HISTORIC AMERICAN ENGINEERING RECORD

TEXAS POWER CORPORATION DEVELOPMENT NUMBER 1
(LAKE DUNLAP DAM AND HYDROPOWER COMPLEX)

HAER NO. TX-3405

Prepared for:
U.S. Army Corps of Engineers, Fort Worth District
and
Guadalupe-Blanco River Authority, Seguin, Texas

November 22, 2021

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1.0 INTRODUCTION

This report presents the Historic American Engineering Record (HAER) TX-3405 documentation of the Guadalupe-Blanco River Authority's (GBRA) Texas Power Corporation Development Number 1 (Lake Dunlap Dam and Hydropower Complex) as it was prepared by Baer Engineering and Environmental Consulting Inc. (Baer Engineering) and approved by the National Parks Service (NPS), the U.S. Army Corps of Engineers (USACE), and GBRA, the project sponsor. As compiled herein, this report includes all HAER TX-3405 documentary materials formatted and submitted by the NPS for inclusion in the Library of Congress' (LOC) HABS/HAER/HALS collections, HABS / HAER / HALS Collection (loc.gov). Minor formatting modifications have been made to facilitate reproduction and distribution of the HAER TX-3405 documentation components as a single report, rather than separate components as archived in the LOC.

The Narrative History section describes the historical significance of GBRA's Lake Dunlap Dam and Hydropower Complex as it was determined eligible for listing in the National Register of Historic Places for its influence on local community development and for its engineering design qualities. The Narrative History section also describes GBRA's Lake Dunlap Dam and Hydropower Complex as it was designed, constructed, operated, and repaired over more than nine decades of service before one of its three roof-weir spillgates failed in May 2019. Appendix A presents a representative selection of original as-built engineering and architectural drawings dating from the system's original period of design and construction (1926 to 1932). Appendix A also includes representative historic photographs dating from circa 1927 to circa 1965 as well as 35-mm color field photos taken between 1980 and 2000. The final section of this report includes twenty large-format black-and-white photographs taken by Baer Engineering staff in 2021 as a mitigation requirement under USACE Permit Number SWF-2015-00168 for GBRA's proposed dam repairs.

Details of the USACE-required mitigation measures are specified in the Section 106 Memorandum of Agreement (MOA) provided in Attachment 1, including GBRA's responsibilities to distribute copies of the final NPS-approved HAER documentation to the USACE, the Texas State Historic Preservation Officer, and three local-level consulting parties - the Comal County Historical Commission, the Guadalupe County Historical Commission, and the City of New Braunfels. The MOA also requires that GBRA publish the final NPS-approved HAER TX-3405 documentation materials through its publicly accessible website. Attachment 2 includes a copy of the NPS' Letter of Acceptance for the HAER TX-3405 documentation contained herein and archived at the Library of Congress.

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Location: Approximately five miles southeast of New Braunfels along the Guadalupe River in the vicinity of Seguin in Guadalupe County, Texas. See Figure 1.

The dam and powerhouse are located at latitude 29.653975, longitude -98.066347. The coordinate represents the approximate center of the TP-1 spillway where it crosses the Guadalupe River channel. The coordinate was obtained on October 4, 2021, using decimal degrees accurate to +/- one meter. The coordinate's datum is WGS 84. The dam and powerhouse location has no restriction on its release to the public.

Present Owner/ Occupant: Guadalupe-Blanco River Authority (GBRA), Seguin, Texas.

Significance: The Texas Power Corporation's Development Number 1 (TP-1) was the first of six hydroelectric power production dams planned and constructed along the Guadalupe River between 1927 and 1932, all of which continue to operate as originally constructed. When the TP-1 spillway required repairs in 2020, the U.S. Army Corps of Engineers, Fort Worth District (USACE-SWF) and the Texas State Historic Preservation Officer (SHPO) concurred that TP-1 was eligible for NRHP listing at a local level of significance under both Criterion A and Criterion C for the following reasons.

The original design of TP-1 in 1926 to 1927 by Fargo Engineering Company of Jackson, Michigan was led by nationally recognized hydropower plant engineer William G. Fargo.[1] Fargo's design of TP-1 reflected a high level of hydroelectric dam engineering as it had evolved under the leadership of the U.S. Bureau of Reclamation (Reclamation) and the U.S. Army Corps of Engineers (USACE) in the early decades of the twentieth century, including the first recorded use of roof-weir type spillway gates in Texas.[2] The Huber & Lutz roof-weir gates used in TP-1 and its contemporary hydropower dams on the Guadalupe River are the largest and the oldest known examples of their type in Texas. TP-1 retains sufficient integrity of location, design, materials, setting, feeling, and association to represent historically significant trends in water conservation and

[1] Fargo Engineering Company Records, Fargo Engineering Company, accessed October 26, 2020, https://quod.lib.umich.edu/b/bhlead/umich-bhl-9543?rgn=Entire+Finding+Aid;sort=occur;subview=detail;type=simple;view=reslist;q1=Fargo+engineering.

[2] C.L. Dowell, Engineer, Dams and Reservoirs in Texas: Historical and Descriptive Information, *Texas Water Commission Bulletin* 6408, July 1964.

hydroelectric dam engineering as they were developed by Reclamation and the USACE and adapted by the design engineering firm, Fargo Engineering Company, for small-scale regional needs. TP-1 exhibits historically distinctive dam design qualities and engineering components that are not represented by other National Register of Historic Places (NRHP)-listed or NRHP-eligible dams in Guadalupe County or in the Guadalupe River Valley of Texas.

Historians: Eugene Foster, Baer Engineering and Environmental Consulting, Inc.'s HAER documentation specialist served as the team lead with historical research and editing support of Nadya Prociuk, Ph.D. Kumar Samant, P.E., with Black & Veatch Corporation provided descriptions of engineering components, alterations, and operations. The project was prepared and completed between October 2020 and December 2021.

Project Information: This historic documentation report was sponsored by the Guadalupe-Blanco River Authority (GBRA), in consultation with the United States Army Corps of Engineers, Fort Worth District (USACE-SWF) and the Texas State Historic Preservation Officer (SHPO), for purposes of mitigating adverse effects caused by the GBRA's proposed repair and improvement of Texas Power Corporation Development Number 1 (TP-1). Planned and constructed by Texas Power Corporation from 1927 to 1928, TP-1 was recorded as Texas Archeological Site No. 41GU47 and recommended as eligible for NRHP listing for its influence on local community development (NRHP Criterion A).[3] Following a partial failure of the dam's central spillway in May 2019, the dam was reassessed and again recommended for NRHP listing under Criterion A as well as Criterion C for its engineering design qualities. When dam repairs became necessary in 2020, the USACE-SWF and the Texas SHPO concurred that TP-1 was eligible for NRHP listing at a local level of significance under both Criterion A and Criterion C.

Mitigation of adverse effects was required by the USACE-SWF to fulfill its responsibility for managing effects to this historic property in accordance with Section 106 of the National Historic Preservation Act (Section 106), as amended and as defined in a Memorandum of Agreement (MOA) between the USACE-SWF, the Texas SHPO, GBRA, and the Guadalupe County Historical Commission as concurring parties. James E. Barrera led the Section 106 consultation and MOA development process for the USACE-SWF with Joseph Murphey providing HAER documentation review and coordination support. Jeff Durst, Caitlyn Brashear, and Hansel Hernandez served as the Texas SHPO's review team throughout the Section 106 consultation process. Kristen Luetkemeier provided National Park Service review and editing of the final HAER documentation.

[3] Eric Schroeder, "Draft Report Cultural Resources Survey Along the Guadalupe-Blanco River Authority's San Marcos Raw Water Pipeline Hays, Caldwell, Comal, and Guadalupe Counties, Texas" (Westlake Hills: Paul Price Associates, 1999).

Research methods employed for this HAER documentation project emphasized acquisition and analysis of reliable primary and secondary sources ranging from original as-built/record drawings and historical photos archived by the project owner, Guadalupe-Blanco River Authority, to technical hydropower dam design and documentation reports published by state and federal agencies. Historical context information was obtained from a variety of websites, including regional newspaper columns and the Texas Historical Commission's (THC) Historic Sites Atlas listings for similar hydropower dam sites. Project engineer Kumar Samant, P.E., of Black and Veatch Corporation, provided engineering documentation of alterations and repairs to TP-1 as well as descriptions of system components and their operation.

Historic documentation services were provided by Baer Engineering and Environmental Consulting Inc., working under contract with Black and Veatch Corporation. GBRA Executive Manager of Engineering, Charles Hickman, P.E., served as the project sponsor and provided access to GBRA's engineering drawing and photograph collections. Mr. Hickman also worked with the USACE-SWF to develop and implement all Section 106 mitigation requirements specified in the MOA for the project.

Copies of this documentary report and its supplementary materials will be filed with the USACE-SWF and the THC. Additional copies of the report along with original drawings and photographs will be archived at GBRA Headquarters in Seguin, Texas.

PART I. Historical Information

A. Physical History:

1. **Date(s) of Construction**: 1927 - 1928

2. **Engineer**: Fargo Engineering Company, Jackson, Michigan

3. **General Contractor**: Summer and Sollet

4. **Generator and Control Equipment Manufacturer**: General Electric Company

5. **Vertical Turbines**: James Leffel & Company, Inc.

6. **Spillway Gates**: The Petroleum Ironworks Company, Beaumont, Texas

7. **Original Plans and Construction**: Most of the drawings were produced by Fargo Engineering Company of Jackson, Michigan from 1925 – 1927 for the original project developer Texas Power Corporation with as-built/record drawing updates also produced by Fargo Engineering Company from 1927 to 1932, though the collection also includes 1927 shop drawings produced by The Petroleum Iron Works Company of Beaumont, Texas, which manufactured the TP-1 spillgates from project-specific design drawings by Fargo Engineering Company. A select group of those drawings are included as Figures 2 through 17 in Appendix A of this report, and others may be accessed at GBRA's engineering records archive. Plans show traditionally massive earthen dam construction with distinctly modern reinforced concrete structural elements and an architecturally detailed powerhouse.

8. **Alterations and Additions**: The original southern embankment and retaining walls constructed in 1928 were reconstructed following a major flood in July 1932 that washed out the right (south) embankment of the TP-1 dam. Minor improvements to the original design were made to provide improved erosion protection along that bank as well as the northern bank. Otherwise, the TP-1 hydropower complex appears to have operated as originally designed until it was acquired by GBRA, its current owner and operator.

   Since acquiring TP-1 and five related hydropower plants in 1963, GBRA has performed minor improvements, maintenance, and repairs to TP-1, beginning with an expansion of the TP-1 control house in the 1960s to provide shelter for the TP-1 dam controls and dam operators. The expanded control house was installed on top of the left (north) regulating pier, retaining the original control house at the northern end of the expanded building.

Over time, the wooden timber facings of the spillgates required maintenance and eventual replacement due to damage caused by floating debris. The original timber facings were replaced with new timbers in the 1980s. The replacement timbers are bound together by grove and tongue joints and attached to the underlying metal trusses using 5/8" bolts, matching the original installation.

The original manual dam controls inside the control house were upgraded to electronically actuated controls in the late 1990s to early 2000s, enabling remote operation and control of the spillgates. A backup engine generator and propane tank were installed on the upstream face of the west embankment for more reliable operation and control of the spillgates during power failures. Similar upgrades were made to the TP-1 powerhouse, enabling the entire system to be monitored and remotely controlled from GBRA Headquarters in Seguin, TX.

In the early 2010s, the spillgates were identified to have structural deficiencies at some of the existing steel components, specifically the tie bars and locking bars, associated structural brackets, and miscellaneous structural steel components that were identified as needing replacement during inspection. These structural repairs to the Lake Dunlap Dam spillgates were completed in 2012. These repairs were all performed internal to the spillgate system and matched the existing structural components.[4]

Figures 18 to 28 included in Appendix B of this report provide historical photographic views of the TP-1 hydropower complex as it was originally constructed, repaired, and modified.

B. Historical Context:

[4] Information regarding alterations and additions to TP-1 was provided by Kumar Samant, P.E., Black & Veatch Corporation.

1. Origins of the Guadalupe Valley Hydroelectric System: Since prehistoric times, human settlement and land use in Texas has been limited by regional and seasonal availability of water, especially in the more arid regions of south, west, and north Texas where natural springs and rivers are few and far between and where annual rainfall is unreliable. Even in the central region of Texas where some of the state's most abundant springs and rivers are located, drought conditions sometimes last for years. Prolonged drought conditions concentrated human settlements along the most well-watered, aquifer-springs-fed rivers, like those in Guadalupe and Comal Rivers in Guadalupe and Comal counties. For many generations prior to the advent of windmills and hydro-power dams, the Native American and European immigrant populations responded to their need for reliable water sources by constructing improvised dams and reservoirs.

The earliest recorded dams in Texas date to the middle-to-late Doña Ana phase (1000-1300 C.E.) in the Trans Pecos region of far west Texas. Now known as the Hueco Tanks, these small basins were created by prehistoric people who constructed rock dams to store water that flowed seasonally during late summer rains. The largest basins were capable of holding thousands of gallons of water for extended periods, allowing plants, animals, and people to flourish locally.[5] Similar dams were also constructed in the historic period at *La Junta de los Ríos*, the juncture of the Rio Conchos and Rio Grande just above Big Bend National Park. In this area Native American and *mestizo* farmers developed a type of dam called *presas de burros y muertos*, also known as *presas* or burro dams. Constructed of green cottonwood trees (*burros*) and bundles of stone and seepwillow branches (*muertos*) weighing up to seventy-seven pounds each, *presas* were in use locally between the 1860s and 1950s.[6]

Among the most historically significant dams and canals constructed in Texas are those associated with Spanish Colonial missions in San Antonio, Texas. Relatively small in scale and typically built of earth and stone, the mission dams in San Antonio were used to divert river flow into earthen canals or *acequias* for purposes of agricultural irrigation. In the post-colonial period, small-scale dams were also built by enterprising individuals along Texas rivers and streams for purposes of operating mechanical milling and ginning machinery.[7] By 1890 a new type of turbine wheel had begun to replace older styles of water wheels, and electric power was being generated by small hydroelectric plants, such as the Saffold Dam in Seguin and another on the San Marcos River near Prairie Lea.[8] Perhaps the largest of Texas's early hydroelectric plants was a dam built across the

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[5] Margaret Howard and Susan Dial, "Hueco Tanks" *Texas Beyond History*, no date, accessed on 8/2/2021, https://texasbeyondhistory.net/hueco/story.html.
[6] Enrique R. Madrid, "Native American and Mestizo Farming at La Junta de los Ríos," *The Journal of Big Bend Studies Vol. 8,* C. Leslie Lehman and Kelly S. Garica (editors) (Center for Big Bend Studies: Sul Ross State University, 1996), pp. 15-31, accessed August 2, 2021, https://texasbeyondhistory.net/junta/images/Madrid-1996-LaJunta-farming.pdf.
[7] Joe L. Bruns and Linda C. Flory, "Saffold Dam," National Register of Historic Places Nomination Form, Washington, DC, U.S. Department of the Interior, National Park Service, 1979, accessed October 26, 2020, https://atlas.thc.texas.gov/NR/pdfs/79002950/79002950.pdf. Published by the Texas Historical Commission, this nomination documents a local example of this type in Seguin which was used to power a local mill and gin in the mid-nineteenth century.
[8] Anonymous, "Water Power," *Handbook of Texas Online*, Texas State Historical Association, accessed October 26, 2020, https://www.tshaonline.org/handbook/entries/water-power .

Colorado River in 1891–92 to serve the city of Austin, though it was soon destroyed in a 1900 flood. [9]

As demand for electricity increased within Texas's rural communities during the late-nineteenth to early-twentieth century, widespread development of community-scale hydropower projects was limited by fluctuating and unreliable water levels in many of Texas's rivers and streams.[10] The Guadalupe River, as one of Texas's most reliable rivers, became a focal point for hydropower development by several private hydroelectric energy production companies. In 1912, several Guadalupe County residents formed the Guadalupe Water Power Company and began purchasing river frontage for development of several lakes and dams to produce electricity. The project was slowed by World War I but gained momentum in 1924 when Alvin Wirtz joined the effort. Wirtz secured financial backing and with the Comal Power Company they formed their electric network. With $2 million as a start, they began planning a project to construct a series of dams between Seguin and New Braunfels.[11]

Water rights for operation of the Guadalupe Water Power Company dams were originally authorized by the State Board of Water Engineers: Permit No. 21 (Application No. 21), dated July 25, 1914, which granted an appropriation not to exceed 1,300 cubic feet per second (cfs), continuously, from the Guadalupe River, for the purpose of hydroelectric power generation. An additional appropriation not to exceed 941,200 acre-feet of water per annum for power development purposes was granted to the Hunt Development Company under Permit No. 1096 (Application No. 1163), dated June 12, 1929.[12]

Construction of the Guadalupe River hydropower system was initiated by the Texas Power Corporation in 1927 with its Development No. 1 (TP-1) creating Lake Dunlap. Figures 18 through 21 in Appendix B provide photographic views of TP-1 as it was being constructed from 1927 to 1928. Two related hydropower dam projects, TP-3 (Lake McQueeney) and TP-5 (Lake Nolte/Meadow Lake), were also constructed by Texas Power Corporation between 1927 and 1928.[13] Shortly thereafter the Texas Hydro Electric Corporation constructed three additional hydro-electric dam projects along the Guadalupe, including TP-4 (Lake Placid), H-4 (Lake Gonzalez), and H-5 (Wood Lake) between 1929 and 1932.

