

BUILT FOR THE PEOPLE OF THE UNITED STATES
FIFTY YEARS OF TVA ARCHITECTURE

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MARIAN MOFFETT
LAWRENCE WODEHOUSE

Art and Architecture Gallery The University of Tennessee

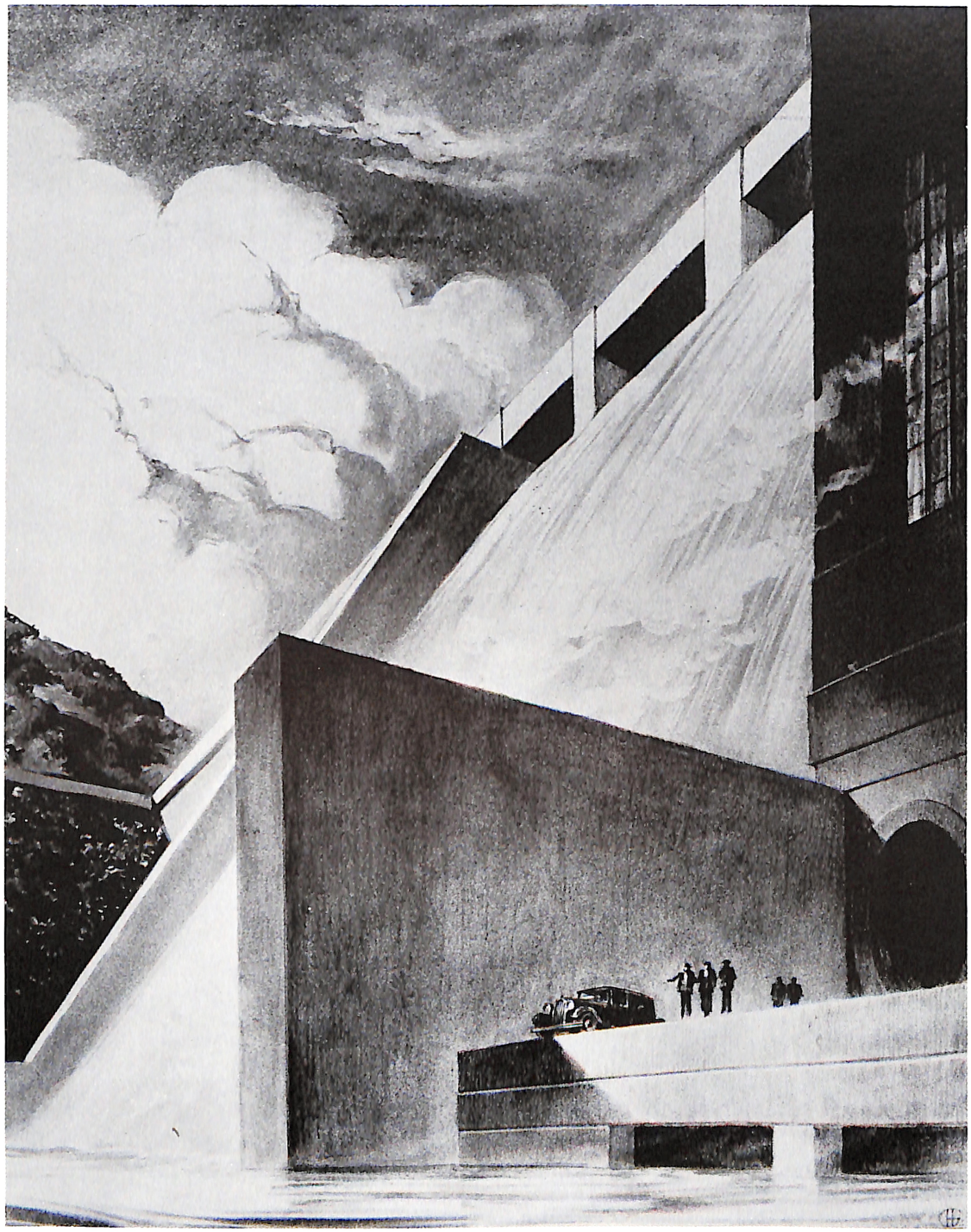
1983

Sam Yates, Director of the Art and Architecture Gallery, served as project coordinator for this exhibition.

