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2.4.8 Cooling Water Canals and Reservoirs

VCS uses a cooling basin as the normal power heat sink for the circulating water system (CWS) of the plant. The CWS is not a safety-related system because all of its structures and components, including the cooling basin, do not support any safety functions as described below. This subsection describes the cooling basin and its various components. The location and general layout of the cooling basin, relative to the VCS power block, are shown in Figure 2.4.8-1.

The hydrologic features of the VCS site are described in Subsection 2.4.1, which includes a topographic map of the VCS site and the nearby area in Figure 2.4.1-2. Besides the cooling basin, there is no other cooling reservoir or cooling canal at the VCS site.

The safety-related emergency cooling system for VCS would depend on the reactor type selected. Some reactor types use a passive cooling system as the ultimate heat sink (UHS) and other reactor types require mechanical draft UHS cooling towers and storage facilities with sufficient water inventory to maintain the plant in a safe shutdown mode for 30 days with no makeup water supply. The safety-related UHS cooling towers would use the cooling basin for makeup water and blowdown, but would not depend on the cooling basin to provide emergency cooling for safe shutdown.

Makeup water for the cooling basin is supplied by the raw water makeup (RWMU) system with an intake pumphouse located at the end of the intake canal that diverts water from the Guadalupe River. The makeup water will be delivered to the cooling basin via a buried pipeline from the RWMU system intake pumphouse to the cooling basin. The intake canal is used for water supply only and has no heat dissipation function for VCS. The RWMU system is a nonsafety-related system. A description of the RWMU system is provided in Subsection 2.4.1.

2.4.8.1 Cooling Basin

VCS uses closed-cycled cooling systems to dissipate up to 10.03 x 10^9 Btu/hour (2940 MWt) per unit, and up to 20.06 x 10^9 Btu/hour (5880 MWt) for the station, of waste heat rejected from the main condensers and the auxiliary heat exchangers during normal plant operation at full station load. The exhaust from the plant's steam turbines is directed to the main condensers, where waste heat is transferred to the circulating water. The heated circulating water from the main condensers is then discharged to the cooling basin via the CWS discharge structure, where the heat content of the circulating water is transferred primarily to the ambient air via evaporative cooling, conduction, and back radiation. After passing through the cooling basin, the cooled water is recirculated back to the main condensers through pumping at the cooling basin CWS intake structure, to complete the closed cycle circulating water loop. Makeup water to replace the cooling basin evaporative water loss, seepage loss, blowdown discharge, and water losses from the UHS/service water cooling towers (for the applicable reactor type) is supplied from the Guadalupe River via the RWMU system. The VCS

CWS has a nominal flow rate of up to 1,280,000 gpm per unit and up to 2,560,000 gpm for the station. The CWS intake and discharge structures are described in Subsection 2.4.8.1.1.

The inflow to the cooling basin includes the blowdown flow from the UHS/service water mechanical draft cooling towers (for the applicable reactor type) and makeup water flow that is supplied via the RWMU system to compensate for the inventory lost at the cooling basin due to evaporation, blowdown, seepage, and water losses from the cooling towers. The cooling basin also receives miscellaneous plant effluents as applicable. The only natural inflow into the cooling basin is direct rainfall because the cooling basin is self-contained and has no other contributing drainage area.

The RWMU system has a total design capacity of 267 cfs (120,000 gpm). The RWMU pumphouse provides makeup water at a rate of up to 217 cfs (97,500 gpm) to the cooling basin, and an additional 50 cfs (22,500 gpm) capacity is reserved for use by another entity or entities in the future. The annual makeup water supply to the cooling basin is based on a diversion limit of 75,000 acre-feet per year, subject to run-of-river availability, which will require securing the necessary water rights at the COL application stage.

To maintain water chemistry to an acceptable level for system efficiency, blowdown from the cooling basin may be necessary. The blowdown system consists of blowdown pumps located in the dedicated blowdown pump forebay at the cooling basin intake structure. The blowdown is discharged to the Guadalupe River via a pipeline to a multi-port diffuser.

The cooling basin has a nominal surface area of about 4900 acres and is formed by embankment dams consisting of clay or clayey sand fill that are constructed above ground. Interior earth dikes inside the cooling basin are used to guide the flow circulation from the cooling basin CWS outfall structure to the cooling basin CWS intake structure as shown in Figure 2.4.8-1. The purpose of the interior dikes is to promote surface heat transfer by reducing ineffective surface cooling areas and potential short circuiting in the flow path. The bottom of the cooling basin is graded to a nominal elevation of 69 feet (21.0 meters) NAVD 88, except for a portion toward the south where the bottom of the basin follows the existing natural grade that varies between elevations 66 feet to 69 feet (20.1 meters to 21.0 meters) NAVD 88.

The elevation of the top of the exterior perimeter embankment dams of the basin is in general at 102 feet (31.1 meters) NAVD 88. At a few locations, the top elevation of the embankment dams is raised to accommodate pipe and spillway crossings. The top elevations of the interior dikes are at 99 feet (30.2 meters) NAVD 88. The embankment dams are approximately 25 feet (7.6 meters) wide at the top. The embankment dam slopes are typically 4 horizontal to 1 vertical (4H:1V) inboard (i.e., interior to the basin) and 3H:1V outboard (i.e. exterior to the basin). The side slope of the interior dikes is 3H:1V on both sides. The inboard slope of the embankment dams and both slopes of the interior dike slopes are covered by a 30-inch (762 millimeters) soil-cement layer, or other suitable material selected at detailed design, to protect against erosion and it has a characteristic stepped surface that provides additional roughness. The outboard slope of the peripheral embankment is covered with vegetation (grasses, etc.) for erosion protection. A detailed description of the embankments is contained in Subsection 2.5.5.

