CENTER HILL DAM
Caney Fork River at State Highway 96
Smithville vicinity
De Kalb County
Tennessee

HAER TN-45
HAER TN-45

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
SOUTHEAST REGIONAL OFFICE
National Park Service
U.S. Department of the Interior
100 Alabama St. NW
Atlanta, GA 30303

HISTORIC AMERICAN ENGINEERING RECORD

CENTER HILL DAM

HAER No. TN-45

I. INTRODUCTION

Location	Center Hill Dam is a water storage dam and hydroelectric generating plant on the Caney Fork River, a tributary of the Cumberland River of Tennessee and Kentucky. The dam straddles the Caney Fork about 26.6 miles upstream of its confluence with the Cumberland River in northern middle Tennessee. Among others, communities in the near vicinity of Center Hill include the small town of Lancaster about 3½ miles to the northwest and the city of Smithville about 15 miles to the south. Center Hill Dam is comprised of several structures: the northeast end of the main dam at the crest is at: longitude 36.09693, latitude -85.8247; the southwest end of the main dam at the crest is at: longitude 36.09248, latitude -85.8298; the west corner of the powerhouse is at: longitude 36.09526; latitude -85.8287; the west corner of the switchyard fence is at: longitude 36.09622, latitude -85.8307; and the center of the saddle dam at the crest is at: longitude 36.09474, latitude -85.8194. These coordinates were obtained on June 28, 2012 by plotting their locations on the 1:24000 Center Hill Dam, TN USGS Topographical Quadrangle Map. The accuracy of the coordinates is + / - 12 meters. The coordinates' datum is North American Datum 1927. There are no restrictions on the location of Center Hill Dam.
Date of Construction	Authorized by Congress in 1938. Construction began in 1942 but suspended in 1943 due to WWII. Construction resumed in 1946 and completed in 1951.
Present Owner:	U.S. Army Corps of Engineers
Present Use:	Hydroelectric power generation, flood control and recreation
Significance	Center Hill Dam is historically significant as an early and integral component of the Cumberland River Basin Project and its role in transforming the social and economic conditions of the Cumberland Valley and lower Ohio and Mississippi Valley regions. The U.S. Army Corp of Engineers (Corps) Nashville District started work on

Significance

the Cumberland River Basin Project with construction of Center Hill and two other large, multipurpose dams in the early 1940s. Completed early in the following decade, those three dams significantly reduced major flooding events along the river for the first time. In the ensuing years, the project and its operations by the Corps saved countless lives and millions upon millions of dollars in property damage to municipal, industrial and agricultural areas in the Cumberland region as well as in the lower Ohio and Mississippi Valleys downstream. Additionally, Center Hill and the Project's other two original multipurpose dams were the first large-scale hydroelectric plants built in the Cumberland River Valley region. The abundant low-cost AC current produced at the facilities enabled the Tennessee Valley Authority to meet growing demands for power at Nashville and other cities in the Cumberland as well as extend electric service into rural areas, many for the first time.

Center Hill Dam is also significant for its engineering and architectural values. It is a good representation of a federal flood control-power development of the early post-World War II era, constructed using state-of-the-art structural designs and materials and furnished with state-of-the-art power generation equipment. One of the facility's components has singular engineering merit, the underground cable tunnel used to convey hydroelectricity from the powerhouse to the outdoors switchyard.

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II. GENERAL DESCRIPTION

Center Hill Dam is one of ten major dams on the U.S. Army Corps of Engineers' Cumberland River Basin Project (Figure 1). A primary artery in the Ohio-Mississippi River system, the Cumberland River and its tributaries drain a watershed of over 18,000 square miles in Kentucky and Tennessee. Headwaters of the Cumberland River rise high in the rugged flat-topped mountains of the Cumberland Plateau in southeast Kentucky. From there, the Cumberland flows southwest into Tennessee, makes a long westerly trek through the northern middle section of that state and reenters southwest Kentucky. It empties into the Ohio River near Smithville, Kentucky. Less than 60 miles downstream, the Ohio River, in turn, joins the Mississippi.

Developed by the Corps' Nashville District between the early 1940s and late 1970s, the Cumberland River Basin Project and its facilities utilize the flow of the river and its tributaries for multiple purposes. Most notably, those purposes include hydroelectric power production, flood control, navigation, and recreation. The Corps operates and manages the project for local water resource needs as well as a key, integral unit of flood control, navigation and power operations downstream in the lower Ohio-Mississippi River region.

Center Hill Dam is located on the Cumberland River's largest tributary, the Caney Fork River. In common with the Cumberland, the Caney Fork originates in the Cumberland Plateau but within Tennessee instead of Kentucky. It flows southwest down off the plateau and then continues in a northwesterly direction through the Eastern Highland Rim, a lower but still rugged country of deeply incised rolling hills blanketed by dense hardwood forests. After a highly twisted run of approximately 145 miles, the Caney Fork discharges into the Cumberland at Carthage, Tennessee. The state's major urban center, Nashville, lies 117 miles downstream of Carthage on the lower Cumberland River.

Center Hill Dam contributes to the Cumberland River Basin Project's flood control, power production and recreational functions. Located 26.6 miles upstream (south-southeast) of Carthage, its main dam is a combination structure comprised of a concrete gravity dam and a rolled earthen embankment (Figure 2). The dam stands at a maximum height of 250' above the bed of the river and has a total crest length of 2,160'. It impounds "Center Hill Lake," a reservoir able to contain and store a maximum of 2,092,000 acre-feet of water. A smaller, 770-foot long earthen dam blocks a natural saddle in the rim of the lake just a short distance upstream of the main dam. The power plant at Center Hill operates three, main turbine-generator units having a combined rated capacity of 135,000 kilowatts (kW). The turbine-generator units and most of the plant's other hydroelectric equipment are housed in a powerhouse building which stands at the toe of the concrete section of dam on the west (left) bank of the river. The plant's high tension switching apparatus and transformers occupy an outdoors switchyard on a flood plain remnant just downstream of the powerhouse.

Hydroelectricity is conveyed from the powerhouse to the switchyard via an underground power cable tunnel. Most of the electricity generated at Center Hill is stepped up to 161 kV for transmission.

III HISTORY

A. Introduction

Development of the Cumberland River Basin Project occurred during what some historians have labeled the "big dam era." Beginning in the 1930s and ending in the 1970s, the era is characterized as the period when many drainage basins across the nation were essentially tamed and put to use for multiple purpose or benefits by the construction of a series of massive dams on main stem rivers and tributaries.[1] Hydroelectric power generation was a common factor at all, if not most of the facilities in any one project, with additional benefits including flood control, navigation, irrigation and/or recreation, among others. While private interests had been responsible for most of the hydroelectric development efforts in the United States prior to the early 1930s, the multipurpose projects of the big dam era primarily were federal undertakings. The U.S. Army Corps of Engineers took the lead in projects on navigable rivers or streams, except for the Tennessee River, the Cumberland River's southern "twin." The Tennessee Valley Authority (TVA) had charge of the massive build up of power, flood control and navigational facilities in the Tennessee River Basin. Still another federal arm, U.S. Bureau of Reclamation built and operated most of the federal dams in the arid West that supplied irrigation water.