Companies like the Guadalupe Water Power Company, which was organized and chartered under the leadership of W.B. Dunlap,[14] reflected an integrated model of water conservation and hydroelectric power generation for private and public use that was developed at the national scale by the U.S. Bureau of Reclamation. To balance the growing public and private interests regarding water conservation and hydroelectric power generation within the Guadalupe River Valley, the

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[9] Ibid.
[10] Ibid.
[11] Floyd McKee, "Area dams have seen better times," Snapshots of Seguin History, *Seguin Gazette*, June 9, 2019, accessed October 26, 2020, http://seguingazette.com/opinion/community_columnists/article_c1f8ef36-8a40-11e9-8837-63a42cfc2ae7.html. See Figure 2 in Appendix A of this report.
[12] Dowell, Dams.
[13] See Figure 3 in Appendix A of this report.
[14] "Corporations Chartered," *Houston Post*, Volume 27, Edition 1, March 6, 1912, published online by the Portal to Texas History, accessed October 26, 2020, https://texashistory.unt.edu/ark:/67531/metapth605132.

Texas legislature established the Guadalupe River Authority in 1933 as a public corporation for purposes of water conservation and reclamation. In 1935, the Guadalupe River Authority was reauthorized by an act of the Texas legislature as the Guadalupe-Blanco River Authority (GBRA) with the power to develop, conserve, and protect the waters of the Guadalupe River and to aid in the preservation of property and protection of people and livestock.

Planning for a larger flood-control reservoir had been initiated in the 1930s to help control the catastrophic flooding that sometimes occurred along the Guadalupe River with Canyon Lake Dam and Reservoir initially planned for a location five miles upstream from New Braunfels. However, initial studies found the limestone geology of the area to be so porous and honeycombed that engineers rejected the initial recommendations to build the dam there. Major floods in 1936 and 1938 caused community leaders to demand action to help reduce the damage caused by the destructive floods. A new study recommended the Canyon Lake Dam and Reservoir site be moved about sixteen miles upstream. Final approval for construction was given with USACE assistance under the Flood Control Act of 1954. In collaboration, the USACE and the GBRA began constructing Canyon Lake Dam and Reservoir in 1958, completing it in April 1966 at a cost of $20.2 million.

As Canyon Lake Dam and Reservoir were under construction, the GBRA acquired ownership of water rights and plant facilities for the six existing downstream hydropower plants in 1963, consolidating the former Texas Power Corporation and Texas Hydro Electric Corporation hydro-power plants into the current Guadalupe Valley Hydroelectric System (GVHS). With the completion of Canyon Lake, the threat of seasonal flooding was reduced and the Guadalupe River below Canyon Lake became a reliable source of water, electrical power, and recreation for New Braunfels, Seguin, and other downstream communities. The diminished threat of flooding and the increased availability of water and electrical power combined to favor residential development over traditional agricultural land use along the banks of the Guadalupe. In recent decades recreational use of the river, including canoeing and inner-tubing as well as a major water park in New Braunfels, have attracted large numbers of visitors to the vicinity and contributed greatly to the area's economy.[15]

2. Evolution of Hydroelectric Dam Design: At the federal level, the U.S. Bureau of Reclamation not only served as the agency leading the nation's regional water conservation efforts in the late-nineteenth century but also as a leader in engineering and design of large hydroelectric dams.[16] Dam-building technology in the United States prior to the twentieth century relied largely on massive earthen embankments or gravity dams whose inherent weight enabled them to remain stable and fulfill their function of impounding large volumes of water - until two developments occurred.[17] With the advent of large-scale earth-moving machinery, dam construction could be feasibly undertaken at a larger scale. Additionally, the emerging science of soil mechanics enabled dam engineers to design large-scale dams, still in the massive gravity dam tradition, but with greater confidence in the earthen dam's ability to resist forces that tended to undermine and

[15] Vivian Elizabeth Smyrl, "Guadalupe River," *Handbook of Texas Online*, accessed August 02, 2021, https://www.tshaonline.org/handbook/entries/guadalupe-river.
[16] U.S. Bureau of Reclamation, *Hydropower Program; The History of Hydropower Development in the United States,* accessed October 26, 2020, https://www.usbr.gov/power/edu/history.html.
[17] David P. Billington, Donald C. Jackson, and Martin V. Melosi, *The History of Large Federal Dams: Planning, Design, and Construction in The Era of Big Dams* (U.S. Department of the Interior, Bureau of Reclamation, Denver, Colorado, 2005).

erode the dam's stability over time. Through the efforts of the U.S. Bureau of Reclamation and later the USACE these two factors contributed to the federal government's design and construction of some of the largest earthen embankment dams ever built, including landmark examples such as the Roosevelt Dam project (1905-1911) in Arizona.

As dam engineering practices evolved in the twentieth century, alternative designs relying on structural forms built of concrete were developed in part for the economic benefits afforded by the rapid construction of much lighter weight structures. The new structural dams were also considered to be more reliable than the older earthen embankment dams that had problems with erosion and failure over time. Despite extensive testing of alternative, lightweight, and very tall structural designs, the Bureau of Reclamation and the USACE continued to rely on the safety and stability factors inherent in massive gravity dams, even in more modern structural dam designs that incorporated steel-reinforced concrete.

The design developed by Fargo Engineering Company for TP-1 features a hybrid earth and concrete design that incorporates elements of both massive earthen gravity dams and structural concrete reinforcing elements. It is also distinctive for its early use of three large Huber and Lutz roof-weir spillgates across the main flow channel of the Guadalupe River. Among the 138 dams and reservoirs documented by the Texas Water Commission in 1964, TP-1 and its contemporary TP-3 (Abbott) Dam at Lake McQueeney were the earliest to incorporate this type of spillgate mechanism.[18] Similar but smaller roof-weir type gates were later installed in the Brazos River Authority's Morris Sheppard Dam at Possum Kingdom Reservoir (1938-1941) and at the Lower Colorado River Authority's Max Starcke Dam (1949-1951) on the Colorado River, though the gates at Max Starcke Dam have since been replaced with hydraulically controlled units.[19]

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[18] Dowell, Dams.

[19] Cody M. Cockroft and James B. Dower, "Replacing Spillway Gates," in *Hydro Review*, Issue 2, Volume 26, April 1, 2007, accessed October 28, 2020, https://www.hydroreview.com/2007/04/01/replacing-spillway-gates.

PART II. Structural/Design Information

A. General Statement:

1. **Character**: Originally designed by Fargo Engineering Company of Jackson, Michigan for the Texas Power Corporation, TP-1 is the northernmost and first-built of six similar hydroelectric dams constructed along the lower Guadalupe River between 1927 and 1932. Incorporating a combination of traditionally massive earthen dam construction with distinctly modern reinforced concrete structural elements, the character of TP-1 is that of a modern hybrid design that reflected evolving national trends in hydropower dam design in the early twentieth century period. TP-1 further incorporates the earliest and largest documented examples of the distinctive "bear trap" roof-weir spillgates originally designed in the 1890s by Huber & Lutz Engineers of Zurich and later used in several major hydropower dams in Texas. The TP-1 hydropower complex further utilizes specialized radial-arm "Tainter Gates" to control water flow to a pair of massive vertical hydropower turbines within TP-1's architecturally detailed powerhouse. Consequently, TP-1 represents a distinctive engineering achievement that combined traditional and modern dam building qualities to address the combined needs of flood control and electrical power production in the Guadalupe River Valley of Texas. While TP-1 and its five related GVHS hydropower projects continued to serve those fundamental purposes for over ninety years, the series of reservoirs created by the GVHS have further stimulated real estate development along the river and provided for water-based recreation and tourism that has benefitted the local regional economy in ways unanticipated when originally designed in the 1920s.

2. **Condition of fabric:** Following repairs to the flood-damaged right (south) embankment and retaining wall in 1932, the TP-1 dam was repaired and remained operational as originally designed with only occasional repairs and modifications until the central TP-1 spillgate structure failed during routine operations on May 21, 2019. Since that date, the TP-1 spillgates have been lowered and the overall TP-1 hydropower system has been maintained in a stable condition pending modifications to remove and replace the three aging spillgates with new hydraulically operated spillgates of a different design.

B. Description: TP-1 is in Guadalupe County on the Guadalupe River, approximately five miles southeast of New Braunfels and nine miles northwest of Seguin, Texas. As a system TP-1 includes the TP-1 dam and spillway, a 1.5-mile long diversion canal, and the TP-1 powerhouse located on an elevated terrace along the left (north) bank of the Guadalupe River.[20] Further downstream from the TP-1 and its powerhouse are the five related GVHS hydropower dams, including Lake McQueeney (TP-3), Lake Placid (TP-4), Meadow Lake Dam (Lake Nolte), Lake Gonzales (H-4), and Wood Lake (H-5). Each hydropower dam in the system is a "run-of-the-river" facility that receives water from Canyon Reservoir located approximately seventeen miles north of TP-1 and its reservoir, Lake Dunlap (see Figures 1 and 2).

[20] Directional references used in all TP-1 descriptions rely on terminology used in the original engineering drawings, with "left" and "right" descriptions oriented from a viewpoint looking downstream. Where used, references to "north" and "south" components of the system correspond to these "left" and "right" conventions, respectively.

1. **TP-1 (Lake Dunlap) Dam and Spillway:** The TP-1 dam and spillway impound the waters of Lake Dunlap by means of a hybrid earth-fill and reinforced concrete dam with its main spillway aligned with the channel of the Guadalupe River. Large retaining walls extend upstream and downstream along each riverbank. From the concrete retaining walls concrete-reinforced earthen embankments extend to the north and south of the central spillway with an emergency spillway located in the north embankment. The main spillway structure is constructed of reinforced concrete with a large "regulating pier" on the north bank of the river, and two intermediary piers that divide the spillway into three bays. The south intermediate pier incorporates a fishway that is a common component of all six GVHS hydropower dams.[21]

Each bay of the main spillway features a roof-weir or "bear trap" spillgate of the type originally designed in the 1890s by Huber & Lutz and adapted by Fargo Engineering Company for the Texas Power Corporation's Guadalupe River hydropower projects.[22] The Texas Water Commission's 1964 inventory of hydropower dams in Texas indicates the TP-1 roof-weir gates were the first and largest of their of type constructed in Texas.[23] The spillgates are hydraulically operated via internal sluice gates that control water flow into and out of vaults inside the dam as needed to raise and lower the spillgates. Operation of the bear trap spillgates thereby provided a limited degree of control over the water level in Lake Dunlap and allowed seasonally high river flows to spill over the dam and into the river channel below. Flanking the main spillway and retaining walls are earth and concrete embankments that tie the central spillway into the adjacent riverbanks, also helping to control river flows during seasonal flood episodes and preventing erosion of the dam and spillway structures. The north and south embankments are earth filled but incorporate approximately 2,000' of concrete and sheet pile corewalls and are armored with concrete paving to prevent erosion.[24]

2. **Main Spillway and Roof-Weir Spillgates**: The main spillway is 255' long and has a maximum crest elevation of 562.77' above mean sea level (amsl). The main spillway is divided into three bays to accommodate three roof-weir gates, also known as "bear trap" spillgates. Each spillgate is 85' wide and 12' tall and is mounted to adjacent concrete piers. Beneath each spillgate is a chamber and below each chamber is an internal grid of reinforced concrete buttresses and cross-walls that divide the spillway substructure into a series of internal vaults. The vaults span between the left (north) regulating pier and the first intermediate pier (Bay No. 1), between the two intermediate piers (Bay No. 2), and between the second intermediate pier and the right (south) retaining wall (Bay No. 3). The entire spillway structure is founded on a concrete base slab with footings that extend into the clay bottom of the riverbed. The downstream edge of the base slab includes a monolithic extension that interlocks with an apron slab extension to limit the undermining effects of river flows coming over the spillway.[25]

Fargo Engineering Company's standard 12' roof-weir spillgate was designed to operate using hydraulic pressure changes within the dam to raise and lower two leaf sections, with the

[21] See Figure 15 in Appendix A of this report for a view of the fishway structure extending from the TP-1 spillway.
[22] See Figure 16 in Appendix A for a schematic drawing of the roof-weir gates designed by Fargo Engineering Company for TP-1 and other GVHS hydropower dams.
[23] Dowell 1964 includes TP-1 but excludes TP-3 based on reservoir size limits used in that survey report.
[24] See Figure 12 in Appendix A of this report for engineering design details of the corewalls embedded within each embankment at TP-1.
[25] See Figure 9 in Appendix A of this report for design and construction details of the TP-1 base slab.

downstream leaf section supporting the upstream leaf section.[26] Each spillgate features an L-shaped upstream leaf section and an arched downstream leaf section, each constructed of riveted steel trusses and covered with a layer of timber plates. The upstream and downstream leaves of each spillgate are anchored to the adjacent concrete piers by engineered hinges. The major components of each hinge include the castings which are anchored to the concrete piers, the hinge pins which connect the castings to the hinge plates, and the hinge plates which are anchored to the spillgate truss. In the fully lowered position, the downstream gate leaf folds under the upstream leaf, and lays flat on the floor of the spillgate chamber. The gates are raised by filling the chamber below the two leaf sections with water. The water level for each spillway bay is controlled by opening or closing sluice gate and drain control valves located inside the control house. The sluice gates are built into the intermediate piers separating the spillway bays.[27] Drains are built into the left (north) regulating pier and into the intermediate piers.

3. Control House: The TP-1 Dam and Spillway control house located on top of the left (north) regulating pier is a simple, rectangular plan, metal-frame building clad with metal wall and roof panels. The original control house was incorporated into the current control house in the early-to-mid 1960s when it was expanded to provide improved shelter for the spillway controls and their operators.[28] The spillway gates are raised by opening the sluice gate control valves, allowing water to passively fill the chamber beneath the spillgate leaves. In their raised position the leaves were braced in place with locking bars. Conversely, the spillgate leaves are lowered by first raising the leaves to release the locking bars and then draining the water in the chamber below through drains located in the spillway piers. Large windows overlooking the main spillway enable dam operators to oversee their operation of the spillgates.

4. Right (South) Embankment: This earthen embankment connects the right (south) retaining wall to the adjacent right (south) riverbank, extending perpendicular from the river channel approximately 115' before turning upstream and continuing for approximately 70' to the point where the embankment crest ties into existing grade. The upstream slope is armored by cast-in-place concrete that extends approximately 70' from the regulating pier. The corresponding downstream slope is fully armored with cast-in-place concrete and soil cement.[29]

5. Left (North) Embankment and Emergency Spillway: The maximum elevation of the dam at the top of the embankments is at 588.58' amsl, with a crest width of 8' adjacent to the control house.[30] The upstream slope is characterized by a 3:1 slope at the base which then transitions to a 2:1 slope at the crest. The downstream slope is constructed with a 1.5:1 slope at the crest that transitions to a 2:1 slope beneath the corewall. The upstream slopes of the embankment are fully protected by cast-in-place concrete along all segments of the embankment. The downstream slopes of the embankment within approximately 100' of the control house are also armored by cast-in-place

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[26] See Figure 17 in Appendix A of this report for hydraulic forces involved in operation of the standard 12' weir-gates at TP-1.
[27] See Figure 14 in Appendix A of this report for details of the TP-1 intermediate piers and sluice gates involved in controlling the spillgates.
[28] See Figure 26 in Appendix B for an image of the original TP-1 control house as it was being expanded in the 1960s.
[29] See Figures 10 and 11 in Appendix A for details of the retaining walls that flank the main spillway.
[30] See Figure 12 in Appendix A for elevations and sections of TP-1 embankments and corewalls.

concrete and a layer of soil cement before transitioning to grass-covered slopes that characterize the remainder of the downstream embankment as it extends north to its terminus.
The upstream side of the embankment extends approximately 300' northeast from the control house where it transitions into an emergency spillway 215' long, which is a simple grass-covered berm approximately 8' high with an upstream slope of 2:1, a crest width of 2', and a downstream slope of 1.5:1. Beyond the emergency spillway, the embankment resumes and continues an additional 115' to the TP-1 by-pass canal. Beyond the canal, the earthen embankment resumes, extending an additional 650' to its termination at an at-grade gravel access road.

6. Diversion Canal: Approximately 400' upstream from TP-1 Dam and Spillway, a diversion canal approximately 50' wide opens into the left (north) bank of the Guadalupe River and extends northeast approximately 450' before turning southeast and passing through the left (north) dam embankment at a concrete canal control structure that includes two radial Tainter Gates. The two control gates are lifted by chain hoists attached to an overhead steel A-frame and pivot on hinges attached to retaining walls that line each bank of the canal. From the control gates, the diversion canal flows approximately one-and-a-half miles southeast, bypassing the natural channel of the Guadalupe River, to the TP-1 powerhouse.

7. Powerhouse: The TP-1 powerhouse is an original component of the TP-1 Dam and Hydropower Complex and the only component that features architectural detailing of concrete and red brick.[31] It is located approximately one-and-a-half miles downstream from the TP-1 Dam on the left (north) bank more than 20' above the natural river channel. A small bypass spillway is located upstream from two upstream control gates to redirect canal flows into the river when the control gates are closed. The pair of control gates are located just upstream of the west wall of the powerhouse and can be raised or lowered to control incoming canal flows entering the powerhouse at an elevation of 573' amsl before falling vertically into the powerhouse wheel pit. A debris screen and a head gate further control the canal flow before it enters the powerhouse wheel pit.

The powerhouse interior is designed with a mezzanine level around two 2,800 horsepower Francis-type vertical turbines originally furnished by James Leffel & Company. At 180 revolutions per minute (rpm), each turbine generates 1,800-kilowatt (KW), three-phase, sixty-cycle, 2.400-volt electrical power. With a direct connected exciter and control panels provided by General Electric Company, the turbines provide a total generating capacity of 3,600 KW.[32] The interior of the powerhouse also features a large overheard crane on rolling tracks for lifting the heavy turbine components when repairs are needed. Electrical power generated by the powerhouse is transmitted to the GVHS electrical grid via an electrical substation mounted atop the powerhouse. While the TP-1 powerplant retains its original power plant control panels, it has been fitted with equipment for fully remote operation from a central control center located in the GBRA headquarters in Seguin, TX.

