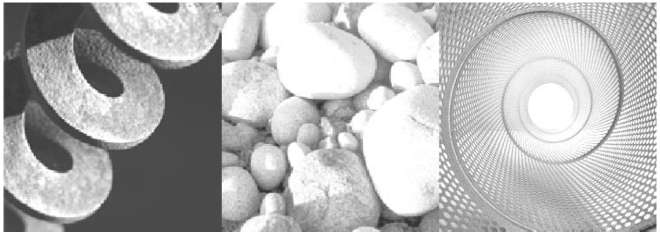

GEI Consultants

Consulting Engineers and Scientists

Terminal Dam Inundation Technical Study

State Dam No. 1055.002
National Dam No. CA00888

Prepared for:
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AUTHOR INITIALS: CV

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Engineer's Certifications

I, Mark Fortner, herby certify on December 27, 2017, that I supervised the preparation of this study, *Terminal Dam Inundation Technical Study*, as a professional engineer licensed in the State of California.

I, Chong Vang, hereby certify on December 27, 2017, that I performed the dam failure and inundation analysis of this study, *Terminal Dam Inundation Technical Study*, as a professional engineer licensed in the State of California.

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Executive Summary

San Luis Obispo County Flood Control and Water Conservation District (District) retained GEI Consultants, Inc. (GEI) to perform an analysis to estimate the downstream flooding due to a hypothetical failure of Terminal Dam for a fair weather (sunny day) event. The District is required to submit inundation maps to the California Department of Water Resources (DWR) Division of Safety of Dams (DSOD) for Terminal Dam by January 1, 2018, per recently adopted "Emergency Regulations for Inundation Maps." The analysis was performed to assess the potential adverse incremental consequences, including loss of life and significant property damage. The dam is currently classified as an "extremely high" hazard dam by California Department of Water Resources (DWR) Division of Safety of Dams (DSOD). This analysis does not refer to the structural integrity of the dam itself, but rather the potential impacts if a dam failure should occur.

Terminal Dam was constructed in 1969 as part of the Lopez Water Supply Project. Terminal Dam is owned and operated by the District, under the purview of the County of San Luis Obispo Public Works Department. Terminal Dam and reservoir is a tributary to the Arroyo Grande Creek in San Luis Obispo County, California, approximately 4.7 miles northeast of the center of the town of Arroyo Grande, California. Terminal Reservoir has a drainage area of 0.63 square miles and provides storage and agricultural water uses for the local communities. The reservoir has an area of 37 acres and a storage capacity of 844 acre-feet (DSOD). The normal operating reservoir level is 330.8 ft (NAVD 88).

GEI simulated a hypothetical piping failure of the Terminal Dam starting at full reservoir pool to the upstream toe at El. 287.8 ft with an average breach width of 121.9 ft, and a time to failure of 0.5 hours.

The hypothetical failure of Terminal Dam for the sunny day mode would create a flood wave that could reach 33 ft-high downstream of the dam in the Arroyo Grande Creek with a peak breach flow of 25,391 cubic feet per second (cfs). The flood wave would travel 8.9 miles downstream, inundating approximately 1,373 acres of floodplain downstream of the dam through the City of Arroyo Grande and town of Oceano before discharging into the Pacific Ocean; 105 acres of the City of Arroyo would be inundated by the dam failure. The peak flood wave for the sunny day failure would take 2 hours and 55 minutes to reach the ocean.

The inundation maps for the sunny day, full reservoir storage dam failure analyses are provided in **Appendix C**.

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1. Introduction

1.1 Purpose

Under a newly enacted state law, effective July 1, 2017, all dam owners are required to prepare an Emergency Action Plan (EAP) for their dams and critical appurtenant structures under certain conditions and specific time limits (California Water Code Sections 6160 – 6162). Terminal Dam, classified as an "extremely high" hazard dam by the California Department of Water Resources (DWR) Division of Safety of Dams, an EAP is to be submitted to DSOD and California Governor's Office of Emergency Services (CalOES) by the end of January 1, 2018. As owner of Terminal Dam, San Luis Obispo County Flood Control and Water Conservation District (District) retained GEI Consultants, Inc. (GEI) to develop inundation maps for a Terminal Dam failure mode analysis to be submitted to DSOD per recent adopted "Emergency Regulations for Inundation Maps." The EAP for dams are a guidance document identifying the potential emergency conditions at the dam and specific actions to be followed to minimize loss of life and property damage. The level of detail to be included in the EAP consists of dam break inundation maps identifying the extents of the breach flood wave attenuation downstream of Terminal Dam.

The dam break analyses and inundation mapping are to be consistent with California Code of Regulations, Title 23. Waters, Division 2. Department of Water Resources, Chapter 1. Dams and Reservoirs, Article 6. Inundation Maps. GEI performed dam breach analyses by modeling a fair weather (sunny day) breach in accordance with Federal Emergency Management Agency (FEMA) guidelines and routed the breach hydrograph downstream with the latest hydraulic numerical model program from the US Army Corps of Engineers (USACE) called Hydrologic Engineering Center's River Analysis System (HEC-RAS).

A summary of the scope of work performed by GEI for this study is presented below:

Data Collection

1. Research and collect information of the dam at DSOD record library and identify potential downstream flood wave extents. Coordinate with the District to obtain data of obstruction structures that may impact the flood wave downstream.

Dam Inundation Technical Study

1. Develop floodplain terrain based on light detection and ranging (LiDAR) collected from Pacific Gas and Electric Company (PG&E), California Coastal Conservancy Coastal LiDAR Project, and US Geological Survey (USGS) National Elevation Dataset (NED). Assigned roughness values for the channels and overland flow areas are based on National Land Cover Database (NLCD) 2011 Land Cover by USGS.

2. Develop breach parameters for the hypothetical dam failure and develop dam breach outflow hydrographs.

3. Perform dam breach parameter sensitivity analyses.

4. Route the base case scenario dam breach hydrograph through the downstream area to create inundated floodplains using HEC-RAS software for unsteady flow conditions.

5. Perform sensitivity analyses to test influence of key assumptions on the flow modeling results.

6. Develop downstream inundation maps with the use of Geographic Information System (GIS) software, ArcMap.

7. Prepare report to summarize the dam breach analyses, present key assumptions of the unsteady flow model input and output results.

1.2 Horizontal and Vertical Datum

The projection used in preparation of this report is in California State Plane Coordinate System Zone 5. The horizontal datum is in the North American Datum of 1983 (NAD83), GRS80 spheroid. Elevations in this report are in feet and referenced with respect to the North American Vertical Datum of 1988 (NAVD88) unless noted on the description. The vertical datum conversation from National Geodetic Vertical Datum 1929 (NGVD29) to NAVD88 is +2.848 feet based on VERTCON conversion at Terminal Dam. The abbreviation “El” represents elevation.

2. Project Description

2.1 Dam and Reservoir

Terminal Dam and Reservoir are in San Luis Obispo County, California, approximately 4.7 miles northeast of the City of Arroyo Grande. The dam is owned and operated by the District. A site location map is shown on **Figure 1**. Terminal Dam is an earth fill dam that was completed in 1969 to provide storage, municipal, and domestic water uses for downstream communities. The reservoir acts as a raw water impoundment providing 30 to 45 days of detention time for Lopez Lake, located at the headwaters of Arroyo Grande Creek, water prior to being treated at the Lopez Water Treatment Plant. Runoff from a half mile segment of Orcutt Road drains into the reservoir but a diversion channel encircles the remainder of the reservoir and prevents runoff from entering the reservoir.

The center core of the dam is composed of materials identified as Random Core Zone “F” at 15 ft wide at the dam crest with slopes at 1H: 2V to upstream and downstream toe, and Random Zone “C”. See As-Builts drawings in **Appendix A**. The 53 ft high dam impounds a volume of 844 ac-ft of water with a crest length of 550 ft. A summary of the dam and reservoir data for Terminal Dam is presented in **Table 1**. See **Figure 2** for dam aerial view. See **Figure 3** for storage-elevation capacity curve of Terminal Dam. The analysis is based on the original capacity curve (**Figure 3**) of the reservoir and does not reflect the current reservoir capacity that may have diminished over time through sediment build-up from upstream basin surface water run-off.

A concrete poured uncontrolled spillway is located on the southwest end of the dam with an ogee crest at elevation at El. 331.8 ft. The crest has an approximate length of 35 ft and design head of 2 ft. The invert slope of the spillway side channel is at 0.01 ft/ft until reaching 145 ft downstream of the center axis of the dam to transition to steeper slopes of 0.178 ft/ft. The spillway side channel is a trapezoidal chute with upstream width of 3 ft and widen to a 10 ft base rectangular chute that is 12 ft downstream. At that location, the spillway becomes a 10 ft wide rectangular chute.

Terminal Dam has outlet structures comprised of an intake tower on the upstream side with four 24-inch butterfly valves at various elevations and one 36-inch isolation butterfly valve to isolate the tower from the low-level outlet pipe. The low-level outlet pipe is a 36-inch concrete encased steel pipe with eight concrete collars along the alignment. The downstream blow-off is a 20-inch butterfly valve, which daylights into the spillway side wall. The valves can be adjusted when necessary to adjust flows into the downstream treatment plant.

2.2 Watershed and Hydrology

Terminal Dam is in the Lower Arroyo Grande Creek sub-basin watershed (USGS Watershed Boundary Dataset [WBD], Hydrologic Unit 10) of the Arroyo Grande Creek watershed (WDB Unit 12) (shown on **Figure 4**). The Lower Arroyo Grande Creek sub-basin has a drainage area of approximately 30.3 square miles and drains into Meadow Creek-Frontal Pacific Ocean sub-basin watershed. Within the sub-basin, an approximate land area of 0.63 square miles drains into Terminal Reservoir.

The climate in the County of San Luis Obispo is mild with precipitation ranges from less than 10 inches per year in the eastern portion to more than 40 inches per year at higher elevations in the Santa Lucia Mountain range. In Arroyo Grande, CA the beginning of a water year can reach mean precipitation of 1.7 inches in November to 3.87 inches in February to March (Hydrology Report 2005). Record low temperatures can reach 23 degrees Fahrenheit in the winter season to record highs of 108 degrees Fahrenheit in summer months.

2.3 Downstream Impact Areas

Downstream of Terminal Dam are the cities of Arroyo Grande, Grover Breach, and unincorporated community Oceano. Arroyo Grande has an estimated population of 18,097 (US Census, 2016) and a total area of 5.83 square miles, Grover Beach has an estimated population of 13,641 (US Census, 2016) and with a total area of 2.31 square miles, and Oceano with a population of 7,286 (US Census, 2010) and total area of 1.55 square miles. The cities are in the coastal plains between the Pacific Ocean and the coastal mountain and valleys with majority of the cities in the low lying flat area with average elevations of El. 130 ft in the northeast city limits of Arroyo Grande close to the mountain terrains to southwest area with average elevations of 50 feet towards Grover Beach and Oceano. The flow path downstream of the dam will flow into Arroyo Grande Creek traveling southwest. Dense residential neighborhoods, commercial and industrial developments, recreational facilities, public facilities, and schools are concentrated in the southern portions of the cities of Arroyo Grande and Grover Beach and northern portion of Oceano.

Eight in-line bridge/structures are identified as impact structures due to a hypothetical dam failure from Terminal Dam to the termination point into the ocean. These structures are considered significant in that they can impact and impede the flood wave of the dam breach and are incorporated in the hydraulic model development. **Table 2** includes the list of structures that are included in the hydraulic model evaluation.

2.4 Topographic Data and Field Survey

The best available topographic data was obtained through National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management, Digital Coast. The Digital Coast houses data sets which ranges from economic data to satellite imagery. A data request for the San Luis Obispo County area through the Digital Coast retrieved LiDAR data by PG&E (2011 and 2013 dataset) and the California Coastal Conservancy Coastal LiDAR Project (2010). Additional terrain data from the National Elevation Dataset (NED) raster product produced and distributed by the USGS were collected. The NED is derived from diverse source data and processed to a common coordinate system and unit of vertical measure. The NED was available at a resolution at 1/3-arc-second (approximately 10 meters) for San Luis Obispo County. The NED raster was used as a supplemental dataset for data gaps within the PG&E and Coastal LiDAR Project.

The LiDAR was mosaic with the Geographic Information Systems (GIS) software ArcMap with the PG&E data set as the priority set, Coastal data set as secondary, and the USGS NED set as last priority. The gridded raster resolution was set as the finest grid from the data sets which was the PG&E data at 1 foot grid. The three data were projected to the same projection, California State Plane Coordinate System Zone 5, in units of feet.

GEI staff coordinated with the District staff to obtain data of bridge structures along Arroyo Grande Creek. A developed hydraulic model, HEC-RAS, was provided to GEI showing the bridge crossings from Highway 101 downstream to the railway crossing. Field survey and measurement of the structures performed by the District is listed on **Table 3**.

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3. Previous Studies and Records

3.1 DSOD Record Documents

Recorded documents of Terminal Dam were retrieved from DSOD. The documents listed below are documents considered relevant to this study and does not include all documents at DSOD. The documents included:

1. Dam Statistics Summary Information Summary.
2. Record of Inspection of Dam performed by DSOD.
3. Certificate of Approval.
4. DSOD Analysis of Spillway.
5. DSOD Embankment Dam Stability Analysis.
6. Lopez Water Supply Project Terminal Dam and Reservoir.
7. Hydrology for Terminal Dam and Reservoir, Lopez Water Supply Project.
8. Spillway Hydraulic Calculation for Terminal Dam and Reservoir, Lopez Water Supply Project.

No previous studies of inundation maps of Terminal Dam were provided or available at the time of this study.

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4. Dam Breach Inundation Analysis

4.1 Hydraulic Model

A hydraulic model was developed to evaluate a hypothetical dam failure analysis of Terminal Dam using HEC-RAS, version 5.0.3. This version of HEC-RAS can perform one-dimensional (1D), two-dimensional (2D), as well as combined 1D and 2D unsteady-flow modeling (Saint Venant equations or Diffusive Wave equations). The hypothetical dam failure produced outflow hydrographs that was routed downstream into the floodplain. The advantages of using 2D modeling for the hypothetical dam failure are:

- Detailed dam breach analyzes.
- Detailed 2D channel and floodplain modeling.
- Direct connection of Terminal Reservoir storage area into the 2D floodplain areas with a hydraulic structure connection (Terminal Dam), and/or the ease of transfer of the dam break hydrograph as an indirect inflow hydrograph boundary condition to the 2D floodplain downstream of the dam.
- One floodplain area modeled from the reservoir to the termination point.
- Mixed flow regime is applied for this application. The 2D capability can handle supercritical and subcritical flow, flow transition from subcritical to super critical, and super critical to subcritical (hydraulic jumps).

2D modeling of the reservoir and floodplain are accomplished by using HEC-RAS geometric feature of adding or drawing *Storage Area* and *2D Flow Area* elements/polygons into the model, developing the 2D computational mesh (structured and unstructured), then linking the 2D flow areas to 1D elements such as hydraulic structures and/or directly connecting boundary conditions to the 2D areas. Associating the terrain to the 2D flow area, HEC-RAS will run a 2D geometric pre-processor for each mesh to establish a list of hydraulic properties table. Additional explanation and detailed procedure are included in the HEC-RAS 2D Modeling User's Manual.

4.2 HEC-RAS Model Development

The developed hydraulic 2D model encompasses the downstream floodplain simulated as an open area under unsteady state flow condition. **Figure 5** shows the topographic terrain extents and the hydraulic model geometric features detailed in HEC-RAS.

4.2.1 2D Flow Area

A HEC-RAS geometry *2D Flow Area* was developed downstream of Terminal Dam to the Pacific Ocean to evaluate the floodplain. To determine the appropriate grid selection for the

2D Flow Area, a model with 2D mesh cell spacing of 50 ft x 50 ft, a model of 100 ft x 100 ft, and a model of 200 ft x 200 ft was analyzed for comparison. The three models were evaluated for floodplain inundation extents downstream of the dam using the same inflow hydrograph with a peak discharge of 25,391 cfs and a volume of 840 ac-ft. Comparing the three gridded models, the 50 ft gridded model inundation a total area of 3,439 acres, the 100 ft gridded model inundated a total area of 3,537 acres, and the 200 ft gridded model inundated a total area of 3,492 acres. The comparison of the additional results are provided in **Table 4**. From the comparison, the grid spacing of 100 ft x 100 ft was selected as the optimal grid size to perform detailed floodplain modeling. Although the time to finish the simulation was not as short as the 200 ft gridded model, the 100 ft gridded model inundation results are within a tolerable range with the 50 ft gridded model, which can capture reasonable results for urban area flood mapping.

HEC-RAS geometric *2D Area Breaklines* was added to capture the alignment of ridges, berms, and high grounds. The *2D Area Breaklines* forced the generated mesh to align its cell faces along the line. This feature will provide additional details to the floodplain area to direct flood wave to the appropriate flow path.

4.2.2 SA/2D Area Connections

HEC-RAS hydraulic connection features called *SA/2D Area Connections* was included in the 2D flow area to represent in-line structures (such as bridges) listed on **Table 3**. *SA/2D Area Connections* is a feature to input data for bridges into the model, such as elevation of top deck, bridge dimensions, culverts, piers, bridge coefficients, etc. The dimensions were referenced from the field survey collected by the District and a previous hydraulic model (HEC-RAS) developed by the District.

4.2.3 Land Cover

Land cover was based on USGS National Land Cover Database (NLCD) of 2011. Calibration efforts were not performed due to unavailable data, therefore, roughness (Manning’s N-Value) values were assigned based on values reported for natural stream channels (Chow 1959) and based on best engineering judgement. **Table 5** includes the list of land cover type and the assigned roughness in the hydraulic model.

Additional sensitivity testing was performed for the land cover and by increasing and decreasing the base n-values by 10 percent. The land cover sensitivity test was performed to test the n-value sensitivity associated with the floodplain. The analyses will determine if the selected base n-values should be changed based on the percentage of depth difference at specific locations downstream of the dam. The 100 ft x 100 ft gridded *2D Flow Area* described in Section 4.2.1 was used with the n-values from **Table 5** as the base land cover model. Comparing the base land cover model to the +10 percent increase of n-value and 10 percent decrease of n-value models, the base land cover model inundated a total area of 3,537 acres, 3,551 acres for the +10 percent case, and 3,492 acres for the -10 percent case. **Table 6** summaries the comparison of depth results at specific locations within the floodplain.

By increasing the base n-values, the +10 percent results generally decreased the inundation depths. By decreasing the n-values, the inundation depths increased. As the inundation depth increases in the floodplain, the comparative depth percent differences decreased, meaning the inundation depths were marginally the same with an increase of inundation depth. Example, on **Table 6** the Huasna Road Bride percent differences were -0.7 percent for 10 percent increase of n-value, and 0.7 percent for 10 percent decrease when comparing to the base n-value. From the n-value comparative results, the base n-values were used for the Terminal Dam failure inundation analysis.

4.2.4 Boundary Conditions

In accordance with the FEMA guidelines for a sunny day dam failure, the reservoir was modeled at normal storage capacity with the starting water surface elevation set at the spillway elevation of El. 331.8 feet. A constant inflow of 10 cubic feet per second (cfs) into the reservoir was applied to account for upstream inflow.

The downstream boundary condition at the model termination point, Pacific Ocean, was assigned a normal depth, friction slope of 0.001. The termination point was extended downstream to a point such that the hydraulic calculated energy slope will not impact the results upstream.

4.2.5 Computational Settings

The dam break model evaluation utilized a 1-second computation time step. This provided a balance between the level of accuracy desired and numerical tolerance stability for expected high velocities, exceeding 20 feet per second (fps). The dam break analysis used a mixed-flow regime along with the Diffusive Wave equation. These options are can be used for rapidly varied flows such as flow transitions from subcritical to supercritical flow and hydraulic jumps.

4.3 HEC-RAS 2D Modeling Limitations

HEC-RAS can perform 2D modeling with known limitations. The following is a list of items HEC is working on to improve the software, and will be available in future versions:

1. More flexibility for adding internal hydraulic structures inside of a 2D flow area.
2. Cannot perform sediment transport erosion/deposition in the 2D flow areas.
3. Cannot perform water quality modeling in 2D flow areas.
4. Cannot connect pump stations to 2D flow area cells
5. Cannot use the HEC-RAS bridge modeling capabilities inside of a 2D flow area, but can be added as culverts, weir, and breaching by using the *SA/2D Area Conn* tool.

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5. Dam Breach Failure Analysis

5.1 Dam Breach Parameters

Breach parameters for Terminal Dam were developed based on published guidance documents, the foundation profile, and dam composition. Breach parameters were not selected to achieve a predetermined breach hydrograph but to provide basis of potential breach hydrographs due to different conditions that could cause a dam failure. A fair weather (sunny day) non-hydrologic dam breach sensitivity analysis was performed for the earthen fill dam. The sunny day failure mode was selected to evaluate the dam breach and are based on the FEMA P-946 guidelines. The selection of parameters of the dam failure were based on best available data collected during this study and may not reflect real time conditions (e.g., weather conditions, vegetation and land cover, location of potential dam failure, reservoir conditions, etc.). For this case study, the parameters are kept consistent to test the dam breach peak, the release of volume, and attenuation. The sunny day dam failure is analyzed by establishing an initial reservoir water level and commencing a breach analysis with minimal inflow into the reservoir.

The Federal Energy Regulatory Commission (FERC) engineering guidelines recommends an average breach width of 1 to 5 times the height of the dam for earthen fill embankments. FERC guidelines for side slopes for engineered earthen structure is 0H: 1V to 1H: 1V and the time to failure is equal to 0.1 to 1 hour. **Table 7** is a summary of the possible estimates for breach characteristics for the various types of dam composition.

The dam breach was not evaluated with the National Weather Service BREACH Model due to lack of information to perform a breach analysis. The NWS BREACH model is a mathematical model used to simulate piping and/or over topping failure of earthen dams, either man-made or naturally formed by a landslide. To perform the dam breach analysis required the soil composites, and the geometric and material properties of the dam which are not currently available.

Referencing the dam breach characteristics set by FERC, the base case scenario for Terminal Dam breach was modeled as a sunny day, full reservoir, linear piping failure initiating at El. 315 ft, with a final bottom breach width of 100 feet, a side slopes of 0.5H: 1V, and a breach formation time of 0.5 hours. The breach geometry resulted in an average breach width of 121.9 ft. The bottom elevation of the breach was set at El. 288 feet. The failure was initiated with the lake pool at El. 331.8 feet. The breach parameters used for the modeling efforts are summarized in **Table 8**.

5.2 Dam Breach Sensitivity Analysis

In addition to the selection of the dam breach parameters for the base case, three sensitivity scenarios of parameter changes were analyzed by increasing and decreasing the breach width, time to failure, and side slope of the failure of the dam (Case 1, 2, and 3). The sensitivity analysis was performed to test the sensitivity of the sunny day base case modeling scenarios with different dam breach parameters.

The minimum and maximum breach parameters were selected based on engineering judgement. The minimum and maximum times to fail the earthen fill dam breach varied from 0.2 to 1 hour. The side slopes were varied from 0.2H: 1V to 1H: 1V and the minimum and maximum bottom breach widths were selected as 40 feet and 150 feet. This resulted in average breach widths varying from a minimum of 48.8 feet to a maximum of 193.8 feet.

The three failure cases are summarized below:

- Case 1 (maximum breach width, short time to failure, and maximum side slopes): Terminal Dam average breach width of 193.8 feet, 0.2 hour to time to failure, and side slopes of 1H: 1V.

- Case 2 (minimum breach width, long time to failure, and minimum side slopes): Terminal Dam average breach width of 48.8 feet, 1 hour to time to failure, and side slopes of 0.2H: 1V.

- Case 3 (medium breach width, medium time to failure, and medium side slopes): Terminal Dam average breach width of 96.3 feet, 0.6 hour to time to failure, and side slopes of 0.6H: 1V.

In addition to the sensitivity analyses recommended in the FERC Engineering Guidelines, analyses were performed to evaluate the model results with breach parameters developed from Froehlich (2008), Von Thun & Gillette (1990), and Xu & Zhang (2009) methods. The regression equations developed by Froehlich, Von Thun & Gillette, and Xu & Zhang have been used for several dam safety studies found in literature and are presented in greater detail in the *HEC-RAS for Dam Break Study, August 2014*.

Following the recommendations from the dam break study, the three additional failure cases are summarized below:

- Case 4 (Froehlich method, 2008): Terminal Dam average breach width of 78.7 feet, 0.38 hour to time to failure, and side slopes of 0.7H: 1V.

- Case 5 (Von Thun & Gillette method, 1990): Terminal Dam average breach width of 126.9 feet, 0.52 hour to time to failure, and side slopes of 0.5H: 1V.

- Case 6 (Xu & Zhang, 2009): Terminal Dam average breach width of 79.3 feet, 0.82 hour to time to failure, and side slopes of 0.76H: 1V.

The breach parameters used for each sensitivity analysis are shown on **Table 9**. The sensitivity analysis results for Terminal Dam and selected locations downstream are discussed in the Results Section.

6. Results

The results indicate that a hypothetical failure of the Terminal Dam for the sunny day conditions would potentially cause adverse consequences such as loss of life, property damage, and economic, social, and environmental impacts. There may also be potential impacts upstream of the dam due to backwater flooding or landslides around the reservoir.

Sections 6.1 and 6.2 summarize the results of the hypothetical sunny day failure and the floodplain inundation. **Table 11** provides a summary of the model results at selected cross sections. The tabulated results include the flood wave arrival time, time to peak, peak water surface elevation (WSEL), peak flow, peak velocity, and maximum depth.

The "initial wave arrival time" is the elapsed time from breach initiation to a 1 ft increase in WSEL at a cross section. The "time to peak" is the elapsed time from breach initiation to peak WSEL at a cross section. The "deflood time" is the time elapsed from the flood wave arrival time until water recedes to within 1 ft of its preflood water elevation at a cross section. The "peak inundation depth" is the maximum water depth at a station resulted across the cross section. The "peak velocity" is the maximum velocity at a station resulted across the cross section. The "peak discharge" is an estimate of the maximum flow rate integrated over the entire cross section. The "peak water elevation" is the maximum water surface elevation reached at a station resulted across the cross section.

The inundation maps for the hypothetical sunny day failure base case are provided in **Appendix C**.

6.1 Dam Sunny-Day Failure Results

The hypothetical dam failure resulted in hydrographs that was used for the hydraulic inundation model analysis. The analysis for the dam breach, base case scenario indicates that a sunny day hypothetical failure of Terminal Dam would produce a peak discharge of 25,391 cfs at the dam approximately 21 minutes after the breach initiates. The breach would drain the reservoir in approximately 5 hours and 4 minutes. The dam breach hydrograph is shown on **Figure 6**. Comparing the base case scenario to the sensitivity analysis of Case 1 to Case 6 (as shown on **Table 10**), the base case scenario was within the median of maximum flows from all seven scenarios. The maximum peak flow occurred on scenario Case 1 with a discharge of 51,125 cfs. This maximum flow can be attributed to the fastest time to failure of 0.2 hour and the widest breach opening that resulted with a fast and intense release of water from the dam breach. The lowest peak flow occurred on scenario Case 2 with a discharge of 13,339 cfs which can be attributed to the long time to failure of one hour with a small breach width opening compared to the seven scenario cases.

6.2 Floodplain Inundation Results

The base case of the hypothetical Terminal Dam sunny day failure results at specific locations are presented in **Table 11**. The tabular table includes the time to peak, maximum water surface elevation, maximum flow, and deflood time. The flood inundation extents and details are provided in **Appendix C**. The results for the sunny day failure assume the flood wave is not diverted into the city stormwater drainage system, no loss of water due to soil infiltration, no pumps are active, and no buildings in place to obstruct, divert, or store the flood wave.

The model results of the sunny day hypothetical failure of the Terminal Dam produced a peak discharge of 25,391 cfs at the dam approximately 23 minutes after the breach initiates. The breach would drain the reservoir in approximately 5 hours and 4 minutes. As the peak flood wave is routed downstream of the dam, the flood wave is dispersed and attenuated through the meandering Arroyo Grande Creek and water flowing out of the channel into the overbanks. The flood wave will travel 8.9 miles downstream reaching the Pacific Ocean at approximately 2 hours and 55 minutes. **Figure 7** shows the flood wave attenuation at specific cross sections detailed below (**Appendix C** shows the cross sections location). The maximum depth of the flood wave would reach 33 ft in the Arroyo Grande Creek and inundate the overbanks with depths up to 5 ft. Approximately 105 acres of the City of Arroyo Grande is inundated within the areas along the Arroyo Grande Creek. Southern communities of Oceano would be inundated at the south bend of Arroyo Grande Creek downstream of Cabrillo Highway. Within the town of Ocenao limits, one healthcare facility is impacted by the flood wave. **Table 12** details the impacted facility.

Cross Section #1, located about 0.2 miles downstream of the reservoir and water treatment plant, the flood wave would arrive about 6 minutes after the breach initiates. About 23 minutes after the breach, the peak water surface elevation would be at El. 285 ft resulting in an incremental maximum rise of 18.3 ft. The flow would be approximately 24,941 cfs and 12.6 fps.

Cross Section #2, the flood wave would arrive at Cecchetti Road located 1.6 miles downstream of Terminal Dam at approximately 20 minutes after the breach initiates. The peak water surface elevation could potentially reach the bridge deck at flows of 23,473 cfs with a maximum depth of 15.5 ft in Arroyo Grande Creek and average depths of 4 ft in the overbanks.

Cross Section #3, 2.5 miles downstream at Huasna Road crossing over Arroyo Grande Creek reaches flows of 15,177 cfs. The flood wave would arrive about 33 minutes after the breach and result in a maximum inundation depth of 33.1 ft in Arroyo Grande Creek in 50 minutes.

Cross Section #4, located about 2.9 miles downstream and south of the Tar Spring Creek, the flood wave would arrive about 42 minutes after the breach initiates. About 1 hour after the breach, the peak inundation depths would reach 18.7 ft. The flood wave would reach peak flows of 13,299 cfs and peak velocities of 5.6 fps. It would take 3 hours and 37 minutes for the water to recede below 1 ft.

Cross Section #5, the flood wave would reach 3.4 miles downstream of the dam at approximately 58 minutes after the breach initiates. The peak water surface elevation would reach El. 139 ft at flows of 10,644 cfs with a maximum depth of 23.7 ft in Arroyo Grande Creek. The peak flood wave would peak at 1 hour and 16 minutes.

Cross Section #6, 4.8 miles downstream at Traffic Way crossing over Arroyo Grande Creek reaches flows of 9,246 cfs with velocities of 6.0 fps. The flood wave would arrive at 1 hour and 12 minutes after the breach and results in an incremental rise of 23.0 ft at 1 hour and 37 minutes in Arroyo Grande Creek. The maximum depth would overflow the channel and inundate low-laying areas of the overbank.

Cross Section #7, located approximately 6.1 miles downstream of the dam at US Highway 101, the flood wave would arrive at 1 hour and 20 minutes after the breach initiates. About 19 minutes thereafter the peak water surface elevation would reach El. 96 ft resulting in an incremental rise of 19.6 ft in the channel. The peak flow would be at 9,067 cfs. Within the cross-sectional extents, the flood wave would recede below 1 ft at 9 hours and 43 minutes.

Cross Section #8, the flood wave would arrive at Fair Oaks Avenue located 6.8 miles downstream of the dam at approximately 1 hour and 32 minutes after the breach initiates. The peak flows would reach 8,358 cfs with a maximum depth of 20.6 ft in the channel. Peak velocities would reach 6.3 fps.

Cross Section #9, 7.7 miles downstream at Cabrillo Highway (Highway 1) reaches flows of 7,178 cfs. The flood wave would arrive at 1 hour and 55 minutes after the breach and results in an incremental rise to 11.4 ft at 2 hours and 21 minutes in the channel and average depths of 3 ft in the overbanks.

Cross Section #10, located approximately 8.7 miles downstream of the dam at the railway crossing Arroyo Grande Creek, the flood wave would arrive at 2 hours and 20 minutes after the breach initiates. About 2 hours and 57 minutes the flood wave would reach the peak water surface elevation of El. 31 ft, resulting in a maximum inundation depth of 8.0 ft in the channel. The peak flow would be at 3,219 cfs with velocities of 3.5 fps. Within the cross-sectional extents, the flood wave would recede below 1 ft at 13 hours and 30 minutes.

Cross Section #11, the extents of the flood wave would reach the outlet of Arroyo Grande Creek into the coastal shores, at approximately 2 hours and 55 minutes. At 8.9 miles downstream, the peak flood wave would take 3 hours and 48 minutes to reach peak flows before being attenuated through the channel and overbanks. Peak flows would reach 1,119 cfs. The incremental rise would reach a maximum depth would reach 6.2 ft in the channel with maximum velocities of 2.1 fps.

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7. Limitation of Liability

Our professional services for preparing the Terminal Dam Inundation Technical Study were performed in accordance with generally accepted engineering practices; no other warranty, expressed or implied, is made. This report presents the results of a hypothetical failure of the Terminal Dam and the subsequent downstream flooding. The hypothetical failure of the Terminal Dam and the subsequent flood wave routing results are based on our best judgment and the suggested breach parameters and hydraulic modeling techniques as recommended in the Federal Emergency Management Agency (FEMA) Federal Guidelines for Inundation Mapping of Flood Risks Associated with Dam Incidents and Failures, First Edition, July 2013 (FEMA P-946). The results of this analysis should only be used to estimate potential downstream impacts based on the assumed breach conditions. If any portion of the Terminal Dam were to fail, actual breach conditions, peak flows, and peak water surface elevation may vary from those presented in this report.

The hypothetical failure, and assumed breach conditions, do not indicate or represent the actual integrity, condition, or safety of Terminal Dam. Reuse of this report for any other purposes, in part or in whole, is at the sole risk of the user.

