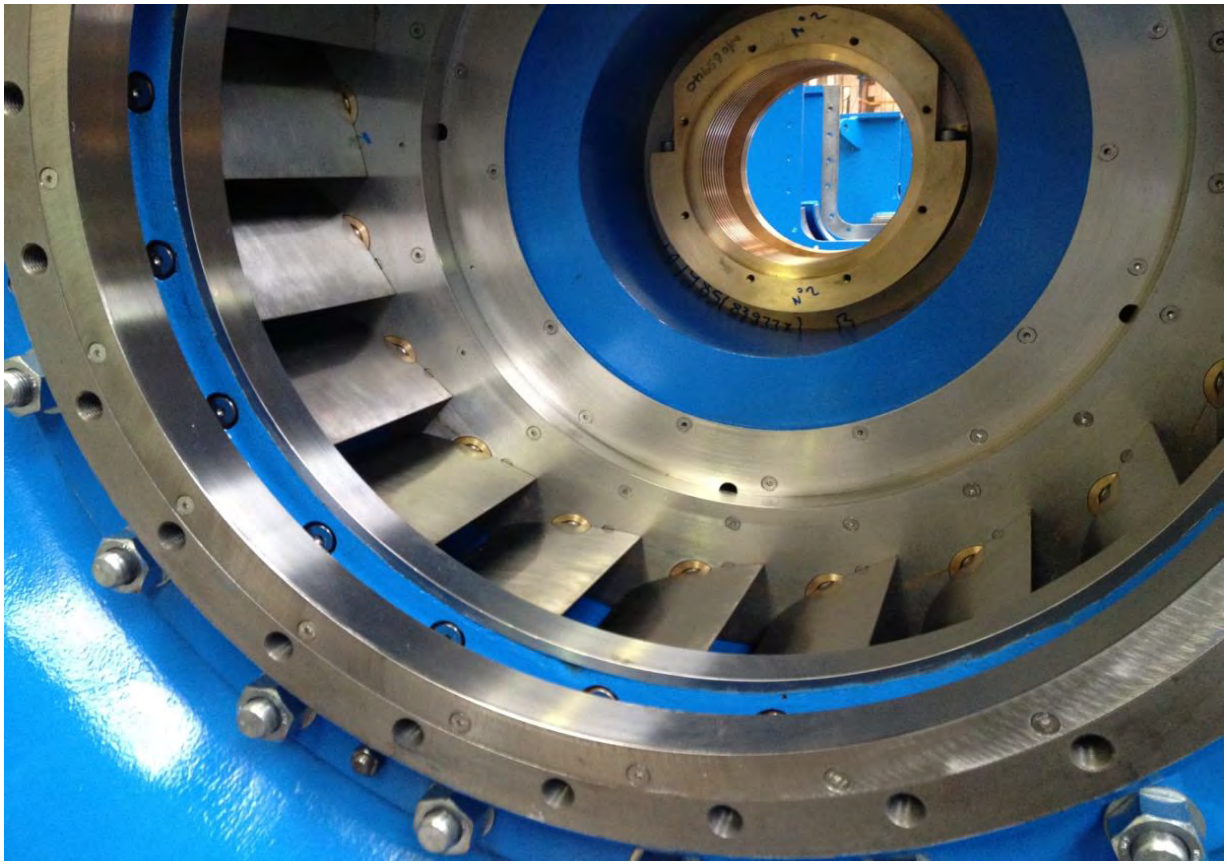
You will note from the above that Gilkes do not only offer a manufacturing service but a complete specialised service comprising of rugged quality equipment along with the experienced technical engineering backup and installation expertise required. We have found from many years' experience that in the long term quality is an important requirement for small hydro plants to ensure optimum reliability and minimum maintenance costs.

Gilkes' Engineering Expertise

Every hydro project supplied by Gilkes is subject to the attentions of a team of highly qualified engineers including a contract manager, degree qualified mechanical engineer, draughtsperson and the sales engineer whom you will be dealing with throughout the tender stage. We believe that this approach ensures that your needs are fully understood by the whole of Gilkes and ensures that

projects proceed smoothly and on time with the minimum of project management and/or engineering design/consultancy services.

In our experience it is always better to design for, rather than close our minds to, possible failure modes. We therefore accept that it is necessary for turbines to reach full run-away speed safely and have generators supplied to us tested at full run-away speed to ensure that no damage will occur. Some suppliers use lower cost generators which will handle 130% or 140% of normal speed and hope to be able to shut their turbines down before the turbine has accelerated to full run-away and accept that if the machine does ever reach full run-away the generator will be damaged. Gilkes experience is that full run-away is usually reached in less than 5 seconds and is therefore extremely difficult to avoid.



Scope of Supply – Turbine #1

1 off	250 G100 Francis turbine fitted with a hydraulic actuator on the guide vanes
1 off	Set of inlet pipework up to the inlet flange of the main inlet valve (including dismantling joint)
1 off	Main inlet valve, butterfly valve, weight to close and hydraulic actuator to open
1 off	60Hz 1200rpm (6 pole), 480V, Induction Generator, with the turbine runner supported on a Gilkes bearing housing connected to the turbine by means of a flexible coupling arrangement
1 off	Electrical controls and switchgear package
1 off	Installation and Commissioning supervision of Gilkes supplied equipment provided upon request

Exclusions

We have not included the following items which are required for our equipment or the project in general:

- Relay protection study (values from the study will be inserted into our relays).
- Secondary injection test at site to prove the results of the protection study.
- Any and all activities related to on-line grid connection with the utility.
- Any and all power and control cabling for main and auxiliary systems.
- Any and all civil works including sealing of cable ducts.
- Any and all crane hire and lifting arrangements.
- Grounding mat.
- Broadband connection/phone line for any remote communication.
- HV switchgear.
- Hydraulic Control Module
- Any and all Building Services.
- Any and all activities related to the head level sensing.
- Any and all physical Installation activities related to the lifting and positioning of the equipment.
- Plant installation and commissioning supervision.
- Performance testing.
- Any and all site set up, facilities and additional site labour.

Extent of Supply

The supply of Gilkes plant terminates at the following points:

- Turbine inlet - at the upstream face of the main inlet valve.
- Turbine discharge – at the draft tube discharge.
- Generator – at the generator terminal connectors.
- Electrical – at the LV of the generator switchgear

Price Schedule – Turbine #1

Item	Qty	Description	Price ($USD Dollars)
1	1	250 G100 Francis Reaction Turbine assembly Including: Case Runner Bearing housing Guide Vanes and Linkages Inlet spool pipe, Outlet Bend and Draft Tube Shims and tools	Included
2	1	Main inlet valve	Included
3	1	Induction generator	Included
4	1	Controls & Switchgear package	Included
5	1	Hydraulic Power Unit	Included
6	0	Installation Supervision of Gilkes supplied equipment available upon request	Not Included
7	0	Commissioning Supervision of Gilkes supplied equipment available upon request	Not Included
		TOTAL BUDGET PRICE – $USD DOLLARS	**$369,455**

All figures are exclusive of local, State, and Federal taxes which will be charged to the customer account where applicable. Import duties and delivery to site is included.

This pricing is indicative only and is based on the information made available to us prior to the date of this offer. None of the prices are fixed or firm and will be subject to further review by Gilkes should you wish to proceed with placing an order.

Please note that this budget offer is not intended to form a legally binding relationship and Gilkes is not bound to accept purchase orders against this proposal.

GILKES

Payment Terms

Unless otherwise agreed, the following representative payment terms apply:-

15 % of total contract price with order

25 % of total contract price on presentation of the following drawings

- General arrangement
- Foundation details to allow civil works to proceed

25 % of total contract price on presentation of runner material certificates.

30 % of total contract price on delivery of equipment to ship to site, or on notification of readiness to ship, if site is unable to receive goods. Storage charge can be applied if delivery is delayed by more than 3 months.

5 % of total contract price due on Completion of Commissioning, or 4 months after delivery to site, or 6 months after notification of readiness to ship, whichever is the sooner.

If Commissioning of Turbine is to be by others then final payment due on shipping.

All payments net 30 Days from date of invoice.

Estimated delivery

We estimate the delivery to site for the equipment offered in our quotation to **48 Working Weeks, DDP Incoterms ® 2010** from receipt of an official order complete with full and final instructions to proceed and on receipt of any initial stage payment.

Deliveries offered are indicative only. Firm delivery periods are dependent upon contract start dates, and are subject to Gilkes' factory work loading and major casting availability at the contract start date.

Contract timescales commence on receipt of an official order complete with full & final instructions to proceed and initial payment. Firm delivery periods will be reviewed at time of order.

General Contract Terms & Conditions

Available on request

Technical Data – Turbine #1

The technical data given in this quotation, unless specifically guaranteed, will be subject to confirmation in the event of an order.