C. Mechanicals/Operations: TP-1 is a run-of-river plant that depends on flows in the Guadalupe River that are highly variable, ranging from twenty-eight cfs to well over 46,300 cfs with a median and average flow of 395 cfs and 613 cfs, respectively. On June 16, 1964, storage began in Canyon Reservoir approximately fifteen miles upstream from New Braunfels, Texas. After that date, the flow of the river was partly regulated by releases from Canyon Reservoir, which has a discharge capacity of

[31] See Figure 7 in Appendix A for architectural elevations and sections of the TP-1 powerhouse.
[32] See Figures 5 and 6 in Appendix A for plans and sections of the TP-1 powerhouse.

approximately 5,000 cfs. During large flood events, rainfall on the intervening watershed areas downstream of Canyon Lake Dam can contribute a significant portion of the river flow.

The roof-weir "bear trap" spillgates at TP-1, like each of the six GVHS dams downstream from Canyon Reservoir, provide primary control of headwater levels in its corresponding reservoir (Lake Dunlap). This head is used to provide controlled water flow via a bypass canal to the TP-1 powerhouse located approximately one-and-a-half miles downstream, where the water level is again controlled by headgates before it enters the powerhouse wheelpit to turn a pair of turbines and produce electricity. The hydraulic profile for the Guadalupe River system includes a drop in elevation of 46.5' between the TP-1 spillway and the TP-1 powerhouse before the outflow returns to the Guadalupe River and continues downstream through each the five GBRA hydroelectric facilities.[33]

During normal operation, TP-1, like each of the six GVHS hydropower facilities, is operated to pass all river flow through the turbines while maintaining the reservoir at its full-pond level to maximize operating head without overflowing the spillgates. When the river flow exceeds the flow capacity through the TP-1 powerhouse, or when the powerhouse is not generating, GBRA will spill the flow over the spillgates. During low river conditions, when river flow is not adequate to operate the TP-1 powerhouse turbines, GBRA shuts the powerhouse down and passes the river flow over the TP-1 spillgates. The total flow capacity through the TP-1 powerhouse at the normal operating level is about 1,250 cfs.

When a flood event occurs, the water level at the TP-1 dam will start to rise and spill over the spillgates. Water flow in the bypass canal will also rise causing excess flow levels at the downstream TP-1 powerhouse. When the water level reaches the spill-point level, GBRA will manually start adjusting the TP-1 spillgate positions in an attempt to keep the water in Lake Dunlap at a specified spill-to-hold level from 0.2' to 0.6' below the spill-point level. Due to the highly variable nature of flooding on the Guadalupe River there is currently no set operational plan for relating changes in water level to gate position. The historic design of the bear trap spillgates makes it very difficult to maintain a desired gate position. Consequently, gate adjustments are made by trial-and-error experience of the GBRA dam operators. GBRA personnel monitor upstream weather conditions and flow releases to help anticipate expected inflows. During spill events, the dams must be staffed twenty-four hours a day to continuously monitor water levels and adjust spillgate positions.

D. Site Information: The TP-1 dam and spillway is the northernmost component of a hydropower plant complex situated along the north bank of the Guadalupe River as it descends from the Texas Hill Country and enters onto the Blackland Prairies of the Texas Coastal Plain. TP-1 is located approximately five miles southeast of New Braunfels and eight miles northwest of the GVHS headquarters in Seguin, TX.[34] When viewed from ground level, the TP-1 dam and spillway is an impressive engineering structure set among mature native trees with the main spillway and south (right) embankment rising to an elevation equal to that of the adjacent riverbank. In contrast, the north (left) bank of the Guadalupe River is substantially lower in elevation, with the TP-1 spillway and its left (north) embankment overlooking the natural river channel below. TP-1's engineered by-pass canal, controlled by a pair of Tainter Gates at the upstream end, is cut into the natural terrace and parallels the north bank of the river for one-and-a-half miles before it reaches the TP-1 powerhouse, itself set into the terrace edge approximately 20' above

[33] See Figure 17 in Appendix A for an illustration of hydraulic pressures involved in operating the spillgates at TP-1.
[34] See Figure 1.

the natural river channel below. From the TP-1 spillway to the TP-1 powerhouse, the overall TP-1 hydropower complex exhibits a distinctive integration of engineering design within a natural riverine landscape that has characterized TP-1 and its related GVHS run-of-the-river hydropower plants for more than ninety years.

PART III. Sources of Information

A. Primary Sources:

Anonymous. "Historical photographs of Texas Power Corporation Development No. 1 (TP-1)." Various dates. Original photographic prints are on file at the Guadalupe-Blanco River Authority Headquarters, Seguin, Texas. Additional historical photographs of TP-1 and its related GVHS hydropower plants are also archived at GBRA headquarters in Seguin, Texas. Some of the original photographic prints within GBRA's collection were likely produced by Otto Seidel of Seidel Photography of New Braunfels, Texas specifically for the Texas Power Corporation development projects. Additional Seidel photographs and negatives of the GVHS hydropower projects are archived at the Sophienberg Museum and Archives in New Braunfels.

Fargo Engineering Company. "As-built/Record drawings of Texas Power Corporation Development No. 1." Various dates. Digitally scanned drawing images are on file at the Guadalupe-Blanco River Authority, Seguin, Texas. Included and additional as-built/records drawings of TP-1 and its related GVHS hydropower plants can be found in the engineering records of the Guadalupe-Blanco River Authority headquarters in Seguin, Texas. Original drawings are archived at the Bentley Historical Library, University of Michigan.

B. Secondary Sources:

Anonymous. "Electrical Power." *Handbook of Texas Online*. Texas State Historical Association. https://www.tshaonline.org/handbook/entries/electrical-power, accessed October 26, 2020

______. *Hydropower Program; The History of Hydropower Development in the United States.* U.S. Bureau of Reclamation. https://www.usbr.gov/power/edu/history.html, accessed October 26, 2020.

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Billington, David P., Donald C. Jackson, and Martin V. Melosi. *The History of Large Federal Dams: Planning, Design, and Construction in The Era of Big Dams.* Denver: U.S. Department of the Interior, Bureau of Reclamation, 2005.

Brazos River Authority. "Morris Shephard Dam 1941." 1941. https://www.brazos.org/About-Us/News/News-Room/Resource-Library/Dams-Backbone-of-the-Authority-Reservoir-System, accessed October 26, 2020.

Bruns, Joe L., and Linda C. Flory, "Saffold Dam," National Register of Historic Places Nomination Form (Washington: U.S. Department of the Interior, National Park Service, 1979. https://atlas.thc.texas.gov/NR/pdfs/79002950/79002950.pdf, accessed October 26, 2020.

Cockroft, Cody M. and James B. Dower. "Replacing Spillway Gates." *Hydro Review*, Issue 2, Volume 26 (April 2007). https://www.hydroreview.com/2007/04/01/replacing-spillway-gates, accessed 10/28/2020.

"Corporations Chartered." *Houston Post* Volume 27, Edition 1 (March 6, 1912). https://texashistory.unt.edu/ark:/67531/metapth605132, accessed October 26, 2020.

Dowell, C. L. "Dams and Reservoirs in Texas: Historical and Descriptive Information." Texas Water Commission Bulletin 6408 (July 1964).

McKee, Floyd. "Area dams have seen better times: Snapshots of Seguin History." *Seguin Gazette* (June 9, 2019). http://seguingazette.com/opinion/community_columnists/article_c1f8ef36-8a40-11e9-8837-63a42cfc2ae7.html, accessed October 30, 2020.

Schroeder, Eric. "Draft report Cultural Resources Survey Along the Guadalupe-Blanco River Authority's San Marcos Raw Water Pipeline Hays, Caldwell, Comal, and Guadalupe Counties, Texas." Westlake Hills: Paul Price Associates.

C. Likely Sources Not Yet Investigated:

None known.

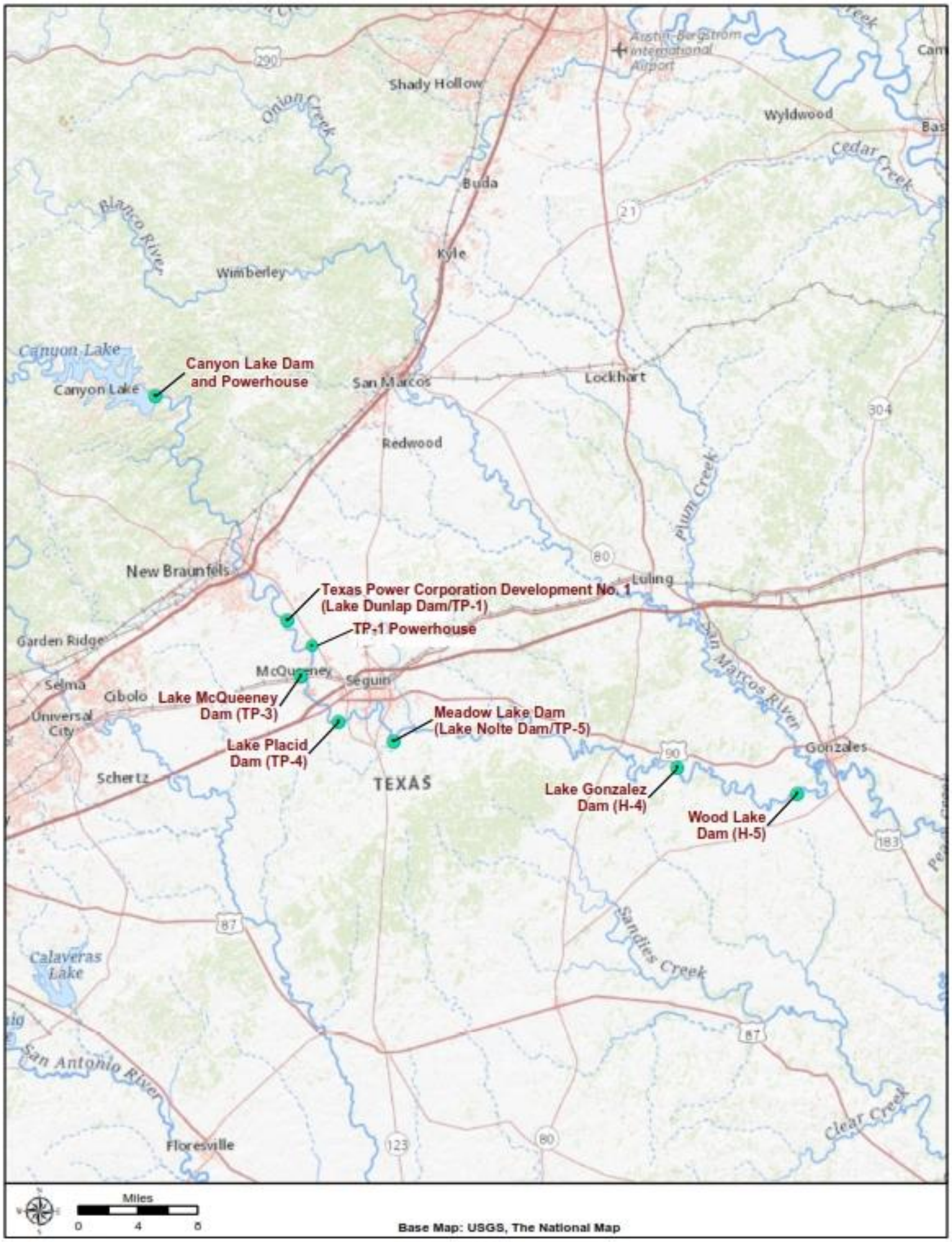


Figure 1. Location Map of Texas Power Corporation Development Number 1 and Related GVHS Plants.

APPENDIX A

REDUCED COPIES OF MEASURED AND INTERPRETIVE DRAWINGS

The engineering drawings identified in this appendix were provided by the project engineering firm, Black and Veatch Inc., from engineering records archived at the Guadalupe-Blanco River Authority's (GBRA) headquarters in Seguin, Texas. Almost all the drawings were prepared by Fargo Engineering Company of Jackson, Michigan, although most of the spilllgate drawings appear to be shop drawings produced by The Petroleum Iron Works Company of Beaumont, Texas for their manufacturing of the spillgates. The Fargo Engineering Company drawings appear to be original construction plans developed between 1926 and 1928 specifically for Texas Power Corporation Project No. 1 (TP-1) and then updated during and after construction to create a final set of record drawings for the project. Margin notes appearing on many of the drawings document ongoing reviews and changes made during project construction. A few drawings make specific reference to as-built conditions documented in field drawings. Several drawings date from 1932 when a flood destroyed the south retaining walland embankment, requiring updated plans for repairing the south embankment and retaining wall as well as modifications to improve erosion control for both the north and south retaining walls and their concrete slope paving systems.

Sixteen engineering drawings have been selected for their representation of the TP-1 hydropower plant as it was originally designed and constructed. Additional drawings and data sheets for TP-1 as well as other GVHS dams are archived as digitally scanned images at GBRA's headquarters in Seguin, Texas. The original TP-1 drawings are archived within the Fargo Engineering Company records at Bentley Historical Library, University of Michigan.