The cooling basin has a design pool level, also referred to as the normal operating level, of 90.5 feet (27.6 meters) NAVD 88. At this level, the minimum water depth in the basin is 21.5 feet (6.55 meters) at the northern, shallower end of the basin that gets deeper towards the southern end. The surface area and storage volume of the cooling basin at the design pool level are approximately 4900 acres and 103,600 acre-feet, respectively. The average residence time in the basin is defined as the storage volume divided by the CWS flow rate, which is approximately 9 days during full load plant operation, when the cooling basin is filled to the design pool level.

The normal maximum operating water level of the cooling basin is 91.5 feet (27.9 meters) NAVD 88 that includes an operating range of 1 foot (0.3 meter). The storage volume of the cooling basin is about 108,500 acre-feet when the basin water level reaches the normal maximum operating level. The cooling basin surface area changes slightly with water depth, increasing at a rate of approximately 11 acres for every 1-foot rise in the basin water depth.

The design low water level at the cooling basin for CWS pump operation is established at 71.5 feet (21.8 meters) NAVD 88. The operating units will be shut down if the cooling basin water level drops below elevation 71.5 feet (21.8 meters) NAVD 88. At this level, the volume of water remaining in the cooling basin is approximately 12,200 acre-feet (15.05 million cubic meters). The storage capacity and surface area of the cooling basin at different water depths are presented in Table 2.4.8-1.

A cooling basin thermal model is used to simulate the spatial and time variation of water temperature in the cooling basin in response to a maximum of 60 years of historical meteorological conditions. For the ESP, the thermal performance of the cooling basin and associated water consumption of the CWS system are evaluated with the use of a representative set of CWS parameters including a station heat load of 19.76 x10^9 Btu/hour, a total circulating water flow rate of 2,200,000 gpm for the station and the resulting condenser temperature rise of 18^{o}F. When the reactor technology is selected during the COL application stage, technology specific plant design parameters and plant performance criteria would be used to reevaluate the thermal performance of the cooling basin and to optimize the CWS design. Water losses from the basin as a result of natural and forced evaporation are predicted as part of the modeling process. The 60 years (from 1947 to 2006) of meteorological data, including dry bulb temperature, wind speed, relative humidity, and cloud cover, come primarily from the Victoria Regional Airport meteorological station and are supplemented by the data from the Corpus Christi and Galveston stations where there are data gaps. The cooling basin thermal model is calibrated using recent water temperature data measured at a cooling pond in the region.

The thermal performance of the cooling basin is evaluated at the design pool level of 90.5 feet (27.6 meters) NAVD 88 and at lower basin water levels down to 73.5 feet (22.4 meters) NAVD 88, based on full load conditions for the plant. The model results demonstrate that the cooling basin intake temperature is less than 100^{o}F at the design pool level and at lower basin levels down to 73.5 feet (22.4 meters) NAVD 88, with VCS in full load operation, rejecting heat at a total rate of 19.76 x 10^9 Btu/hour. The annual combined natural and forced evaporation losses from the cooling basin are estimated to vary from a maximum of about 172.5 inches (4382 millimeters) to a long-term average of about 154.0 inches (3912 millimeters) at the design pool level. The long-term average evaporation losses are estimated using the station capacity factor of 96 percent. The evaporation loss varies very slightly with different basin water levels. Because the representative heat load of 19.76 x 10^9 BTU/hr used in the ESP evaluation is lower than the bounding heat load of 20.06 x 10^9 BTU/hr by a small amount, about 1.5 percent, no significant impact on the predicted cooling basin thermal performance and evaporative water losses is expected when the system would be reevaluated at the COL application stage.

A water budget analysis of the cooling basin is performed to evaluate the impacts of potential drought conditions on the water supply to sustain plant operation. The study assumes a repeat of the historical hydrometeorological conditions from 1947 to 2006, including the drought of record from 1950 to 1956.

The analysis includes as inflow to the cooling basin direct precipitation, makeup water flow from the RWMU system, blowdown flow from the UHS/service water mechanical draft cooling towers, and other miscellaneous plant effluents, as applicable. For direct precipitation, the historical rainfall record available from the Victoria Regional Airport meteorological station is used. The makeup water flow rate to the cooling basin used for the evaluation is determined based on a maximum annual diversion of 75,000 acre-feet and a maximum instantaneous RWMU system pumping rate of 217 cfs, both subject to run-of-river availability. The run-of-river availability at the RWMU system intake location, for the model period of 1947 to 2006, is projected based on an extension to 2006 of the conservative "Full Authorization" scenario of the Guadalupe-San Antonio River Basin Water Authority Model (GSA-WAM) for the region. The "Full Authorization" scenario reflects the condition in which all water rights in the river basin use their maximum authorized amounts. The cooling basin water budget model further assumes that 70,000 acre-feet per year of treated effluent is discharged by the City of San Antonio and is added to the run-of-river flow available for withdrawal at the RWMU intake location. The period of record for the existing GSA-WAM is 1934 through 1989. The extension of the GSA-WAM to 2006 is based on a simplified hydrologic data extension that relies on gaged stream flow for the 1990 to 2006 period, with limited adjustments for flow naturalization. The extended GSA-WAM stream flow values, in a monthly interval, are disaggregated and redistributed to daily values based on historical daily stream flow patterns and used as input to the water budget model.