Model	:	250 G100 Francis Turbine
No. of Units	:	1
Mean Diameter of Runner	:	250 mm
Rated Speed	:	1200 rpm
Maximum Overspeed	:	2220 rpm
Maximum continuous overspeed period	:	2 minutes in any 24-hour period
Runner material	:	CA6NM or equivalent Stainless steel
Shaft orientation	:	Horizontal
Mechanical shaft power at 244.5ft Net Head and 8cfs Flow	:	147 kW
Turbine efficiency at 244.5ft Net Head and 8cfs Flow	:	88.5%

Performance Curve

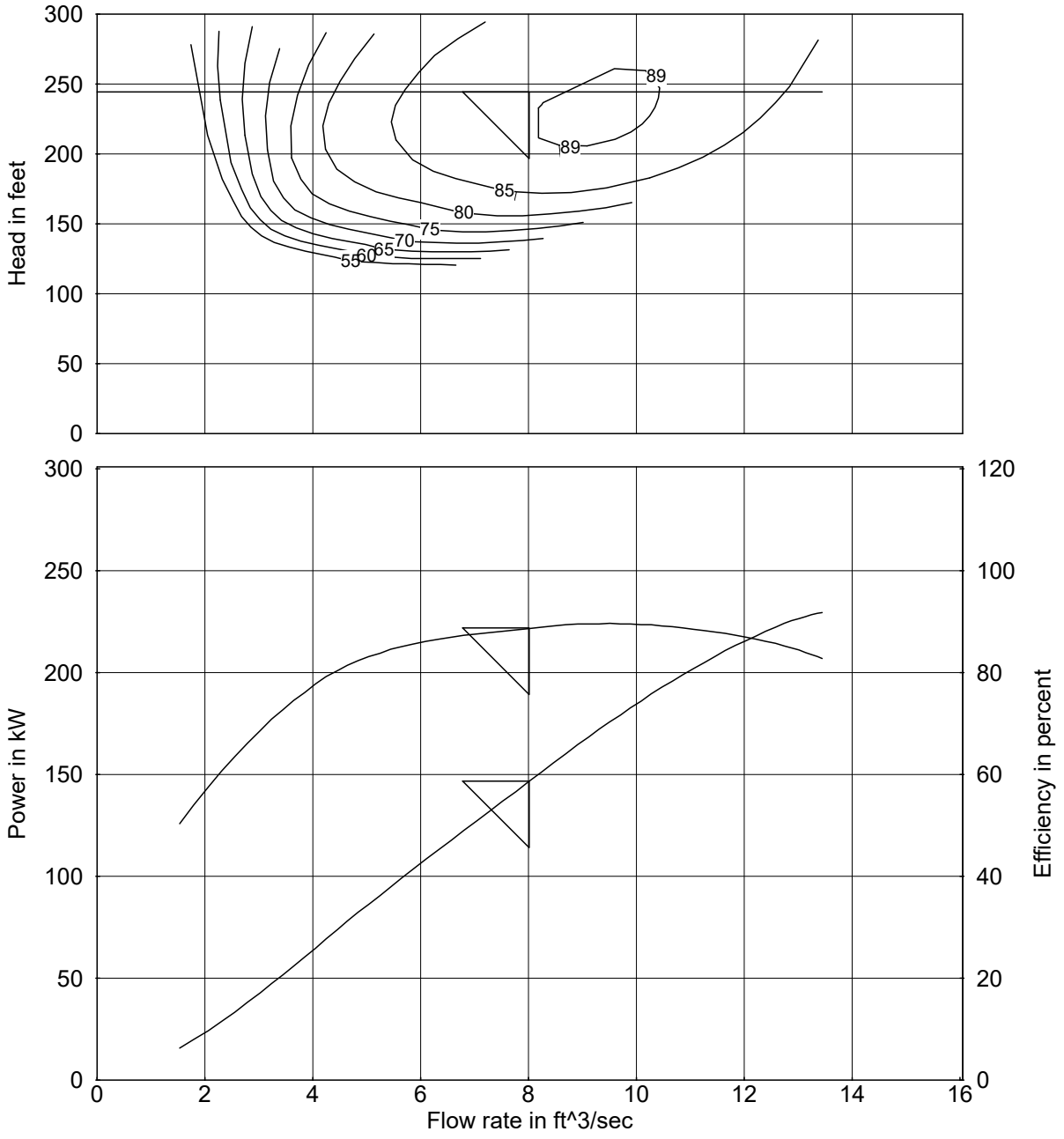
The following performance and efficiency curve are representative of your project's hydraulic conditions and is depicts the turbine's mechanical power (kW) and efficiency (%) as a function of head (ft) and flow (cfs).

GILKES

Francis Turbine

250 G100

Speed 1200 Rpm



Name	Head feet	Flow rate ft^3/sec	Power kW	Efficiency percent	Vent mm
New Duty	244.5	8	147	88.5	13.6

Gilbert Gilkes and Gordon Ltd
Kendal, Cumbria, UK. LA9 7BZ
Tel: 01539 720028 Fax: 01539 732110

Approved

13/11/18

CA Vault

Version Number 20

Scope of Supply – Turbine #1

1 off	250 G100 Francis turbine fitted with a hydraulic actuator on the guide vanes
1 off	Set of inlet pipework up to the inlet flange of the main inlet valve (including dismantling joint)
1 off	Main inlet valve, butterfly valve, weight to close and hydraulic actuator to open
1 off	60Hz 1200rpm (6 pole), 480V, Induction Generator, with the turbine runner supported on a Gilkes bearing housing connected to the turbine by means of a flexible coupling arrangement
1 off	Electrical controls and switchgear package
1 off	Installation and Commissioning supervision of Gilkes supplied equipment provided upon request

Exclusions

We have not included the following items which are required for our equipment or the project in general:

- Relay protection study (values from the study will be inserted into our relays).
- Secondary injection test at site to prove the results of the protection study.
- Any and all activities related to on-line grid connection with the utility.
- Any and all power and control cabling for main and auxiliary systems.
- Any and all civil works including sealing of cable ducts.
- Any and all crane hire and lifting arrangements.
- Grounding mat.
- Broadband connection/phone line for any remote communication.
- HV switchgear.
- Hydraulic Control Module
- Any and all Building Services.
- Any and all activities related to the head level sensing.
- Any and all physical Installation activities related to the lifting and positioning of the equipment.
- Plant installation and commissioning supervision.
- Performance testing.
- Any and all site set up, facilities and additional site labour.

Extent of Supply

The supply of Gilkes plant terminates at the following points:

- Turbine inlet - at the upstream face of the main inlet valve.
- Turbine discharge – at the draft tube discharge.
- Generator – at the generator terminal connectors.
- Electrical – at the LV of the generator switchgear

Price Schedule – Turbine #2

Item	Qty	Description	Price ($USD Dollars)
1	1	300 G100 Francis Reaction Turbine assembly Case Runner Bearing housing Including: Guide Vanes and Linkages Inlet spool pipe, Outlet Bend and Draft Tube Shims and tools	Included
2	1	Main inlet valve	Included
3	1	Induction generator	Included
4	1	Controls & Switchgear package	Included
5	1	Hydraulic Power Unit	Included
6	0	Installation Supervision of Gilkes supplied equipment available upon request	Not Included
7	0	Commissioning Supervision of Gilkes supplied equipment available upon request	Not Included
		TOTAL BUDGET PRICE – $USD DOLLARS	**$398,919**

All figures are exclusive of local, State, and Federal taxes which will be charged to the customer account where applicable. Import duties and delivery to site is included.

This pricing is indicative only and is based on the information made available to us prior to the date of this offer. None of the prices are fixed or firm and will be subject to further review by Gilkes should you wish to proceed with placing an order.

Please note that this budget offer is not intended to form a legally binding relationship and Gilkes is not bound to accept purchase orders against this proposal.

GILKES

Payment Terms

Unless otherwise agreed, the following representative payment terms apply:-

15 % of total contract price with order

25 % of total contract price on presentation of the following drawings

- General arrangement
- Foundation details to allow civil works to proceed

25 % of total contract price on presentation of runner material certificates.

30 % of total contract price on delivery of equipment to ship to site, or on notification of readiness to ship, if site is unable to receive goods. Storage charge can be applied if delivery is delayed by more than 3 months.

5 % of total contract price due on Completion of Commissioning, or 4 months after delivery to site, or 6 months after notification of readiness to ship, whichever is the sooner.

If Commissioning of Turbine is to be by others then final payment due on shipping.

All payments net 30 Days from date of invoice.

Estimated delivery

We estimate the delivery to site for the equipment offered in our quotation to **48 Working Weeks, DDP Incoterms ® 2010** from receipt of an official order complete with full and final instructions to proceed and on receipt of any initial stage payment.

Deliveries offered are indicative only. Firm delivery periods are dependent upon contract start dates, and are subject to Gilkes' factory work loading and major casting availability at the contract start date.

Contract timescales commence on receipt of an official order complete with full & final instructions to proceed and initial payment. Firm delivery periods will be reviewed at time of order.

General Contract Terms & Conditions

Available on request

Technical Data – Turbine #2

The technical data given in this quotation, unless specifically guaranteed, will be subject to confirmation in the event of an order.

Model	:	300 G100 Francis Turbine
No. of Units	:	1
Mean Diameter of Runner	:	300 mm
Rated Speed	:	1200 rpm
Maximum Overspeed	:	2220 rpm
Maximum continuous overspeed period	:	2 minutes in any 24-hour period
Runner material	:	CA6NM or equivalent Stainless steel
Shaft orientation	:	Horizontal
Mechanical shaft power at 244.5ft Net Head and 8cfs Flow	:	162 kW
Turbine efficiency at 244.5ft Net Head and 8cfs Flow	:	89.9%

Performance Curve

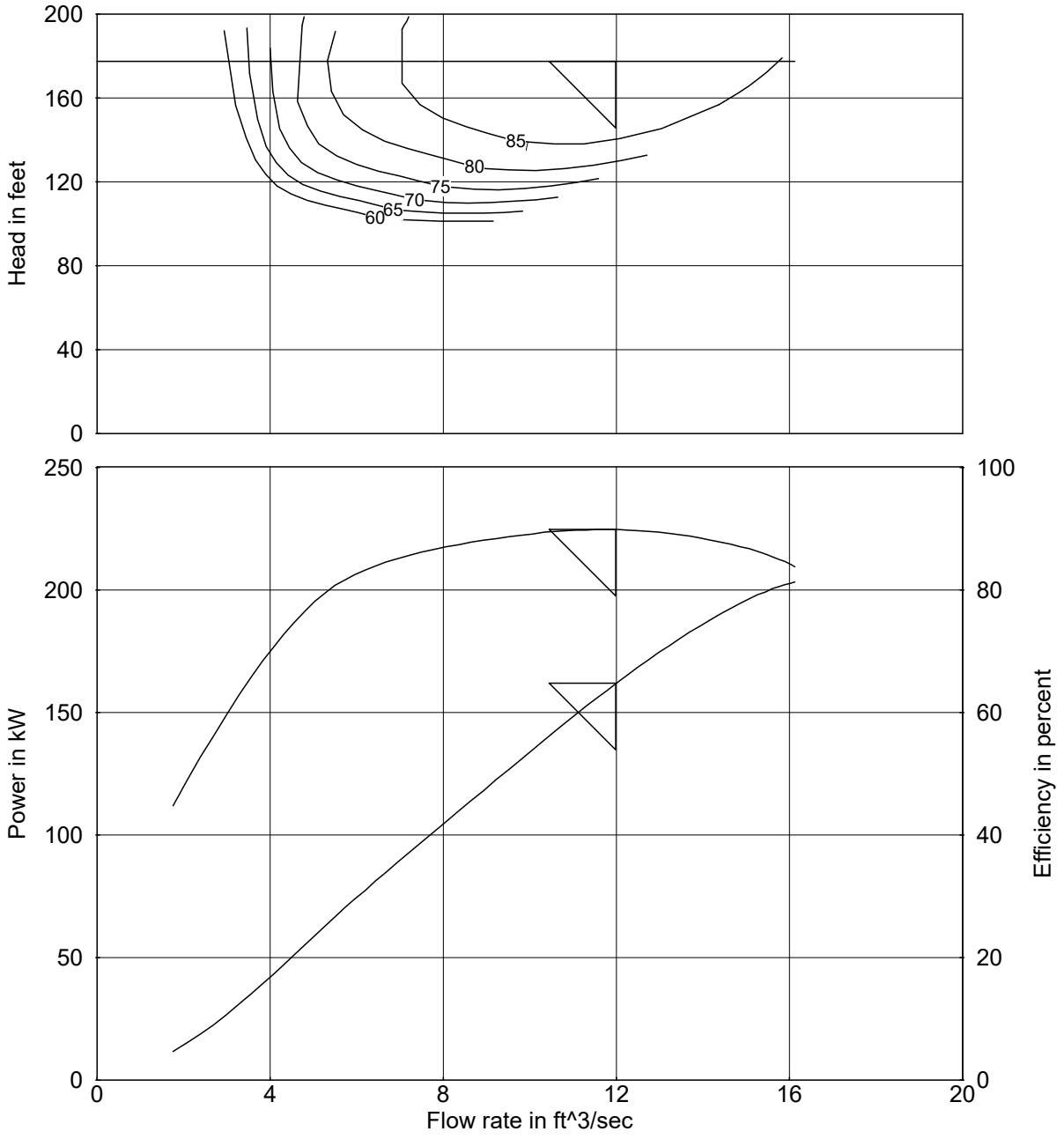
The following performance and efficiency curve are representative of your project's hydraulic conditions and is depicts the turbine's mechanical power (kW) and efficiency (%) as a function of head (ft) and flow (cfs).

