SVCW Conveyance System Program

Front-of-Plant Electrical Power Planning Report

Prepared for

Silicon Valley Clean Water

Redwood City, CA

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SVCW
Silicon Valley Clean Water

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Section 1: Introduction

Electrical utility power serving the Silicon Valley Clean Water (SVCW) treatment plant is currently provided from a single 12kV Pacific Gas and Electric Company (PG&E) connection located near the front of the plant entrance. This PG&E power service enters the plant's main 12kV switchgear where it is metered and then distributed to all plant electrical loads.

The purpose of this report is to present PG&E power service options that will facilitate expansion of the SVCW plant's power distribution system to accommodate the addition of the planned Receiving Lift Station (RLS), new Headworks and provide for the ability to connect alternative, on-site sources of power such as photovoltaics, battery systems and cogeneration units.

1.1 Background

SVCW is a Joint Powers Authority (JPA) that owns and operates a regional WWTP at the eastern end of Redwood Shores, within Redwood City, and related wastewater pumping and conveyance facilities in Belmont, San Carlos, Redwood City, and Menlo Park. The JPA Member Agencies include the cities of Belmont, Redwood City, San Carlos, and the West Bay Sanitary District (WBSD), which provides sanitary sewer collection services to the cities of Menlo Park, Portola Valley, and portions of Atherton, Woodside and East Palo Alto. The JPA Member Agencies also provide service to other unincorporated areas of San Mateo County. The existing conveyance system includes four pump stations, one for each of the four Member Agency's collection systems, a wet weather booster station located in the San Carlos Pump Station (SCPS), a lift station located at the WWTP, and an approximately nine-mile long, reinforced concrete force main. The individual Member Agencies of the JPA own and operate the sanitary sewer collection systems within their respective jurisdictions, and WBSD also owns the existing Flow Equalization Facility (FEF), which can be used to store Menlo Park wastewater during wet weather conditions. **Figure 1-1** shows the existing conveyance system.

Figure 1-1. SVCW Existing Conveyance System

The conveyance system pump stations are in varying states of condition, ranging from poor to very poor. In most instances, equipment is at the end of its useful life, and the condition has degraded to the extent that the systems require extensive maintenance to ensure functionality and reliability. In addition, the majority of the 45-year old concrete force main's condition is poor and has exceeded its designed useful lifespan, with a history of joint leaks caused by unstable Young Bay Mud soil conditions and internal and external corrosion of the concrete and reinforcing steel. The frequency of pipeline leaks is expected to increase given the current poor condition of the pipelines, continued movement of weak soils and continuing corrosion.

Due to the condition of the existing conveyance system, a Conveyance System Master Plan (CSMP) was issued in 2011 and initial steps of the CSMP were implemented. A pump station predesign was started, and replacement of Segment 2 of the force main (the 48-inch pipe between Redwood City and San Carlos Pump Stations) was designed and a portion of it, from the Redwood City Pump Station (RCPS) to the end of Bair Island by the San Carlos Airport, was constructed and placed into service.

The CSMP proposed replacement of Segment 5 (see Figure 1-1), which is a 54-inch section of the SVCW Influent Force Main, with a larger 63-inch force main. Following the CSMP's recommendation, it was determined during predesign construction of a force main along the current Segment 5 alignment would be too disruptive to the Redwood Shores community and surrounding areas. Therefore, an analysis was conducted to identify alternatives that may reduce impacts to residents, businesses and other facilities along the Segment 5 alignment.

The alternatives analysis identified over 140 combinations of pipeline alignments and pump station locations that included different construction methods and modes of operation (e.g., gravity and pressure conveyance and configuration and location of conveyance storage). Each of the components of the conveyance system affects the other components so a change to one component will affect the scope, cost, and operation of the other components.

A systematic feasibility assessment was conducted on the alternatives to reduce the number of alternatives to 15 for a more detailed evaluation. Table 1-1 lists the 15 alternatives. A more detailed summary description and flow diagram for each alternative can be found in the "Alternatives Analysis used to select the Recommended Silicon Valley Clean Water Conveyance System Replacement Project" Technical Memorandum (TM) dated August 30, 2016 and prepared by Whitley Burchett & Associates.

