SECTION 2.0

Project Description

2.1 Introduction

Section 2.0 describes the design and operation of the proposed project, associated electric transmission lines, natural gas supply line, and water lines. Site selection and alternative sites considered are presented in Section 9.0.

Subsection 2.1 is the introduction, which provides a brief overview of the project. Subsection 2.2 contains a description of the generating facility, its design, and its proposed operation. Subsection 2.3 discusses the safety design of the facility. Subsection 2.4 discusses the expected facility reliability. Subsection 2.5 refers to the laws, ordinances, regulations, and standards (LORS) applicable to each engineering discipline.

The Turlock Irrigation District (TID) Walnut Energy Center (WEC) will be a nominal 250-megawatt (MW) combined-cycle generating facility configured using two natural-gas-fired combustion turbines and one steam turbine. The WEC will connect to TID's electrical transmission system via new 115- and 69-kV transmission lines. The new 115-kV transmission line will be approximately 1,950 feet long and will loop one circuit of an existing double-circuit TID 115-kV transmission line into WEC. The 115-kV transmission line will be a double-circuit transmission line on one set of poles. The new 69-kV transmission line will be approximately 670 feet long and will loop an existing TID 69-kV line into the WEC. The 69-kV transmission line will also be a double-circuit transmission line on one set of poles (see Section 5, Electric Transmission). Natural gas for the facility will be delivered via approximately 3.6 miles of new 8-inch pipeline that will connect to Pacific Gas & Electric Company's (PG&E's) existing gas transmission lines (Line 215) located 3.6 miles south of the project site at Bradbury Road. The project will include an onsite fuel gas compressor station.

The WEC project will use up to 1,800 acre feet per year (afy) of recycled water provided by the City of Turlock's (City) Wastewater Treatment Plant (WWTP) for cooling tower make-up. Cooling water will be cycled in the cooling tower approximately three and a half times. The blowdown will be concentrated and the water recycled onsite using a zero-liquid-discharge (ZLD) system (see Subsection 2.2.9.1.2). The ZLD system will provide the steam-cycle makeup water.

The recycled water will be delivered via a new 1.6-mile pipeline from the WWTP to the project site. The City is currently developing a Title 22 water treatment facility and is required by the Regional Water Quality Control Board (RWQCB) to have it operational by May 2006. Since the WEC project will commence operations the fourth quarter of 2005, TID proposes to use potable water from the City of Turlock to meet the WEC's water demands until the City's recycled water is available. The potable water will be provided via a new 0.9-mile pipeline connecting to an existing City water main located in Tegner Road, east of the WEC site. Potable water for drinking, safety showers, fire protection water, service water, and sanitary uses will continue to be served from the City's potable water system. Sanitary wastewater disposal will be linked to an onsite septic and leach field system.

The WEC will be located on approximately 18 acres of land at the northeast corner of a 69-acre parcel. TID has executed a purchase option for the parcel. The site is located in an industrial area about 4 miles west of the downtown portion of the City of Turlock, in Stanislaus County. Figure 2.1-1 (all figures are located at the end of this section) shows the location of the generating facility, electric transmission lines, natural gas supply pipeline, recycled water supply pipeline, and potable water supply line. The legal description of the project site and documentation showing site control by TID are provided in Appendix 1A. Property owners within 1,000 feet of the WEC boundaries, and within 500 feet of project transmission lines, the natural gas pipeline, and water pipelines are listed in Appendix 1B.

2.2 Generating Facility Description, Design, and Operation

This section describes the facility's conceptual design and proposed operation.

2.2.1 Site Arrangement and Layout

The site plan on Figure 2.2-1 and typical elevation views on Figures 2.2-2a and 2b illustrate the location and size of the proposed generating facility. Settled areas, parks, and recreational and scenic areas near the site and the proposed transmission lines are shown in Figure 2.2-3.

The site is located southeast of the intersection of West Main Street and South Washington Road. Access to the site will be via a new 1,900-foot road built off South Washington Road through the west side of the project parcel (see Figure 2.1-1). Part of the power block will be paved to provide internal access to all project facilities and onsite buildings. The areas around equipment, where not paved, will have gravel surfacing. The 115-kV transmission lines will interconnect from the project site, about 1,950 feet west to one of two of the existing TID 115-kV transmission lines, which run along the west side of South Washington Road. The 69-kV transmission line will interconnect from the project site and run about 670 feet to an existing TID 69-kV transmission line, which runs along the south property line of the project parcel. The routes for the 115- and 69-kV transmission lines are shown in Figure 2.1-1. The single-line representation of the interconnection scheme is depicted in Figure 2.2.4.

2.2.2 Process Description

The generating facility will consist of two combustion turbine generators (CTGs) equipped with dry, low oxides of nitrogen (NO_x) combustors; two heat recovery steam generators (HRSGs); one condensing steam turbine generator (STG); a deaerating surface condenser; a 5-cell mechanical-draft cooling tower; and associated support equipment providing a total nominal generating capacity of 250 MW (at average annual ambient conditions). The combustion turbines will be General Electric Frame 7EA units. The project will not include steam power augmentation to the CTGs, duct firing of the HRSGs, an auxiliary boiler, or a standby generator.

Each CTG will generate approximately 84 MW at base load under average ambient conditions. The CTG exhaust gases will be used to generate steam in the HRSGs. The HRSGs will be a reheat design without duct firing. Steam from the HRSGs will be admitted to a condensing STG. Approximately 100 MW will be produced by the steam turbine when the CTGs are operating at base load at average ambient conditions. The project is expected to have an overall annual availability of 92 to 98 percent.

The generating facility base load operation heat balance is shown on Figure 2.2-5. This balance is based on an ambient dry bulb temperature of (61°F) (annual average), an ambient wet bulb temperature of 53°F (annual average), with evaporative cooling of the combustion air.

Associated equipment will include emission control systems necessary to meet the proposed emission limits. Stack NO_x emissions will be controlled to 2.0 parts per million by volume, dry basis, corrected to 15 percent oxygen (ppmc) by a combination of low NO_x combustors in the CTGs and selective catalytic reduction (SCR) systems in the HRSGs. An oxidation (CO) catalyst will be installed in the HRSGs to limit stack CO emissions to 4.0 ppmc.

2.2.3 Generating Facility Cycle

In the CTGs, combustion air flows through the inlet air filter, evaporative cooler, and associated air inlet ductwork, is compressed in the gas turbine compressor section, and then flows to the CTG combustor. Natural gas fuel is injected into the compressed air in the combustor and ignited. The hot combustion gases expand through the power turbine section of the CTG, causing the shaft to rotate and drive the electric generator and CTG compressor. The hot combustion gases exit the turbine at approximately 1,000°F and enter the HRSG. In the HRSG's, boiler feedwater is converted to superheated steam and delivered to the steam turbine at three pressures: high pressure (HP), intermediate pressure (IP), and low pressure (LP). The use of multiple steam delivery pressures increases cycle efficiency and flexibility. High-pressure steam expands through the HP section of the steam turbine. This expanded steam, referred to as cold reheat steam, is combined with the IP steam from the HRSGs and returned to the reheater section of the HRSGs. This mixed, reheated steam (called "hot reheat") is then expanded in the IP section of the steam turbine. Steam exiting the IP section is mixed with LP steam from the HRSGs and expanded in the LP section of the steam turbine. Steam leaving the LP section enters the surface condenser where it is condensed. The heat energy of the condensing steam transfers to a circulating water loop, which, in turn, exhausts heat to the atmosphere by means of a mechanical-draft cooling tower.

2.2.4 Combustion Turbine Generators, Heat Recovery Steam Generators, Steam Turbine Generator, and Condenser

Electricity is produced by the two CTGs and the STG. The following subsections describe the major components of the generating facility.

2.2.4.1 Combustion Turbine Generators

Thermal energy is produced in the CTGs through the combustion of natural gas, which is converted into mechanical energy required to drive the combustion turbine compressors and electric generators. Two General Electric Frame 7EA CTGs have been selected for the WEC.

Each CTG system consists of a stationary combustion turbine generator, supporting systems, and associated auxiliary equipment. The CTGs will not be equipped with power augmentation capability.

The CTGs will be equipped with the following required accessories to provide safe and reliable operation:

- Inlet air filters
- Inlet air evaporative coolers
- Metal acoustical enclosure
- Double lube oil cooler
- Dry low-NOx combustion system
- Compressor wash system
- Fire detection and protection system

The metal acoustical enclosure, which contains the CTGs and accessory equipment, will be located outdoors.

2.2.4.2 Heat Recovery Steam Generators

The HRSGs provide for the transfer of heat from the exhaust gases of the CTGs to the feedwater, which is turned into steam. The HRSGs will be three-pressure, natural circulation units equipped with inlet and outlet ductwork, insulation, lagging, and separate exhaust stacks.

Major components of each HRSG include a feedwater preheater, LP evaporator, IP drum, LP superheaters, IP economizer, IP evaporator, IP drum, IP superheaters and reheaters, HP economizers, HP evaporator, HP drum, and HP superheaters. The feedwater preheater receives condensate from the condenser hot well via the condensate pumps. The feedwater preheater is the final heat transfer section to receive heat from the combustion gases prior to exhausting them to the atmosphere.

From the feedwater preheater, the condensate is directed to the LP drum where it is available to generate LP steam and supply condensate to the boiler feed pumps. The boiler feed pumps draw suction from the LP drum and provide additional pressure to serve the separate IP and HP sections of the HRSG.

Feedwater from the boiler feed pumps is sent to the HP section of the HRSG. High-pressure feedwater flows through the HP economizers where it is preheated prior to entering the HP steam drum. Within the HP steam drum, a saturated liquid state will be maintained. The saturated water will flow through downcomers from the HP steam drum to the inlet headers at the bottom of the HP evaporator. Saturated steam will form in the tubes as energy from the combustion turbine exhaust gas is absorbed. The HP saturated liquid/steam mixture will then return to the steam drum where the two phases will be separated by the steam separators within the drum. The saturated water will return to the HP evaporator, while the steam continues on to the HP superheaters. Within the HP superheaters, the temperature of the HP steam will be increased above its saturation temperature, or “superheated” prior to being admitted to the HP section of the steam turbine.

Feedwater will also be sent to the IP section of the HRSG by an interstage bleed from the boiler feed pumps. Similar to the HP section, feedwater will be preheated in the IP economizer and steam will be generated in the IP evaporator. The saturated IP steam will pass through the IP superheaters and then be mixed with “cold reheat” steam from the discharge of the steam turbine HP section. The blended steam will then pass through two additional IP superheaters, reheating the steam to a superheated state. The "hot reheat" steam will then be admitted to the steam turbine IP section.

Condensate will be preheated by the feedwater preheater prior to entering the LP steam drum. Similar to the HP and IP sections, steam will be generated in the LP evaporator and superheated in the LP superheaters. The superheated LP steam will then be admitted to the LP section of the steam turbine along with the steam exhausting from the steam turbine IP section.

Duct burners will not be installed in the HRSGs.

Each HRSG will be equipped with an SCR emission control system that will use ammonia in the presence of a catalyst to reduce NO_x in the exhaust gases. The catalyst module will be located within the HRSG casing. Ammonia (NH_3) gas from the anhydrous ammonia storage tank will be diluted with air, then injected into the CTG exhaust gas stream via a grid of nozzles located upstream of the catalyst module. The subsequent chemical reaction will reduce NO_x to nitrogen and water, resulting in an exhaust gas NO_x concentration leaving the HRSG stack no greater than 2.0 ppmc.

An oxidation catalyst will also be installed within the HRSG casing to control the concentration of CO in the exhaust gas leaving the HRSG stack to no greater than 4 ppmc. Exhaust from each HRSG will be discharged from individual 132-foot-tall, 16-foot-diameter exhaust stacks.

2.2.4.3 Steam Turbine Generator

The steam turbine system consists of a condensing steam turbine generator (STG) with reheat, gland steam system, lubricating oil system, hydraulic control system, and steam admission/induction valving.

Steam from the HRSG HP, IP, and LP superheaters enters the associated steam turbine sections through the inlet steam system. The steam expands through multiple stages of the turbine, driving the generator. On exiting the turbine, the steam is directed into the surface condenser.

2.2.5 Major Electrical Equipment and Systems

The bulk of the electric power produced by the facility will be transmitted to the TID grid. A small amount of electric power will be used onsite to power auxiliaries such as pumps and fans, control systems, and general facility loads including lighting, heating, and air conditioning. Some will also be converted from alternating current (AC) to direct current (DC), which is used as backup power for control systems and other uses. Transmission and auxiliary uses are discussed in the following subsections.