This project was supported in part by a grant from the National Endowment for the Arts in Washington, D.C., a federal agency, and by the Tennessee Valley Authority.

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7. Norris Dam and powerhouse. Drawn by S.H. Gurnee.

PREFACE

The Tennessee Valley Authority has a distinguished record of architectural achievements which at the fiftieth anniversary on May 18, 1983, of the signing of the Act by Franklin Delano Roosevelt, deserve wider public recognition. Numerous publications and articles have been written on general aspects of the TVA, but precious few have specifically centered on its architectural contribution, and those mostly in the 1940s and 1950s. The *Architectural Forum* and *Progressive Architecture* have both recognized the high quality of architectural design in the dams and adjacent structures of the heroic period. The New York Museum of Modern Art recognized "TVA Architecture" during 1941, but the last major appreciation was in 1958 when John Kyle wrote *The Building of TVA*, a twenty-five-year retrospective. Since 1958, several dams, all the nuclear power plants, the Raccoon Mountain Pumped Storage facility, and the Chattanooga Office Complex, plus planning, recreational, townlift, and solar energy projects, have been produced by the Architectural Design Branch of the TVA. Although perhaps not of such international significance as the early works under the direction of Roland A. Wank, they still present a significant body of work, marking a fifty-year selective retrospective survey totally justifiable.

"Built for the People of the United States: Fifty Years of TVA Architecture" is also appropriately the first architectural exhibition originated at The University of Tennessee's Art and Architecture Gallery, located in the new Art and Architecture Building and directed by Sam Yates.

Even a small exhibition costs an inordinate amount of money to prepare, both for the mounting of drawings and photographs and for the publication of a catalogue. This project is supported in part by a grant from the National Endowment for the Arts in Washington, D.C., a federal agency.

We wish to thank Carl Condit of Northwestern University, Buford Pickens of Washington University, St. Louis, and Eric Delony, Principal Architect of the Historic American Engineering Record, for so generously supporting our application to the Endowment. We also wish to express our gratitude to Roy F. Knight, Dean of the School of Architecture at The University of Tennessee, for his continuous encouragement of this project.

The TVA has also been generous in opening up its wealth of raw material, providing all photographic reproductions and lending original renderings, drawings, and architectural models for the show. R. Michael Parker, Acting Head of the Architectural Design Branch, and architect Marvin Johnson have been both cooperative and amenable in all aspects of this project. Two other architects within the Branch, however, must be cited for the inordinate amount of effort contributed toward the making of this exhibition. David Joyner, whose excellent renderings are exhibited in the show, acted as archivist-retriever over a three-week period when Professor William Jordy was researching material for his article on Raccoon Mountain and another on Norris Village. The major task of selecting original drawings was thus more or less completed before our project began. James Pomy has also worked diligently searching out private collections of colored illustrations from his colleagues, digging into files and other uncatalogued sources, and in the process discovering forgotten drawings such as the colored renderings of the Cumberland Steam Plant (1968-73).

Jesse Mills, Chief Librarian of the TVA, always knows the location of sources and information and has been invaluable in his contacts, and so, too, has Daniel Yearout of the Information Office.

This catalogue depends upon its two major contributors, Walter L. Creese, Chairman and Professor of History and Preservations at the University of Illinois at Urbana School of Architecture,and William H. Jordy, Henry Ledyard Goddard Professor of Art at Brown University.