Table 1-1. List of Alternatives	
1 Series	Outer Bair Island Tunnel
1A	Bair Island Tunnel + 54-inch Slipline
1B	Bair Island Tunnel + Microtunnel
2 Series	Slough Tunnel
2A	Slough + Redwood City Tunnel
2B	Slough + Redwood City Microtunnel
3	Lagoon Tunnel
4 Series	Middle Out Tunnel
4A	Middle Out + Microtunnel to 48-inch on Inner Bair Island
4B	Middle Out + Tunnel to 48-inch on Inner Bair Island + Belmont Microtunnel
4BE	Middle Out + Tunnel to 48-inch on Inner Bair Island + Belmont Slipline
4C	Middle Out + Tunnel to RCPS and Belmont
4D	Middle Out + Tunnel to RCPS + Microtunnel to Belmont
4DE	Middle Out + Tunnel to RCPS + Belmont Slipline
5	Redwood Shores Microtunnel from WWTP to near Airport
6 Series	Redwood Shores Open Cut
6A	Open Cut from WWTP to near Airport
6B	Slipline and Open Cut from WWTP to near Airport
7	Remote FEF + Slipline from WWTP to Inner Bair Island

Alternative 4BE (Middle Out + Tunnel to 48-inch on Inner Bair Island + Belmont Slipline) was selected as the best alternative to complete the environmental documentation and proceed into pre design. The proposed overall project consists of the replacement/rehabilitation or repurposing of existing pump stations, improvements to the existing WWTP, and replacing portions of the existing force main pipeline with a deep gravity pipeline and new force mains. The Project is characterized by major conveyance components including installing a new gravity pipeline, RLS, flow diversion facilities, influent connector pipes, and the replacement, rehabilitation or re-purposing of the four pump stations. Figure ES-1 shows a schematic of Alternative 4BE with the location of the RLS at the WWTP.

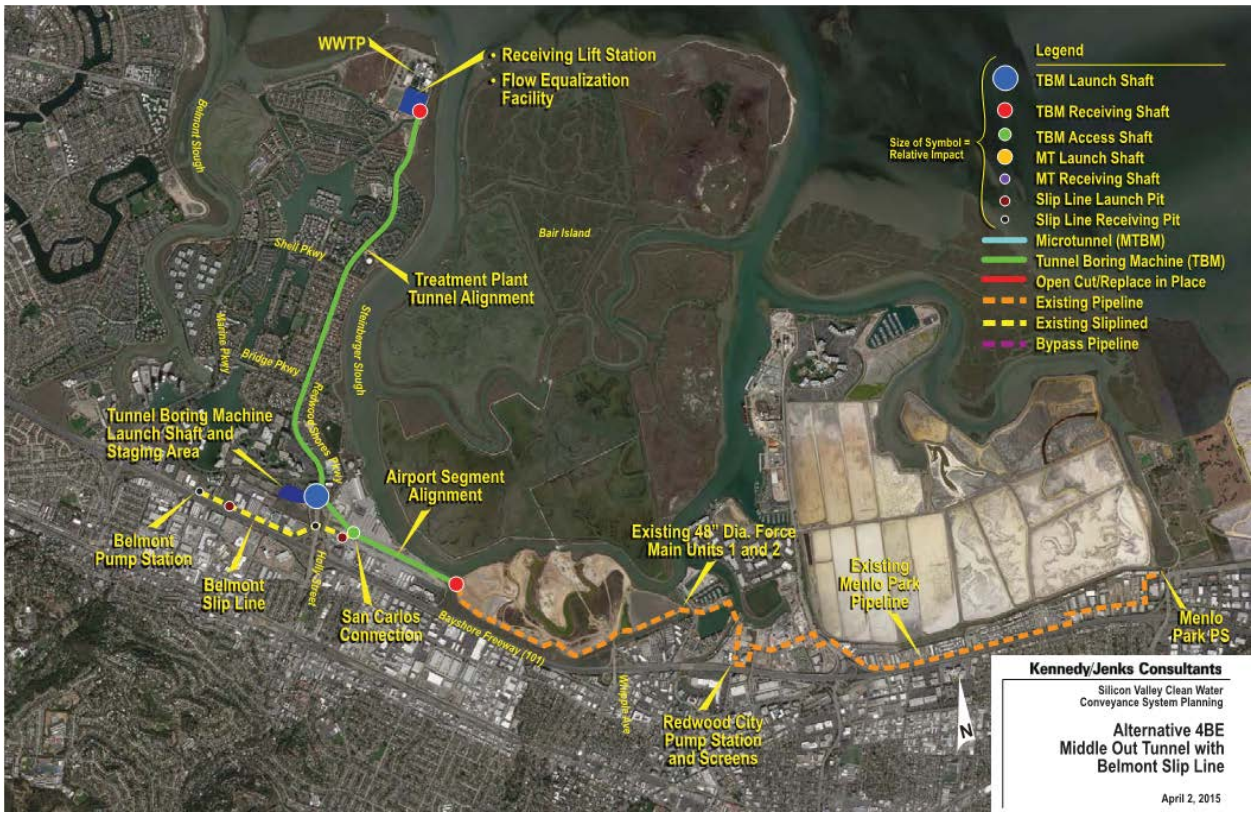


Figure ES-1. Schematic Diagram of Alternative 4BE (Source: Kennedy/Jenks Consultants)