The outflow from the cooling basin includes the natural and forced evaporative water losses, seepage through the bottom of the cooling basin and through the embankments, makeup flow to the UHS/service water mechanical draft cooling towers, and blowdown discharge from the cooling basin to the Guadalupe River. For the cooling basin outflow, the combined natural and forced evaporative loss is estimated using the cooling basin thermal model described above. A conservative seepage rate of 5700 gpm, which includes 22.5 to 225 gpm of seepage through the embankment dikes of the cooling basin as described in Subsection 2.5.5, and seepage through the cooling basin bottom, is used to represent the total seepage losses from the cooling basin. This seepage rate is higher than the 3930 gpm of cooling basin seepage estimated by the groundwater model as described in Subsection 2.4.12 and therefore, represents a more conservative scenario for plant water use evaluation. The blowdown outflow is represented in the model as a continuous discharge of 6500 gpm during normal years, but it reduces to 1000 gpm during drought periods to reflect the effect of administrative controls for low flow conditions. The low flow conditions that initiate blowdown reduction are defined in the model as whenever the basin water level is 4 feet or more below the design pool level. The results of the water budget model indicate that with a design pool level of 90.5 feet (27.6 meters) NAVD 88, the 4900-acre cooling basin has a sufficient inventory to support plant cooling water needs and sustain plant operation during the repeat of the historical meteorological conditions of 1947 to 2006. This period includes the drought of record from 1950 to 1956 when there would be reduced and infrequent makeup. It is predicted that with the plant operation at a long-term average station capacity factor of 96 percent, the water level is not expected to drop below 73.5 feet (22.4 meters) NAVD 88, even with the recurrence of the drought of record. The thermal performance analysis of the cooling basin also indicates that the cooling basin will perform adequately for a cooling basin water level as low as 73.5 feet (22.4 meters) NAVD 88 in full load conditions, using a 100^{o}F intake (cold side) temperature as an evaluation criterion of the plant CWS requirements.

Details about low flow conditions in the Guadalupe and San Antonio Rivers and the source of makeup water for the cooling basin are addressed in Subsection 2.4.11. However, no impact to safety-related SSCs will result from operation of the cooling basin at normal or low water conditions.

2.4.8.1.1 Cooling Basin Intake and Discharge Structures

The cooling basin CWS intake structure is located on the northern embankment dam and on the west side of the north dike as shown in Figure 2.4.8-1. Circulating water pumps are located in the intake structure. Depending on the selected technology, additional nonsafety-related makeup pumps to the UHS/service water mechanical draft cooling towers would be installed and would share the pump bays with the circulating water pumps. The cooling basin blowdown pumps are located in a stand-alone bay of the CWS intake structure.

The CWS discharge structure is also located on the northern embankment dam, but on the east side of the north dike (Figure 2.4.8-1).The flow is discharged via circulating water pipes over the embankment dam into the discharge structure in the cooling basin. There are short intake and discharge channels associated with these structures, respectively. The intake and the discharge structures are designed to allow continuous CWS operation until the cooling basin water level drops below the design low water level of 71.5 feet (21.8 meters) NAVD 88. Both the intake and discharge structures are nonsafety-related structures.

2.4.8.1.2 **Emergency Spillway**

An emergency spillway is located on the southwest corner of the cooling basin embankment dam to release excess water to Kuy Creek during extreme storm events. There is no normal discharge through this spillway except during storm events that have a return period higher than 100 years. The emergency spillway is designed to pass outflow during a probable maximum precipitation (PMP) event. It has four slide gates of 6 feet (1.83 meters) by 7 feet (2.13 meters) each on top of a 31.5-foot (9.6 meters) wide ogee weir with a crest elevation at 87 feet (26.5 meters) NAVD 88. The top of the gates when closed is at elevation 94.0 feet (28.65 meters) NAVD 88. The spillway channel is also 31.5 feet (9.6 meters) wide having a total length of about 400 feet (121.9 meters) with a slope of 20H:1V. The base of the spillway section is at elevation 50 feet (15.24 meters) NAVD 88, where a 50-foot long stilling basin with baffle blocks is located for energy dissipation purposes. The spillway gates are designed to open to release flood water only when 1 foot or more of precipitation, which corresponds to a 24-hour storm of 100-year return period or higher, is accumulated in the basin. The operating procedure and schedule of the spillway gates will be developed during the detailed design phase. Figures 2.4.8-5 and 2.4.8-6 present the plan and cross section of the conceptual design of the emergency spillway. The spillway is a nonsafety-related structure.

The maximum water surface elevation of the cooling basin during a PMP event is estimated by routing a 72-hour local intense PMP through the cooling basin. The procedures for developing the PMP are described in Subsection 2.4.2. The PMP event used in this evaluation has a total rainfall depth of 55.7 inches (1415 millimeters) in 72 hours and a maximum hourly rainfall of 19.8 inches (503 millimeters). Other parameters taken into account for the storm routing are the cooling basin area and capacity relationships with the basin water depth, initial water level in the cooling basin, which is conservatively set equal to the normal maximum operating water level of 91.5 feet (27.9 meters) NAVD 88, and the rating curve of the spillway discharge that is developed using a discharge coefficient of 3.9 for ogee weirs.

This analysis results in a maximum cooling basin water surface elevation of 95.7 feet (29.17 meters) NAVD 88, conservatively assuming that the gates would open fully after the water level in the cooling basin exceeds elevation 94.0 feet (28.66 meters) NAVD 88. In the extreme case that the gates were assumed to be not operational, the maximum cooling basin water surface would reach an elevation of 96.2 feet (29.33 meters) NAVD 88, using a discharge coefficient of 3.2 that corresponds to a sharp-crested weir to represent the overflow condition. Finally, the water level in the cooling basin during a 50 percent local intense PMP is estimated to be elevation 93.9 feet (28.62 meters) NAVD 88 and this storm is fully contained when the gates are closed.

2.4.8.1.3 Embankment Freeboard

As part of the dam safety evaluation, the wind setup, wave height, and wave run-up elevation are determined for three scenarios: (1) a 2-year wind speed with appropriately adjusted duration, in conjunction with the maximum still water level of 96.2 feet (29.33 meters) NAVD 88 in the cooling basin, resulting from a local intense PMP with the spillway gates not operational, (2) a wind speed resulting from the probable maximum hurricane (PMH) coincidental with the normal maximum operating water level in the cooling basin of 91.5 feet (27.9 meters) NAVD 88, and (3) a 10-year wind speed that occurs coincidentally with the maximum still water level of 96.2 feet (29.33 meters) NAVD 88 resulting from the PMP with the spillway gates not operational. The first two scenarios are selected based on the combined events criteria in Section 10 of ANSI/ANS-2.8-1992 (Reference 2.4.8-1) for safety-related facilities, even though the cooling basin is not a safety-related structure. The last scenario is adopted from the guidelines of the U.S. Department of the Interior, Bureau of Reclamation (Reference 2.4.8-3) for the design of storage dams.