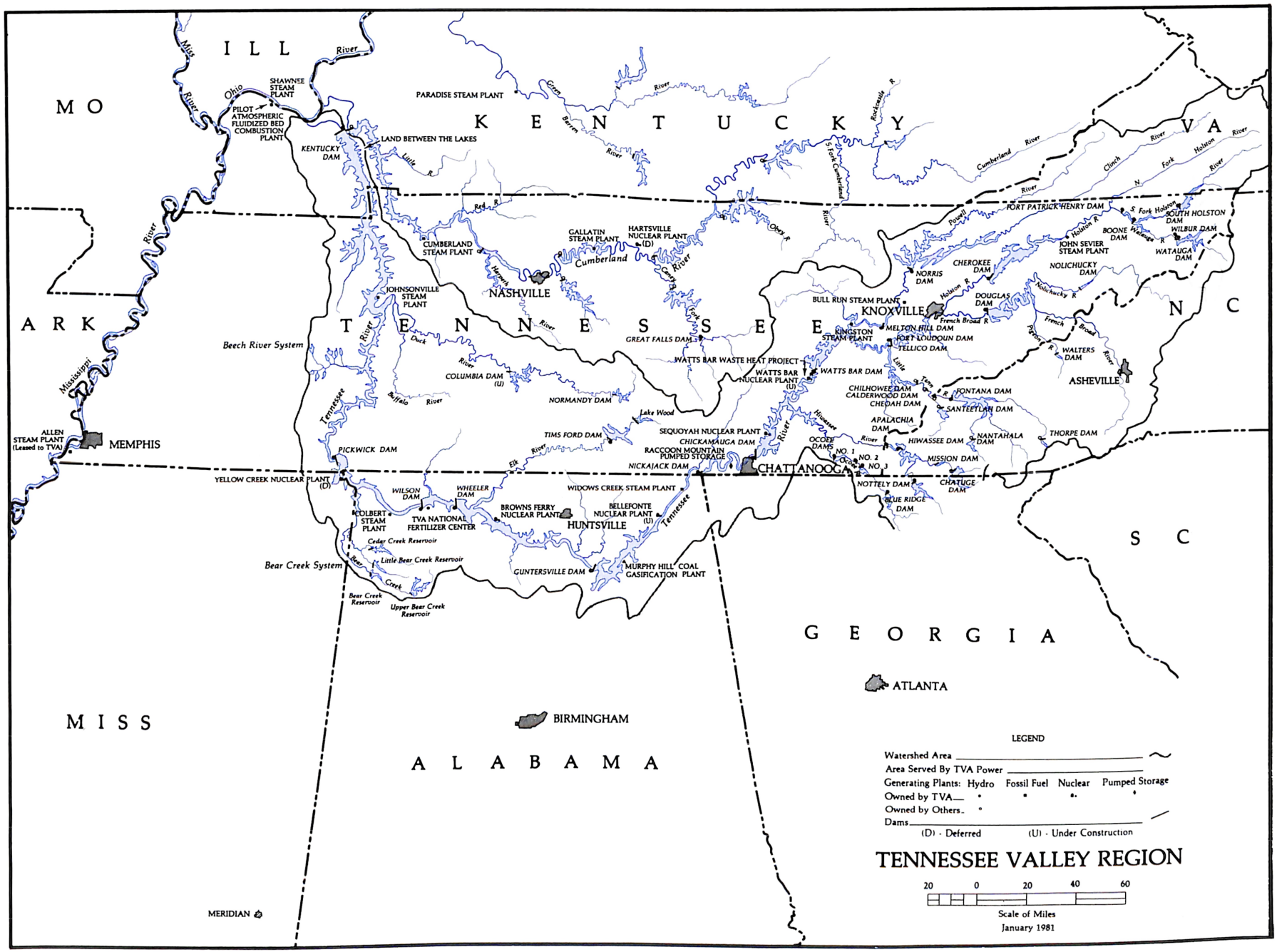
We would like to thank Mr. Mills for proofreading all manuscripts, although we, as editors, accept responsibility for any omissions or errors. The secretarial help at the School of Architecture, notably Belenda Alexander, have provided the excellent typing effort needed in a project of this scope.