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Table 1. Terminal Dam Statistics Summary (Source: DSOD)

Description	Value
Elevation of dam crest (feet)	337.8
Elevation of spillway crest (feet)	331.8
Upstream slope	2H: 1V
Downstream slope	2H: 1V
Elevation of upstream toe (feet)	287.8
Elevation of streambed (downstream toe) (feet)	277.8
Storage capacity at dam crest (estimated, acre-feet)	1,100
Storage capacity at spillway elevation (estimated, acre-feet)	844
Dam height (feet)	53
Dam crest length (feet)	550
Dam crest width (feet)	24
Total Freeboard (feet)	6

1. Elevation datum NAVD 88

Table 2. Hydraulic Structures Downstream of Terminal Dam

Structures	Distance Downstream of Dam
Cecchetti Road crossing over Arroyo Grande Creek	1.6 miles
Huasna Road crossing over Arroyo Grande Creek	2.5 miles
Mason Street crossing over Arroyo Grande Creek	4.5 miles
Bridge Street crossing over Arroyo Grande Creek	4.7 miles
Traffic Way crossing over Arroyo Grande Creek	4.8 miles
US Highway 101 crossing over Arroyo Grande Creek	6.1 miles
Fair Oaks Avenue crossing over Arroyo Grande Creek	6.8 miles
Cabrillo Highway (Hwy 1) crossing over Arroyo Grande Creek	7.7 miles
2nd Street crossing over Arroyo Grande Creek	8.6 miles
Railroad bridge crossing over Arroyo Grande Creek	8.7 miles

Table 3. Field Measurement of Bridges (December 2017)

Structures	Deck Width (ft)	Deck Length (ft)	Abutment Length (ft)	# Piers
Grieb Ranch Way	24	130		24
Talley Farms Road	24	94		
Huasna Road	22	87	43	
Mason Street	28	169	22	
Bridge Street	36	141		
Traffic Way	45	225		
Fair Oaks Avenue	76	130		5 groups

Table 4. 2D Flow Area Gridded Model Sensitivity Comparison

Results	50 ft Grids	100 ft Grids	200 ft Grids
Area of Inundation Extents (acre)	3,439	3,537	2,394
Model Simulation Time (hh:mm:ss)	1:28:28	0:42:37	0:06:36
Maximum Depth (feet)	58.1	51.1	38.2
Model Cells (No.)	269,980	67,360	16,791

Table 5. NLCD Land Cover and Assigned Manning's N-Value

USGS ID	Description	Manning's N-Value
11	Open Water	0.03
12	Perennial Ice/Snow	0.03
21	Developed, Open Space	0.08
22	Developed, Low Intensity	0.1
23	Developed, Medium Intensity	0.15
24	Developed, High Intensity	0.2
31	Barren Land (Rock/Sand/Clay)	0.04
41	Deciduous Forest	0.1
42	Evergreen Forest	0.1
43	Mixed Forest	0.1
52	Shrub/Scrub	0.07
71	Grassland/Herbaceous	0.035
81	Pasture/Hay	0.04
82	Cultivated Crops	0.035
90	Woody Wetlands	0.05
95	Emergent Herbaceous Wetlands	0.08

Table 6. Assigned Manning's N-Value Model Sensitivity Results Comparison

Location #	Location / Description	D/S of Dam (mi)	Base Case Depth (ft)	+10% Case Depth (ft)	-10% Case Depth (ft)
1	Huasna Road Bridge		42.72	42.43	43.02
2	Intersection Allen St & Garden St		6.68	5.9	7.43
3	Intersection Leanna Dr. & Pearl Dr.		5.16	4.52	5.73
4	Cabrillo Hwy Bridge		0.89	0.9	1.08
5	South of Oceano County Airport		1.74	1.77	1.71
6	Intersection 22nd St & Produce Pl		0.37	0.24	0.54

Table 7. Ranges of Possible Values for Breach Characteristics (Source: *HEC-RAS Dam Break Study, August 2014*)

Dam Type	Average Breach Width (B_{ave})	Horizontal Component of Breach Side Slope (H) (H:V)	Failure Time, t_f (hours)	Agency
Earthen/Rockfill	(0.5 to 3.0) x HD	0 to 1.0	0.5 to 4.0	USACE 1980
	(1.0 to 5.0) x HD	0 to 1.0	0.1 to 1.0	FERC
	(2.0 to 5.0) x HD	0 to 1.0 (slightly larger)	0.1 to 1.0	NWS
	(0.5 to 5.0) x HD*	0 to 1.0	0.1 to 4.0*	USACE 2007
Concrete Gravity	Multiple Monoliths	Vertical	0.1 to 0.5	USACE 1980
	Usually ≤ 0.5 L	Vertical	0.1 to 0.3	FERC
	Usually ≤ 0.5 L	Vertical	0.1 to 0.2	NWS
	Multiple Monoliths	Vertical	0.1 to 0.5	USACE 2007
Concrete Arch	Entire Dam	Valley wall slope	≤ 0.1	USACE 1980
	Entire Dam	0 to valley walls	≤ 0.1	FERC
	(0.8 x L) to L	0 to valley walls	≤ 0.1	NWS
	(0.8 x L) to L	0 to valley walls	≤ 0.1	USACE 2007
Slag/Refuse	(0.8 x L) to L	1.0 to 2.0	0.1 to 0.3	FERC
	(0.8 x L) to L		≤ 0.1	NWS

***Note:** Dams that have very large volumes of water, and have long dam crest lengths, will continue to erode for long durations (i.e., as long as a significant amount of water is flowing through the breach), and may therefore have longer breach widths and times than what is shown in Table 3. HD = height of the dam; L = length of the dam crest; FERC - Federal Energy Regulatory Commission; NWS - National Weather Service

Table 8. Sunny-Day Breach Parameters (Base Case)

Parameter	Value
Failure Scenario	Sunny Day
Failure Mode	Piping
Failure Progression	Linear
Initial Water Surface Elevation (feet)	331.8
Initial Storage (acre-feet)	844
Bottom Breach Elevation (feet)	288
Breach Height (feet)	43.8
Bottom Breach Width (feet)	100
Side Slopes (_H:1V)	0.5
Average Breach Width (feet)	121.9’
Time to Full Formation (hours)	0.5

Table 9. Terminal Dam Breach Sensitivity Analysis Parameters

Parameters	Base Case	Case 1	Case 2	Case 3	Case 4 Froehlich (2008)	Case 5 Von Thun & Gillete	Case 6 Xu & Zhang
Dam Crest Length, feet	550	550	550	550	550	550	550
Dam Crest Elevation, feet	337.8	337.8	337.8	337.8	337.8	337.8	337.8
Min Foundation Elevation, feet	288.0	288.0	288.0	288.0	288.0	288.0	288.0
Max Height of Dam, feet	53	53	53	53	53	53	53
Dam Breach Height, feet	43.8	43.8	43.8	43.8	43.8	43.8	43.8
Side Slopes, _H:1V	0.5	1	0.2	0.6	0.7	0.5	0.76
Top Breach Width, feet	143.8	237.7	57.5	122.6	109.4	148.8	112.6
Average Breach Width, feet	121.9	193.8	48.8	96.3	78.7	126.9	79.3
Bottom Breach Width, feet	100	150	40	70	48	105	46
Bottom Breach Elevation, feet	288.0	288.0	288.0	288.0	288.0	288.0	288.0
Maximum Reservoir Elevation, feet	337.8	337.8	337.8	337.8	337.8	337.8	337.8
Reservoir Elevation at Breach Initiation, feet	331.8	331.8	331.8	331.8	331.8	331.8	331.8
Time of Failure, hours	0.5	0.2	1	0.6	0.38	0.52	0.82

Table 10. Terminal Dam Breach Sensitivity Hydrograph Comparison

Scenario #	Peak Discharge (cfs)	Time to Peak from Initial Breach (min)	Time for Reservoir to Drain (min)
Base Case	25,391	21	221
Case 1	51,125	9	161
Case 2	13,339	49	423
Case 3	21,242	29	283
Case 4	29,331	23	349
Case 5	25,061	21	217
Case 6	17,243	45	377

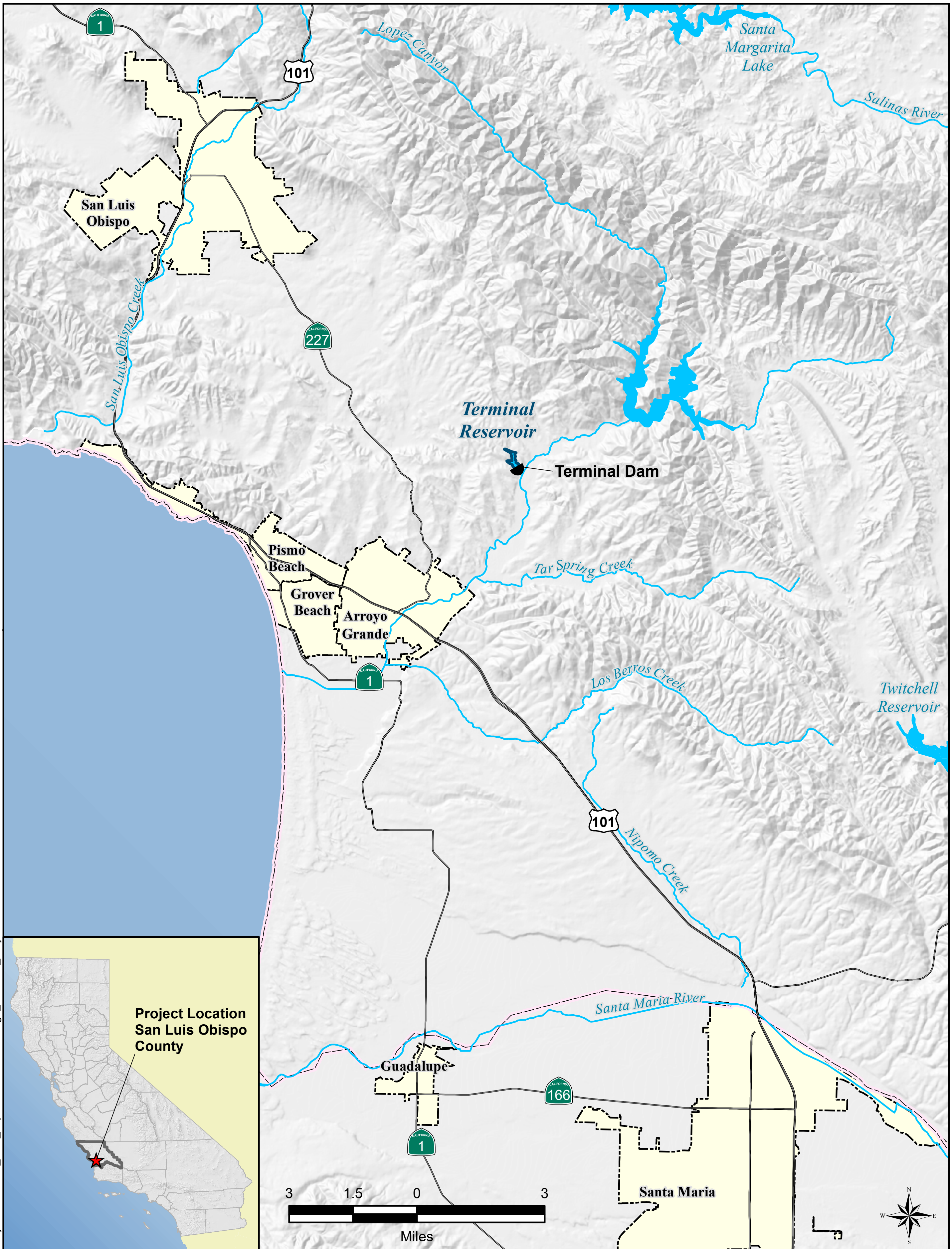
Table 11. Terminal Dam Inundation Cross Sectional Results

Cross Section	Distance from Dam (mi)	Station	Initial Wave Arrival Time, 1 Foot (hh:mm)	Time to Peak (hh:mm)	Deflood Time, 1 Foot (hh:mm)	Peak Inundation Depth[1] (ft)	Peak Velocity (fps)	Peak Discharge (cfs)	Peak Water Surface Elevation (ft)	Location Description
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25,391	N/A	At Terminal Dam
1	0.2	10+49	0:06	0:23	0:49	18.3	12.6	24,941	285	Downstream of Terminal Reservoir
2	1.6	83+22	0:20	0:34	1:47	15.5	8.8	23,473	228	Cecchetti Road
3	2.5	131+49	0:33	0:50	2:19	33.1	10.7	15,177	200	Upstream of Huasna Road
4	2.9	153+20	0:42	1:00	3:37	18.7	5.6	13,299	155	Downstream of Tar Spring Creek
5	3.4	179+82	0:58	1:16	6:35	23.7	11.2	10,644	139	
6	4.8	255+54	1:12	1:37	7:14	23.0	6.0	9,279	102	Traffic Way
7	6.1	320+24	1:20	1:39	9:43	19.6	4.9	9,067	96	US 101 Highway
8	6.8	359+57	1:32	1:52	12:30	20.6	6.3	8,358	80	Fair Oaks Avenue
9	7.7	406+81	1:55	2:21	13:06	11.4	4.5	7,178	53	Cabrillo Highway (Hwy 1)
10	8.7	460+77	2:20	2:57	13:30	8.0	3.5	3,219	31	Railroad Bridge downstream of 22nd Street
11	8.9	467+83	2:55	3:48	15:54	6.2	2.1	1,119	14	Outlet of Arroyo Grande Creek into Ocean

1. Peak Inundation Depth is not representative of the flooding depth along the entire cross section but the water surface elevation to the lowest ground of the cross section.

Table 12. Terminal Dam Sunny Day Failure Impact Facilities

Facility #	Facility	Name	Max. Inundation Depth (ft)
1	Healthcare	Community Health Centers, Oceano	3.3



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Terminal Dam Inundation Technical Study San Luis Obispo County, California	GEI Consultants	Project Location
San Luis Obispo County Flood Control and Water Conservation District		DECEMBER 2017 FIGURE 1

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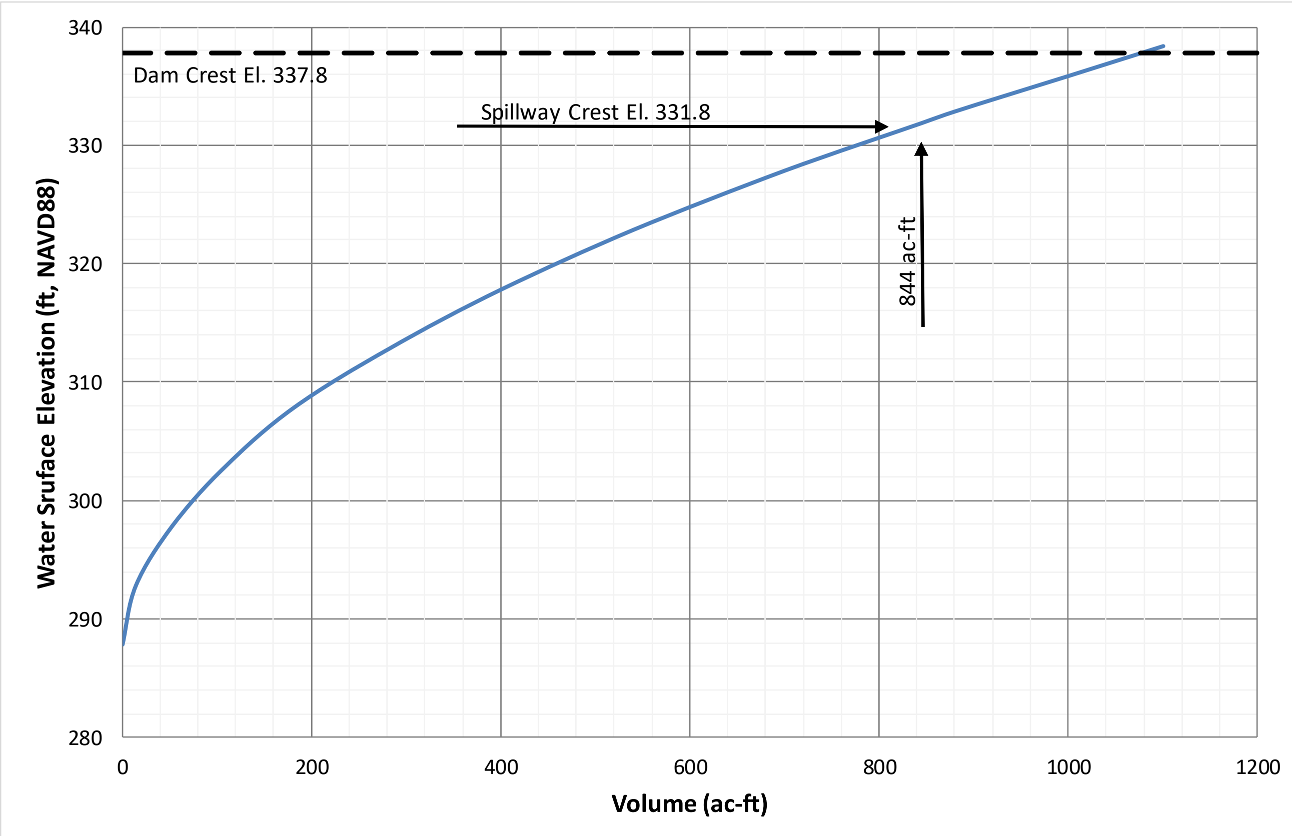
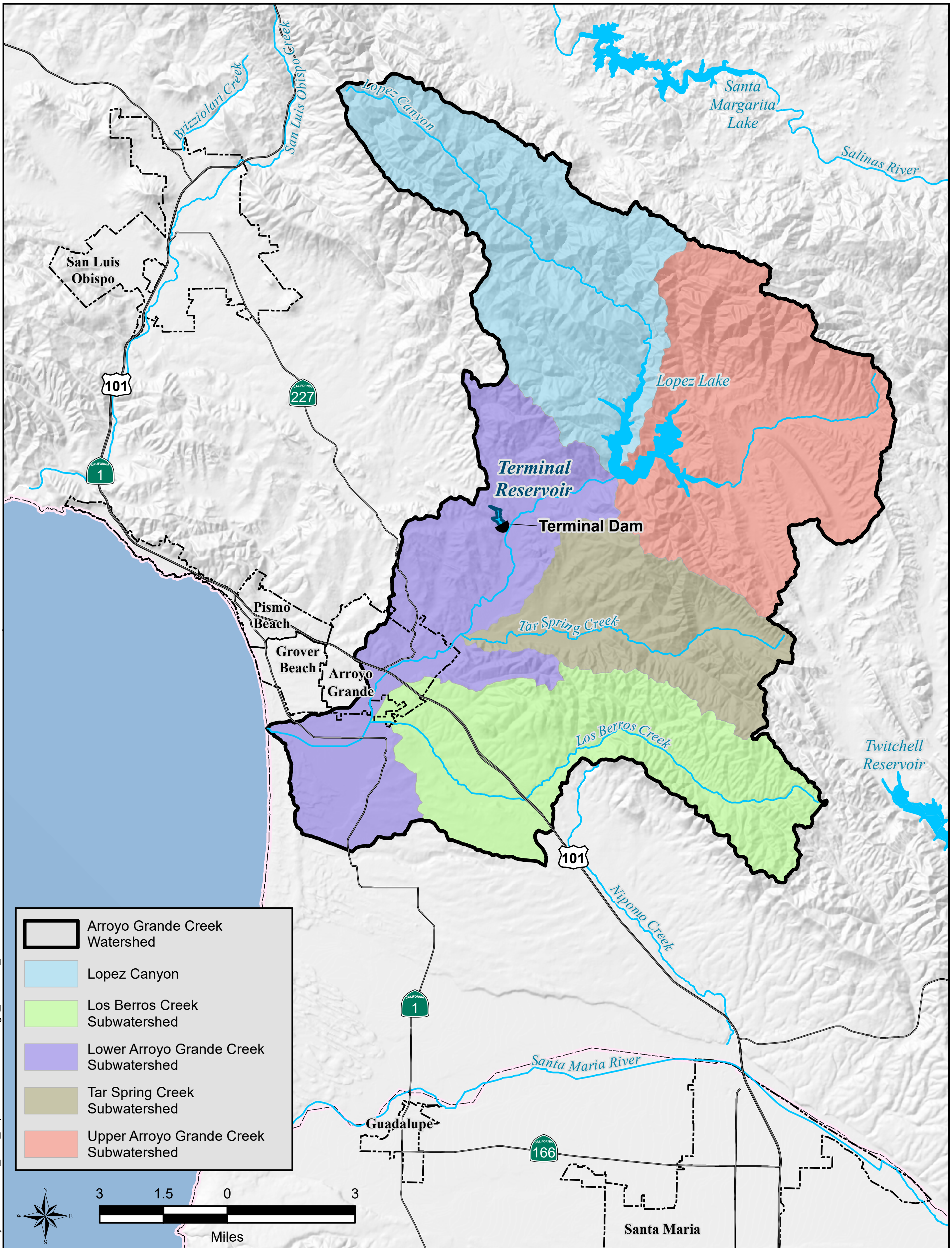
Terminal Dam Inundation Technical Study San Luis Obispo County, California	GEI Consultants	Terminal Dam and Spillway	
San Luis Obispo County Flood Control and Water Conservation District		DECEMBER 2017	FIGURE 2



Notes:
1. Elevation-storage capacity curve reference from the as-built plans, Lopez Water Supply Project, Terminal Dam & Reservoir, Terminal Dam Topography As Constructed, Sheet 23B, October 6, 1970. (DSOD record copy 1055-2),
2. During normal operating level, Elevation 330.8, total storage is 808 ac-ft with 36.4 acres of water surface, of which 28 ac-ft and 3.3 acres are northerly of Biddle Ranch Road and 92 ac-ft and 4.4 acres are within the major finger northwesterly of the dam, resulting in an effective storage of 688 ac-ft with 28.7 acres of water surface.

Elevation (ft)	Volume (ac-ft)
287.8	0
292.8	14
297.8	52.4
302.8	108
307.8	181
312.8	282
317.8	401
322.8	540
327.8	700
331.8	844
332.8	880
335.8	1000
338.3	1100



Terminal Dam Inundation Technical Study
San Luis Obsipo County, California

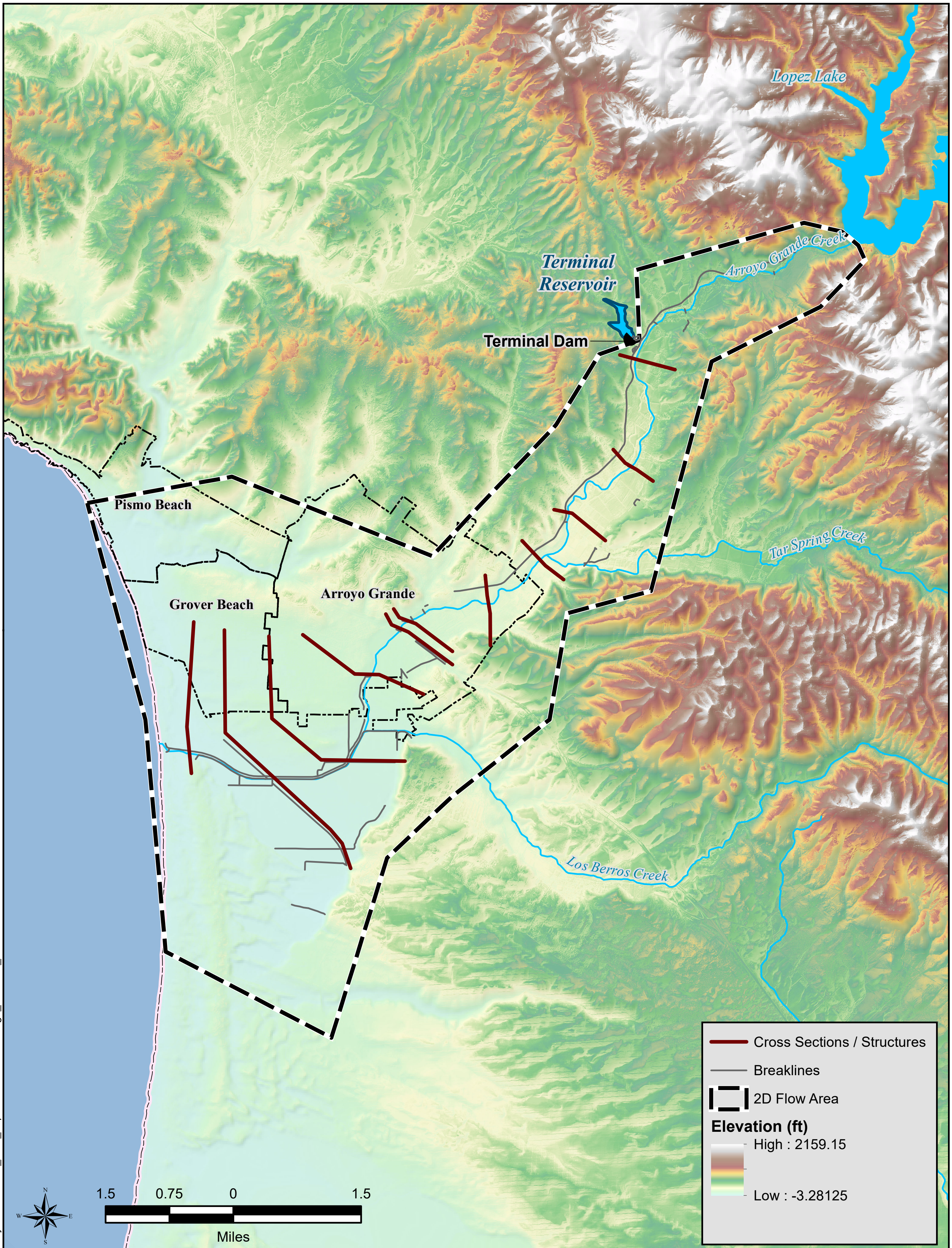
San Luis Obispo County Flood Control and Water Conservation District

GEI Consultants

Drainage Watersheds

DECEMBER 2017

FIGURE 4



Terminal Dam Inundation Technical Study
San Luis Obispo County, California

San Luis Obispo County Flood Control
and Water Conservation District

GEI Consultants

HEC-RAS Model Extents
and Geometry Features

DECEMBER 2017

FIGURE 5

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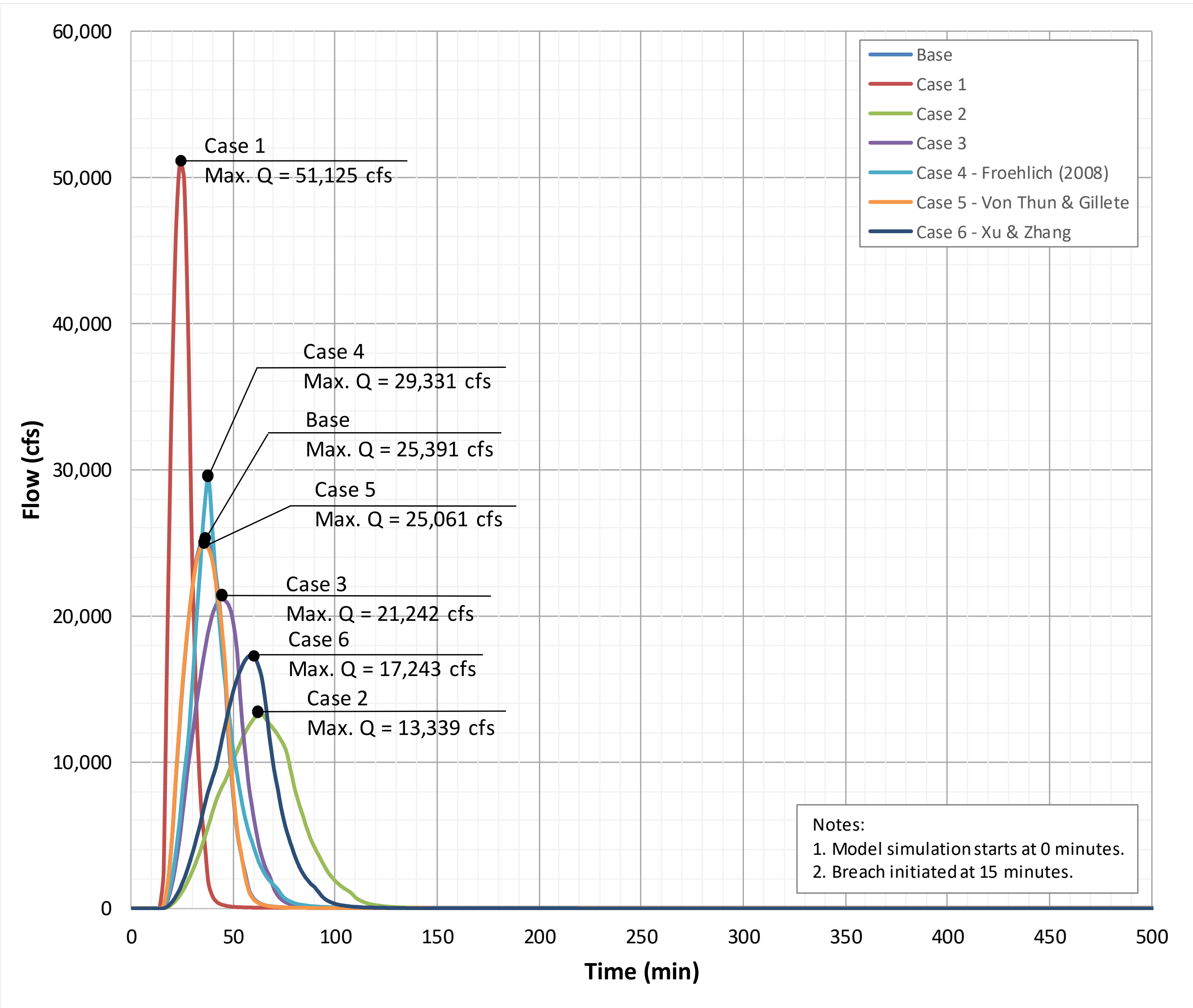

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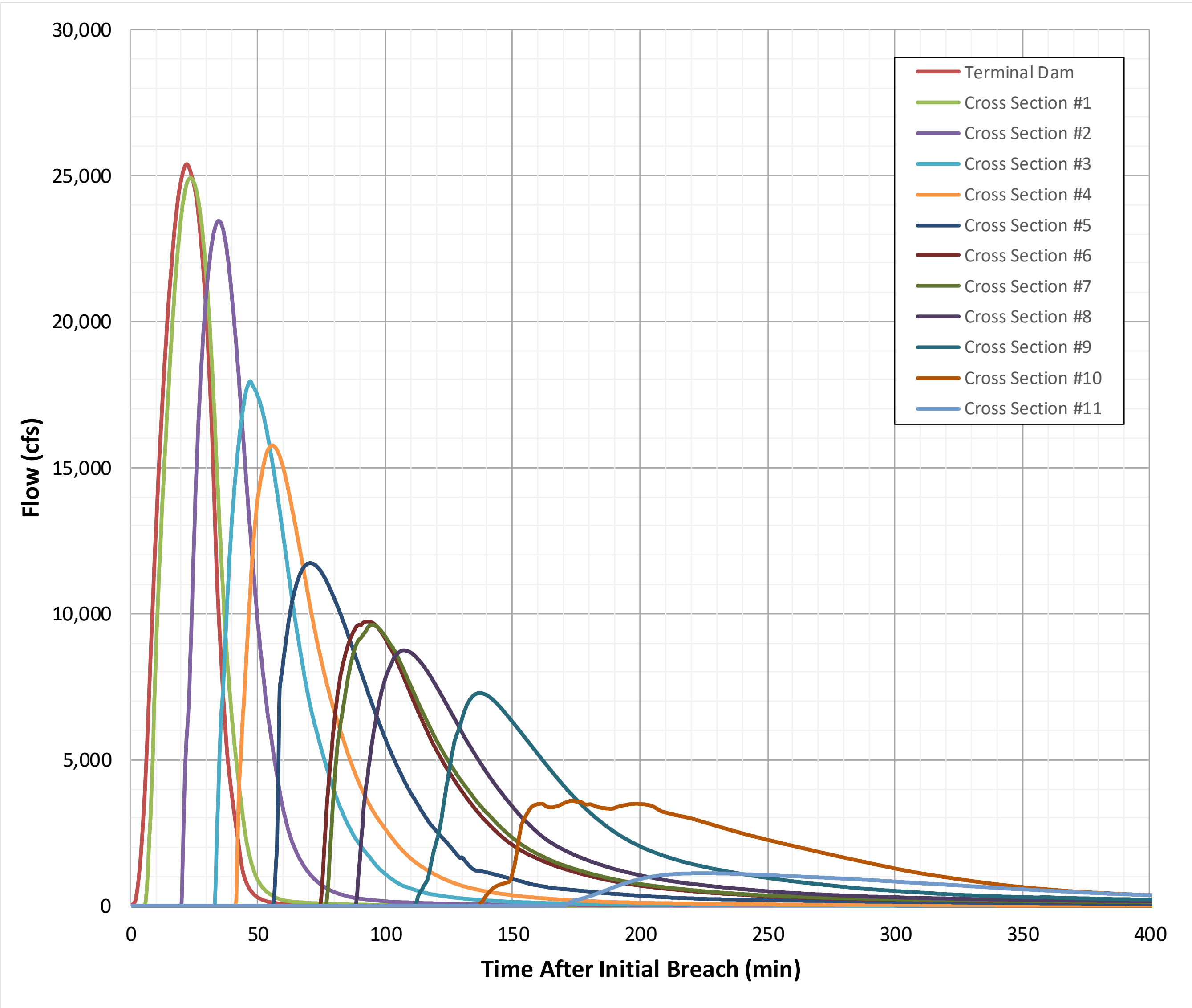
Terminal Dam Inundation Technical Study San Luis Obispo County, California	GEI Consultants	Terminal Dam Breach Hydrograph Comparison
San Luis Obispo County Flood Control and Water Conservation District		DECEMBER 2017 — FIGURE 6



Terminal Dam Inundation Technical Study San Luis Obispo County, California	GEI Consultants	Downstream Flood Wave Hydrograph Attenuation
San Luis Obispo County Flood Control and Water Conservation District		DECEMBER 2017 FIGURE 7

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Appendix A

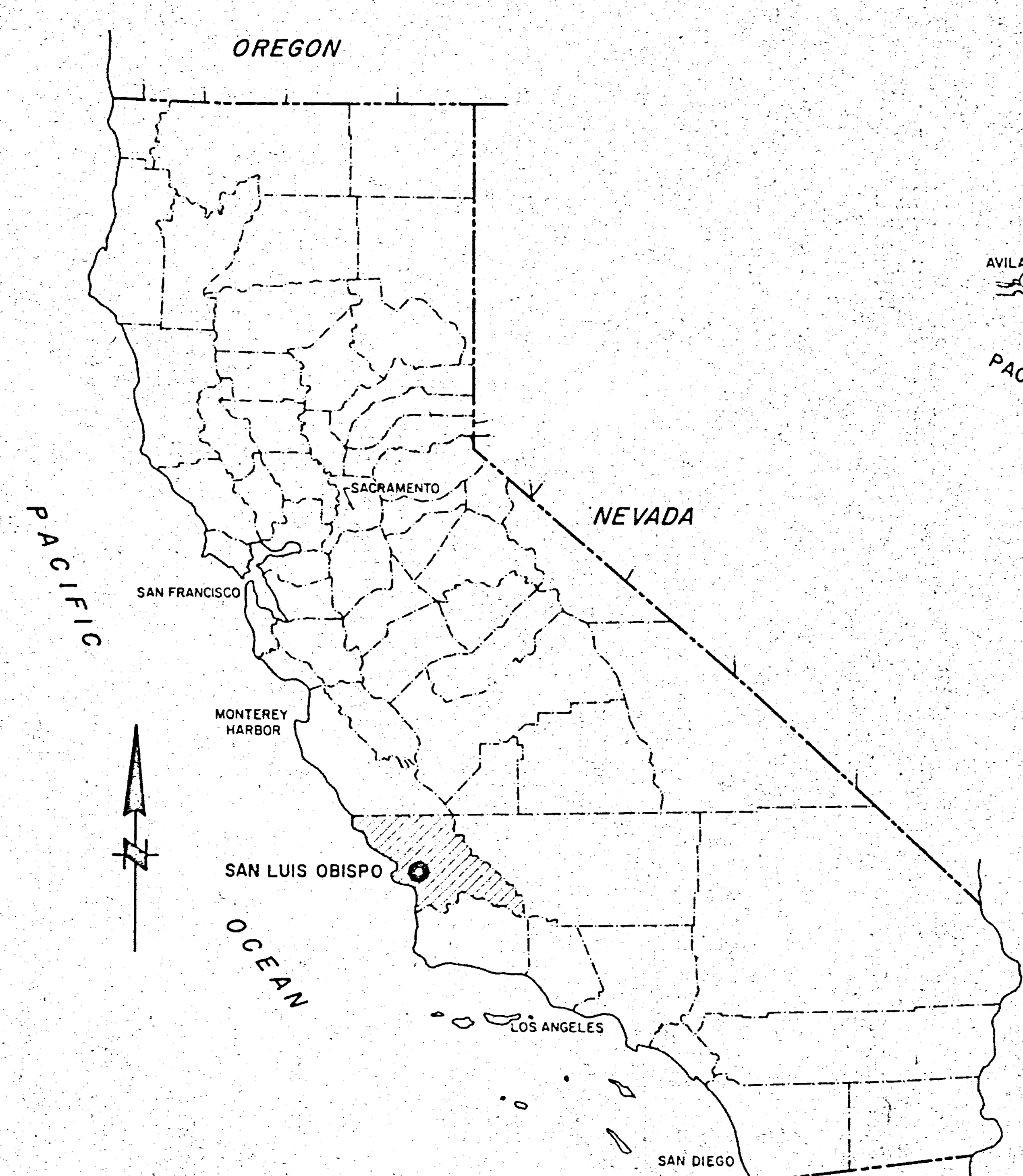
Terminal Dam Design/As-Built Drawings

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

VOLUME II
SPECIFICATION NO. 0803-68-3



STATE OF CALIFORNIA

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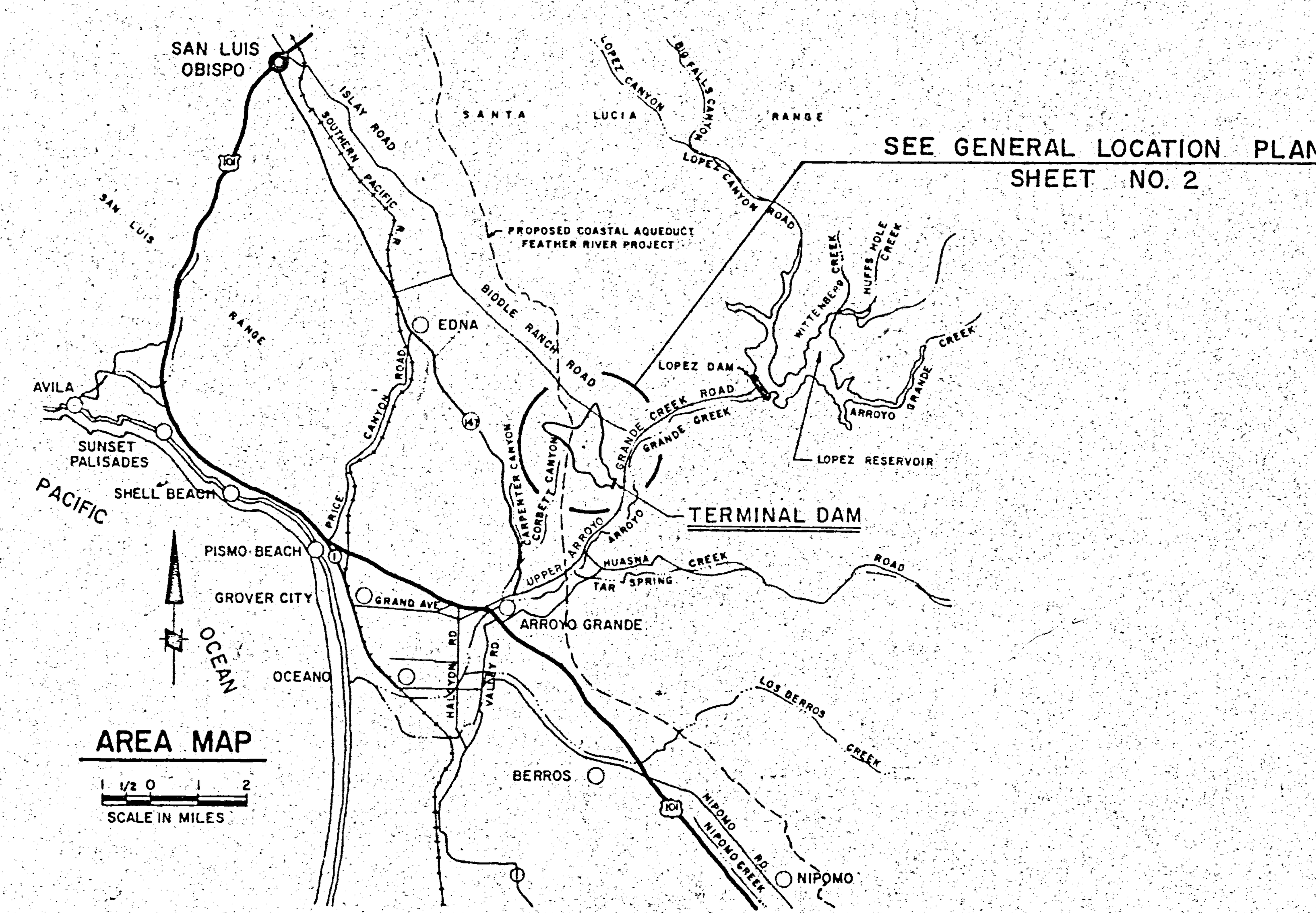
SCALE IN MILES



AREA MAP

SCALE IN MILES

INDEX OF DRAWINGS

SHEET NO.	TITLE
1.	TITLE SHEET, VICINITY MAP, AREA MAP AND INDEX OF DRAWINGS
2.	GENERAL LOCATION PLAN
3.	DAM EMBANKMENT PLAN AND SPILLWAY GRADING PLAN
4.	SPECIAL EXCAVATION PLAN
5.	SPILLWAY AND CHANNEL PROFILE AND DETAILS
6.	TYPICAL EMBANKMENT SECTIONS AND DETAILS
7.	SEEPAGE RELIEF WELLS AND MISCELLANEOUS DETAILS
8	INSTRUMENTATION PLAN AND DETAILS
9.	SPILLWAY INLET STRUCTURE - PLAN AND DETAILS
10.	SPILLWAY CHUTE PLAN, PROFILE AND DETAILS
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15.	SPILLWAY AND CHANNEL SECTIONS - PIEZOMETER BUILDING DETAILS
16.	VALVE CHAMBER PLAN AND SECTIONS - MISCELLANEOUS DETAILS
17.	BASKET SCREEN PLAN AND DETAILS - FENCE DETAILS
18.	ELECTRICAL PLAN AND DETAILS
19	PERIMETER CHANNEL, STATION 0+25 TO 35+00
20.	PERIMETER CHANNEL, STATION 00+35 TO 88+00
21.	BIDDLE RANCH ROAD, STATION 9+00 TO 23+00
22.	BIDDLE RANCH ROAD, STATION 23+00 TO 33+00
23	ROADWAY AND PERIMETER CHANNEL TYPICAL DETAILS
23A	TERMINAL DAM EXCAVATION AS CONSTRUCTED
23B	TERMINAL DAM TOPOGRAPHY AS CONSTRUCTED