1.2 Project Purpose

The primary purpose for the Front-of-Plant Electrical Expansion Project (FOPE) is to provide adequate electrical power supply to support the new Receiving Lift Station (RLS) and new Headworks facilities. Additional project objectives shall include provisions for the future connections of alternative, on-site power generation sources such as photovoltaics, battery systems and additional cogeneration units. Use of biogas fuel produced by the SVCW plant in conjunction with solar power will enhance SVCW's ability to become less dependent on grid power and thus assist with the overall reduction of power demand on California's power grid.

Section 2: Setting

This section describes the area where the new FOPE electrical equipment and associated connections are initially being planned.

2.1 Physical Setting

Figure 2-1 shows the conceptual layout of new facilities located near the front of the existing treatment plant.

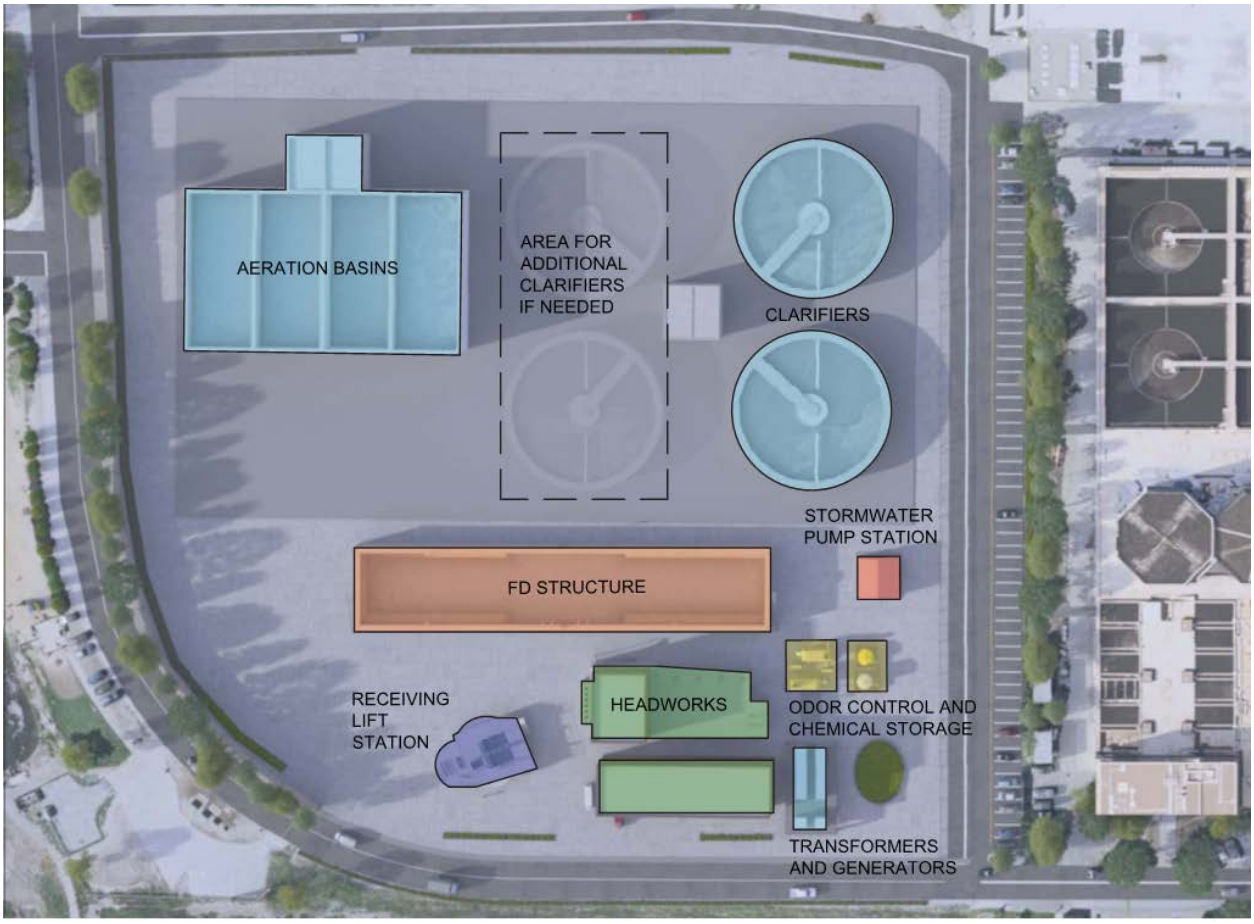


Figure 2-1: Front-of-Plant Site Layout (Source: Draft EIR)