Marian Moffett

Lawrence Wodehouse

School of Architecture
The University of Tennessee, Knoxville

18 May 1983


ILL
MO
KENTUCKY
TENNESSEE
ARK
MISS
ALABAMA
GEORGIA
S C
N C
VA
Miss River
Ohio River
Mississippi River
SHAWNEE STEAM PLANT
PILOT ATMOSPHERIC FLUIDIZED BED COMBUSTION PLANT
PARADISE STEAM PLANT
KENTUCKY DAM
LAND BETWEEN THE LAKES
Green River
Barren River
Rockcastle R
Cumberland River
S Fork Cumberland River
Clinch River
Holston River
N Fork Holston River
FORT PATRICK HENRY DAM
S Fork Holston
SOUTH HOLSTON DAM
WILBUR DAM
WATAUGA DAM
BOONE DAM
Watauga R
JOHN SEVIER STEAM PLANT
NOLICHUCKY DAM
CHEROKEE DAM
NORRIS DAM
Powell R
Holston R
Nolichucky R
French Broad R
DOUGLAS DAM
BULL RUN STEAM PLANT
KNOXVILLE
KINGSTON STEAM PLANT
MELTON HILL DAM
FORT LOUDOUN DAM
TELLICO DAM
WALTERS DAM
ASHEVILLE
Pigeon R
French Broad River
Little Tenn R
Tenn R
FONTANA DAM
CHILHOWEE DAM
CALDERWOOD DAM
CHEOAH DAM
SANTEETLAH DAM
APALACHIA DAM
HIWASSEE DAM
NANTAHALA DAM
THORPE DAM
OCOEE DAMS
NO. 1
NO. 2
NO. 3
MISSION DAM
CHATUGE DAM
NOTTELY DAM
BLUE RIDGE DAM
CHATTANOOGA
Hiwassee River
Ocoee River
WATTS BAR DAM
WATTS BAR NUCLEAR PLANT (U)
WATTS BAR WASTE HEAT PROJECT
GREAT FALLS DAM
Caney Fork River
Obey R
Red R
Harpeth R
Cumberland
CUMBERLAND STEAM PLANT
GALLATIN STEAM PLANT
HARTSVILLE NUCLEAR PLANT (D)
NASHVILLE
JOHNSONVILLE STEAM PLANT
Duck River
Beech River System
COLUMBIA DAM (U)
NORMANDY DAM
Buffalo River
Tennessee River
Lake Wood
SEQUOYAH NUCLEAR PLANT
CHICKAMAUGA DAM
RACCOON MOUNTAIN PUMPED STORAGE
NICKAJACK DAM
TIMS FORD DAM
Elk River
PICKWICK DAM
YELLOW CREEK NUCLEAR PLANT (D)
ALLEN STEAM PLANT (Leased to TVA)
MEMPHIS
WILSON DAM
WHEELER DAM
COLBERT STEAM PLANT
TVA NATIONAL FERTILIZER CENTER
BROWNS FERRY NUCLEAR PLANT
WIDOWS CREEK STEAM PLANT
BELLEFONTE NUCLEAR PLANT (U)
HUNTSVILLE
Tennessee
Cedar Creek Reservoir
Little Bear Creek Reservoir
Bear Creek System
Bear Creek
Bear Creek Reservoir
Upper Bear Creek Reservoir
GUNTERSVILLE DAM
MURPHY HILL COAL GASIFICATION PLANT
MERIDIAN
BIRMINGHAM
ATLANTA
LEGEND
Watershed Area
Area Served By TVA Power
Generating Plants: Hydro Fossil Fuel Nuclear Pumped Storage
Owned by TVA
Owned by Others
Dams
(D) - Deferred
(U) - Under Construction
TENNESSEE VALLEY REGION
20 0 20 40 60
Scale of Miles
January 1981

CONTENTS

PREFACE 1

INTRODUCTION 3

CATALOGUE 7

RACCOON MOUNTAIN 49
William H. Jordy

THE T.V.A. AS AN ALLEGORY 59
Walter L. Creese

BIBLIOGRAPHY 64

INTRODUCTION

> The Authority has been an astounding success, its achievement such a brilliant exhibition of political, technical, and scientific skills that Congress has never dared repeat the masterpiece of legislation that established it.
>
> - Carl Condit, *American Building: Twentieth Century*

Even though the Act establishing the Tennessee Valley Authority was signed by President Roosevelt on May 18, 1933, the story of the TVA begins earlier. The Tennessee River, a 640-mile-long watercourse draining parts of Virginia, North Carolina, Georgia, Alabama, Mississippi, Kentucky, and Tennessee on its way to the Ohio River, runs through land that, by the early twentieth century, had become greatly impoverished. High annual rainfall (from forty to sixty inches a year in the mountainous eastern portions of the drainage basin) and poor farming practices had encouraged severe soil erosion, while treacherous rapids and variable water flow impeded navigation on the main river. Isolated communities, seasonal flooding, and endemic malaria created additional hardships for the largely rural population, which endured a standard of living well below the national average.