APPROVED BY: Hans Heilmann 5-20-1968
HANS HEILMANN DATE

CHAIRMAN OF THE BOARD OF SUPERVISORS OF THE SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE 5-10-68
BY K. G. Koebig
RCE 10651

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

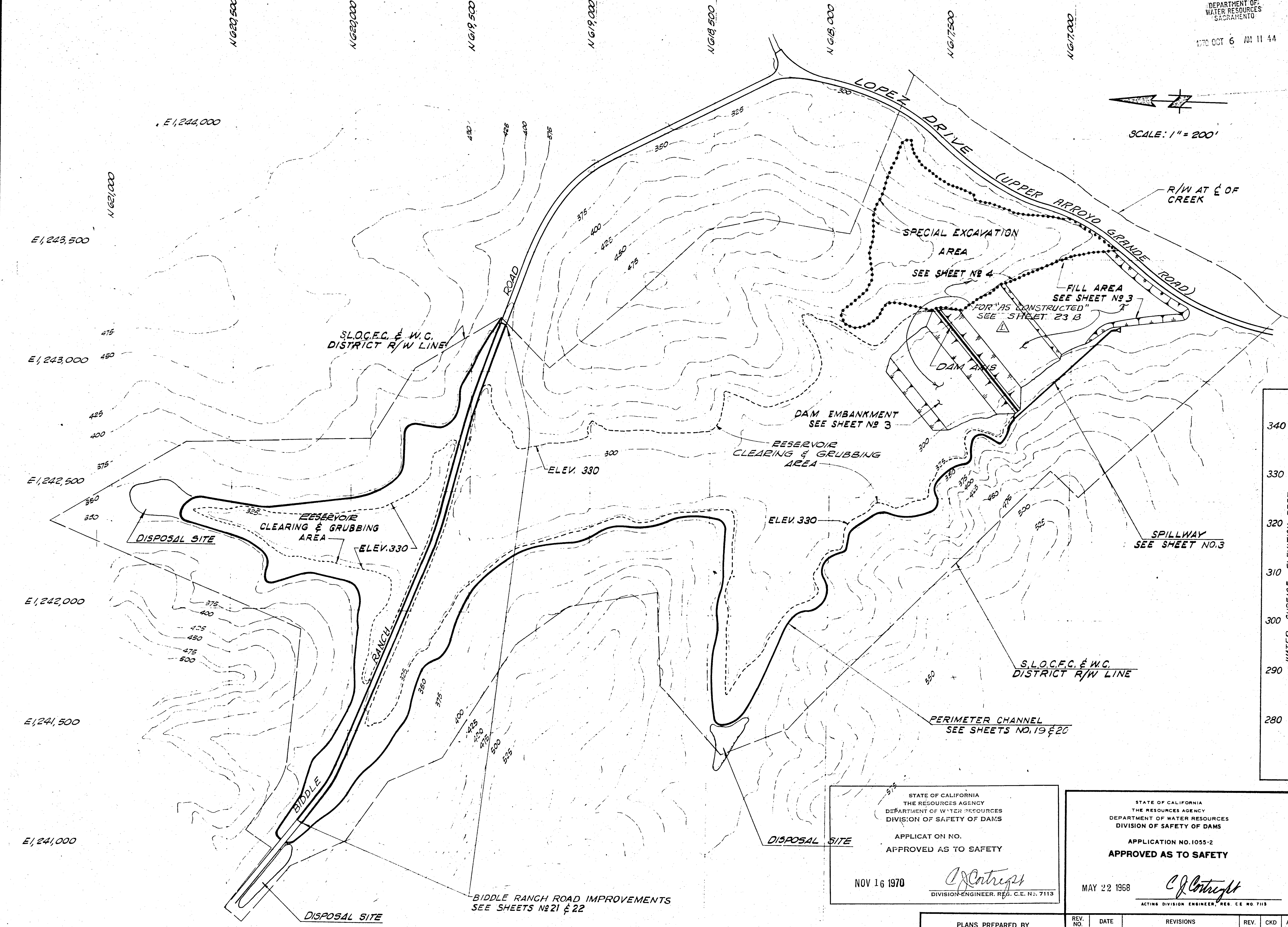
LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

TITLE SHEET, VICINITY MAP, AREA MAP AND INDEX OF DRAWINGS

RECOMMENDED DATE
APPROVED COUNTY HYDRAULIC ENGINEER R C E NO. 9614

DRAWN	TRACED	CHKD	DRWG	SHEET 1 OF 23



BASIS OF BEARING

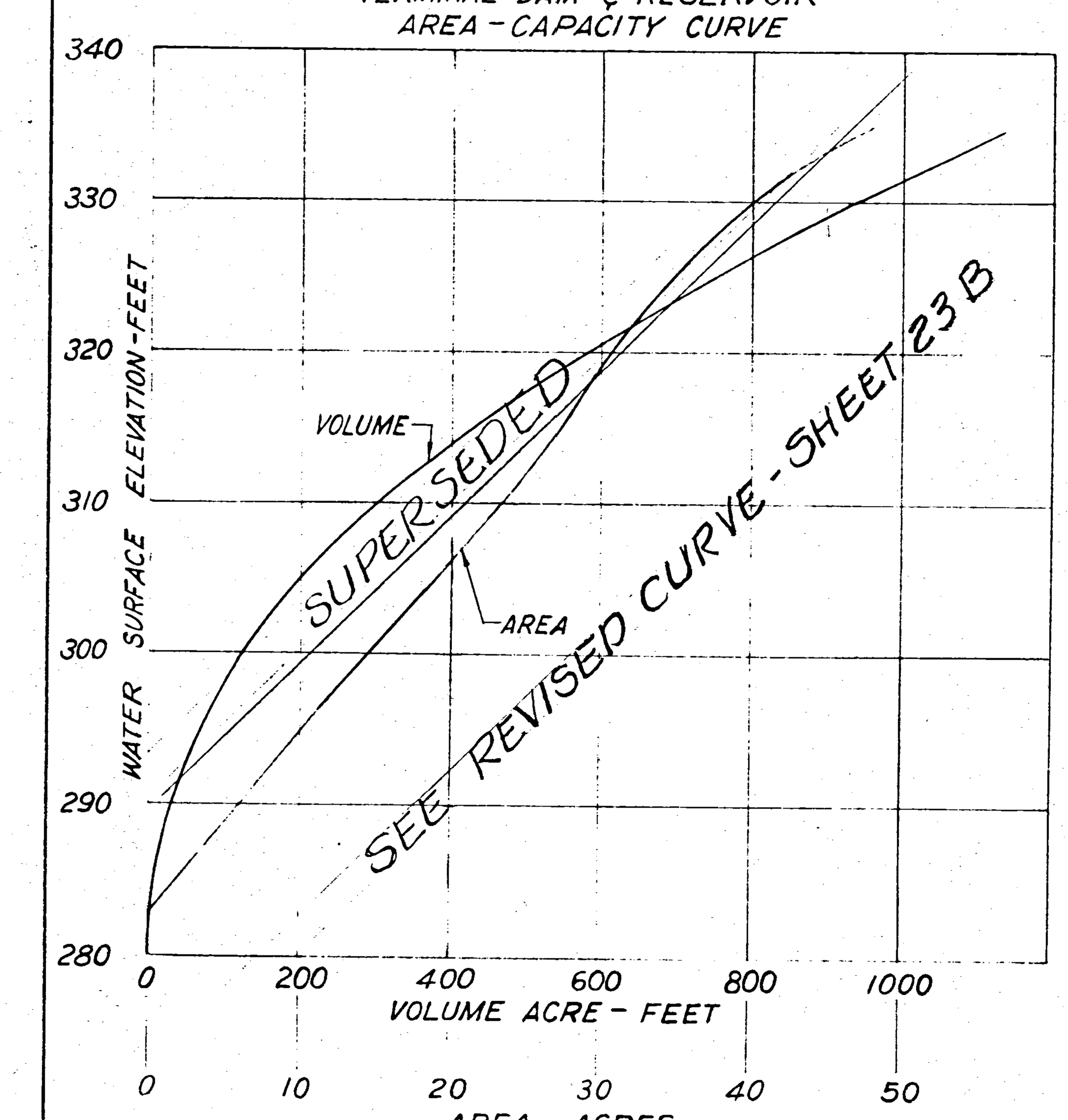
ALL BEARINGS AND DISTANCES SHOWN ON THESE DRAWINGS ARE IN CONFORMITY WITH THE "CALIFORNIA STATE COORDINATE SYSTEM, ZONE V, "BASED ON UNITED STATES GEOLOGICAL SURVEY MONUMENT "BALD MTN. 1964" AND ON UNITED STATES COAST & GEODETIC SURVEY MONUMENT" BIDDLE, 1932". THE BASIS OF BEARING FOR THESE DRAWINGS WAS CALCULATED BETWEEN THESE TWO MONUMENTS FROM THEIR RECORD COORDINATES, THE GRID BEARING BEING N 14° 49' 47" W.

BENCH MARK

BRASS DISK ESTABLISHED BY COAST & GEODETIC SURVEY AT ARROYO GRANDE, 0.6 MILE NORTHEAST ALONG ARROYO GRANDE ROAD (BRANCH STREET) FROM THE BANK OF AMERICA, AT THE "Y" JUNCTION OF AN ASPHALT ROAD LEADING SOUTH TO THE HIGH SCHOOL ATHLETICS GROUNDS, ABOUT 200 FEET SOUTH OF THE APPROXIMATE CENTER OF THE JUNCTION IN THE TOP OF THE NORTHEAST CORNER OF THE CONCRETE STONE MASONRY WALL OF THE TENNIS COURT SURROUNDED BY A FENCE, 22 1/2 FEET EAST OF THE APPROXIMATE CENTER OF THE ROAD, ABOUT 10 FEET LOWER THAN THE STREET, ABOUT 4 FEET HIGHER THAN THE ROAD, AND 0.8 FOOT NORTHEAST OF THE NORTHEAST CORNER OF THE FENCE.

DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 44

LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM & RESERVOIR
AREA - CAPACITY CURVE



DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES
OCT 6 1970

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
C J Cortright
DIVISION ENGINEER, REG. C.E. NO. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
C J Cortright
ACTING DIVISION ENGINEER, REG. CE NO 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY Martin A. Liebermann RCE 13168

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
△		AS CONSTRUCTED	RWS		KMD

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

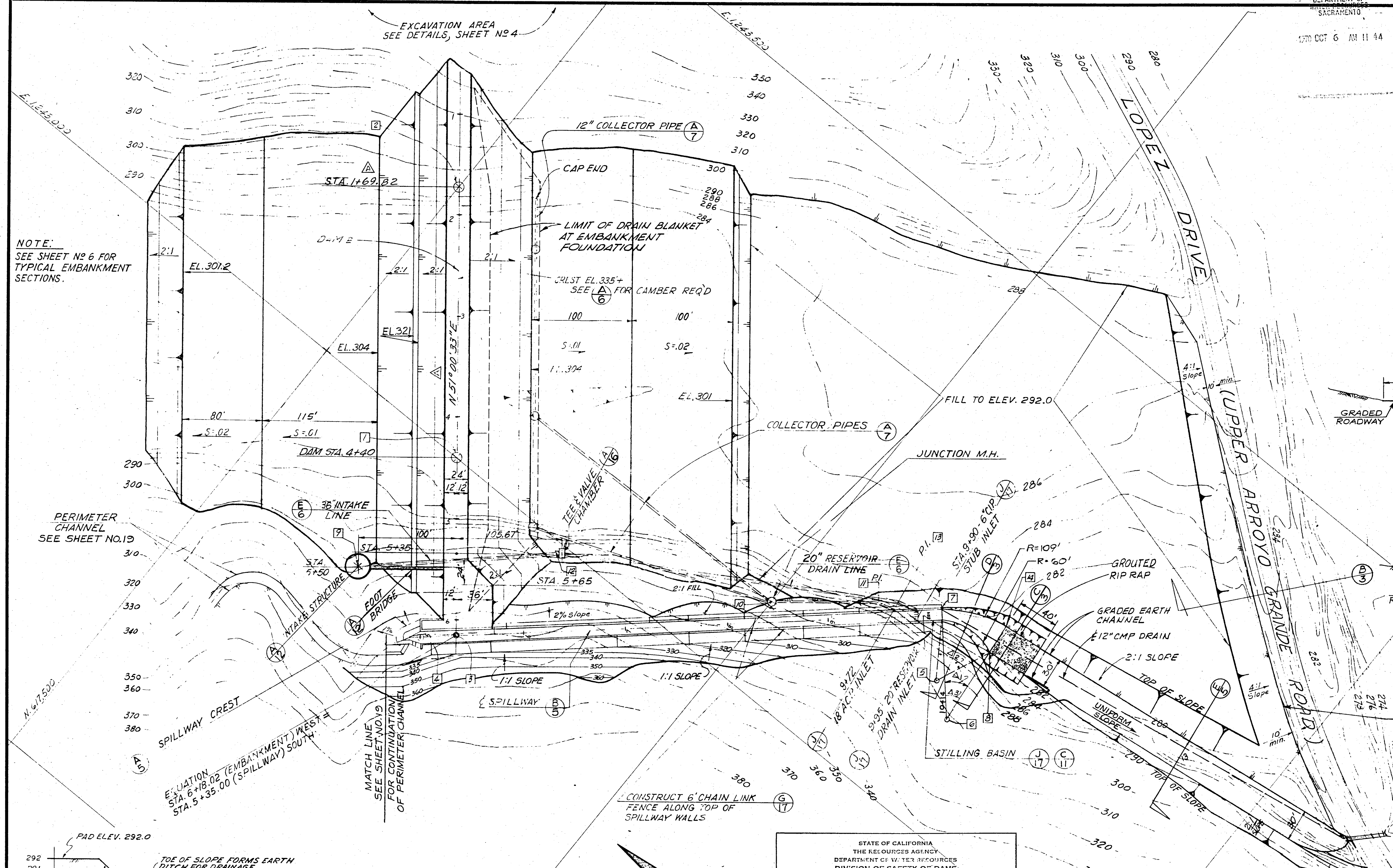
LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

GENERAL LOCATION PLAN

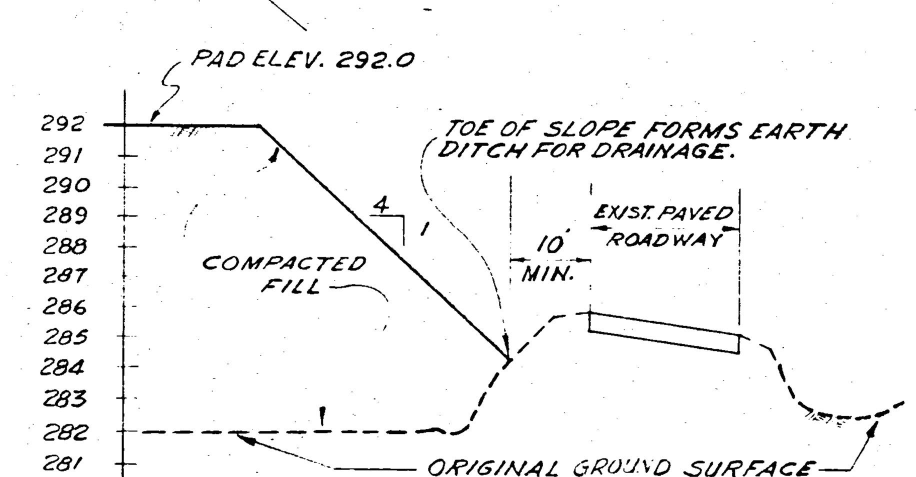
RECOMMENDED Richard J. Drake DATE 5-11-68
APPROVED R.W. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9414 5-11-68
DRAWN C.H. TRACED E.C. CHKD C.H. DRWG SHEET 2 OF 23

1055-2
RECORD COPY



PLAN
SCALE: 1"=50'

FOR "AS CONSTRUCTED" TOPOGRAPHY SEE SHEET 23 B



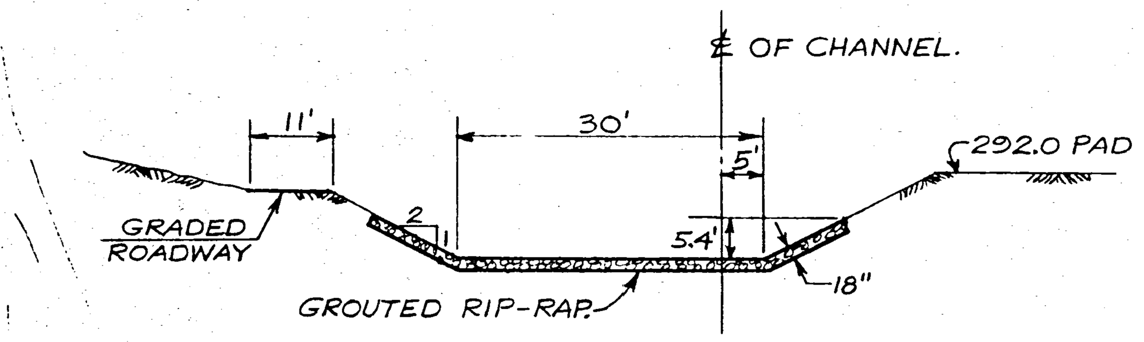
TYPICAL SECTION
SCALES: HORIZ. 1"=20'
VERT. 1"=5'

COORDINATE TABLE

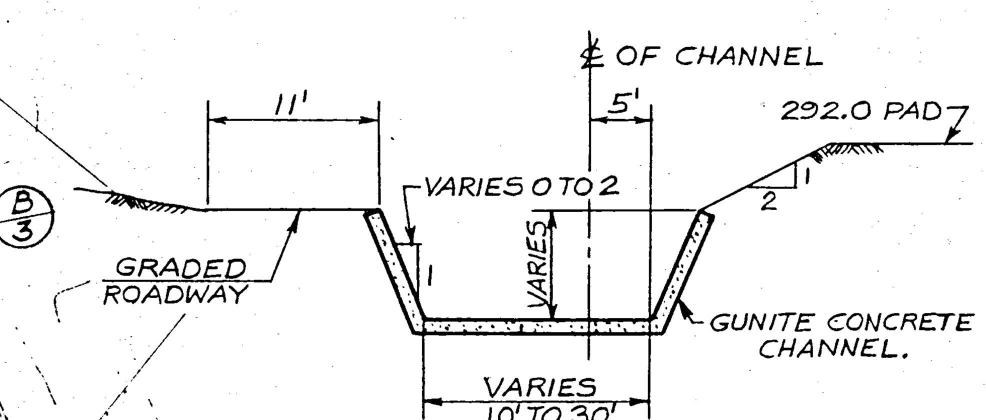
POINT	NORTH	EAST
1	617,330.00	1,243,000.00
2	617,500.00	1,243,210.00
3	617,217.99	1,242,861.64
4	617,244.01	1,242,838.23
5	616,825.58	1,243,128.08
6	616,792.30	1,243,104.63
7	616,865.19	1,243,185.67
8	616,801.60	1,243,183.08
9	617,347.95	1,242,863.24
10	616,997.93	1,243,101.56
11	616,917.66	1,243,153.08
12	617,192.50	1,242,989.08
13	616,919.30	1,243,156.50
14	616,805.13	1,243,212.87

CURVE TABLE

Nº	Δ	R	L	T	B.C.	E.C.
Δ1	35°12'33"	109.00	66.98'	34.59'	-	-
Δ2	56°50'21"	60.00'	59.52'	32.47'	-	-
Δ3	35°12'33"	104.00	63.91'	33.00'	10+14.00	10+77.91



CHANNEL SECTION
NO SCALE



CHANNEL SECTION
NO SCALE

GRADE TOE OF SLOPE TO FORM EARTH DITCH FOR DRAINAGE TO CONCRETE CHANNEL.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968 C. J. Cortright
ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970 C. J. Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING
DATE May 9, 1968
BY Martin A. Liebman R.C.E. 13168

DAM DESIGNED BY
WOODWARD, CLYDE & ASSOCIATES
CONSULTING ENGINEERS & GEOLOGISTS
DESIGNED J.C. APPROVED Stanley F. [signature] R.C.E. NO. 10352
DRAWN
CHECKED S.F.G.

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1	7/11/68	REVISED COORDINATES	RWS	KGT	
2		AS CONSTRUCTED	RWS.		

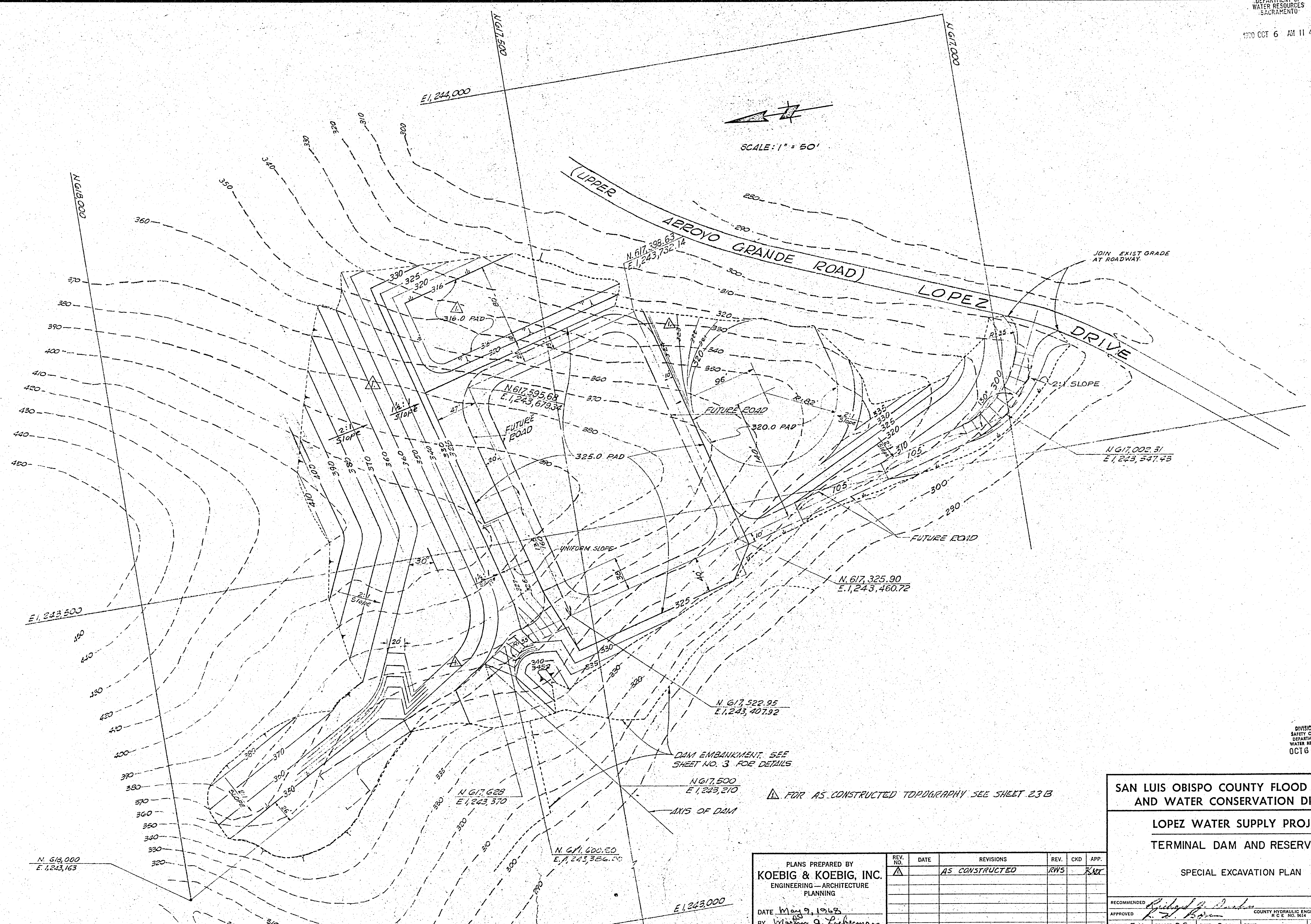
SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM AND RESERVOIR
DAM EMBANKMENT PLAN AND SPILLWAY GRADING PLAN

RECOMMENDED Richard A. Drake DATE 5-11-68
APPROVED R. A. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN C.H. TRACED D.S. CHKD C.H. DRWG SHEET 3 OF 23

1055-2

RECORD COPY

DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 44



⚠ FOR AS CONSTRUCTED TOPOGRAPHY SEE SHEET 23 B

DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY Martin A. Lieberman RCE 13148

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
⚠		AS CONSTRUCTED	RWS		KW

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

SPECIAL EXCAVATION PLAN

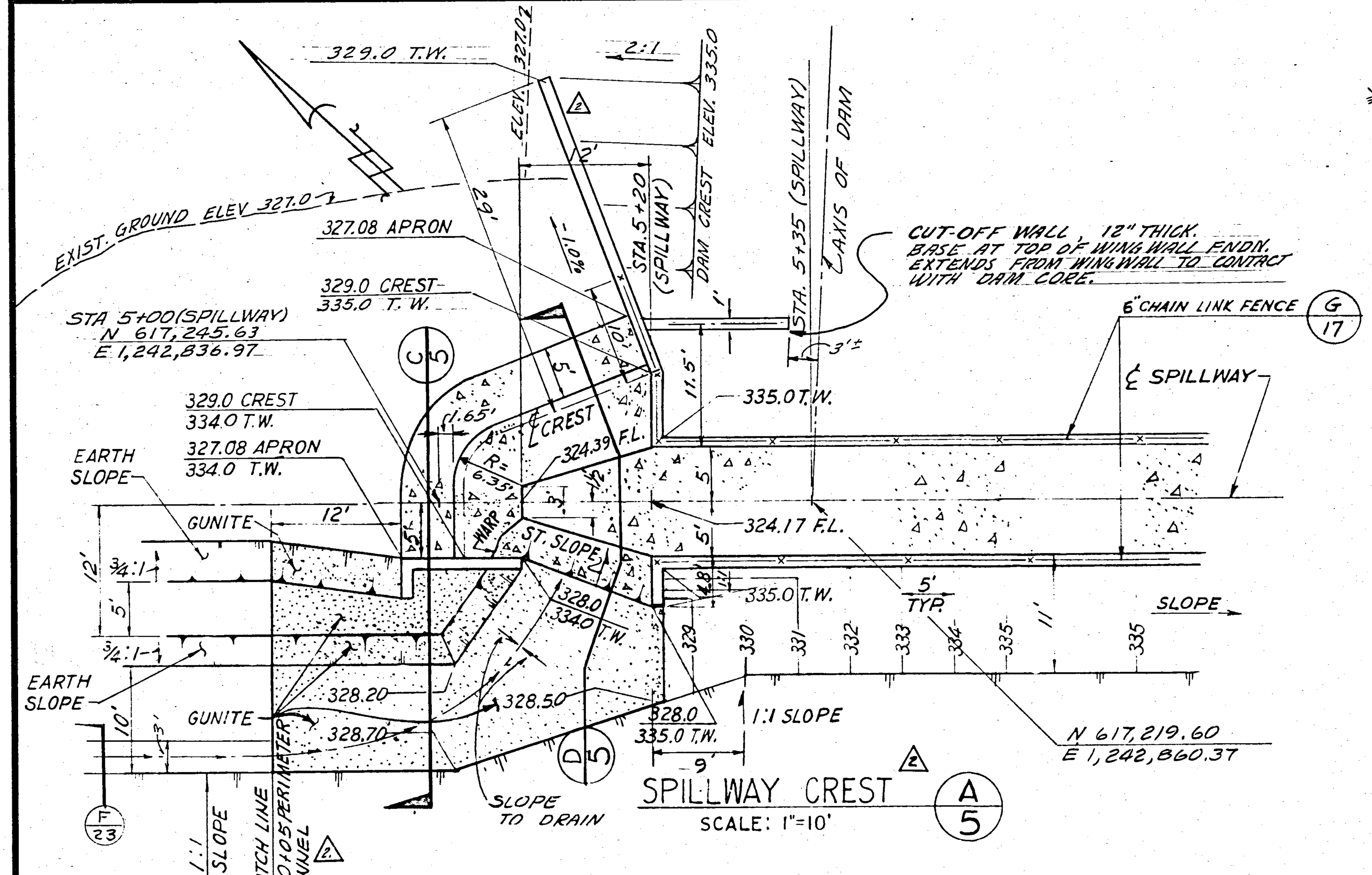
RECOMMENDED Richard J. Anderson DATE 5-11-68
APPROVED R. D. Born COUNTY HYDRAULIC ENGINEER R C E NO. 9614 5-11-68

DRAWN E.K.	TRACED D.S.	CHKD C.H.	DRWG	SHEET 4 OF 23

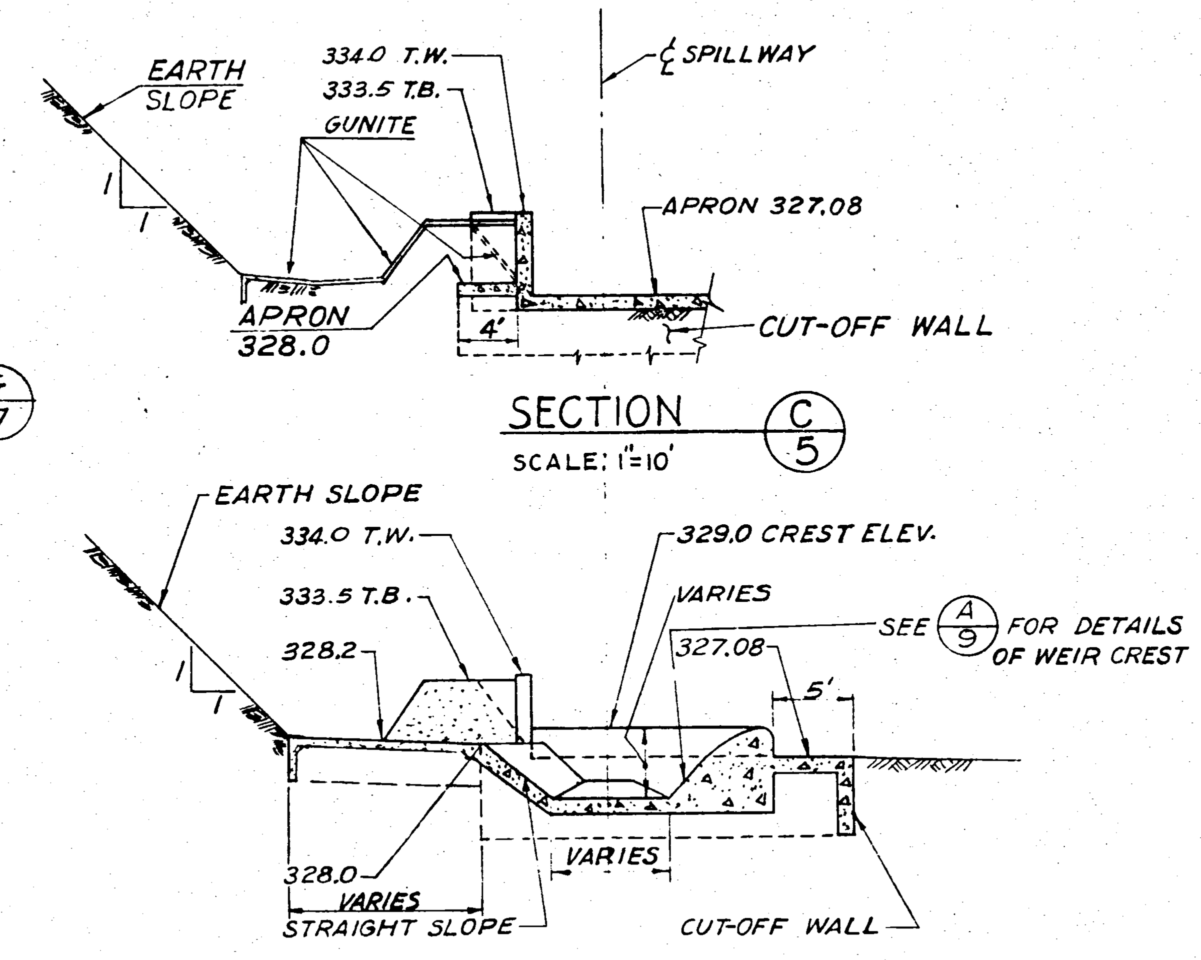
1055-2

RECORD COPY

DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 44

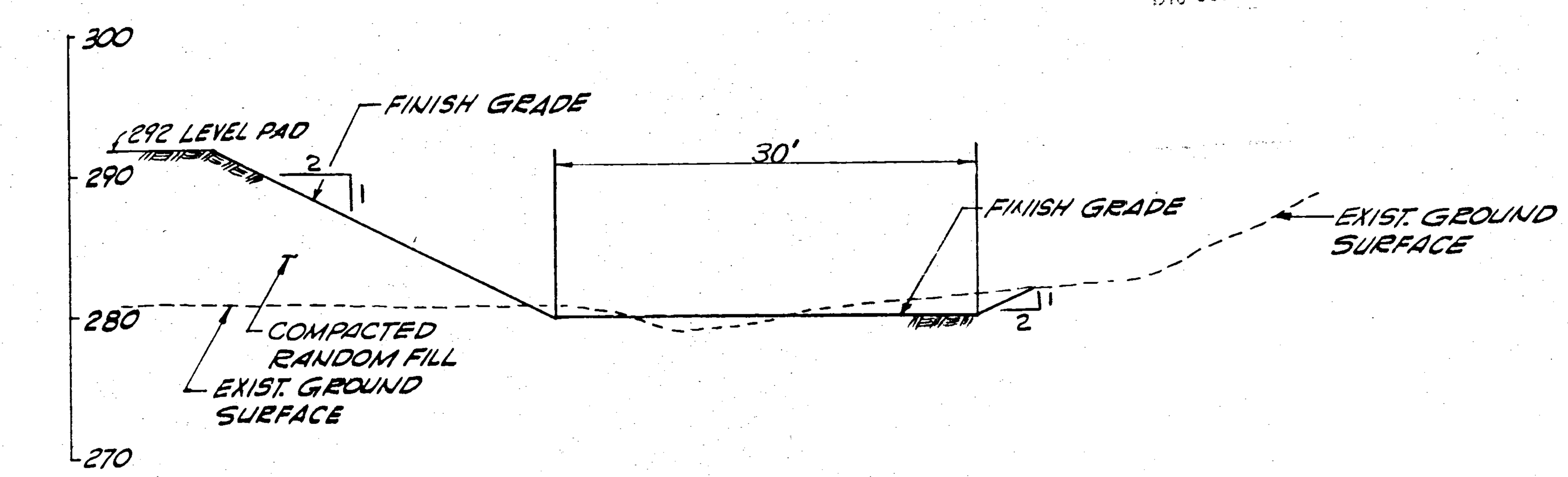


SPILLWAY CREST (A/5)
SCALE: 1"=10'

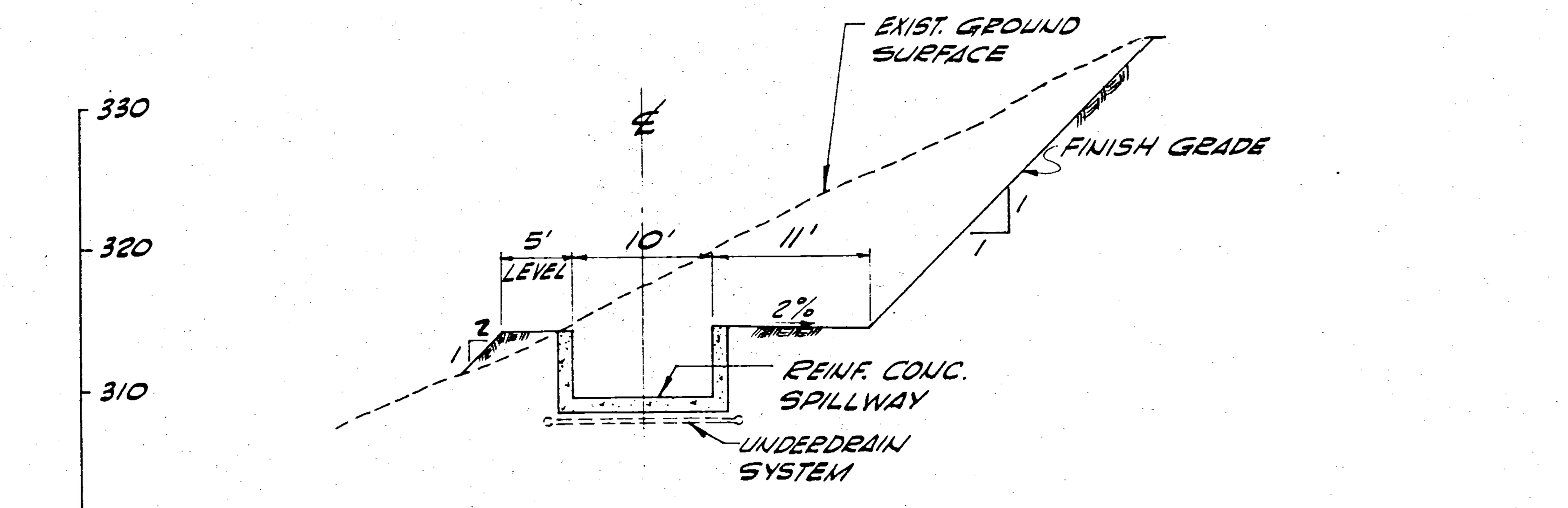


SECTION (C/5)
SCALE: 1"=10'

