

APPENDIX A
CIVIL ENGINEERING DESIGN CRITERIA

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1.0 INTRODUCTION

Control of the design, engineering, procurement, and construction activities on the Project will be completed in accordance with various predetermined standard practices and project specific practices. An orderly sequence of events for the implementation of the Project is planned consisting of the following major activities:

- Conceptual design
- Licensing and permitting
- Detailed design
- Procurement
- Construction and construction management
- Startup, testing, and checkout
- Project completion

The purpose of this appendix is to summarize the codes and standards and standard design criteria and practices that will be used during the Project. The general foundation and civil engineering design criteria defined herein form the basis of the design for the foundation and civil systems of the Project. More specific design information will be developed during preliminary and detailed design to support equipment procurement and construction specifications. It is not the intent of this appendix to present the detailed design information for each component and system but to summarize the codes, standards, and general criteria that will be used.

Section 2.0 summarizes the applicable codes, standards laws and ordinances, and Section 3.0 includes the general criteria for foundations, design loads, and general site information.

2.0 DESIGN CODES, STANDARDS, LAWS AND ORDINANCES

The design and specification of work shall be in accordance with all applicable laws and regulations of the federal government, the State of California, and the applicable local codes and ordinances. The following laws, ordinances, codes, and standards have been identified as applying to civil engineering design and construction.

When an edition date is not indicated the latest edition and addenda at time of plant design and construction shall apply.

2.1 FEDERAL

- Title 29, Code of Federal Regulations (CFR), Part 1910, Occupational Safety and Health Standards.
- Title 40, CFR Section 112, et seq., US Environmental Protection Agency (EPA), requires a Spill Prevention Control and Countermeasure (SPCC) plan of facilities storing oil in excess of 660 gallons

in any single above ground storage tank; 1,320 gallons in aggregate tanks above ground; and 4,200 gallons below ground.

2.2 STATE

- Business and Professions Code Section 6704, et seq., Sections 6730 and 6736, requires state registration to practice as a Civil Engineer or Structural Engineer in California.
- Vehicle Code Section 35780, et seq., requires a permit from Caltrans to transport heavy loads on state roads.
- Labor Code Section 6500, et seq., requires a permit for construction of trenches or excavations 5 feet or deeper where personnel have to descend. This also applies to construction of any building, structure, false work or scaffolding which is more than three stories high or equivalent.
- Design will conform to the requirements of California Occupational Safety and Health Administration (CALOSHA).
- State of California Department of Transportation (Caltrans), Standard Specifications.
- Title 24, California Administration Code (CAC) Section 2-111, et seq.; Sections 3-100, et seq.; Section 4-106, et seq.; Section 5-102, et seq.; Section 6-T8-769, et seq.; Section 6-T8-3233, et seq.; Section 6-T8-3270, et seq.; Section 6-T8-5138, et seq.; Section 6-T8-5465, et seq.; Section 6-T8-5531, et seq.; and Section 6-T8-5545, et seq., adopts current edition of Uniform Building Code (UBC) as minimum legal building standards.
- Title 8, CAC, Section 1500, et seq.; Section 2300, et seq.; and Section 3200, et seq., describes general construction safety orders, industrial safety orders, and work safety requirements and procedures.

2.3 COUNTY

- Rancho Cucamonga City Building Code 2001.

2.4 CODES AND INDUSTRY STANDARDS

The following general design requirements and procedures will be followed in development of project specifications regarding the use of Codes and Industry Standards.

- Specifications for materials will generally follow the standard specification for the American Society for Testing and Materials (ASTM) and the American National Standards Institute (ANSI).
- Field and laboratory testing procedures for materials will follow standard ASTM specifications.
- Design and placement of structural concrete will follow the recommended practices and the latest version of the American Concrete Institute Code (ACI) and the Concrete Reinforcing Steel Institute (CRSI).

- Welding procedures and qualifications for welders will follow the recommended practices and codes of the American Welding Society (AWS).
- Preparation of metal surfaces for coating systems will follow the specifications and standard practices of the Steel Structures Painting Council (SSPC), National Association for Corrosion Engineers (NACE) and the specific instructions of the coatings manufacturer.
- Plumbing will conform to the Uniform Plumbing Code (UPC).