In many respects, the antecedents of the big dam era trace back to survey work conducted by the Corps for the Cumberland and Tennessee River systems during the early to mid-1920s. Those surveys built on the Corps' long-standing water resource mission of navigational improvements. Considerable attention, however, also was paid to the potential for hydroelectric power production and flood control, water developments outside of the Corps' general purview at the time, except for a few special projects. The multipurpose surveys of the Cumberland and Tennessee were quickly followed by similar river basin investigations across the nation. It wasn't until the deepening of the Great Depression in the early 1930s and the onset of World War II in the early 1940s, that the multipurpose/big dam era began in earnest.

B. Early Navigational Improvements on the Cumberland

As the American frontier spread west of the Appalachia Mountains in the late 1700s and the early 1800s, the Cumberland River became a natural focus of settlement activities. The well-

[1] D.C. Jackson, *Building the Ultimate Dam: John S. Eastwood and the Control of Water in the West* (Laurence: University of Kansas Press, 1995); David P. Billington, Donald C. Jackson and Martin V. Melosi, *The History of Large Federal Dams: Planning, Design, and Construction in the Era of the Big Dams* (Denver, CO: U.S. Department of the Interior, Bureau of Reclamation, 2005).

watered valleys of the river and its tributaries offered fertile ground for raising crops and livestock, while the river provided a natural corridor for shipping the region's agricultural products downstream for market in New Orleans. Nashville took root at the river's head of year round navigation -- 191 miles upstream of the Ohio River -- and quickly emerged as an important port and center for the Cumberland Valley river trade.[2]

Early travel on the Cumberland was generally a one-way trip downstream by flatboat or other simple craft, requiring Nashville merchants to purchase groceries and other import goods from eastern cities and haul them over the mountains by wagon. Commerce and trade at Nashville grew after river men introduced the lighter keelboats --which men and animals could more easily maneuvered upstream -- to the river around 1804. A more intensive-level of commerce and trade awaited the arrival of the much more powerful steamboat to the river in the late 1810s. Within a few years, a dozen or more steamboats were running the Cumberland, bringing in dry goods, sugar, salt and a variety of other import items and hauling out hemp, cotton, flour and other Cumberland Valley exports. Steamboat travel above Nashville reached as far as Carthage at the mouth of the Caney Fork River in the late 1820s, and soon progressed up the Caney Fork as well as other larger tributaries [3]

In common with the Mississippi and Ohio Rivers, numerous obstacles plagued travelers and cargo floating the Cumberland. Many a boat sunk after being punctured by a snag or submerged logs, overturned in rapids, smashed against boulders or stranded on a sand bar, for example. Calls for federal assistance in improving river conditions gained momentum after the War of 1812 demonstrated the importance reliable transportation corridors for national defense. Even after the following rise and growth of steamboat traffic on the rivers, however, action was slow in coming, as contentious political factions argued over the constitutionality of such federal intervention into state affairs.[4]

In early 1824, the Supreme Court set the stage for the addition of navigational improvements as a key mission of the U.S. Army Corps of Engineers. At that time, it ruled that federal authority extended to interstate commerce, including river traffic. Congress responded that same year by allocating $75,000 for the Corps to improve the Ohio and Mississippi Rivers by removing rocks, snags and other debris and constructing wing dams to scour sandbars and deepen channels. This initial assignment soon expanded to other navigable rivers that supported commercial shipping enterprises, including the Cumberland. The Corps had cleaned and cleared

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[2] Leland R. Johnson, *Engineers on the Twin Rivers: A History of the Nashville District Corps of Engineers United States Army* (Nashville: U.S. Army Engineer District, 1978), 14-16; 27-30.

[3] Ibid.

[4] U.S. Army Corps of Engineers, "Improving Transportation," *The U.S. Army Corps of Engineers: A Brief History*," http://www/usace.army.mil/History/Documents Brief/03-transporation/transport.html (accessed 22 September 2011).

the lower Cumberland up to Nashville before national depression encouraged Congress to curtail funding for internal improvement projects in the late 1830s.[5]

Congressional support for easing river navigation revived in the decade after the Civil War. Steamboat traffic was at its peak, while the Ohio and Mississippi Rivers had come to support healthy traffic of commercial barges as well. Instead of just temporary cleaning and clearing measures, the Corps sought a more permanent solution for opening the rivers to reliable year-round navigation and accommodating barges, a deeper draft vessel than steamboats. It eventually turned to a practice used in Europe but yet untried in the United States, the channelization a river to a uniform navigation depth by the construction of a series of low dams and locks. The dams created deep slack water pools behind them, while the locks served as controlled canals in which the water level could be raised or lowered to facilitate the passage of vessels from one pool to another. Construction of a dam and lock system with a 6-foot deep channel on the Ohio River commenced in 1879 with a project at Devils Island near Pittsburgh. It took the Corps over 30 years to finish the Ohio channelization project between Pittsburgh and Cairo.[6]

Meanwhile, in the early 1890s a 6-foot channelization project came to the Cumberland. Planning for the project had begun a few years earlier when the Corps established a district office of engineers at Nashville. Construction commenced with two locks and dams near Nashville. The Nashville District intended to not only channelize the river's lower, year-round navigable section but also envisioned construction of several dams and locks on the upper Cumberland to Carthage and beyond to the long-time seasonal port city of Burnside, Kentucky. Located 325 miles upstream of Nashville, Burnside had entered into an unprecedented period of growth and prosperity in the post Civil War era when coal mining industry of eastern Kentucky emerged. Mine operators turned to the city as the jumping off point for barges laden with coal, although traffic remained limited to the high water season.[7]

By the early 1900s, a series of eight locks and dams controlled the stretch of the Cumberland between Nashville and Carthage. River traffic had however dramatically declined, however, primarily due to the aggressive activities of the railroads in extending service into the region and taking over the coal freighting business. In response, the Nashville District decided to concentrate on completing the channelization project below Nashville and suspended work on the locks and dams proposed for the upper Cumberland except the one at Burnside and another just above Carthage. Congressional appropriations for the project proved sporadic in the ensuing years, dragging out the construction process. Work ended for good in 1924 when the last of

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[5] Ibid.; U.S. Army Corps of Engineers, Nashville District, ca. 1966, "Handbook for Guides [at Center Hill,]" 13, typed manuscript on file at Center Hill Dam.