2.2.5.1 AC Power—Transmission

Power will be generated by the two CTGs and the STG at 13.8 kV and then stepped up by three transformers to 69 and 115 kV for transmission to the grid. An overall single-line diagram of the facility's electrical system is shown on Figure 2.2-4. The generators will be connected by non-segregated bus duct and/or iso-phase bus duct to oil-filled step-up transformers that increase the voltage to 69 or 115 kV as indicated on the single-line diagram. Surge arresters will be provided at the high-voltage bushings to protect the transformers from surges on the 69- and 115-kV system caused by lightning strikes or other system disturbances. The transformers will be set on concrete pads within containments designed to contain the transformer oil in the event of a leak or spill. Fire protection systems will be provided for the transformers. The high-voltage side of the step-up transformers will be connected via overhead cables to the plant's separate 69- and 115-kV switchyards. From the switchyards, power will be transmitted via separate 69- and 115-kV transmission lines to the TID grid.

The WEC facility will be connected to TID's transmission system by looping both the 69- and 115-kV lines into the WEC switchyard. At the 69-kV level, this will be accomplished by intercepting the 69-kV transmission line immediately south of the plant site and installing a double-circuit pole line into the WEC 69-kV switchyard. At the 115-kV level, this will be accomplished by intercepting one of two 115-kV transmission lines that run along the west side of South Washington Road and installing a double-circuit pole line into the WEC 115-kV switchyard. A detailed discussion of the transmission system is provided in Section 5. Figure 2.2-3 illustrates the settled areas, scenic areas, and existing transmission lines within one mile of the proposed transmission line routes.

2.2.5.2 AC Power—Distribution to Auxiliaries

Auxiliary power to the combustion turbine and steam turbine power block will be supplied at 4,160 volts AC by a double-ended 4,160-volt switchgear lineup. Two oil-filled, 13.8-kV to 4.16-kV unit auxiliary stepdown transformers will supply primary power to the switchgear. The high-voltage side (13.8-kV) of the unit auxiliary transformers will be connected to the outputs of one of the two CTGs and the STG. This connection will allow the switchgear to be powered from either or both of the two generators or by back-feeding power from either the 69 or 115-kV switchyard. Low-voltage side (13.8-kV) generator circuit breakers will be provided for the CTGs and STG. For the turbines provided with unit auxiliary transformers, these circuit breakers, used to isolate and synchronize the generators, will be located between the generators and the connections to the transformers. In addition, a power feed from TID's local 12-kV distribution system will be connected to the 4,160-volt level via a standby auxiliary transformer.

The 4,160-volt switchgear lineup supplies power to the various 4,160-volt motors, to the combustion turbine starting system, and to the load center (LC) transformers, rated 4,160 to 480 volts, for 480-volt power distribution. The switchgear will have vacuum interrupter circuit breakers for the main incoming feeds and for power distribution.

The LC transformers will be oil-filled, each supplying 480-volt, 3-phase power to the double-ended load centers.

The load centers will provide power through feeder breakers to the various 480-volt motor control centers (MCCs). The MCCs will distribute power to 480-volt motors, to 480-volt power distribution panels, and lower voltage lighting and distribution panel transformers. Power for the AC power supply (120-volt/208-volt) system will be provided by the 480-volt MCCs and 480-volt power panels. 480-120/208-volt dry-type transformers will provide transformation of 480-volt power to 120/208-volt power.

2.2.5.3 125-Volt DC Power Supply System

One common 125-volt DC power supply system consisting of one 100 percent capacity battery bank, two 100 percent static battery chargers, a switchboard, and two or more distribution panels will be supplied for balance-of-plant and STG equipment. Each CTG and the switchyard protection relay panel will be provided with their own separate battery systems and redundant chargers.

Under normal operating conditions, the battery chargers supply DC power to the DC loads. The battery chargers receive 480-volt, three-phase AC power from the AC power supply (480-volt) system and continuously charge the battery banks while supplying power to the DC loads.

Under abnormal or emergency conditions, when power from the AC power supply (480-volt) system is unavailable, the batteries supply DC power to the DC system loads. Recharging of a discharged battery occurs whenever 480-volt power becomes available from the AC power supply (480-volt) system. The rate of charge depends on the characteristics of the battery, battery charger, and the connected DC load during charging. The anticipated maximum recharge time will be 12 hours.

The 125-volt DC system will also be used to provide control power to the 4,160-volt switchgear, to the 480-volt LCs, to critical control circuits, and to the emergency DC motors.

2.2.5.4 Uninterruptible Power Supply System

The combustion turbines and steam turbine power block will also have an essential service 120-volt AC, single-phase, 60-hertz (Hz) uninterruptible power supply (UPS) to supply AC power to essential instrumentation to critical equipment loads and to unit protection and safety systems that require uninterruptible AC power.

Redundant UPS inverters will supply 120-volt AC single-phase power to the UPS panel boards that supply critical AC loads. The UPS inverters will be fed from the station 125-volt DC power supply system. Each UPS system will consist of one full-capacity inverter, a static transfer switch, a manual bypass switch, an alternate source transformer, and two or more panelboards.

The normal source of power to the system will be from the 125-volt DC power supply system through the inverter to the panelboard. A solid-state static transfer switch will continuously monitor both the inverter output and the alternate AC source. The transfer switch will automatically transfer essential AC loads without interruption from the inverter output to the alternate source upon loss of the inverter output.

A manual bypass switch will also be included to enable isolation of the inverter for testing and maintenance without interruption to the essential service AC loads.

The distributed control system (DCS) operator stations will be supplied from the UPS. The continuous emission monitoring (CEM) equipment, DCS controllers, and input/output (I/O) modules will be fed using either UPS or 125-volt DC power directly.

2.2.6 Fuel System

The CTGs will be designed to burn natural gas only. The natural gas requirement during base load operation at annual average ambient temperatures is approximately 1,980 MMBtu/hr (HHV basis, total for two CTG units). The maximum natural gas requirement, experienced during low ambient temperature operation, is approximately 2,095 MMBtu/hr (HHV basis) or approximately 49 MMSCFD.

Natural gas will be delivered to the site via pipeline (see Section 6.0). This 3.6-mile pipeline will extend from where it interconnects to PG&E's Line 215 at West Bradbury Road, north approximately 2.8 miles along Commons Road until it reaches the railroad tracks, where it will turn east to the WEC site. The natural gas will flow through a flow-metering station, gas scrubber/filtering equipment, a gas pressure control station, booster compressors (when required), and a fuel gas heater prior to entering the combustion turbines.

Historical data indicates that the pressure on the PG&E Line 215 will vary. At times when the pressure at the fence line drops below 425 psig, an electric motor-driven gas compressor will be used to boost the plant gas pressure. Two 100-percent capacity or three 50-percent capacity fuel gas compressors will be provided. The gas compressors will be located outdoors.

2.2.7 Water Supply and Use

This subsection describes the quantity of water required, the sources of the water supply, and water treatment requirements. Two water balance diagrams are included, representing two operating conditions. Figures 2.2-6a and 2.2-6b represent: (1) annual average operation at 61°F with 2 CTGs operating at 100 percent load and CTG inlet evaporative cooling, and (2) peak operation at 97°F with 2 CTGs operating at 100 percent load and CTG inlet evaporative cooling.

The WEC project will use up to 1,800 afy of recycled water provided by the City of Turlock's WWTP for cooling tower make-up. Recycled water for WEC will be produced by new treatment facilities, located in Turlock's existing WWTP. The new tertiary treatment facilities will meet Title 22 requirements. The recycled water will be delivered to WEC through a new 12- to 24-inch pipeline, approximately 1.6 miles in length. The recycled water pipeline will be routed from the boundary of the Turlock WWTP on South Kilroy Road and run generally west to WEC (see Figure 2.1-1). A ZLD system will be used to recycle cooling tower blowdown onsite. A portion of the distillate generated from the ZLD process will be further treated by offsite regenerated mixed bed demineralizers and used as steam cycle make-up water. Distillate from the ZLD treatment system will be used to provide all of the steam cycle makeup water for WEC.

The RWQCB has mandated that the City's water treatment facilities be operational by May 2006. Since the WEC project will commence operations the fourth quarter of 2005, TID proposes to use potable water from the City of Turlock to meet WEC's water demands until the City's recycled water is available. A new 8- to 12-inch pipeline, approximately 0.9-mile in length, will be constructed to deliver potable water to WEC from an existing main located in South Tegner Road, east of the WEC (see Figure 2.1-1). The connection to the City of Turlock's existing line will be near the intersection of South Tegner Road and Ruble Road, and the pipeline will be installed in the Ruble Road right-of-way and proceed west to the plant site. Once recycled water is available, potable water for drinking, safety showers, fire protection water, service water, and sanitary uses will continue to be served from the potable water system. Sanitary wastewater disposal will be to an onsite septic system and leach field.

A more detailed description of the water supply system, treatment, and permits is provided in Section 7.0, Water Supply Pipelines, and Subsection 8.14, Water Resources.

2.2.7.1 Water Requirements

A breakdown of the estimated average daily quantity of water, required for operation of WEC, is presented in Table 2.2-1. The daily water requirements shown are estimated quantities based on the combined-cycle plant operating at full load, with evaporative cooling of the CTG inlet air, at an ambient temperature of 61°F (annual average dry bulb temperature). Peak water requirements shown in Table 2.2-1 are based on the plant operating at full load, with evaporative cooling of the CTG inlet air, at an ambient temperature of 97°F (1 percent dry bulb temperature).

TABLE 2.2-1
Average Daily, Maximum Daily and Maximum Annual Water Usage and Wastewater Discharge for WEC

Water Use	Average Daily Use (gpd)	Maximum Daily Use (gpd)	Maximum Annual Use (afy)
Process and Cooling Water	1,400,000	2,000,000	1,800
Potable Water Service	2,000	2,000	3
Wastewater Discharge (to onsite septic and leachfield)	2,000	2,000	3

2.2.7.2 Water Supply

During normal operation, approximately 97 percent of the total WEC water demand is for cooling tower makeup water to replace water lost to evaporation. The remaining water demands include process makeup water for the HRSGs, CTG evaporative cooling makeup, plant service water, and potable water for domestic uses. A detailed description of the water supply is presented in Subsection 8.14.

2.2.7.3 Water Quality

Subsection 8.14 includes a projection of the recycled water quality based on data from the Turlock WWTP.

2.2.7.4 Water Treatment

Figures 2.2-6a and 2.2-6b illustrate the water treatment and distribution system. Water use can be divided into the following four levels based on the quality required: (1) water for the circulating (or cooling) water system; (2) service water for the plant, which includes all other miscellaneous uses; (3) demineralized water for makeup to the steam cycle; and (4) potable water. Water treatment required to obtain these four levels of quality is described in the following paragraphs.

2.2.7.4.1 Water for the Circulating Water System

Recycled water will be fed from the recycled water pipeline into the recycled water storage tank, located near the cooling tower. Until recycled water is available, potable water instead of recycled water will be used. The recycled water storage tank will provide approximately 4 hours of operational storage (about 500,000 gallons) in the event there is a disruption in the flow of recycled water from the Turlock WWTP. If a disruption in the recycled water flow lasts longer than 4 hours, potable water will be used as a backup supply. Makeup water will be fed by gravity from the recycled water storage tank to the cooling tower basin as required to replace water lost to evaporation, drift, and blowdown.

A chemical feed system will supply water conditioning chemicals to the circulating water to minimize corrosion and control the formation of mineral scale and biofouling. Sulfuric acid will be fed into the circulating water system in proportion to circulating water pH for alkalinity reduction to control the scaling tendency of the circulating water. The acid feed equipment will consist of a bulk sulfuric acid storage tank and two sulfuric acid metering pumps.

To further inhibit scale formation, a polyacrylate solution will be fed into the circulating water system as a sequestering agent in an amount proportional to the circulating water blowdown flow. The scale inhibitor feed equipment will consist of a chemical solution bulk storage tank and two scale inhibitor metering pumps.

To prevent biofouling in the circulating water system, sodium hypochlorite will be fed into the system. The hypochlorite feed equipment will consist of a bulk storage tank and two sodium hypochlorite metering pumps. Additional chemical storage and feed systems will be provided for feeding alternate oxidizing and non-oxidizing biocides.

2.2.7.4.2 Service Water

Service water includes all water uses at the plant except for the circulating water previously discussed, demineralized water used for makeup to the steam cycle, and potable water. City (potable) water protected by a reduced pressure backflow prevention device or air gap will be used for service water. Service water will be stored in an above-ground steel tank that will also provide onsite storage of fire protection water. No additional treatment of the City water is required for use as service water.