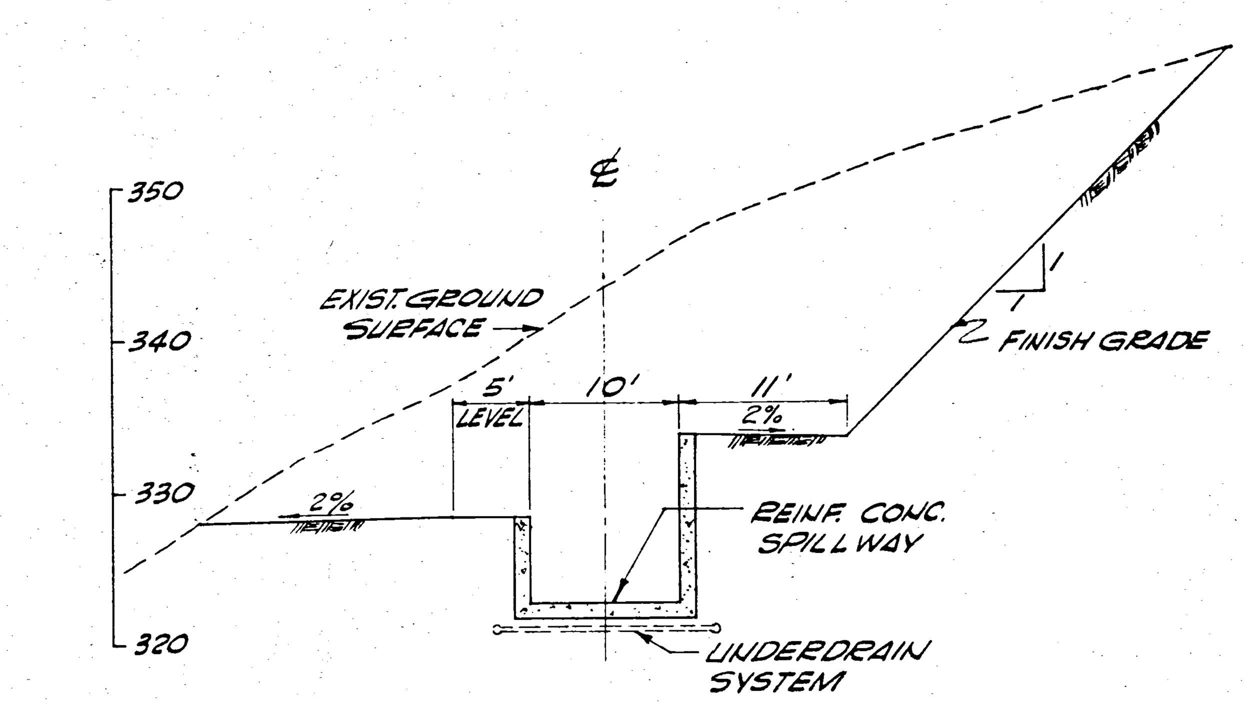
SECTION (D/5)
SCALE: 1"=10'



EARTH CHANNEL CROSS SECTION (E/5)
@ STA. 13+00
SCALE: 1" = 10'

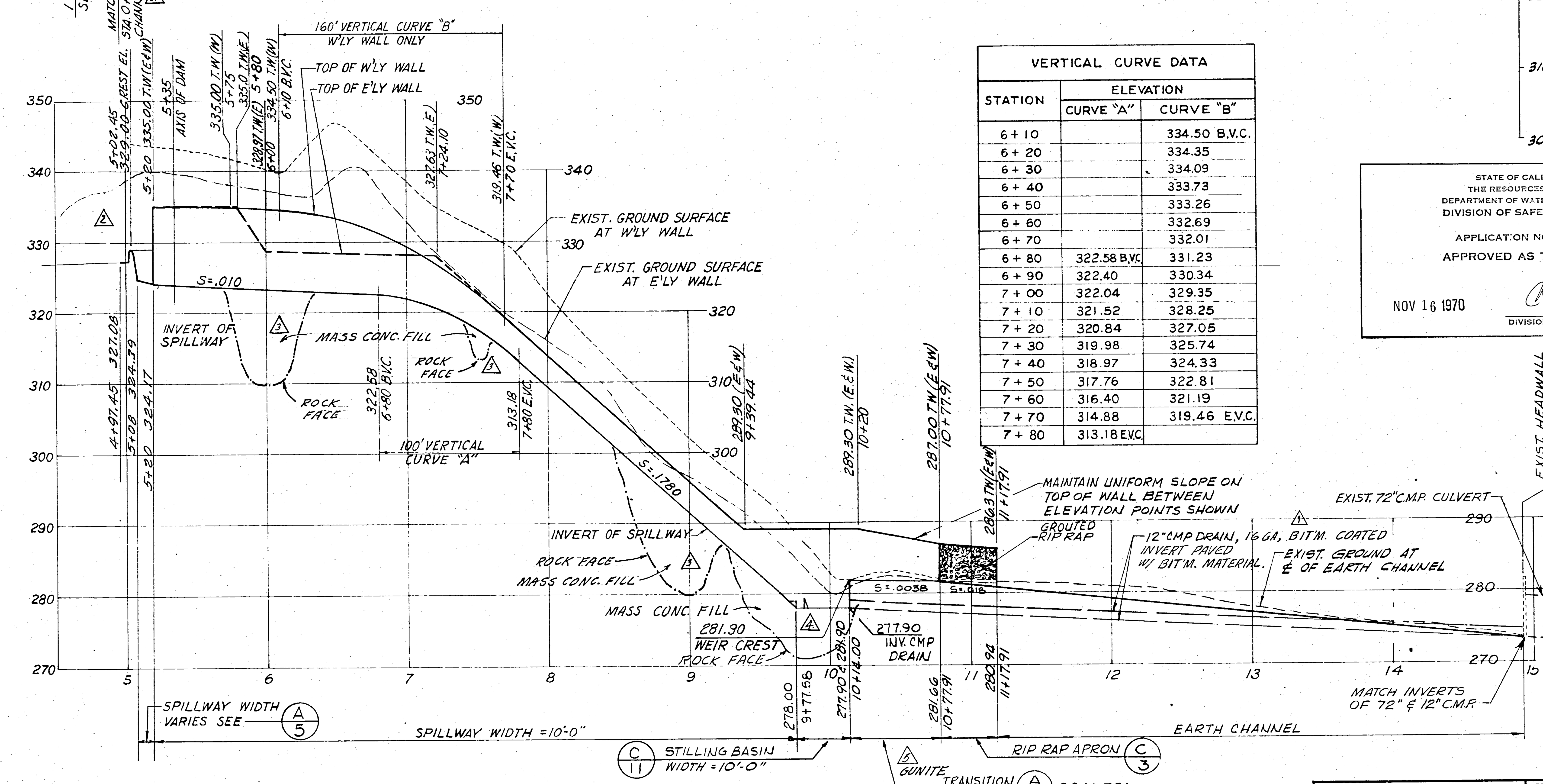


SPILLWAY CROSS SECTION (F/5)
@ STA. 8+00
SCALE: 1" = 10'



SPILLWAY CROSS SECTION (G/5)
@ STA. 6+50
SCALE: 1" = 10'

DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970



SPILLWAY PROFILE (B/5)

SCALES:
HORIZ. = 1"= 50'
VERT. = 1"= 10'

VERTICAL CURVE DATA		
STATION	ELEVATION	
	CURVE "A"	CURVE "B"
6+10		334.50 B.V.C.
6+20		334.35
6+30		334.09
6+40		333.73
6+50		333.26
6+60		332.69
6+70		332.01
6+80	322.58 B.V.C.	331.23
6+90	322.40	330.34
7+00	322.04	329.35
7+10	321.52	328.25
7+20	320.84	327.05
7+30	319.98	325.74
7+40	318.97	324.33
7+50	317.76	322.81
7+60	316.40	321.19
7+70	314.88	319.46 E.V.C.
7+80	313.18 E.V.C.	

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
DIVISION ENGINEER, REG. C.E. No. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING
DATE May 9, 1968
BY Martin A. Lieberman RCE 13168

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1	7-11-68	ADDENDUM Nº 2	RWS	HD	
2	8-21-68	REV. WEIR LOC. & WINGWALL	RWS	HD	
3		CHANGE ORDER # 2 - 8/15/68	RWS		
4		CHANGE ORDER # 3	RWS		
5		AS CONSTRUCTED	RWS.		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

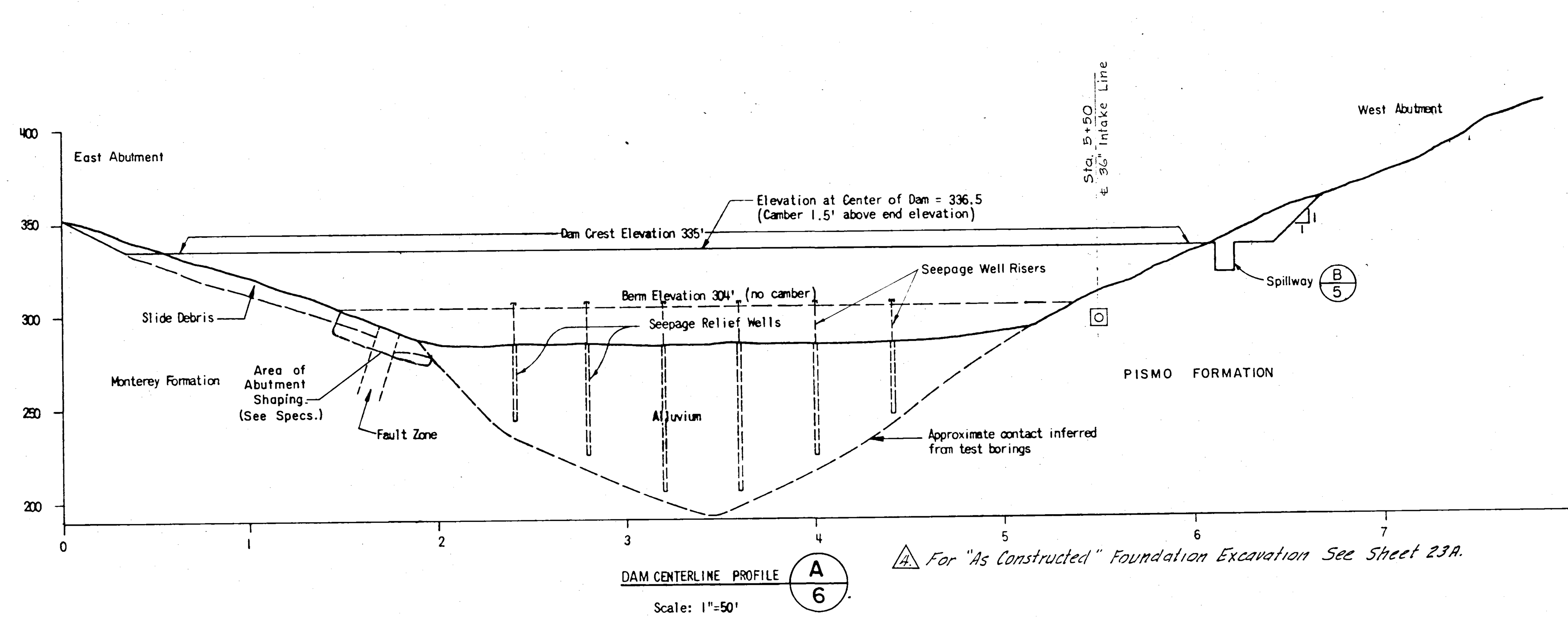
SPILLWAY AND CHANNEL

PROFILE AND DETAILS

RECOMMENDED Richard A. Drake DATE 5-11-68
APPROVED R. J. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN C.H. TRACED D.S. CHKD C.H. DRWG SHEET 5 OF 23

1055-2
RECORD COPY

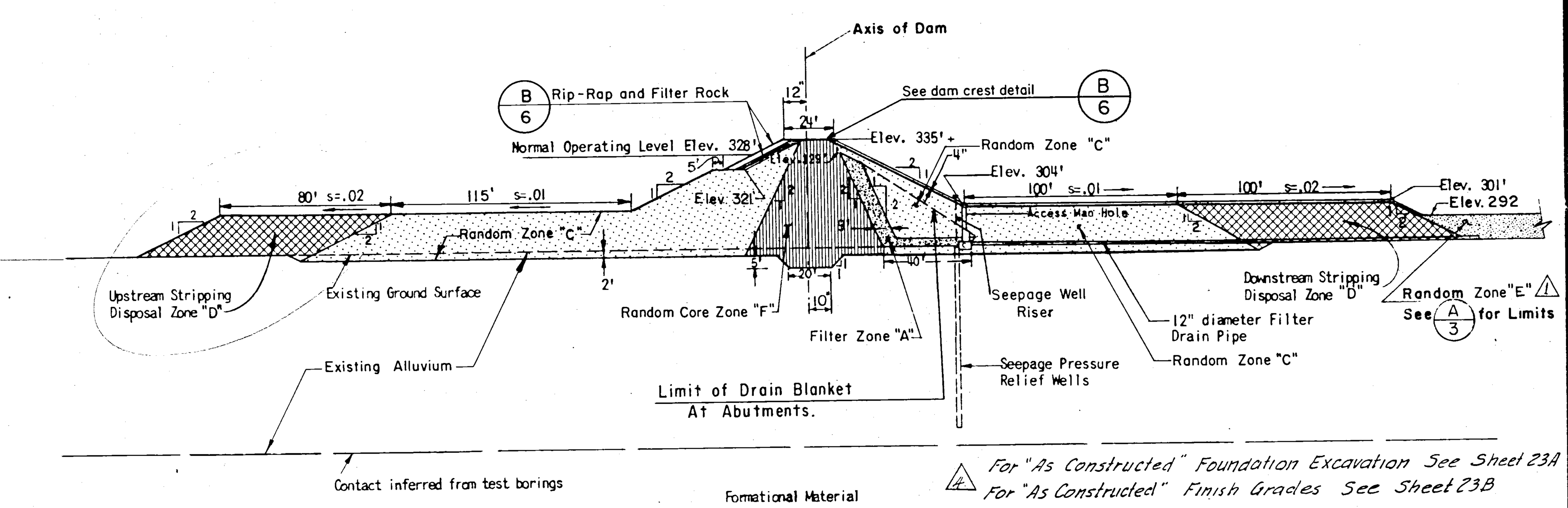
DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 44



DAM CENTERLINE PROFILE (A/6)

Scale: 1"=50'

For "As Constructed" Foundation Excavation See Sheet 23A.

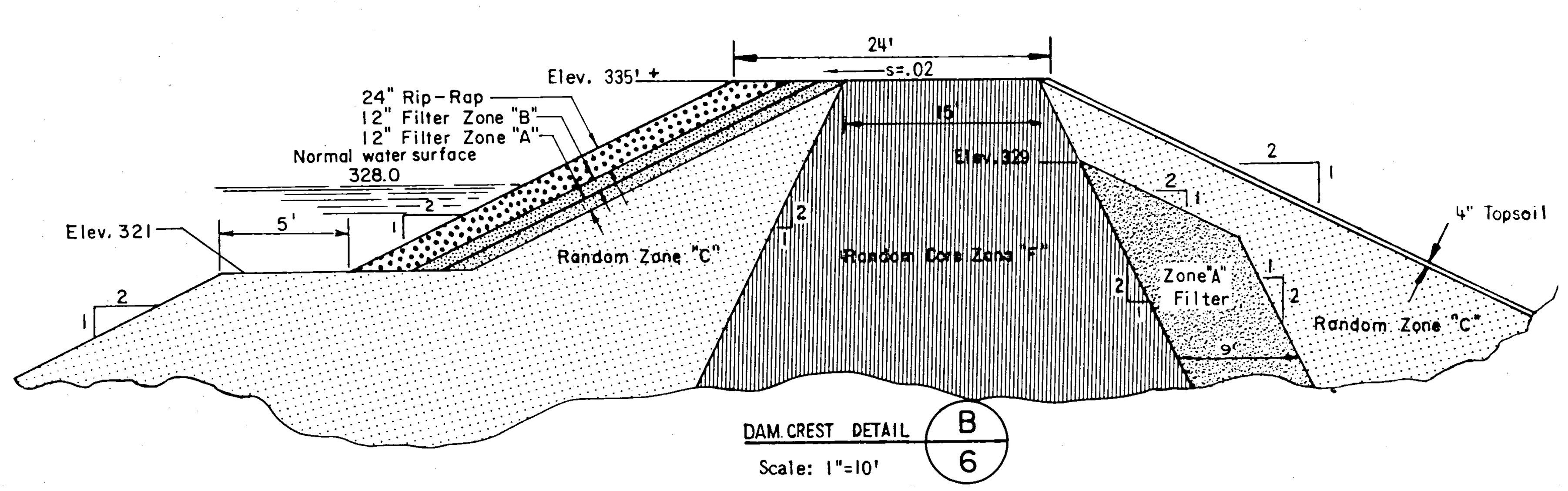


For "As Constructed" Foundation Excavation See Sheet 23A

For "As Constructed" Finish Grades See Sheet 23B

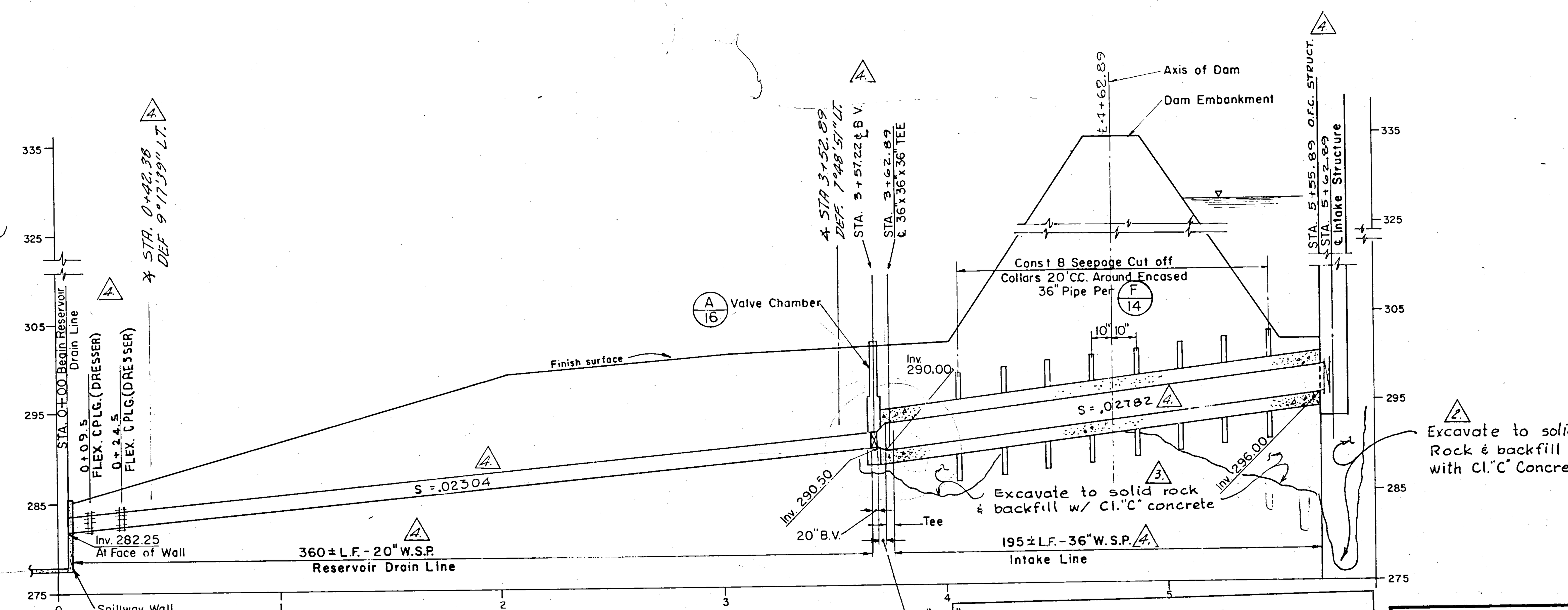
SECTION OF DAM AND FOUNDATION STATION 4+10 (D/6)

Scale: 1"=50'



DAM CREST DETAIL (B/6)

Scale: 1"=10'

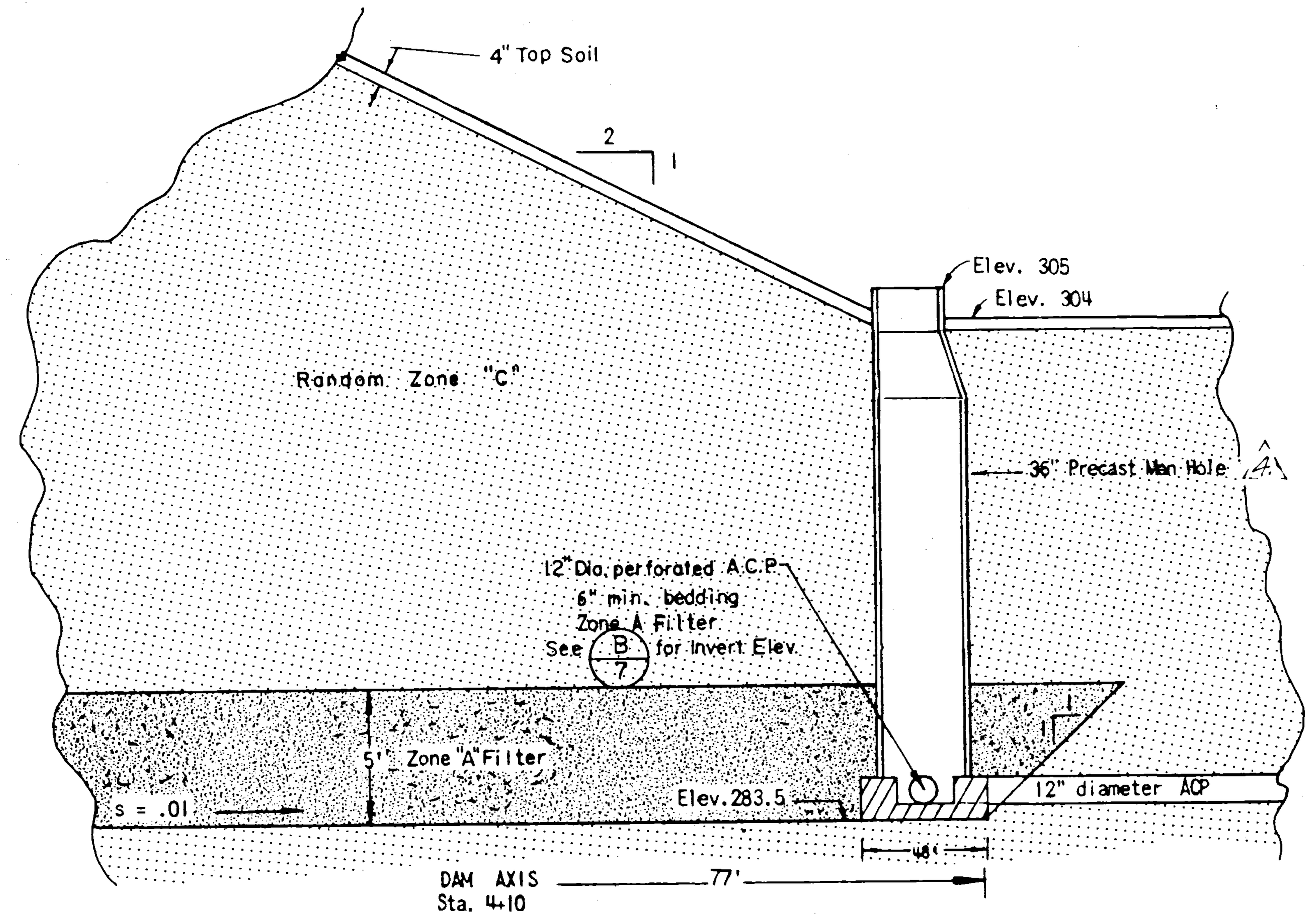


INTAKE LINE AND RESERVOIR DRAIN LINE PROFILE (E/6)

SCALES: HORIZ. 1"= 40' VERT. 1"= 10'

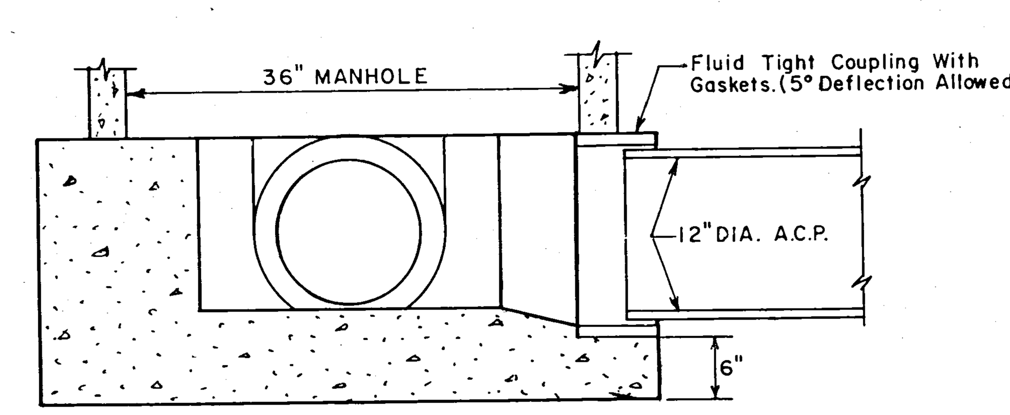
ABBREVIATIONS

- A.C.P. - ASBESTOS CEMENT PIPE
- C.C.P. - CONCRETE CYLINDER PIPE
- C.I.P. - CAST IRON PIPE
- CONC. - CONCRETE
- GALV. - GALVANIZED
- GSP. - GALVANIZED STEEL PIPE
- INV. - INVERT
- M.H. - MANHOLE
- M.I. - MALLEABLE IRON
- P.V.C. - POLYVINYLCHLORIDE
- REINF. - REINFORCED
- SS - STAINLESS STEEL, TYPE 316
- T.B. - TOP OF BERM
- T.W. - TOP OF WALL
- W.S.P. - WELDED STEEL PIPE, CEMENT MORTAR LINED AND COATED



DETAIL OF FILTER DRAIN COLLECTOR AND MAN HOLE (TYPICAL) (C/6)

Scale: 1"=5'



TYPICAL DETAIL OF PIPE TO MANHOLE BASE CONNECTION (F/6)

Scale: 1"= 1'-0"

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
C. J. Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
C. J. Cortright
ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY Martin A. Lieberman RCE 13168

DAM DESIGNED BY
WOODWARD, CLYDE & ASSOCIATES
CONSULTING ENGINEERS & GEOLOGISTS

DESIGNED J.C. APPROVED Stanley F. [signature] R.C.E. NO. 10352
DRAWN
CHECKED S.E.G.

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1	7-11-68	ADDENDUM NO 2 - 6/11/68	RWS		
2		CHANGE ORDER NO 1 - 8/8/68	RWS		
3		CHANGE ORDER NO 3 - 9/6/68	RWS		
4		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

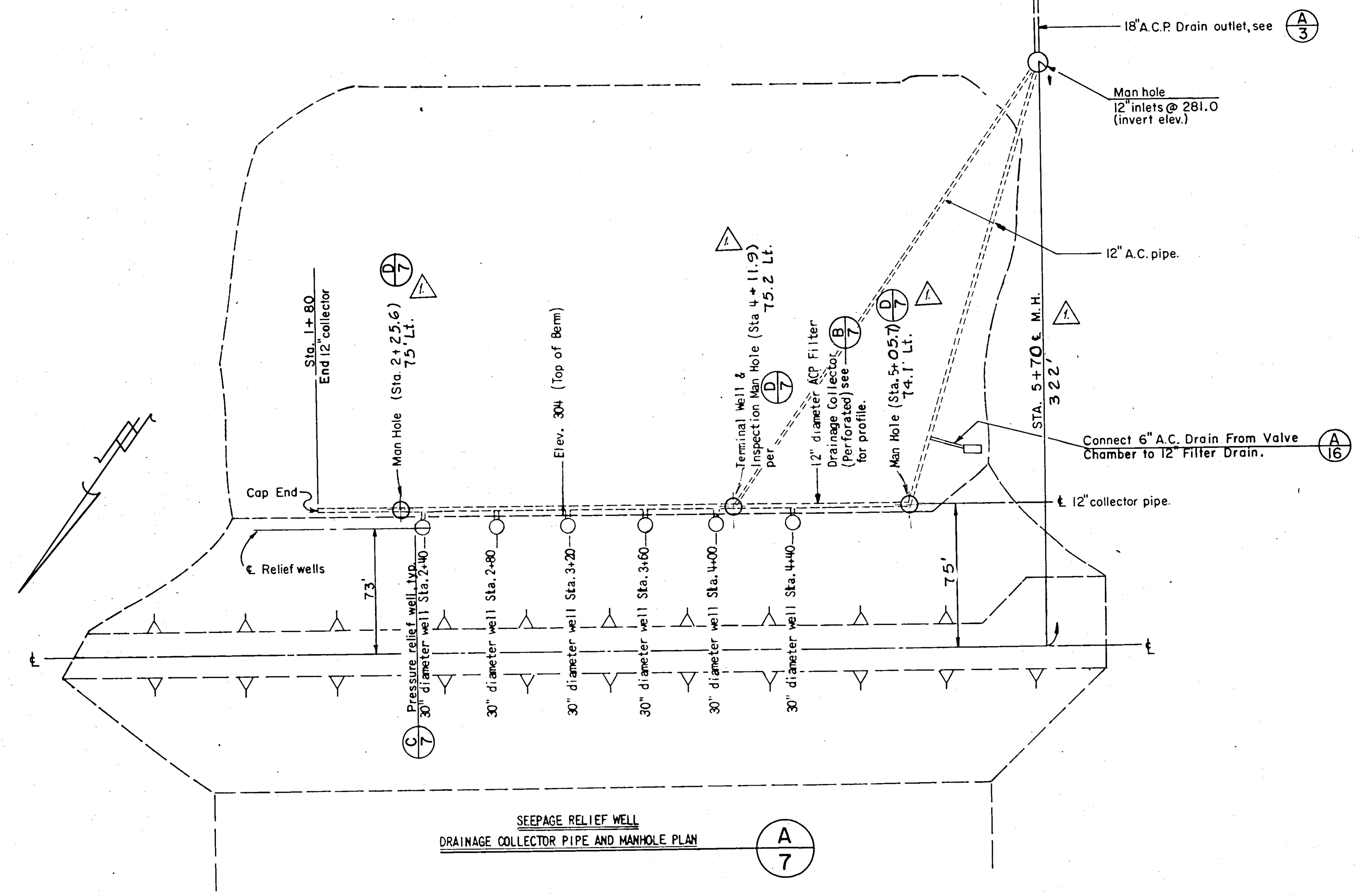
TERMINAL DAM AND RESERVOIR

TYPICAL EMBANKMENT SECTIONS AND DETAILS

DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970

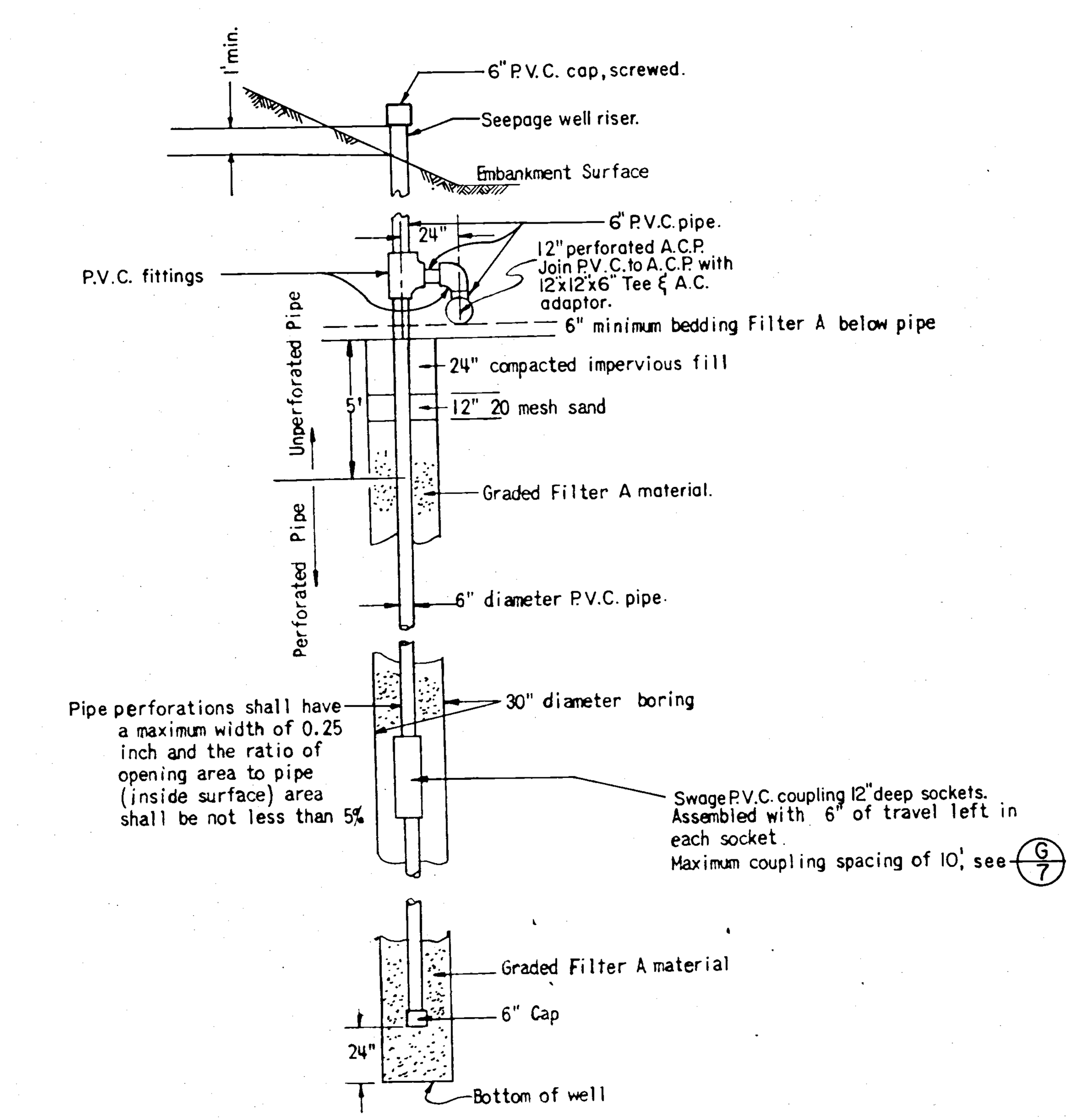
RECOMMENDED Richard A. Drahn DATE 5-11-68
APPROVED R.J. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN C.H. TRACED E.C. CHKD C.H. DRWG SHEET 6 OF 23

1055-2 RECORD COPY



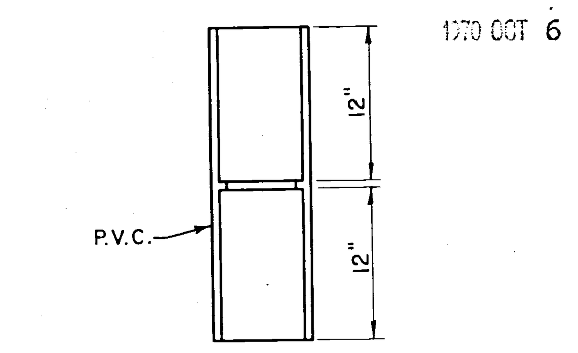
SEEPAGE RELIEF WELL
DRAINAGE COLLECTOR PIPE AND MANHOLE PLAN (A/7)

Scale: 1" = 50'



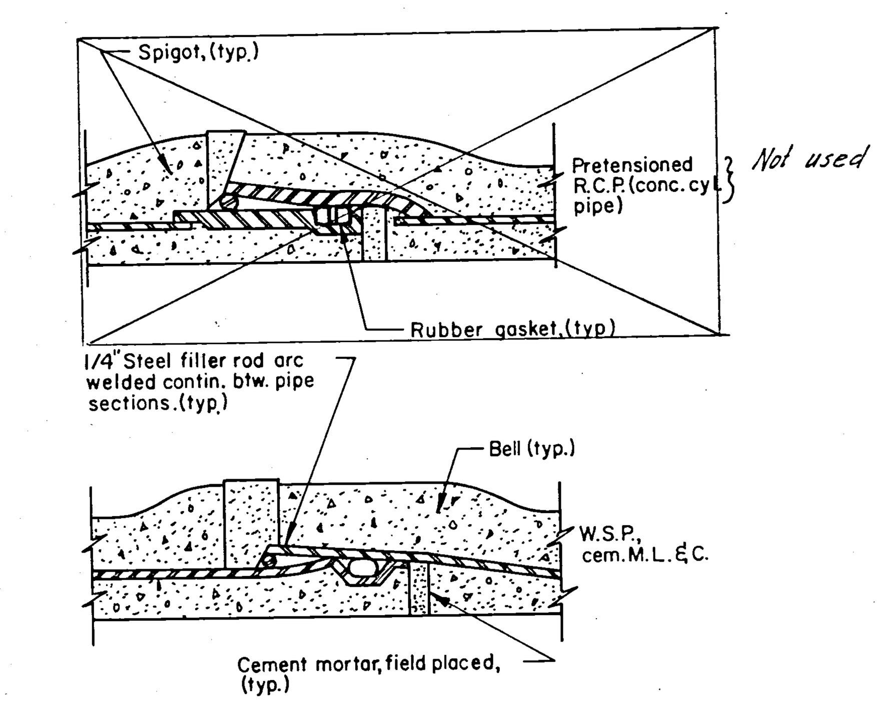
SEEPAGE RELIEF WELL DETAIL (C/7)

Scale: 1" = 5'



SWAGE COUPLING SECTION (G/7)

Scale: 1" = 1'



DETAIL FOR WELDING OF RUBBER GASKET PIPE JOINTS (F/7)

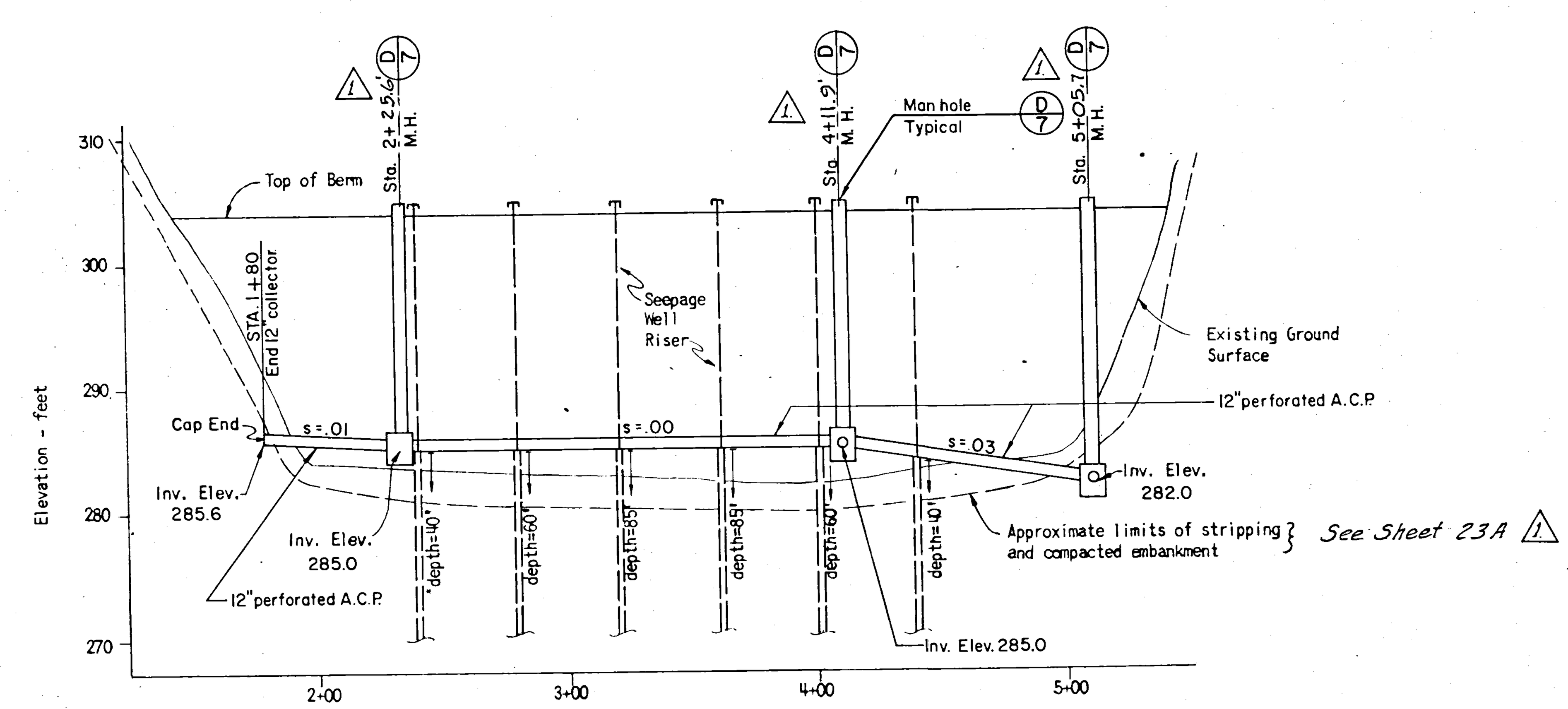
PIPING NOTES

1. ~~Either Pretensioned Reinforced Concrete Cylinder Pipe or~~ Cement Mortar Lined and Coated Welded Steel Pipe ~~may be~~ used where ~~one or both is~~ indicated on the drawings, ~~at the Contractor's option.~~

2. Cement Mortar Lining of welded steel pipe shall be continuous including all joints, shop and field whether welded, coupled or flanged.