[6] Leland R. Johnson, *The Falls City Engineers: A History of the Louisville District, Corps of Engineers, United States Army, 1970-1983* (Louisville, KY: U.S. Army Engineer District, 1984), 155-73.

[7] Johnson, *Engineers on the Twin Rivers*, 147-59; U.S. Army Corps of Engineers, Nashville District, "Handbook for Guides at Center Hill," 13.

locks and dams below Nashville was finally completed, bringing the total number of facilities to fifteen. Shipping on the long wild stretch of river between Burnside and Carthage was destined to remain subject to the whims of nature for decades to come.[8]

C. Early Water Power Developments in the Cumberland River Basin

The vast hydro power of the Cumberland River and its tributaries saw little application for industrial muscle into the early twentieth century. Granted, early settlers had turned to the less powerful and narrower sections of tributary streams conducive to the construction of small dams for diverting water to operate small gristmills, flour mills and sawmills. State government declared construction of larger impoundment dams that impeded boat travel off limits to all but the upper reaches of the Cumberland River as well as many navigable tributaries. Instead of hydro power, coal-fired steam plants fueled Nashville's rise as an important center for the manufacture of textiles and foods. The city's first electric plant of the early 1880s also used coal-fire steam as the motive force for its direct current (DC) generating equipment.[9]

Local entrepreneurs and industrialists began investigating various Cumberland tributaries for potential sites for larger dam projects after engineers in Europe and United States developed reliable and economic systems for the production and transmission of high voltage alternating current (AC) electricity over long distances in the mid-1890s. Lacking the technical expertise and considerable funds needed to construct a dam and power plant as well as string miles of transmission line, most necessarily turned to investors for financial support. In common with other predominately rural agricultural regions in the United States, however, the absence of a large consumer base discouraged investment, and most projects never got beyond the initial planning stages. There was, however, one notable exception. In late 1916, a Nashville-based utility completed construction of a 12,000 horsepower plant at the Great Falls of the Caney Fork River. While Nashville residents and industries benefited from the project, those living the valley's smaller cities remained dependent on their old DC current systems. At the same time, the region's substantial rural population still had no access to electric service and still used candles and kerosene lamps to light their nights.[10]

For the most part, the Tennessee River Valley region south of the Cumberland also retained a decidedly rural agricultural character by the early twentieth century. The federal government, however, brought hydroelectric development to the Tennessee River in a big way

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[8] Johnson, *Engineers on the Twin Rivers*, 147-59.

[9] Ibid., 169-73; James E. Fickle, "Industry," *Tennessee Encyclopedia of History and Culture,* http://tennesseeencyclopedia.net/entry.php?rec+683 (accessed 18 December 2011); James B. Jones, Jr., "Towards an Understanding of the History and Material Cultural of Pre-TVA Hydroelectric Development in Tennessee," part 1 posted 17 January 2004, http://www/southernhistroy.net/modules.php?op=modload&name+News &file+article&si… (accessed November 2011).

[10] Jones, "Pre-TVA Hydroelectric Development in Tennessee," part 1; Arthur Weir Crouch, *The Caney Fork of the Cumberland River* (Nashville: 1973), 52, http://danielhaston.com/places/caney-fork/crouch/26-great-falls-plant1.htm (accessed 14 October 2011).

during World War I. In 1917, President Wilson selected a potential hydro site on the lower Tennessee at Muscle Shoals, Alabama for a large nitrate plant to make munitions and turned responsibility for construction a hydroelectric facility to power the plant over to the Corps. With the exception of a small turbine-generator installation at a lock and dam on the Mississippi, the Muscle Shoals facility, soon named Wilson Dam, was the first foray by Corps or any other federal entity into the design and construction of a hydroelectric project. It was a massive project as proposed, including a tall concrete gravity dam, power plant of eighteen generator-turbine units, and a double-chamber lock. Construction work on the dam had barely commenced when the war ended in late 1918. Rising sentiments in Congress against federal operation of the facility during a peacetime economy delayed Wilson Dam's initial completion until 1924.[11]

D. Coming of the Cumberland River Basin Project

For some inside the Corps, including its Chief of Engineer at the time, General Lansing H. Beach, planning for Wilson Dam brought to light the potential of hydropower development as means to spur industrial growth. While raising of that lower Tennessee dam was still underway, in 1920 he ordered the commander of the Nashville District, Major Harold Fiske, to investigate the region upstream and identify prospective hydroelectric power sites as well as important mineral deposits and other prospective industrial resources. Additionally, Fiske was to consider options for flood control and other factors, "as may reasonable appear to have an appreciable influence," on future navigational improvements, the only river work that the agency then held general authority for.[12]

Despite limited funds, Fiske's work on the upper Tennessee River proved both innovative and exhaustive. Relying on the relatively new technology of aerial photography, he identified numerous sites suitable for hydroelectric development on the river as well as its tributaries. While locks were a necessary feature of main stem river dams, Fiske proposed the construction of dams tall enough to store water for use in power production as well as flood control purposes on the tributaries. In his report on the survey and its findings, Fiske argued that this comprehensive multipurpose approach to water resource development would have on tremendous impact on the regional economy. Specifically, the availability of abundant low cost electricity would entice industrialist to invest in new and massive projects exploiting the region's vast coal reserves and other natural resources. Those same industrialists would then utilize the river as a safe, reliable and economical means of shipping their commodities to market.[13]

Fiske's finding drew attack from both inside and outside the Corps. Of greatest concern was the perceived implication of federal intervention into the production and sale of

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[11] Johnson, *Engineers on the Twin Rivers,* 169-73; Polly M. Rettig, National Register of Historic Places nomination form, "Wilson Dam," February 1976.

[12] Billington, Jackson and Melosi, *History of Large Federal Dams,* 119.

[13] Ibid., 120-21; Johnson, *Engineers of the Twin Rivers,* 181-86.

hydroelectricity. By the early 1920s, private utility companies controlled 94% of the nation's electric power market.[14]

At least one private utility company found Fiske's recommends for hydroelectric development on the upper Tennessee intriguing. In 1923, officials of the Cumberland Hydro Power Company convinced the Nashville District to allow Fiske to investigate potential power sites it controlled on the wild upper Cumberland River above Burnside. Fiske and his staff completed the survey and concluded that development of dams on this stretch of the river could produce significant amounts of power as well reduce the river's peak flood crest by as much as 20 feet. While Cumberland Hydro-Electric Power apparently had insufficient financial resources to pursue the project further, the Nashville District's multipurpose survey of Cumberland continue. Several prospective sites for the construction of power-navigation dams on the main stem of the river downstream of Burnside were identified as well as additional power-flood control dams on the larger tributaries.[15]