The existing PG&E 12kV main underground service is currently routed from an existing PG&E pad-mounted switch (located adjacent to the Dog Park), along the treatment plant entrance road and then enters the existing 12kV Main Plant Switchgear just inside the entrance gate to the plant. At the location just across the entrance road from the area designated as "Transformers and Generators" in Figure 2-1, it is initially planned that a new PG&E pad-mounted 12kV switch will be added to in essence "split" the existing, incoming PG&E 12kV service to facilitate the installation of a second incoming PG&E 12kV service to a new, second 12kV Main Plant Switchgear line-up (to be located in the area designated as "Transformers and Generators" in Figure 2-1.

Section 3: Compiled Data and Assumptions

This section includes plant power demand data along with projected plant power demand which includes the new RLS and Headworks facilities and physical space requirements for plant power connections.

3.1 Existing Plant Power Demand

There is one (1) single PG&E service circuit which supplies power to the vicinity in and around the Redwood Shores area which is designated by PG&E as circuit "Belmont 1109". Based on the "Supplemental Review" prepared by PG&E for the Cogeneration Project (dated February 14, 2014), the following data was provided:

- Circuit 1109 Capability (i.e. maximum supply capacity, Summer Peak): 11.65 MW
- Circuit 1109 Capability (i.e. maximum supply capacity, Winter Off-Peak): 11.88 MW
- Circuit 1109 Peak Loading (i.e. per PG&E historical data, Summer Peak): 8.6 MW
- Circuit 1109 Peak Loading (i.e. per PG&E historical data, Winter Off-Peak): 5.13 MW

Currently, the treatment plant peak loading occurs during the Winter Off-Peak period (i.e. during wet weather events) and based on treatment plant power consumption data has reached a maximum demand loading of approximately 3 MW.

3.2 Projected RLS and Headworks Added Power Demand

The following data is based on preliminary demand load information for the new RLS and Headworks facilities:

- RLS Maximum Demand (i.e. Wet Weather Event): 1.925 MW
- Headworks Facility Maximum Demand (i.e. Wet Weather Event): 0.3 MW

Combining this projected demand load data with the existing plant demand data:

Maximum PG&E Circuit 1109 Capacity (Winter Off-Peak)	11.88 MW
Total PG&E Circuit 1109 Peak Loading, Winter Off-Peak	5.13 MW
Net PG&E Circuit 1109 Available Spare Capacity, Winter Off-Peak	6.75 MW
Projected, Additional RLS and Headworks Demand Load	2.26 MW
Projected PG&E Circuit 1109 Peak Loading, Winter Off-Peak (with RLS and Headworks Connected)	7.39 MW

As the data indicates, the addition of the new RLS and Headworks facilities to the existing PG&E Circuit 1109 service is feasible based on the provided PG&E historical peak loading data and historical plant demand data during the Winter Off-Peak time frame (i.e. when Wet Weather events are likely to occur).

The physical connection provisions at the existing 12kV Main Switchgear equipment is limited due to the lack of available circuit breaker compartments within the existing switchgear line-up. There is currently one (1) available space located within the existing switchgear line-up that could be retrofitted to install an additional 12kV feeder circuit. Installation of this circuit breaker, however, would essentially drive the existing 12kV Main Switchgear equipment to the build-out condition and would prevent any future connections for additional treatment process equipment loads or the addition of future alternative energy source connections.

Section 4: Project Specific Analyses

This section discusses the alternatives for expanding the existing plant power distribution system to accommodate the new RLS and Headworks, enhance plant power system reliability and to facilitate future connections for alternative on-site power generation systems.

4.1 Flood Plain Considerations

The existing 12kV Main Plant Switchgear and associated upstream PG&E pad-mounted switching equipment is currently installed at an elevation that is below the FEMA flood plain elevation for a 100-Year Storm Event. By constructing a second, new 12kV Main Plant Switchgear line-up at an elevation above the FEMA elevation, power supply to the new RLS and Headworks facilities will be enhanced during a 100-Year Storm Event. Furthermore, pending acceptance by PG&E, the new entrance road PG&E pad-mounted 12kV switch equipment will also be constructed at an elevation above the stated flood plain. This elevated construction for other SVCW-owned power distribution equipment related to the new RLS and Headworks (i.e. substation equipment, standby generator equipment, motor control centers, variable frequency drives, etc.) will also be applied as part of the final design for the RLS and Headworks projects.