3. The 20 inch Reservoir Drain Line pipe, within the valve chamber, shall not be Cement Mortar Coated but shall receive a coating equal to that specified for piping below the floor level of the Intake Structure.

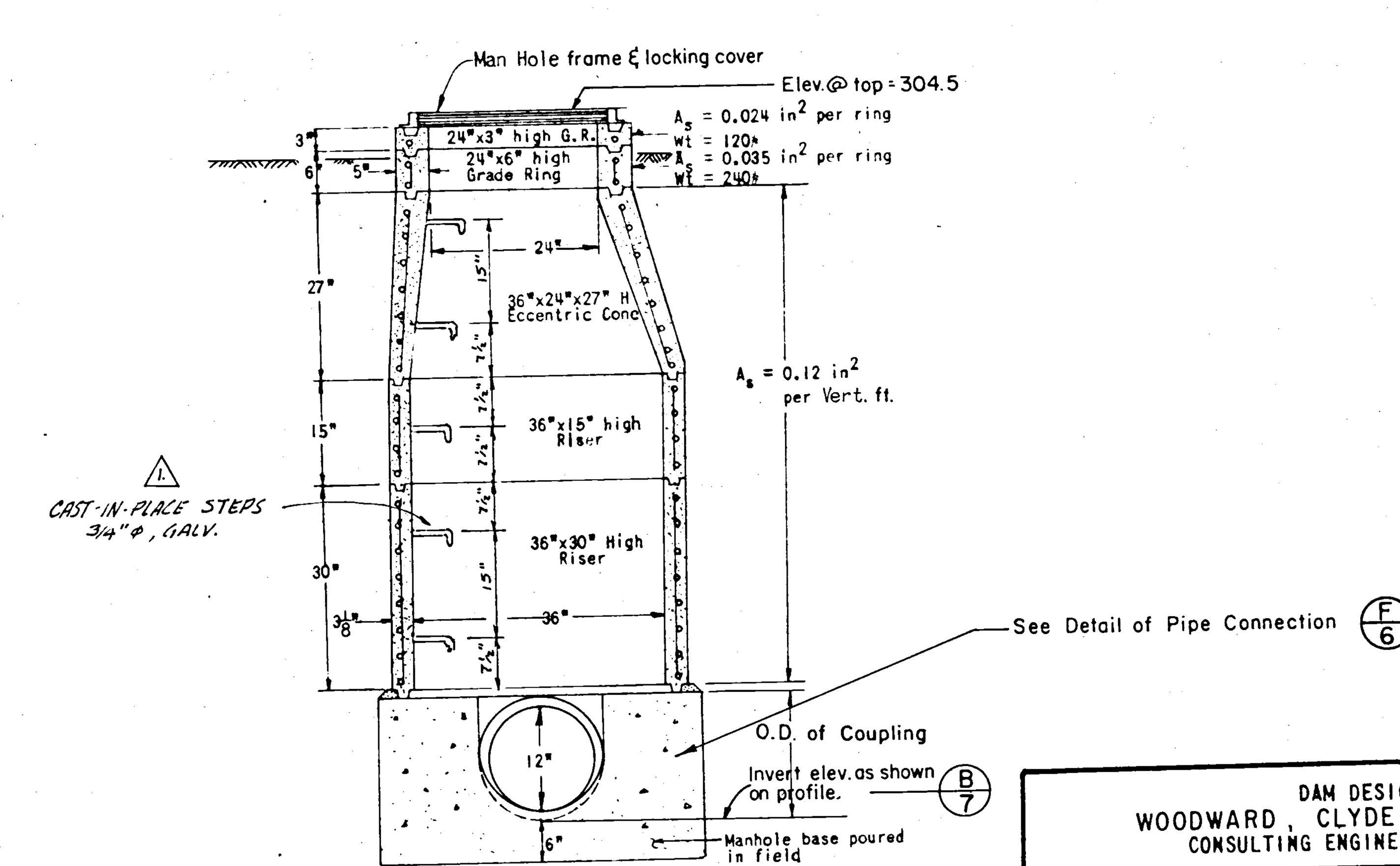
4. Cement Mortar coating shall be omitted at all Flanged Flexible Couplings and such couplings shall receive a coating equal to that specified for piping below the floor level of the Intake Structure.



DRAINAGE COLLECTOR PIPE PROFILE (B/7)

SCALES: Horiz. 1" = 50'
Vert. 1" = 10'

NOTE: Well depths shown are maximum depths below the bottom of the Zone "A" Filter blanket. A smaller depth is acceptable if the well boring reaches undisturbed Pismo Formation.



TYPICAL SECTION MAN. HOLE (D/7)

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING
DATE 5/9/68
BY Charles H. Lawrence R.C.E. 9037

DAM DESIGNED BY
WOODWARD, CLYDE & ASSOCIATES
CONSULTING ENGINEERS & GEOLOGISTS

DESIGNED
DRAWN
CHECKED
APPROVED R.C.E. NO. 10352

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED			

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

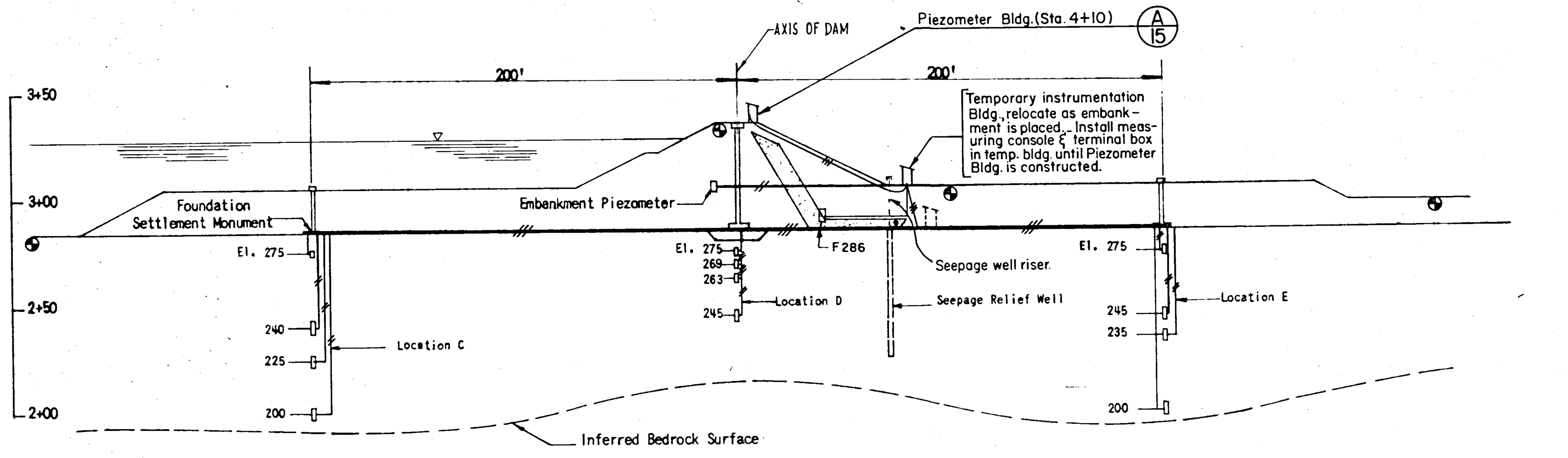
TERMINAL DAM AND RESERVOIR

SEEPAGE RELIEF WELLS AND MISCELLANEOUS DETAILS

RECOMMENDED Richard A. Drake DATE 5-11-68
APPROVED R. A. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9616 5-11-68
DRAWN TRACED CHKD AHE DRWG SHEET 7 OF 23

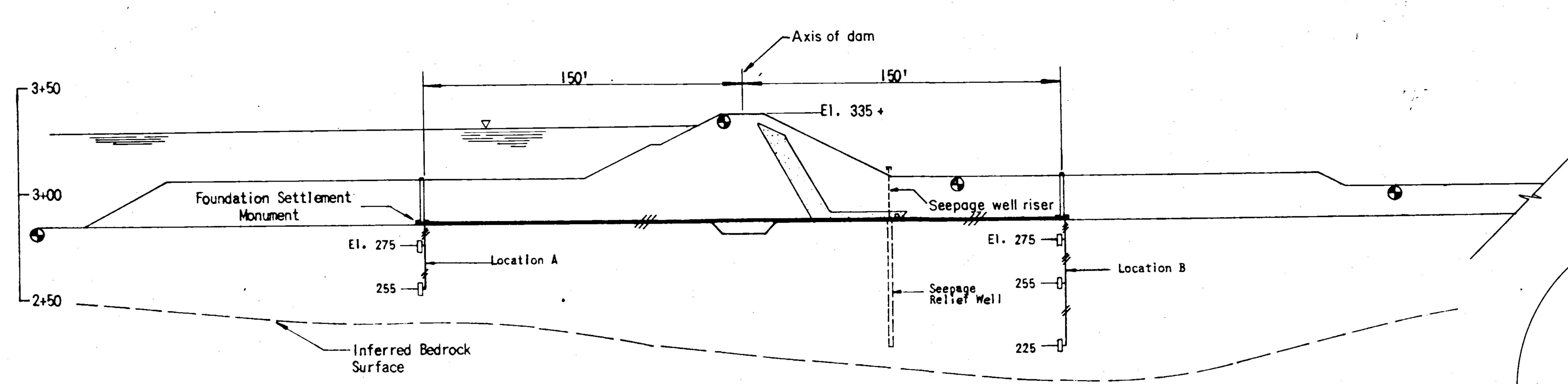
DEPARTMENT OF WATER RESOURCES SACRAMENTO

1970 OCT 6 AM 11 45



SECTION AT STATION 4+00 (A/8)

Scale: 1"=50'

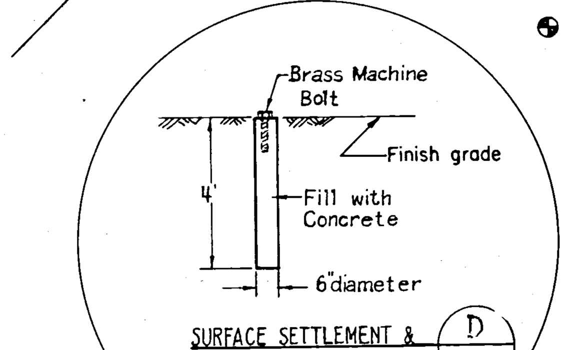


SECTION AT STATION 2+75 (B/8)

Scale: 1"=50'

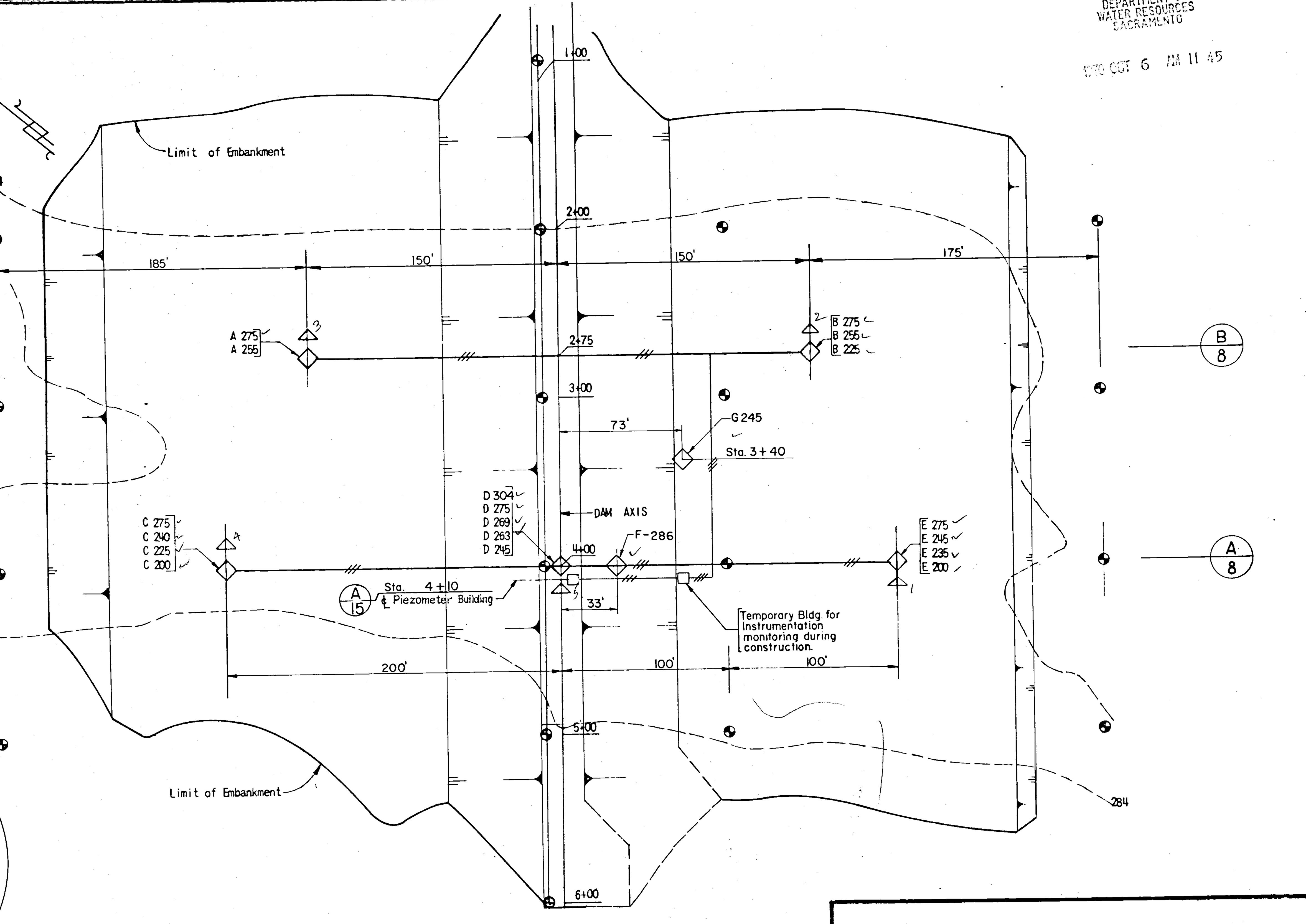
NOTE:

Piezometer B-225, C-200 & D-245 shall be monitored through piezometer annunciator panel.



SURFACE SETTLEMENT & ALIGNMENT MONUMENT (D/8)

No Scale

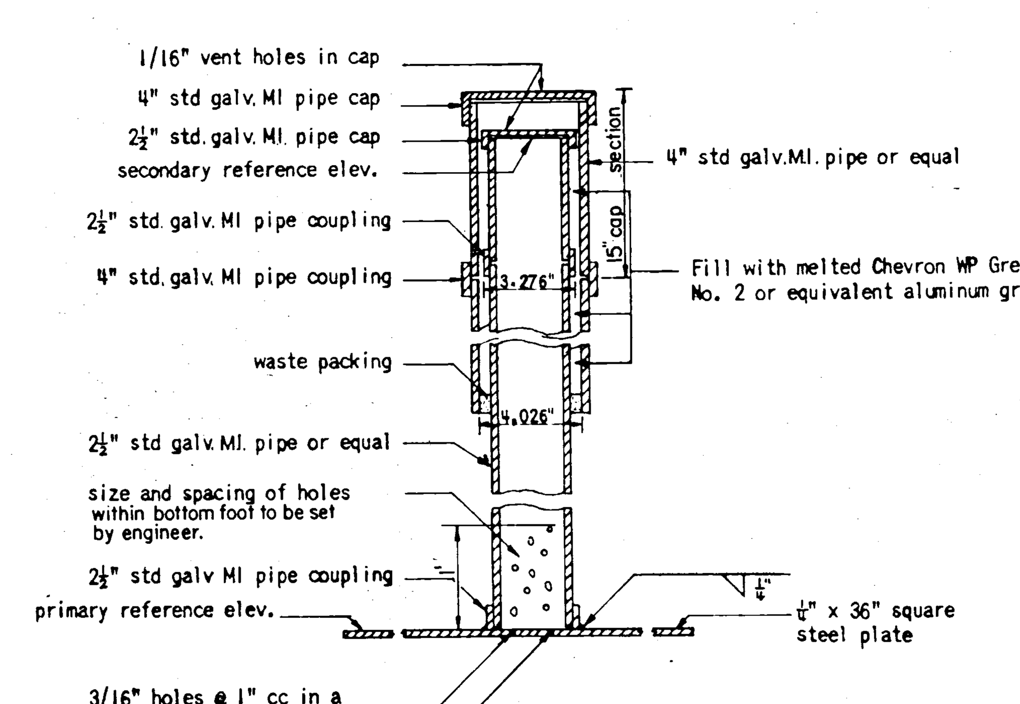


INSTRUMENTATION PLAN (G/8)

Scale: 1"=50'

LEGEND

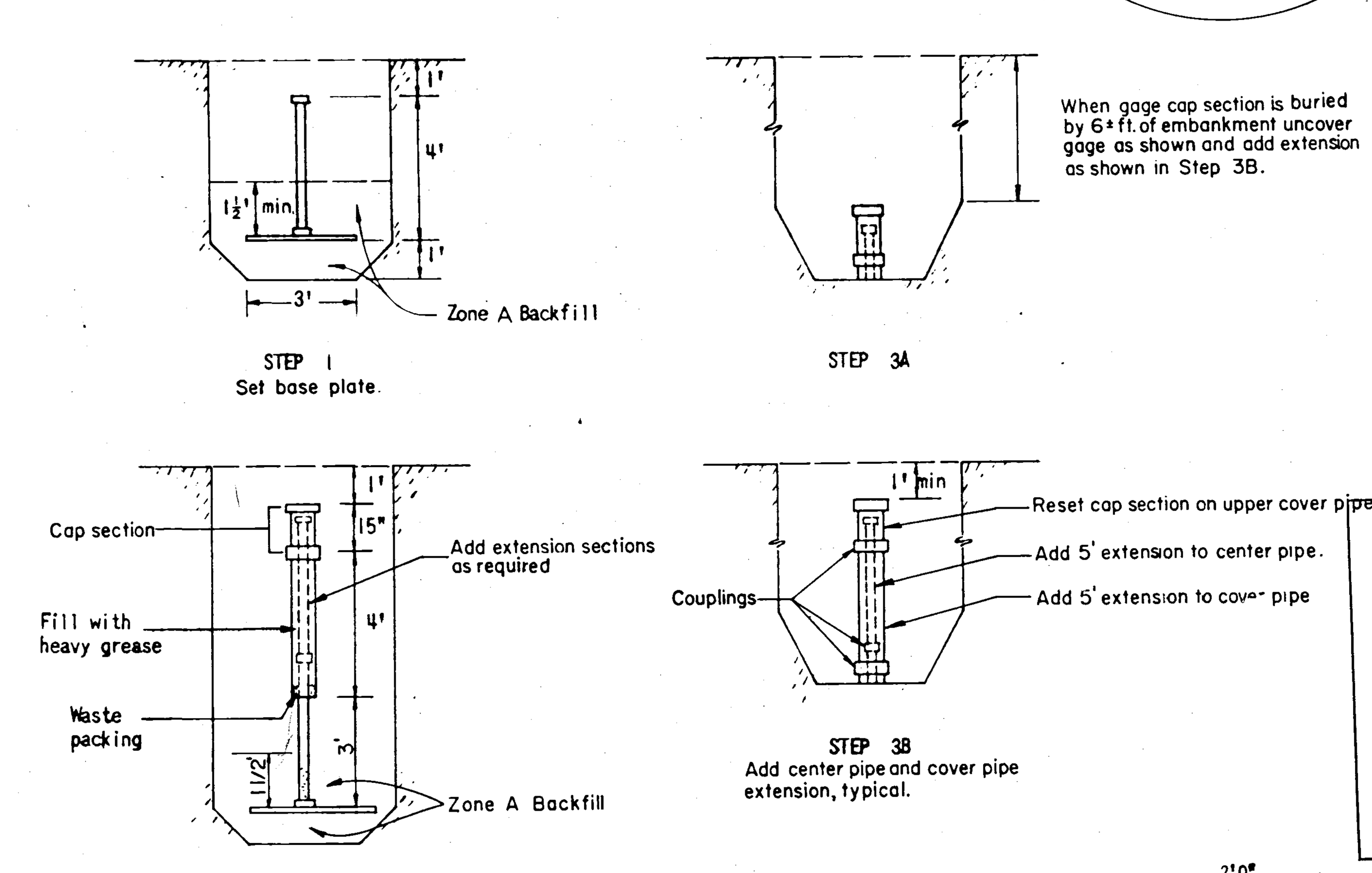
- Surface Settlement and Alignment Monuments.
- Piezometer (plan).
- Foundation Settlement Gage.
- Piezometer (section)
- Single Unit Line
- Multiple Unit Line
- C 200 — Elevation, Designation, Location



SECTIONAL DETAIL

COMBINED SETTLEMENT GAGE & OPEN PIPE PIEZOMETER (C/8)

No Scale



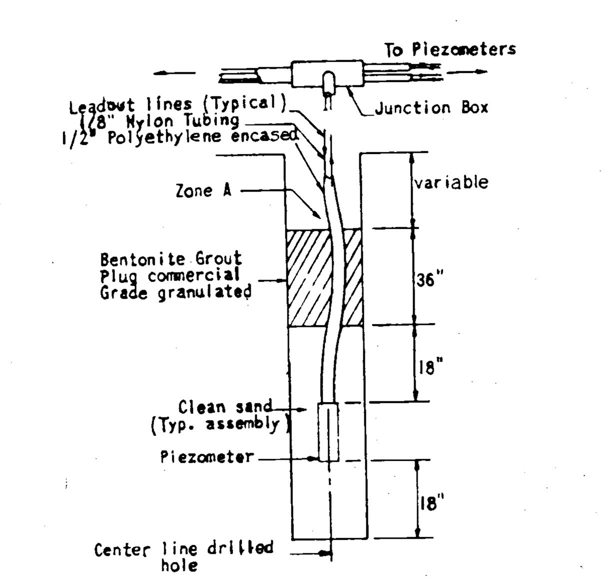
INSTALLATION PROCEDURE

SETTLEMENT GAGE - OPEN PIPE PIEZOMETER (E/8)

No Scale

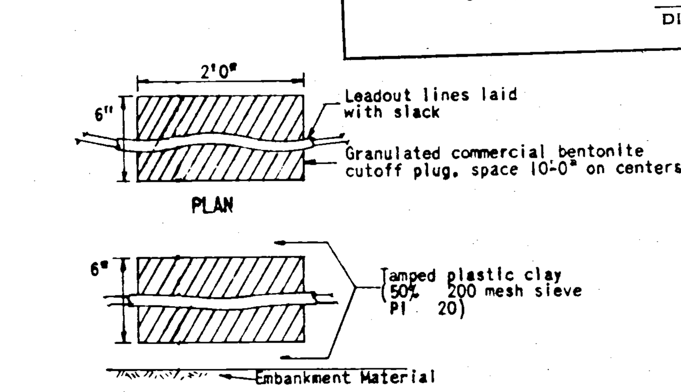
NOTE:

Upon completion of the embankment, the settlement gage shall be extended to 6" above the finish grade, except for settlement gage located within the crest of the dam which shall be flush with the finish grade.



PIEZOMETER INSTALLATION DETAIL (H/8)

No Scale



LEADOUT LINE TRENCH DETAIL (—/8)

No Scale

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
C J Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

NOTES

1. Provide continuous protection, location and identification of entire instrumentation system throughout construction.
2. Piping and protective coating shall be as specified.
3. Local soil materials may be used for construction purposes subject to the approval by the Engineer.
4. Construction scheduling shall be subject to approval by the Engineer.
5. Provide adequate number of junction boxes to accommodate all piezometers shown plus not less than 50% additional leadout lines for future spares.
6. Contractor's operations involving installation of embankment instrumentation shall be conducted only during the presence of the manufacturer's representative unless otherwise authorized by the Engineer.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
C J Cortright
ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE 5/9/68
BY Charles H Lawrance R.C.E. 9037

DAM DESIGNED BY
WOODWARD, CLYDE & ASSOCIATES
CONSULTING ENGINEERS & GEOLOGISTS

DESIGNED TC
DRAWN
CHECKED SFC
APPROVED Stanley F. [signature] R.C.E. NO. 10352

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
		AS CONSTRUCTED	R.M.S.		KLH

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

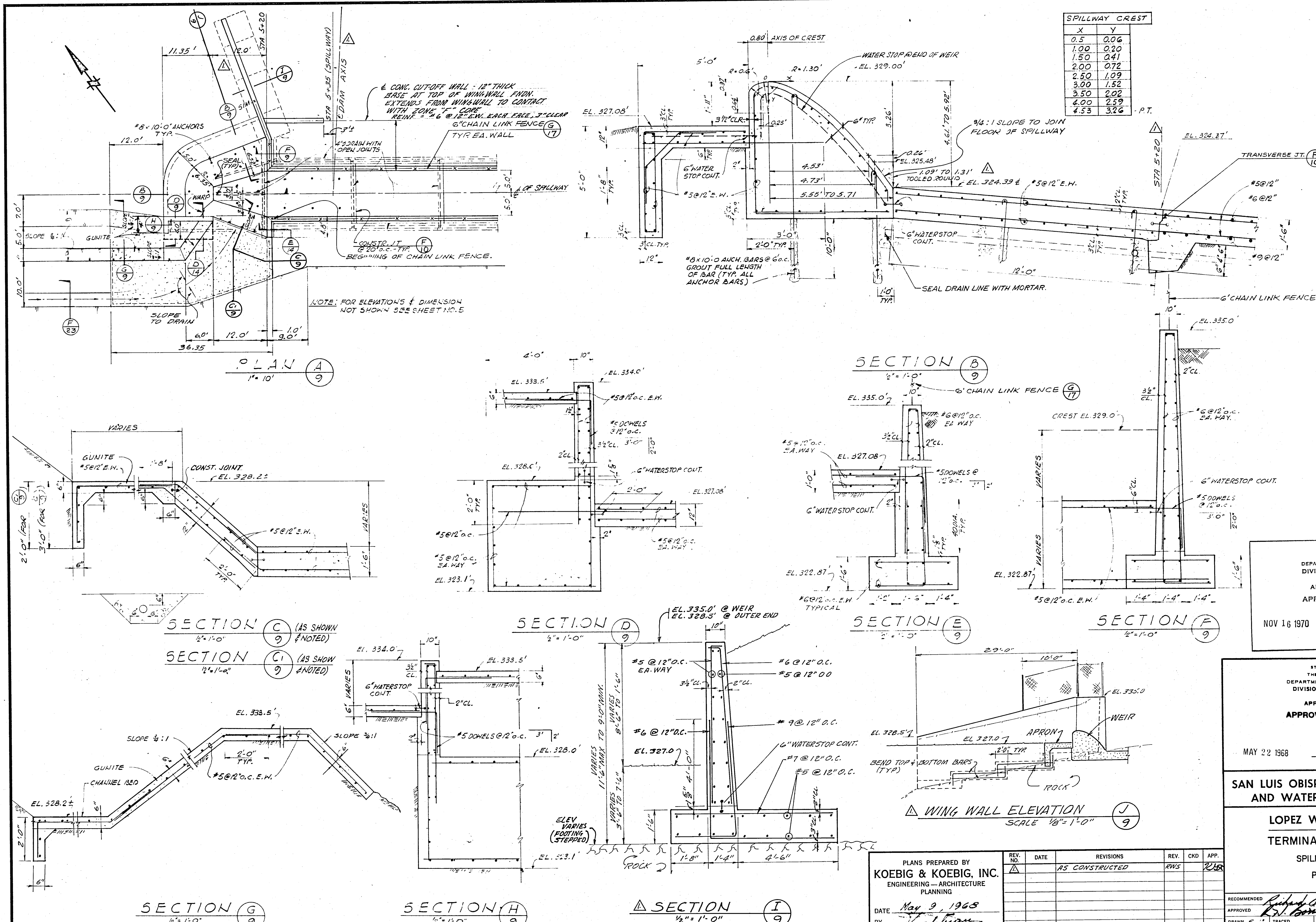
TERMINAL DAM AND RESERVOIR

INSTRUMENTATION PLAN AND DETAILS

DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970

RECOMMENDED Richard A. Drake 5-11-68 DATE
APPROVED R. J. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN C.H. TRACED D.S. CHKD CHL DRWG SHEET 8 OF 23

1055-2 RECORD COPY



SPILLWAY CREST	
X	Y
0.5	0.06
1.00	0.20
1.50	0.41
2.00	0.72
2.50	1.09
3.00	1.52
3.50	2.02
4.00	2.59
4.53	3.26

- P.T.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.
APPROVED AS TO SAFETY

NOV 16 1970

DIVISION ENGINEER, REG. C.E. No. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO. 1055-2
APPROVED AS TO SAFETY

MAY 22 1968

ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE May 9, 1968
BY

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
△		AS CONSTRUCTED	RWS		RJB

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

SPILLWAY INLET STRUCTURE
PLAN AND SECTIONS

DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970

RECOMMENDED Richard A. Deahn   5-11-68 DATE
APPROVED R.J. Born   COUNTY HYDRAULIC ENGINEER R C E NO. 9614   5-11-68
DRAWN S.K. | TRACED | CHKD | DRWG | SHEET 9 OF 23

1055-2 RECORD COPY


DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 45
TYPE "A" SEE K/15
OPEN JOINTS
TIGHT CAULKED JOINTS
OPEN JOINTS
4" DRAIN PIPE - TYPICAL
CONSTR. JT. TYP. @ 20'± O.C.
DRAIN OUTLET
STA. 5+00
STA. 6+80
STA. 7+80
6' CHAIN LINK FENCE G/17 TYP. EA. WALL
PARTIAL PLAN OF SPILLWAY A/10
1" = 10'
VERTICAL CURVE "B" WEST WALL ONLY
STA. 5+00 T.W. 335.00 (E&W)
TOP OF EAST WALL STA. 5+75 T.W. 335.00 (W)
TOP OF WEST WALL STA. 6+10 T.W. 334.50 (W) B.V.C.
INV. 324.37
STA. 6+80
STA. 7+24.10 T.W. 327.63 (E)
STA. 7+50 T.W. 323.02 (E)
7" ⌀ DRAIN OUTLET INV. EL. 317.1
STA. 7+70 T.W. 319.46 (W) E.V.C.
STA. 7+80 T.W. 317.68 (W) T.W. 317.68 (E)
STA. 5+80 T.W. 335.0 (E)
STA. 6+00 T.W. 328.97 (E.)
PARTIAL SECT. OF SPILLWAY B/10
1" = 10'
TRANSVERSE JT. F/10
INV. 322.58' B.V.C.
18" INLET J/17
100' VERTICAL CURVE "A"
INV. 313.18 E.V.C.
STA. 7+80
OPEN JOINTS
TIGHT CAULKED JOINTS
4" DRAIN PIPE - TYPICAL
OPEN JOINTS
TIGHT CAULKED JOINTS
CONSTR. JT. TYP. @ 20' ± O.C.
DRAIN OUTLET
6' CHAIN LINK FENCE
#8 x 10'-0" ANCHORS FROM STA 5+00 TO STA. 9+00.
TYPE "B" SEE K/15
OPEN JOINTS
CAULKED JOINTS
TYPE "A" SEE K/15 (SIM.)
STA. 9+77.58
PARTIAL PLAN OF SPILLWAY C/10
1" = 10'
NOTE: FOR ELEVATIONS & DIMENSIONS NOT SHOWN ON THIS DRAWING SEE SHEET No. 6
GENERAL NOTE: ALL 4 INCH SUBDRAIN PIPE SHALL BE CLAYPIPE AND CONFORM TO ASTM STANDARD C-211, CLASS 2, UNGLAZED. GRAVEL FILL SHALL BE COMMERCIAL PEA GRAVEL No 4, 3/8 INCH MAXIMUM SIZE WITH NOT MORE THAN 5% PASSING THE No 4 SQUARE SIEVE.
STA. 7+80 T.W. 317.68 (W) T.W. 317.68 (E)
INV. 313.18 E.V.C.
10'-0" MAX.
6' CHAIN LINK FENCE G/17 TYP. EA. WALL
#8 x 10'-0" ANCHORS - TYP. FOR LOCATION SEE PLAN
4" DRAIN OUTLET 8+50 INV. EL. 303.75
NOTE: PROVIDE FITTING AS REQUIRED AT ALL DRAIN PIPE INTERSECTIONS SEE PLANS AT SHEETS 10 & 11
APPLY 2 COATS OF BITUMINOUS PAINT
SLOPE: .1780
1/4" R. TOOLED EDGE
6" RUBBER WATERSTOP
STA. 9+39.44 (E&W) T.W. 289.30
STA. 9+72
STA. 9+77.58 T.W. 289.30 (E&W)
18" INLET INV. EL. 280.31
INV. 279.00'
INV. 278.00'
6" RUBBER WATERSTOP
12" CONTRACTION JT.
℄ DRAIN
FORM OR BURLAP - TYP.
#5 @ 12" o.c. BEND AS SHOWN
4-#5 CONT.
PARTIAL SECT. OF SPILLWAY D/10
1" = 1'
2-#5-TYP.
TYP. WALL JOINT E/10
TYP. TRANSVERSE JT. F/10
TYP. ADD'L REINF. @ OPNG G/10
N.T.S.
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
DIVISION ENGINEER, REG. C.E. No. 7115
STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
ACTING DIVISION ENGINEER, REG. CE NO 7115
SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM AND RESERVOIR
SPILLWAY CHUTE PLAN
PROFILE AND DETAILS
DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970
PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY
REV. NO. | DATE | REVISIONS | REV. | CKD | APP.
1 | 7-11-68 | ADDENDUM No 2 | R.W.S.
2 | | AS CONSTRUCTED | R.W.S.
RECOMMENDED 5-11-68
APPROVED COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9414 5-11-68
DRAWN J.K. TRACED S.K. CHKD DRWG SHEET 10 OF 23
1055-2
RECORD COPY

PLANS PREPARED BY KOEBIG & KOEBIG, INC. ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY [signature]

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		ADDENDUM No 2	KWS		
2		AS CONSTRUCTED	EWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

CHANNEL PLAN, PROFILE AND DETAILS

DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970

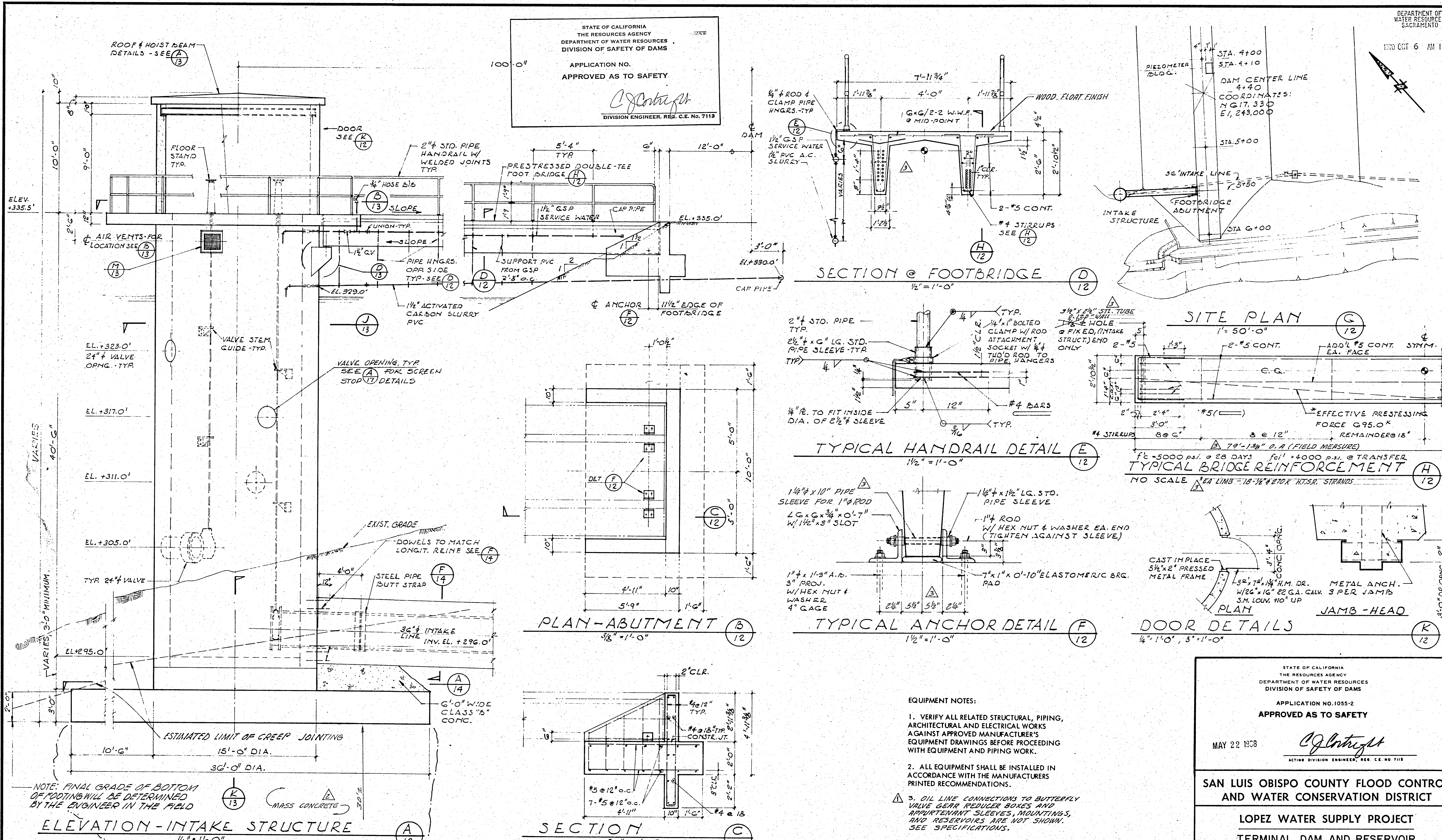
RECOMMENDED [signature] DATE 5-11-68
APPROVED [signature] COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-1-68
DRAWN M.I. | TRACED | CHKD | DRWG | SHEET 11 OF 23

1055-2 RECORD COPY

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.
APPROVED AS TO SAFETY
C J Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

DEPARTMENT OF WATER RESOURCES
SACRAMENTO
1970 OCT 6 AM 11 45



EQUIPMENT NOTES:

1. VERIFY ALL RELATED STRUCTURAL, PIPING, ARCHITECTURAL AND ELECTRICAL WORKS AGAINST APPROVED MANUFACTURER'S EQUIPMENT DRAWINGS BEFORE PROCEEDING WITH EQUIPMENT AND PIPING WORK.