A critical test for multipurpose development came when Beach presented the Tennessee and Cumberland survey reports to the House Committee on Rivers and Harbors. The Committee hailed Fiske's work and found his recommendation for a comprehensive program of power, flood control and navigation improvements "astounding and amazing." In 1925, Congress responded to its positive assessment by directing the Corp to prepare cost estimates for similar surveys of navigable rivers and tributaries across the nation (except the Colorado River) where hydroelectric power development seemed feasible. Fiske conducted the investigation, prepared the estimates and wrote up his findings in a short, four page report. In April 1926, the Chief Engineer Beach submitted the report to Congress as House Document 308.[16]

The 308 Report, as the document became known, contended that federal, state and local government entities and private interests could and should work together to insure the most efficient and beneficial use of a river basin's water resources. The Corps would be responsible for conducting the surveys, identifying sites suitable for the construction of hydroelectric plants, water storage dams and/or navigation facilities, and delineating present and potential power markets. It would then utilize the findings or individual "308 report" for a particular river basin to coordinate the planning efforts of private utility companies and/or municipalities interested in constructing and operating hydroelectric plants. For projects on rivers supporting shipping traffic, the Corps could contribute to the cost of constructing navigational facilities. Otherwise, the companies and/ or state and local governments would assume most other construction costs and retain operational control of the hydroelectric projects, including the sale of power on the open market.[17]

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[14] Ibid.

[15] Johnson, *Engineers on the Twin Rivers*, 183-84.

[16] Billington, Jackson, and Melosi, *History of Large Federal Dams*, 120-21.

[17] Ibid., 121.

In January 1927 and May 1928, Congress enacted laws authorizing and appropriating funds for the Corps to conduct multipurpose surveys for 24 river basin projects. Most of the rivers systems selected were part of the greater Mississippi basin. Others ranged in size from the small Raritan River in New Jersey to the vast Columbia River in the Northwest. Additionally, the appropriation contained funds to continue investigations of the Cumberland and Tennessee.[18]

Corps engineers spent considerable time and effort on multipurpose surveys in their respective districts over the next several years. In the meanwhile, however, the onset and deepening of the Great Depression in late 1920s and early 1930s had a detrimental impact on the nation's hydroelectric industry. Many manufacturers and other industrial consumers of electric power drastically reduced production or went completely out of business. Consequently, private utility companies became reluctant to invest in the construction of the new hydroelectric facilities.[19]

President Franklin D. Roosevelt soon turned to multipurpose water development as a means to combat some the debilitating social and economic conditions facing the nation. In May 1933, he signed legislation creating the Tennessee Valley Authority (TVA) and turned responsibility for constructing and operating the projects envisioned by the Corps for the Tennessee River basin over to this new federally-controlled corporation. Additionally, the TVA received authority for managing and regulating the sale of power at low cost to both public and private entities. In keeping with Roosevelt's larger New Deal program, the TVA's dam building activities soon brought much needed economic relief in the form of jobs to the region's desperate farmers and unemployed workers, many of whom had suffered from poverty long before the depression. As one after another project came on line, the TVA's power network and abundant and low cost power it provided paved the way for modernizing farm life and practices and attracting new industries to the region.[20]

By the mid-1930s, a strong ground swell of local support had emerged for inclusion of the Cumberland River Valley into the TVA program. A variety of proposals for TVA involvement in the Cumberland were hotly debated at local, state and national levels. The War Department and the Corps, however, waged an aggressive campaign behind the scene to keep the Cumberland under the Corps' jurisdiction.[21]

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[18] Ibid., 120-21.

[19] Johnson, *Engineers on the Twin Rivers,* 185-86; U.S. Army Corps of Engineers, "Multipurpose Waterway Development," *The U.S. Army Corps of Engineers: A Brief History,* http://www.usace.army.mil/History/Documents/Brief/07-development/develop.html (accessed 22 September 2011).

[20] Ibid.; W. Bruce Wheeler, "Tennessee Valley Authority," *Tennessee Encyclopedia* (Nashville: Tennessee Historical Society, 1998), http://tennesseeencyclopedia.net/entry.php?rec=1362 (accessed September 2011).

[21] Johnson, *Engineers on the Twin Rivers,* 196; U.S. Congress Senate, Subcommittee, Committee on Agricultural and Forestry, *Including Cumberland River Basin in Tennessee Valley Authority,* 1941, 77th Cong., 1st sess.

While the Nashville District lamented the loss of the Tennessee River project to the TVA, other New Deal programs placed the Corp in charge of three major hydroelectric developments elsewhere in the nation by the mid-1930s. Intended to make work for the nation's unemployed those projects were in Maine; Bonneville Dam on the Columbia River in Pacific Northwest; and Fork Peck Dam on the upper Missouri in Montana.

Instead of economic relief, the dire need for flood protection in the lower Ohio-Mississippi region ultimately became the stimulus for initial construction work on the Cumberland River Basin Project. Flooding in the region occurred on annual basis and often reached catastrophic levels. The federal government, however, was slow to intervene, and by the 1920s projective measures consisted of little more than the construction of levees. One of the nation's worst flooding events late that same decade demonstrated the woefully inadequacies of the levee only system. The flood was the result of heavy rains throughout most of the Mississippi drainage area, including the Cumberland and Tennessee River Valleys. It inundated over 16 million acres of land, caused millions of dollars in property damages, took the life of between 250 and 500 people and displaced over 500,000 more from their homes. Hardest hit was the lower Ohio and Mississippi Valleys where the entire force of the raging flood waters had converged.[22]

After two consecutive years of devastating floods along the Ohio, in 1936 Congress passed a Flood Control Act which, at long last, designated comprehensive planning and actions for the purpose of flood control a federal responsibility. Among other flood control measures, the Corps could now build dams for storing and regulating river flows. A companion Flood Control Act followed in 1938. It authorized construction of 70 water storage dams in the Ohio River Basin. Many of those dams were proposed for sites off the main stem of the river, including six locations in the Cumberland River Basin. As proposed, the Corps would regulate water releases from the off stem reservoirs so that they were able to contain the flood crest of their headwaters, thus reducing considerably the amount of flow to reach the Ohio and Mississippi during the peak of the flood season.[23]

While the Flood Control Act of 1938 did not authorize federal construction of hydroelectric plants, it did acknowledge the need to accommodate the potential for power production in the future. Essentially, the act inferred that dams could be built of sufficient size to impound the additional water needed for power production as well as incorporated penstocks and "other similar facilities" for the regulation and intake of a reservoir's power reserve. Inclusion of

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[22] Johnson, *Engineers on the Twin Rivers,* 191; U.S. Army Corps of Engineers, "Multipurpose Waterway Development;" Arthur Maass, *Muddy Waters: The Army Engineers and the Nation's Rivers* (New York: Da Capo Press, 1974), 190 (Orig. pub. 1951).