As shown in Figure 1 of ANSI/ANS 2.8-1992 (Reference 2.4.8-1), the 2-year fastest mile wind speed at 30 feet (9.15 meters) above ground at the VCS site is 50 mph (80.5 km/hr). From Subsection 2.4.5, the maximum PMH wind speed at the VCS site is estimated to be 105.5 knots or 121.4 mph (195.4 km/hr). According to page C-12 in the U.S. Army Corps of Engineers, Engineer Manual 1110-2-1412, *Storm Surge Analysis and Design Water Level Considerations,* (Reference 2.4.8-2), this value corresponds to the maximum 10-minute average wind speed at 32.8 feet (10 meters). The 10-year return period 3-second wind gust is estimated to be about 81.4 mph (131.0 km/hr), in accordance with Table C6-3 of the ASCE Standard *Minimum Design Loads for Building and Other Structures* (Reference 2.4.8-4). These values are adjusted for duration, wind speed above water, and fetch length, as applicable, for the estimates of wind setup and wave run-up on the cooling basin embankment.

The wind setup, wave height, and run-up elevation are estimated at five different locations at the cooling basin. These locations are the CWS intake and discharge structures, the RWMU discharge structure, the cooling basin emergency spillway, and the north/south cooling basin embankment. The fetch alignments at each of the locations are depicted in Figures 2.4.8-2 through 2.4.8-4. The fetch distances for each of the alignments are presented in Table 2.4.8-2.

Methodologies described in the U.S. Army Corps of Engineers, Coastal Engineering Manual (Reference 2.4.8-5) and by Kamphius (Reference 2.4.8-6) are used to determine the wave height, wind setup, and wave run-up elevation at the embankment of the cooling basin. Also, appropriate checks were made to examine if the waves are duration-limited or fetch-limited. Finally, a check was made to ensure that the waves are not limited by water depth (Reference 2.4.8-5). In the wind-wave analysis, the cooling basin bottom elevation of 69 feet (21.0 meters) NAVD 88 and the inboard slope of the embankment dams of 4H:1V are used. A roughness correction factor of 0.8 on the wave run-up estimation is used to represent the soil-cement stair-stepped protective liner on the inboard slope of the embankment dams.

For the 2-year wind condition, the wind setup and the 2 percent wave run-up elevation at the five locations in the cooling basin are presented in Table 2.4.8-3. Adding to the maximum still water elevation of the cooling basin of 96.2 feet (29.33 meters) NAVD 88, resulting from a local intense PMP when the spillway gates are not operational, the maximum basin water level is calculated to be the highest, about 100.0 feet (30.5 meters) NAVD 88, at the north/south embankments. With the top-of-embankment elevation at 102 feet (31.1 meters) NAVD 88, sufficient freeboard is provided for all locations as shown in Table 2.4.8-3.

The wind setup and the 2 percent wave run-up elevations for the concurrent PMH condition at the five locations in the cooling basin are presented in Table 2.4.8-4. These values are added to the normal maximum operating water elevation of 91.5 feet (27.9 meters) NAVD 88. The resulting PMH flooding level is calculated to be the highest at the north/south embankments, equal to 101.5 feet (30.94 meters) NAVD 88. The resulting freeboards at various locations in the cooling basin for the concurrent PMH wind condition are presented in Table 2.4.8-4.

The wind setup and the 2 percent wave run-up elevation for the 10-year wind condition, at the five locations in the cooling basin are presented in Table 2.4.8-5. These values are added to the maximum still water elevation of the cooling basin of 96.2 feet (29.33 meters) NAVD 88, similar to the 2-year wind condition. The resulting flooding level is calculated to be the highest at the north/south embankments, equal to 101.3 feet (30.88 meters) NAVD 88. The resulting freeboards for the 10-year wind condition at the various locations are shown in Table 2.4.8-5.

2.4.8.2 **Seiche in Cooling Basin**

A seiche is a standing wave in an enclosed or partially enclosed body of water. It can be induced by the passage of a hurricane over the water body or a seismic event. When a hurricane passes over the body of water, the change in wind and barometric pressure fields create waves on the water surface. When the forces causing the wind/pressure changes stop, seiche oscillations on the water surface might occur. Subsection 2.4.5.4 evaluates the potential effect of hurricane induced seiches on VCS. During a seismic event, the oscillating movement of the earth generates waves which propagate from one side of the reservoir to the other, and back, thus creating a seiche. Flooding of the VCS site as a result of a seismic induced seiche in the cooling basin has not been evaluated specifically because the cooling basin is not a safety-related facility. However, the potential impact of flooding at the safety-related facilities at the power block resulting from the breaching of the cooling basin embankment dams during a 50 percent PMP event is described in Subsection 2.4.4. The embankment breach flooding scenario with the basin water level at the 50 percent PMP level would have bounded the flooding impact resulting from a seiche-induced embankment failure event.

2.4.8.3 References

2.4.8-1 American National Standard Institute, American Nuclear Society, ANSI/ANS 2.8-1992, *Determining Design Basis Flooding at Nuclear Power Reactor Sites*, July 1992.

2.4.8-2 U.S. Army Corps of Engineers, Engineer Manual 1110-2-1412, *Storm Surge Analysis and Design Water Level Considerations*, 15 April 1986.

2.4.8-3 U.S. Department of the Interior, Bureau of Reclamation *Freeboard Criteria and Guidelines for Computing Freeboard Allowance for Storage Dams*, Acer Technical Memorandum No. 2, Revised 1992.

2.4.8-4 American Society of Civil Engineers Standard (ASCE 7-98), *Minimum Design Loads for Buildings and Other Structures*, 2003.

2.4.8-5 U.S. Army Corps of Engineers, *Coastal Hydraulics Laboratory*, EM1110-2-1100, Coastal Engineering Manual, October 2006.