The potential of the Tennessee River for transportation and hydroelectric power generation had been noted, however, with the most difficult and promising site being Muscle Shoals, Alabama, where the river dropped eighty-five feet over rocky shoals in one fifteen-mile section. It was here in 1916 that the Army Corps of Engineers began construction of a dam to supply power for two nitrate plants being built to provide explosives for munitions. Until the dam, named for President Wilson, could be completed, electric power was generated by a coal-fired steam plant, also built by the Corps. Nitrate production had scarcely begun when the war ended, leaving Wilson Dam to be completed on a more leisurely schedule in 1924. As Congress had intended that the nitrates manufactured would be used for fertilizer during peacetime, disposal of the now-surplus plants came under the purview of the Senate Committee on Agriculture and Forestry.

The Senate agriculture committee was chaired by George William Norris (1861-1944), a progressive liberal Republican who, throughout his life, championed what he considered right for America and democracy. In 1921, when Henry Ford offered to purchase the $130 million Muscle Shoal installation - two nitrate plants, a steam plant, and the hydroelectric units at Wilson Dam - for five million dollars, Senator Norris vigorously opposed the sale. He proposed instead that this public investment be applied to the public good. In his view, Wilson Dam and its related facilities could become part of a publicly-owned power network which would help to improve the quality of life in the economically depressed Tennessee Valley. Seven times between 1921 and 1933 Norris introduced bills to create a federal agency to undertake the generation of electric power in the Tennessee Valley, and twice his proposals passed through the Congress only to be vetoed by President Coolidge in 1928 and President Hoover in 1931. With the election of Roosevelt in 1932, there was at last a president who shared Senator Norris' conviction regarding the future of the Muscle Shoals property. Roosevelt's message to Congress, sent on April 10, 1933, added the concept of regional resource development to Norris' longstanding commitment to public service power:

> It is clear that the Muscle Shoals development is but a small part of the potential public usefulness of the entire Tennessee River. Such use, if envisioned in its entirety, transcends mere power development: it enters the wide fields of flood control, soil erosion, afforestation, elimination from agricultural use of marginal lands, and distribution and diversification of industry. In short, this power development of war days leads logically to national planning for a complete river watershed involving many States and the future lives and welfare of millions....
>
> I, therefore, suggest to the Congress legislation to create a Tennessee Valley Authority - a corporation clothed with the power of government but possessed of the flexibility and initiative of a private enterprise. It should be charged with the broadest duty of planning for the proper use, conservation, and development of the natural resources of the Tennessee River drainage basin and its adjoining territory for the general social and economic welfare of the Nation.

The Act creating the TVA was signed on May 18, 1933, making Senator Norris' vision an experiment in unified regional resource development that exceeded his most optimistic dreams. In appreciation of Norris' efforts, the first TVA dam was named in his honor, the only project which the TVA has ever named for an individual.

The TVA Act established the Authority as an independent federal agency, reporting directly to the President, to be governed by a three member Board of Directors. To comprise the first Board, President Roosevelt selected as Chairman Arthur E.

Morgan, an engineer who was then president of Antioch College; Harcourt A. Morgan (no relation to A.E.), an agriculturist who was president and former dean of the Agriculture School at The University of Tennessee; and David E. Lilienthal, a progressive lawyer whose experience on Wisconsin's Public Service Commission identified him as a supporter of public power. (Lilienthal later became the first chairman of the Atomic Energy Commission.) While internal disagreements among these men would eventually lead to Roosevelt's removal of A. E. Morgan from the Board in 1938, it is safe to say that never since that time has the TVA had such distinguished leadership in its directors.

Among the first tasks facing the new Board were the development of policies to implement the charges given it by Congress and the organization of individuals to accomplish the work. The Act defined the general scope of the TVA:

> To improve the navigability and to provide for the flood control of the Tennessee River; to provide for reforestation and the proper use of marginal lands in the Tennessee Valley; to provide for the agricultural and industrial development of said valley; to provide for the national defense by the creation of a corporation for the operation of Government properties at and near Muscle Shoals in the State of Alabama, and for other purposes.

It also specifically assigned TVA its first construction project, the building of Cove Creek (now Norris) Dam on the Clinch River. By controlling the flow of the Clinch, a tributary of the Tennessee, the generating capacity of Wilson Dam would be enhanced; towards that end, design studies for Cove Creek Dam had already been undertaken by the Bureau of Reclamation. The TVA Directors decided to construct the dam (and all future projects) by force account, with TVA hiring, training, and directing the workmen, rather than giving the job to private contractors. In July of 1933, the Cove Creek project was renamed to honor Senator Norris, and work began in October on the dam and its related construction town.