To address the potential risk of flooding related to the existing 12kV Main Plant Switchgear, alternatives for either constructing a dike around the existing switchgear equipment or possibly raising the existing switchgear equipment will be investigated.

4.2 Power Distribution System Connection Considerations

As previously stated, the existing 12kV Main Plant Switchgear has limited space for connection of additional 12kV feeders. Currently there is only one (1) available space within the switchgear equipment which can be retrofitted to include an additional 12kV feeder circuit breaker. Although it is possible to utilize this space for connection of the new RLS and Headworks facilities, this approach is not

recommended. Utilizing the single remaining space in the existing 12kV Main Switchgear line-up will prevent any future expansion of the 12kV power distribution to the plant. Should the future need arise where as additional 12kV distribution feeders are required (e.g. addition of alternative on-site generation systems, addition of nutrient removal process treatment, etc.), expansion of the 12kV system will likely require that a second PG&E 12kV service and associated main 12kV Main Switchgear lineup be constructed. What makes the immediate installation of this second PG&E service and associated second 12kV Main Switchgear line-up in conjunction with the new RLS and Headworks facilities is the physical proximity of these new electrical loads to a convenient site location for tie-in to the existing PG&E 12kV service feeder and existing 12kV Main Plant Switchgear. Since the front-of-plant site location will be significantly altered during the construction of the new RLS and Headworks facilities, installation elements related to site trenching and grading, space allocation and construction sequencing will be much more efficient as by incorporating the installation of the second PG&E service and second 12kV Main Switchgear into one overall, coordinated planning effort with the new RLS and Headworks facilities.

In conjunction with the new RLS and Headworks facilities, SVCW is separately pursuing the possibility of introducing alternative, on-site power generation systems to reduce the usage of PG&E-supplied power. This approach not only will reduce SVCW's overall annual power costs but will also serve to reduce the power demand on the California power grid. Currently, the plant utilizes on-site cogeneration units to produce electrical power using biogas from the plant digesters as fuel. Due to the existing PG&E service agreement in conjunction with CPUC Rule 21 limitations on power system protection, the cogeneration units cannot be operated at their full rated capacity, primarily due to a "non-export" agreement with PG&E. By adding additional on-site, alternative power generation sources (e.g. battery systems in conjunction with photovoltaics), the problem related to limited on-site power generation in relation to plant electrical demand load will be made worse and further limit how much on-site power can be produced. Based on the requirements of CPUC Rule 21, SVCW could initiate a change in their agreement with PG&E to allow exporting of excess, on-site produced power to the grid. To accomplish this, however, will likely require expensive alterations to the existing 12kV Main Switchgear equipment protection equipment along with elaborate temporary power provisions to shut down the 12kV Main Switchgear in order to implement the revised Rule 21 protection requirements.

By introducing a new, second PG&E service and associated 12kV Main Switchgear line-up, the new switchgear equipment can be constructed with the necessary CPUC Rule 21 protection requirements which will allow power export to the PG&E grid without impacting existing plant operation. Furthermore, the second switchgear line-up can be constructed and energized with little impact to the existing main switchgear line-up, thus greatly simplifying the construction and start-up for the new RLS and Headworks facilities. From a physical connection space perspective, the new 12kV Main Switchgear line-up can be designed with adequate space to accommodate the connection of additional, on-site power generation systems along with provisions for the future connections of additional treatment process areas within the plant.

To further enhance overall plant operational and maintenance flexibility, the remaining, single circuit breaker space available at the existing 12kV Main Switchgear line-up could be utilized for adding a tie

circuit breaker to allow connection between the existing 12kV Main Switchgear and the new 12kV Main Switchgear. Another approach that will be considered is to re-purposed the existing cogeneration system 12kV feeder circuit breaker as a tie circuit breaker to the new 12kV Main Switchgear. Regardless of which approach is implemented, this would greatly enhance the ability to perform repair or maintenance tasks on either of the two (2) main switchgear line-ups with minimal impact to plant operation.

Section 5: Selected Project Description

This section discusses the elements associated with the recommended addition of a second PG&E 12kV plant service in conjunction with a new, second 12kV Main Switchgear line-up.