2.4.8-6 Kamphuis, J. William, *Introduction to Coastal Engineering and Management*, Advanced Series on Ocean Engineering, Volume 16, World Scientific, 2000.

Table 2.4.8-1
Storage Capacity and Surface Area for the Cooling Basin

Elevation (feet NAVD 88)	Storage Capacity (Acre-feet)	Surface Area (Acre)
69.0	0	650
71.5	12,200	4,680
73.5	21,700	4,730
77.5	40,700	4,770
90.5	103,600	4,910
91.5	108,500	4,930
99.0	145,800	5,010

Table 2.4.8-2
Fetch Distances at Various Locations in the Cooling Basin

Structure	Fetch Distance	
	(Miles)	(Kilometers)
Cooling Basin CWS Intake Structure	2.02	3.25
Cooling Basin CWS Discharge Structure	2.25	3.62
Cooling Basin Emergency Spillway	2.65	4.27
Cooling Basin North/South Embankment	3.38	5.45
RWMU Discharge Structure at Cooling Basin	2.73	4.39

Table 2.4.8-3
Cooling Basin Maximum PMP Flooding Level

Structure	Wind Setup (feet)	Wave Run-Up (feet)	Maximum Flooding Level[(a)] (feet, NAVD 88)	Freeboard[(b)] (feet)
Cooling Basin CWS Intake Structure	0.13	2.65	98.98	3.0
Cooling Basin CWS Discharge Structure	0.15	2.82	99.16	2.8
Cooling Basin Emergency Spillway	0.17	3.10	99.47	2.5
Cooling Basin North/South Embankment	0.22	3.54	99.95	2.0
RWMU Discharge Structure at Cooling Basin	0.19[(c)]	3.32[(c)]	99.71[(c)]	2.3[(c)]

(a) Maximum still water level from local intense PMP for the cooling basin is 96.2 feet NAVD 88. Wind setup and the 2 percent wave run-up are derived from a concurrent 2-year wind speed of 50 mph.
(b) Top-of-embankment elevation is assumed to be at 102 feet NAVD 88.
(c) Based conservatively on a fetch length of 3.01 miles.

Table 2.4.8-4
Cooling Basin Maximum PMH Flooding Level

Structure	Wind Setup (feet)	Wave Run-Up (feet)	Maximum Flooding Level[(a)] (feet, NAVD 88)	Freeboard[(b)] (feet)
Cooling Basin CWS Intake Structure	0.74	6.55	98.79	3.2
Cooling Basin CWS Discharge Structure	0.82	6.96	99.28	2.7
Cooling Basin Emergency Spillway	0.96	7.65	100.11	1.9
Cooling Basin North/South Embankment	1.22	8.79	101.51	0.5
RWMU Discharge Structure at Cooling Basin	1.09[(c)]	8.22[(c)]	100.80[(c)]	1.2[(c)]

(a) Normal maximum operating water level for the cooling basin is 91.5 feet NAVD 88. Wind setup and the 2 percent wave run-up are derived from a concurrent PMH with a wind speed of 121.4 mph.
(b) Top-of-embankment elevation is assumed to be at 102 feet NAVD 88.
(c) Based conservatively on a fetch length of 3.01 miles.

Table 2.4.8-5
Cooling Basin Maximum Flooding Level for 10-Year Wind Condition

Structure	Wind Setup (feet)	Wave Run-Up (feet)	Maximum Flooding Level[a] (feet, NAVD 88)	Freeboard[b] (feet)
Cooling Basin CWS Intake Structure	0.23	3.52	99.95	2.1
Cooling Basin CWS Discharge Structure	0.25	3.74	100.20	1.8
Cooling Basin Emergency Spillway	0.30	4.11	100.61	1.4
Cooling Basin North/South Embankment	0.38	4.72	101.30	0.7
RWMU Discharge Structure at Cooling Basin	0.34[c]	4.42[c]	100.96[c]	1.0[c]

(a) Maximum still water level from local intense PMP for the cooling basin is 96.2 feet NAVD 88. Wind setup and the 2 percent wave run-up derived from a concurrent 10-year wind speed of 81.4 mph, corresponding to the 3-second gust wind speed.
(b) Top-of-embankment elevation is assumed to be at 102 feet NAVD 88.
(c) Based conservatively on a fetch length of 3.01 miles.