2.2.7.4.3 Makeup Water for the Steam Cycle

Demineralized water will be used for makeup water for the steam cycle, CTG wash water, and for makeup to the CTG inlet air evaporative coolers. Demineralized water will be produced by passing distillate from the ZLD brine concentrators through a mixed-bed ion exchange demineralizer and stored in a 250,000-gallon demineralized water storage tank. The mixed bed demineralizers will be regenerated offsite.

To minimize steam cycle corrosion and scale formation, chemical feed systems will feed an oxygen scavenger to the condensate for dissolved oxygen control, a neutralizing amine to the condensate for corrosion control, and a phosphate solution to the HRSG steam drums for pH control. The design will provide for automatic feed of the oxygen scavenger in proportion to condensate flow and the amine in proportion to condensate flow with a pH bias. The system will include an oxygen scavenger solution feed tank, two oxygen scavenger feed pumps and an amine solution feed tank, and two amine feed pumps. The oxygen scavenger system and the amine system will include a relatively high-volume metering pump to provide sufficient quantities of chemicals to support wet lay-up of the HRSGs during short down-periods.

The phosphate feed system will be designed for operation using the low solids, coordinated phosphate or other standard method of boiler water treatment. The phosphate feed will be manually initiated based on boiler water phosphate residual and manually biased for pH. One solution tank and one phosphate feed pump will be provided for each HP and IP steam drum with one common spare pump serving each HRSG.

2.2.7.4.4 Steam Cycle Sampling and Analysis System

The Steam Cycle Sampling and Analysis System will monitor the water quality at various points in the steam cycle and provide sufficient data to operating personnel for detection of deviations from control limits so that corrective action can be taken. The samples will be routed to a sample panel, located in the Cycle Chemical Feed Building, where pressure and temperature will be reduced as required. At the sample panel, samples will be directed to automatic analyzers for continuous monitoring, and grab samples will be provided for wet chemical analyses. All monitored values will be sent to the DCS where alarm set points will be controlled.

2.2.8 Plant Cooling Systems

The cycle heat rejection system will consist of a deaerating steam surface condenser, cooling tower, and circulating water system. The heat rejection system will receive exhaust steam from the low-pressure section of the steam turbine and condense it back to water for reuse. The surface condenser will be a shell-and-tube heat exchanger with the steam condensing on the shell side and the circulating water flowing in one or more passes inside the tubes. The condenser will be designed to operate at sub-atmospheric pressure, ranging from 1 to 5 inches of mercury, depending on ambient temperature and plant load. The condenser will remove between about 250 and 670 MMBtu/hr, depending on ambient temperature and plant load. Approximately 66,000 gpm of circulating cooling water will be used to condense the steam at maximum plant load.

The circulating water will circulate through a counter-flow mechanical draft-cooling tower, which uses electric-motor-driven fans to move the air in a direction opposite the flow of the water. The heat removed in the condenser will be discharged to the atmosphere by heating the air and through evaporation of a portion of the circulating water. Drift, the fine mist of water droplets entrained in the warm air leaving the cooling tower, will be limited to 0.0005 percent of the circulating water flow.

An open-loop auxiliary cooling system will be provided for cooling plant equipment other than the steam condenser. Equipment served by the auxiliary cooling water system includes the CTG and STG lube oil coolers, CTG and STG generator coolers, STG hydraulic control system cooler (if required by STG manufacturer), boiler feed pump lube oil and seal water coolers, fuel gas compressor coolers, and sample coolers. Auxiliary cooling water pumps will pump circulating water from the cooling tower basin through the individual equipment coolers to remove heat. The hot auxiliary cooling water will be returned to the cooling tower along with the hot circulating water.

2.2.9 Waste Management

Waste management is the process whereby all wastes produced at WEC are properly collected, treated if necessary, and disposed of. Wastes include process and sanitary wastewater, nonhazardous waste and hazardous waste, both liquid and solid. Waste management is discussed in more detail in Subsection 8.13.

2.2.9.1 Wastewater Collection, Treatment, and Disposal

The primary wastewater collection system will collect process wastewater from all of the plant equipment, including the HRSGs, cooling tower, and water treatment equipment. Since the WEC is a ZLD facility, process wastewater will be recycled and reused, to the extent practical. The leftover concentrated brine solution, high in total dissolved solids (TDS), will be dried in an evaporative crystallizer and further dewatered using a filter press or belt press to a solid salt cake. The salt cake is expected to be non-hazardous and be taken offsite for disposal in a municipal landfill, as described in Subsection 8.13. The water balance diagrams, Figures 2.2-6a and 2.2-6b, show the expected wastewater streams and flow rates for WEC. The second wastewater collection system will collect sanitary wastewater from sinks, toilets, showers, and other sanitary facilities, and discharge it to an onsite septic and leach field system. The two wastewater systems are described below.

2.2.9.1.1 Circulating Water System Blowdown

Circulating water system blowdown will consist of recycled water from the Turlock WWTP along with various process waste streams that have been concentrated approximately three times along with residues of the chemicals added to treat the circulating water. These chemicals control scaling and biofouling of the cooling tower and control corrosion of the circulating water piping and condenser. Cooling tower blowdown will be discharged to a ZLD treatment system, where it will be recycled for reuse within the plant.

2.2.9.1.2 Zero-Liquid Discharge Treatment System

The ZLD at WEC makes use of three concentration steps – the cooling tower, brine concentrators, and crystallizers. All process waste streams (oil/water separator effluent, quenched HRSG blowdown, and excess brine concentrator distillate) will be directed to the cooling tower for initial concentration. The cooling tower concentrates these streams to a point near the mineral solubility limit for the constituents of concern. Based on the projected quality of the Turlock WWTP recycled water, the cooling tower circulating water will be near the mineral solubility limit for silica. A portion of this concentrated water will then be removed from the cooling tower via the blowdown to prevent the mineral scale formation on heat transfer surfaces.

Cooling tower blowdown will pass through a storage tank that will minimize flow variations in feeding blowdown to the brine concentrators. After the blowdown storage tank, the cooling tower blowdown will pass through a multimedia filter to remove suspended solids as required to minimize fouling of downstream ZLD equipment.

In the brine concentrator, heat will be applied to evaporate approximately 96 percent of the feed water. Evaporated water will be reclaimed using a condenser producing a distillate very low in TDS. This distillate will be stored in a tank from which it will be pumped through offsite regenerated mixed-bed ion exchange demineralizers. Demineralized water exiting the mixed-bed demineralizers will be stored in the demineralized water storage tank for use in the combustion turbines and HRSG steam cycle. The concentrated brine will be sent to crystallizers.

The crystallizers will further concentrate the brine solution, producing a salt sludge which will be dewatered using either a filter press or belt press. The salt cake exiting the press will be discharged to a storage bin. The relatively dry salt cake will be trucked offsite for disposal. Naturally occurring substances, such as trace metals present in the WEC source water, will become concentrated in the salt cake produced by the ZLD system.

2.2.9.1.3 Plant Drains and Oil/Water Separator

General plant drains will collect containment area washdown, sample drains, and drainage from facility equipment drains. Water from these areas will be collected in a system of floor drains, hub drains, sumps, and piping and routed to the wastewater collection system. Drains that potentially could contain oil or grease will first be routed through an oil/water separator. Water from the plant wastewater collection system will be recycled to the cooling tower basin. Wastewater from combustion turbine water washes will be collected in holding tanks or sumps and will be trucked offsite for disposal at an approved wastewater disposal facility or pumped to the cooling tower basin, depending on the quality of the wastewater.

2.2.9.1.4 Power Cycle Makeup Water Treatment Wastes

Distillate from the ZLD system will be used as the feed water for the power cycle makeup treatment system. Since this distillate is already very low in TDS, the power cycle makeup treatment system will consist only of mixed-bed ion exchange demineralizers. The mixed-bed demineralizers will be regenerated offsite, thus there will be no wastewater stream specifically resulting from the power cycle makeup water treatment.

2.2.9.1.5 HRSG Blowdown

HRSG blowdown will consist of boiler water discharged from the HRSG HP and IP steam drums to control the concentration of dissolved solids and silica within acceptable ranges. HRSG blowdown will ultimately be discharged to atmospheric flash tanks where the steam is vented to atmosphere and the condensate is cooled by mixing it with a small amount of recycled water. The quenched condensate will then be discharged to the cooling tower basin, thus recycling most of the HRSG blowdown.

2.2.9.1.6 Solid Wastes

WEC will produce maintenance and plant wastes typical of power generation operations. Generation plant wastes include oily rags, broken and rusted metal and machine parts, defective or broken electrical materials, empty containers, and other solid wastes, including the typical refuse generated by workers. Additionally, the WEC will generate a relatively dry salt cake from the ZLD system, as discussed above. These materials will be collected by the local waste disposal company (see Subsection 8.13). Recyclable materials will be taken offsite. Waste collection and disposal will be in accordance with applicable regulatory requirements to minimize the potential for health and safety impacts.

2.2.9.1.7 Hazardous Wastes

Several methods will be used to properly manage and dispose of hazardous wastes generated by WEC. Waste lubricating oil will be recovered and recycled by a waste oil recycling contractor. Spent lubrication oil filters will be disposed of in a Class I landfill.

Spent SCR and oxidation catalysts will be recycled by the supplier or disposed of in accordance with regulatory requirements. Workers will be trained to handle hazardous wastes generated at the site.

Chemical cleaning wastes will consist of alkaline and acid cleaning solutions used during pre-operational chemical cleaning of the HRSGs, acid cleaning solutions used for chemical cleaning of the HRSGs after the units are put into service, and turbine wash and HRSG fireside washwaters. These wastes, which are subject to high metal concentrations, will be temporarily stored onsite in portable tanks or sumps, and disposed of offsite by the chemical cleaning contractor in accordance with applicable regulatory requirements.

2.2.10 Management of Hazardous Materials

There will be a variety of chemicals stored and used during construction and operation of WEC. The storage, handling, and use of all chemicals will be conducted in accordance with applicable LORS. Chemicals will be stored in appropriate chemical storage facilities. Bulk chemicals will be stored in storage tanks, and most other chemicals will be stored in returnable delivery containers. Chemical storage and chemical feed areas will be designed to contain leaks and spills. Berm and drain piping design will allow a full-tank capacity spill without overflowing the berms. For multiple tanks located within the same bermed area, the capacity of the largest single tank will determine the volume of the bermed area and drain piping. Drain piping for volatile chemicals will be trapped and isolated from other drains to eliminate noxious or toxic vapors. After neutralization, if required, water collected from the chemical storage areas will be directed to the cooling tower basin.

The anhydrous ammonia storage area will have spill containment and ammonia vapor detection equipment.

Safety showers and eyewashes will be provided adjacent to or in the vicinity of chemical storage and use areas. Hose connections will be provided near the chemical storage and feed areas to flush spills and leaks to the plant wastewater collection system. Plant personnel will use approved personal protective equipment during chemical spill containment and cleanup activities. Personnel will be properly trained in the handling of these chemicals and instructed in the procedures to follow in case of a chemical spill or accidental release. Adequate supplies of absorbent material will be stored onsite for spill cleanup.

A list of the chemicals anticipated to be used at WEC and their storage locations is provided in Subsection 8.12, Hazardous Materials Handling. This list identifies each chemical by type, intended use, and estimated quantity to be stored onsite. Subsection 8.12 includes additional information on hazardous materials handling.

2.2.11 Emission Control and Monitoring

Air emissions from the combustion of natural gas in the CTGs will be controlled using state-of-the-art systems. Emissions that will be controlled include NO_x, reactive organic compounds (ROCs), CO, and particulate matter. To ensure that the systems perform correctly, continuous emissions monitoring will be performed. Subsection 8.1, Air Quality, includes additional information on emission control and monitoring.

2.2.11.1 NO_x Emission Control

Selective Catalytic Reduction (SCR) will be used to control NO_x concentrations in the HRSG stack exhaust to 2.0 ppmvd at 15 percent oxygen. The SCR process will use anhydrous ammonia. Ammonia slip, or the concentration of unreacted ammonia in the HRSG stack exhaust, will be limited to 10 ppmvd at 15 percent oxygen. The SCR equipment will include a reactor chamber, catalyst modules, ammonia storage system, ammonia vaporization and injection system, and monitoring equipment and sensors.

2.2.11.2 Carbon Monoxide and Reactive Organic Compound Emission Control

CO and ROC will be controlled at the CTG combustor with state-of-the-art combustion technology. CO emissions will be further controlled by means of a CO oxidation catalyst, if required. Since CO catalysts have not been proven to control ROC emissions effectively and consistently in practice, no ROC reductions at the CO catalyst shall be assumed.