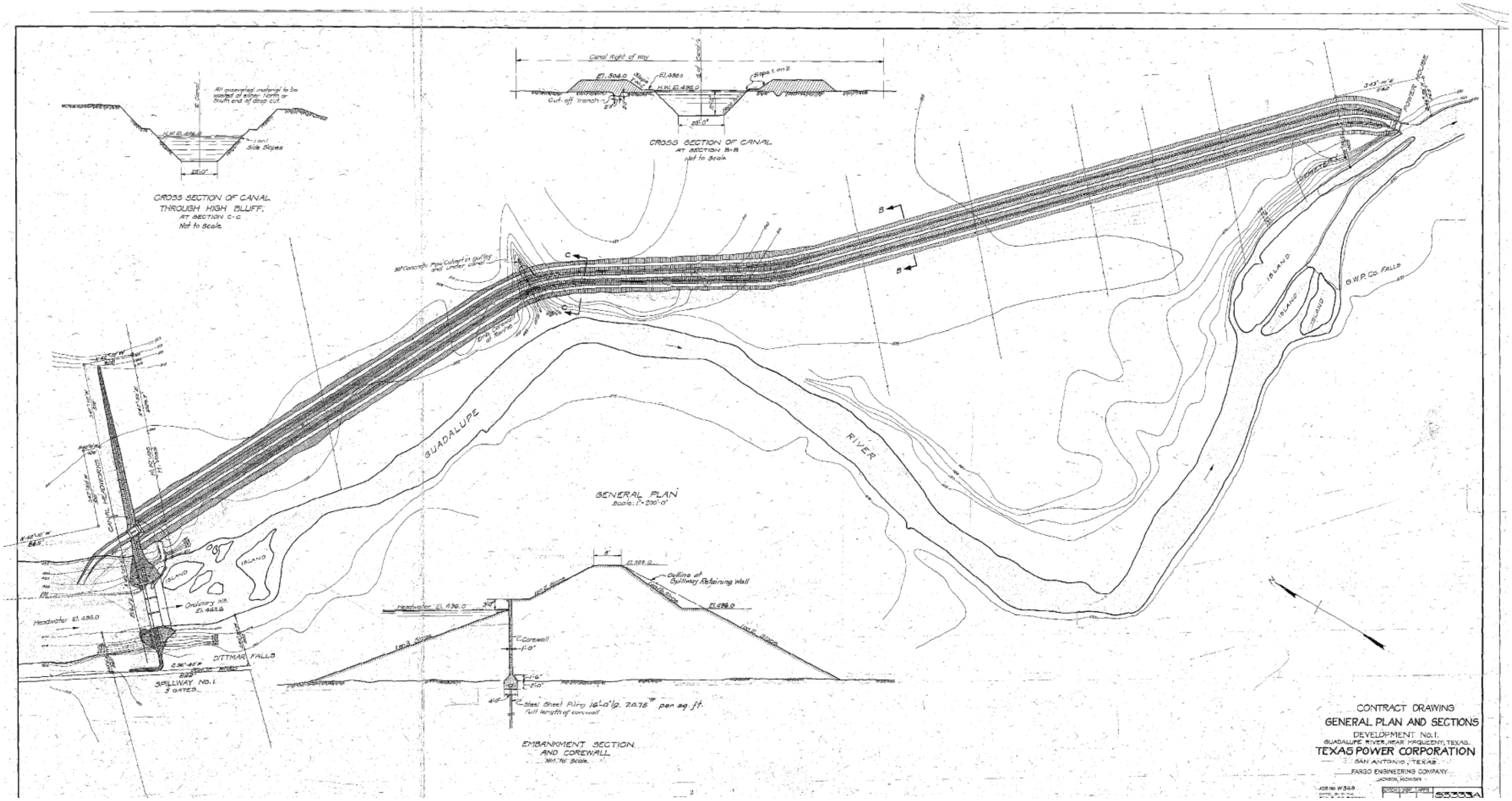


Figure 2. General Plan and Sections

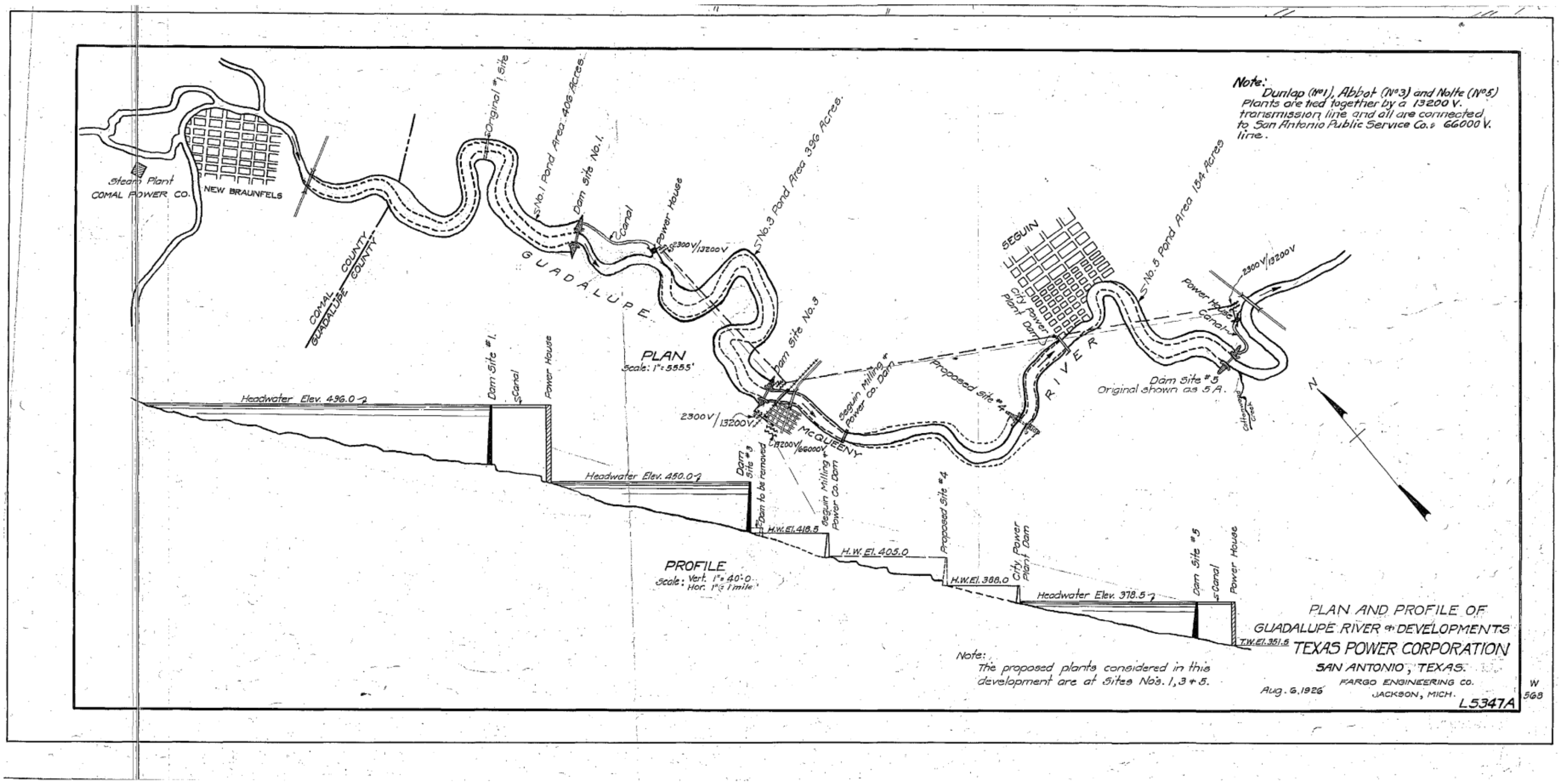


Figure 3. Plan and Profile of Guadalupe River Developments

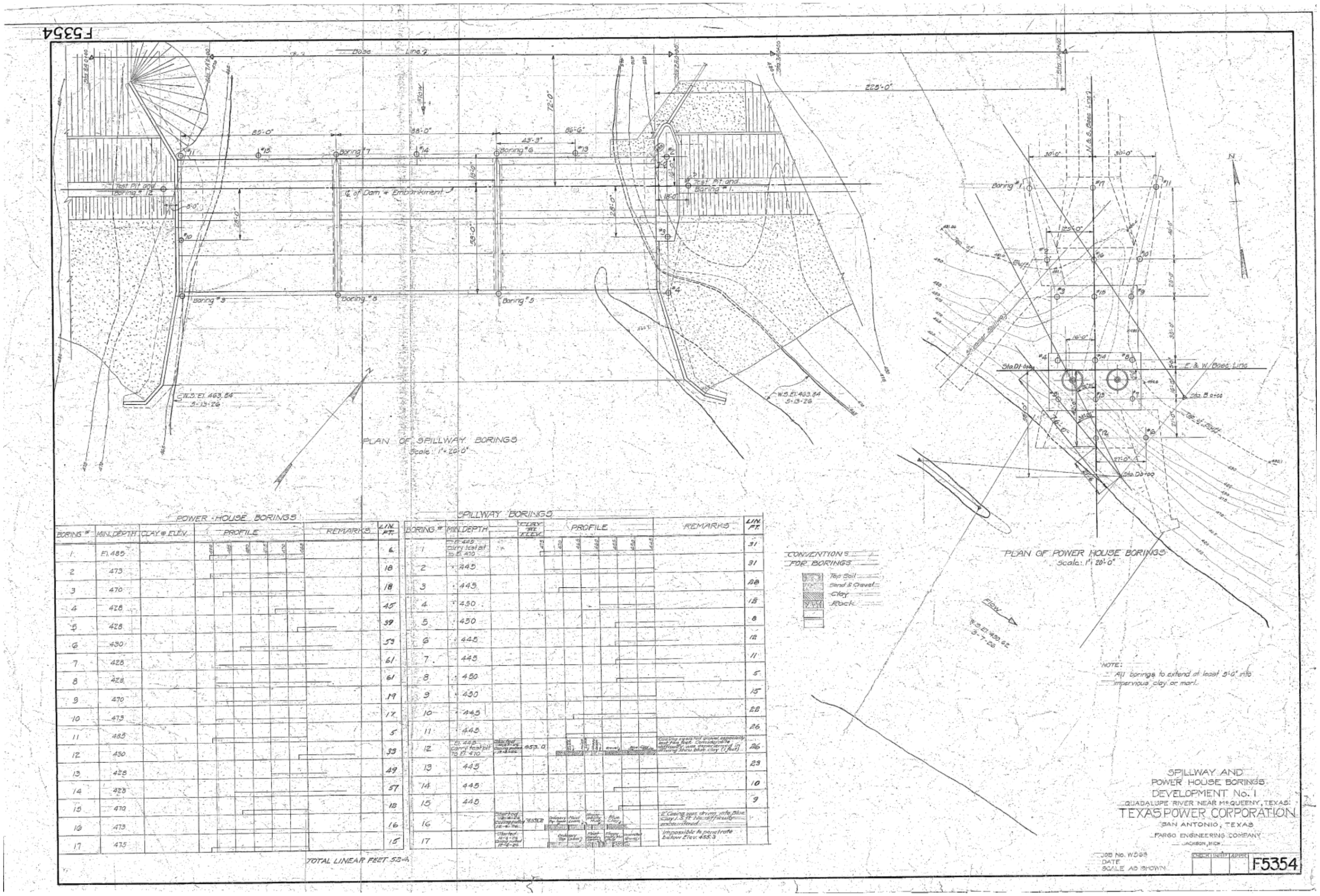


Figure 4. Spillway and Power House Borings

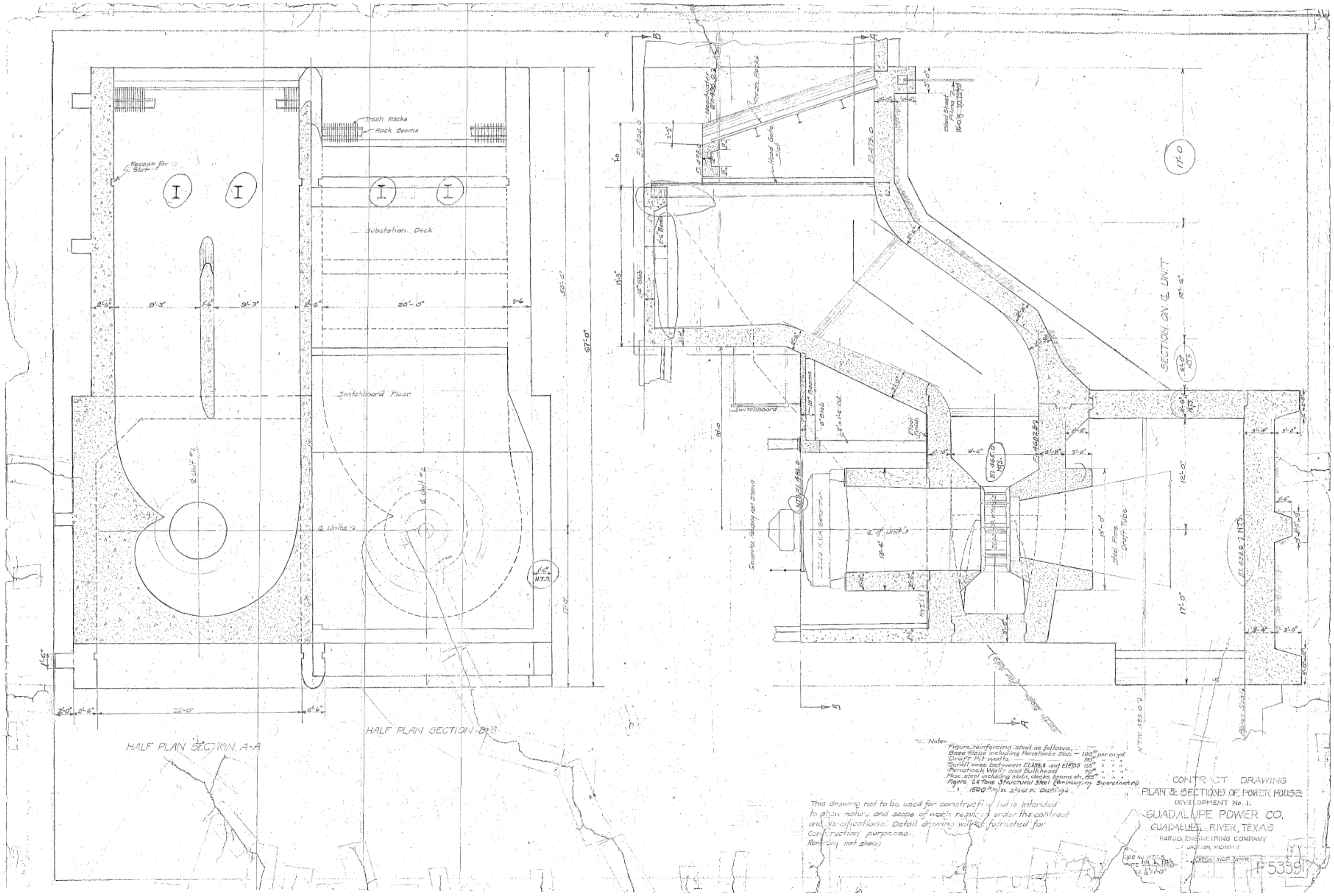


Figure 5. Plan and Section of Power House

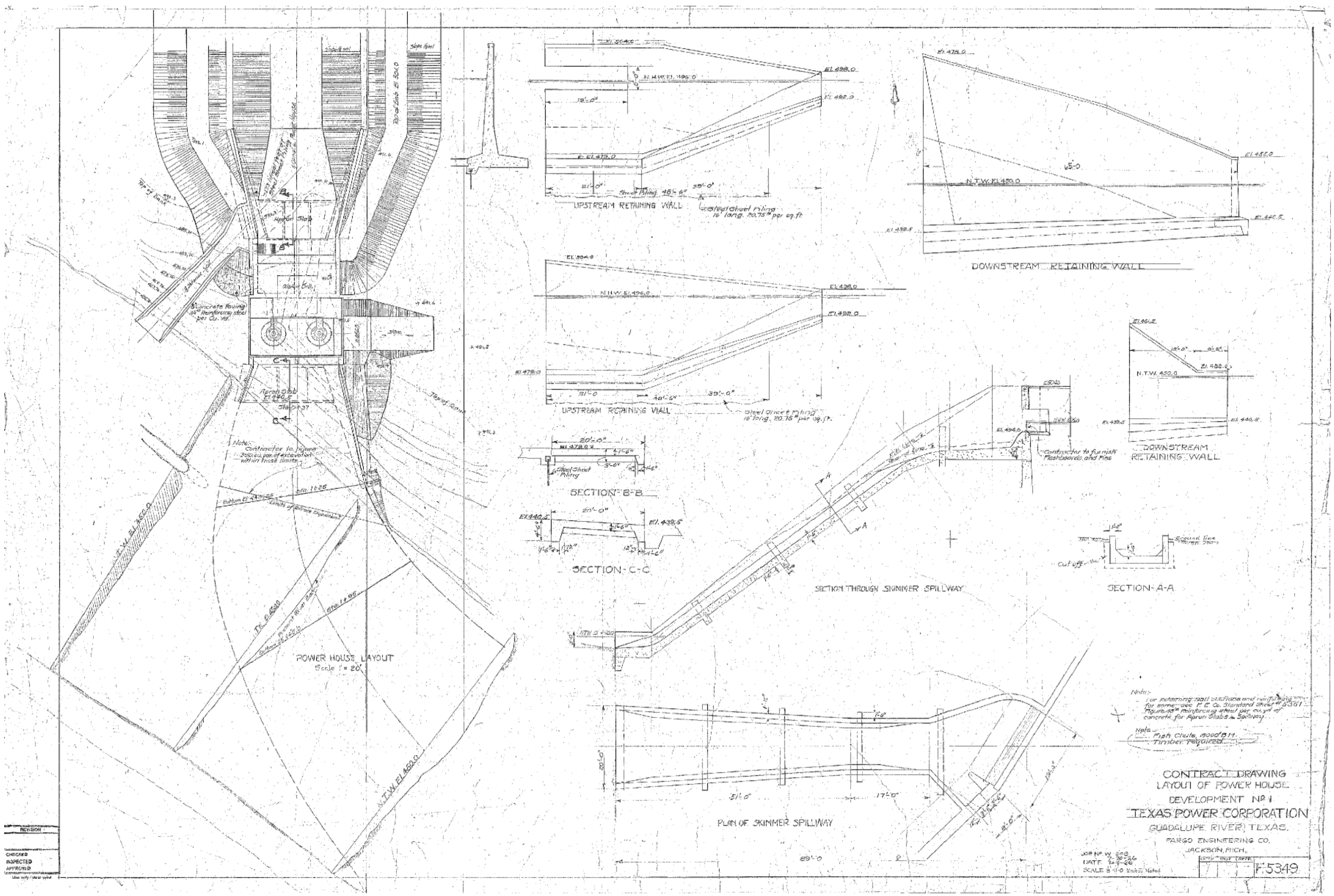


Figure 6. Layout of Power House

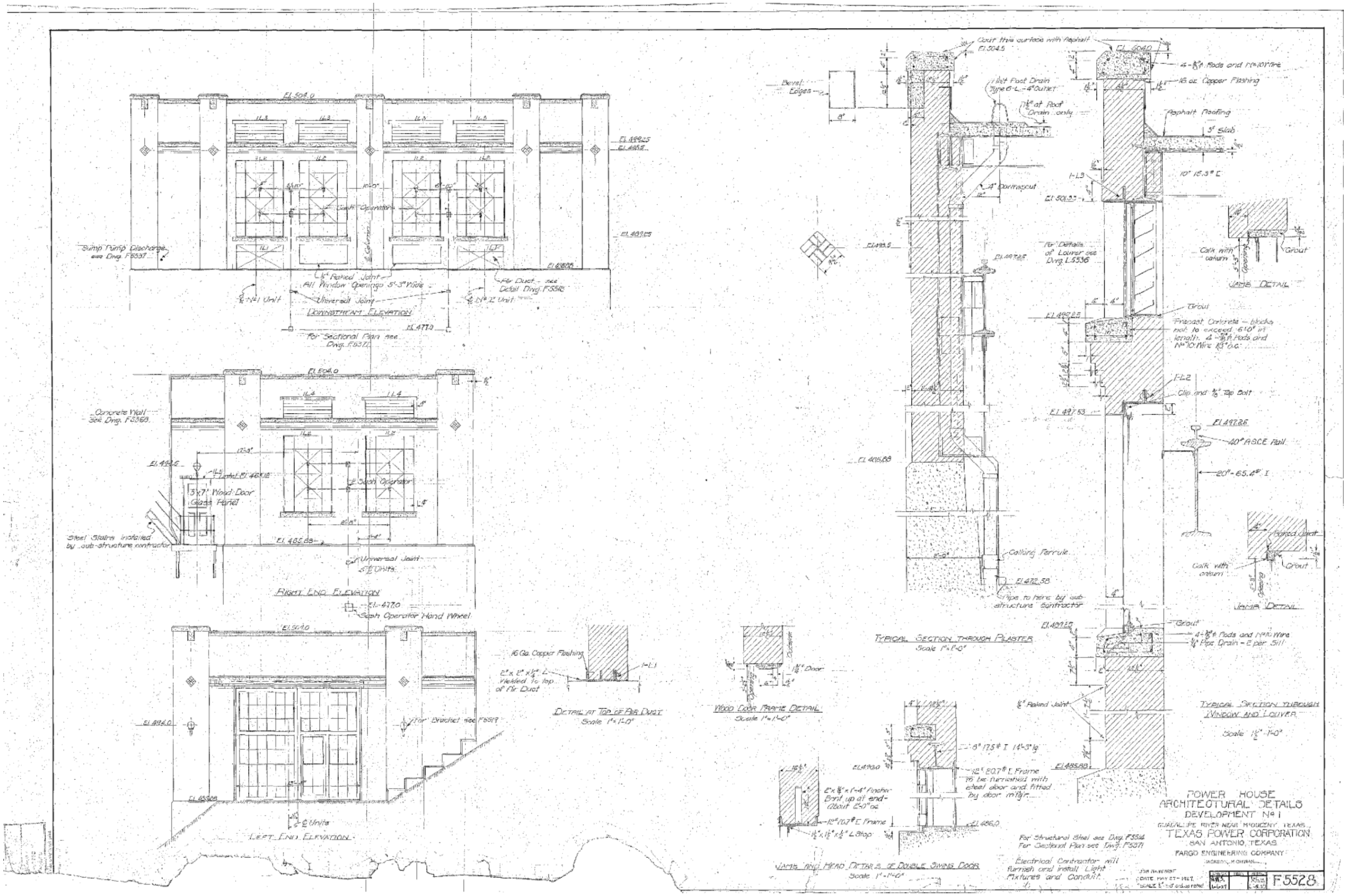


Figure 7. Power House Architectural Details

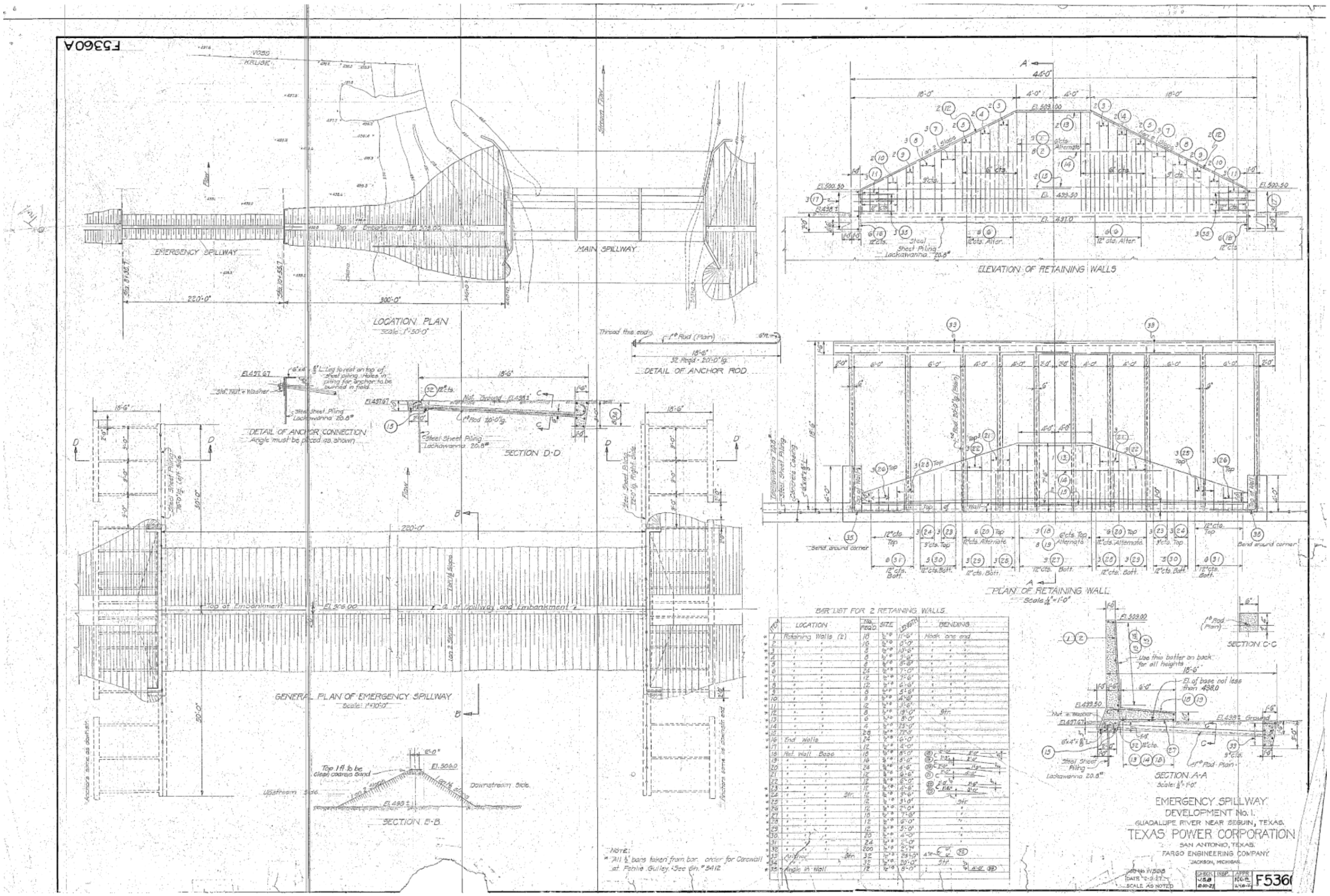


Figure 8. Emergency Spillway

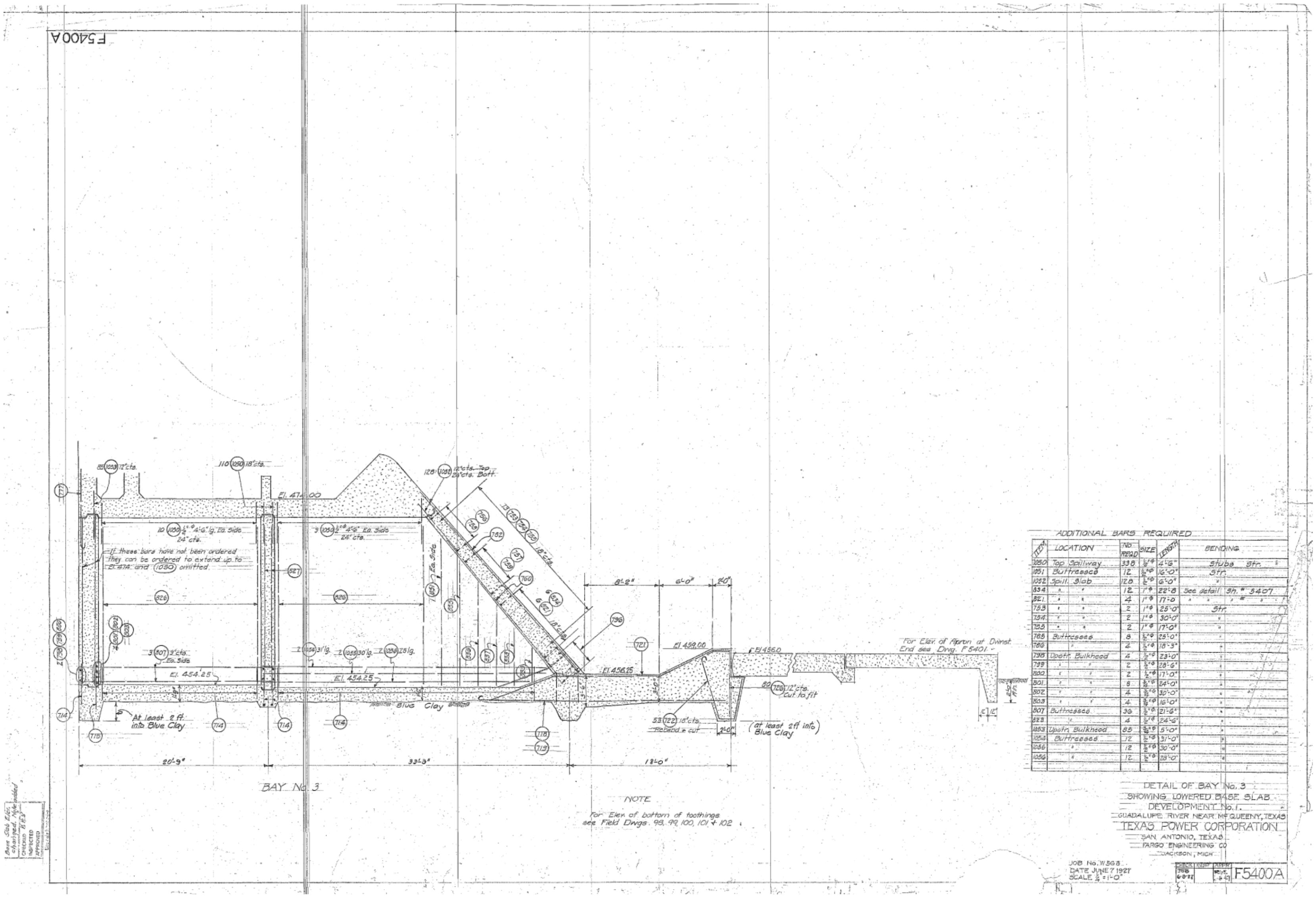


Figure 9. Lowered Base Slab of Bay 3

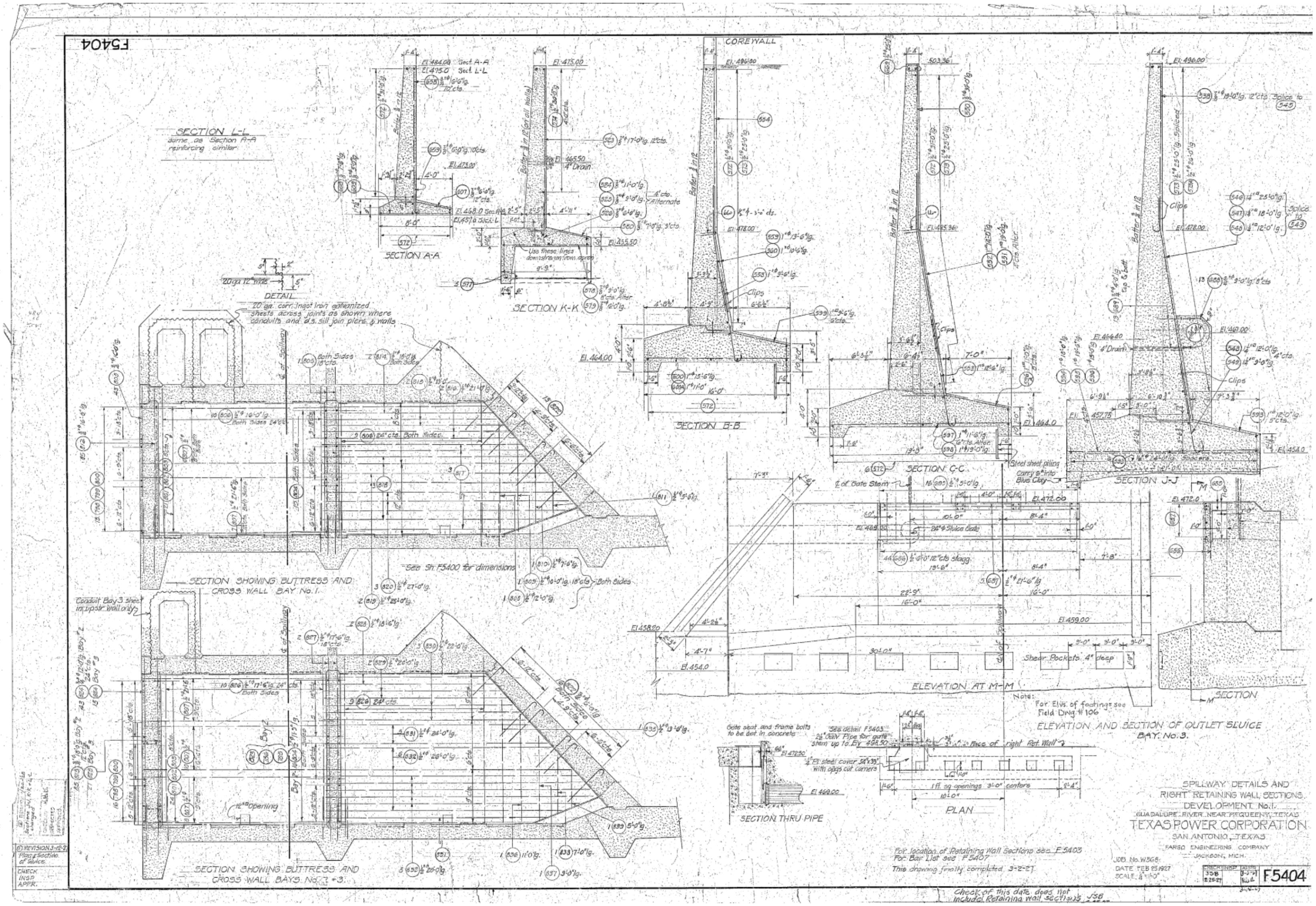


Figure 10. Spillway Details and Right Retaining Wall Sections

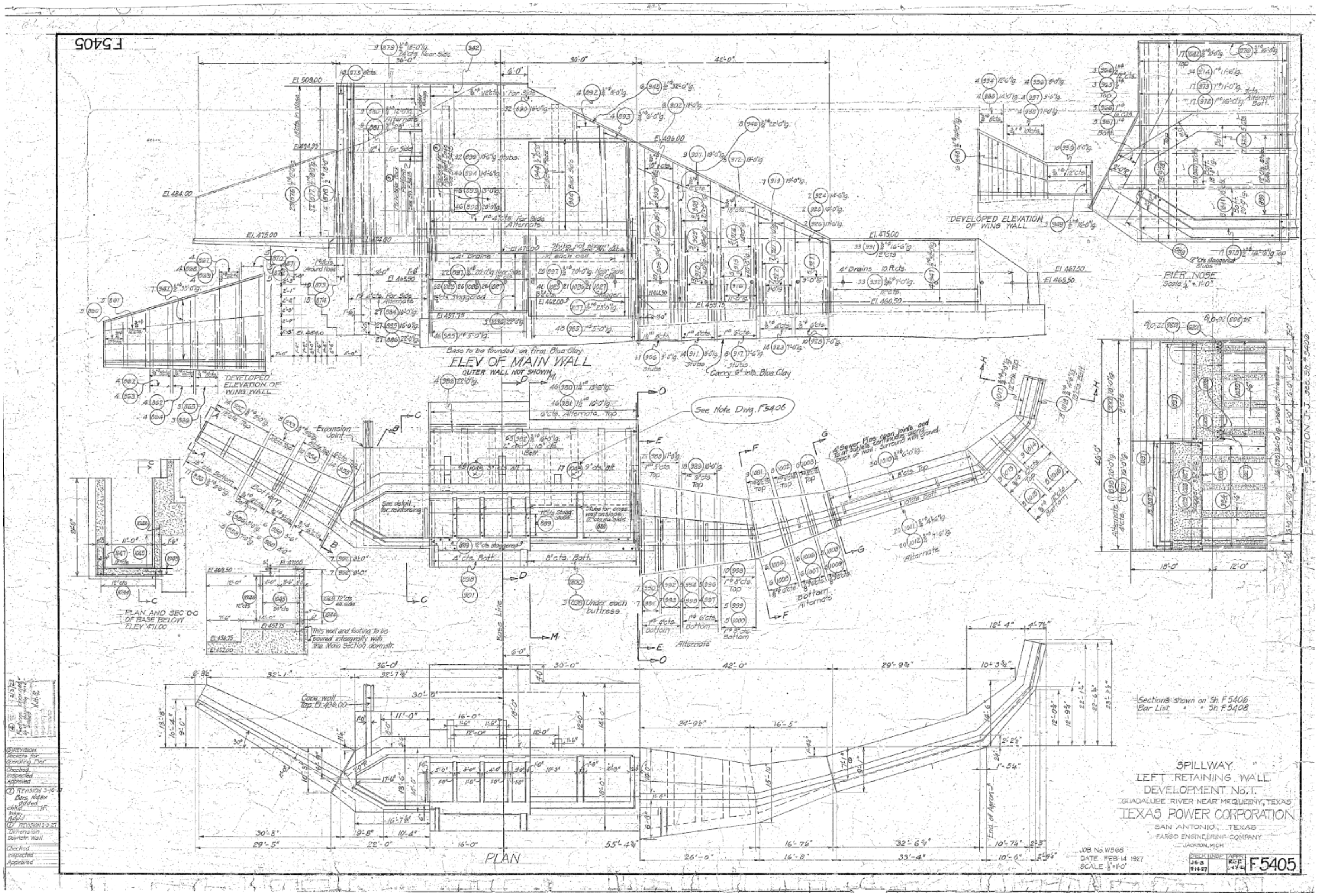


Figure 11. Spillway Left Retaining Wall

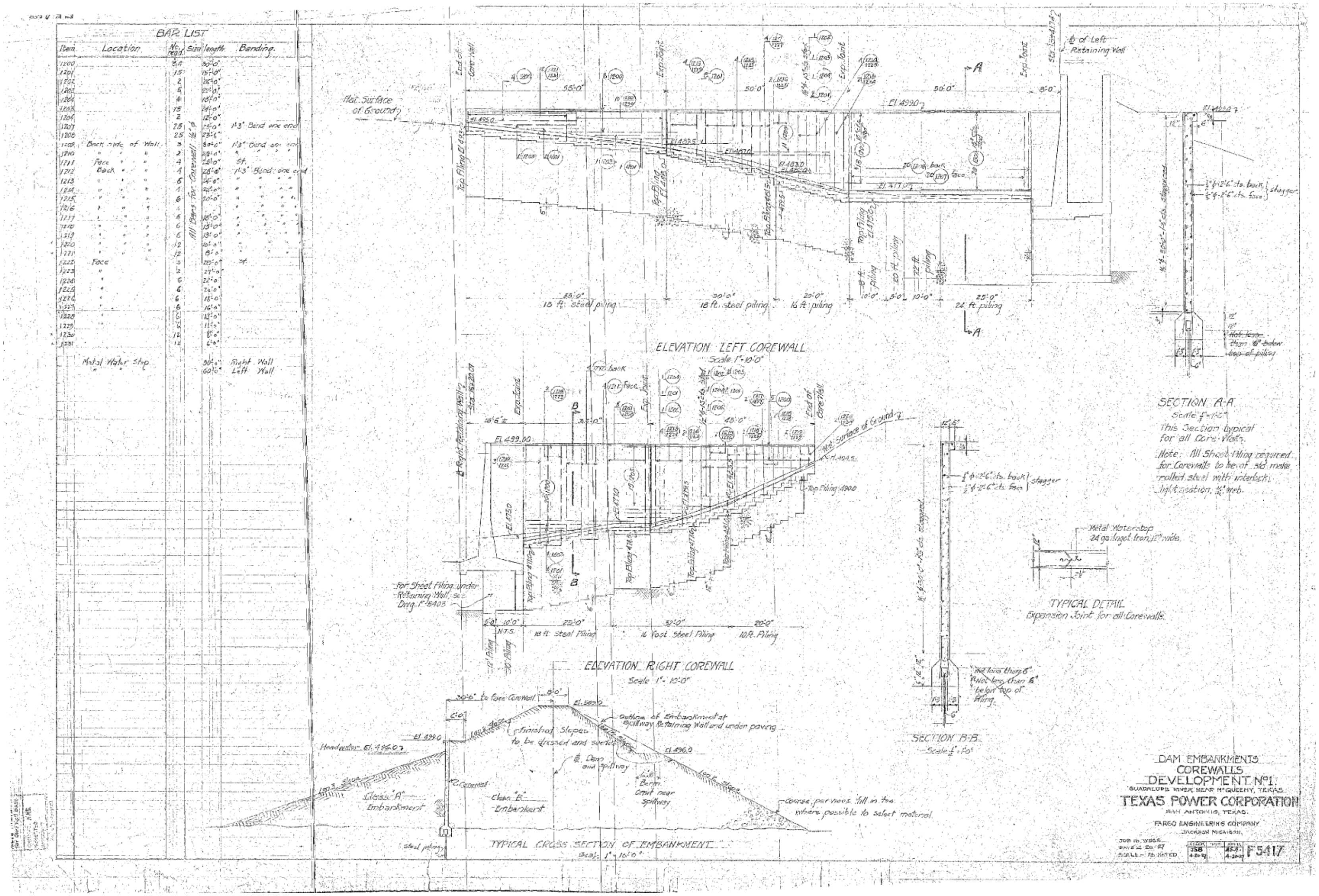


Figure 12. Dam Embankments and Corewalls

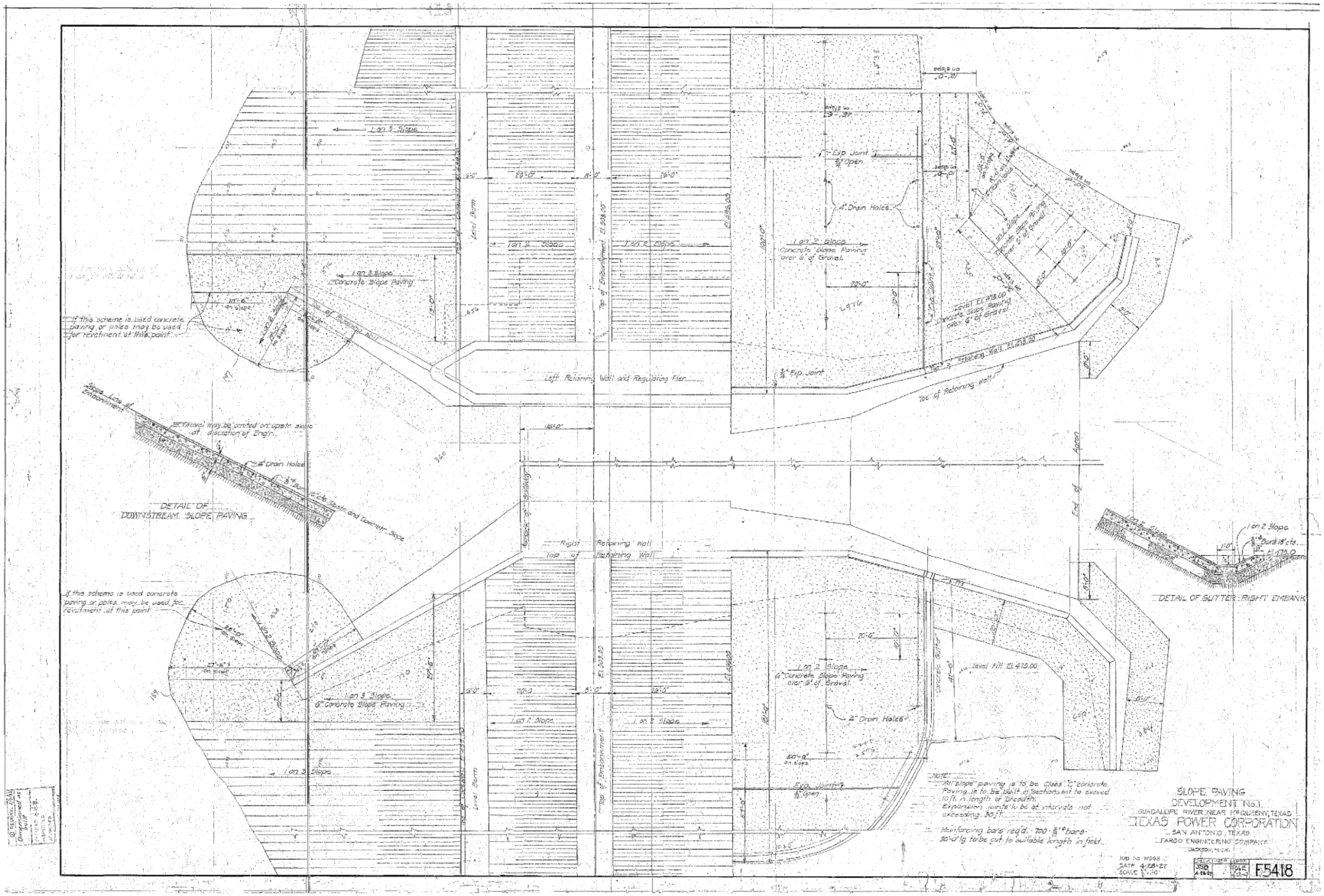


Figure 13. Slope Paving

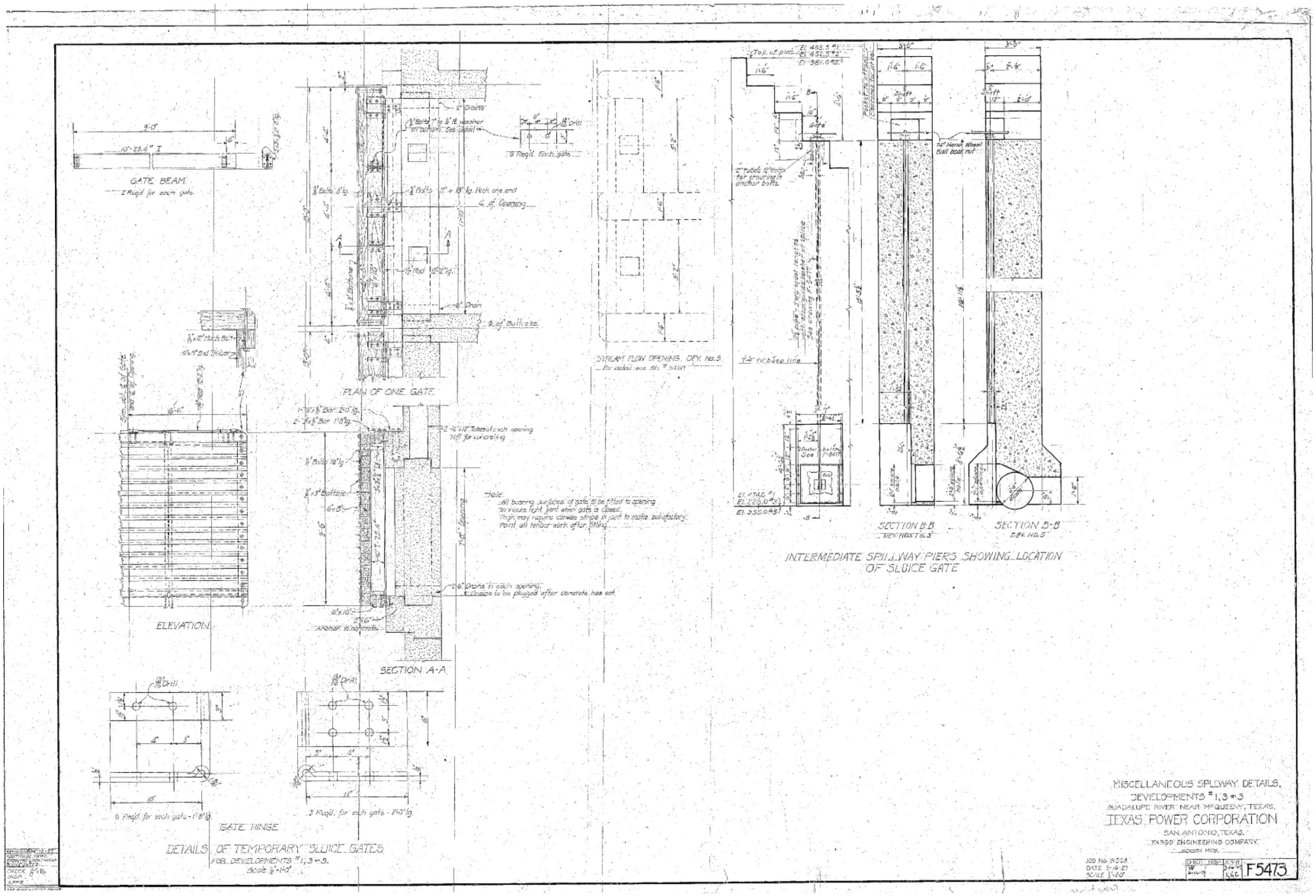


Figure 14. Miscellaneous Spillway Details

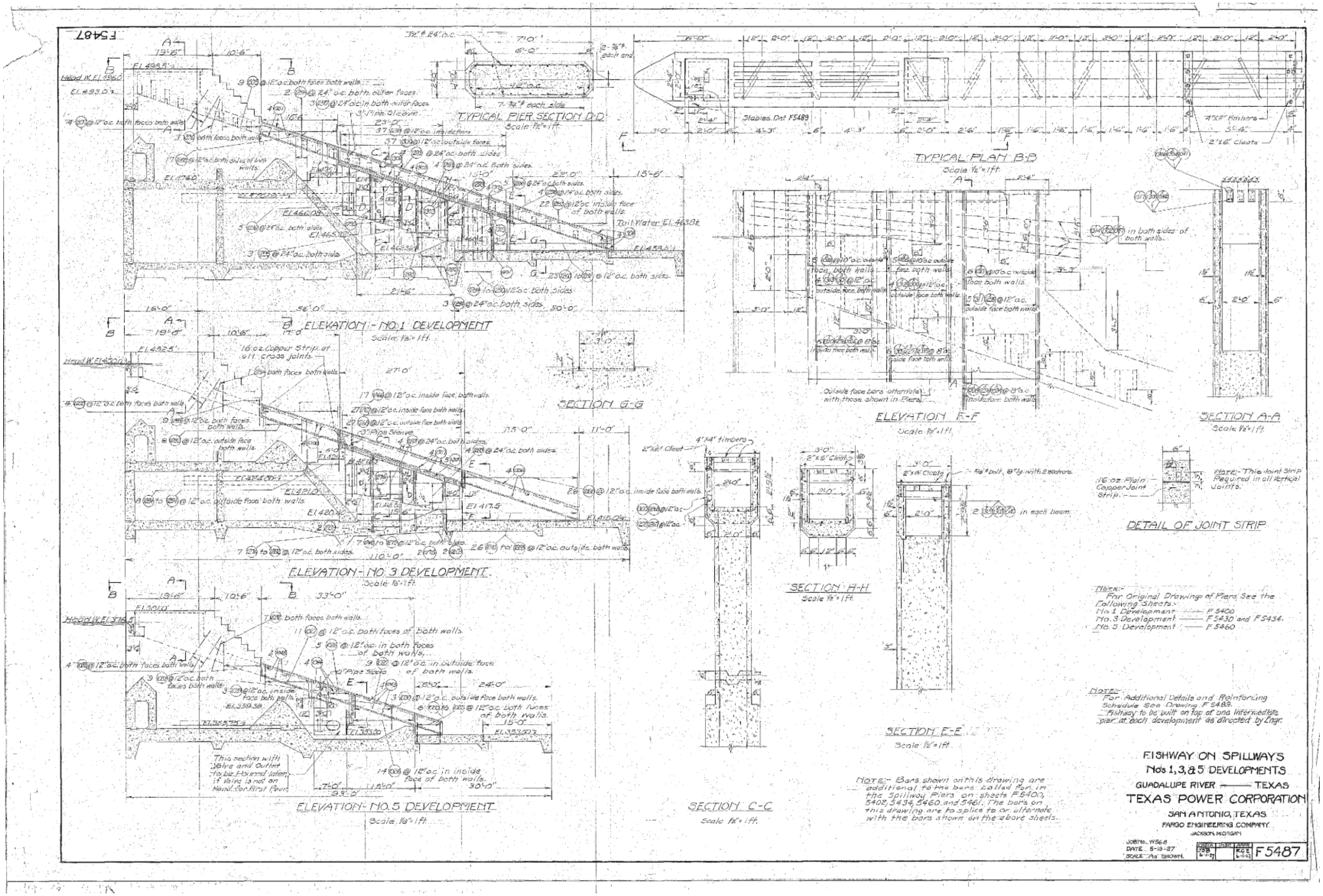


Figure 15. Fishway on Spillway

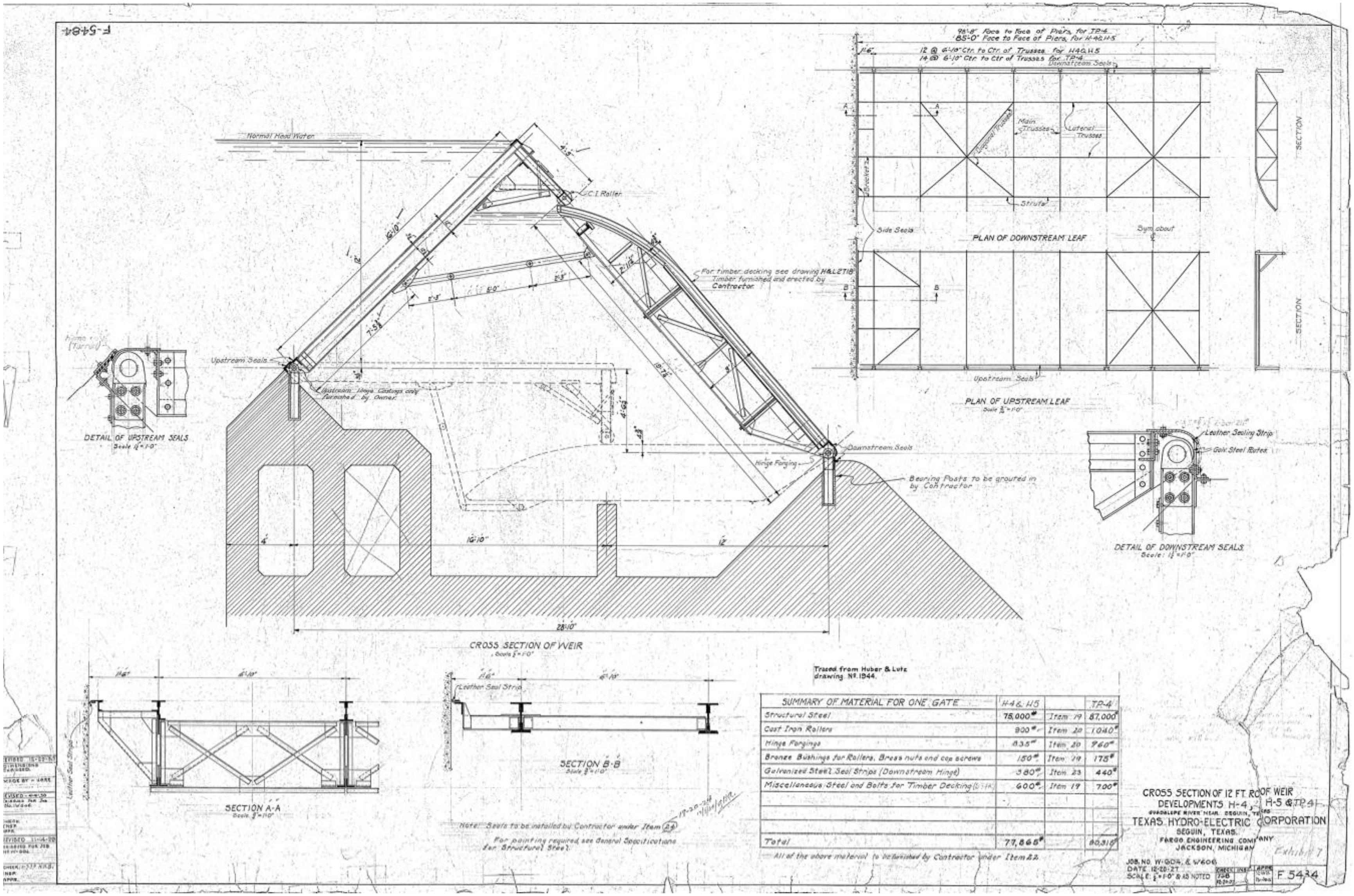


Figure 16. Cross Section of 12 Ft. Roof Weir

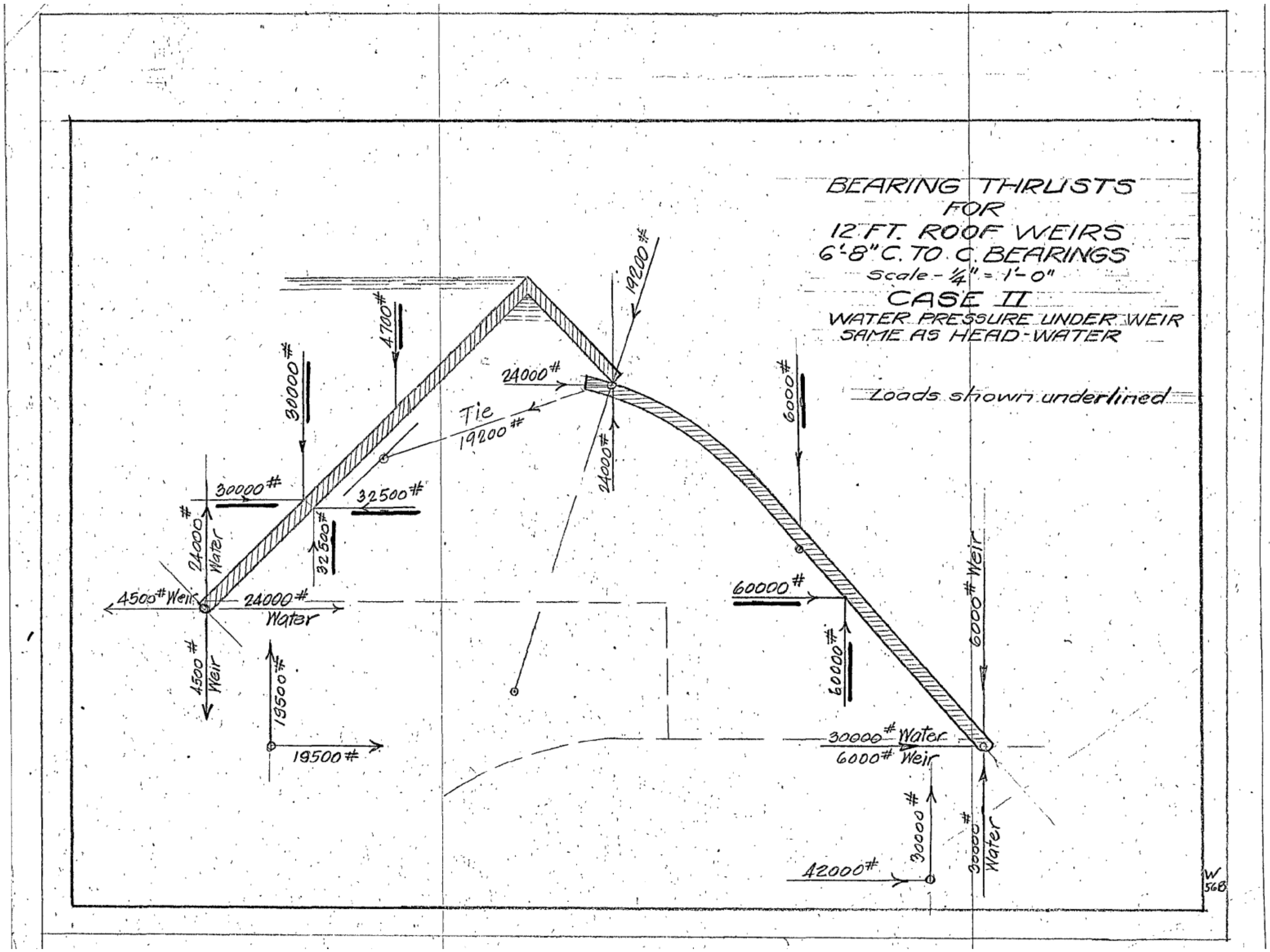


Figure 17. Bearing Thrusts for 12 Ft. Roof Weirs

Appendix B Historic and Digital Photographs

The eleven historical photographs included in this appendix were scanned from original prints archived in the engineering records collections at the Guadalupe-Blanco River Authority's headquarters in Seguin, Texas. Photographer/s are unknown, and all but one image are undated. The historical images are organized in a general chronological sequence. Figures 18 through 21 are believed to be 1927 to 1928 construction-phase photographs recognizable by the construction activities. Only Figure 19 is dated, April 15, 1928, and represents TP-1 (Lake Dunlap Dam) when it was newly completed. Figures 22 through 24 appear to document reconstruction of the right (south) embankment and retaining wall system following a 1932 flood. Figure 25 is an aerial view that shows the original TP-1 control house atop the