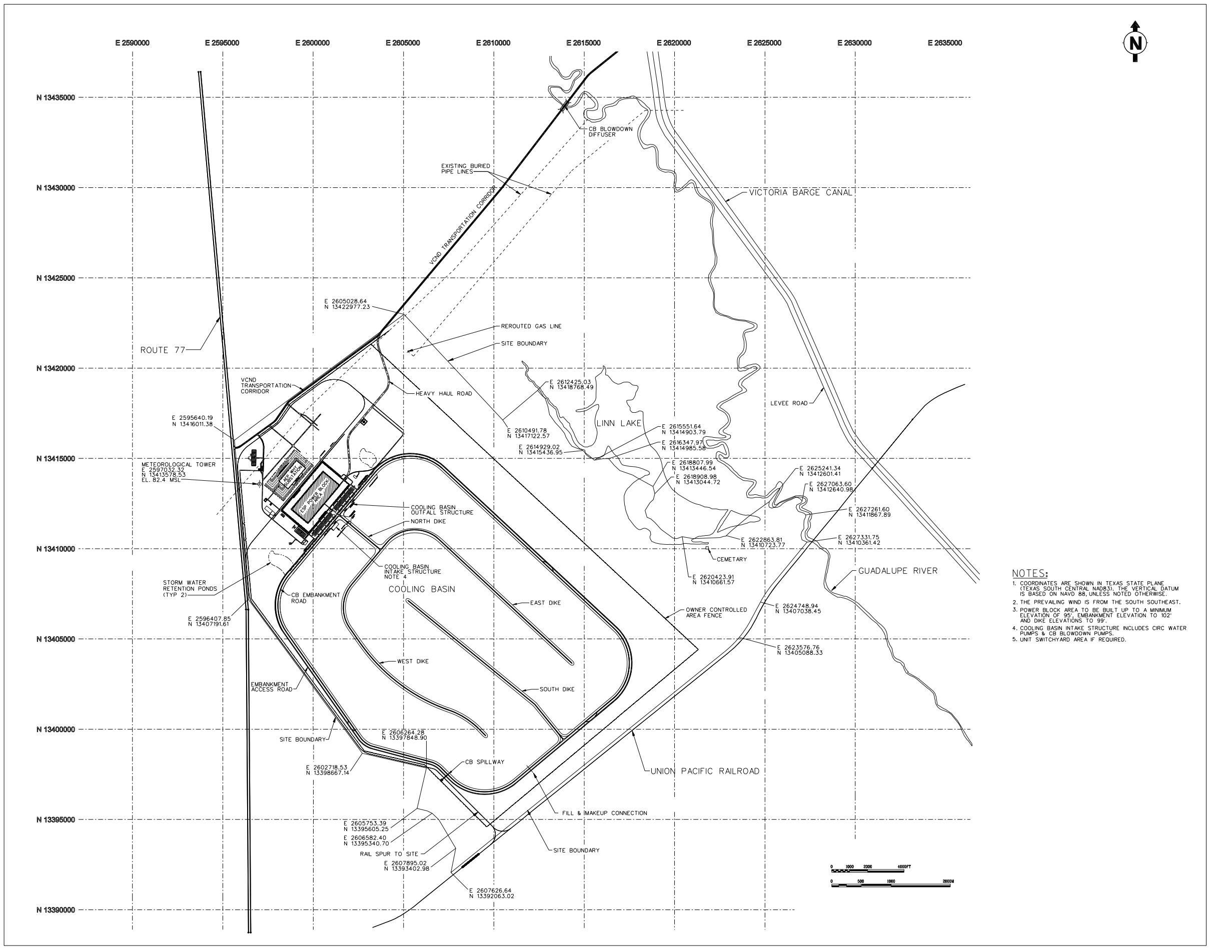

Figure 2.4.8-1 Layout of the Cooling Basin

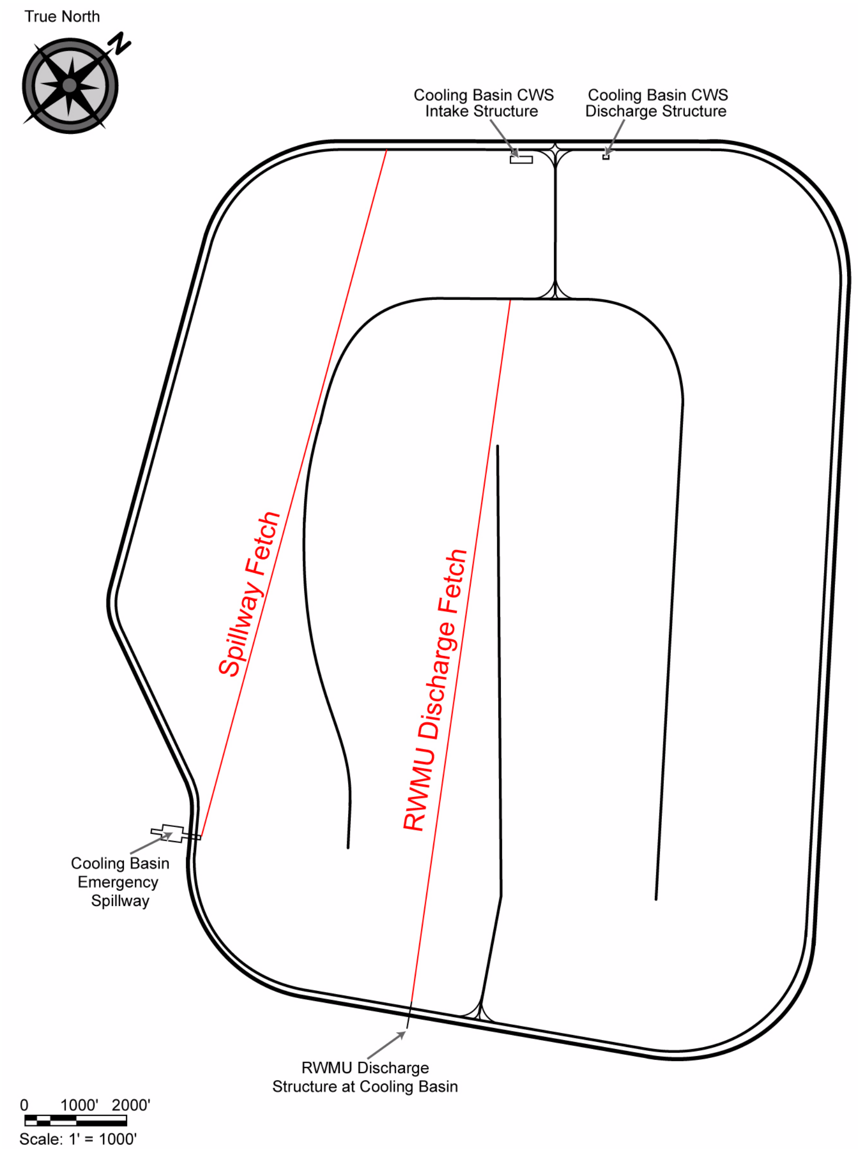

Figure 2.4.8-2 Fetch Alignments for Cooling Basin Emergency Spillway and the RWMU System Discharge Structure at Cooling Basin