5.1 Equipment Locations and Installation Timing with Respect to RLS and Headworks Projects

The locations for the new, second PG&E service pad-mounted switch and new 12kV Main Plant Switchgear will need to be closely coordinated with the overall site plan for the new front-of-plant process facilities. Consideration will need to be given not only to physical space required but also to RLS and Headworks excavation requirements and construction equipment access. From a timing perspective, it would be advantageous for the new main switchgear to be constructed, energized and ready for connection to the new RLS and Headworks facilities prior to start-up of either of these new facilities. In other words, the ideal situation would be to have the new 12kV Main Switchgear operational with all of its equipment and underground connection locations safely out of the way to facilitate construction of the new RLS and Headworks structures.

To accomplish this, the new PG&E 12kV pad-mounted switch will likely be located along the western edge of the plant entrance road. The north/south location of the switch will likely be selected based on the location of the new 12kV Main Switchgear. The location of this new switchgear will need to be closely coordinated with the design firms responsible for the incoming influent tunnel, new RLS facility and new Headworks facility. It is envisioned that the new 12kv Main Switchgear will be located in the area designated as “Transformers and Generators” on the conceptual front-of-plant site plan. Along with the installation of the new 12kV Main Switchgear, new underground provisions will also need to be coordinated with the other front-of-plant facility designs to allow for power feeder connection interface to the new facilities along with future underground connection provisions for additional on-site power generation systems and additional process areas.

5.2 Modifications to Existing PG&E 12kV Service

In order to introduce the new PG&E 12kV pad-mounted switch into the existing, incoming plant PG&E service, a shutdown of the existing PG&E service will be required. The work sequence is summarized below:

1. Hand-excavate in and around the vicinity of the existing PG&E underground service conduits where the new PG&E pad-mounted switch shall be located to expose the exact location of the existing PG&E underground service feeder conduit.
2. Construct the new PG&E pad-mounted 12kV switch and associated concrete pad and underground conduits. The conduits shall be routed to the vicinity of the existing PG&E underground service location and also extended to a location on the east side of the entrance road to facilitate extension to the new 12kV Main Switchgear.
3. Configure temporary power provisions at the plant to allow for a 1-2 day interruption of PG&E power to allow for intercepting the existing PG&E underground service conductors and splicing/connection of the PG&E service conductors to the new PG&E pad-mounted switch.
4. After approval by on-site PG&E inspection, all trenching shall be backfilled, the PG&E service shall be re-energized and the plant shall be brought back on-line, supplied from the PG&E source (i.e. normal power operating condition).

5.3 Tie Between Existing 12kV Main Switchgear and New 12kV Main Switchgear

Based on past experience on the Cogeneration Project, it will require approximately one (1) full day for the existing switchgear compartment to be retrofitted with provisions for the installation of a new tie circuit breaker. During this time, the plant will need to be powered from either the on-site standby diesel generators or by temporary generators connected to the plant's 480 volt power distribution system. Once this tie circuit breaker is installed at the existing 12kV Main Switchgear, the tie connection to the new 12kV Main Switchgear can be easily made without further disruption of plant power. Another approach may be to modify the existing cogeneration system 12kV feeder by extending it to the new 12kV Main Switchgear. By doing this, the existing cogeneration system 12kV feeder circuit breaker could be re-purposed to be used as the tie circuit breaker to the new 12kV Main Switchgear. This would eliminate the need to retrofit the existing 12kV Main Switchgear with another circuit breaker and alleviate the need for temporarily powering the plant.

5.4 CPUC Rule 21 Compliance and Inspection by PG&E

The new 12kV Main Switchgear shall be equipped with power protection devices and equipment that will allow for SVCW to export power to the grid based on excess power production from on-site cogeneration and photovoltaic systems. As part of this process, it is required by the CPUC that PG&E review and approve the system design followed by on-site inspection and testing of the new equipment and protective features before approval to parallel the on-site generation sources with the utility grid will be granted. This coordination with PG&E typically begins at the onset of project Pre-Design and continues until the end of project construction at which time the PG&E "Pre-Parallel Inspection" occurs.