GILKES

Francis Turbine

300 G100

Speed 900 Rpm



Name	Head feet	Flow rate ft^3/sec	Power kW	Efficiency percent	Vent mm
New Duty	177.6	12	162	89.9	20.9

Gilbert Gilkes and Gordon Ltd
Kendal, Cumbria, UK. LA9 7BZ
Tel: 01539 720028 Fax: 01539 732110

Approved

13/11/18

CA Vault

Version Number 20

Turbine Description & Material Specification

Runner	:	Material 13/4 Chrome Steel to BSEN10293: 2005 or ASTM A743 CA6NM Single casting, part machined, with hand finished blades. The runner blade profile will be finished using templates to meet the current IEC standards. Dynamic balancing specified to G6.3. OR 13/4 Chrome Steel to BS 3100 425 C1; ASTM 473 S41500; A743 CA6N; EN 1.4313 or similar. The runner will be machined from solid forgings and fabricated construction: CNC machined from a fully heat treated forged disc with hand polished buckets. The runner skirt and crown will have adequate metal thickness for machining to facilitate the fitting of loose wear rings should this ever be necessary.

GILKES

		Fixing to the generator shaft will be by keyway, flange connection or hydraulic locking device.
Spiral Case	:	Material Ductile Spheroidal Graphite Cast Iron to BSEN1563 Gr: 450/10 Single casting with horizontal inlet. The casting will be complete with hand hole covers, drain outlet, manual valves and all necessary joints, tappings, pipework, brackets and foundation bolts.
Top & Bottom Covers	:	Material: Ductile Iron ASTM A536 GR 60-45-10 Fitted with self-lubricating bearings for the guide vane shafts. The operating ring cylindrical extension piece will be fitted with a bearing liner in cast leaded gun metal to BS EN1982 CC491K.
Chamber facings / Cheek Plates	:	Material – Stainless Steel to BSEN10293: 2005 or ASTM A743 CA6NM or C95xxx Aluminum Bronze Replaceable wearing chamber facing plates, secured to the turbine top and bottom covers by counter sunk screws. The covers will be fully machined, and fitted with loose stainless steel wear rings and facing plates.
Main Shaft Seal (overhung design)	:	Proprietary throttle bush and labyrinth incorporating catchment chamber and pipe.
Guide Vanes	:	Material 13/4 Chrome Steel to BSEN10293: 2005 or ASTM A743 CA6NM Single casting with fully machined spindles, part hand finished blades. The spindles extend through the inlet cover through bronze bushes which are self-lubricated by graphite filled spiral grooves requiring no additional external lubrication. 'O' ring seals prevent any leakage between the spindles and bushes. A PTFE thrust bearing is incorporated for each guide vane. The guide vane levers will be connected to the guide vane by clamping their split bosses on the guide vane drive spindle. This will provide a friction hold to permit slip should a guide vane become

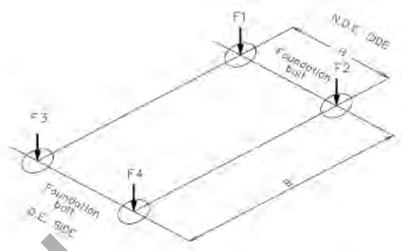
		jammed by debris. The guide vane levers and spindles are match marked to permit easy resetting should the mechanism be disturbed. The guide vane levers are regulated by the operating ring via an individual link mechanism regulates the guide vane levers. All moving pins are carried in renewable self-lubricating bronze bushes.
Guide vane Operating Ring	:	Material Fabricated Carbon Steel Plate to BSEN 10025 Gr S275 JR The operating ring will be connected to the turbine guide vane mechanism and operated by an Electric or Hydraulic actuator.
Guide vane Operator	:	The guide vane operator will regulate water flow The operator will be fitted with: - a) End of travel and intermediate limit switches. b) Linear variable displacement transducer.
Inlet Pipe	:	Material Fabricated Carbon Steel to BSEN 10025 Gr S275 JR. The inlet pipe will be flange connected to the turbine case. The plain upstream end will be machined for connection to a flanged dismantling joint, (included in our supply). The inlet pipe will be supplied with 1 off pressure transducer and dial type pressure gauge.
Outlet Bend	:	Material Ductile Spheroidal Graphite Cast Iron to BS 1563 450/10
Draft Tube	:	Fabricated Carbon Steel Plate to BS EN 10025:1993 S275 Tapered pipe with flange suitable for connection to turbine discharge.
Dismantling Joint	:	A Viking Johnson flanged dismantling joint is included. The dismantling joint will be located between the turbine inlet pipe and the main inlet valve to assist alignment and disassembly of the turbine inlet pipework for maintenance purposes.
Foundation Bolts	:	All necessary foundation bolts plus a generous supply of packing pieces for installation setting up purposes are included.
Painting	:	All Components were required will be painted in accordance with Gilkes current standard Paint system.

Example Drawings

The following example drawings show the typical layout of a similar sized Gilkes Francis Turbine. Please note these drawings are intended for information purposes only and should not to be relied upon for construction.

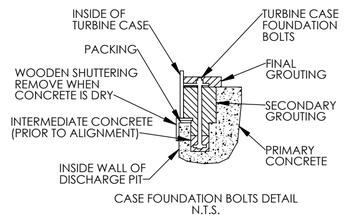
REVISIONS			
REV.	DESCRIPTION	DATE	SIGN
1	ISSUED FOR MANUFACTURE	25/02/2016	GD
2	MIV ROTATED THROUGH 90° AT CUSTOMER REQUEST	29/06/2016	GD

IF IN DOUBT - PLEASE ASK

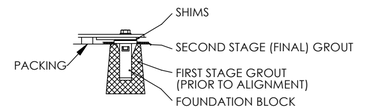


H=	508	mm
B=	457	mm
ROTATION:		CW

Foundation total loads table	F1 (kN)	F2 (kN)	F3 (kN)	F4 (kN)
Loads at full load torque	1,3	3,0	1,3	3,0
Loads at maximum torque	-5,3	9,5	-5,3	9,6



CASE FOUNDATION BOLTS DETAIL
N.T.S.



DETAIL OF GENERATOR FOUNDATIONS
NOT TO SCALE

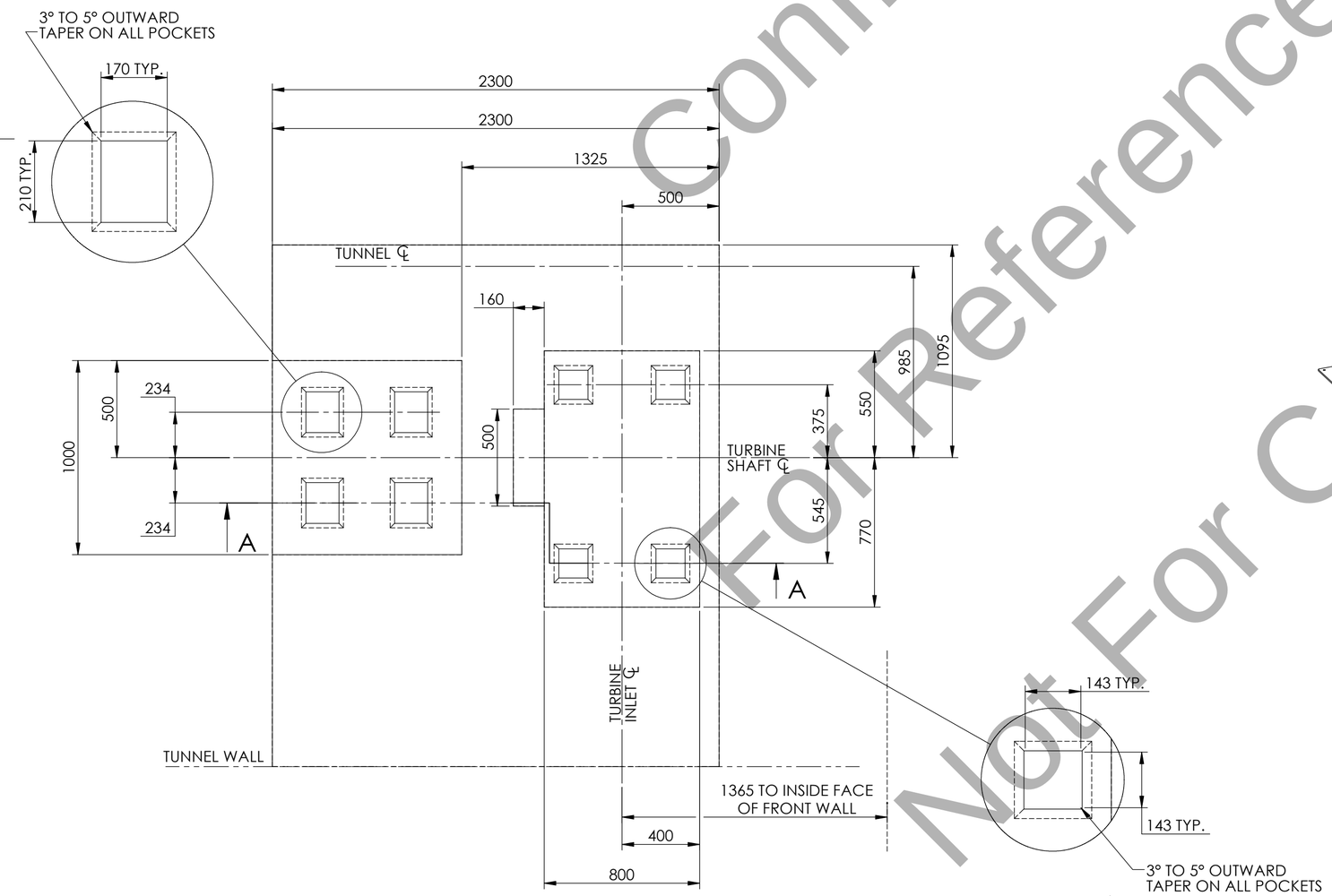
GENERATOR TO BE LOWERED INTO POSTION WITH FOUNDATION BLOCKS FITTED AND A MINIMUM 6MM SHIM. AFTER PRELIMINARY ALIGNMENT FIRST STAGE GROUT POURED TO APPROXIMATE LEVEL SHOWN. WHEN GROUT HAS SET ALIGNMENT CAN THEN BE CARRIED OUT. GENERATOR IS THEN FINALLY POSITIONED AND SECOND STAGE (FINAL) GROUT CAN BE POURED.