2. ALL EQUIPMENT SHALL BE INSTALLED IN ACCORDANCE WITH THE MANUFACTURERS PRINTED RECOMMENDATIONS.

3. OIL LINE CONNECTIONS TO BUTTERFLY VALVE GEAR REDUCER BOXES AND APPURTENANT SLEEVES, MOUNTINGS, AND RESERVOIRS ARE NOT SHOWN. SEE SPECIFICATIONS.

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1	7-11-68	ADDENDUM Nº 2	R.W.S.		
2		CHANGE ORDER Nº 1 - 8/8/68	R.W.S.		
3		AS CONSTRUCTED	R.W.S.		

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
C J Cortright
ACTING DIVISION ENGINEER, REG. C.E. NO 7113

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

INTAKE TOWER AND FOOTBRIDGE

PLANS, SECTIONS AND DETAILS

RECOMMENDED 5-16-68
APPROVED COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN RAW | TRACED | CHKD | DRWG | SHEET 12 OF 23

1055-2 RECORD COPY

DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970

DEPARTMENT OF WATER RESOURCES SACRAMENTO

1970 OCT 6 AM 11 45

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.

APPROVED AS TO SAFETY

C J Cortright

DIVISION ENGINEER, REG. C.E. No. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO. 1055-2

APPROVED AS TO SAFETY

MAY 22 1968 C J Cortright

ACTING DIVISION ENGINEER, REG. C.E. NO 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE May 9, 1968

BY [signature]

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED	RWS.		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

INTAKE TOWER SECTIONS AND DETAILS

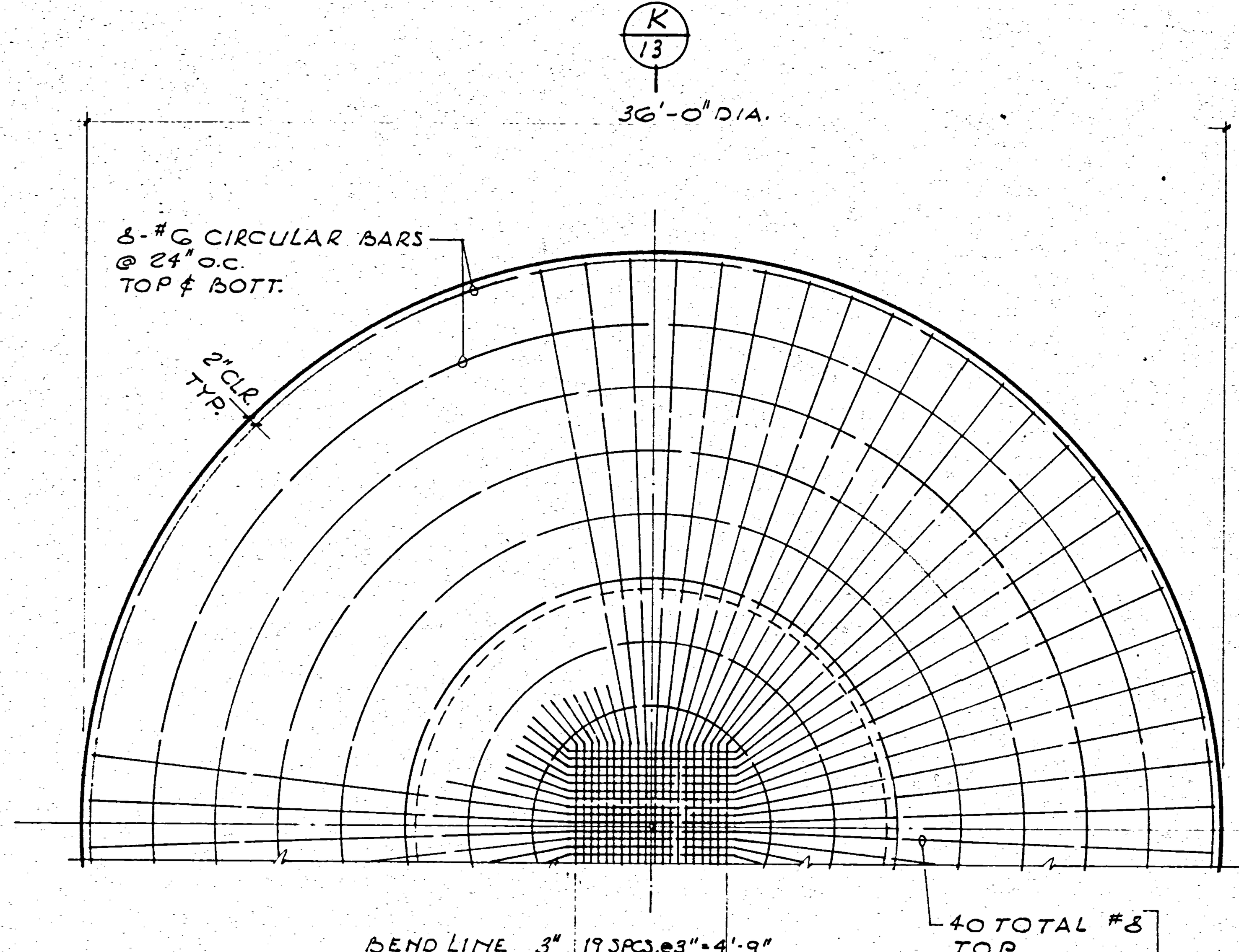
RECOMMENDED Richard A. Drake 5-11-68

APPROVED R. D. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 DATE 5-11-68

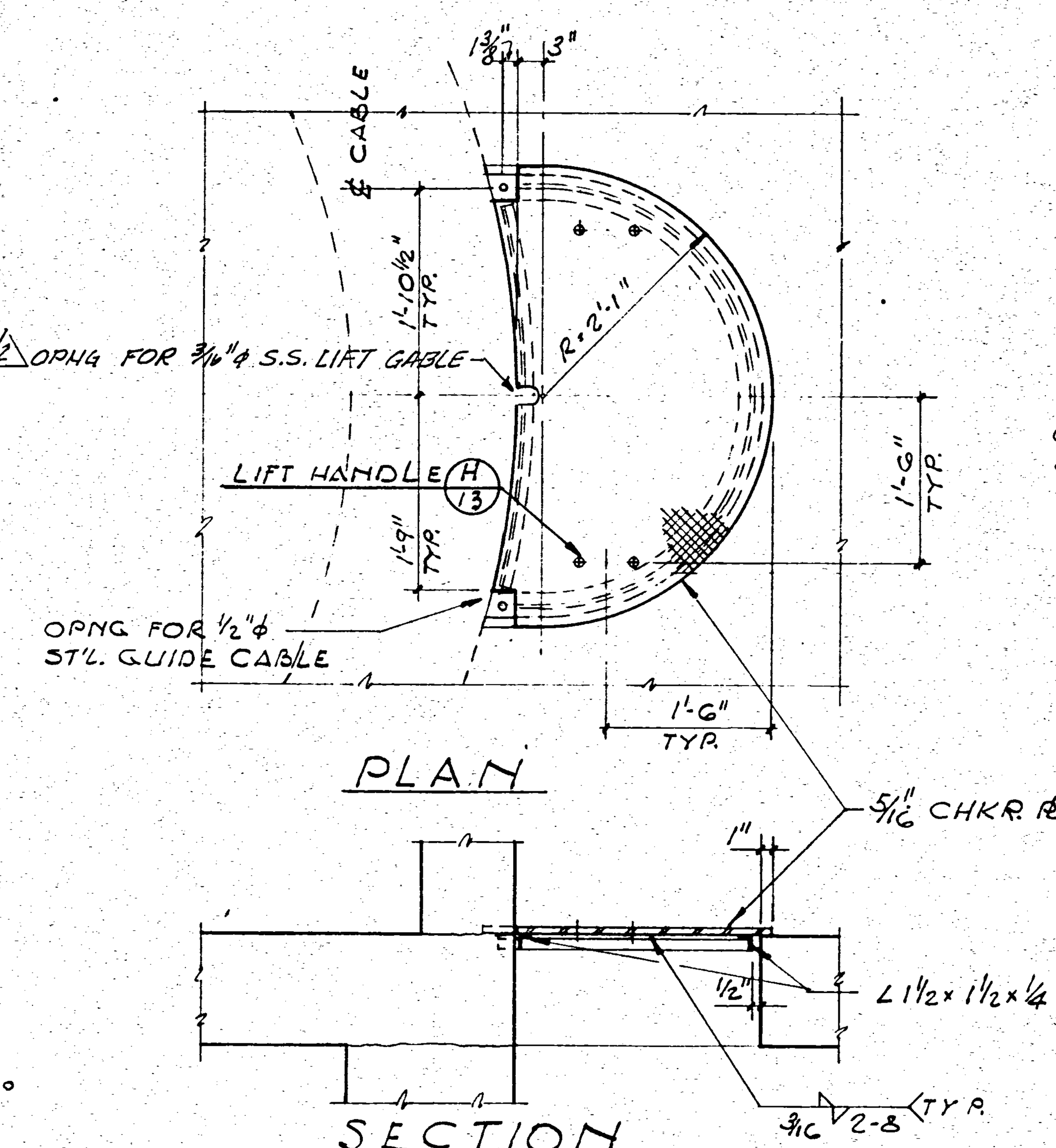
DRAWN JOO RAW TRACED CHKD DRWG SHEET 13 OF 23

1055-2

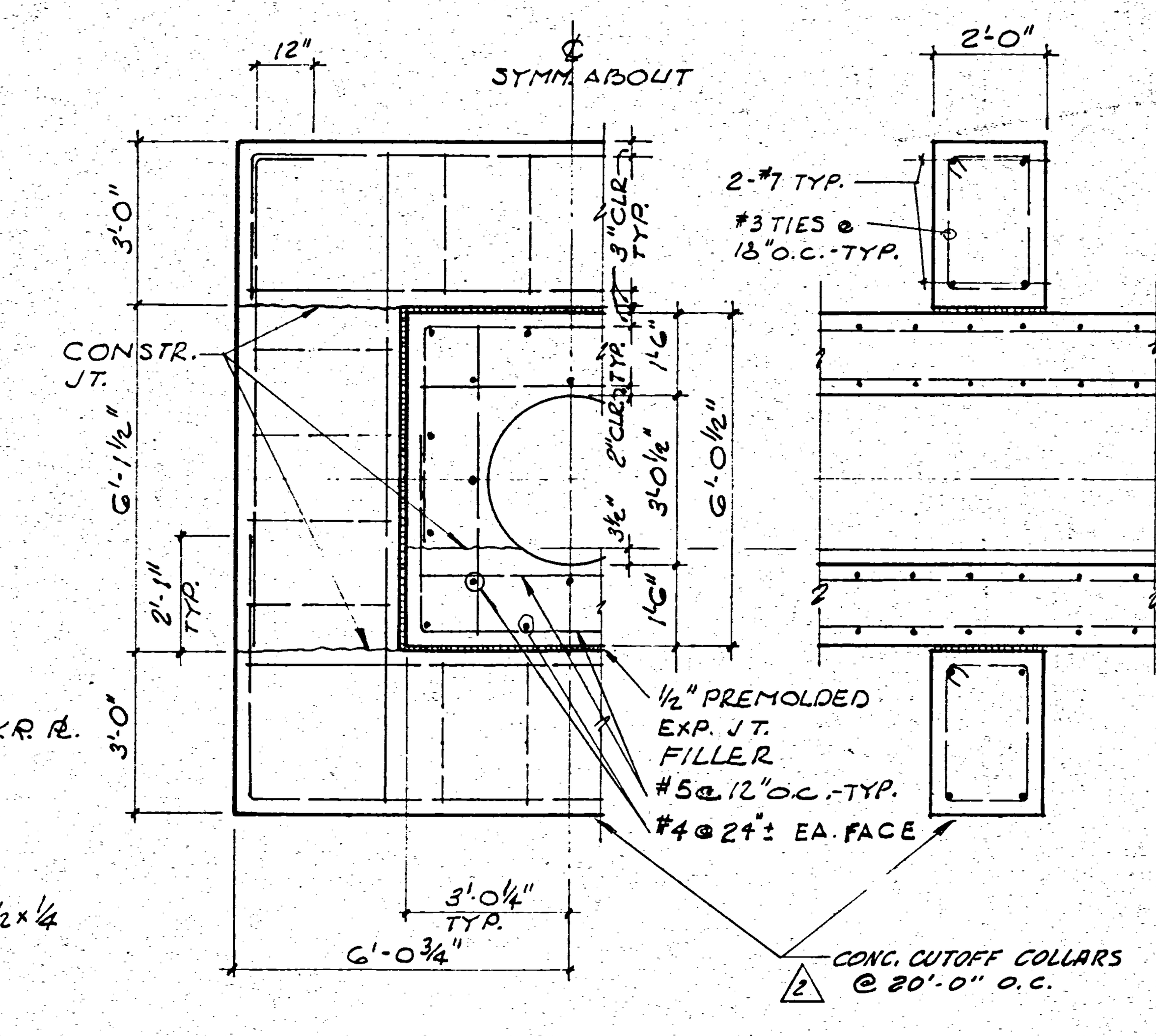
RECORD COPY
DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970



PLAN @ FOUNDATION (A/14)
1/4" = 1'-0"



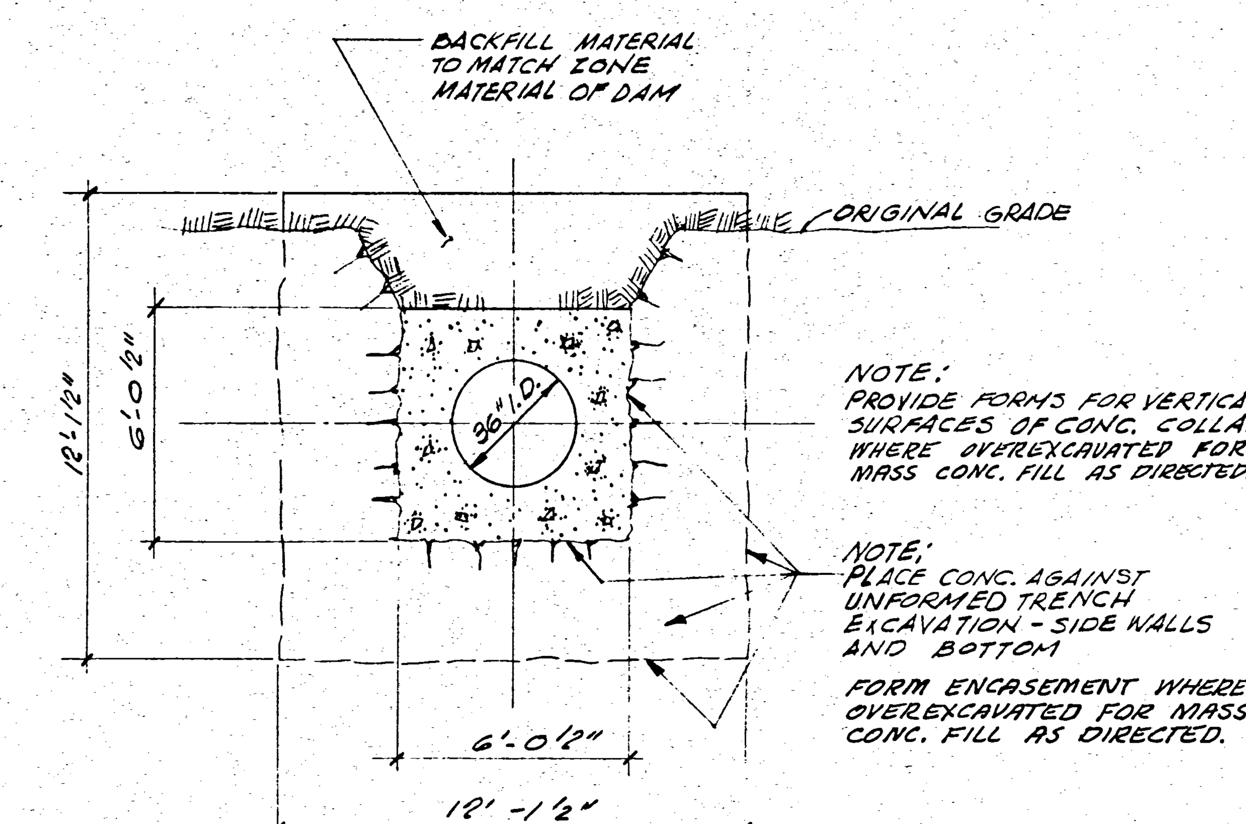
SECTION
HATCH COVER (B/14)
3/4" = 1'-0"



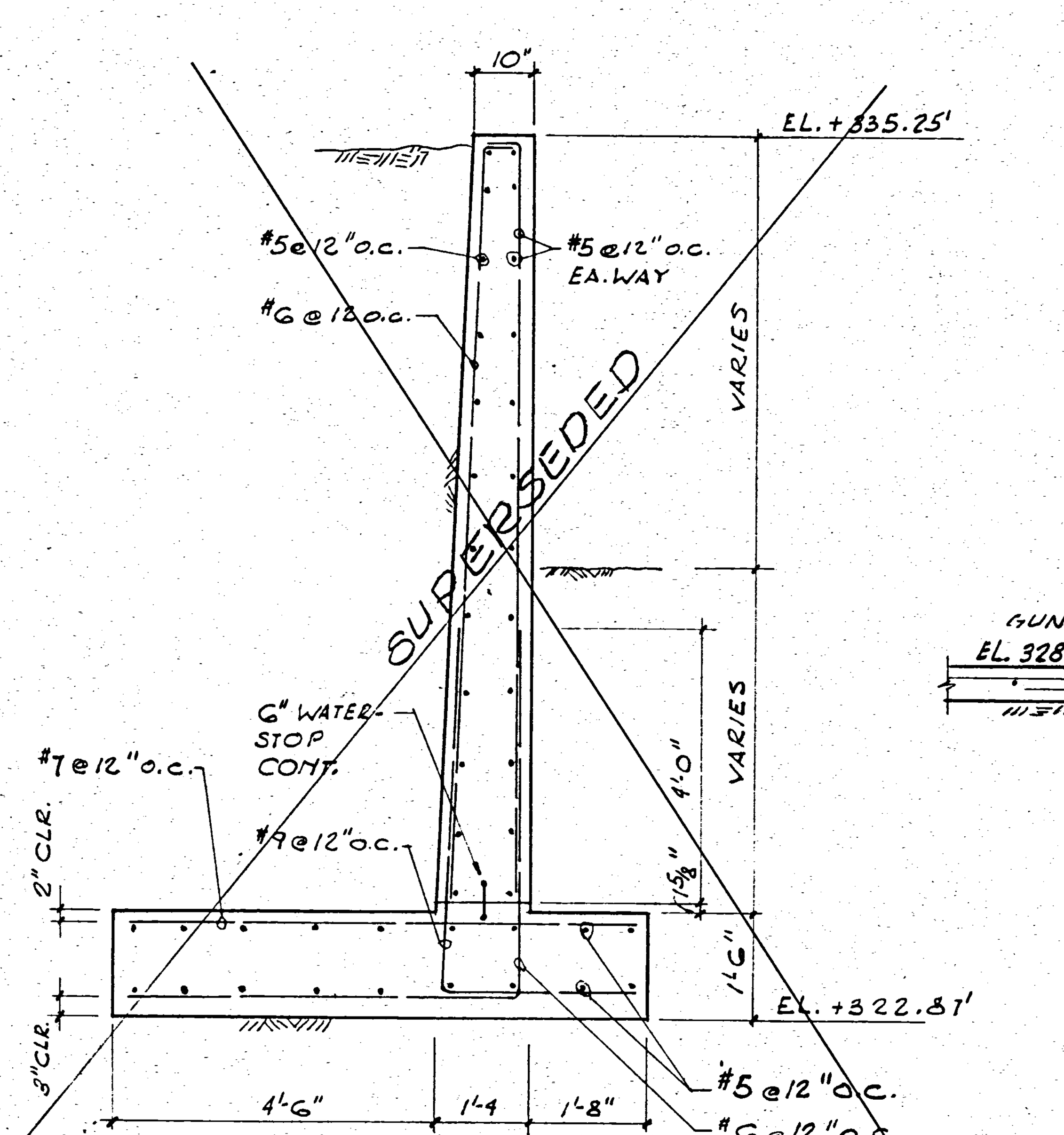
INTAKE LINE ENCASEMENT (F/14)
3/8" = 1'-0"

GENERAL NOTES:

1. PERMANENTLY EXPOSED FORMED EDGES SHALL BE CHAMFERED 3/4" x 3/4".
2. CONCRETE SHALL BE CLASS A-1" AND SHALL ATTAIN A MINIMUM ULTIMATE COMPRESSIVE STRENGTH OF 3000 psi AT 28 DAYS.
3. MINIMUM LAP OF REINFORCEMENT BARS SHALL BE 30 DIAMETERS OR 12" WHICHEVER IS GREATER, UNLESS OTHERWISE SHOWN.
4. STEEL REINFORCING BARS SHALL BE INTERMEDIATE GRADE, DEFORMED, CONFORMING TO ASTM 305.
5. APPLY 2 COATS OF SEALING COMPOUND TO ONE SIDE OF CONTRACTION JOINTS.
6. CONCRETE PROTECTIVE COVERING FOR REINFORCEMENT STEEL SHALL BE 2" WHEN FORMED AND 3" WHEN PLACED AGAINST GROUND, UNLESS OTHERWISE SHOWN.
7. ALL EQUIPMENT HOLD DOWN BOLTS SHALL BE FURNISHED AND INSTALLED BY THE CONTRACTOR IN ACCORDANCE WITH APPROVED MANUFACTURERS' DRAWING.
8. NO BACKFILL SHALL BE PLACED UNTIL THE CONCRETE HAS ATTAINED THE 28 DAY STRENGTH SPECIFIED.
9. PROVIDE AT CHANNEL WALL THE OFFSET SHOWN AT DETAIL (L/15)
10. ALL MISCELLANEOUS STEEL SHALL BE GALVANIZED AFTER FABRICATION, EXCEPT STAINLESS STEEL.
11. ALL VERTICAL CONSTRUCTION JOINTS SHALL BE CONSTRUCTED AS PER DETAIL (E/10)

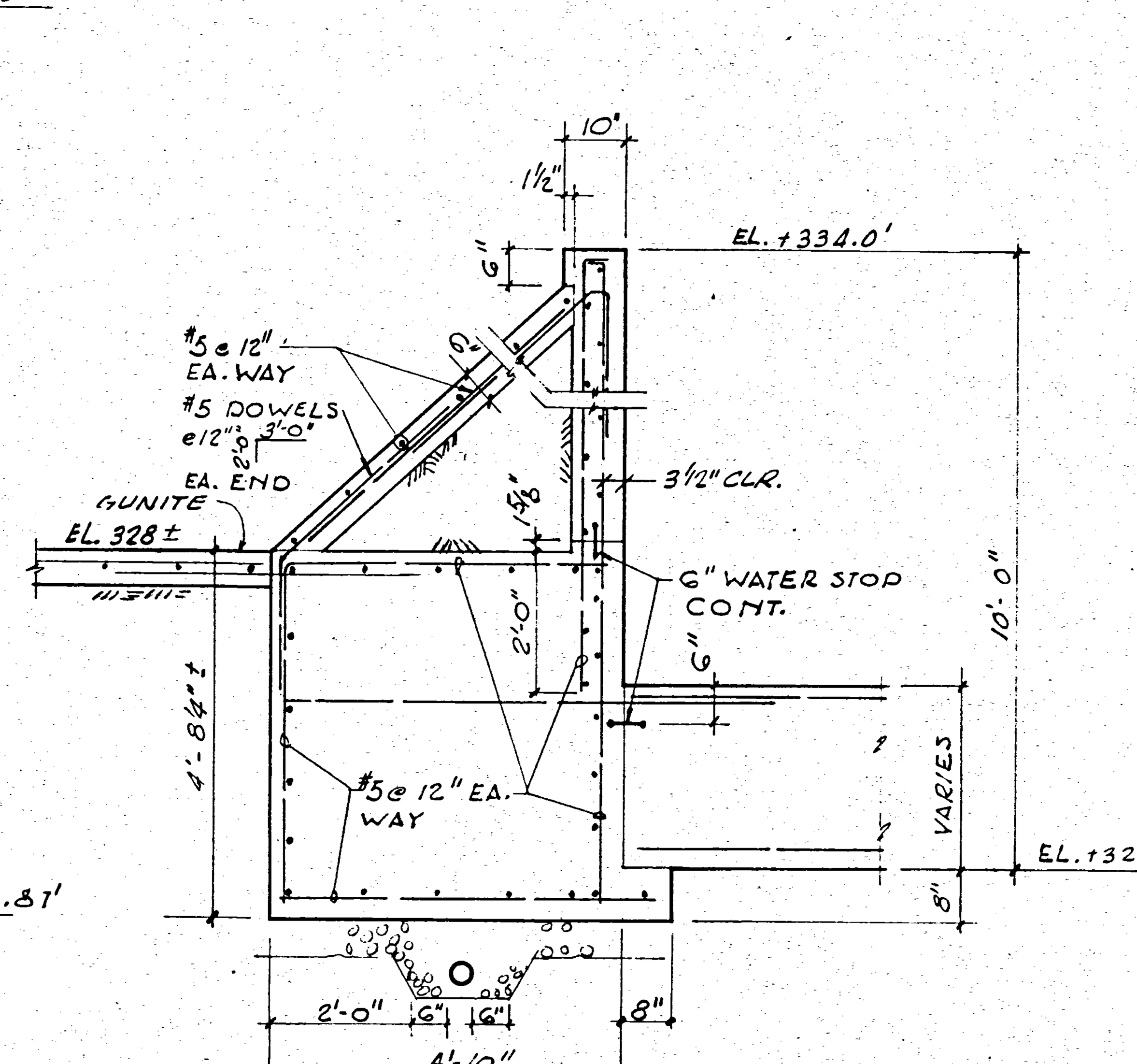


DETAIL OF INTAKE PIPE LINE
PLACED IN TRENCH WITHOUT FORMING
1/4" = 1'-0"

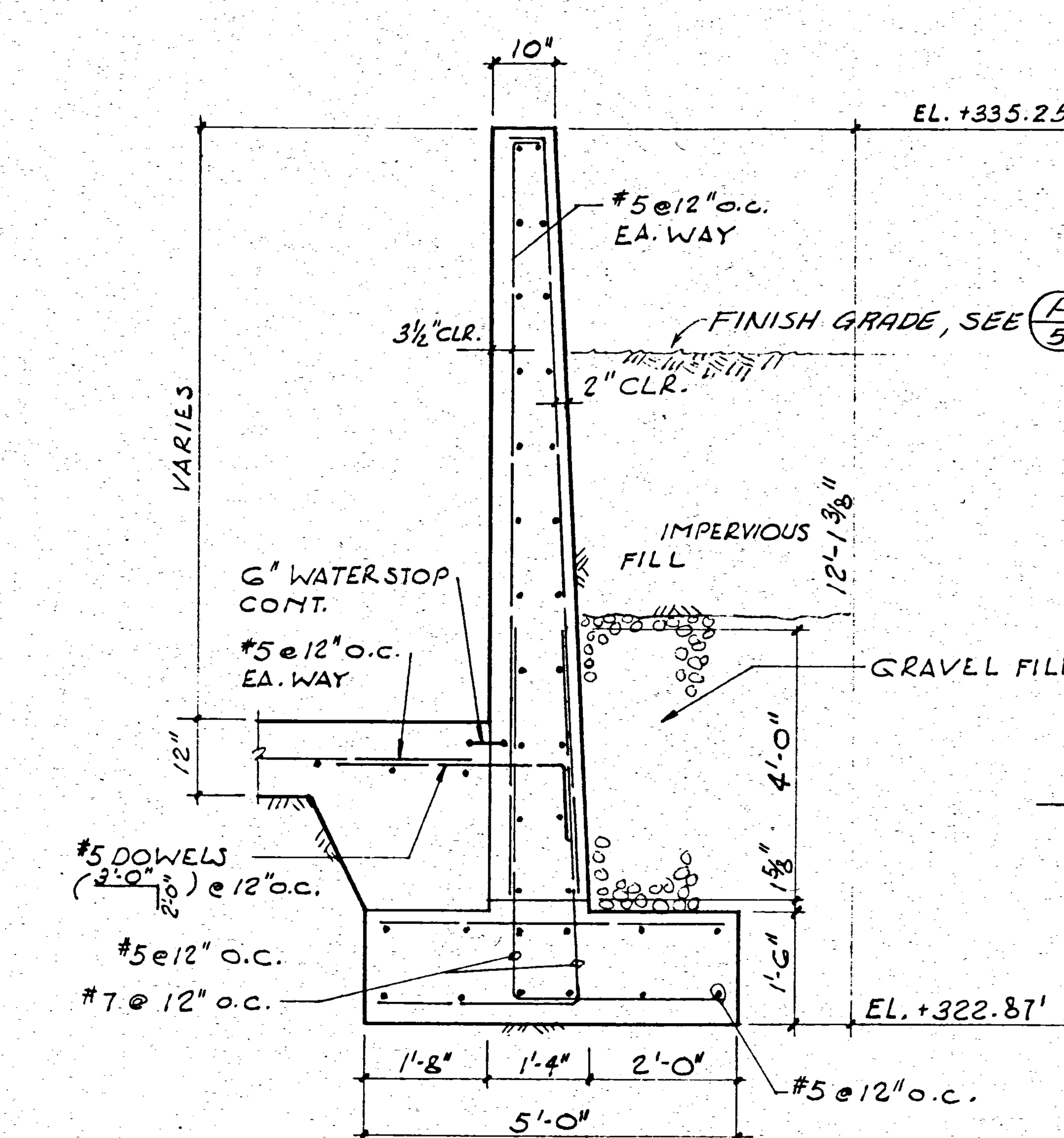


REPLACED BY SECTION (I/9) AS CONSTRUCTED

SECTION (C/14) 9
1/2" = 1'-0"



SECTION (D/14) 9
1/2" = 1'-0"



SECTION (E/14) 9
1/2" = 1'-0"

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968 C J Cortright
ACTING DIVISION ENGINEER, REG. CE NO. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
C J Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY [signature]

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		CHANGE ORDER #3 - 9/6/68	RWS		
2		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM AND RESERVOIR
INTAKE TOWER AND SPILLWAY
MISCELLANEOUS DETAILS AND GENERALS NOTES

RECOMMENDED Richard A. Drahn DATE 5-11-68
APPROVED R. D. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9414 DATE 5-11-68
DRAWN DDD RAW | TRACED | CHKD | DRWG | SHEET 14 OF 23

1055-2 RECORD COPY

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO. 1055-2
APPROVED AS TO SAFETY
MAY 22 1968
ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS
APPLICATION NO.
APPROVED AS TO SAFETY
NOV 16 1970
DIVISION ENGINEER. REG. C.E. NO. 7113

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9, 1968
BY

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM AND RESERVOIR
SPILLWAY AND CHANNEL SECTIONS
PIEZOMETER BUILDING DETAILS

RECOMMENDED 5-11-68
APPROVED COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 DATE 5-11-68
DRAWN M.I. TRACED CHKD DRWG SHEET 15 OF 23

1055-2 RECORD COPY

DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 46

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.

APPROVED AS TO SAFETY

NOV 16 1970

DIVISION ENGINEER, REG. C.E. No. 7113

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO. 1055-2

APPROVED AS TO SAFETY

MAY 22 1978

ACTING DIVISION ENGINEER, REG. C.E. NO. 7113

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

VALVE CHAMBER PLAN AND SECTION MISCELLANEOUS DETAILS.

RECOMMENDED Richard A. Drake — DATE 5-11-68
APPROVED R. W. Born — COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 — 5-11-68
DRAWN A.H.E. | TRACED S.K. | CHKD C.H.L. | DRWG | SHEET 16 OF 23

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE 5/9/68
BY Charles V. Lawrence R.C.E. 9037

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED	RWS.		

1055-2 RECORD COPY

DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970

TYPICAL BASKET SCREEN PLAN (A/17) — SCALE: 1/2" = 1'-0"

BASKET SCREEN SECTION (E/17) — SCALE: 1/2" = 1'-0"

CHAIN LINK FENCE (G/17) — SCALE: 1/2" = 1'-0"

BARB WIRE DETAIL (H/17) — NO SCALE

GATE DETAIL (I/17) — SCALE: 3/8" = 1'-0"

GUIDE CABLE ANCHOR DETAIL (B/17) — NO SCALE

BASKET SCREEN DETAIL (C/17) — SCALE: 1" = 1'-0"

BASKET SCREEN ELEVATION (F/17) — SCALE: 1/2" = 1'-0"

SPILLWAY INLETS DETAIL (J/17) — SCALE: 1" = 10'

FENCE CUT OUT DETAIL (D/17) — NO SCALE

PLANS PREPARED BY KOEBIG & KOEBIG, INC. ENGINEERING — ARCHITECTURE PLANNING

DATE 5/9/68

BY Charles H. Lawrance R.C.E. 9037

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED			

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

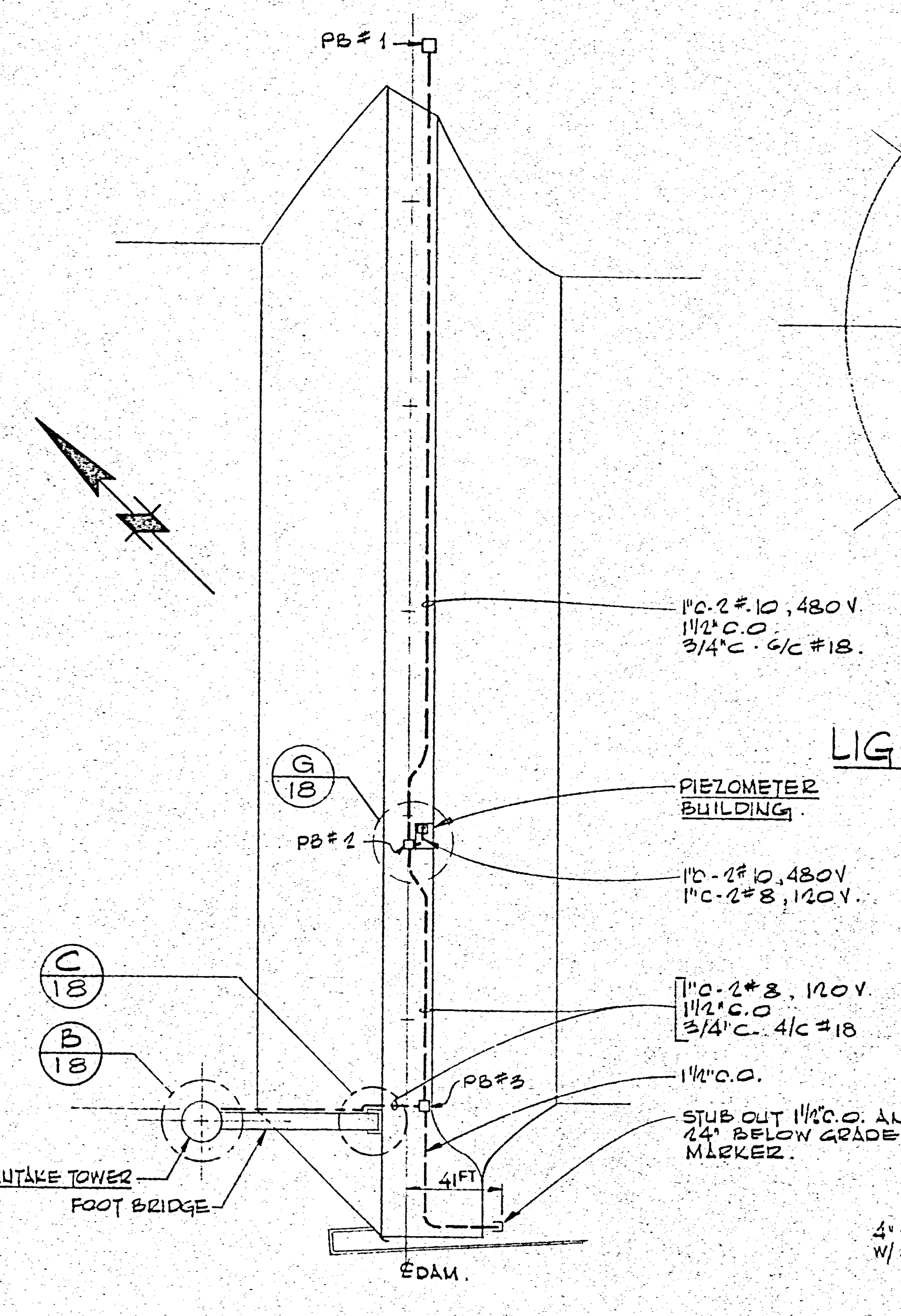
BASKET SCREEN PLAN AND DETAILS. FENCE DETAILS.