[23] Johnson, *Engineers on the Twin Rivers,* 194, 196; Billington, Jackson, and Melosi, *History of Large Federal Dams,* 353-54; U.S. Army Corps of Engineers, "Multipurpose Waterway Development."

such adaptations to a dam building project, however, required approval from the Secretary of War.[24]

By the summer the of 1941, Congress had allocated funds to the Nashville District for initiating work on three of the storage dams proposed for the Cumberland River Basin Project. All above Nashville, the major priority for flood projection in the Cumberland Valley, those initial-stage facilities were: Wolf Creek Dam on the far upper and non-navigable reaches of river's main stem; Dale Hollow Dam on the Obey River near the Celina, Tennessee; and Center Hill Dam on the Caney Fork River near Smithville, Tennessee. Of those, however, only Wolf Creek was funded for immediate construction. Allocations for Dale Hollow and Center Hill merely covered costs for investigating and analyzing potential construction alternatives.[25]

E. Construction of Center Hill Dam

Selection of the Caney Fork River's Center Hill area as suitable for multiple purpose development dated back to Major Fiske's Cumberland Rivers Basin survey of the early to mid-1920s. When Nashville District engineers investigated the area over 20 years later in the summer of 1941, they determined that two sites, one at river mile 26.6 and the other at river mile 28.05, offered the best foundation conditions for supporting a large water storage dam. The 26.6 mile site was recommended due to its "more favorable power potentialities" and adaptability to the "most economical dam construction." At this location, the valley was somewhat narrower and on the east (right) bank it flowed against a tall rock cliff, a good anchor feature for a dam. A suitable site for a power plant and a staging area for project construction, in turn, existed on the west (left) bank of the river. It consisted of a flood plain remnant about 750 feet wide.[26]

In addition to a prospective powerhouse site, the "favorable power potentialities" of river mile 26.6 stemmed from the fact of its greater distance upstream from two pre-existing hydroelectric plant on the Caney Fork. One of those plants the Great Falls facility was on the main stem of the river about 64 miles downstream of Center Hill. As noted above, a private utility first developed Great Falls for hydroelectric production in 1916. About ten years, later another and much larger company increased the facility's capacity significantly to 30,000 kW, and in the late 1930s that company sold the Great Fall plant and other power facilities in owned in the Tennessee River Valley to the TVA. The second smaller plant, known as Burgess Falls, also lay about 64 miles upstream of Center Hill but on the river's Falling Water tributary.

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[24] Johnson, *Engineers on the Twin Rivers*, 194; Maass, *Muddy Waters*, 191; War Department, U.S. Engineer Office, *Definite Project Report: Center Hill Dam and Reservoir, Caney Fork River, Tennessee* (Nashville: September 1941), 1.

[25] Johnson, *Engineers on the Twin Rivers*, 197-98.

[26] U.S. Engineers Office, Nashville District, *Definite Project Report: Center Hill Dam and Reservoir*, Appendix VII.

Constructed in the early 1920s, it operated as a municipal facility for the nearby city of Cookeville.[27]

By September 1941, Nashville District engineers had devised several design alternatives for Center Hill and recommended one as the preferred option for two-stage construction, or development for flood control first and power production later. The preferred option established the normal maximum level of the reservoir's pool at an elevation of 680 feet. At that level, the reservoir could back into the tail waters at the Great Falls and Burgess Fall plants but without reducing the generating efficiency at either of the powerhouses.[28]

The preferred plan for the impoundment at Center Hill detailed a substantial, combination concrete-gravity dam and rolled earth embankment. The concrete dam featured an ogee spillway in the river channel and a power intake section on the river's west bank. Engineers provided the spillway six controlled sluiceways for flood regulation, and placed its permanent crest at an elevation of 642 feet. Crest control was to be provided by three, 38-foot tall taintor gates which would raise the spillway's crest to the 680-foot elevation mark when closed. The power intake section incorporated three, 20-foot diameter penstocks. Engineers anticipated that, when Center Hill was authorized for power production, the powerhouse would be erected at the toe of intake section so that the penstocks would comprise the entire water delivery system for the plant's turbine-generator units. A concrete nonoverflow section tied the power intake section deeply into the earthen embankment. The earthen embankment, in turn, spanned the flood plain remnant and anchored the dam to the tall rocky bluff along the valley's west side.[29]

The Nashville District put further planning for Center Hill and Dale Hollow on hold in the fall of 1941, while shifting is its efforts to monitoring construction activities at Wolf Creek. Its workload, however, soon dramatically changed when the Japanese attacked Pearl Harbor and the United States entered World War II on December 7th. Within the next few weeks, Congress placed a rush order on completing Wolf Creek and authorized the use of War Department funds for constructing the dams at Center Hill and Dale Hollow. The action anticipated the tremendous power needed to fuel the rapid growth of defense industries in the southeast. Of particular concern was having sufficient electricity on hand to allow for a substantial increase in the production of aluminum. Effected through an electrolytic process, the light metal was required to fabricate the nation's wartime fleet of bombers, fighters and other aircraft.[30]

By the year's end, the Corps placed construction of the dam at Center Hill out for bid by private contracting firm. Four firms responded, and in mid-January 1942, the Corps awarded the

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[27] Ibid., 3-4; Crouch, *The Caney Fork of the Cumberland River.*

[28] U.S. Engineers Office, Nashville District, *Definite Project Report: Center Hill Dam and Reservoir,* 6, 10.

[29] Ibid., 10-11.

[30] Johnson, *Engineers on the Twin Rivers*, 198; Senate Committee on Agricultural and Forestry, *Including Cumberland River Basin in Tennessee Valley Authority,* 84-86.

contract to a joint venture firm comprised of three mid-western companies: the Massman Construction Company, Metcalf Construction Company and the Gordon Hamilton Contracting Company. Nashville District engineers attributed Massman-Metcalf-Hamilton's success not only to its offer of the "most reasonable unit prices" but also its demonstrated ability to mobilize sufficient equipment "to meet the demands of an expedited construction program." The firm's total of bid amounted to just under $11,666,000.[31]

Actual signing of the Nashville District's contract with Massman-Metcalf-Hamilton became delayed after the Chief of Engineers ordered a re-evaluation of options for power production at Center Hill. Nashville District engineers were specifically charged with maximizing the amount water reserve at Center Hill that would be available for power production. It was ultimately decided to raise the elevation of the dam's permanent spillway crest from 642 to 648 feet and the elevation of the top of the gated spillway crest from 680 to 685 feet. The modification increased the potential power pool to 492,000 acre-feet, an addition of 18,000 acre-feet, and provided the reservoir a maximum storage capacity of 2,092,000 acre-feet. Concerns over reducing the efficiencies at Great Falls remained, but engineers anticipated that the reservoir at Center Hill would only reach and be maintained at capacity for a short time during the flood season. The Burgess Falls plant, in turn, was destined for permanent shutdown once production of hydroelectricity at Center Hill commenced.[32]