NOTE:

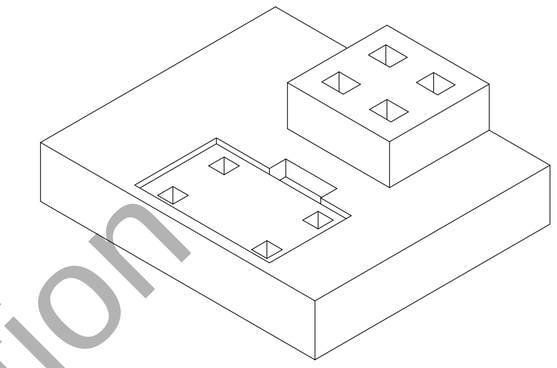
FIRST STAGE GROUT TO BE CONBEXTRA EPR OR EQUIVALENT

SECOND STAGE (FINAL) GROUT TO BE HIGH STRENGTH NON-SHRINK GROUT, SUCH AS CONBEXTRA HF OR EQUIVALENT

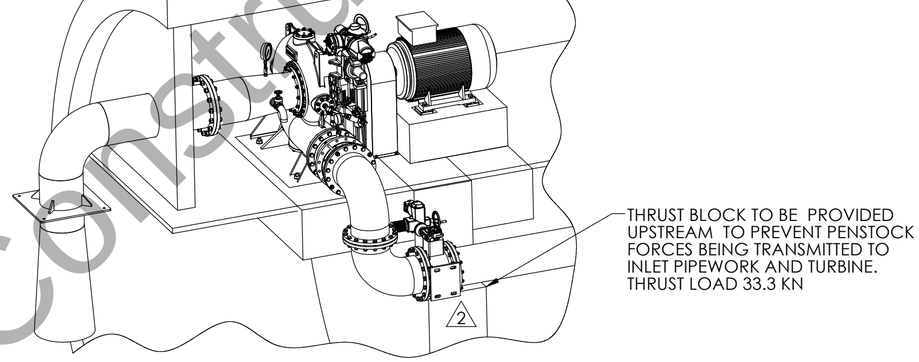
ALTERNATIVELY CONBEXTRA EPR CAN BE USED THROUGHOUT



SECTION A-A



PICTORIAL VIEW OF FOUNDATION BLOCK
NOT TO SCALE



PICTORIAL VIEW SHOWING FOUNDATION BLOCK
WITH TURBINE, GENERATOR AND EXISTING STRUCTURE
TUNNEL SECTIONED ON VERTICAL CENTRE LINE
NOT TO SCALE

UNLESS OTHERWISE SPECIFIED ALL LINEAR, ANGULAR AND GEOMETRIC TOLERANCES TO BS EN 22768-mK THREAD TOLERANCES TO BE 6g/6H
MACHINE AT ∇
FINISH IN µm
DIMENSION IN mm.
REMOVE SHARP CORNERS

	NAME	DATE
DRAWN	G.Dixon	22/02/2016
CHECKED	J.Fothergill	24/02/2016
APP (ENG)	H.Parsons	25/02/2016

FIRST ANGLE PROJECTION

GILKES
© GILBERT GILKES & GORDON LTD

ORIGINAL SALES ORDER NUMBER: 200142
ORIGINAL TURBINE NUMBER: 56774
SOURCE DRAWING: N/A
CASTING/MATERIAL NUMBER: N/A
PATTERN NUMBER: N/A
MATERIAL: CONCRETE

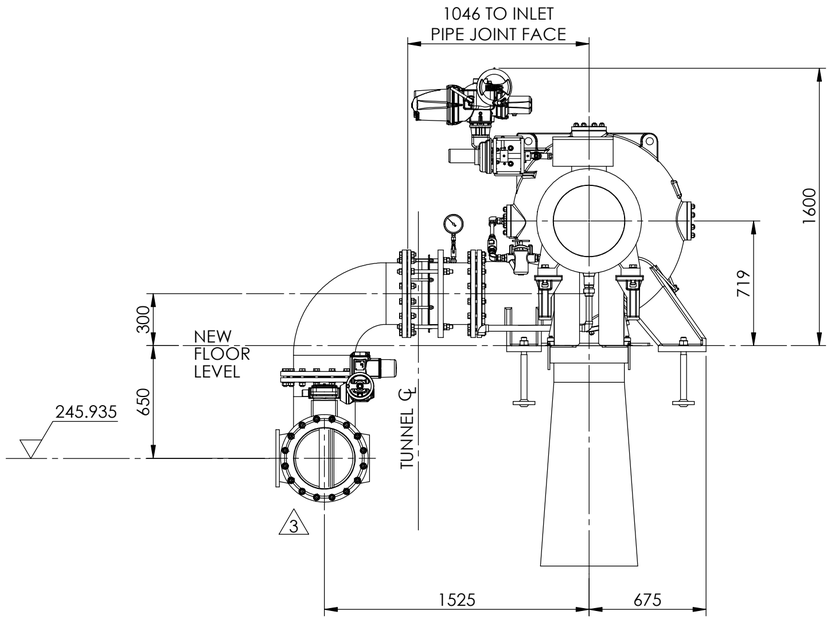
TITLE:
FOUNDATIONS Ø300 G190 FRANCIS TURBINE