2.2.11.3 Particulate Emission Control

Particulate emissions will be controlled by the use of best combustion practices and the use of natural gas, which is low in particulates, as the sole fuel for the CTGs. PM_{10} emissions from the cooling tower will be controlled through the use of high-efficiency drift eliminators with an emission rate of 0.0005 percent.

2.2.11.4 Continuous Emission Monitoring

Continuous emission monitors (CEMs) will sample, analyze, and record fuel gas flow rate, NO_x and CO concentration levels, and percentage of O_2 in the exhaust gas from the two HRSG stacks. This system will generate reports of emissions data in accordance with permit requirements and will send alarm signals to the plant-distributed control system (DCS) when the emissions approach or exceed pre-selected limits.

2.2.12 Fire Protection

The fire protection system will be designed to protect personnel and limit property loss and plant downtime in the event of a fire. The primary source of fire protection water will be the City of Turlock's potable water system. The onsite service/fire water storage tank, with a dedicated firewater storage volume of 240,000 gallons, will provide a backup supply of fire protection water. The dedicated water supply is sized in accordance with National Fire Protection Association (NFPA) guidelines to provide 2 hours of flow at 2,000 gpm (the largest fixed fire suppression system demand plus 500 gpm for hose stream demand). The service/fire water storage tank will include a standpipe on the service water supply line so that the dedicated firewater portion of the storage cannot be used for other purposes.

An electric jockey pump and electric-motor-driven main fire pump will be provided to increase the water pressure in the plant fire main to the level required to serve all fire fighting systems. In addition, a diesel engine-driven fire pump will be provided to pressurize the fire loop if the power supply to the electric-motor-driven main fire pump fails. A fire pump controller will be provided for the fire pumps.

All three fire pumps will discharge to a dedicated underground firewater loop piping system. Normally, the jockey pump will maintain pressure in the firewater loop. Both the fire hydrants and the fixed suppression systems will be supplied from the firewater loop.

Fixed fire suppression systems will be installed at determined fire risk areas such as the transformers and turbine lube oil equipment. Sprinkler systems will also be installed in the Administration/Control/Warehouse/Maintenance Building and Fire Pump enclosure as required by NFPA and local code requirements. The CTG units will be protected by a CO_2 fire protection system. Handheld fire extinguishers of the appropriate size and rating will be located in accordance with NFPA 10 throughout the facility. The cooling tower will be constructed of fiberglass with a flame-spread rating of 25 or less and will, therefore, not have a sprinkler system.

Subsection 8.12, Hazardous Materials Handling, includes additional information for fire and explosion risk, and Subsection 8.8, Socioeconomics, provides information on local fire protection capability.

2.2.13 Plant Auxiliaries

The following systems will support, protect, and control the generating facility.

2.2.13.1 Lighting

The lighting system provides personnel with illumination for operation under normal conditions and for egress under emergency conditions, and includes emergency lighting to perform manual operations during an outage of the normal power source. The system also provides 120-volt convenience outlets for portable lamps and tools.

2.2.13.2 Grounding

The electrical system is susceptible to ground faults, lightning, and switching surges that result in high voltage that constitute a hazard to site personnel and electrical equipment. The station grounding system provides an adequate path to permit the dissipation of current created by these events.

The station grounding grid will be designed for adequate capacity to dissipate the ground fault current from the ground grid under the most severe conditions in areas of high ground fault current concentration. The grid spacing will maintain safe voltage gradients.

Bare conductors will be installed below-grade in a grid pattern. Each junction of the grid will be bonded together by an exothermic weld.

Ground resistivity readings will be used to determine the necessary numbers of ground rods and grid spacing to ensure safe step and touch potentials under severe fault conditions.

Grounding conductors will be brought from the ground grid to connect to building steel and non-energized metallic parts of electrical equipment.

2.2.13.3 Distributed Control System (DCS)

The DCS provides modulating control, digital control, monitoring, and indicating functions for the plant power block systems.

The following functions will be provided:

- Controlling the STG, CTGs, HRSGs, and other systems in a coordinated manner

- Controlling the balance-of-plant systems in response to plant demands
- Monitoring controlled plant equipment and process parameters and delivery of this information to plant operators
- Providing control displays (printed logs, cathode ray tube [CRT]) for signals generated within the system or received from input/output (I/O)
- Providing consolidated plant process status information through displays presented in a timely and meaningful manner
- Providing alarms for out-of-limit parameters or parameter trends, displaying on alarm CRT(s), and recording on an alarm log printer
- Providing storage and retrieval of historical data

The DCS will be a redundant microprocessor-based system and will consist of the following major components:

- CRT-based operator consoles
- Engineer work station
- Distributed processing units
- I/O cabinets
- Historical data unit
- Printers
- Data links to the combustion turbine and steam turbine control systems

The DCS will have a functionally distributed architecture comprising a group of similar redundant processing units linked to a group of operator consoles and the engineer workstation by redundant data highways. Each processor will be programmed to perform specific dedicated tasks for control information, data acquisition, annunciation, and historical purposes. By being redundant, no single processor failure can cause or prevent a unit trip.

The DCS will interface with the control systems furnished by the CTG and STG suppliers to provide remote control capabilities, as well as data acquisition, annunciation, and historical storage of turbine and generator operating information.

The system will be designed with sufficient redundancy to preclude a single device failure from significantly affecting overall plant control and operation. This also will allow critical control and safety systems to have redundancy of controls, as well as an uninterruptible power source.

As part of the quality control program, daily operator logs will be available for review to determine the status of the operating equipment.

2.2.13.4 Cathodic Protection

The cathodic protection system will be designed to control the electrochemical corrosion of designated metal piping buried in the soil. Depending upon the corrosion potential and the site soils, either passive or impressed current cathodic protection will be provided.

2.2.13.5 Freeze Protection

The freeze protection system will provide heating to protect various outdoor piping, gauges, pressure switches, and other devices from freezing. Power to the self-limiting freeze protection circuits will be controlled by an ambient thermostat. Any process heating requirements will be met by tracing and insulation of the lines. If the line is subject to higher than 220°F temperature, then mineral-insulated resistance-type heat tracing will be employed.

2.2.13.6 Service Air

The service air system will supply compressed air to hose connections for general plant use. Service air headers will be routed to hose connections located at various points throughout the facility.

2.2.13.7 Instrument Air

The instrument air system will provide dry air to pneumatic operators and devices. An instrument air header will be routed to locations within the facility equipment areas and within the water treatment facility where pneumatic operators and devices will be located.

2.2.14 Interconnect to Electrical Grid

The two CTGs and the STG will be connected to TID's transmission system by looping existing 69-kV and 115-kV transmission lines into the WEC switchyard. One CTG will be connected to the 69-kV switchyard, the second CTG will be connected to the 115-kV switchyard, and the STG will be connected to both switchyards via an autotransformer.

2.2.15 Project Construction

Construction of the generating facility, from site preparation and grading to commercial operation, is expected to take place from the first quarter 2004 to the first quarter of 2006 (20 to 24 months total). Major milestones are listed in Table 2.2-2.

TABLE 2.2-2
Project Schedule Major Milestones

Activity	Date
Begin Construction	First Quarter 2004
Startup and Test	Fourth Quarter 2005
Commercial Operation	First Quarter 2006

There will be an average and peak workforce of approximately 124 and 277, respectively, of construction craft people, supervisory, support, and construction management personnel onsite during construction (see Table 8.8-8).

Noisy construction will be scheduled to occur between 7 a.m. and 7 p.m. on weekdays and 9 a.m. and 8 p.m. on weekends and holidays. Additional hours may be necessary to make up schedule deficiencies, or to complete critical construction activities (e.g., pouring concrete at night during hot weather, working around time-critical shutdowns and constraints). During some construction periods and during the startup phase of the project, some activities will continue 24 hours per day, 7 days per week.

The peak construction site workforce level is expected to last from Month 11 through Month 19 of the construction period.

Table 2.2-3 provides an estimate of the average and peak construction traffic during the 24-month construction period for the plant and associated linear facilities.

TABLE 2.2-3
Average and Peak Construction Traffic

Vehicle Type	Average Daily Trips	Peak Daily Trips
Construction Workers	192	426
Deliveries	10	20
Total	**202**	**446**

Construction laydown and parking areas will be within the 51-acre area available on the WEC project parcel, west of the plant area. Construction access will generally be from Highway 99 to West Main Street to South Washington Road to the plant entrance road, as shown on Figure 2.1-1. Materials and equipment will be delivered by truck or rail. An existing railroad and bypass track border the north side of the project site and are available for delivery of large or heavy equipment.

2.2.16 Generating Facility Operation

WEC will be operated by 2 operators per 12-hour rotating shift, plus 2 relief operators, 5 maintenance technicians, and 6 administrative personnel during the standard 8-hour work day. The facility will be operated 7 days a week, 24 hours per day. Total operations would include 21 personnel.

WEC is expected to have an annual plant availability of 92 to 98 percent. It will be possible for plant availability to exceed 98 percent for a given 12-month period. TID expects to operate the WEC primarily as a base load unit, with some amount of load following and cycling. The exact operational profile of the plant, however, cannot be defined in detail since operation of the facility depends on varying hydroelectric power availability and variable demand in the TID service area.

The facility may be operated in one or all of the following modes:

- **Base Load**. The facility would be operated at its maximum continuous output for as many hours per year as TID’s system requires, depending on the availability of hydroelectric power. It is anticipated that the facility will operate as a base load unit throughout the summer months.
- **Load Following**. During non-peak seasons (primarily Spring and Fall), the facility may be operated at loads that vary between maximum continuous output (both CTGs

operating at base load) and minimum load (one CTG operating as low as 50 percent load) to meet TID's system demand at all times of the day.

- **Daily Cycling**. During low demand periods, the facility may be operated in daily cycling mode, where the plant is operated at loads up to maximum continuous output during the day and totally shut down at night or weekends. This mode of operation may occur either with daily nighttime shutdowns or with weekend shutdowns depending on TID's system demand, hydroelectric power availability, and other issues.
- **Full Shutdown**. This would occur if forced by equipment malfunction, fuel supply interruption, transmission line disconnect, or scheduled maintenance.

In the unlikely event of a situation that causes a longer-term cessation of operations, security of the facilities will be maintained on a 24-hour basis, and the California Energy Commission (CEC) will be notified. Depending on the length of shutdown, a contingency plan for the temporary cessation of operations may be implemented. Such contingency plan will be in conformance with all applicable LORS and protection of public health, safety, and the environment. The plan, depending on the expected duration of the shutdown, could include the draining of all chemicals from storage tanks and other equipment and the safe shutdown of all equipment. All wastes will be disposed of according to applicable LORS. If the cessation of operations becomes permanent, the plant will be decommissioned (see Section 4.0, Facility Closure).

2.3 Facility Safety Design

WEC will be designed to maximize safe operation. Potential hazards that could affect the facility include earthquake, flood, and fire. Facility operators will be trained in safe operation, maintenance, and emergency response procedures to minimize the risk of personal injury and damage to the plant.

2.3.1 Natural Hazards

The principal natural hazard associated with the WEC site is earthquakes. The site is located in Seismic Risk Zone 3. Structures will be designed to meet the seismic requirements of CCR Title 24 and the 1998 California Building Code (CBC). (See Subsection 8.15, Geologic Hazards and Resources.) This subsection includes a review of potential geologic hazards, seismic ground motion, and potential for soil liquefaction due to ground-shaking. Potential seismic hazards will be mitigated by implementing the 1998 CBC construction guidelines. Appendix 10B, Structural Engineering, includes the structural seismic design criteria for the buildings and equipment.

Flooding is not a hazard of concern. According to the Federal Emergency Management Agency (FEMA), the site is not within either the 100- or 500-year flood plain. Subsection 8.14, Water Resources, includes additional information on the potential for flooding.

2.3.2 Emergency Systems and Safety Precautions

This subsection discusses the fire protection systems, emergency medical services, and safety precautions to be used by project personnel. Subsection 8.8, Socioeconomics, includes additional information on area medical services, and Subsection 8.7, Worker Safety, includes additional information on safety for workers. Appendices 10A through 10G contain the design practices and codes applicable to safety design for the project. Compliance with these requirements will minimize project effects on public and employee safety.

2.3.2.1 Fire Protection Systems

The project will rely on both onsite fire protection systems and local fire protection services.

2.3.2.1.1 Onsite Fire Protection Systems

The fire protection systems are designed to protect personnel and limit property loss and plant downtime from fire or explosion. The project will have the following fire protection systems.

CO_2 Fire Protection System

This system protects the combustion turbines and certain accessory equipment compartments from fire. The system will have fire detection sensors in all protected compartments. Actuating one sensor will provide a high-temperature alarm on the combustion turbine control panel. Actuating a second sensor will trip the combustion turbine, turn off ventilation, close ventilation openings, and automatically release the CO_2. The CO_2 will be discharged at a design concentration adequate to extinguish the fire.