Of the many far-sighted decisions made during these early months by the Board of Directors, none would have greater architectural impact than the hiring of Roland Anthony Wank (1898-1970) as the first Chief Architect. Wank, a young Hungarian, had received his architectural training in Hungary and Czechoslovakia, where he then worked for various engineering and construction organizations until emigrating to the United States in 1924. For a period of seven years, he was associated with Fellheimer and Wagner, a firm which specialized in large commercial and industrial projects such as railroad stations; Wank is credited with the architectural design of their masterpiece, the Cincinnati Union Terminal. The experience thus gained with large scale complex facilities recommended him to the TVA. Though he was at first hired to work on the town of Norris, Wank was soon asked by Chairman Morgan to tackle the design of the dam itself. After studying the Bureau of Reclamation's plans, he proposed a new design, devoid of the neo-classical ornament favored by the Corps of Engineers, for the dam and powerhouse. He also encouraged visitors at Norris by providing an information center, powerhouse reception room, and overlooks so that the public could understand the dam's functions and share in the pride of ownership of the new project, itself a symbol of a better future. This tradition of openness begun with Norris has continued in subsequent TVA projects, save only the nuclear-powered steam plants where stringent security requirements preclude public visits. At all TVA facilities, the approach drive, parking areas, project buildings, and scenic overlooks harmonize with the landscape in the tradition of romantic naturalism, giving rise to the often-cited (but unverifiable) remark of a foreign guest who noted that the TVA had been extremely fortunate to be able to locate its major projects in such handsome parks. Within the reception area of each project, one finds the legend, "Built for the People of the United States," flanked by the project's beginning and completion dates.

In the eleven years from 1933-44 he spent at the TVA, Wank was ably assisted by a small group of architects. Together, they worked with TVA engineers on sixteen projects which followed Norris: the main river dams of Wheeler, Pickwick Landing, Guntersville, Chickamauga, Kentucky, Watts Bar, and Fort Loudoun; and the tributary dams of Apalachia, Hiwassee, and Chatuge, on the Hiwassee River; Ocoee No. 3 on the Ocoee River; Nottely on the Nottely River; Fontana on the Little Tennessee River; Douglas on the French Broad; and Cherokee and South Holston on the Holston River; and Watts Bar Steam Plant. For all of these, they made compositional studies of the simple but huge elements of the dams, powerhouses, and gantry cranes, studying the design from its overall site relationships to the smaller elements. Light fixtures, Art Deco lettering, flagpoles, ladders, handrails, and door pulls were custom-designed; and the texture of materials, whether board-formed concrete, marble, terrazzo, quarry tile, steel, or brushed aluminum, was combined with subtle paint hues on interior surfaces to create a feeling of permanence, efficiency, dignity, and modernity. As a result, there is a pervasive consistency and harmony in these great concrete constructions, a unity that became hard to maintain in postwar projects.

Today, the Tennessee Valley Authority operates an extended network of power generation facilities, including hydroelectric, coal-fired steam, and nuclear-powered steam plants. In keeping with TVA's three-fold charge to provide for navigation (an eleven-foot channel is maintained from Knoxville to Paducah), flood control, and power generation, in that order of priority, the dams generate electricity as part of an integrated water regulation system. The lakes behind the dams have been developed for recreation uses, providing valuable aquatic reserves for a region that previously had no natural lakes: the shoreline length of TVA lakes equals that provided by the Great Lakes. At present, TVA operates forty-two dams in the Tennessee Valley as part of its system; most were designed and built by TVA, others were purchased, and thirteen are owned by the Aluminum Company of America and operated by TVA. (In the Cumberland River Basin, the Army Corps of Engineers operates nine additional dams, which contribute electricity to the TVA system.) Ten other non-power dams control tributary rivers or creeks within the Tennessee Valley. There are only three major dams in the Valley neither built nor controlled by TVA - Elk River Dam, operated by the Air Force; Burnett Dam, operated by the City of Asheville; and Walters Dam, operated by Carolina Power and Light Company.