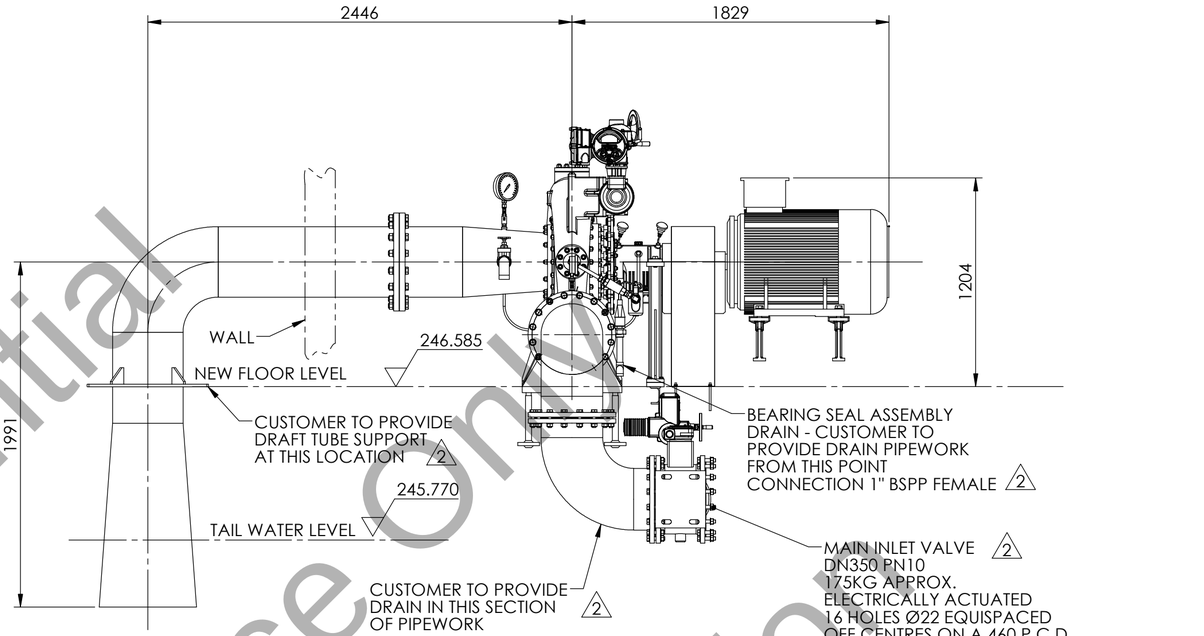
DWG NO. 161818
REVISION 2

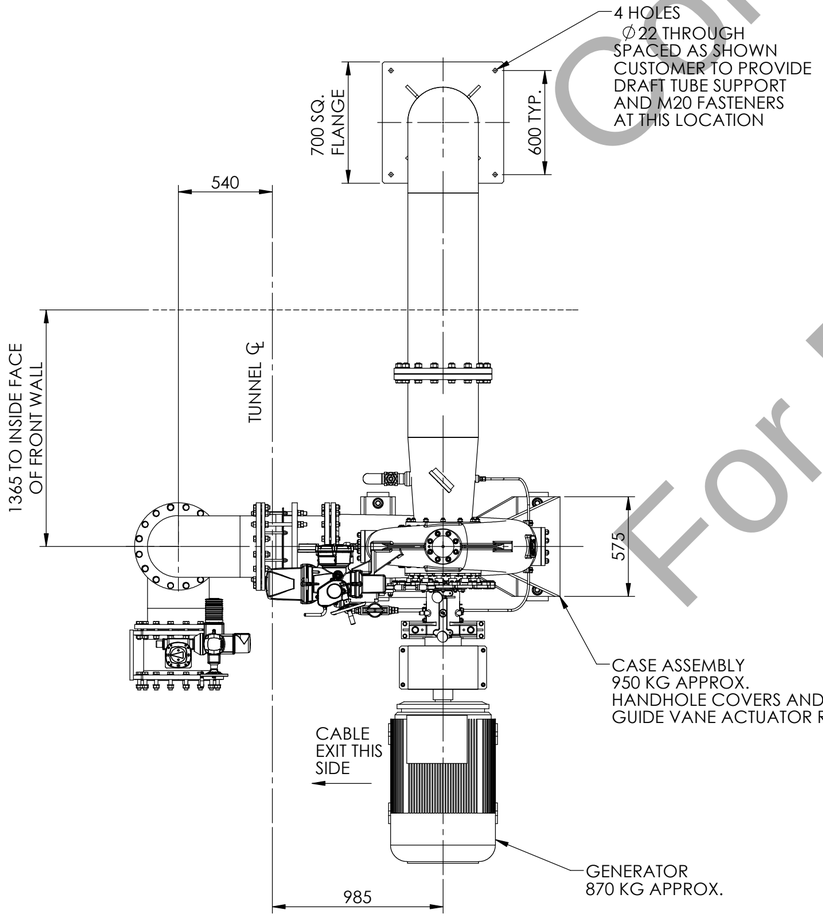
WEIGHT: N/A | DO NOT SCALE DRAWING | SCALE 1:20 | SHEET 1 OF 1 | A2

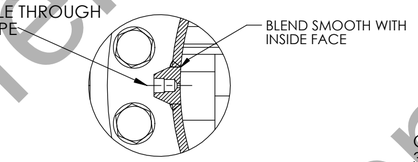
IF IN DOUBT - PLEASE ASK

REVISIONS			
REV.	DESCRIPTION	DATE	SIGN
1	ISSUED FOR MANUFACTURE	25/02/2016	GD
2	DRAFT TUBE NOW IN SECTIONS. DRAFT TUBE OVERALL LENGTH CORRECTED. DRAIN AND DRAFT TUBE SUPPORT NOTES ADDED. MAIN INLET VALVE DETAIL CONFIRMED. GUIDE VANE ACTUATOR DESIGN CONFIRMED.	13/04/2016	GD
3	MAIN INLET VALVE ROTATED THROUGH 90° AT CUSTOMER REQUEST	29/06/2016	GD

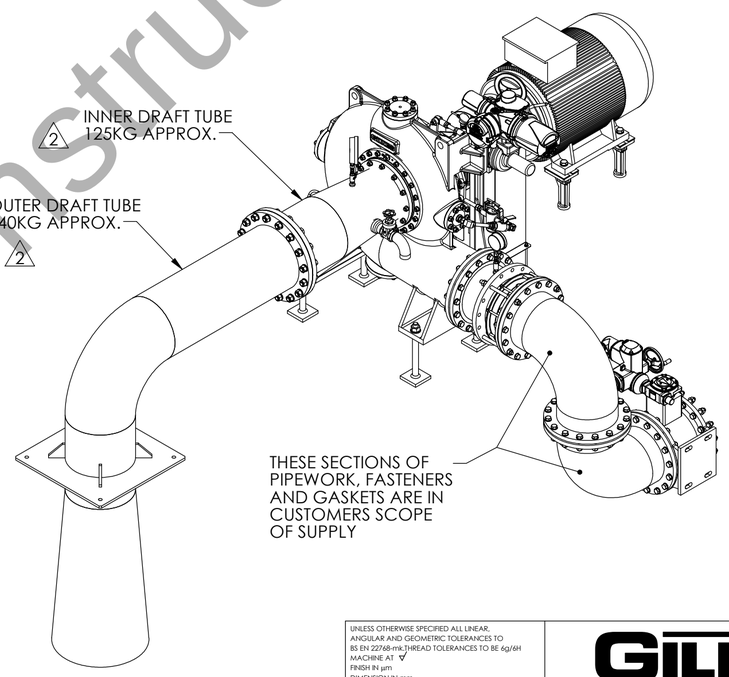


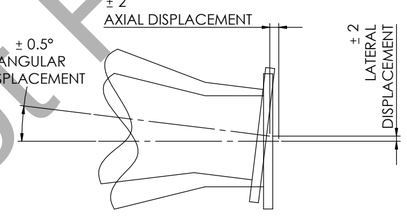






DETAIL OF THREADED OUTLET
REQUIRED IN CUSTOMER'S INLET PIPE
FOR PRESSURE TRANSDUCER





SCRAP VIEW SHOWING ACCEPTABLE LIMITS
FOR POSITION OF CUSTOMERS INLET PIPEWORK

UNLESS OTHERWISE SPECIFIED ALL LINEAR, ANGULAR AND GEOMETRIC TOLERANCES TO BS EN 22768-mK.THREAD TOLERANCES TO BE 6g/6H
MACHINE AT ∇
FINISH IN µm
DIMENSION IN mm.
REMOVE SHARP CORNERS

	NAME	DATE
DRAWN	G.Dixon	23/02/2016
CHECKED	J.Fothergill	24/02/2016
APP (ENG)	H.Parsons	25/02/2016

FIRST ANGLE PROJECTION

GILKES
© GILBERT GILKES & GORDON LTD

ORIGINAL SALES ORDER NUMBER: 200142
ORIGINAL TURBINE NUMBER: 56774
SOURCE DRAWING: N/A
CASTING/MATERIAL NUMBER: N/A
PATTERN NUMBER: N/A
MATERIAL: N/A

TITLE:
GENERAL ARRANGEMENT Ø300 G190 FRANCIS TURBINE

DWG NO. 161819
REVISION 3

WEIGHT: 4417.0 kg | DO NOT SCALE DRAWING | SCALE 1:25 | SHEET 1 OF 1 | A2

APPENDIX E
PLANT OPERATING RECORDS

City of Santa Ana Public Works Agency
Water Resources Division Production and Control Section
SA-1 Generator Panel Readings

date	Kwatts	voltage			amperage			Inlet pressure	r.p.m.	Generator hours	Operator initials	
		One-two	Two-three	Three-one	one	two	three					
12/08	O/S	~	~	~	~	~	~	170	-	12873.5	M	
7-27	65	490	490	490	150	150	150	158	1806	12873.7	RH	
8-4	110	500	500	500	165	160	165	162/152	1807	13069.4	DK	
8-6-4	104	500	500	500	160	150	150	152	1806	13110.0		8.45
8-12-4	106	500	500	500	160	150	155	158	1806	13256.0	D	8.35 ofc
8-18	130	495	495	500	175	170	175	168	1809	13401.5	DK MWD	7.9 8.3
8-25-4	132	497	498	500	177	170	175	172	1809	13571.2	DK	P.4 ofc
8-30-4	136	500	494	500	178	170	175	174	1809	13691.2		
9-9	136	495	495	500	180	168	178	178	1809	13931.6	M	
9-21	140	500	500	~500+	170	165	170	170	1808	14216.7	DK	8.2
9-29	136	500	500	500	160	150	150	156	1810	14414.1	M	MWD 7.85
10-5	138	500	500	500+	170	165	175	172	1807	14547.8	RH	
10/13	140	500	500	500	175	175	175	168	1808	14740.4	RH	
10/22	150	500	500	500	180	175	185	180	1810	14957.9	RH	
10/27	150	500	500	505	185	178	185	190	1810	15078.6	RH	
11-8-4	132	510	508	511	168	160	168	168	1808	15364.7	D	
11-14-4	136	510	508	510	170	163	168	167	1808	15530.2	D	8.2 ofc
11-22-4	145	508	508	512	182	170	180	180	1809	15703.0	DK	
12-3-4	155	510	510	511	185	180	185	179	1810	15964.2	DK	
12-8	164	500	505	510	195	182	188	186	1811	16086.4	M	
12-17	142	505	505	510	175	168	172	168	1808	16303.9	M	
12-21	148	505	500	505	182	170	180	180	1809	16435.8	M	
12-28	150	505	505	505	180	175	180	178	1810	16567.8	M	
1-4	164	500	500	505	190	182	190	190	1811	16734	RH	
1-12	158	500	505	505	195	182	190	188	1809	16924.4	RH	
1-20	164	510	510	510	195	190	198	190	1810	17119.9	RH	
1-26	165	505	505	505	195	190	198	190	1810	17263	RH	
2/3	155	505	505	510	190	180	190	180	1809.7	17454	RH	
2/7/15	153	505	510	512	185	177	185	185	1809	17551.5	D	8.1
2/11/15	155	505	505	508	185	175	185	190	1810	17815.6	D	8.4 ofc
2/23/15	154	503	503	508	191	183	185	198	1811	17932.0	D	8.6 ofc
3/4/15	152	505	503	506	185	175	182	185	1810	18079.7	D	
3/8/15	C	O	N	N	E	C	T	1	J	N	OFF	M
3/14/15	165	505	505	505	190	185	190	190	1811	18147.5	M	
3-23	156	500	505	505	185	180	185	188	1809	18365.4	M	
4-1	150	500	505	505	190	185	190	190	1807	18586.1	M	
4-5	138	510	505	510	178	165	170	163	1808	18657.5	RH	
4-13	145	510	510	515	180	178	180	180	1808	18865.1	RH	
4-20	140	505	505	505	178	165	9170	175	1808	19031.2	RH	
4-27	140	505	505	505	170	165	170	170	1807	19203.7	RH	