The following Codes and Industry Standards shall be used:

- California Energy Commission (CEC). "Recommended Seismic Design Criteria for Non-Nuclear Generating Facilities in California," June 1989.
- International Conference of Building Officials. "Uniform Building Code" (UBC), 1997 Edition.
- California Building Code (CBC) 2001 Edition and Emergency Supplements.
- American Association of State Highway and Transportation Officials (AASHTO) (1990), "A Policy on Geometric Design of Highways and Streets."
- Hydraulic Institute Standards.
- American Water Works Association (AWWA).
- "Standards for Prestressed Concrete Pressure Pipe, Steel Cylinder Type for Water and Other Liquids" (AWWA C301).
- "Standards for Reinforced Concrete Water Pipe-Noncylinder Type, Not Prestressed" (AWWA C302).
- Asphalt Institute, Pacific Coast Division, Asphalt Institute Handbook, 1989 Edition.

3.0 CIVIL DESIGN CRITERIA

3.1 CIVIL WORKS

3.1.1 Geotechnical Investigation

The Owner has a previous geotechnical site investigation and seismic survey. Borings will be provided prior to final contract negotiation. The Contractor shall be responsible for obtaining a detailed soils investigation as required for use in engineering and design.

3.1.2 Surveying

The Owner has obtained a property survey and will provide a property map of the site area.

The Contractor shall obtain a topographic survey of the plant site and any other required surveying outside of the site boundary.

3.1.3 Site Development and Earthwork

3.1.3.1 Scope of Site Development Work

- Construction of temporary construction access road from 6th Street to the site area and later removal.
- Construction of temporary laydown and construction parking on offsite leased property and later removal
- Construction of temporary laydown area within the proposed San Gabriel Generating Station area and later removal.
- Demolition of the Cooling Tower for Units 1&2 and other equipment and removal of tower foundations
- Demolition of existing roads
- Clearing and grubbing, and disposal of waste
- Installation and maintenance of construction parking and construction laydown areas
- Installation of a retaining wall along the north and west borders of the site area
- Rough grading to shape the natural grade as required for the Facility
- Providing a permanent runoff detention pond
- Construction of temporary and permanent drainage facilities
- Construction of oil-water sewers and an oil separator
- Construction of sanitary sewer facilities including a septic tank and a tile field
- Construction of permanent asphalt paved roads and concrete pavement
- Placement of crushed rock surfacing
- Providing temporary erosion control during earthwork
- Providing permanent erosion control and surface runoff control devices as required
- Restoration of the temporary access road, construction parking, and construction laydown areas following project completion

- Providing spill containment facilities for ammonia tanks
- Final grading and cleanup after the Facility is essentially complete

3.1.3.2 Facility Grading

Facility grading includes the following items:

- Shape the natural grade as required to accommodate permanent Facility equipment and construction facilities while minimizing earthwork
- Obtain proper cross section, longitudinal slopes, and curvature for roads
- Construct adequate in-plant surface drainage to discharge the 10-year runoff without flooding and the 50-year runoff without flooding plant facilities
- Construct a small beam around the perimeter of the air cooled condenser to avoid intrusion from in-plant surface drainage from the 50-year runoff
- Obtain proper area slopes to provide drainage without ponding
- Construct stable, erosion-resistant earthen side slopes. Cover slopes with soil cement to prevent erosion

3.1.3.3 Clearing and Grubbing

Areas to be graded shall be cleared and grubbed of all vegetation. Waste from the clearing and grubbing operation shall be disposed of offsite in accordance with regulatory requirements.

3.1.3.4 Stripping

All topsoil and other organic materials shall be stripped from the areas to be graded prior to starting earthwork. Topsoil shall be disposed of in an offsite disposal area in accordance with regulatory requirements.

3.1.3.5 Disposal of Unusable Soils

Excavated materials unusable for reuse shall be disposed of in an offsite disposal area by the Contractor in accordance with the requirements of state and local authorities.