Transformer Deluge Spray System

This system provides fire suppression for the generator step-up transformers and unit auxiliary and standby auxiliary transformers in the event of a fire. The deluge systems will be fed by the plant underground fire water system.

Steam Turbine Bearing Preaction Water Spray System

This system provides suppression for the steam turbine bearings in the event of fire. The preaction system is fed by the plant underground fire water system.

Steam Turbine Lube Oil Areas Water Spray System

This system provides suppression for the steam turbine area lube oil piping and lube oil storage.

Fire Hydrants/Hose Stations

This system will supplement the plant's fixed fire suppression systems. Water will be supplied from the plant underground fire water system.

Fire Extinguisher

The plant Administrative/Control/Warehouse/Maintenance Building, water treatment building, and other structures will be equipped with portable fire extinguishers as required by the local fire department.

2.3.2.1.2 Local Fire Protection Services

In the event of a major fire, the plant personnel will be able to call upon Turlock Fire Services for assistance. The Hazardous Materials Risk Management Plan (see Subsection 8.12, Hazardous Materials Handling) for the plant will include all information necessary to allow fire-fighting and other emergency response agencies to plan and implement safe responses to fires, spills, and other emergencies.

2.3.2.2 Personnel Safety Program

The WEC project will operate in compliance with federal and state occupational safety and health program requirements. Compliance with these programs will minimize project effects on employee safety. These programs are described in Subsection 8.7, Worker Safety.

2.4 Facility Reliability

This subsection discusses the expected facility availability, equipment redundancy, fuel availability, water availability, and project quality control measures.

2.4.1 Facility Availability

Because of the TID system needs, it is anticipated that the facility will normally be called upon to operate at high average annual capacity factors. The facility will be designed to operate between about 25 and 100 percent of base load to support dispatch service in response to customer demands for electricity.

WEC will be designed for an operating life of 30 years. Reliability and availability projections are based on this operating life. Operation and maintenance procedures will be consistent with industry standard practices to maintain the useful life status of plant components.

The percent of time that the combined-cycle power plant is projected to be operated is defined as the "service factor." The service factor considers the amount of time that a unit is operating and generating power, whether at full or partial load. The projected service factor for the combined-cycle power block, which considers projected percent of time of operation, differs from the equivalent availability factor (EAF), which considers the projected percent of energy production capacity achievable.

The EAF may be defined as a weighted average of the percent of full energy production capacity achievable. The projected equivalent availability factor for the WEC is estimated to be approximately 92 to 98 percent.

The EAF, which is a weighted average of the percent of energy production capacity achievable, differs from the "availability of a unit," which is the percent of time that a unit is available for operation, whether at full load, partial load, or standby.

2.4.2 Redundancy of Critical Components

The following subsections identify equipment redundancy as it applies to project availability. A summary of equipment redundancy is shown in Table 2.4-1. Final design could differ.

TABLE 2.4-1
Major Equipment Redundancy

Description	Number	Note
Combined-cycle CTGs and HRSGs	Two trains	Steam turbine bypass system allows both CTG/HRSG trains to operate at base load with the steam turbine out of service.
STG	One	See note above pertaining to CTGs and HRSGs.
HRSG feedwater pumps	Two—100 percent per HRSG	
Condensate pumps	Three—50 percent capacity	
Condenser	One	Condenser must be in operation for combined cycle operation or operation of CTG in steam turbine bypass mode. The condenser will be provided with split water boxes to allow online tube cleaning and repair.
Circulating water pumps	Two—50 percent capacity	The facility may operate at reduced load with one of the two circulating water pumps in service.
Cooling tower	One	Cooling tower is multi-cell mechanical draft design.
Auxiliary cooling water pumps	Two—100 percent capacity	
Fuel gas booster compressors	Two—100 percent capacity or three—50 percent capacity	
Demineralizer system	Three—50 percent capacity	
ZLD system—brine concentrators	Two—50 percent capacity	
ZLD system—crystallizers	Two—50 percent capacity	

2.4.2.1 Combined-cycle Power Block

Two separate CTG/HRSG power generation trains will operate in parallel within the combined-cycle power block. Each CTG will provide approximately 31 percent of the total combined-cycle power block output. The exhaust gas from each CTG will be used to produce steam in the steam generation system. Thermal energy from the steam generation system will be converted to mechanical energy, and then electrical energy in the STG. The expanded steam from the STG will be condensed and recycled to the feedwater system. Power from the STG will contribute approximately 37 percent of total combined-cycle power block output.

The major components of the combined-cycle power block consist of the following subsystems.

2.4.2.1.1 Combustion Turbine Generator Subsystems

The combustion turbine subsystems include the combustion turbine, inlet air filtration and evaporative coolers, generator and excitation systems, turbine lube oil system, hydraulic system, and turbine control and instrumentation. The combustion turbine will produce thermal energy through the combustion of natural gas and the conversion of the thermal energy into mechanical energy through rotation of the combustion turbine that drives the compressor and generator. Steam injection power augmentation will not be employed. Exhaust gas from the combustion turbine will be used to produce steam in the associated HRSG. The generator will be cooled by totally enclosed water-to-air coolers (TEWAC). The generator excitation system will be a solid-state static system. Combustion turbine control and instrumentation (interfaced with the DCS) will cover the turbine governing system, and the protective system.

2.4.2.1.2 Steam Generation Subsystems

The steam generation subsystems consist of the HRSG and blowdown systems. The HRSG transfers heat from the CTG exhaust gas to feedwater for steam production. This heat transfer produces steam at the pressures and temperatures required by the steam turbine. Each HRSG system consists of ductwork, heat transfer sections, an SCR system, an oxidation catalyst, and exhaust stack. The blowdown system provides vents and drains for each HRSG. The system includes safety and auto relief valves and processing of continuous and intermittent blowdown streams.

2.4.2.1.3 Steam Turbine Generator Subsystems

The steam turbine converts the thermal energy in the steam to mechanical energy to drive the STG. The basic subsystems include the steam turbine and auxiliary systems, turbine lube oil system, and generator/exciter system. The generator will be cooled by totally enclosed water-to-air coolers.

The combined-cycle power block is served by the following balance-of-plant systems.

2.4.2.2 Distributed Control System

The DCS will be a redundant microprocessor-based system that will provide the following functions:

- Control the HRSGs, STG, CTG, and other systems in response to unit load demands (coordinated control)
- Provide control room operator interface
- Monitor plant equipment and process parameters and provide this information to the plant operators in a meaningful format
- Provide visual and audible alarms for abnormal events based on field signals or software-generated signals from plant systems, processes, or equipment

The DCS will have functionally distributed architecture comprising a group of similar redundant processing units linked to a group of operator consoles and an engineer workstation by redundant data highways. Each processor will be programmed to perform specific dedicated tasks for control information, data acquisition, annunciation, and historical purposes.

Plant operation will be controlled from the operator panel located in the control room. The operator panel will consist of two individual CRT/keyboard consoles and one engineering workstation. Each CRT/keyboard console will be an independent electronic package so that failure of a single package does not disable more than one CRT/keyboard. The engineering workstation will allow the control system operator interface to be revised by authorized personnel.

2.4.2.3 Boiler Feedwater System

The boiler feedwater system transfers feedwater from the LP drum to the HP and IP sections of the HRSGs. The system will consist of two pumps per HRSG, each pump sized for 100 percent capacity for supplying one HRSG. The pumps will be multistage, horizontal, motor-driven with intermediate bleed-off, and will include regulating control valves, minimum flow recirculation control, and other associated piping and valves.

2.4.2.4 Condensate System

The condensate system will provide a flow path from the condenser hotwell to the HRSG LP drum and boiler feed pumps. The condensate system will include three 50-percent capacity multistage, vertical, motor-driven condensate pumps.

2.4.2.5 Demineralized Water System

Makeup to the demineralized water system will be distillate from the brine concentrators. The demineralized water system will consist of one three 50-percent mixed-bed demineralizer trains. Demineralized water will be stored in a 250,000-gallon demineralized water storage tank.

2.4.2.6 Power Cycle Makeup and Storage

The power cycle makeup and storage subsystem provides demineralized water storage and pumping capabilities to supply high-purity water for system cycle makeup and chemical cleaning operations. Major components of the system are the demineralized water storage tank, providing an approximate 24-hour supply of demineralized water at peak load, and two 100-percent capacity, horizontal, centrifugal, cycle makeup water pumps.

2.4.2.7 Circulating Water System

The circulating water system provides cooling water to the condenser for condensing steam turbine exhaust steam and steam turbine bypass steam. In addition, the system supplies cooling water to the open-loop auxiliary cooling water system. Major components for this subsystem are a 5-cell mechanical draft cooling tower, two 50-percent capacity motor-driven vertical wet-pit circulating water pumps, and associated piping and valves.

2.4.2.8. Auxiliary Cooling Water System

The auxiliary cooling water system transfers heat from various plant equipment heat exchangers to the circulating water system. Major components for this subsystem are two 100-percent capacity, motor-driven vertical wet pit auxiliary cooling water pumps, and associate piping and valves.

2.4.2.9 Compressed Air

The compressed air system provides instrument air and service air to points of use throughout the facility. The compressed air system will include two 100-percent capacity motor-driven air compressors, two 100-percent capacity air dryers with prefilters and after filters, an air receiver, instrument air header, and service air header. All compressed air will be dried. A control valve will be provided in the service air header to prevent high consumption of service air from reducing the instrument air header pressure below critical levels.

2.4.3 Fuel Availability

Fuel will be delivered via a new 3.6-mile pipeline, which will interconnect into PG&E's Line 215. Line 215 connects to Line 2 and Line 401, which carry natural gas from Canada (see Section 6.0, Natural Gas Supply). It is conceivable that the connecting line to WEC could become temporarily inoperable due to a breach in the line or from other causes, resulting in fuel not being available at the WEC.

2.4.4 Water Availability

The WEC project will use up to 1,800 afy of recycled water provided by the City of Turlock's Wastewater Treatment Plant (WWTP) for cooling tower make-up. Cooling water will be cycled in the cooling tower approximately 3.5 times. The blowdown will be concentrated and the water recycled onsite using a ZLD system. The ZLD system will provide the steam cycle makeup water.

The City is currently developing a Title 22 water treatment facility and is required by the Regional Water Quality Control Board to have it operational by May 2006. Since the WEC project will commence start-up and testing the fourth quarter of 2005, TID proposes to use a bridge supply of potable water from the City of Turlock to meet WEC's water demands until the City's recycled water is available. Once recycled water is available, potable water for drinking, safety showers, fire protection water, service water, and sanitary uses will continue to be served from the City's potable water system. Sanitary wastewater disposal will be to an onsite septic system and leach field.

The availability of water to meet the needs of WEC is discussed in more detail in Subsection 8.14, Water Supply.

2.4.5 Project Quality Control

The Quality Control Program that will be applied to WEC is summarized in this subsection. The objective of the Quality Control Program is to ensure that all systems and components have the appropriate quality measures applied; whether it be during design, procurement, fabrication, construction, or operation. The goal of the Quality Control Program is to achieve the desired levels of safety, reliability, availability, operability, constructibility, and maintainability for the generation of electricity.

The required quality assurance for a system is obtained by applying controls to various activities, according to the activity being performed. For example, the appropriate controls for design work are checking and review, and the appropriate controls for manufacturing and construction are inspection and testing. Appropriate controls will be applied to each of the various activities for the project.

2.4.5.1 Project Stages

For quality assurance planning purposes, the project activities have been divided into the following nine stages that apply to specific periods of time during the project:

- **Conceptual Design Criteria.** Activities such as definition of requirements and engineering analyses.

- **Detail Design.** Activities such as the preparation of calculations, drawings, and lists needed to describe, illustrate, or define systems, structures, or components.
- **Procurement Specification Preparation.** Activities necessary to compile and document the contractual, technical, and quality provisions for procurement specifications for plant systems, components, or services.
- **Manufacturer's Control and Surveillance.** Activities necessary to ensure that the manufacturers conform to the provisions of the procurement specifications.
- **Manufacturer Data Review.** Activities required to review manufacturers' drawings, data, instructions, procedures, plans, and other documents to ensure coordination of plant systems and components, and conformance to procurement specifications.
- **Receipt Inspection.** Inspection and review of product at the time of delivery to the construction site.
- **Construction/Installation.** Inspection and review of storage, installation, cleaning, and initial testing of systems or components at the facility.
- **System/Component Testing.** Actual operation of generating facility components in a system in a controlled manner to ensure that the performance of systems and components conform to specified requirements.
- **Plant Operation.** As the project progresses, the design, procurement, fabrication, erection, and checkout of each generating facility system will progress through the nine stages defined above.