SA1

Date	Totalizers			Chlorine		WSO	Comments
	Location	SCADA	Difference	Total	Free		
8-18-4	at noon 16690505	at 14:00 282772.0				DK	
8-25-4	16738147	286376 8/24				DK	
8-30-4	16771475					D	
9-9	16839641					M	
9-17	16893649					M	
9-21-4	16919842			1.6		DK	
10-5-4	17013109	311143.0				MH	
10-12-4	17067257					MH	
10-22-4	17128367					MH	
10/27/4	17162554					MH	
11-5-4	17227236					D	
11-19-4	17317183	337925.0				D	
11-22-4	17337629					DK	
12-3-4	17411008					DK	
12-8-4	17445324			1.5		M	
12-17	17506463	~~356963.4~~		1.7		M	
12-21	17533210 DK	356963.4		1.8 DK		M	
12-28	17580601			1.7		M	
1-4-5	17627500					MH	
1-12	17680731			2.0		MH	
1-20	17735672					MH	
1-26	17776084					MH	
2/3	17829823					MH	
2/7/5	17858116		Now	2.36	2/15	D	
2/14/5	17931275					D	
2/23/5	17964020					D	
3-1-5	18005567			+1.8		D	
3-8	18024981					M	Off line
3-14	18025179			>2.2		M	
3-23	18086361			>2.2		M	
	18227171					MH	

City of Santa Ana Public Works Agency

Water Resources Division 50061 Water Production Section

SA- 1 Connection Readings 2006

Date	Totalizer			Pressure			Chlorine Residual	WSO Intials	Notes
	MWD	SCADA	Diff.	MWD	Mid	System			
9-27-06	21588452			170	72	69	—	[illegible]	
10-5-		—	—	165	68	65		[illegible]	
10-11	21682028			168	75	68	>2.2	M—	
10-26				171	71	65	N/A	[illegible]	
11-1-06	21830958			175	71	66	N/A	[illegible]	
11-7	21865692			169	68	60	—	rH	
11-15	21918530			160	70	65		rh	
11-21	21959354			160	70	65		rH	
11-30	22020885			157	70	65		rh	
12-6	22054672			166	70	64	~A	D	
12-13-6	22107491			150	72	68	2.7	D	
12-19-6	22142407			152	72	68	2.9	D	
12/29/6	22215654			172	72	67	—	[illegible]	
1-3-7	22290617			174	71	68	2.3	m—	

City of Santa Ana Public Works Agency
Water Resources Division 50061 Water Production Section
SA- 1 Hydroelectric Generator Readings 2006

Date	Hours	Volts				Amps				System kW	Power Factor	KVA	kWh	Flow	RPM	WSO Initials
		System	L1 to 2	L2 to 3	L3 to 1	System	L1	L2	L3							
10-11	27388.3	492.6	493.9	491.0	494.0	161.9	157.2	164.3	164.9	147.0	092C	157.7	70	7.8	1889	M
10-26	27751	488	490	487	490	162	166	172	173	150	0.94	167.6	75	7.9	1810	D
11-1-06	27916	493	494	491	494	172	168	174	174.6	158.3	0.94	167	78	7.75	1810	D
11-7	28039	492	494	490	493	155	157	162	163	142	0.93	163	79	7.8	1810	CH
11-15	28 227	490	492	489	492	155	154	158	158	138	0.92	155	82	7.8	1808	CH
11-21	28 373	493	495	492	495	161	156	162	162	147	0.92	160	84	7.8	1808	CH
11-30	28 589	499	500	497	500	170	158	167	163	145	0.90	160	87	7.6	1808	CH
12-5-6	28710.5	495	496	493	496	161	158	163	164	145	.92	160	89	7.8	1809	D
12/13/6	28897.5	498	499	496	499	175	172	177	177	162	.93C	175	92	7.7	1810	D
12/18/6	29024.4	499	501	497	501	179	174	186	186	166	.94C	176	94	7.77	1810	D
12/24/6	29226.5	491	492	489	492	168	160	167	167	154	.94C	163	97	7.8	1811	D
1-3-7	29348	492	493	490	493	172	168	174	174	162	94C	162	99	7.6	1809	M

500261

City of Santa Ana Public Works Agency

Water Resources Division Water Production Section

SA- 1 Connection Readings 2006

Date	Totalizer			Pressure			Chlorine Residual	WSO Intials	Notes
	MWD	SCADA	Diff.	MWD	Mid	System			
12-20	19841508						≈2	M	
1-4	19943622			155	N/A	70	2.3	M	
1-12	19996773	N/A		155	—	69-70	N/A	D	
1-19	20044466			155	-	68	≈2.2	M	
1-24	20078113	N/A		140	—	68-	N/A	D	
2/9	20 183 994			155	-	68	NA	RH	
2/22	20 269 987			165	—	68	—	RH	
2/28	20 310 925			195	—	68	—	RH	
3-7-6	20 358 994			185		63	N/A	DN	
3-16-6	"			—	—	—	—	D	O/S HYDRO PULLED BACK IN SERVICE
3-28-6	2037 1767			164	70	70	N/A	DN	
4-7	20426135	—		165	70	65	None	D	
4-14	20466083						<2	M	
4-18	20501371	—		146	70	65	—	D	
5-4	20607654			168	70	68	—	RH	
5-10	20699801			165	70	68	—	RH	
5-17	20702680			165	70	65	—	RH	
5-25	20 750 711			1608	70	68	—	RH	
6-5-6	20 825 049			167	68	62		D	
6-13-6	20879 006			167	72	68		D	
6-22-6	20960154			162	70	63		DN	
6-29-6	20987540			162	70	66		DN	
7-3-6	21019350			160	72	63		D	
7-14	21087363			160	70	68		M	
7-19				160	70	63		M	
7-28	21176432	N/A		169	70	68		D	
8-2	21209421			142	75	68		M	
8/7	21 244 067			160	155	58		RH	
8/17	21311527			170	75	75		D	
8/21	21 337 977			158	60	57		RK	
8/29				155	60	57		RK	
9-7-6	21451 872			150	73	68	—	D	
9-13-6	2144 3979			168	70	≤2		D	

SA1

50061

Date	Totalizers			Chlorine		WSO	Comments
	Location	SCADA	Difference	Total	Free		
11/22/5	19654975			≈1.5		D	
11/30/5	19708758			≈1.8		D	
12-6	19748827			≈2		M	
12-13	19795691			≈2.1		M	
12-20	19841508			≈2		M	

50061

SA1 2005

Date	Totalizers			Chlorine		WSO	Comments
	Location	SCADA	Difference	Total	Free		
4/13	18227128					RH	running
4/19	18273891					RH	
4/27	18322344					RH	
5-5-5	18374486			≈1.8		D	
5/12/5	18422486			≈1.8		D	
5/16/5	18450596					D	
5/24/5	18504453					D	
5-31	18550791					D	
6-7	18598642			≈2		M	
6-14	18645708			≈2		MP	
6 23	18706390			≈2		M	
6-30	18753255			≈2		M	
7-5	18787627					RH	
7.13	18840603					RH	
7.26	18929564					RH	
8-11-5	19037058			72.2		D	
8-17-05	19076220					PCD	
8-23	19116990					P	
8-29-5	19158739					D	
9-12	19252805			>2.2		M	
9-19	19273314			>2.2		M	
9-23	19326105			>2.2		MP	
9-26	19345630					M	
10-4	19400063					RH	
10.12	19453045					RH	
10.19	19500987					RH	
10.27	19554500					RH	
11.2	19560420					RH	OFF
11-5-5	19560531			1.7		D	
11-18-	19601447			~1		DP	off (Avon)

50061

City of Santa Ana
Public Works Agency
Water Production

2005 SA-1 WEEKLY READINGS

Date	Time	Inlet PSI	Outlet PSI	Gen. RPM	Gen. Hours	Sys. Volts	Sys. Amps	Pow. Factor	KVA	KVAR	Sys. KW	Total KWH	WOS	Notes
26-Oct-05	10:00	149.2	62.4	1,808.6	22860 ?	499.5	167.7	0.92	164.8	-63.2	151.2	56,385.0	JP/PP	
11/2	14:30	·	65	·	22881	·	·	·	·	·	·	·	RH	off line | valve closed
11/9/5	1210	157	70	0	22881.7						0		D	O/S
11/15/5	1000	150	67		22881.7								DP	O/S
11/22/5	0940	140	69	0	22881.7								D	O/S
11/30/5	1145	141	69		22981.7								D	Hy. O/S 7.7 hr
12-6	1300	140	70	0	22881.7								M	O/S
12-13	1100	148	72	0	22881.7								M	O/S
12-20	0815	142	70	0	22881.7								M	O/S

APPENDIX F
MONTHLY PRODUCTION REPORTS

City of Santa Ana
Public Works Agency
Water Production

MONTHLY PRODUCTION REPORT

January, 2017

A- Ground Water Production:

A 1- Wells Pumped to Res.:

Well No.	Production: CF (Constant=100)
16	0
18	3,326,696
20	6,047,949
21	97,928
24	2,048,192
26	5,329,344
27	12,301,565
29	0
30	12,723,584
33	0
34	11,300
36	6,757,760
39	5,493,764
Total: CF	**54,138,082**
AF	**1,242.8**

A 2- Wells Pumped to System:

28	8,175,067
31	6,092,008
32	0
35	9,650,250
37	4,252,437
38	118,490
40	0
41	10,205,148
Total: CF	**38,493,400**
AF	**883.7**

A 3- Total Ground Production:

Total: CF	**92,631,482**
AF	**2,126.5**

B- Station Production:

B 1- Stat. Boosted to System:

Station Discharge:	Production: CF (Constant=100)
West	18,957,695
John G.	18,271,820
Crooke	12,127,300
Cambridge	333,529
East	5,346,280
South	18,970
Walnut	0
Total: CF	**55,055,594**
AF	**1,263.9**

B 2- By-Passed from System:

West	0
John G.	0
Crooke	0
Cambridge	361,291
East	0
South	53,847
Walnut	0
Total: CF	**415,138**
AF	**9.5**

B 3- Station Net Production:

West	18,957,695
John G.	18,271,820
Crooke	12,127,300
Cambridge	-27,762
East	5,346,280
South	-34,877
Walnut	0
Total: CF	**54,640,456**
AF	**1,254.4**

C- MWD Production:

MWD Connect.	Production: CF	AF
SA 1	400	0.0
SA 2	0	0.0
SA 3	500	0.0
SA 4	0	0.0
SA 5	0	0.0
SA 6	2,410,100	55.3
SA 7	2,402,400	55.2
Total:	**4,813,400**	**110.5**

D- Prod. of the Month:

D 1- Total Water Production:

	CF	AF	%
Total:	**97,444,882**	**2,237.0**	
Ground:	**92,631,482**	**2,126.5**	**95.06%**
MWD:	**4,813,400**	**110.5**	**4.94%**

D 2- CUP Credit Due:

Credit Due:		**0.0**	

D 3- Peak Production:

	Time	Day	Production
Pk Day: CF		1/18/2017	3,934,125
Pk Hr: CFS	12:14	1/18/2017	82.2

E- Prod. Of the Fiscal Year:

Fiscal Year Elapsed Days: 215

E 1-Total F.Y. Production:

	CF	AF	%
Total:	**854,389,329**	**19,616.0**	
Ground:	**709,792,729**	**16,296**	**83.08%**
MWD:	**144,596,600**	**3,320**	**16.92%**

E 2- F.Y. CUP Credit Due:

Credit Due:		**0.0**	

E 3-Total F.Y. Production with CUP:

	AF	%
Total:	**19,616.0**	
Ground-CUP	**16,296.0**	**83.08%**
MWD+CUP	**3,320.0**	**16.92%**

E4- Peak Production

	Time	Day	Production
Pk Day: CF		7/25/2016	5,026,468
Pk Flw CFS	20:12	6/20/2016	87.7

F- Production Reduction Compared to 2013 Calendar Month:

	AF	%
2013	**2,748.3**	**18.6%**

APPENDIX G
TURBINE COST ESTIMATES

City of Santa Ana
Hydro Turbine Generators
Project Cost Estimate

SA-1 Replace Turbine Generator with a New Unit

Equipment Description	Qty	Bare Material Cost Per Unit ($)	Extended Bare Material Cost ($)	Bare Labor Cost per Unit ($)	Extended Bare Labor Costs ($)	Reference
Canyon Hydro Soar In Line Turbine 8.0 CFS, 90-120 psi, 183 kW max	1	$ 261,000	$ 261,000	$ -	$ -	1
Includes Soar ILT 12-33-9.0 Variable Flow Hydro Turbine, 1800 rpm, adjustable wicket gates; US Motors Vertical Shaft 250 hp, 480 VAC Induction Generator; 12 inch Electrically Actuated Turbine Inlet Valve; HPU to support wicket gate actuation with accumulator sized to close wicket gates in power failure; Switchgear and Control Panels with protective relays to utility grid standards	0	$ -	$ -		$ -	1
Commisioning Parts, Startup, Site Testing	1		$ -	$ 10,000	$ 10,000	1
	0	$ -	$ -		$ -	
Mechanical/Electrical Building Modifications	1	$ 10,000	$ 10,000	$ 10,000	$ 10,000	2
Construction, EPC Contractor	1	$ -	$ -	$ 100,000	$ 100,000	2
Demolition of Existing Plant (Offsetting with Salvage Value)	1	$ -	$ -	$ -	$ -	
Salvage Value of Existing In Line Turbine	1	$ -	$ -	$ -	$ -	
Shipping - In Line Turbine	1	$ 5,000	$ 5,000		$ -	2
	1		$ -		$ -	
Development Costs - Permitting, Interconnection, SCE	1		$ -	$ 5,000	$ 5,000	2
	1		$ -		$ -	
Balance of Plant Contingency	1	$ 25,000	$ 25,000		$ -	2
Subtotal			$ 301,000		$ 125,000	
Materials + Labor			$ 426,000			
Sales Tax on Materials		9.25%	$ 27,843			
Contractor Construction Management		5%	$ 21,300			
Contractor O&P		15%	$ 63,900			
Contingency on Construction Contract		20%	$ 85,200			
Design Engineering		9%	$ 38,340			
City Project Management		7%	$ 29,820			
City Construction Support		6%	$ 25,560			
Project Total			$ 717,963			
SA-1 Incentive from SGIP		$ 0.60	/Watt			
or		$ 600	/kW			
Average Load		132	kW			
Incentive			$ 79,200			
Net Project Cost			$ 638,763			

References
1. Canyon Hydro Proposal 17 Aug 2018
2. NAM

City of Santa Ana
Hydro Turbine Generators
Project Cost Estimate

SA-3 Install New Turbine Generator in a New Vault

Equipment Description	Qty	Bare Material Cost Per Unit ($)	Extended Bare Material Cost ($)	Bare Labor Cost per Unit ($)	Extended Bare Labor Costs ($)	Reference
Canyon Hydro Soar In Line Turbine 8.0 CFS, 90-120 psi, 183 kW max	1	$ 261,000	$ 261,000	$ -	$ -	1
Includes Soar ILT 12-33-9.0 Variable Flow Hydro Turbine, 1800 rpm, adjustable wicket gates; US Motors Vertical Shaft 250 hp, 480 VAC Induction Generator; 12 inch Electrically Actuated Turbine Inlet Valve; HPU to support wicket gate actuation with accumulator sized to close wicket gates in power failure; Switchgear and Control Panels with protective relays to utility grid standards	0	$ -	$ -		$ -	1
Commisioning Parts, Startup, Site Testing	1		$ -	$ 10,000	$ 10,000	1
Vault - Excavation, concrete, backfill, lid, sidewalk, landscaping	1	$ 15,000	$ 15,000	$ 20,000	$ 20,000	
10' x 10' at $350/sf	0	$ -	$ -		$ -	
	0	$ -	$ -		$ -	
Mechanical/Electrical Building Modifications	1	$ 10,000	$ 10,000	$ 10,000	$ 10,000	2
Construction, EPC Contractor	1	$ -	$ -	$ 100,000	$ 100,000	2
Demolition of Existing Plant (Offsetting with Salvage Value)	1	$ -	$ -	$ -	$ -	
Salvage Value of Existing In Line Turbine	1	$ -	$ -	$ -	$ -	
Shipping - In Line Turbine	1	$ 5,000	$ 5,000		$ -	2
	1		$ -		$ -	
Development Costs - Permitting, Interconnection, SCE	1	$ 35,000	$ 35,000	$ 5,000	$ 5,000	2
	1		$ -		$ -	
Balance of Plant Contingency	1	$ 25,000	$ 25,000		$ -	
Subtotal			$ 351,000		$ 145,000	
Materials + Labor			$ 496,000			
Sales Tax on Materials		9.25%	$ 32,468			
Contractor Construction Management		5%	$ 24,800			
Contractor O&P		15%	$ 74,400			
Contingency on Construction Contract		20%	$ 99,200			
Design Engineering		9%	$ 44,640			
City Project Management		7%	$ 34,720			
City Construction Support		6%	$ 29,760			
Project Total			$ 835,988			

References
1. Canyon Hydro Proposal 17 Aug 2018
2. NAM

City of Santa Ana
Hydro Turbine Generators
Project Cost Estimate

SA-6 Install New Turbine Generator in a New Vault

Equipment Description	Qty	Bare Material Cost Per Unit ($)	Extended Bare Material Cost ($)	Bare Labor Cost per Unit ($)	Extended Bare Labor Costs ($)	Reference
Gilkes 300 G100 Francis Turbine Assembly	1	$ 398,919	$ 398,919	$ -	$ -	1
Includes 300 G100 Francis Reaction Turbine, Case, Runner, Bearing Housing, Guide Vanes and Linkages, Inlet Spool Pipe, Outlet Bend and Draft, Tube, Shims, Main Inlet Valve, Induction Generator, Controls & Switchgear Package, Hydraulic Power Unit.	0	$ -	$ -		$ -	1
Commisioning Parts, Startup, Site Testing	1		$ -	$ 10,000	$ 10,000	1
Vault - Excavation, concrete, backfill, lid, sidewalk, landscaping	1	$ 15,000	$ 15,000	$ 20,000	$ 20,000	
10' x 10' at $350/sf	0	$ -	$ -		$ -	
	0	$ -	$ -		$ -	2
Mechanical/Electrical Building Modifications	1	$ 10,000	$ 10,000	$ 10,000	$ 10,000	2
Construction, EPC Contractor	1	$ -	$ -	$ 100,000	$ 100,000	2
Demolition of Existing Plant (Offsetting with Salvage Value)	1	$ -	$ -	$ -	$ -	
Salvage Value of Existing In Line Turbine	1	$ -	$ -	$ -	$ -	
Shipping - In Line Turbine	1	$ 5,000	$ 5,000		$ -	2
	1		$ -		$ -	
Development Costs - Permitting, Interconnection, SCE	1	$ 35,000	$ 35,000	$ 5,000	$ 5,000	2
	1		$ -		$ -	
Balance of Plant Contingency	1	$ 25,000	$ 25,000		$ -	2
Subtotal			$ 488,919		$ 145,000	
Materials + Labor			$ 633,919			
Sales Tax on Materials		9.25%	$ 45,225			
Contractor Construction Management		5%	$ 31,696			
Contractor O&P		15%	$ 95,088			
Contingency on Construction Contract		20%	$ 126,784			
Design Engineering		9%	$ 57,053			
City Project Management		7%	$ 44,374			
City Construction Support		6%	$ 38,035			
Project Total			$ 1,072,174			

References
1. Canyon Hydro Proposal 17 Aug 2018
2. NAM

APPENDIX H
SOLAR MODEL PARAMETERS

Solar Model Parameters

The sheet contains the parameters used in the financial model. All cells (grey) must be completed.

Date		Auto populates
Client		Linked to OnePager footer
Project Name		Linked to OnePager Title
Project Number		
General Notes		

Escalation/Degradation Rates		Notes
Energy Use Escalation	0.0%	Reasonable range: 0.0% to 2.5%
PV Degradation	0.5%	Reasonable range: 0.5% to 2.5%
Utility Escalation	3.50%	Escalation for for both load and generation. And also for both rates and meter charges.