north regulating pier as it was being expanded with a steel-frame shelter shown in Figure 26. Figure 27 appears to show routine maintenance of the timber facings of the TP-1 spillgates in the 1960s. Figure 28 appears to be contemporaneous with Figures 25 through 27. It shows the original "Tainter Gates" near the head of the TP-1 by-pass canal in much the same condition as they were when they were recorded in January 2021.

The remaining twelve photos are images taken by the project owner and their TP-1 dam repair project consultants with no available photographic negatives.

Figure 18. TP-1 spillway, bays 1 and 2 with intermediate support pier under construction, ca. 1927, looking northeast

Figure 19. TP-1 spillway, April 15, 1928, looking northeast

Figure 20. Concrete armored left (north) embankment and regulating pier, ca. 1928, with transmission lines and tower, looking southwest

Figure 21. TP-1 right (south) embankment, ca. 1928, looking north

Figure 22. TP-1 right (south) upstream retaining wall under repair, ca. 1932, looking southeast

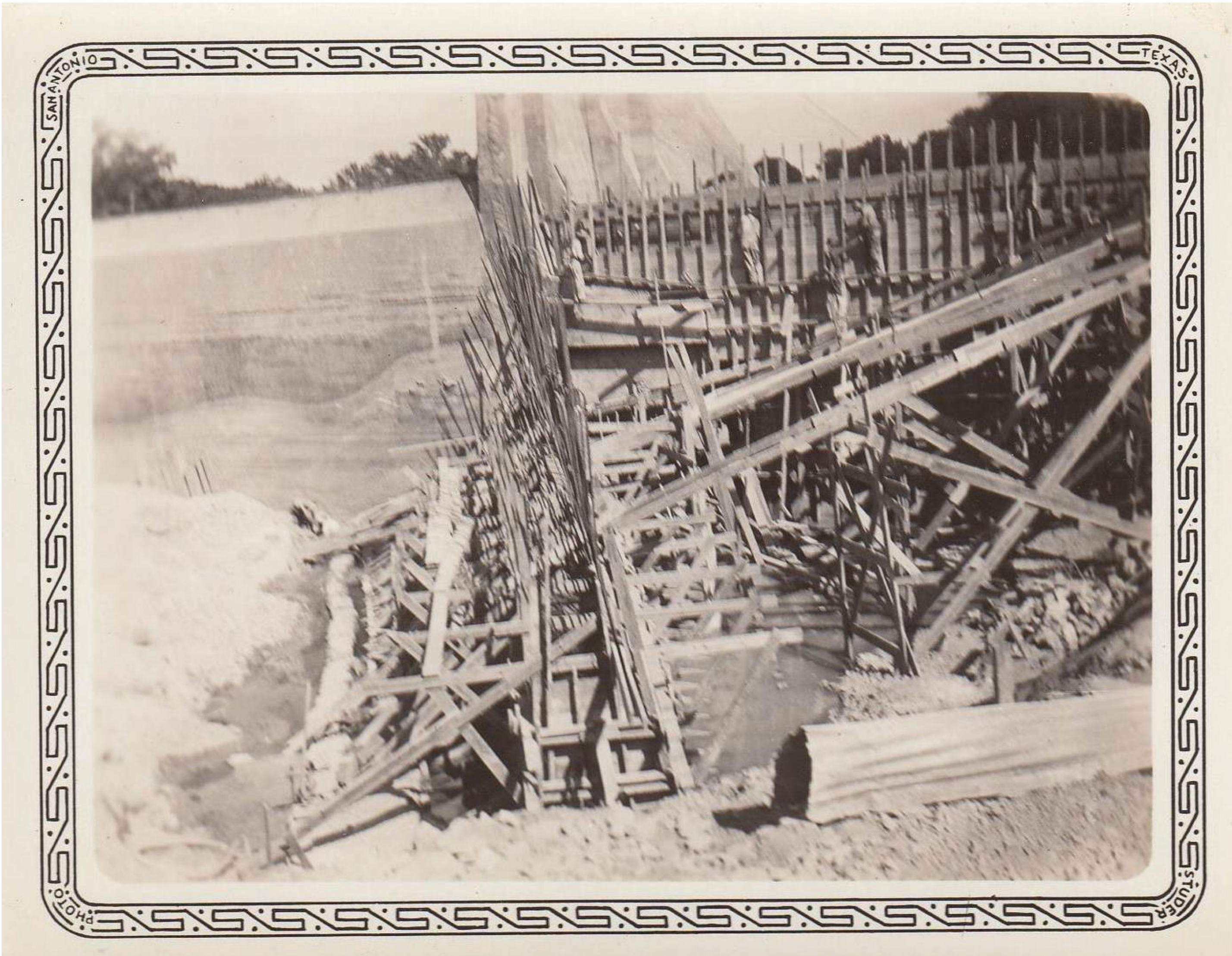


Figure 23. TP-1 right (south) downstream retaining wall under repair, ca. 1932, looking northwest

Figure 24. TP-1 right (south) embankment and retaining wall under repair with north regulating pier and control house (background), ca. 1932, looking east

Figure 25. TP-1, aerial perspective, ca. 1965, looking north

Figure 26. Expansion of TP-1 control house with original control house (right), ca. 1965, looking southwest

Figure 27. TP-1 Spillway undergoing spillgate maintenance with intermediate piers, fishway, and right (south) retaining wall, ca. 1965, looking northwest

Figure 28. TP-1 by-pass canal with control gates and lifting frame at TP-1 emergency spillway, ca. 1965, looking north

Figure 29. Replacement of TP-1 spillgate timber facings, ca. 1980, looking northwest

Figure 30. Expanded TP-1 control house with remote-control equipment, ca. 2000, looking southeast (Note original control house extending from north end wall.)

Figure 31. Detail of TP-1 electronic spillgate control actuator for bay 2 intake, ca. 2000, looking southwest

Figure 32. Detail of TP-1 backup generator on TP-1 north embankment, ca. 2000, looking northeast