2.4.5.2 Quality Control Records

The following quality control records will be maintained for review and reference:

- Project instructions manual
- Design calculations
- Project design manual
- Quality assurance audit reports
- Conformance to construction records drawings
- Procurement specifications (contract issue and change orders)
- Purchase orders and change orders
- Project correspondence

For procured component purchase orders, a list of qualified suppliers and subcontractors will be developed. Before contracts are awarded, the subcontractors' capabilities will be evaluated. The evaluation will consider suppliers' and subcontractors' personnel, production capability, past performance, and quality assurance program.

During construction, field activities are accomplished during the last four stages of the project: receipt inspection, construction/installation, system/component testing, and plant operations. The construction contractor will be contractually responsible for performing the work in accordance with the quality requirements specified by contract.

The subcontractors' quality compliance will be surveyed through inspections, audits, and administration of independent testing contracts.

A plant operation and maintenance program, typical of a project this size, will be implemented by the WEC to control operation and maintenance quality. A specific program for this project will be defined and implemented during initial plant startup.

2.5 Laws, Ordinances, Regulations, and Standards

The applicable LORS for each engineering discipline are included as part of the Engineering Appendices 10A through 10G. A summary of all LORS is provided in Appendix 1D.

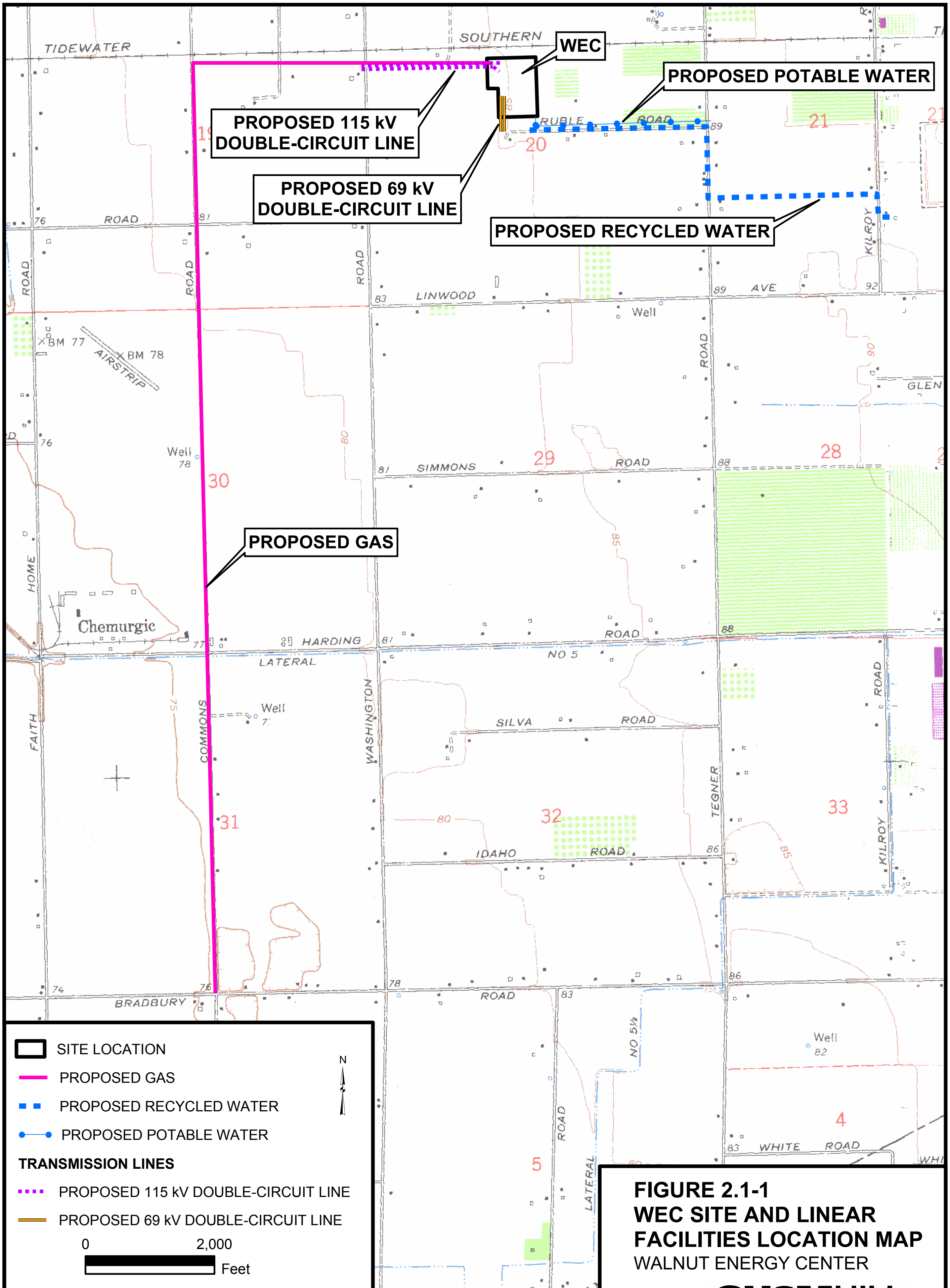

FIGURE 2.1-1
WEC SITE AND LINEAR FACILITIES LOCATION MAP
WALNUT ENERGY CENTER

CH2MHILL

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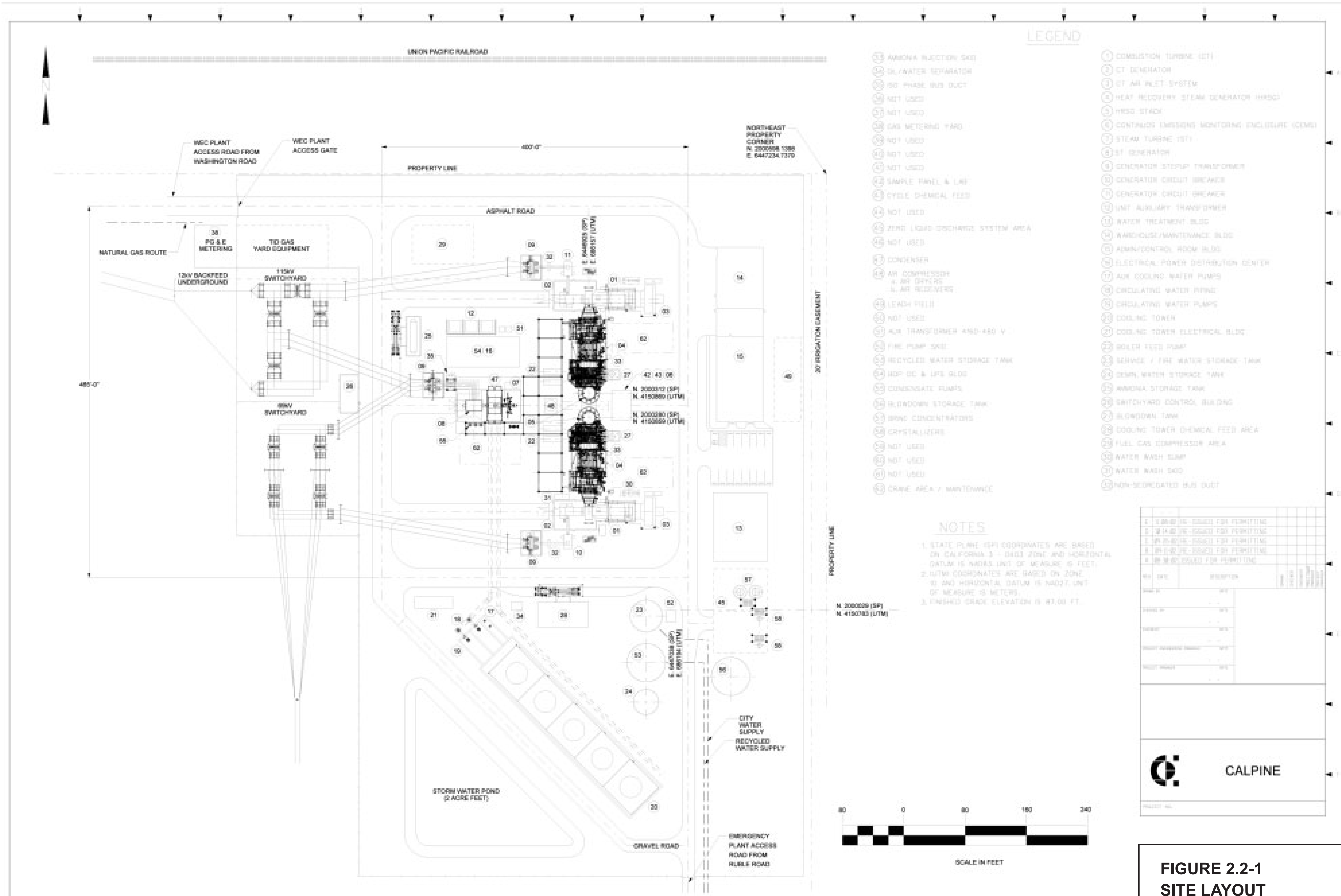