While awaiting completion of the Corps' redesign work, Massman-Metcalf-Hamilton kept busy with other projects related to Center Hill's construction. Around mid-January 1942, it started work on a separate contract agreement with county officials for construction of an access road to the dam site. Approximately 4 miles of difficult road from a secondary highway in the hills above the west side of the valley down to the flood plain remnant at the dam site was required. By late that same month, the grade of the road was sufficiently complete to allow the company to start moving in materials and equipment needed to erect its construction plant. Facilities on the flood plain remnant soon included a carpenter shop, machine and electric shop, warehouses and concrete mixing plant. The company also set up an aggregate plant at a rock outcropping exposed in a nearby section of bluff.[33]

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[31] *Smithville Review* 14 January 1942; U.S. Army Corps of Engineers, Nashville District, *Construction of Dam, Access Roads and Powerhouse Substructure,* vol. I of *Center Hill Reservoir Project, Caney Fork River, Tennessee: Completion Report* (Nashville: July 1952), 1-2; U.S. Army Corps of Engineers, Nashville District, *Completion of Center Hill Power Plant,* vol. II of *Center Hill Reservoir Project, Caney Fork River, Tennessee: [Completion Report]* (Nashville: August 1952), 3.

[32] Jones, "Pre-TVA Hydroelectric Development in Tennessee," part 1; U.S. Engineer Office, *Addendum to Definite Project Report Hydroelectric Power, Center Hill Dam and Reservoir, Caney Fork, Tennessee* (Nashville: 15 January 1942), 1-4; U.S. Engineer Office, *Center Hill Dam, Caney Fork River, Tennessee (Cumberland River Basin): Analysis of Design* (Nashville: March 1942), chapter 2, pp. 3-4, plate II-2; U.S. Army Corps of Engineers, "Center Hill Dam Statistical Information," http://www.lrn.usace.army.mil/op/cen/rec/stats/htm (accessed 16 September 2011).

[33] *Smithville Review* 8 January 1942; U.S. Army Corps of Engineers, Nashville District, *Construction of Dam, Access Roads and Powerhouse Substructure,* 12 and Plate 13, "Sketch Construction Plant Layout."

By early March, Nashville District engineers finalized the revised plans and specifications for the dam and signed the construction contract with Massman-Metcalf-Hamilton. In addition to raising the crest height, revisions to the main dam increased the number of spillway gates from two to eight and increased the width of the crest to from one end to the other to accommodate its future use as a state highway. Another significant change added a fourth but much smaller penstock to the dam's power intake section. That penstock was intended for use as the water conveyance to a small turbine-generator unit, which in turn would power plant operations. Planning for power production facilities at Center Hill, however, stopped at that, awaiting further authorization from Congress.[34]

Construction on all three of the Cumberland River Project's water storage facilities progressed into the fall of 1942 before slowed by the ever-growing and critical need of men and materials for the war effort. That October, the War Department officials revoked the project's priority rights for steel and other wartime materials, leaving work to continue with only those materials already stock piled on-site. Six months later, in early March 1943, the Corps decided to suspend all activities at Center Hill and Wolf Creek if favor of bringing Dale Hollow on-line for flood control as quickly as possible. At the time, the dam at Dale Hollow was about 19% complete, while only about 8% of the work at Center Hill was done and even less so at Wolf Creek. Within a matter of a few months, Dale Hollow dam stood sufficiently complete to allow filling of the reservoir behind it.[35]

As the war continued to rage, in 1944 Congress passed another Flood Control Act that dealt directly with a host of issues and concerns over the operation and management of multipurpose water resource projects developed by the Corps. Among the most critical of these was the means by which power generated at Corps projects would be disposed. The Act specifically charged the U.S. Department of Interior for marketing the power "in such a manner to encourage the most widespread use thereof at the lowest cost to consumers."[36] Public-owned utilities and co-operatives were given preference for power over private utilities. Additionally, the Act recognized the rights of states to review and comment on plans for a project within their borders prior to construction. Another important provision authorized a new purpose for water resource development at reservoirs, the construction and maintenance of parks and other recreational facilities for the enjoyment of the public. In addition to the Corps, the act extended the right to engage in recreational developments to local, state and private entities.[37]

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[34] U.S. Engineer Office, *Addendum to Definite Project Report Hydroelectric Power, Center Hill Dam,* chapter 6, pp. 2-3, 6-7.

[35] *Smithville Review* 17 September 1942; U.S. Army Corps of Engineers, Nashville District, *Construction of Dam, Access Roads and Powerhouse Substructure*, 3.

[36] "[Extracts from] The Flood Control Act of 1944," 800, chapter from unidentified publication, http://www.usbr.gov/power/legislation/fldcntra.pdf (accessed November 2010).

[37] Ibid., 796-801; Johnson, *Engineers on the Twin Rivers*, 215.

The end of World War II brought orders for a return of construction on the Cumberland River Project. Work resumed at Center Hill first, beginning in late January 1946. Just six months later, the course of the project significantly changed when a new Rivers and Harbors Act officially authorized Center Hill, Wolf Creek and Dale Hollow for power production. The Act additionally approved deepening of the Cumberland's navigation channel from the Ohio to Burnside to 9 feet.[38]

By November 1948, Messman-Metcalf-Hoffman had sufficiently completed Center Hill dam to allow for filling of the reservoir, soon to be known as "Center Hill Lake." The Corps accepted the project for flood control operations at that time. A fair amount of work remained, however, to finish the dam for the project's power production function.[39]

That same fall, Nashville District engineers finalized plans and specifications for the power plant. Some of the facility's critical aspects had previously been set by the design of the dam, such as the location of the powerhouse at the toe of the intake section, a main turbine-generator installation of three units with a combined rated capacity of 135,000 kW, and the use of reinforced concrete as the building's construction material. One of the important aspects of the plant design yet to be determined was the location for the outdoors switchyard. It was finally decided to erect the switchyard on the flood plain remnant just downstream of the powerhouse. Some of the contractor's construction camp facilities stood in this same area, thus necessitating their relocation.[40]

By their own account, Nashville District engineers relied on an innovative measure for conveying hydroelectricity from the powerhouse to the switchyard. While overhead power lines were the standard, they asked the General Electric Company to design an underground "power cable tunnel" instead. A concrete-lined conduit, the tunnel was to contain four, high-pressure cables, each in its own oil-filled pipe. Three cables would carry hydroelectricity to the switchyard's main banks of 13.2/161 kV transformers, while the fourth ran to a 13.2/46 kV transformer bank.[41]

Instead of placing the power plant's construction out for bid, had been determined that the best course of action would be to modify the Corps' existing contract with Messman-Metcalf-Hoffman to include the work. That way, no time would be lost to a full-scale change over in construction personnel and equipment. Of equal in not greater importance, construction of the power plant could commence before the company fully finished the dam.[42]

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[38] Johnson, *Engineers on the Twin Rivers*, 216-21; U.S. Army Corps of Engineers, Nashville District, *Completion of Center Hill Power Plant*, 2.