Figure 33. Detail of TP-1 spillgate structural repairs, ca. 2012, looking northeast

Figure 34. TP-1 spillgates, piers, and south retaining wall, October 2020, looking south

Figure 35. TP-1 control house and intermediate pier, October 2020, looking south

Figure 36. TP-1 north embankment with downstream armoring and fishway pier, October 2020, looking west

Figure 37. TP-1 diversion canal and headgate lifting frame, October 2020, looking northeast

Figure 38. TP-1 Tainter headgates with lifting frame, October 2020, looking north

Figure 39. TP-1 canal embankment (left) and powerhouse with substation (background), November 2020, looking southeast

Figure 40. TP-1 powerhouse with outflow bays and spillway (left), November 2020, looking northeast

HISTORIC AMERICAN ENGINEERING RECORD

INDEX TO PHOTOGRAPHS

TEXAS POWER CORPORATION DEVELOPMENT NUMBER 1 HAER No. TX-3405
(Lake Dunlap Dam and Hydropower Complex)
Approximately 5 miles southeast of New Braunfels along the Guadalupe River
Seguin vicinity
Guadalupe County
Texas

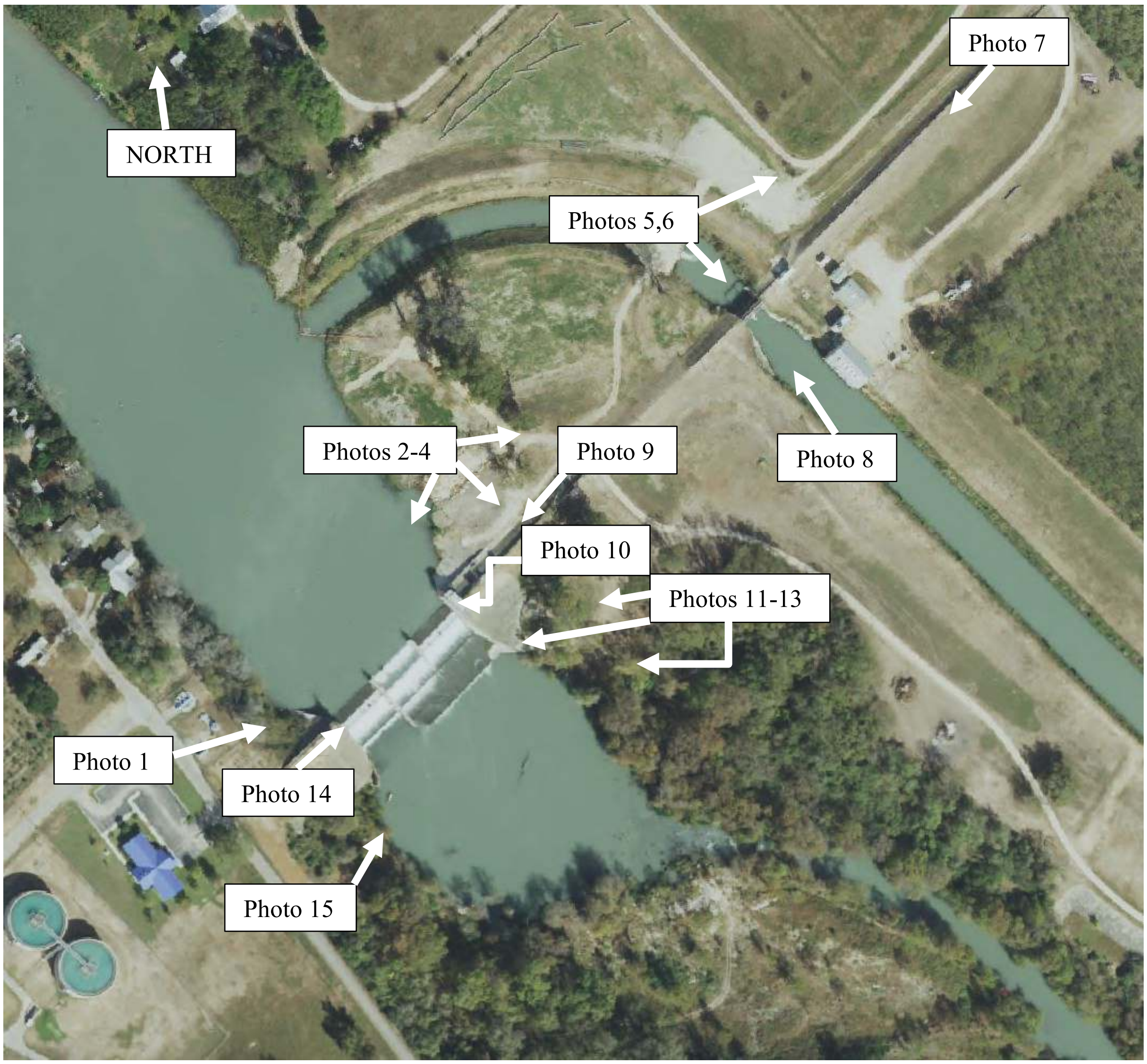
INDEX TO BLACK AND WHITE PHOTOGRAPHS

Eugene Foster, photographer, January 2021

TX-3405-1	General upstream perspective of TP-1 with right (south) embankment (right foreground), main spillway with intermediate piers, and left (north) regulating pier with control house (center rear), looking east.
TX-3405-2	General upstream perspective of TP-1 with concrete-reinforced embankment (left foreground), control house on top of the north regulating pier, main spillway piers exposed mid-stream, and right (south) retaining wall visible on opposite bank (right rear), looking south.
TX-3405-3	Upstream concrete-armored north embankment with TP-1 control house (far right), looking southeast.
TX-3405-4	General perspective of concrete-armored north embankment (right) with emergency spillway (center), and canal headworks (left), looking east.
TX-3405-5	Upstream view of TP-1 by-pass canal and headworks looking southeast.
TX-3405-6	General perspective of TP-1 northern embankment terminus, upstream side, looking east.