FIGURE 2.2-1
SITE LAYOUT
WALNUT ENERGY CENTER

CH2MHILL

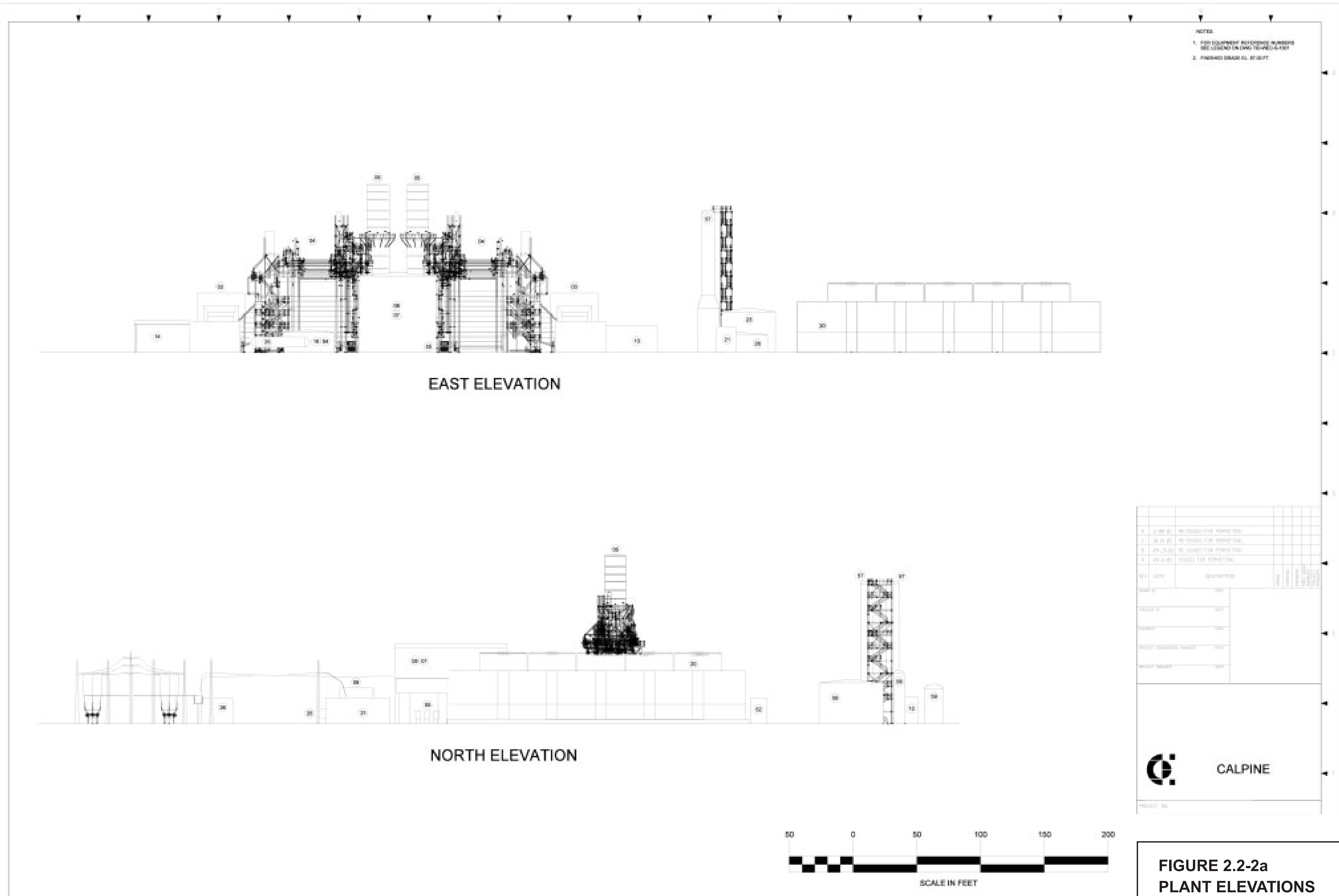


FIGURE 2.2-2a
PLANT ELEVATIONS
WALNUT ENERGY CENTER

CH2MHILL

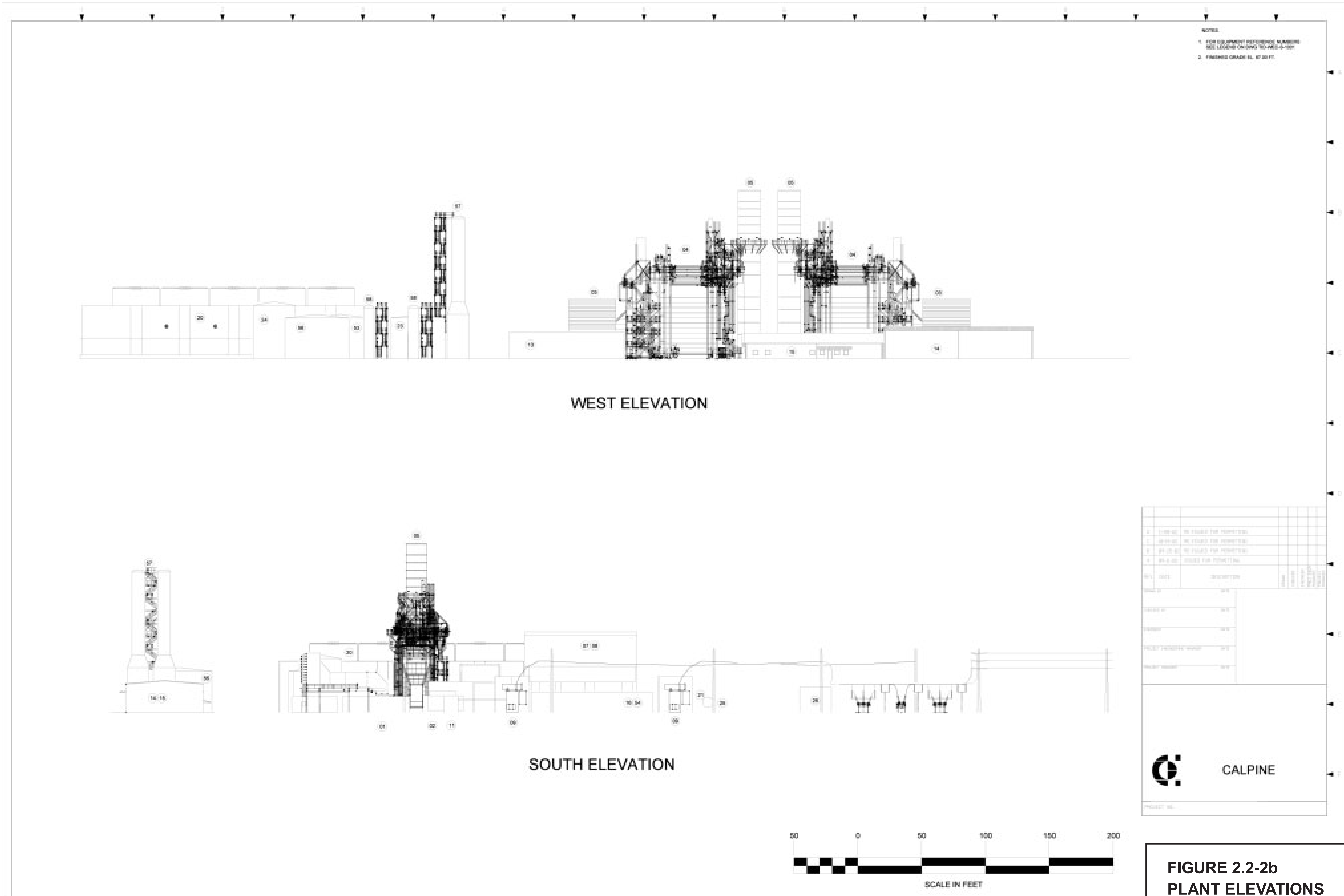
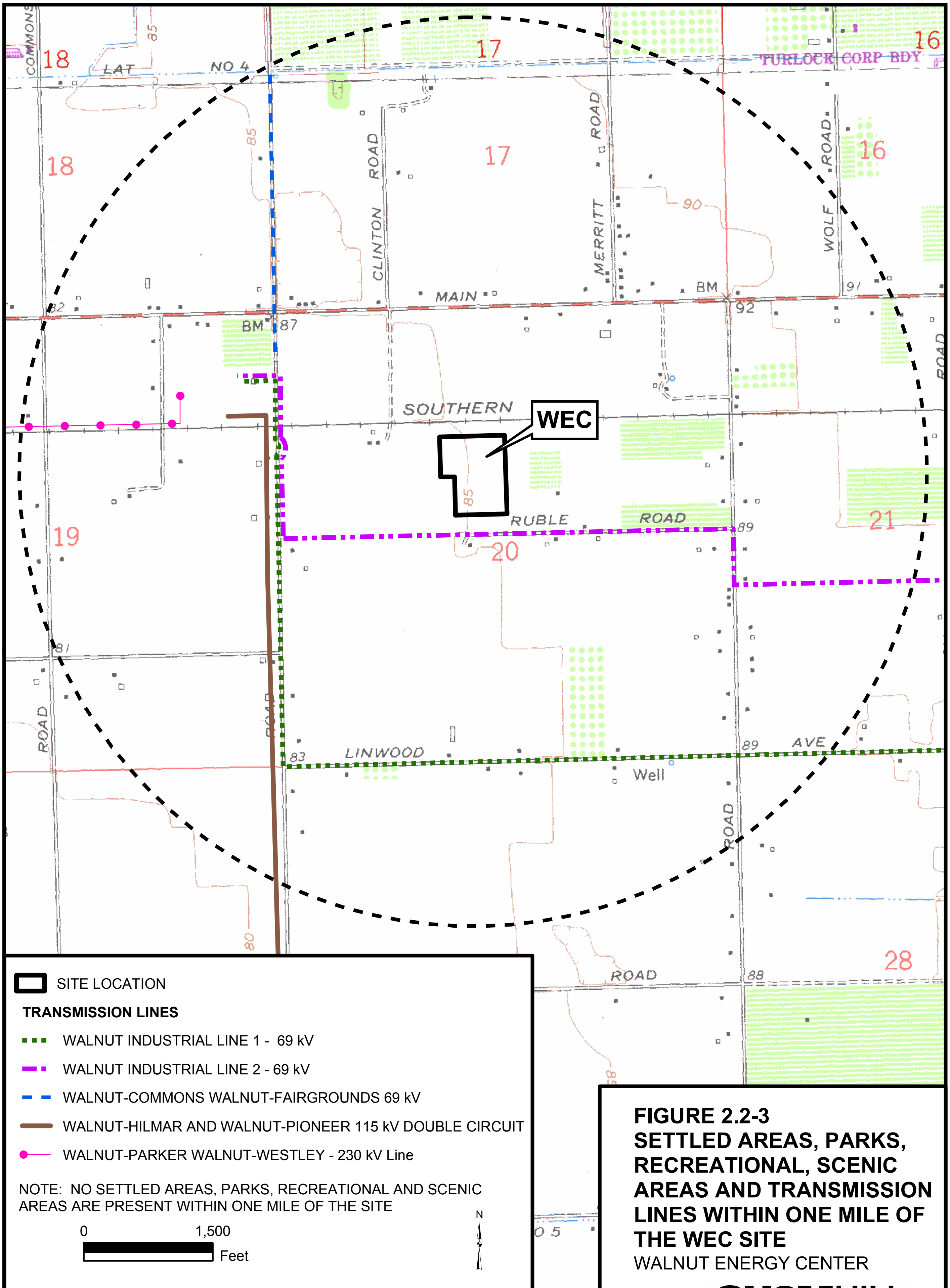


FIGURE 2.2-2b
PLANT ELEVATIONS
WALNUT ENERGY CENTER

CH2MHILL



SITE LOCATION

TRANSMISSION LINES

- WALNUT INDUSTRIAL LINE 1 - 69 kV
- WALNUT INDUSTRIAL LINE 2 - 69 kV
- WALNUT-COMMONS WALNUT-FAIRGROUNDS 69 kV
- WALNUT-HILMAR AND WALNUT-PIONEER 115 kV DOUBLE CIRCUIT
- WALNUT-PARKER WALNUT-WESTLEY - 230 kV Line

NOTE: NO SETTLED AREAS, PARKS, RECREATIONAL AND SCENIC AREAS ARE PRESENT WITHIN ONE MILE OF THE SITE

0 1,500 Feet

N

FIGURE 2.2-3
SETTLED AREAS, PARKS, RECREATIONAL, SCENIC AREAS AND TRANSMISSION LINES WITHIN ONE MILE OF THE WEC SITE
WALNUT ENERGY CENTER

CH2MHILL

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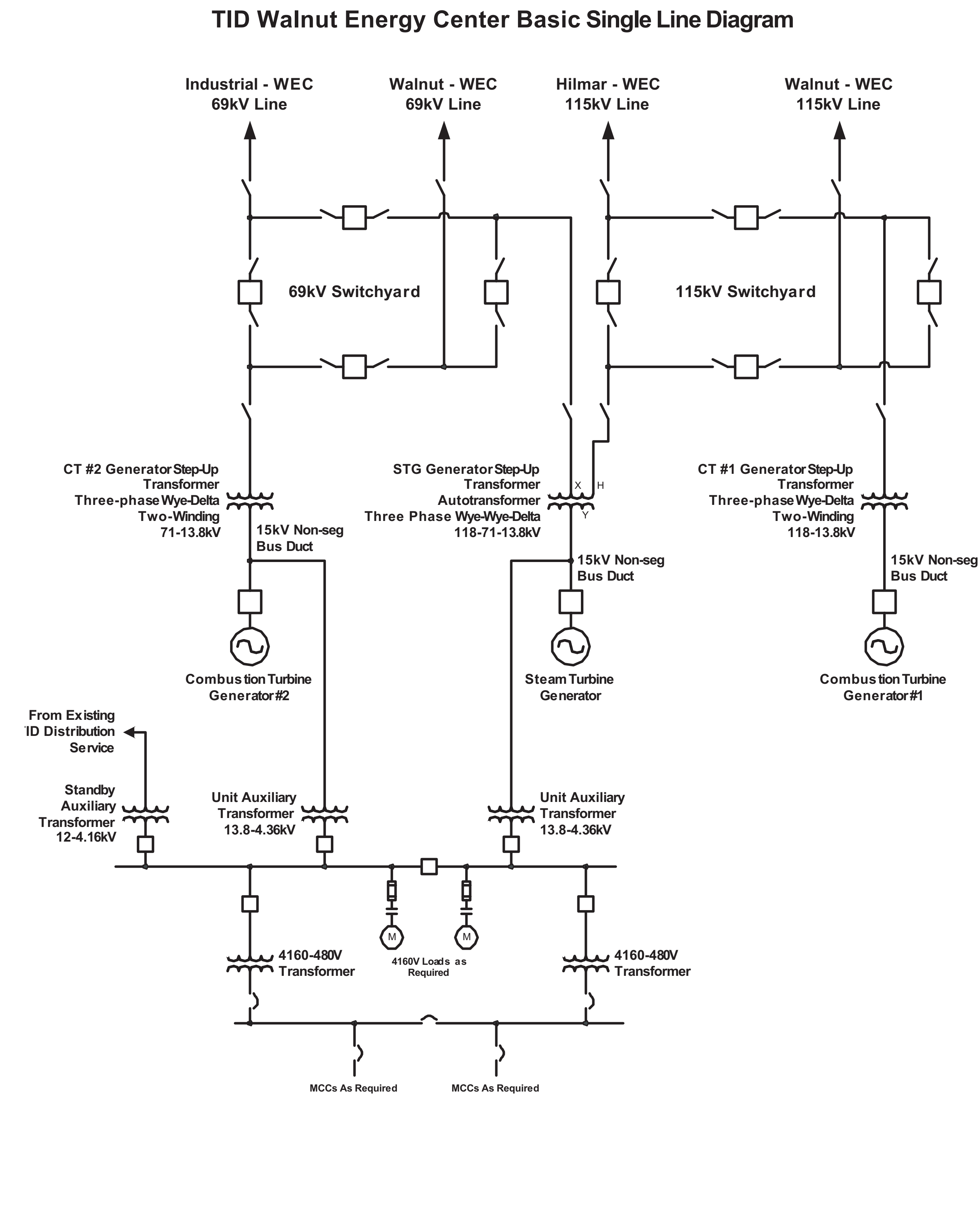