	Costs and Term		Notes
	Construction, PeGu, & O&M Cost Calc Method	Metric ($/W)	
Ownership	PM, Contingency - Ownership		As percentage of upfront costs
	Cash Purchase Term (Years)		
	PM, Contingency - PPA		As percentage of upfront costs
PPA	PM, Contingency - Term		Range 0 to 25, 0 represents upfront lump cost. Applies to PPA cash flow.
	PPA Term (Years)		Typically 20 or 25 years
	O&M Cost - Escalator (%/yr)		
O&M	O&M Cost - Term		Range 0 to 25, 0 represents upfront lump cost. Applies to non-PPA cash flow.
	Simple Loan Term (Years)		(previously known as bond term)

Financing Assumptions		Notes
# of Projects	1	Total number of projects being considered
Rating Code	3	From 1 to 3, default to 3
NPV Discount Rate	3.00%	
Start Month	1	Month of operation/installation
	2019	
Basic Interest Rate	4.50%	Range 4.5% to 6.5%
Utility Rebate 1 Term (Years)	5	

CITY OF SANTA ANA
DROUGHT ACTION PLAN

Deepening drought conditions in California called for Governor Brown to issue an executive order earlier this year to reduce statewide water use by 25 percent from 2013 levels. The State Water Resources Control Board followed the executive order with expanded emergency regulations to safeguard the state's remaining water supplies. The City of Santa Ana has been under a **Phase 2 Water Supply Shortage Emergency** since the City Council's approval of Resolution No. 2015-025 (June 2, 2015). By this resolution, the City Council declared that a water shortage exists throughout the area served by the City of Santa Ana Water Resources Division and ordered that water customers must reduce their monthly total potable water consumption by **12%**, using 2013 as the base year. The Phase 2 Water Supply Shortage Resolution implements additional regulations and restrictions on the delivery of the water and the consumption within the City of water supplied for public use with the goal of conserving water supply for the greatest public benefit with particular regard to domestic use, sanitation, and fire protection.

The City of Santa Ana Water Resources Division has prepared the following Drought Action to assist in the meeting of the state's mandatory 12% reduction in water use. The following recommended Drought Action Plan summarizes: the reason for the state's mandatory reduction in water use; the permanent water conservation requirements found in Section 39-106 of the Santa Ana Municipal Code; the mandatory water requirements that apply during a declared **Phase 2 Water Supply Shortage**; and the additional short term and long term City action items being recommended to be implemented by the City of Santa Ana.

DROUGHT ACTION PLAN

Due to the following, the City of Santa Ana has established a Drought Action Plan to meet the state's mandatory 12% reduction in water use:

A. The State of California is in its fourth year of severe drought conditions.

B. On April 1, 2015, Governor Jerry Brown issued an executive order to cities and towns across California to cut water use by 25% as part of a sweeping set of mandatory drought restrictions, the first in state history.

C. On April 1, 2015, State water officials measured the lowest April 1 snowpack in more than 60 years of record-keeping in the Sierra Nevada.

D. On April 14, 2015, the Governing Board of the Metropolitan Water District ("MWD") took action to reduce water deliveries to its member agencies, including the City of Santa Ana, effective July 1, 2015.

E. Because of the action taken by the MWD, beginning July 1, 2015, the City's water deliveries will be reduced by 15%.

F. The MWD action also includes heavy surcharges for member agencies that exceed their allocations. The surcharge will be roughly four times the normal price of an acre foot of water for use beyond the allocated amount.

G. The State of California's Drought Emergency Water Conservation regulations provide that the City of Santa Ana must reduce its monthly total potable water production by **12%**, using 2013 as the base year.

H. On May 19, 2015, the City Council amended Chapter 39, Article VI of the Santa Ana Municipal Code's to include "Water Shortage Contingency Plan". Pursuant to Santa Ana Municipal Code section 39-105 and Water Code sections 350 and 353, the City Council shall adopt such regulations and restriction on the delivery of water and the consumption within said area of water supplied for public use as will in the sound discretion of the Council conserve the water supply for the greatest public benefit with particular regard to domestic use, sanitation, and fire protection.

I. By Resolution No. 2015-025, the City Council of Santa Ana declared that a water shortage now exists through the area served by the City of Santa Ana Water Resources Division and is ordering that water customers must reduce their monthly total potable water consumption by **12%**, using 2013 as the base year; and pursuant to Santa Ana Municipal Code section 39-105, the City Council declared a **Phase 2 Water Supply Shortage** that implements additional regulations and restrictions on the delivery of water and the consumption within said area of water supplied for public use as will conserve the water supply for the greatest public benefit with particular regard to domestic use, sanitation, and fire protection.

The following is the recommended City of Santa Ana ***Drought Action Plan,*** based on the **Phase 2 Water Supply Shortage**:

Per Section 39-106 of the Santa Ana Municipal Code, the following water conservation requirements are effective at all times and are permanent (these requirements are found in section 39-106 of the Santa Ana Municipal Code and are repeated here for convenience):

(1) Washing down sidewalks, walkways, driveways, parking areas or other paved surfaces, except as is required to dispose of dangerous liquids or alleviate safety or sanitary hazards and then only by use of a hand-held bucket, or hand-held hose equipped with a positive self-closing water shut-off device is prohibited.

(2) The use of water to clean, fill or maintain levels in decorative fountains, ponds, lakes or other similar aesthetic structures unless such water is part of a recirculating system is prohibited.

(3) No restaurant, hotel, café, cafeteria or other public place where food is sold, served or offered for sale shall serve drinking water to any customer unless expressly requested.

(4) Using water to wash or clean a vehicle, including but not limited to any automobile, truck, van, bus, motorcycle, boat or trailer, is prohibited, except by use of a hand-held bucket or hand-held hose equipped with a positive self-closing water shut-off nozzle or device.

(5) Hotels, motels and other commercial lodging establishments must provide customers the option of not having towels and linen laundered daily. Commercial lodging establishments must prominently display notice of this option in each bathroom using clean and easily understood language.

(6) Food preparation establishments such as restaurants or cafes, are prohibited from using non-water conserving dish wash spray valves.

(7) Watering or irrigating of any lawn, landscape or other vegetated area in a manner that causes or allows excessive water flow or runoff onto an adjoining sidewalk, driveway, street, alley gutter or ditch is prohibited.

(8) The use of water to irrigate outdoor landscapes during or within 48 hours after measurable rainfall is prohibited.

(9) The irrigation with potable water of ornamental turf on public street medians is prohibited.

(10) The irrigation with potable water outside of landscapes outside of newly constructed homes and buildings in a manner inconsistent with regulations or other requirements established by the California Building Standards Commission and the Department of Housing and Community Development is prohibited (must be delivered by drip or micro-spray systems).

Per Section 39-108 of the Santa Ana Municipal Code, the following mandatory water conservation requirements apply during a declared **Phase 2 Water Supply Shortage**. These requirements are found in section 39-108 of the Santa Ana Municipal Code and are repeated here for convenience:

(1) Watering lawn, landscape or other turf area shall be modified to prohibit watering more often than two days per week or Monday and Thursday. Such areas shall only be watered between the hours of 6:00 p.m. and 6:00 a.m. This provision shall not apply to commercial nurseries and golf courses.

(2) It is prohibited to water lawn, landscape or other turf areas of commercial nurseries or golf courses more often than every other day and watering shall only occur between the hours of 6:00 p.m. and 6:00 a.m. There shall be no restriction on watering utilizing reclaimed water.

(3) It is prohibited to use water from fire hydrants except for firefighting and related activities. Other uses for municipal purposes shall be limited to activities necessary to maintain the public health, safety and welfare.

(4) No customer shall make, cause, use or permit the use of water for any purpose in excess of the applicable percentage of the amount used in the customer's premises during the corresponding billing period of the base year as set by the City Council, such percentage to be determined by City Council and set forth in the resolution declaring Phase 2 water supply shortage. This percentage has been set at 12%. There shall be no restriction on the use of reclaimed water under this provision.

(5) All leaks, breaks, or other malfunctions in the water user's plumbing or distribution system must be repaired within forty-eight (48) hours of notification by the City, unless other arrangements are made with the City.

(6) Re-filling of more than one foot and initial filling of residential swimming pools or outdoor spas with potable water is prohibited.

In addition to the permanent water conservation requirements and the Phase 2 requirements stated above, the City's Drought Action plan includes the implementation of following action items:

Short Term Action Items

1. Intensify Drought Outreach Campaign: media relations (press releases & news articles); bill inserts; website and social media; outdoor advertising; education programs; community and school events; and business outreach programs.

2. Focus outreach campaign on identified areas within the City with higher outdoor irrigation usage. This will include performing community outreach efforts to discuss the importance of water conservation and help customers convert to more efficient irrigation systems.

3. Continue to support and promote water conservation incentive programs: turf removal rebate program; MWD BeWaterWise program, and SoCal WaterSmart program (high-efficiency clothes washers and toilets, rotating sprinkler nozzles, weather-based irrigation controllers, soil moisture sensory systems, rain barrels, etc.). This includes providing staff resources to assist in and speed up various rebate programs. See Santa Ana's Water Conservation Page at santa-ana.org/waterconservation/.

4. Continue implementation of Water Wasting Reporting Program (Water Hotline, e-mail at conservewater@santa-ana.org, or use City MySantaAna smart phone app).

5. Continue enforcement: water wasting violations and pending violation of 12% use reduction.

6. Specific short term action plans to be implemented by the City and City Departments:

    - Upgrade the City Corporation Yard car wash;
    - Reduce watering in passive areas of parks, continue watering active areas (sports fields);
    - Amend the Zoning Code to update the City's Water Efficient Landscape Standards;
    - Continue to update and amend the Citywide Design Guidelines to reflect the new water efficient technologies; and
    - Upgrade the Planning Division webpage to provide examples of drought tolerant landscaping and water efficient water systems;

Long Term City Action Items

1. Implement a lawn replacement program (replace with drought tolerant plants) at all City Water Production Facilities.

2. Remove ornamental turf on all street medians and replace with drought tolerant planting, gravel or other water efficient landscapes.

3. Within city parks and facilities, remove grass where possible and install drought tolerant plants or install synthetic turf, where feasible.

4. At City parks, install master control valves, flow and moisture sensors, and weather-based irrigation controllers.

5. Within City buildings and facilities, continue the replacement of plumbing fixtures (toilet and sink valves) with low water use (water efficient) fixtures.

6. Convert large water irrigation customer's old meters to AMI meters (which allow real-time monitoring of water use for precise irrigation practices).

7. Continue the feasibility study for City-wide AMI meter replacement implementation program.

8. Conduct recycled water feasibility study in conjunction with OCWD.