3.1.3.6 Erosion Control

Temporary facilities shall be provided by the Contractor for control of erosion and turbid runoff during earthwork operations and from graded areas until they are stabilized. Temporary facilities shall be acceptable to local authorities. The Contractor shall be responsible for obtaining any necessary erosion control permits.

The Contractor shall provide permanent erosion control facilities as required for ditches and slopes, such as riprap, headwalls, rock surfacing and slope pavement.

3.1.3.7 Earthwork Testing Requirements

The Purchaser shall specify requirements for earthwork testing. The Contractor shall implement a program for testing soils during earthwork and when installation of underground utilities and foundations are performed.

The minimum moisture and density testing requirements for structural fill shall be one test per 75 cubic yards with at least one test under each foundation greater than 15 square feet.

3.1.4 Drainage and Stormwater

3.1.4.1 General

The Facility shall be provided with the following drainage systems:

- Clean stormwater sewer and ditch system
- Oil-contaminated runoff sewer system
- Process wastewater sewer system

Surface drainage systems inside the Facility shall be sized to discharge the 10-year, 24-hour runoff without flooding and the 50-year, 24-hour storm event without flooding the Facility and equipment. The storm events shall be as defined by the San Bernardino County Hydrology Manual.

3.1.4.2 Clean Stormwater Sewer and Ditch System

Clean stormwater runoff is runoff from Facility areas not subject to contamination. Clean stormwater shall be collected via a stormwater sewer and discharged to a stormwater detention basin. The outlet from the detention basin shall discharge to Chadwick Channel.

The following areas shall be provided with a storm sewer system:

- Entire power block area within the loop road around equipment
- Utilities area and area south of the utilities area between the existing tanks and the Chadwick Channel
- Control building and adjacent parking lot
- Building roof drains

The storm sewer system consists of catch basins for collecting surface water and an underground piping system with manholes at all junction points and turns.

The stormwater runoff system shall be designed and constructed in accordance with ASCE Manual No. 77 "Design and Construction of Urban Storm Water Management Systems" or local jurisdictional code.

Roof drains from the control/administration building shall discharge directly into a stormwater sewer system and not flow over parking lots, ground slabs, etc.

All areas not drained via storm sewers shall be drained via an open ditch system consisting of trapezoidal ditches with culverts at roads.

When culverts are utilized, the inlets and outlets shall be provided with permanent erosion protection.

The slope angle for ditch side slopes shall not exceed 3H to 1V.

3.1.4.3 Oil-Contaminated Wastewater Sewer System

An oil-water sewer system shall be provided to collect discharges from areas which have potential for oil contamination, including the following:

- Turbine area floor and equipment drains
- Boiler feed pumps
- Bulk storage building (lube oil drums)

Areas where only minor oil leakage is possible shall have equipment skid attached containment for local collection and subsequent cleanup, when required.

Oil contaminated runoff shall be directed by gravity to an oil separator. Oil separator effluent shall be combined with process wastewater and pumped to the waste water sump that discharges out the west side of the plant to a publicly owned wastewater treatment plant. A separate storage tank for skimmed oil, sludge removal facilities, and an effluent pump structure shall be provided with the separator. The following shall be provided:

- One double-wall oil separator shall be provided
- Packaged coalescing plate separator providing 15 mg/L effluent quality
- Waste oil transfer pump to transfer oil to the Purchaser's tank truck for disposal
- Packaged effluent lift station with two 100%-capacity pumps
- Pipeline to transport effluent to the wastewater collection system piping

All equipment having the potential to spill oil and not buried underground, shall be contained in a curbed area in order to prevent spillage.

Underground gravity lines carrying oily wastewater will not require double containment piping.

3.1.4.4 Process Wastewater

Discharges to the process wastewater sewer system shall be non-oily wastewater with a potential for chemical contamination. These include equipment drains such as HRSG drains, and area or building drains that contain potentially chemical contaminated runoff. These areas shall be collected using floor drains, trenches or sumps and piped to the wastewater collection piping. At a minimum the following areas shall be included.