[39] U.S. Army Corps of Engineers, Nashville District, *Construction of Dam, Access Roads and Powerhouse Substructure*, 3.

[40] Ibid., 12.

[41] Ibid., 19-20, 121-22.

[42] Ibid., 3, 12, see Appendix C for a list of subcontractors.

Messman-Metcalf-Hoffman signed the contract modification in February 1949. Terms of the agreement called for the company to construct the powerhouse building, power cable tunnel and the switchyard. The company's bid covered the costs for construction materials but only minor pieces of the equipment. In turn, the Corps retained responsibility for procuring the turbines, generators and most of the other hydroelectricity generation equipment and furnishing the machinery to the company for installation. Messman-Metcalf-Hoffman subcontracted a considerable amount of the work out to other firms, a practice often employed for projects of the complexity and scope of the Center Hill power plant. Pouring of concrete for the power house's substructure and grading the switchyard site began with in a few weeks of the primary contract award.[43]

The power plant's construction schedule staggered the installation of the three main turbine-generator units as well as their placement into commercial service. Delays in the receipt of some materials and equipment slowed construction activities and ultimately placed the project about one month behind schedule. Massman-Mecalf-Hoffman placed Unit 1 on line in December 1950, Unit 2 in January 1951 and Unit 3 in April 1951. The Nashville District declared the company's contract officially complete in the following November. Total construction costs by then amounted to over $43 million.[44]

F. Early Operations at Center Hill Dam

Center Hill's ability to remedy flood events was put to test soon after the dam's initial completion in 1948. It joined Dale Hollow in the Corps' flooding fighting efforts that year and together the two facilities saved the communities, farmland and industries downstream from extensive damage. Two years later, Center Hill, Dale Hollow and the newly completed dam at Wolf Creek reportedly reduced the river's flood crest by 30 feet at Celina, 20½ feet at Carthage and 11 feet at Nashville.[45]

In terms of hydroelectric generating capacity, Center Hill was neither the smallest nor the largest of the Cumberland project's three original facilities. Placed into service in 1949, Dale Hollow produced half less power than Center Hill; while after all six of its turbine-generator units came on line in 1952, Wolf Creek became a 270,000 kW plant, or double the size of Center Hill. Even at that, Wolf Creek could only be considered a medium-sized producer in the nation's burgeoning public-power system. Grand Coulee Dam on the Columbia River in Washington

[43] Ibid., 3, 123.

[44] Ibid., 3; Frank P. Gaines and John T. Dennison, "Development of the Cumberland River Basin," Proceedings of the American Society of Civil Engineers, Paper 1121, *Journal of the Waterways and Harbors Division* 82, no. WW5 (December 1956): 6.

[45] Johnson, *Engineers on the Twin Rivers*, 217.

State, for example, had an installed capacity of 1,219,000 kW at the time of its initial completion in 1941.[46]

Under the provisions of the Flood Control Act of 1944, the Southeastern Power Administration, an agency of the Department of the Interior, was vested with the authority to oversee the transmission and disposition of the hydroelectricity generated at the Corps' Cumberland River Basin facilities. Before the Center Hill, Dale Hollow and Wolf Creek plants came on line, however, in late 1948 the Department of Interior agreed to sale the production from all three facilities to the TVA. The Southeastern Power Administration was given responsibility for receiving power at facility's switchyard and entering into contract agreements with the TVA for its sale and distribution. Similar to the hydroelectric projects it operated, the TVA was tasked with building and operating transmission lines from the Cumberland facilities and marketing the electricity at rates set only high enough to repay the federal investments. Publicly owned utilities and rural co-ops were given first call for power.[47]

By the mid-1950s, the Corps operated 21 hydroelectric plants and was the largest single producer of hydroelectricity in the United States. Its multipurpose construction program continued strong into the 1970s when curtailed by ever growing concerns over the delirious effect of large-scale dam and reservoir projects on wildlife and other facets of the natural and cultural environments. The total number of Corps hydroelectric projects nationwide by the mid-1980s totaled 70.[48]

While Center Hill Lake resulted in the loss of thousands of acres of productive farm land, it quickly met another local need, public recreation. In addition to Center Hill Lake, visitors in ever increasing numbers flocked to Upper Cumberland Lake at Wolf Creek Dam and the Dale Harbor reservoir to fish, boat, sightsee and partake in other recreational activities. The largest and most scenic, Lake Cumberland ranked among the most frequented of the Corps' recreational reservoirs nationwide by the mid-1950s.[49]

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[46] Gaines and Dennison, "Development of the Cumberland River Basin," 5-6; Billington, Jackson, and Melosi, *History of Large Federal Dams*, 2.

[47] "[Extracts from] The Flood Control Act of 1944," 801; U.S. Army Corps of Engineers, Nashville District, "Center Hill Dam," ca. 1998, manuscript on file at Center Hill Dam.

[48] U.S. Army Corps of Engineers, *Hydropower: The Role of the U.S. Army Corps of Engineers* (1987), 1, 4-5, 16.

[49] Johnson, *Engineers on the Twin Rivers*, 217.

IV. FUTURE OF THE PROPERTY

The Nashville District plans to rehabilitate some of the hydroelectric generating equipment and electrical control systems at the Center Hill Dam powerhouse. It has entered into a Memorandum of Agreement with the Tennessee Historic Preservation Office to mitigate the adverse effect of the rehabilitation project. Recording the powerhouse and its equipment to Historic American Engineering Record standards was one of the mitigation measures identified. This overview of Center Hill Dam is accompanied by more detailed HAER documentation for the powerhouse and equipment.