TX-3405-7	Axial view along crest of TP-1 north embankment with concrete core wall (center), concrete armoring on upstream slope (right), and grass-covered slope on downstream side (left), looking west.
TX-3405-8	Perspective view of TP-1 by-pass canal and headworks with Tainter gates and lifting frame, looking north.
TX-3405-9	Axial view of TP-1 north embankment crest with upstream armoring (right), control house (center), and grass-covered downstream slope (left), looking southwest.
TX-3405-10	Interior detail of TP-1 control house with original manual spillgate controls and modified controls with electronic actuators, looking northwest.

TX-3405-11	Downstream perspective of TP-1 control house atop concrete-armored left (north) embankment, intermediate spillway piers with fishway, and right (south) bank retaining wall (background), looking west.
TX-3405-12	Perspective view of TP-1 spillway bays with intermediate piers, fishway, and south bank retaining wall (left), looking west.
TX-3405-13	General downstream perspective of TP-1 spillway with control house atop left (north) embankment, main spillway with fishway, and right (south) retaining wall (left rear), looking west.
TX-3405-14	Oblique view of TP-1 spillway with spillgates in lowered position, intermediate pier with fishway (right foreground), and control house on left (north) regulating pier, looking northeast.
TX-3405-15	General downstream perspective of TP-1 dam with concrete-armored right (south) embankment (foreground), TP-1 spillway (center), and control house atop north regulating pier (background), looking northeast.
TX-3405-16	General view of TP-1 powerhouse with by-pass canal, intake control gates with lifting frame, and roof-mounted electrical substation, looking south.
TX-3405-17	East facade of TP-1 powerhouse with roof-mounted electrical substation and concrete retaining wall for intake canal (right), looking west.
TX-3405-18	Interior perspective of TP-1 powerhouse, mezzanine level, with original General Electric Company generators and control panels, looking west.
TX-3405-19	General perspective looking east of TP-1 powerhouse, south wall looking northwest.
TX-3405-20	General perspective of TP-1 powerhouse, south and west walls with outfall bays and concrete retaining wall, looking east.