Section 6: Cost Estimate and Schedule

Preliminary project cost estimate and schedule information is shown below:

Front-of-Plant Electrical Expansion Project: Cost Item Description	**Estimated Installed Cost**
Modifications to Existing PG&E Service (i.e. PG&E engineering fees, new 12kV pad-mounted switch and underground electrical)	$230,000
New 12kV Main Switchgear (in pre-fabricated outdoor building)	$1,800,000
New 12kV Underground (i.e. feeders to new RLS, new Headworks, provisions for future 12kV feeder connections)	$500,000
Modifications to Existing 12kV Main Switchgear (i.e. new feeder circuit breaker, protective device modifications per Rule 21 requirements)	$200,000
Substation "PDP3" Transformers and 480V Switchgear	$1,600,000
Switchgear "PDP3" Standby Generators	$2,500,000
Switchgear "PDP2" Modifications, Feeders and Equipment for RLS Feed	$1,200,000
Substation "PDP4" Transformers and Connections	$400,000
Alternative On-Site Power Source Transformers and Connections	$400,000
Miscellaneous Electrical Contingency (30%)	$2,649,000
Front-of-Plant Expansion Project: Total Estimated Construction Cost	**$11,479,000**

Completion durations for the project are listed below:

- Pre-Design: Includes coordination with the RLS and Headworks projects along with overall front-of-plant site use planning: ***12 weeks*** (after notice to proceed is granted for the project and provided that information related to the RLS, Headworks and front-of-plant site use is substantially finalized to allow for finalizing the locations of the new front-of-plant electrical equipment and underground routes).

- PG&E New Service Application: Once the project's preliminary site plan and single line diagram have been developed as part of the Pre-Design effort, a PG&E service request shall be initiated. Once initiated, PG&E will begin an engineering review of the proposed service addition and modifications, ultimately providing design requirements for the PG&E services, new 12kV Main Switchgear metering section and required modifications to the existing 12kV

Main Switchgear. As part of this coordination with PG&E, CPUC Rule 21 requirements will be reviewed by PG&E with associated switchgear design requirements defined. It is anticipated that this process will require approximately ***9 months*** to complete.
Note: If additional on-site alternative power sources are implemented during this time frame then the design of these systems will also need to be included as part of the CPUC Rule 21 compliance review by PG&E. It would be most efficient to proceed in this manner to allow PG&E to provide their engineering review of the overall power system all at once. If the addition of alternative power sources precedes or follows PG&E's system review required for implementing the new second PG&E service and associated new 12kV Main Switchgear then a separate system review and inspection by PG&E will be required.

- Final Design: Completion of final design of the project is anticipated to require ***12 weeks***. It is assumed that biddable documents will be issued for advertisement and competitive bidding.

- Bidding Period: Assumed to be ***60 days***.

- Contractor Award and Issuance of Notice-to-Proceed with Construction: ***30 days***.

- Submittal Information Development and Review: ***60 days***.

- Equipment Fabrication and Procurement: ***4 months***.

- Equipment Installation, Testing and PG&E Tie-in: ***3 months***.

- Final Project Acceptance: ***1 month***.

Total Project Duration (Project Design NTP to Final Installation Acceptance): 28 Months

Based on the information provided for the RLS Project, start-up of the new RLS facility is scheduled to begin in December of 2021. It therefore appears that the implementation of the Front-of-Plant Electrical Expansion Project can be feasibly completed prior to the need for electrical power to the new RLS facility start-up.

Section 7: Outstanding Issues to Carry into Pre-Design

Following are the items that will need to be addressed at the onset of project Pre-Design:

- **Site Location Coordination:** Locations for the new PG&E service equipment, underground electrical routings and new 12kV Main Switchgear will need to be coordinated with the new incoming influent tunnel, RLS and Headworks projects along with coordination for the overall front-of-plant site use. It will be important to finalize the locations of the new electrical equipment prior to initiating coordination with PG&E.