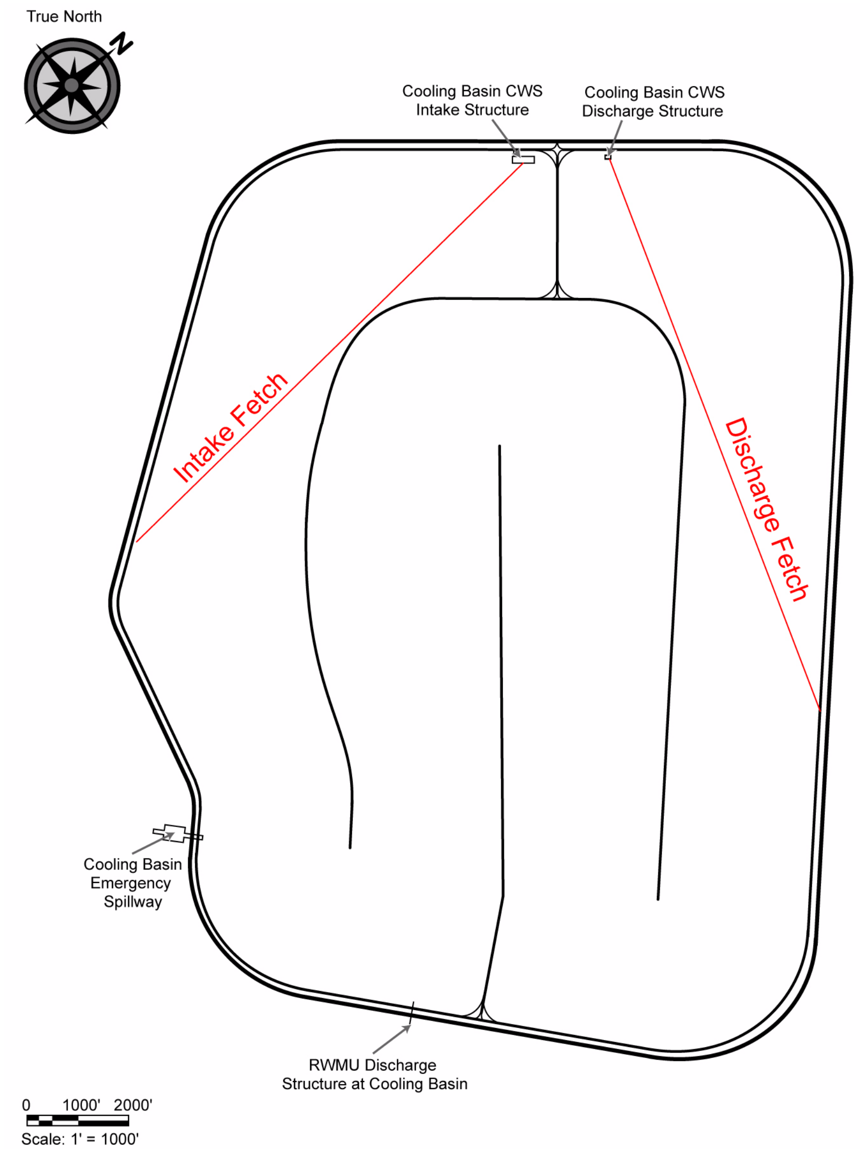

Figure 2.4.8-3 Fetch Alignments for the CWS Intake and Discharge Structures

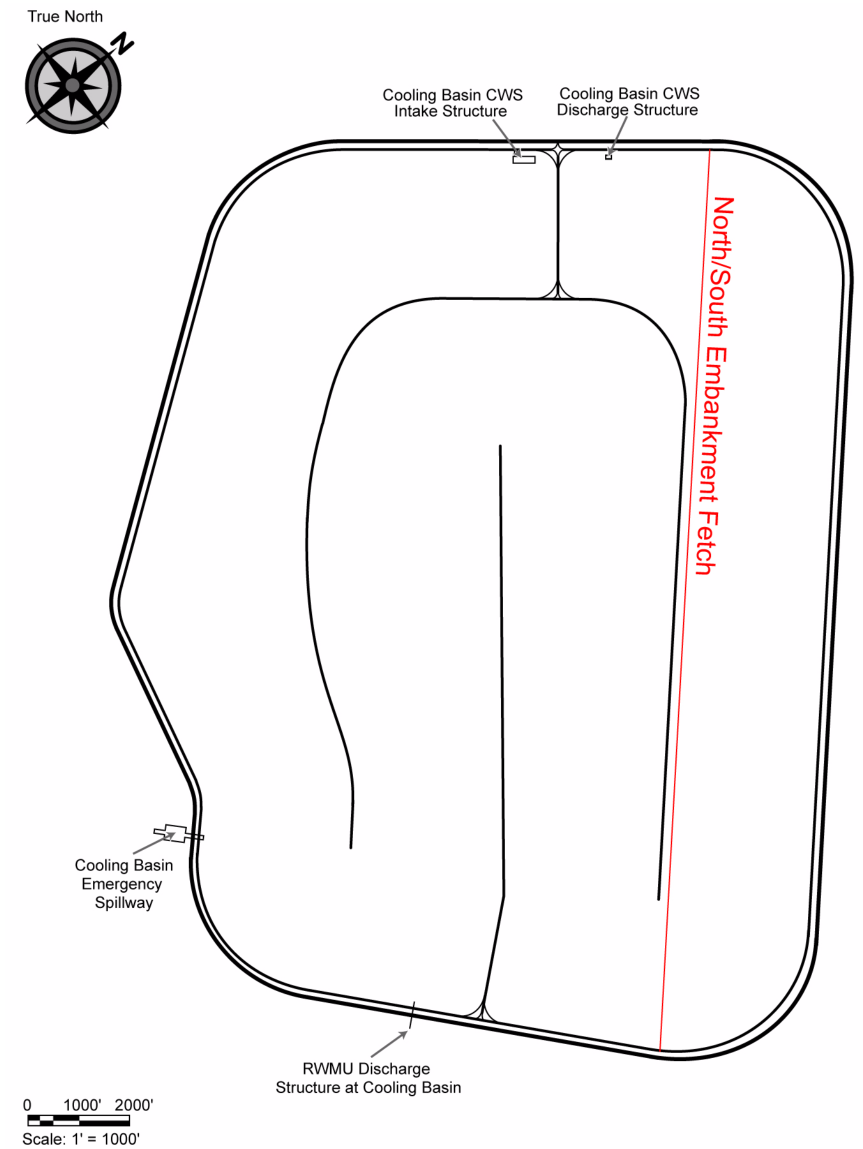

Figure 2.4.8-4 Fetch Alignments for the North/South Embankments