Large-Format Photo Key Map



Dam and Spillway

(United States Department of Agriculture (USDA).
Texas NAIP Imagery, 2020-04-01. Web. 021-11-04)

Large-Format Photo Key Map

Canal and Powerhouse

(United States Department of Agriculture (USDA).
Texas NAIP Imagery, 2020-04-01. Web. 2021-11-04)

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-1


RESTRICTED AREA
NO ONE ALLOWED WITHIN
400 FEET OF DAM

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-3

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-4

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-5

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-7

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-8

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-9

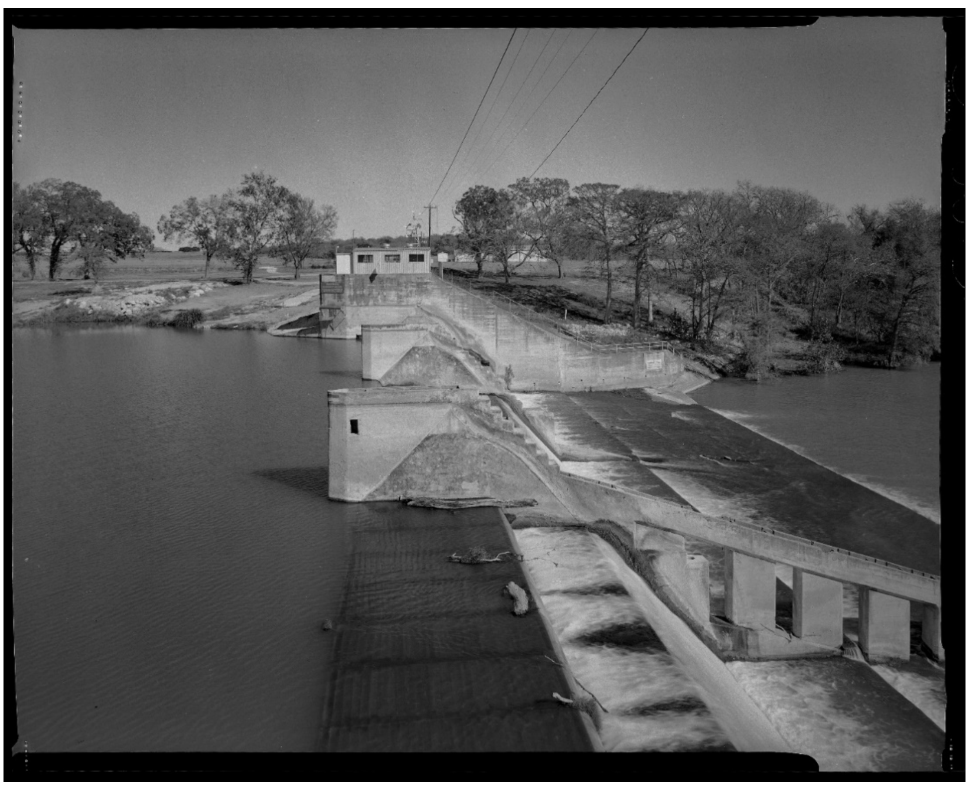
HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-10

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-11

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-12

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-13

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-14



HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-15

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-17

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-18


RESTRICTED AREA
NO ONE ALLOWED WITHIN
200 FEET OF BUILDING

HISTORIC AMERICAN ENGINEERING RECORD
SEE INDEX TO PHOTOGRAPHS FOR CAPTION
HAER No. TX-3405-20

Attachment 1

Memorandum of Agreement

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND GUADALUPE-BLANCO RIVER AUTHORITY,
REGARDING THE LAKE DUNLAP DAM
LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

WHEREAS, the United States Army Corps of Engineers, Fort Worth District (USACE), the lead Federal agency, is reviewing a permit application under Section 404 of the Clean Water Act to authorize dredge and fill activities for modification of the Lake Dunlap Dam (Dam) by Guadalupe-Blanco River Authority (GBRA); and

WHEREAS, GBRA proposes to modify the Dam (Project) located in Guadalupe County, Texas (see attached map); and

WHEREAS, the Project requires a USACE permit in compliance with Section 404 of the Clean Water Act; and

WHEREAS, the activity requiring a USACE permit pursuant to Section 404 of the Clean Water Act constitutes an undertaking (Undertaking) under Section 106 of the National Historic Preservation Act (NHPA) of 1966 (as amended); and

WHEREAS, the USACE, in consultation with the Texas State Historic Preservation Officer (SHPO), considered the potential effects of the Project as provided in 33 CFR 325, Appendix C and 36 CFR 800 and established an Area of Potential Effects (APE) for direct effects to include the Dam, associated temporary and permanent workspace, and impacts to waters of the U.S.; and

WHEREAS, GBRA has completed a cultural resource scope of work titled *Revised Section 106 Scope of Work for Lake Dunlap Spillgate Replacement and Dam Armoring, Guadalupe Blanco River Authority, Guadalupe County*, dated November 2, 2020, which recommended the Dam as eligible for the National Register of Historic Places (NRHP), and recommended the Project as an adverse effect to a historic property; and,

WHEREAS, the USACE and the SHPO have concurred that the proposed Project effects to the Dam as a result of the Undertaking is an adverse effect, and the USACE consulted with the Advisory Council on Historic Preservation (ACHP) regarding this adverse effect; and,

WHEREAS, USACE and the SHPO invited GBRA to participate in the consultation and to join this Memorandum of Agreements (MOA) as an Invited Signatory; and

WHEREAS, the USACE has consulted with the Guadalupe County Historical Commission, Comal County Historical Commission, and the New Braunfels Historic Preservation Office, and invited them to sign this MOA as concurring parties; and

WHEREAS, USACE, in accordance with 33 CFR 325, Appendix C(2) and 36 CFR 800.2(c), the USACE has identified consulting parties, sought their views on the proposed effects to the Dam, and provided them with documentation of the adverse effects and the proposed mitigation measures (as well as the public outreach component), including review of this Memorandum of Agreement; and

WHEREAS, USACE, in accordance with 33 CFR 325, Appendix C(7)(d) and 36 CFR 800.6(a)(1), notified the ACHP of its adverse effect determination with specified documentation, and the ACHP chose not to participate in the consultation pursuant to 36 CFR 800.6(a)(1)(iii); and,

WHEREAS, the USACE, the SHPO, and GBRA agreed to accomplish compliance with Section 106 through the development and execution of this MOA, and to ensure that GBRA provides mitigation for the adverse effects to the Dam as outlined in the stipulations of this MOA, and this MOA will be a permit condition for any USACE permit issued for the Project; and

NOW, THEREFORE; the USACE, the SHPO, and GBRA agree that the Project shall be implemented in accordance with the following stipulations in order to take into account the adverse effect of the Project on the Dam to satisfy the USACE's Section 106 responsibilities for this Project.

STIPULATIONS

The USACE will ensure that the following stipulations are carried out by GBRA to mitigate adverse effects to the Dam resultant from the Undertaking.

I. DOCUMENTATION

a. GBRA shall procure documentation of the dam complex to the written and photographic standards of the Historic American Building Survey/Historic American Engineering Record (HABS/HAER) Level II.
    i. Large-format photography shall be coordinated for appropriateness of number of images required to document the resource. Scans of images shall be submitted to the USACE and SHPO for a 30-day review. All SHPO submissions shall be through the THC e-TRAC system.
    ii. The Undertaking may proceed upon USACE and SHPO written acceptance of the appropriateness of the large-format images distributed to all parties of this agreement.
    iii. The written narrative shall be submitted to the USACE and SHPO for a 30-day review. All SHPO submissions shall be through the THC e-TRAC system.
    iv. The final documentation package shall be submitted to the Library of Congress for potential inclusion in the HABS/HAER collection within one year of the signing of this agreement.

b. Electronic copies of the documentation shall be made available in the Adobe Acrobat PDF file format to all signatories upon submission to the Library of Congress within one year of the signing of this agreement.

c. The HAER Level II documentation package shall be permanently exhibited on GBRA's website and made available for download.

II. CURATION AND DISPOSITION OF MATERIALS, RECORDS AND REPORTS

A. *Curation.* GBRA shall ensure that materials and associated records as required for mitigation in this MOA, are accessioned into a curatorial facility that has been certified, or granted provisional status, by the SHPO in accordance with Chapter 29.6 of the Texas Historical Commission rules (Rules of Management and Care of Artifacts and Collections).

B. *Reports.* GBRA shall provide copies of final documentation as required for mitigation to the signatories and consulting parties. The signatories and consulting parties shall withhold from the public all site location information and other data that may be of a confidential or sensitive nature pursuant to 33 CFR 325, Appendix C(4)(c) and 36 CFR 800.11(c).

III. PROFESSIONAL QUALIFICATIONS

All historic preservation-related investigations and mitigation requirements specified in this Agreement shall be performed by personnel meeting professional qualifications of the Secretary of the Interior's *Professional Qualification Standards (*36 CFR 61) in historic architecture.

IV. DISPUTE RESOLUTION

Should any Signatory to this MOA object within thirty (30) calendar days upon receipt of any plans or other documents, pursuant to this MOA, provided by USACE, the SHPO, GBRA, or others for review, or object at any time to any actions proposed or the manner in which the terms of this MOA are implemented, the objector is encouraged to consult the other signatories in resolving the objection. If the USACE determines that such objection cannot be resolved, USACE shall perform the following tasks.

A. CONSULT ACHP. Forward all documentation relevant to the dispute, including the USACE's proposed resolution, to the ACHP. The ACHP shall provide the USACE with its advice on the resolution of the objection within 30 days of receiving adequate documentation. Prior to reaching a final decision on the dispute, the USACE shall prepare a written response that takes into account any timely advice or comments regarding the dispute from the ACHP, signatories and concurring parties, and shall provide them with a copy of this written response. The USACE will then proceed according to its final decision.

B. FINAL DECISION. If the ACHP does not provide its advice regarding the dispute within the 30-day time period, the USACE may make a final decision on the dispute and proceed accordingly. Prior to reaching such a final decision, the USACE shall prepare a written response that takes into account any timely comments regarding the dispute from the signatories and concurring parties to the MOA, and shall provide the signatories, concurring parties, and the ACHP with a copy of such written response.

C. The parties shall carry out all other actions subject to the terms of this MOA that are not the subject of the dispute.

D. At any time during the implementation of the measures stipulated in this MOA is raised by interested persons, then USACE shall consider the objection and consult, as appropriate, with the objecting party and the consulting parties to attempt to resolve the objection.

V. DURATION, AMENDMENT, AND TERMINATION:

A. DURATION. Unless terminated or amended as outlined below, this Agreement shall remain in effect for a period of five (5) years from the date the MOA goes into effect and may be extended for an additional 5-year term with the written consent of all the signatories.

B. AMENDMENT. This Agreement may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with the ACHP.

C. TERMINATION. Any Signatory to this agreement may terminate this MOA by providing thirty (30) calendar days written notice to the other Signatories, pursuant to 36 CFR 800.6(c)(8). During the period after notification and prior to termination, the Signatories shall consult to seek agreement on amendments or other actions that would avoid termination. Termination of this MOA will require compliance with 36 CFR 800. This MOA may be terminated by the execution of a subsequent MOA that explicitly terminates or supersedes its terms.

VI. REPORTING AND MONITORING:

Each year following the execution of the MOA until it expires or it is terminated, GBRA shall provide all parties to this MOA a summary report detailing work undertaken pursuant to its terms. Such report shall include any scheduling changes proposed, any problems encountered, and any disputes and objections received in GBRA's efforts to carry out the terms of the MOA.

VII. EXECUTION:

Signature of this Programmatic Agreement by the USACE, the SHPO, GBRA, and implementation of its terms evidence that the USACE has taken into account the effects of this Project on historic properties and afforded the ACHP an opportunity to comment. Pursuant to 36 CFR 800.6(b)(1)(iv) this Agreement will go into effect when a fully executed version is received by the ACHP.

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND GUADALUPE-BLANCO RIVER AUTHORITY,
REGARDING THE LAKE DUNLAP DAM
LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

SIGNATORY:

United States Army, Corps of Engineers, Fort Worth District

MADDEN.DAVID.E.1230339917 Digitally signed by MADDEN.DAVID.E.1230339917 Date: 2020.12.21 12:01:59 -06'00' Date ______________

For: Brandon W. Mobley, Chief, Regulatory Division

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
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Permit Number: SWF-2015-00168

SIGNATORY:

Texas State Historic Preservation Office

Mark Wolfe

Mark Wolfe, State Historic Preservation Officer

Date 12-14-2020

MEMORANDUM OF AGREEMENT
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THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
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LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

INVITED SIGNATORY:

Guadalupe-Blanco River Authority

Charles Hickman

Charles Hickman, Executive Manager of Engineering

Date 12/15/2020

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND GUADALUPE-BLANCO RIVER AUTHORITY,
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LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

CONCURRING PARTY:

Guadalupe County Historical Commission

Tom DeKunder
Tom DeKunder, Chairman

Date 12-12-2020

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND GUADALUPE-BLANCO RIVER AUTHORITY,
REGARDING THE LAKE DUNLAP DAM
LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

CONCURRING PARTY:

Comal County Historical Commission

Cindy Coers Date 12/17/20
Cindy Coers, Chair and Comal County Historic Preservation Officer

MEMORANDUM OF AGREEMENT
AMONG
THE UNITED STATES ARMY, CORPS OF ENGINEERS, FORT WORTH DISTRICT,
THE TEXAS STATE HISTORIC PRESERVATION OFFICER,
AND GUADALUPE-BLANCO RIVER AUTHORITY,
REGARDING THE LAKE DUNLAP DAM
LOCATED IN GUADALUPE COUNTY, TEXAS

Permit Number: SWF-2015-00168

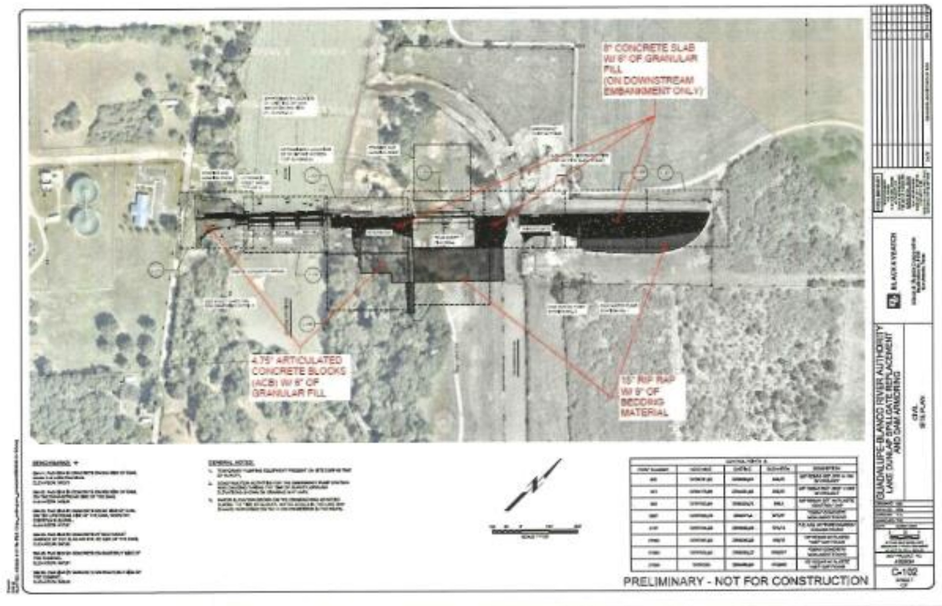
CONCURRING PARTY:

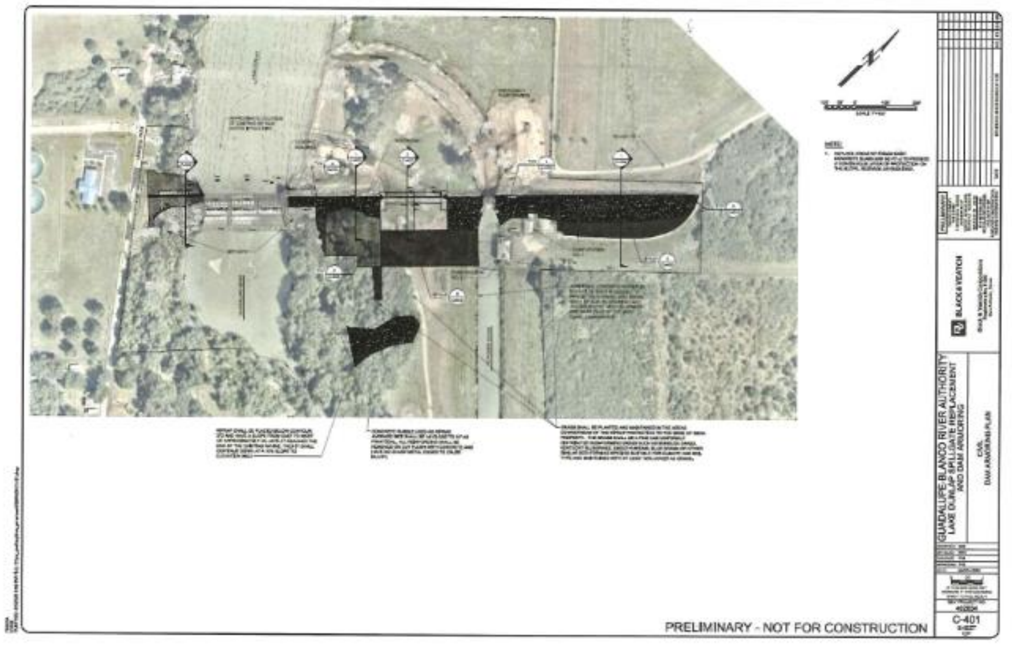
City of New Braunfels

Caleb Gasparek
Caleb Gasparek, Historic Preservation Officer

Date 12-18-20

Attachment A – Engineering Plans and Renderings (Black & Veatch 2020)




BLACK & VEATCH
GUADALUPE-BLANCO RIVER AUTHORITY
LAKE DUNLAP SPILLGATE REPLACEMENT
AND DAM ARMORING
CIVIL
DAM ARMORING PLAN
C-401
PRELIMINARY - NOT FOR CONSTRUCTION

Attachment 2

National Parks Service Letter of Acceptance

United States Department of the Interior

NATIONAL PARK SERVICE
INTERMOUNTAIN REGION
12795 West Alameda Parkway
P.O. Box 25287
Denver, Colorado 80225-0287

H38 (IMDE-OCR) HABS

November 17, 2021

Mr. Eugene Foster
Baer Engineering & Environmental Consulting
7756 Northcross Drive, Suite 211
Austin, TX 78757

Dear Eugene:

I am pleased to inform you that we have reviewed and accepted the Historic American Engineering Record (HAER) level two documentation for the Texas Power Corporation Development Number 1, HAER TX-3405. We will transmit the documentation to the Library of Congress for permanent storage.

We appreciate your commitment to the recordation of our nation's endangered historic resources.

If you have any questions or concerns please contact me at Kristen.luetkemeier@nps.gov or 928-326-1088.

Sincerely,

KRISTEN LUETKEMEIER Digitally signed by KRISTEN LUETKEMEIER Date: 2021.11.17 09:30:21 -07'00'

Kristen Luetkemeier
Historian
Heritage Partnerships Program