- Water treatment facility floor and equipment drains
- Chemical bulk storage building drains
- Chemical tank spill containment area drains
- Chemical truck spill containment area drains
- Sample panel building drains
- Chemical lab sink drain
- Battery room emergency shower and eye wash drains

Batteries shall be provided with curbed containment within the battery room.

Process wastewater, including blowdown and equipment drains shall be pumped to the existing wastewater system for discharge to a publicly owned wastewater treatment plant.

3.1.4.5 Miscellaneous Valved Stormwater Runoff

- Transformer basins shall have a sump with valved outlet for draining collected rainwater to the clean stormwater runoff drainage system.
- The ammonia unloading area shall be provided with valved spill containment for draining collected rainwater from the truck unloading and the storage tank to the clean stormwater runoff drainage system.

3.1.5 Detention and Pond Design Criteria

3.1.5.1 Basin Requirements

- The detention ponds shall meet the requirements of “San Bernardino County Hydrology Manual” San Bernardino County, May 1983, and “Detention Basin Design Criteria for San Bernardino County” (no date).
- One permanent detention basin is required.

3.1.5.2 Design Requirements

- Each basin shall be sized such that the post-development peak flow rate shall be equal to or less than 90% of the predevelopment peak flow rate for all frequency storms up to and including the 100-year storm
- Only the 2, 10, 25 and 100-year storms need to be analyzed
- Detention basins shall be drained within 24 hours after the basin reaches its 100-year peak depth/volume
- Inflow and outflow hydrographs shall be developed using the procedures in San Bernardino County's Hydrology Manual
- The emergency spillage shall be developed using the procedures in San Bernardino County's Hydrology Manual
- The emergency spillage shall be designed to pass the 1,000-year peak flow rate ($Q_{1000} = 1.35Q_{100}$)
- Freeboard shall be a minimum of 1 foot above the 1,000-year HWL or 2 feet above the 100-year HWL in the basin, whichever is larger
- The permanent basin shall be sized with vertical concrete walls
- Each basin shall be designed to meet the requirements of "Detention Basin Design Criteria for San Bernardino County"

3.1.6 Existing Underground Lines

Existing blowdown lines and an existing sanitary sewer force main to the meter vault shall be relocated if required. Firewater lines shall be relocated as required. Circulating water lines and other inoperable lines associated with the existing cooling tower shall be removed as required.

3.1.7 Roads, Parking, Surfacing and Bridges

3.1.7.1 Facility Roads

- The main Facility access road shall be connected to an existing facility access road which connects to Etiwanda Avenue.
- Interior Plant roads shall be provided around each power block, and where access is required to equipment, pump structures, or entrances to buildings or enclosures.
- All interior plant roads shall be asphalt paved.

3.1.7.2 Road Width and Clearance Requirements

The minimum road widths shall be as follows:

Road	Total Width (ft)	Paved Width (ft)	Shoulder Width (ft)
Access Roads	32	24	4
Interior Roads	28	20	4
Entrances to Enclosures	22	16	3

Clearance requirements over roads shall be 22 vertical feet from high point of road to bottom of lowest overhead obstruction.

3.1.7.3 Road Pavement

Road and parking lot pavement shall be or asphalt concrete.

Road pavements shall be designed for AASHTO H-20 truck loads and loads due to a 125-ton wheel-mounted maintenance crane.

Parking lot pavement shall be designed for auto and light trucks.

Design life of the asphalt pavement shall be 20 years.

3.1.7.4 Parking Lots

Paved parking lots for passenger cars and light trucks shall be provided as follows:

	<u>Number of Stalls</u>
Control/building/warehouse/shops	10 minimum
Water treatment area	3 minimum

Stalls shall be 90 degree angle, 10 feet wide, 19 feet long. At least two stalls shall be provided for handicap parking at the control/administration building. Handicap stall shall comply with requirements of the Americans with Disabilities Act (ADA).

All stalls shall be asphalt paved, striped, provided with precast concrete bumpers, and provided with signage as required.