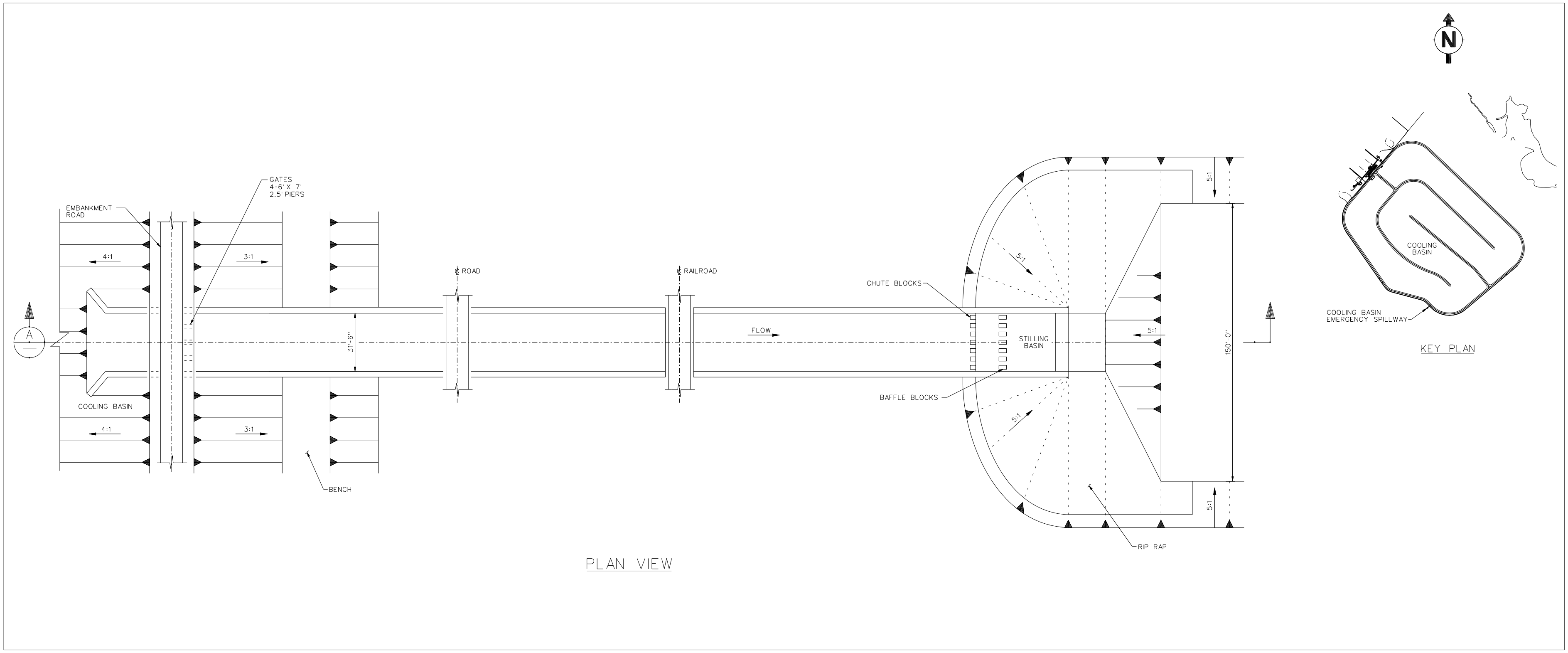

Figure 2.4.8-5 Plan View of Cooling Basin Emergency Spillway

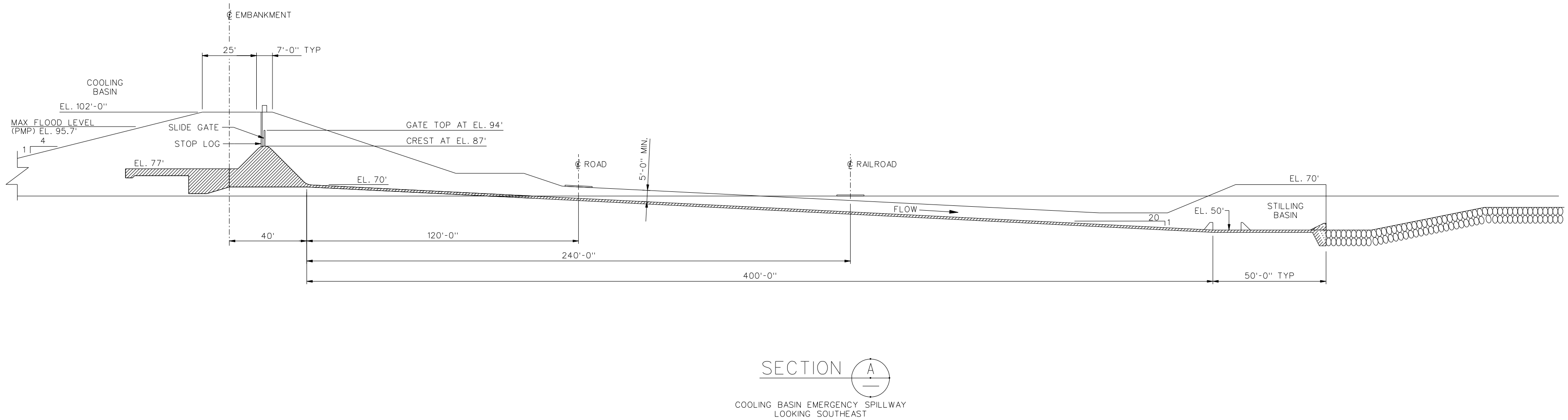

Figure 2.4.8-6 Cross Section View of Cooling Basin Emergency Spillway