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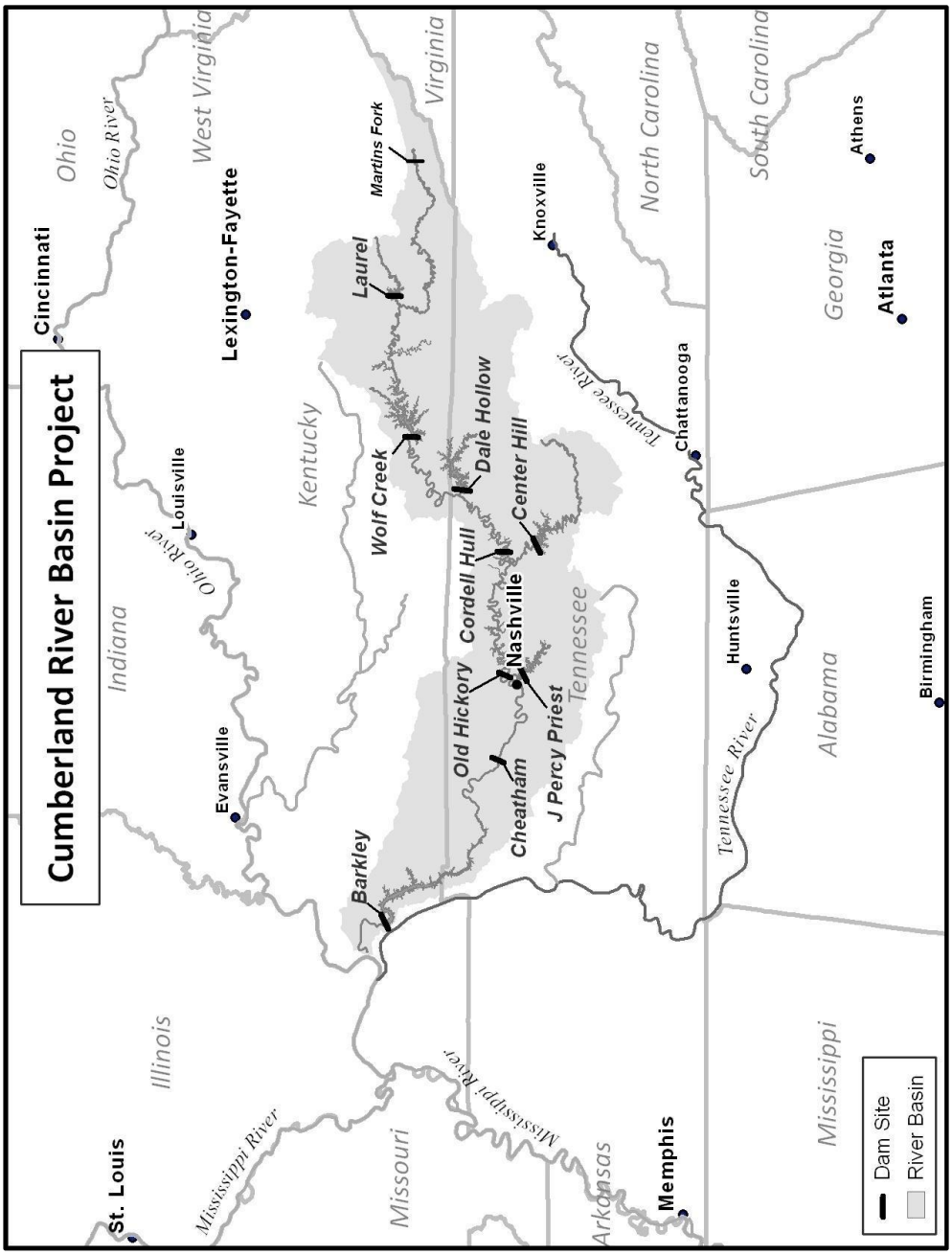

Figure 1. Map of Cumberland River Basin Project showing location of Center Hill and other major dams on the Cumberland River Basin Project.

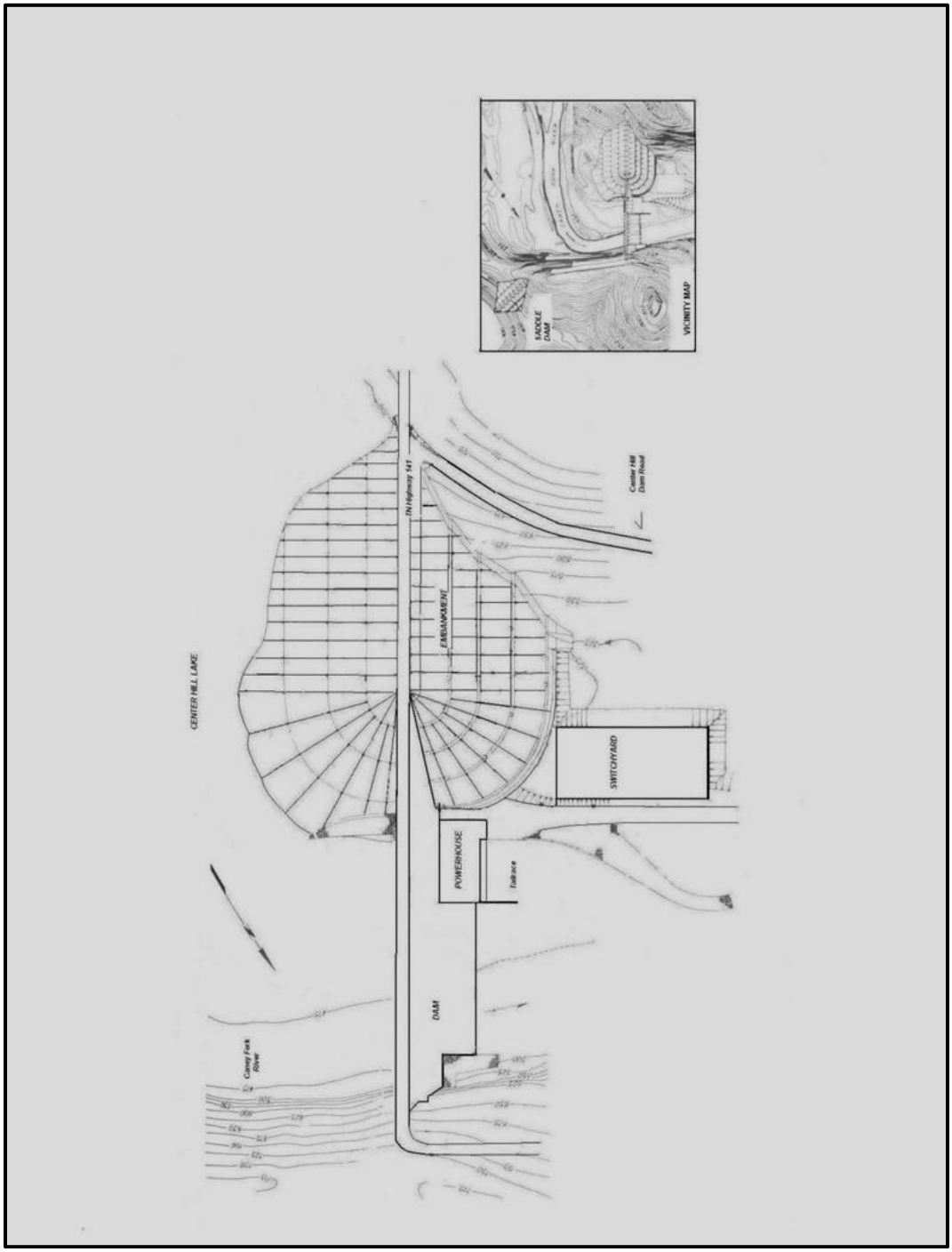

Figure 2. Site plan map of Center Hill Dam.