3.1.7.5 Facility Area Surfacing

Final area surfacing shall be provided as follows:

Type	Minimum Thickness	Location
Wire mesh reinforced concrete	8 in.	<ul style="list-style-type: none"> • All chemical truck unloading spill containment areas • 10 ft by door width in front of all maintenance doors <p>Maintenance pads around equipment required for maneuvering and positioning cranes, fork lifts and other wheeled-vehicles</p> <ul style="list-style-type: none"> • Access areas to equipment
Wire mesh reinforced concrete	4 in.	<ul style="list-style-type: none"> • 5.0 ft wide sidewalks between building doors and parking areas • 4.0 ft wide parking area sidewalks
Base material or crushed rock area surfacing (well graded material with maximum size of 1”) (ASTM D2940, ASTM D448, Size No. 57 or similar)	6 in.	<ul style="list-style-type: none"> • All unpaved areas within the loop road with the potential to support maintenance equipment, mobile cranes, fork lifts and other wheeled vehicles • All areas around closed cycle cooling water fin fan cooler not enclosed or surfaced with concrete or asphalt • Interior of the switchyard • Unpaved access pathways from loop road to equipment, enclosures • Maintenance trailer area • Beneath ACC

Type	Minimum Thickness	Location
Base material or crushed rock area surfacing (well-graded material with maximum size of 1", ASTM D448, Size No. 57 or similar. Color or gradation to be distinguishable from drivable surface areas).	4 in.	<ul style="list-style-type: none">• All areas within loop road not requiring vehicular access• Areas requiring vegetative control

3.1.7.6 Retaining Walls

Provide a retaining wall along the north property line and a portion of the west property line. The height of the wall shall be as required to install the power block.

3.1.7.7 Bridge

- A bridge shall be constructed for the permanent access road to span the main ditch. The bridge shall be designed for the larger of an H-20 load, a 125-ton crane, or a main power transformer being moved on a multi-axle carrier.
- The budge shall be a minimum of 80 feet long. It shall have a minimum drainage area beneath the beams of 5 feet high by 60 feet wide.

3.1.7.8 Spill Containment

The ammonia tank shall be provided with spill containment for 110 percent of the capacity of the tanks. The truck unloading area shall be provided with spill containment to capture 100 percent of the truck capacity plus 6 inches of freeboard.

3.1.8 Railroad Access

Railroad access shall not be provided.

3.1.9 Potable Water System

The existing plant potable water system is a well water system. The facility potable water system shall consist of a 3-inch pipe connection to this system, including valves and backflow preventors as required. The water distribution system shall be sized to deliver peak demand to each building at a normal pressure of 40 psi, maximum pressure of 80 psi. Ferrous metal pipes shall be lined or coated to provide both internal and external corrosion protection.

3.1.10 Sanitary Wastewater

Sanitary wastewater shall be collected by gravity, and discharged into a septic tank. The septic tank shall discharge into a leach field. The septic tank/leach field will be sized for a maximum of 25 persons discharging 50 gal/person/day.

3.1.10.1 Gravity sanitary drains which are routed to this sump shall be designated as follows:

- Minimum pipe size – 4 in.
- Minimum pipe velocity – 2 fps
- Maximum pipe velocity – 7.5 fps
- Minimum slope
 - 4 in. pipe – 2%
 - 6 in. and larger pipe – 1%
- Maximum manhole spacing – 300'
- Additional manholes – provide, at all turns, junction changes in pipe size and changes in pipe slope

3.1.10.2 Fencing

Security fencing shall be provided around the entire Facility area with separate security fencing around the entire switchyard.

Fencing shall be six foot-high chain link topped by an extension arm holding three strands of barbed wire at 45 degree facing out. (Fencing shall have pipe line posts at maximum 10 foot, 0-inch centers, and a top and bottom tension wire.) Chain link fence, holding three strands of barbed wire, shall be recessed 1 foot, 0-inches inside the property line.

All posts, rails, fabric, wire, and gates shall be galvanized. Road gates shall be a minimum of 6-foot-high by 24-foot-wide double swing gates with three strands of barbed wire.

The fence shall be grounded to limit step potentials below the permissible touch levels of IEEE 80.