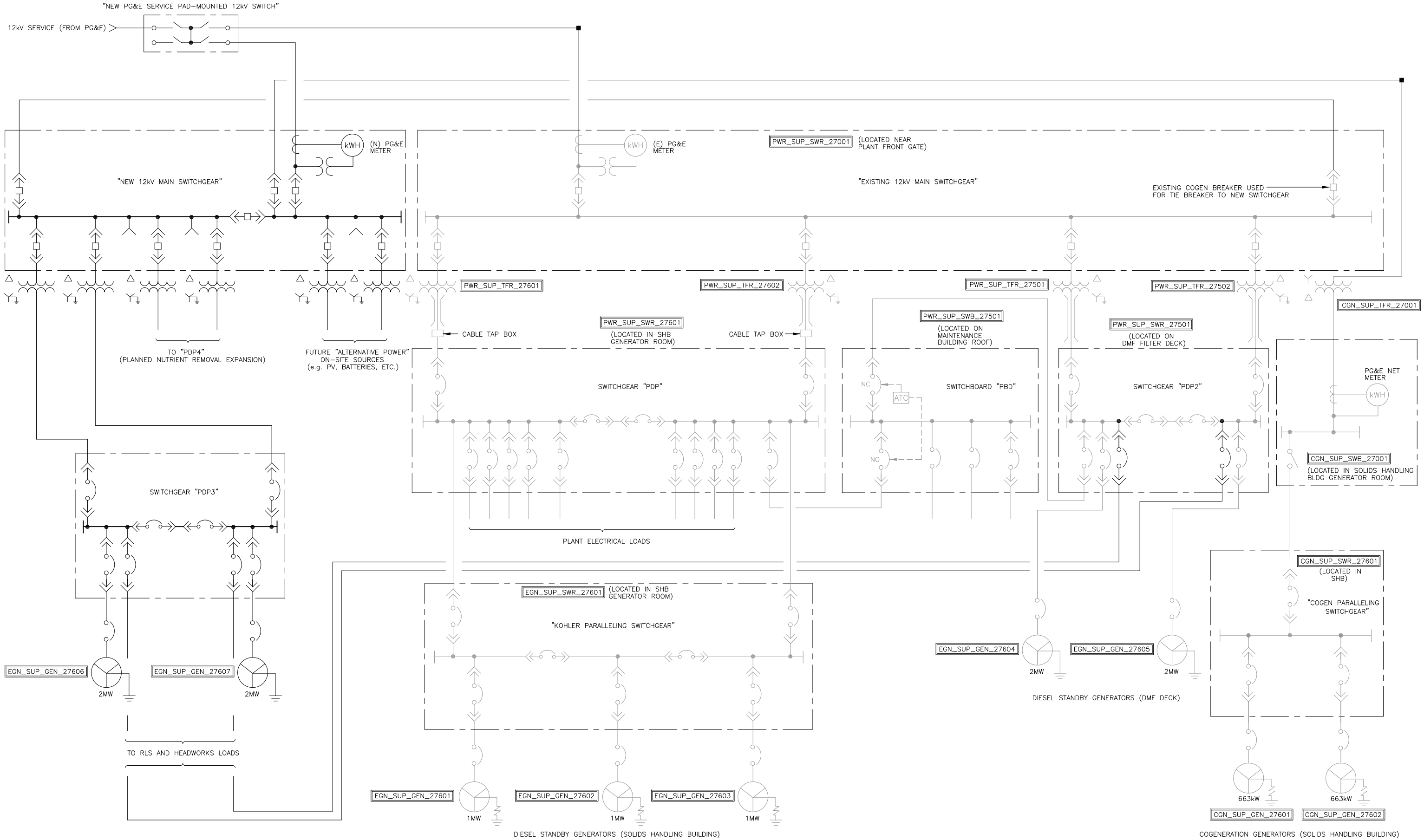
- **PG&E Service Application and Rule 21 Review:** Once the site plan has been set for the new front-of-plant electrical equipment and conduit routings, along with the substantial completion of design for any added alternative on-site power production systems, a new PG&E service application will need to be initiated. This service application process will require extensive coordination with PG&E related to proposed system design along with determining the PG&E metering agreement for the second PG&E service which will allow power export to the grid. Although this process will be initiated at the onset of Pre-Design, it is anticipated that ongoing discussions, design and equipment review and on-site inspection by PG&E will carry through until the end of the project construction period.

- **Contractor Selection Approach:** As part of the Pre-Design effort, the decision to move forward with either a traditional "Design-Bid-Build" or "Progressive Design/Build" approach will need to be made. This decision will impact the level of final design completion and detail and may also alter how the coordination with PG&E is performed.

Appendix A

Modified Plant Main Single Line Diagram

The following drawing indicates the plant power distribution system configuration with the second PG&E service and associated new 12kV Main Switchgear implemented.



NO:	DATE	BY	REVISIONS

PROJECT NO.: XXXX
DESIGN BY: TODD BEECHER, P.E.
DRAWN BY: TODD BEECHER, P.E.
CHECKED BY: xxx
DRAWING DATE: APRIL 2017

Beecher Engineering, Inc.

SILICON VALLEY CLEAN WATER
FRONT-OF-PLANT ELECTRICAL EXPANSION

SVCW Silicon Valley Clean Water

ELECTRICAL

MAIN SINGLE LINE DIAGRAM - FRONT-OF-PLANT MODIFICATIONS

VERIFY SCALES
BAR IS ONE INCH ON ORIGINAL DRAWING
0 1"
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NO. XXXX
DRAWING NO. E-1
SHEET NO. XX OF XX