RECOMMENDED [signature] DATE 5-11-68

APPROVED [signature] COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68

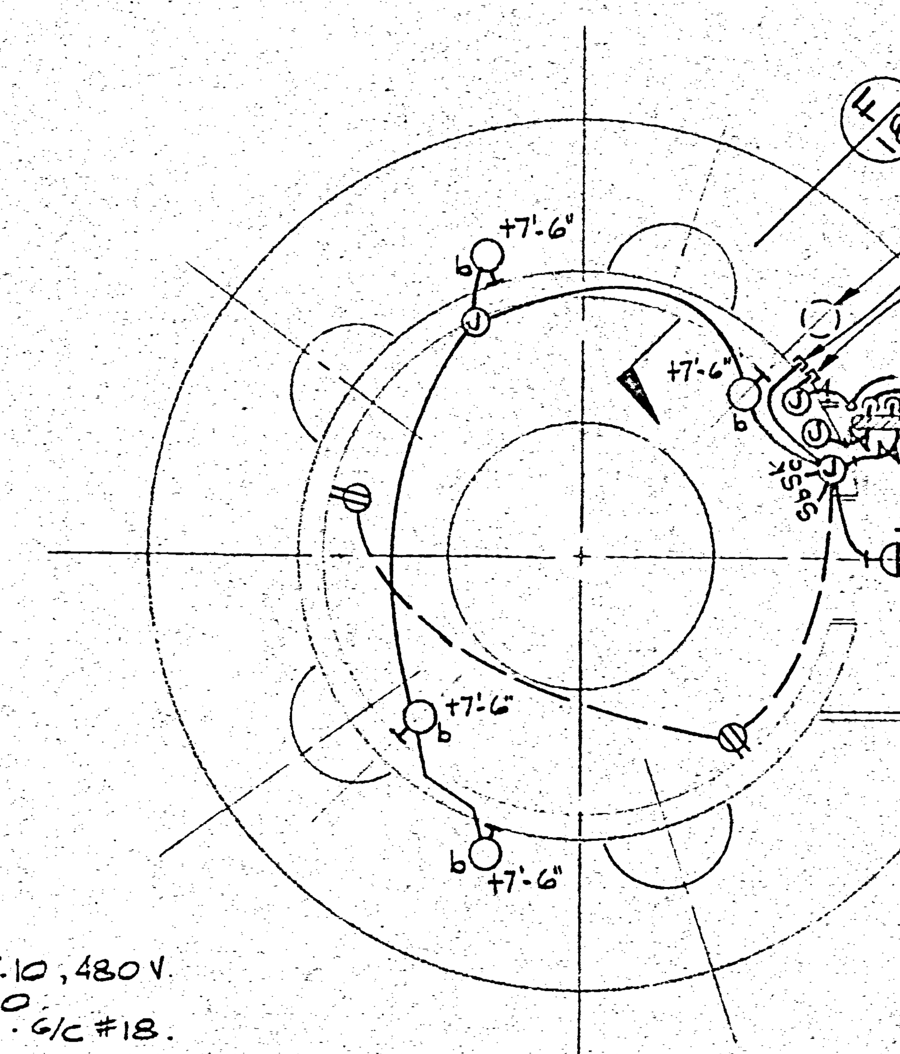
DRAWN A.H.E. TRACED S.K. CHKD C.H.L. DRWG SHEET 17 OF 23

1055-2 RECORD COPY



PLOT PLAN (A/18)

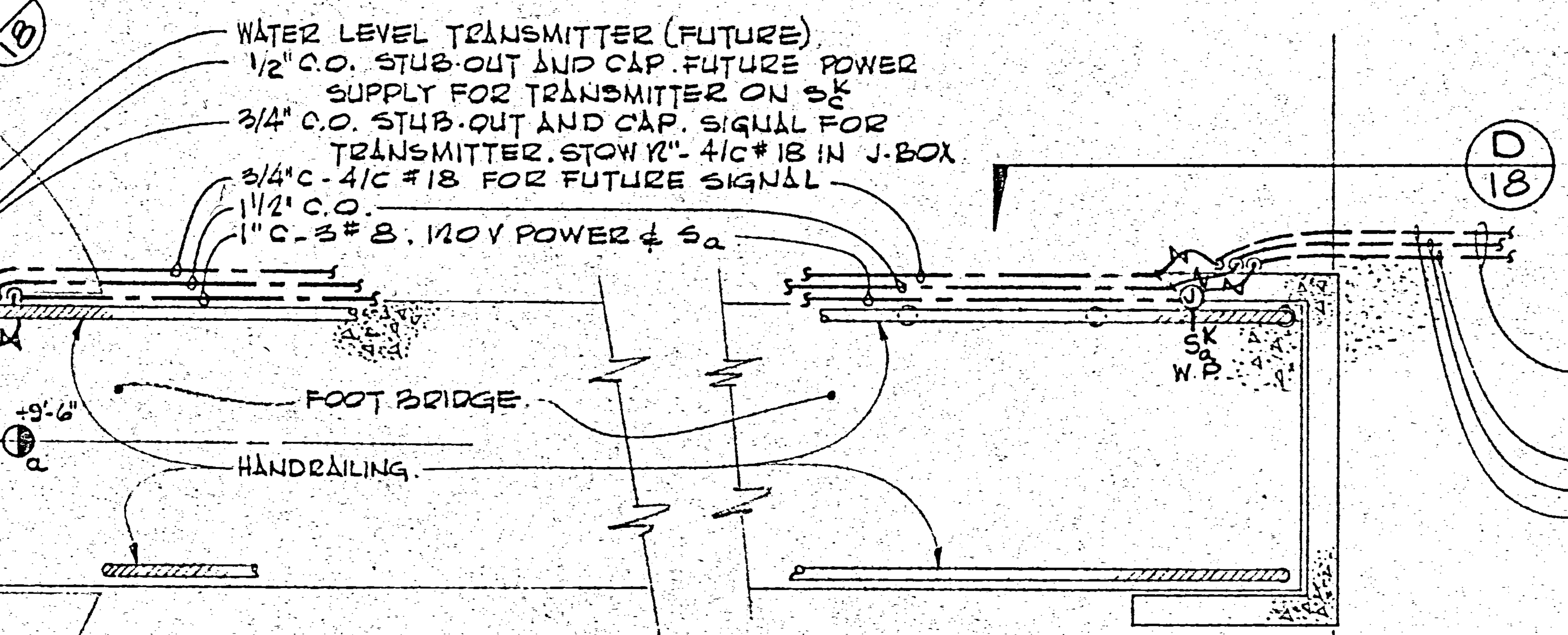
1" = 50'



LIGHTING & POWER PLAN

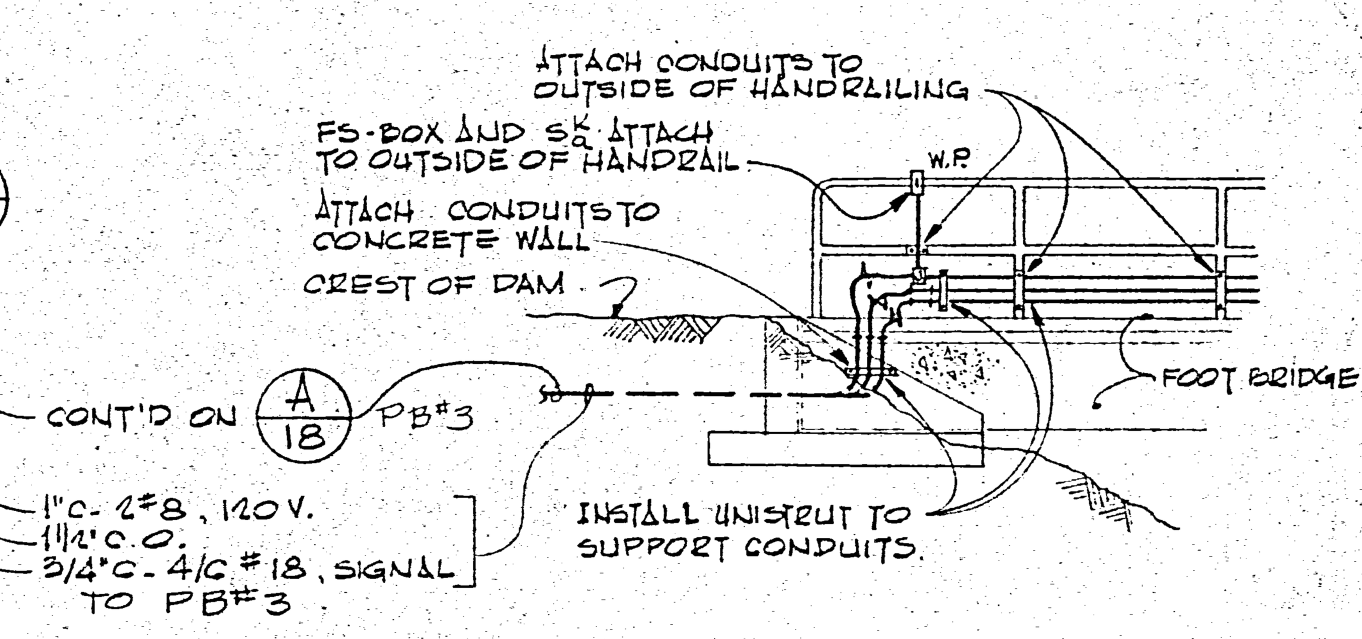
INTAKE TOWER (B/18)

SCALE: 1/4" = 1'-0"



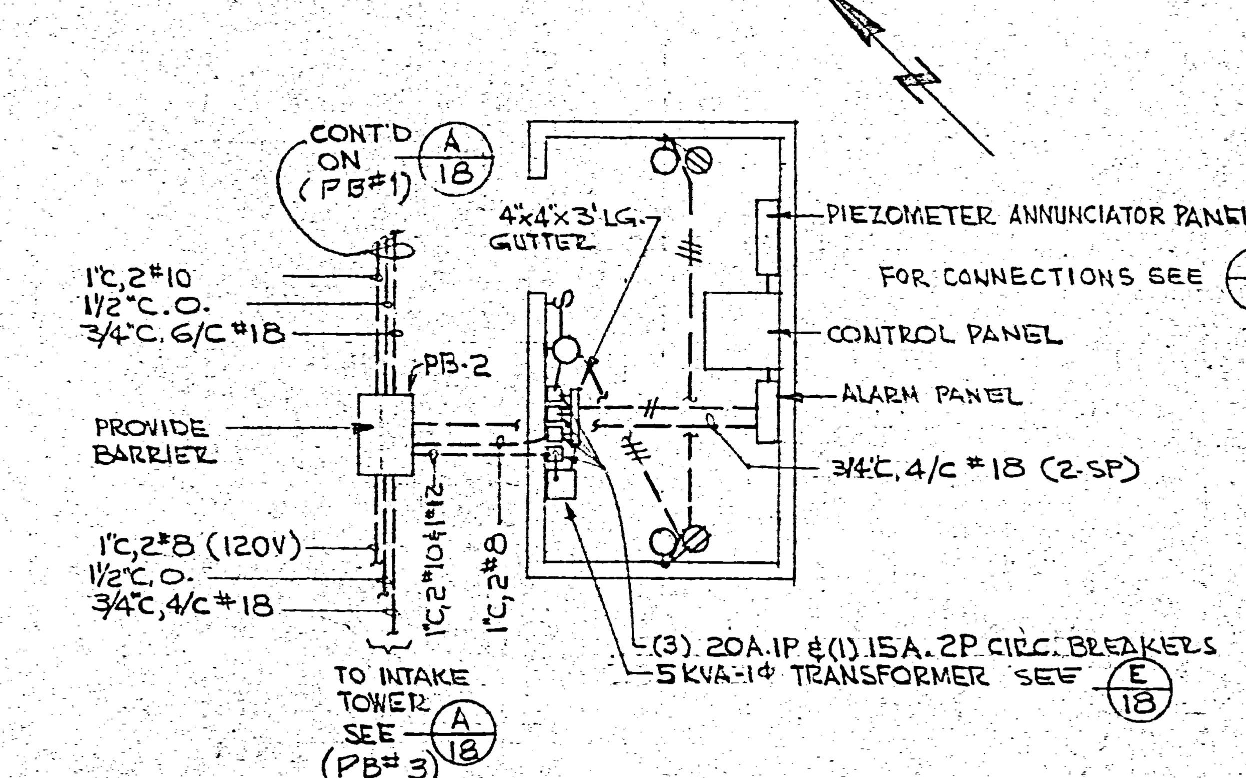
PARTIAL PLAN (C/18)

1/4" = 1'-0"



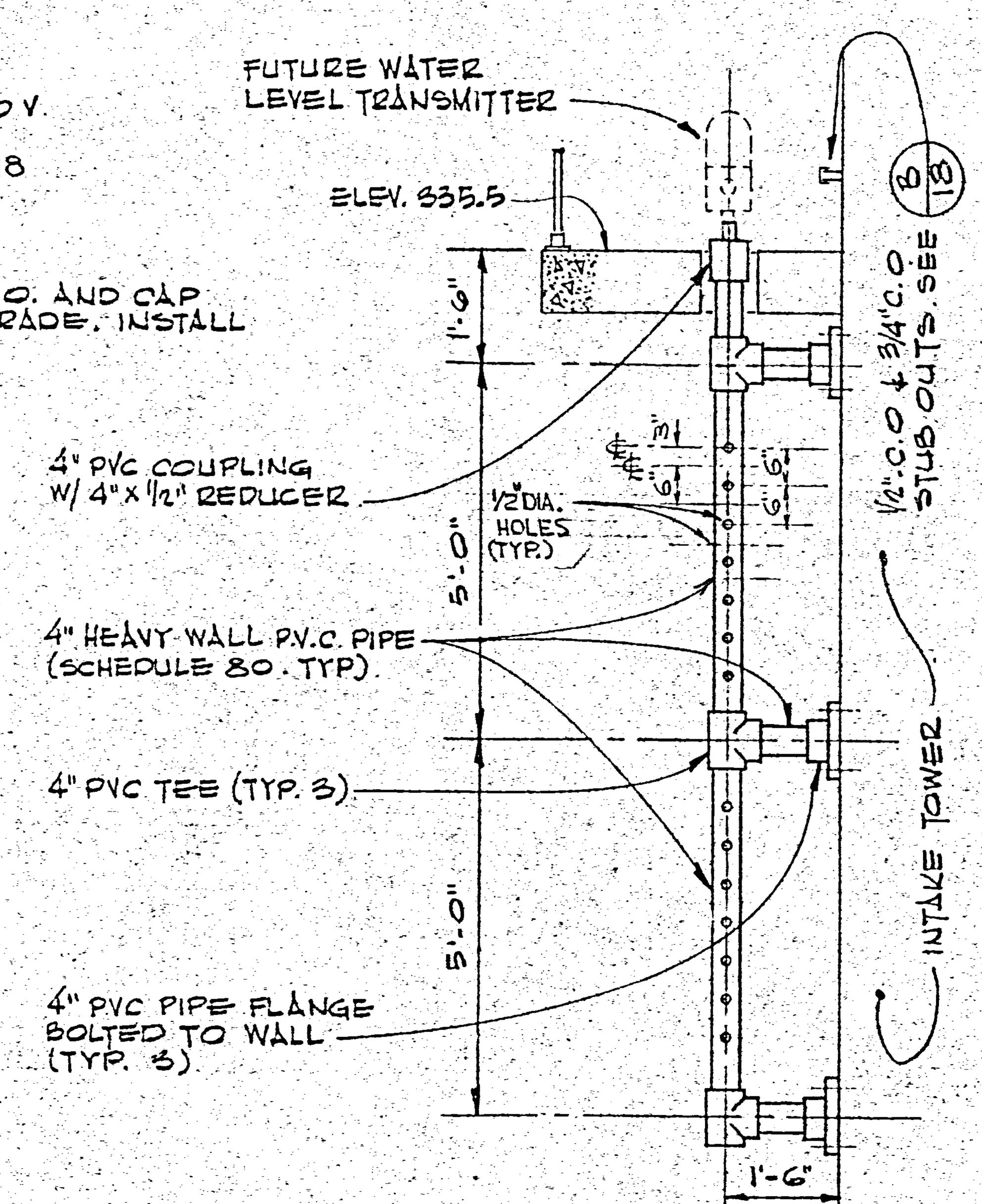
ELEVATION (D/18)

1/4" = 1'-0".



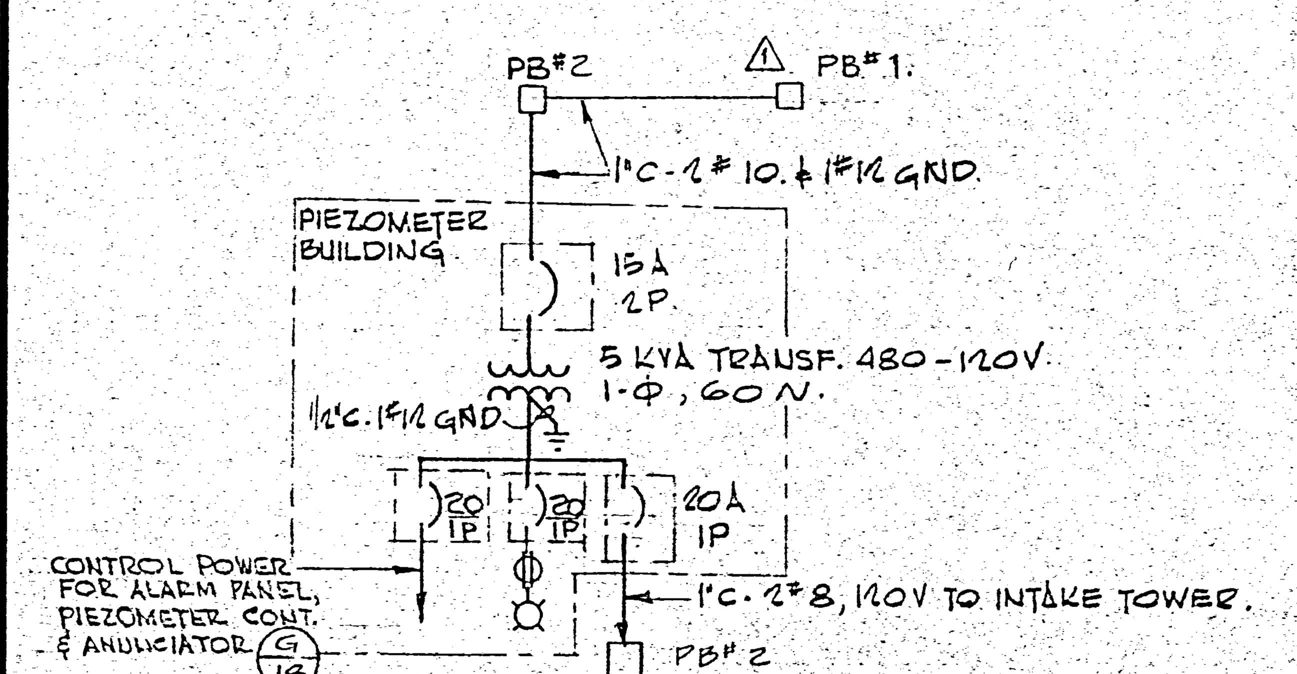
PIEZOMETER BLDG. DETAIL (G/18)

1/4" = 1'-0"



ELEVATION (F/18)

1/2" = 1'-0"



SINGLE LINE DIAGRAM (E/18)

NO SCALE

LEGEND

SYMBOL	DESCRIPTION.
———	CONDUIT RUN ABOVE GRADE, CONCEAL WHERE POSSIBLE SIZE AND NUMBER OF WIRES AS NOTED
– – – –	CONDUIT RUN BELOW GRADE OR IN FLOOR SIZE AND NUMBER OF WIRES AS NOTED.
— - — -	CONDUIT RUN EXPOSED. SIZE AND NUMBER OF WIRES AS NOTED.
⊢○	INCANDESCENT, WALL MOUNTED FIXTURE W/150 WATT LAMP, INSIDE FROSTED. A. MARCO CAT # 6201 VTG B. MC. PHILBEN CAT # 43-54 VT. C. HOLDCAST CAT # 2050
⊢◐	MERCURY VAPOR, WALL MOUNTED FIXTURE W/100 WATT COLOR IMPROVED MERCURY LAMP. A. HOLOPHANE CAT # 410-120 CG. B. MC. PHILBEN CAT # 7-15 C. MARCO CAT # 6-306.
	FLEXIBLE CONDUIT, WEATHER PROOF.
S_a^K	SINGLE POLE TOGGLE SWITCH +4'-6" a INDICATES SWITCH DESIGNATION. K INDICATES KEY OPERATED
Ⓙ	JUNCTION BOX.
T	TRANSFORMER.
⊖	15 AMP, 3-WIRE, GROUNDING TYPE, CONVENIENCE OUTLET. +12".
□	PULL BOX, PRECAST CONCRETE. WITH BARRIER (2'x3'x3')
C.O.	CONDUIT ONLY.
W.P.	WEATHER PROOF.

DIVISION OF SAFETY OF DAMS DEPARTMENT OF WATER RESOURCES OCT 6 1970

WATER RESOURCES SACRAMENTO 1970 OCT 6 AM 11:56

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE May 9 1968
BY

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

ELECTRICAL PLAN AND DETAILS

RECOMMENDED — DATE 5-11-68
APPROVED — COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 — 5-11-68
DRAWN H.J.T. TRACED H.J.T. CHKD W.A. DRWG SHEET 18 OF 23

1055-2 RECORD COPY

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

PERIMETER CHANNEL

STA. 0+25 TO STA. 35+00

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE 5-10-68
BY K. G. Tromberger RCE 10651

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1		AS CONSTRUCTED	RWS		KGo.

RECOMMENDED Richard A. Drahen — COUNTY HYDRAULIC ENGINEER R C E NO. 9614 — DATE 5-11-68
APPROVED R. L. Born — 5-11-68
DRAWN S.T. TRACED A.R. CHKD DRWG SHEET 19 OF 23

1055-2 RECORD COPY

1055-2 RECORD COPY

APPROVAL RECOMMENDED May 16 1968
BY: B. Ward Whelan
ASSISTANT ROAD COMMISSIONER R.C.E. 14746
APPROVED MAY 17 1968
[signature]
COUNTY ROAD COMMISSIONER AND SURVEYOR R.C.E. 10197

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING
DATE 5-10-68
BY R. G. [signature] R.C.E. 12657

REV. NO	DATE	REVISIONS	REV.	CKD	APP
1	7-11-68	ADDENDUM Nº 2	RWS		
2		AS CONSTRUCTED	RWS		

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

BIDDLE RANCH ROAD

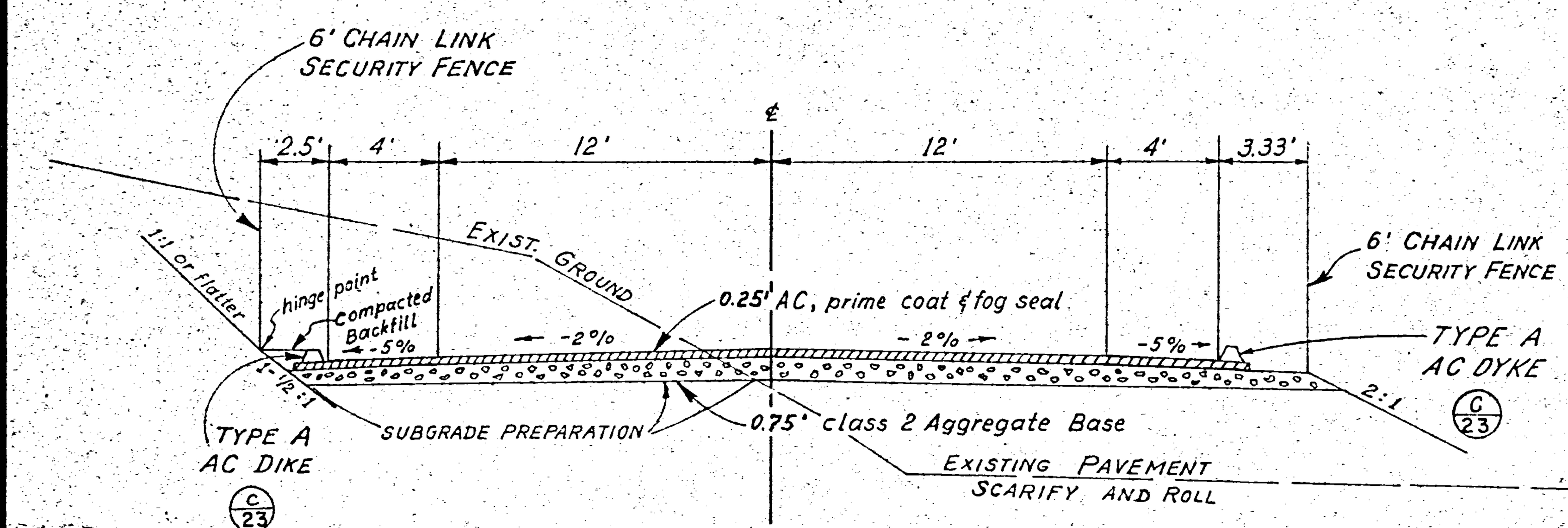
STA. 9+00 TO STA. 23+00

RECOMMENDED Richard A. Drahos DATE 5-11-68
APPROVED [signature] COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN S.T. TRACED A.R. CHKD DRWG SHEET 21 OF 23

1055-2 RECORD COPY

10/66 DIETERICH-POST CLOTH

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT
LOPEZ WATER SUPPLY PROJECT
TERMINAL DAM AND RESERVOIR
BIDDLE RANCH ROAD
STA. 23+00 TO STA. 33+00
SHEET 22 OF 23
DRAWN S.T.
TRACED A.R.
PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING
DATE 5-10-68
APPROVAL RECOMMENDED May 16 1968
ASSISTANT ROAD COMMISSIONER
R.C.E. 14746
APPROVED May 17 1968
COUNTY ROAD COMMISSIONER AND SURVEYOR
R.C.E. 10197
REV. NO.
DATE
REVISIONS
REV.
CKD
APP
1 7-11-68 ADDENDUM Nº 2 R.W.S.
2 2-11-69 CHANGE ORDER Nº 4 (4-9-68) R.W.S.
3 AS CONSTRUCTED R.W.S.
RECOMMENDED
APPROVED
COUNTY HYDRAULIC ENGINEER
1055-2
RECORD COPY
DIVISION OF SAFETY OF DAMS
DEPARTMENT OF WATER RESOURCES
OCT 6 1970
DEPARTMENT OF WATER RESOURCES SACRAMENTO
1970 OCT 6 AM 11 46
200' V.C.
400' V.C.
CONFORM
FINISH GRADE
EXIST. GROUND
+0.32%
END PROJECT 33+00
PLAN DETAIL "A" NO SCALE
TOP, FACE OF DIKE
18"x4" OPENING
36" CMP D1
TOP OF EMBANKMENT
PROFILE "A" STATION 23+00
PLACE 40 LF 18" CMP 16 GAUGE & 2-36" CMP D1s
36" CMPDI H=4'
INVERT 328.6
INVERT 328.8
F.G. 332.16
SCALES:
HORIZ: 1"=50'
VERT: 1"=5'
LAYOUT LINE PERIMETER CHANNEL SHEET 20
50' TRANSITION, BENCH TO PERIMETER CHANNEL
10' GRADED BENCH - SEE DETAIL B 23
N 619,489.259
E 1,242,919.347
PI
S=0.002
N 70°11'28"W
N 68°49'58"W
1398.26'
12' SINGLE GATE
3 STRANDS BARBED WIRE
EXISTING EDGE OF PAVEMENT
BIDDLE RANCH ROAD
DELETED GATE NO SCALE
END CHAIN LINK FENCE 34+02±
BY OTHERS
INV. 348.0
F/L= 347.0
33+00 PLACE 60 LF 22"x13" CMPA-16Ga
INV. 348.3
STA. 33+10 INSTALL 12' SINGLE GATE
CONFORM 33+00
23+00 Construct D.I. & Culvert per Profile "A" and note below.
23+35 - EXTEND EXIST. CULV. W/ 10'- 8" CMP
23+50 - PLACE 72' OF 24" RCP CL. III
EXIST. CULVERT TO REMAIN IN PLACE. CLEAN TO DRAIN.
REMOVE EXISTING FENCE
INSTALL CHAIN LINK SECURITY FENCE 8+32± TO 34+02±
B.C. 28+11.89
E.C. 30+48.96 (OLD STATION 18+93.70)
28+16 RT. TO 28+24 RT. SINGLE 8' C.L. GATE IN FENCE
R = 10,000'
Δ = 1°21'30"
T = 118.54'
L = 237.07'
NOTE:
INSTALL 36" CMPDI BEHIND AC DIKE AT STA. 23+00 AND PROVIDE OPENING TO DRAIN - COVER SHALL BE STEEL CHECKER PLATE AS SHOWN IN STANDARD PLANS - SHEET D75-5 H=4'00"
DETAIL 0.17 DIKE NO SCALE
STA. 28+14 TO 28+39
and as required
SURFACING
Scale: 1"=50'

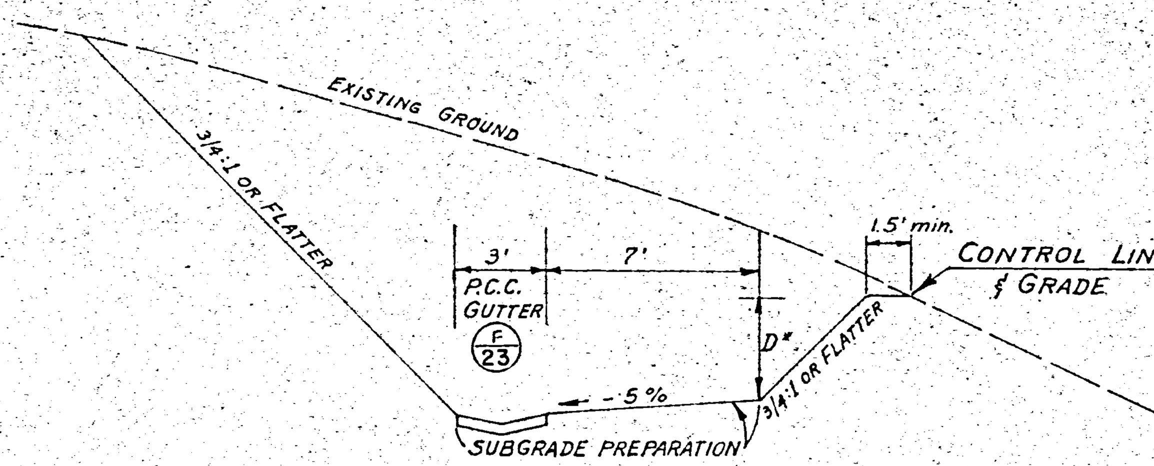


TYPICAL SECTION (A/23)
BIDDLE RANCH ROAD
NO SCALE

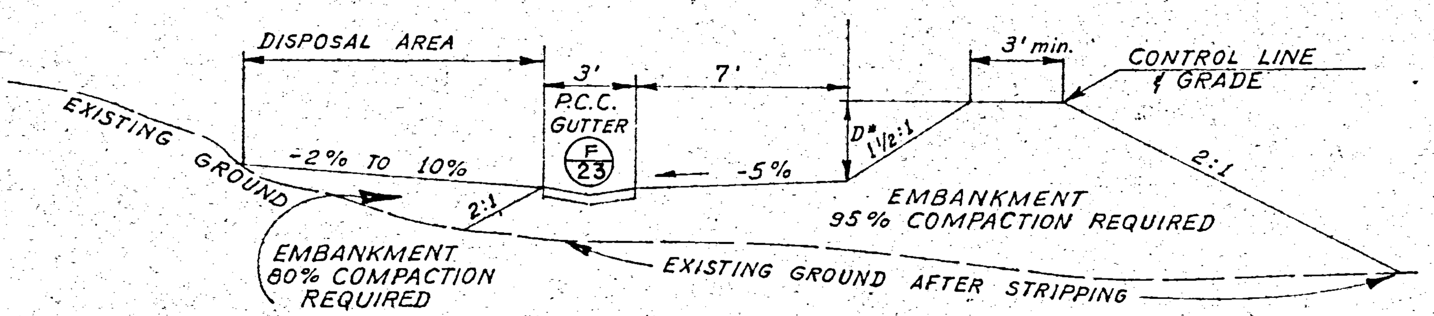
DESIGN DESIGNATION
ADT (67) = 650   D = 60%
ADT (87) = 1950   T = 8%
DHV = 350   V = 50 mph
T.I. = 6

REQ. GE = 1.4016 MIN. R = 27 (top 2')

ACTUAL THICKNESS	MATERIAL	GRAVEL EQUIVALENT
0.25'	A.C.	.58
0.75'	Cl 2 AB	.825
1.00		1.405

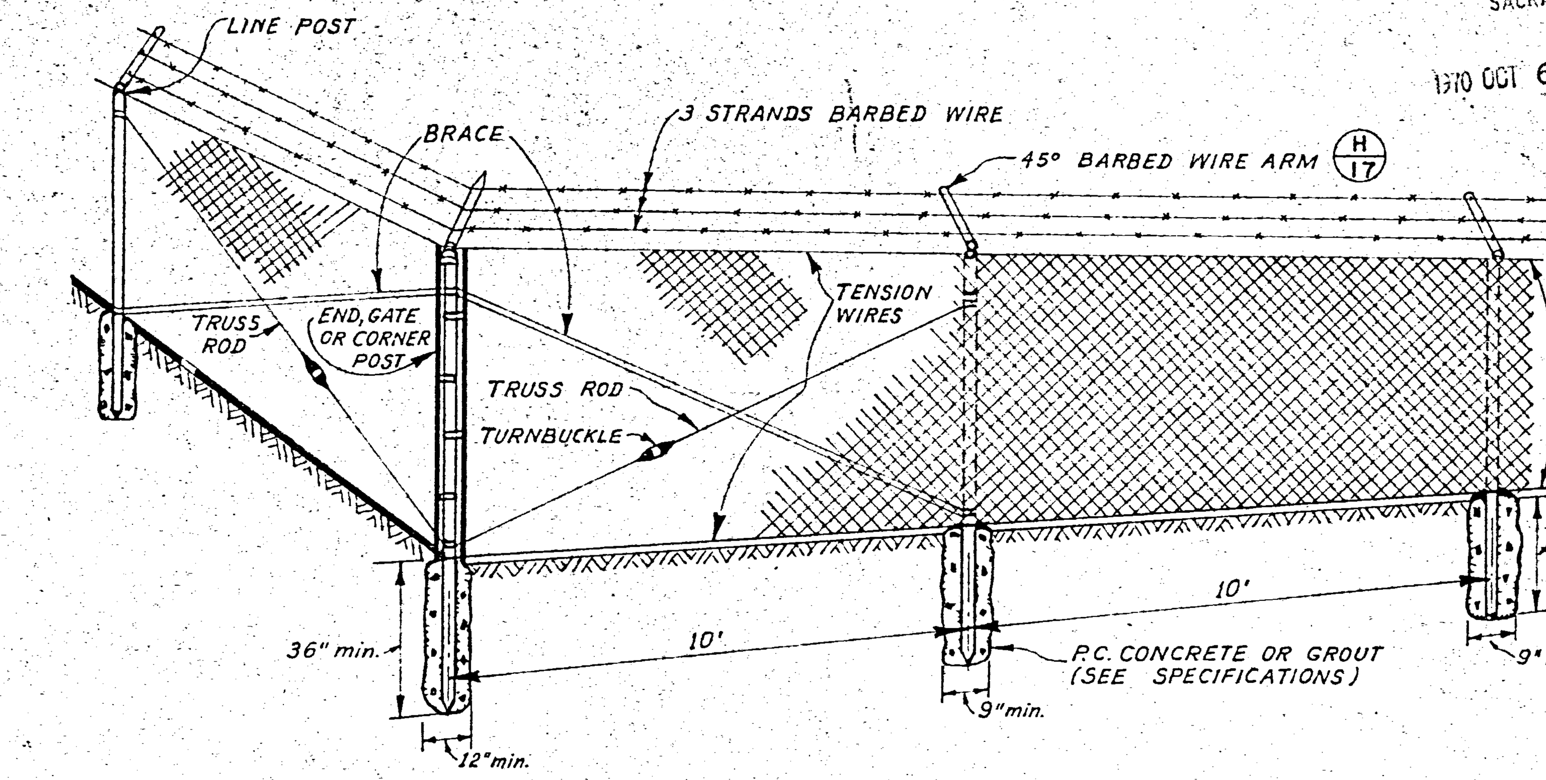


PERIMETER CHANNEL TYPICAL SECTION (D/23)
SCALE: 1" = 5'

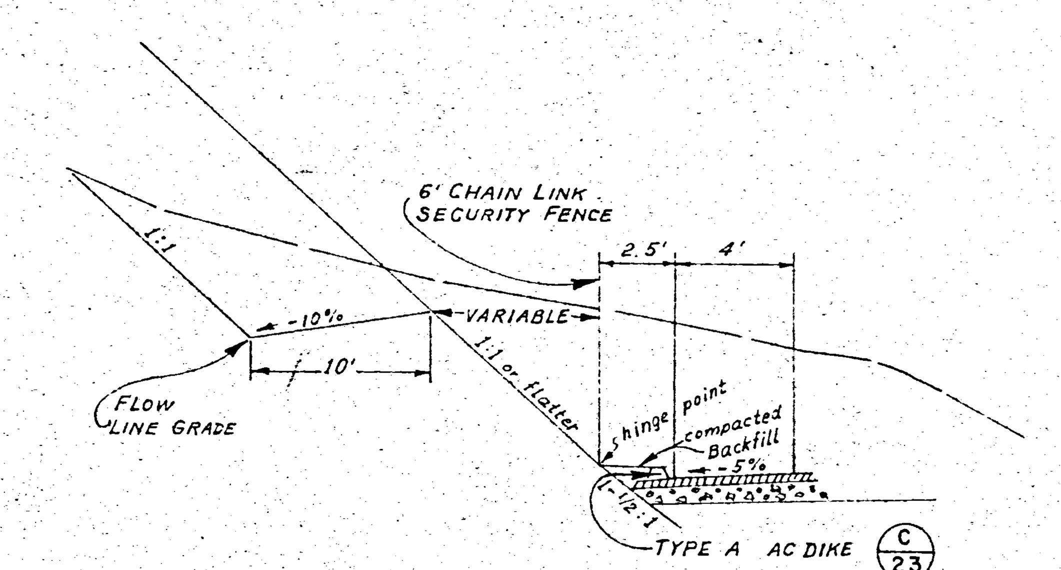


PERIMETER CHANNEL EMBANKMENT SECTION (E/23)
SCALE: 1" = 5'