FIGURE 2.2-4
SINGLE-LINE DIAGRAM
WALNUT ENERGY CENTER
CH2MHILL

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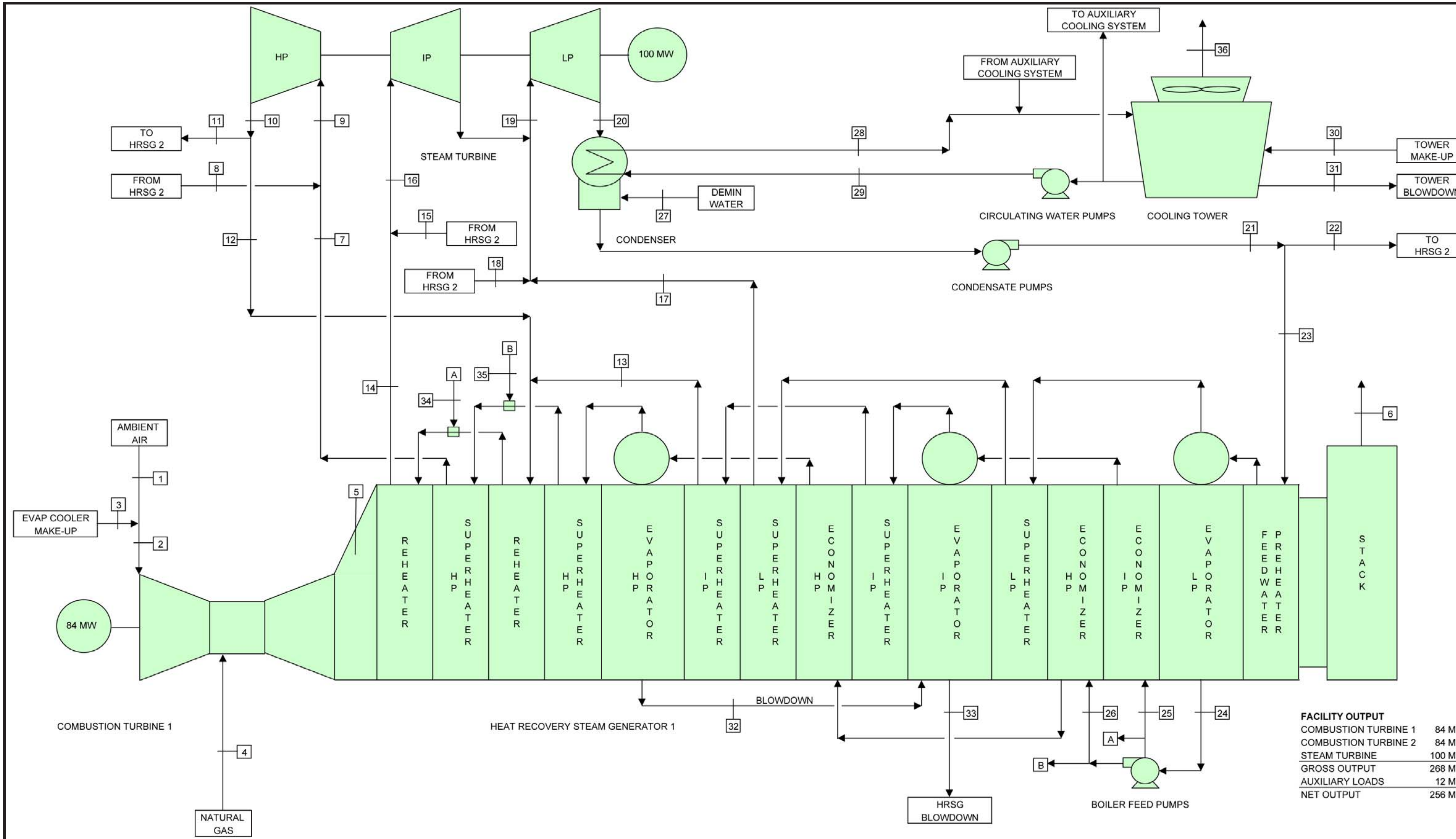

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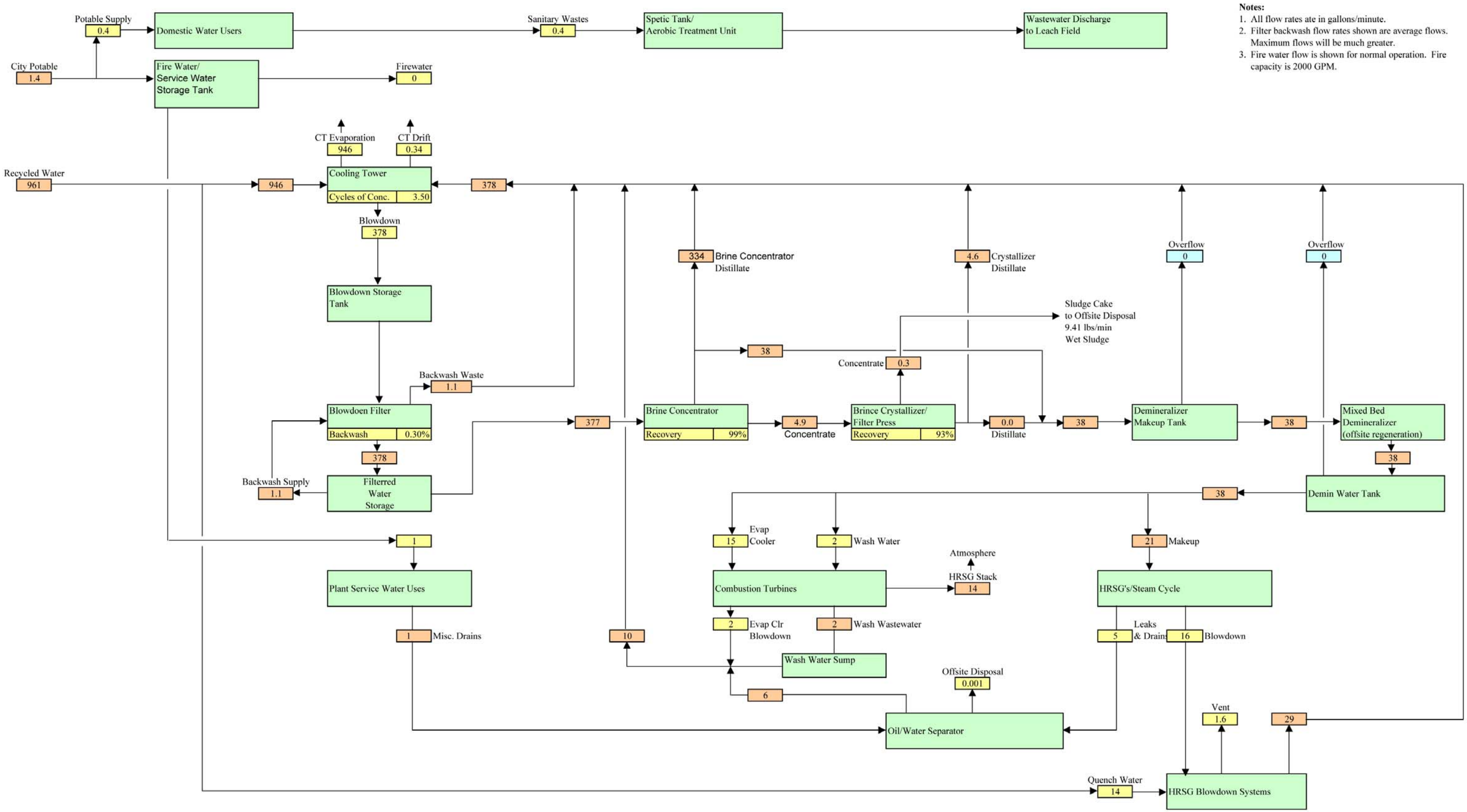
FIGURE 2.2-5
HEAT BALANCE DIAGRAM
WALNUT ENERGY CENTER
CH2MHILL



Notes:
1. All flow rates ate in gallons/minute.
2. Filter backwash flow rates shown are average flows. Maximum flows will be much greater.
3. Fire water flow is shown for normal operation. Fire capacity is 2000 GPM.

FIGURE 2.2-6a
WATER BALANCE-AVERAGE DAY
WALNUT ENERGY CENTER
CH2MHILL

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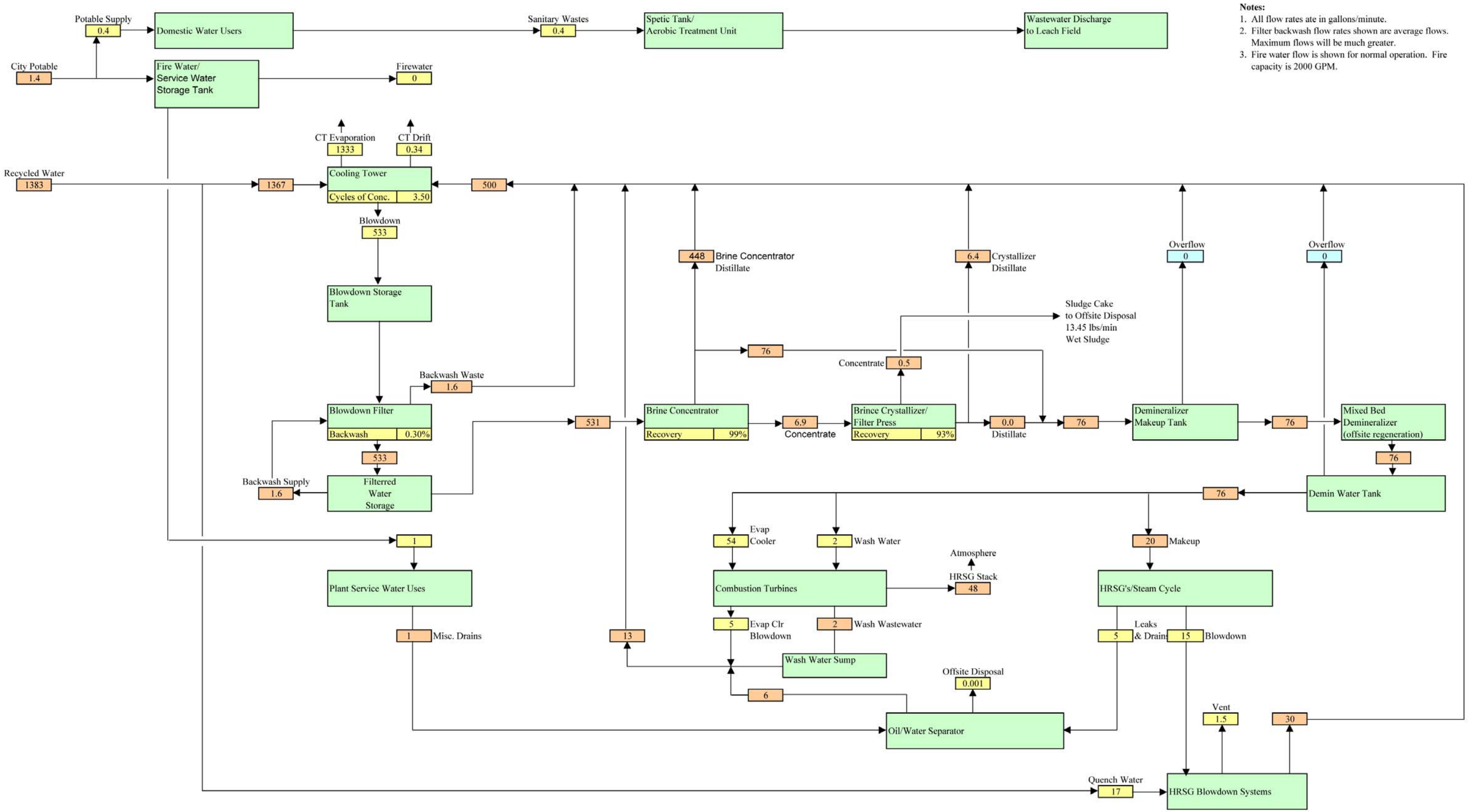

Notes:

1. All flow rates ate in gallons/minute.
2. Filter backwash flow rates shown are average flows. Maximum flows will be much greater.
3. Fire water flow is shown for normal operation. Fire capacity is 2000 GPM.

FIGURE 2.2-6b
WATER BALANCE-HOT DAY
WALNUT ENERGY CENTER
CH2MHILL

D102002001RDD_02 (11/14/02)