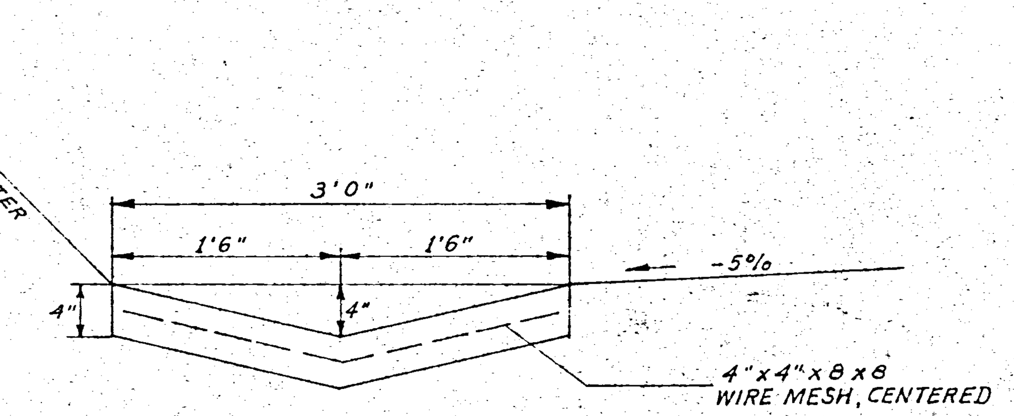
APPROXIMATE STATION TO STATION		D* DEPTH
0+00	25+00	3.5
25+00	50+00	3.0
50+00	72+00	2.25
72+00	88+00	2.0



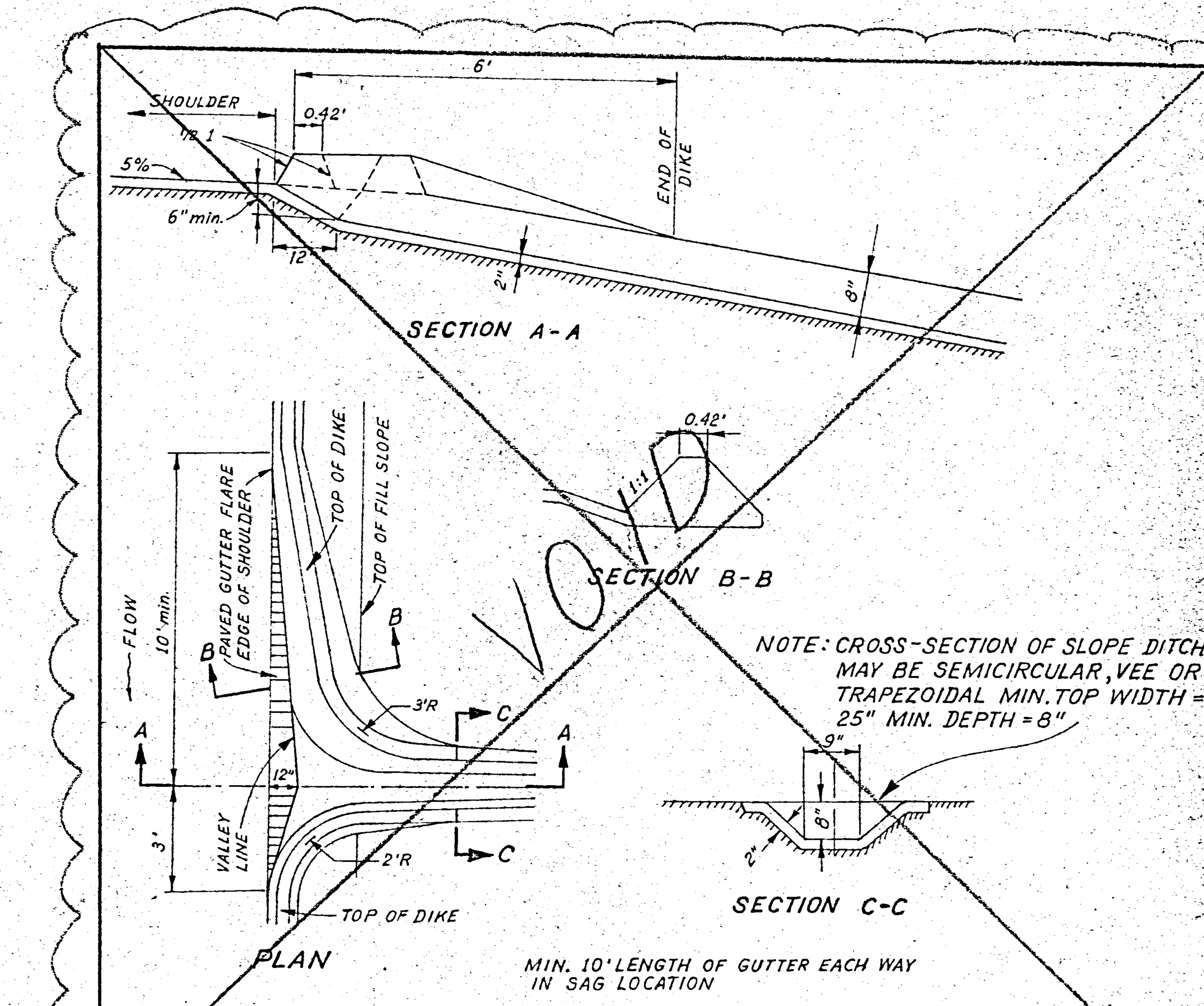
CHAIN LINK SECURITY FENCE (H/23)
STA. 8+32± TO STA. 34+02±
BIDDLE RANCH ROAD
NO SCALE



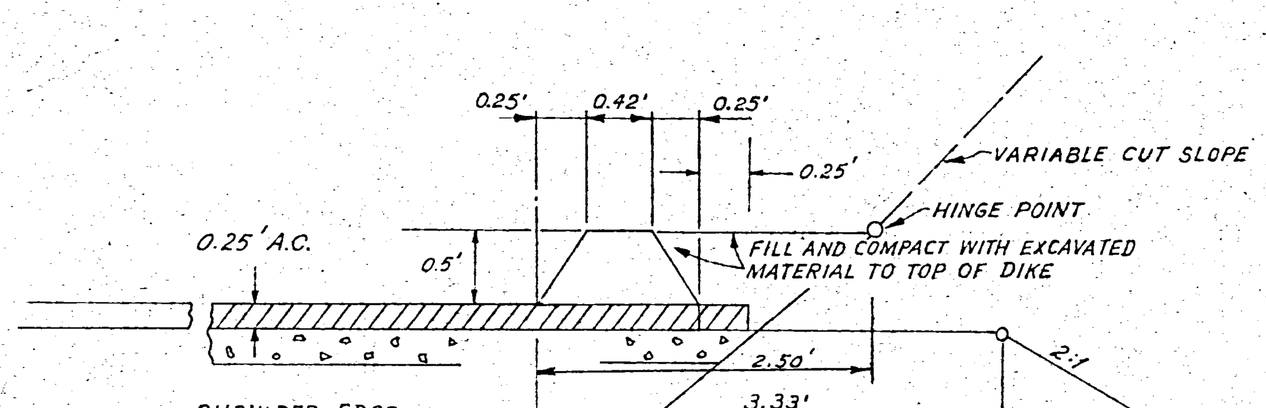
TYPICAL BENCH SECTION (B/23)
STA. 28+00 to STA. 33+00
BIDDLE RANCH ROAD
NO SCALE



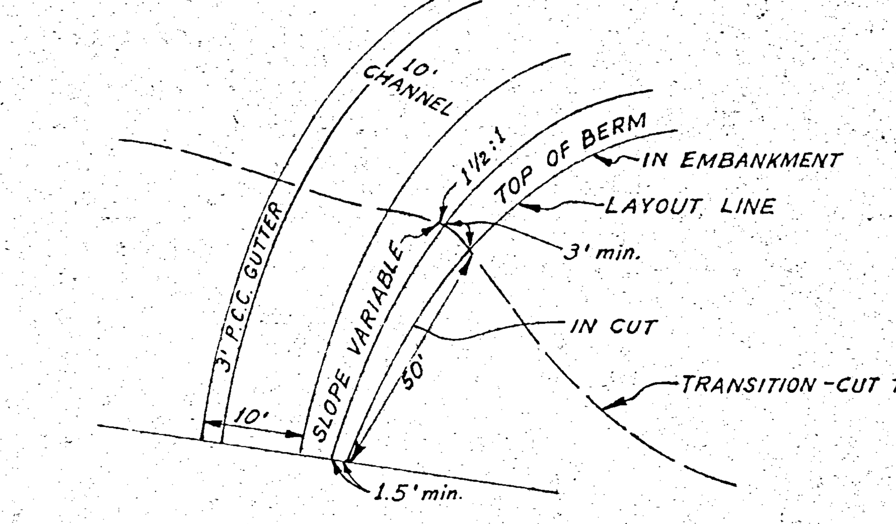
P.C.C. GUTTER DETAIL (F/23)
SCALE: 1" = 1'



ASPHALT CONCRETE SPILLWAY (I/23)
NO SCALE



TYPE 'A' A.C. DIKE (C/23)
BIDDLE RANCH ROAD
NO SCALE



PERIMETER CHANNEL TRANSITION DETAIL (G/23)
NO SCALE

APPROVAL RECOMMENDED May 16 1968
BY: R. Ward Phelps
ASSISTANT ROAD COMMISSIONER R.C.E. 14746
APPROVED May 17 1968
C.C. Boh
COUNTY ROAD COMMISSIONER AND SURVEYOR R.C.E. 10197

REV. NO.	DATE	REVISIONS	REV.	CKD	APP.
1	7-11-68	ADDENDUM Nº 2	R.W.S.		
		AS CONSTRUCTED			

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE PLANNING
DATE 5-10-68
BY K. G. Trautvetter R.C.E. 10651

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM AND RESERVOIR

ROADWAY AND PERIMETER CHANNEL

TYPICAL DETAILS

RECOMMENDED Richard A. Decker DATE 5-11-68
APPROVED R.D. Born COUNTY HYDRAULIC ENGINEER R.C.E. NO. 9614 5-11-68
DRAWN S.T. TRACED A.R. CHKD DWG SHEET 23 OF 23

1055-2

RECORD COPY

DEPARTMENT OF
WATER RESOURCES
SACRAMENTO
1970 OCT 6 AM 11 47

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.

APPROVED AS TO SAFETY

NOV 16 1970

C J Cortright
DIVISION ENGINEER. REG. C.E. No. 7113

DIVISION OF
SAFETY OF DAMS
DEPARTMENT OF
WATER RESOURCES
OCT 6 1970

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE 1-15-69
BY KHD

SAN LUIS OBISPO COUNTY FLOOD CONTROL
AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

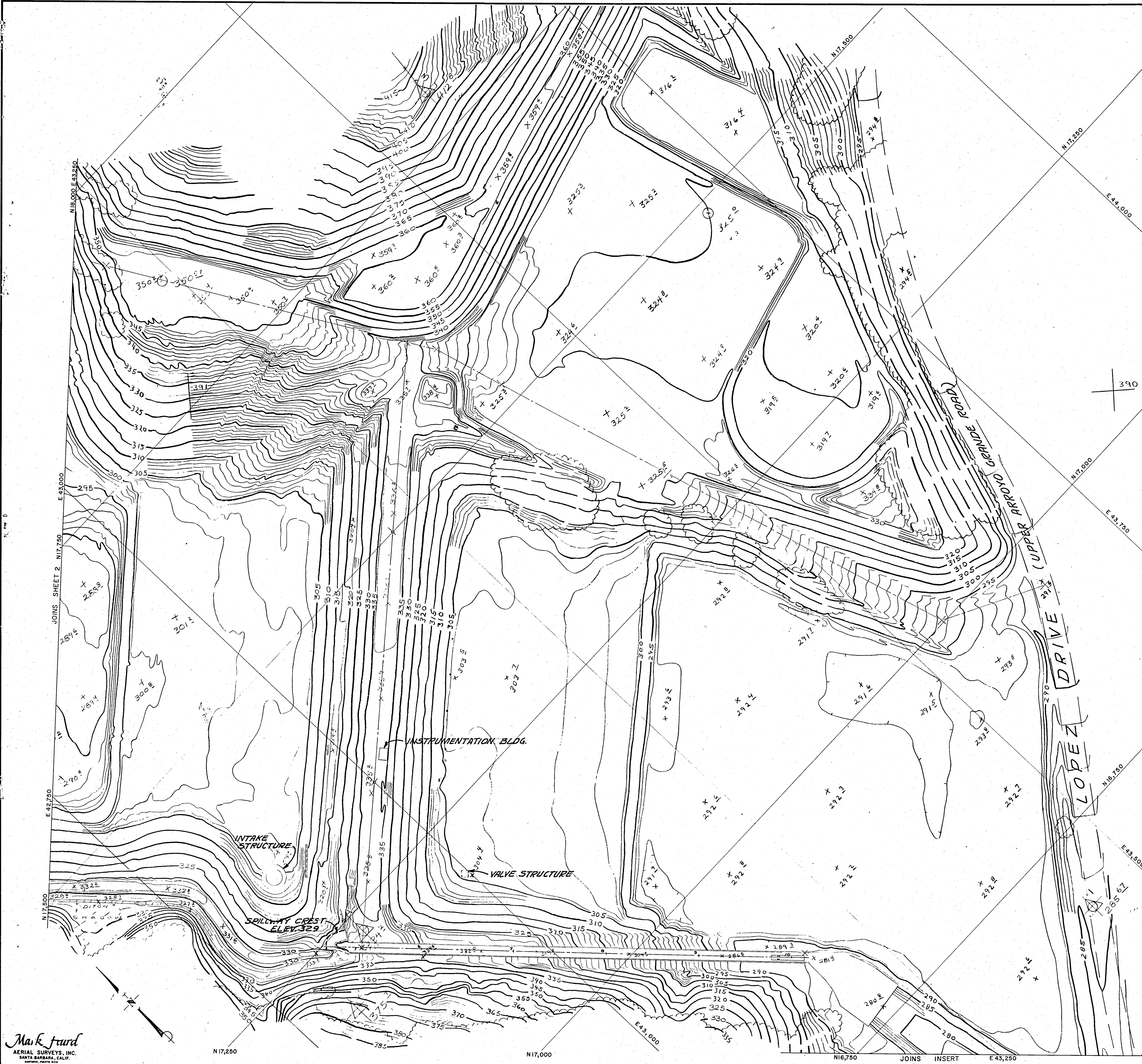
TERMINAL DAM AND RESERVOIR
TERMINAL DAM EXCAVATION
AS CONSTRUCTED

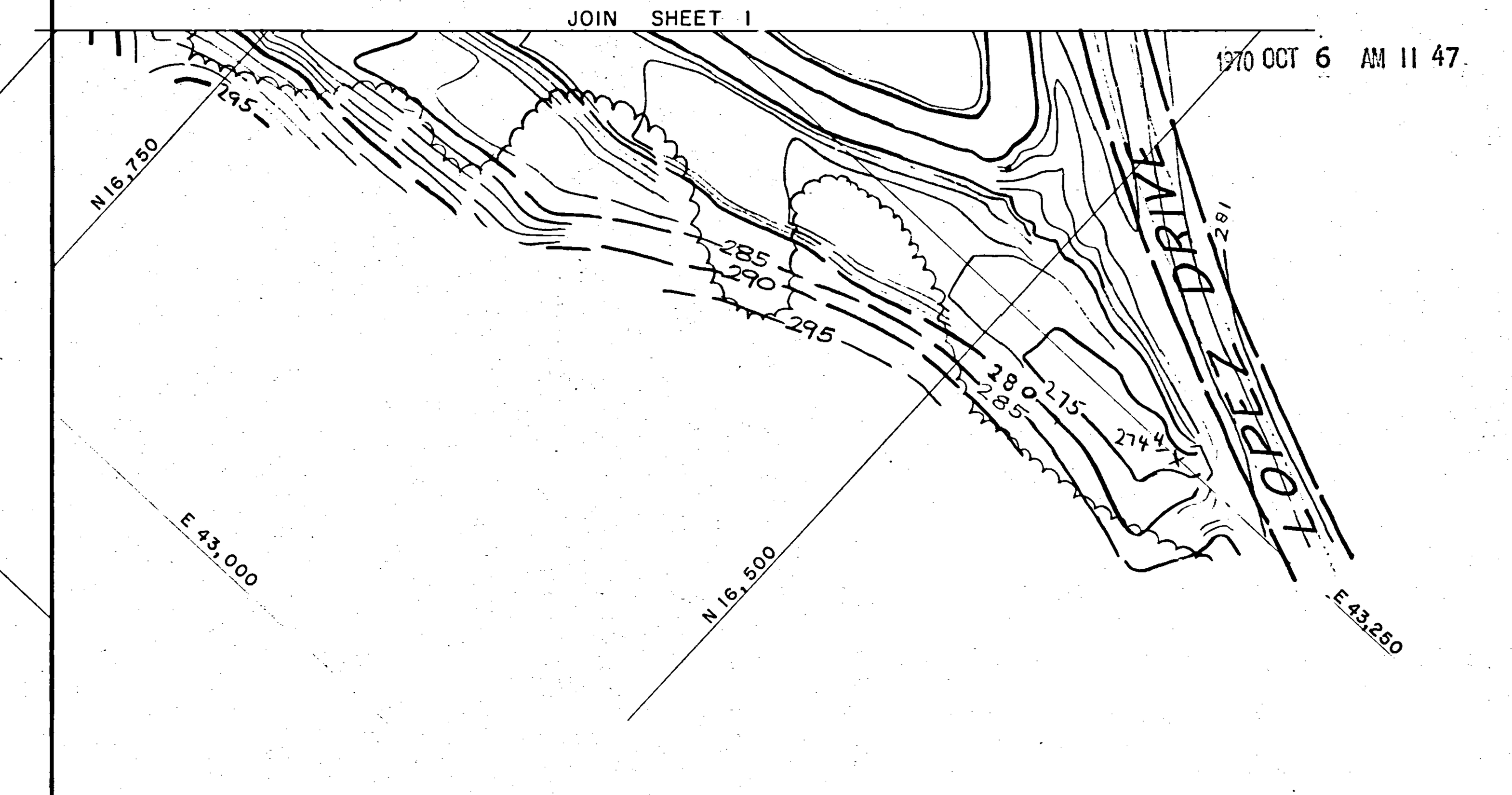
RECOMMENDED — DATE
APPROVED — COUNTY HYDRAULIC ENGINEER R C E NO. 9614

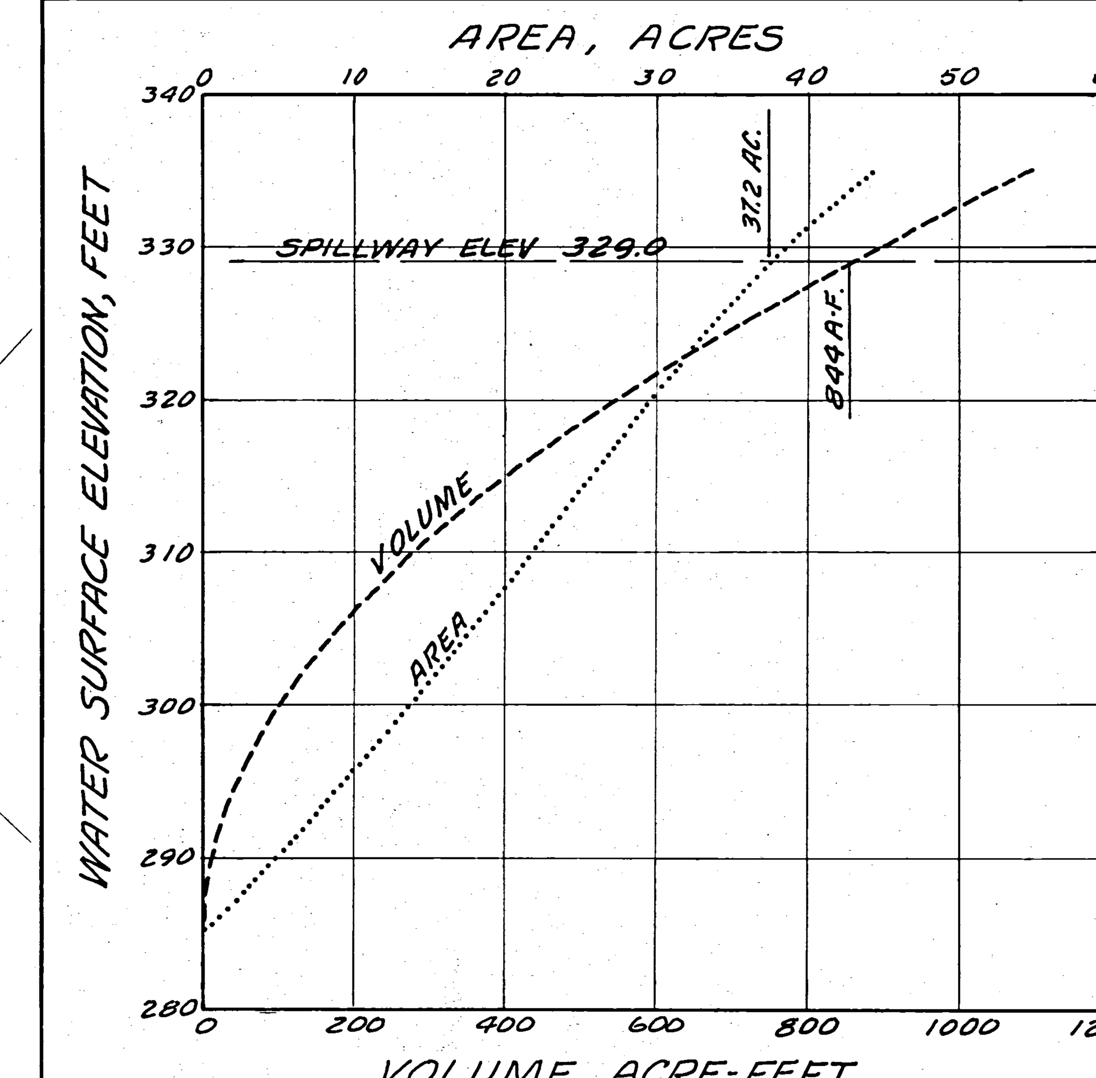
DRAWN	TRACED	CHKD	SUPPLEMENTAL SHEET 23A OF

1055-2

RECORD
COPY







AREA-CAPACITY CURVE

AREA-CAPACITY CURVE VALUES

ELEV FEET	AREA ACRES	VOLUME ACRE-FEET
285	0	0
290	5.6	14.0
295	9.5	52.4
300	12.5	108
305	17.9	181
310	21.7	282
315	25.8	401
320	29.7	540
325	34.4	700
330	38.0	880

NOTE:
DURING NORMAL OPERATING LEVEL, ELEVATION 328, TOTAL STORAGE IS 808 A.F. WITH 36.4 AC. OF WATER SURFACE, OF WHICH 28 A.F & 3.3 AC. ARE NORTHERLY OF BIDDLE RANCH ROAD AND 92 A.F. & 4.4 AC. ARE WITHIN THE MAJOR FINGER NORTHWESTERLY OF THE DAM, RESULTING IN AN EFFECTIVE STORAGE OF 688 A.F. WITH 28.7 AC. OF WATER SURFACE.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES
DIVISION OF SAFETY OF DAMS

APPLICATION NO.
APPROVED AS TO SAFETY

C J Cortright
DIVISION ENGINEER, REG. C.E. No. 7113

NOTE:
1. ADD 1,200,000 TO EAST COORDINATES AND 600,000 TO NORTH COORDINATES FOR CALIFORNIA COORDINATE SYSTEM, ZONE V.
2. PHOTOGRAMMETRY PREPARED FROM AERIAL PHOTOGRAPHS TAKEN DECEMBER 11, 1968

SCALE 1" = 50'

PLANS PREPARED BY
KOEBIG & KOEBIG, INC.
ENGINEERING — ARCHITECTURE
PLANNING

DATE 1-15-69
BY K. H. Tranbarger RCE 10651

SAN LUIS OBISPO COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

LOPEZ WATER SUPPLY PROJECT

TERMINAL DAM & RESERVOIR

TERMINAL DAM TOPOGRAPHY

AS CONSTRUCTED

RECOMMENDED Richard A. [illegible] DATE 7/11/69
APPROVED Robert W. Born COUNTY HYDRAULIC ENGINEER R C E NO. 9614 7-14-69
DRAWN | TRACED | CHKD | SUPPLEMENTAL SHEET 23B OF

Mark Hurd AERIAL SURVEYS, INC. SANTA BARBARA, CALIF.
D-303 T

1055-2

RECORD COPY

Appendix B

Survey Field Notes Performed by the District

Bridge Data, from US to DS

Grieb Ranch Way

Bridge Length = 130’; Bridge width = 24’

24 pilings each 12-14” with 3”x8” cross brace

Talley Farms Road

Bridge Length = 94’; Bridge width = 24’; Single span

Huasna Road

Bridge Length = 87’; Bridge width = 22’

Center span/opening = 43’

Abutment each side, Length = 20’, Height = 35-40’ (approximate)

Mason Street

Bridge Length = 169'; Bridge width = 28'

Abutment, with concrete arch support under deck

Abutment length = 22'

Bridge Street

Bridge length = 141'; Bridge width = 36'

Traffic Way

Bridge length = 225’; Bridge width = 45’

5 groups/sets of piers

US 101 – Bridge 49-175

Unable to photograph

Fair Oaks

Bridge Length = 130’; Bridge width = 76’

Appendix C

Flood Inundation Maps

Cross Section	Distance from Dam (mi)	Station	Initial Wave Arrival Time, 1 Foot (hh:mm)	Time to Peak (hh:mm)	Deflood Time, 1 Foot (hh:mm)	Peak Inundation Depth (ft)	Peak Veloicty (fps)	Peak Discharge (cfs)	Peak Water Elevation (ft)	Location Description
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25,391	N/A	At Terminal Dam
1	0.2	10+49	0:06	0:23	0:49	18.3	12.6	24,941	285	Downstream of Lopez Reservoir
2	1.6	83+22	0:20	0:34	1:47	15.5	8.8	23,473	228	Cecchetti Road
3	2.5	131+49	0:33	0:50	2:19	33.1	10.7	15,177	200	Upstream of Huasna Road
4	2.9	153+20	0:42	1:00	3:37	18.7	5.6	13,299	155	Downstream of Tar Spring Creek
5	3.4	179+82	0:58	1:16	6:35	23.7	11.2	10,644	139	
6	4.8	255+54	1:12	1:37	7:14	23.0	6.0	9,279	102	Traffic Way
7	6.1	320+24	1:20	1:39	9:43	19.6	4.9	9,067	96	US 101 Highway
8	6.8	359+57	1:32	1:52	12:30	20.6	6.3	8,358	80	Fair Oaks Avenue
9	7.7	406+81	1:55	2:21	13:06	11.4	4.5	7,178	53	Cabrillo Highway (Hwy 1)
10	8.7	460+77	2:20	2:57	13:30	8.0	3.5	3,219	31	Railroad Bridge downstream of 22nd Street
11	8.9	467+83	2:55	3:48	15:54	6.2	2.1	1,119	14	Outlet of Arroyo Grande Creek into Ocean

Notes:

1. This map was developed for the benefit of local emergency managers and the California Emergency Management Agency. The infomation shown is approximate and should be used as a guide for emergency response and preparation purposes.

2. The inundation map meets all applicable state and federal standards and has been prepared in consideration of all potential downstream hazards by a licensed civil engineer.

3. The results presented herein do not reflect the structural integrity of the dam and are not a statement of the dam's safety. The analysis presented is based on a hypothetical dam failure using 2D modeling software with a 100' grid.

4. Cross Section Values:
Distance from Dam and **Stationing** are reckoned from the centerline of Terminal Dam along the displayed Flow Path.
Distance from Dam is in miles and **Stationing** is in feet (Stationing 12+34 = 1,234').
Initial Wave Arrival Time, 1 Foot is the time to achieve 1 foot of water depth after initiation of the dam break.
Time to Peak is the time to achieve the maximum water depth after initiation of the dam break.
Deflood Time, 1 Foot is the time elapsed from the flood wave arrival time until water recedes to within one foot of its preflood water elevation.

4. Cross Section Values continued:
Peak Inundation Depth is the maximum water depth.
Peak Velocity is the maximum velocity.
Peak Discharge is an estimate of the maximum flow rate integrated over the entire cross section line.
Peak Water Elevation is the maximum water surface elevation.
Time Above 1 Foot is the time water depth is above 1 foot.
Location Description indicates major roads that cross, or are near, the Flow Path at that cross section.

5. The values displayed in the table for each cross section are the maximum for that parameter along each cross section line, except for the **Initial Wave Arrival Time, 1 Foot** and **Time to Peak** which are the minimum for that parameter along each cross section line. The minimum time values associated with 1D channels embedded in the 2D model are excluded.

6. For other details refer to the supporting report "Terminal Dam Failure and Inundation Study" 31 December 2017.

7. Structures are shown in the aerial photo on the maps but may not clearly display all possible structures potentially within the inundation limits.

8. Map projection: California State Plane, Zone 5, Feet, North American Datum 1983. **Reference Points** and border tics display these coordinate values. All elevations are referenced to North American Vertical Datum 1988.

0 0.25 0.5 1 Miles

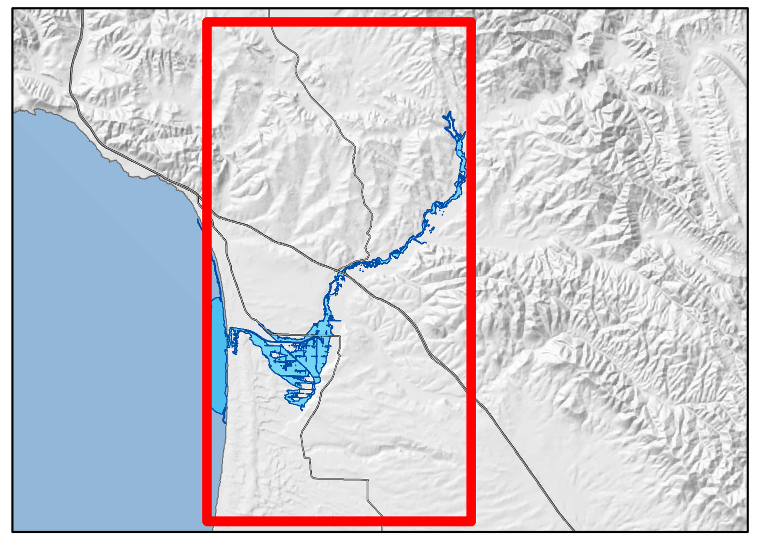
0 1,000 2,000 4,000 Feet

Scale 1:24,000 or 1 " = 2,000 '

School/Day Care
Law Enforcement Facility
CalFire Facility
Licensed Healthcare Facility
Flow Path
Cross Section
2 Approx. Time to 1 Foot Depth (hrs)

Approx. Maximum Flooding Extent

Maximum Inundation Depth (feet)
≤ 2
>2 to 5
>5 to 10
>10 to 20
>20



DO NOT DISTRIBUTE THIS MAP OR THE ASSOCIATED MODEL INFORMATION WITHOUT PRIOR NOTIFICATION TO THE FEDERAL DAM OWNER

NOTICE

San Luis Obispo County deems this information to be Confidential. Do not share the information unless prior approval is obtained from SLO County's Dam Safety Officer at (805) 781-5252.

Inundation Depth Map for Fair Weather
Hypothetical Failure of
Terminal Dam
Flood Depth and Arrival Time
Federal Dam ID: CA00888 State Dam ID: 1055.002
Detail Sheet 1 of 1
San Luis Obispo County

Rev	Date	Description	Prepared By	Accepted By
	31 December 2017 **DRAFT**	DRAFT	GEI Consultants	

Dam Owner:
San Luis Obispo County Flood Control and Water Conservation District
County Government Center, Room 206
San Luis Obispo, CA 93408

Information Contact: John Diodati, (805) 781-5252
Emergency Contact: (805) 781-5252

Inundation Analysis Performed by and Inundation Maps Created By:
GEI Consultants, Inc.
Mark Fortner, PE 48266

Data Sources: Incorporated City Limits from CalFire, January 2017. Licensed Healthcare Facilities from Office of Statewide Health Planning and Development, January 2012. Schools, Fire Stations and Prisons from Geographic Names Information System (GNIS), October 2017. Highways are from TIGER, 2013. Aerial Photography from National Agricultural Imagery Program, USDA, 2016.

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Cross Section	Distance from Dam (mi)	Station	Initial Wave Arrival Time, 1 Foot (hh:mm)	Time to Peak (hh:mm)	Deflood Time, 1 Foot (hh:mm)	Peak Inundation Depth (ft)	Peak Velocity (fps)	Peak Discharge (cfs)	Peak Water Elevation (ft)	Location Description
N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	25,391	N/A	At Terminal Dam
1	0.2	10+49	0:06	0:23	0:49	18.3	12.6	24,941	285	Downstream of Lopez Reservoir
2	1.6	83+22	0:20	0:34	1:47	15.5	8.8	23,473	228	Cecchetti Road
3	2.5	131+49	0:33	0:50	2:19	33.1	10.7	15,177	200	Upstream of Huasna Road
4	2.9	153+20	0:42	1:00	3:37	18.7	5.6	13,299	155	Downstream of Tar Spring Creek
5	3.4	179+82	0:58	1:16	6:35	23.7	11.2	10,644	139	
6	4.8	255+54	1:12	1:37	7:14	23.0	6.0	9,279	102	Traffic Way
7	6.1	320+24	1:20	1:39	9:43	19.6	4.9	9,067	96	US 101 Highway
8	6.8	359+57	1:32	1:52	12:30	20.6	6.3	8,358	80	Fair Oaks Avenue
9	7.7	406+81	1:55	2:21	13:06	11.4	4.5	7,178	53	Cabrillo Highway (Hwy 1)
10	8.7	460+77	2:20	2:57	13:30	8.0	3.5	3,219	31	Railroad Bridge downstream of 22nd Street
11	8.9	467+83	2:55	3:48	15:54	6.2	2.1	1,119	14	Outlet of Arroyo Grande Creek into Ocean

0 0.25 0.5 1 Miles

0 1,000 2,000 4,000 Feet

Scale 1:24,000 or 1 " = 2,000 '

Notes:

1. This map was developed for the benefit of local emergency managers and the California Emergency Management Agency. The infomation shown is approximate and should be used as a guide for emergency response and preparation purposes.

2. The inundation map meets all applicable state and federal standards and has been prepared in consideration of all potential downstream hazards by a licensed civil engineer.

3. The results presented herein do not reflect the structural integrity of the dam and are not a statement of the dam's safety. The analysis presented is based on a hypothetical dam failure using 2D modeling software with a 100' grid.

4. Cross Section Values:
   Distance from Dam and **Stationing** are reckoned from the centerline of Terminal Dam along the displayed Flow Path.
   Distance from Dam is in miles and **Stationing** is in feet (Stationing 12+34 = 1,234').
   Initial Wave Arrival Time, 1 Foot is the time to achieve 1 foot of water depth after initiation of the dam break.
   Time to Peak is the time to achieve the maximum water depth after initiation of the dam break.
   Deflood Time, 1 Foot is the time elapsed from the flood wave arrival time until water recedes to within one foot of its preflood water elevation.

4. Cross Section Values continued:
   Peak Inundation Depth is the maximum water depth.
   Peak Velocity is the maximum velocity.
   Peak Discharge is an estimate of the maximum flow rate integrated over the entire cross section line.
   Peak Water Elevation is the maximum water surface elevation.
   Time Above 1 Foot is the time water depth is above 1 foot.
   Location Description indicates major roads that cross, or are near, the Flow Path at that cross section.

5. The values displayed in the table for each cross section are the maximum for that parameter along each cross section line, except for the **Initial Wave Arrival Time, 1 Foot** and **Time to Peak** which are the minimum for that parameter along each cross section line. The minimum time values associated with 1D channels embedded in the 2D model are excluded.

6. For other details refer to the supporting report "Terminal Dam Failure and Inundation Study" 31 December 2017.

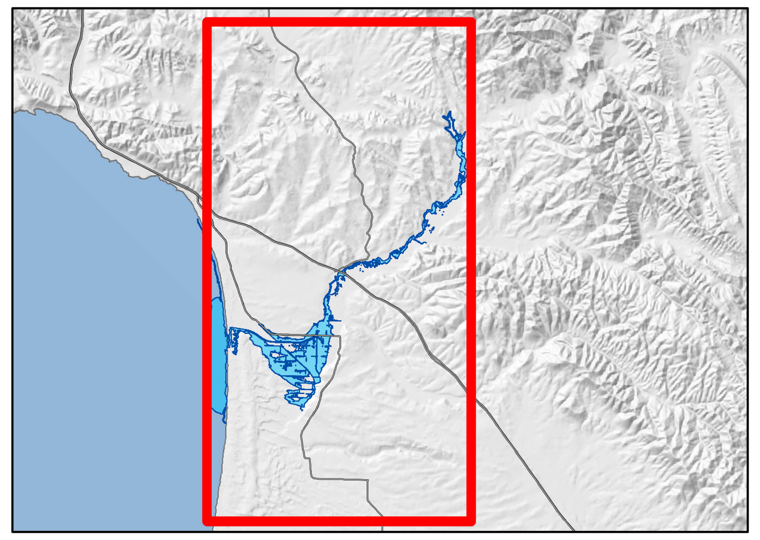
7. Structures are shown in the aerial photo on the maps but may not clearly display all possible structures potentially within the inundation limits.

8. Map projection: California State Plane, Zone 5, Feet, North American Datum 1983. **Reference Points** and border tics display these coordinate values. All elevations are referenced to North American Vertical Datum 1988.

School/Day Care
Law Enforcement Facility
CalFire Facility
Licensed Healthcare Facility
Flow Path
Cross Section
Approx. Deflood Time (hrs)

Approx. Maximum Flooding Extent

Maximum Inundation Depth (feet)
- ≤ 2
- >2 to 5
- >5 to 10
- >10 to 20
- >20



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NOTICE

Inundation Depth Map for Fair Weather
Hypothetical Failure of

Terminal Dam

Flood Depth and Time to Deflood

Federal Dam ID: CA00888 State Dam ID: 1055.002

Detail Sheet 1 of 1

San Luis Obispo County

Rev	Date	Description	Prepared By	Accepted By
	31 December 2017 **DRAFT**	DRAFT	GEI Consultants	

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