Coal-fired steam plants, beginning with the original facility inherited at Muscle Shoals, have been built to expand the power capacity of the hydro system. Though the Muscle Shoals plant has since been retired, other facilities, most on a truly gigantic scale, have been constructed or purchased to give TVA twelve plants today. Four of these are also equipped with gasoline combustion turbines to meet peak load demands. In the last two decades, TVA has built or begun seven nuclear-powered steam plants, three of which are presently deferred due primarily to the slackening of demand and the escalating price of construction. Since the costs of TVA power operations must be borne by users of the electricity, completion of proposed plants or expansion of existing ones will be an economic decision to be faced in the future.

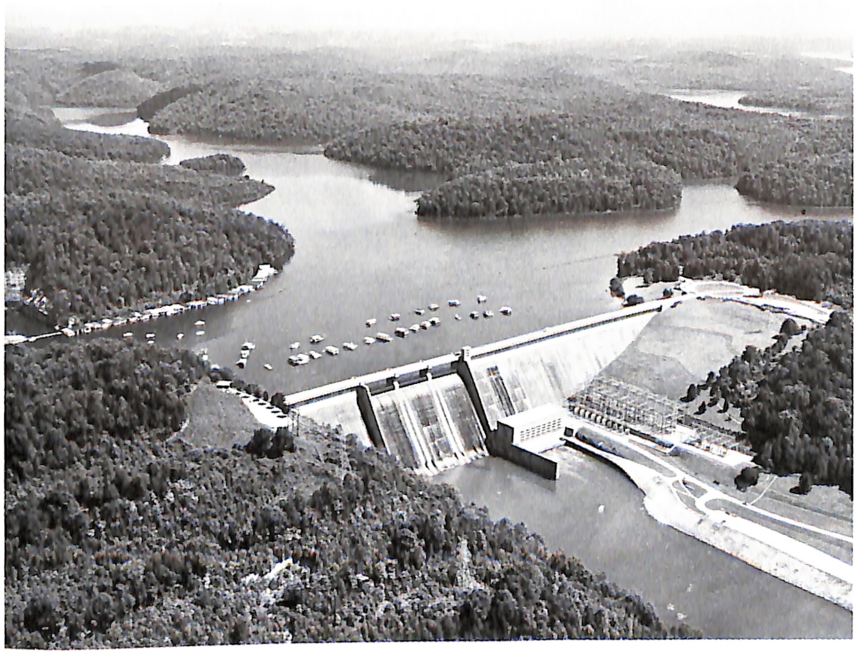
CATALOGUE

For this exhibition, we have selected thirty-four projects to illustrate the diversity of TVA architecture. The works are presented with descriptive notes in the broad categories of main river dams, tributary dams, coal-fired steam plants, and nuclear-powered steam plants. Except as otherwise noted, all photographs, models, and drawings are made by the Tennessee Valley Authority. In the complete listing of this exhibition which follows, those items indicated by a solid circle are reproduced in this catalogue; those with an open square are not.

1. **NORRIS DAM** (October 1, 1933 to March 4, 1936)

□ Panoramic photograph, upstream side.
Rell Clements #102, March 15, 1935.

Although a tributary dam, Norris is presented first because it was the first TVA project. Technical design of the dam was drawn largely from plans made by the Bureau of Reclamation prior to 1933, but TVA's Roland Wank was responsible for much of the exterior appearance of the completed project. These panoramic photographs are the work of Rell Clements, a local photographer who used his camera to take weekly shots of the work at this and other TVA construction sites, selling the prints to the public. The TVA Technical Library has a limited sample of what must have been a vast collection of photographs by Clements.



• Norris Dam aerial view.

2. **NORRIS DAM**

□ Panoramic photograph, downstream side.
Rell Clements #76, October 20, 1934.

□ Panoramic photograph, upstream side.
Rell Clements #93, January 7, 1935.

□ Panoramic photograph, upstream side.
Rell Clements #124, August 21, 1935.

3. **NORRIS DAM**

• Tennessee River Survey, Cove Creek Dam, Clinch River.
General plan drawn by the U.S. Engineer Office, Chattanooga, Tenn., December 1927.

4. **NORRIS DAM**

• Norris Dam: Plan, elevations, and sections.
Record drawing as constructed, April 29, 1937.

5. **NORRIS DAM**

□ Spillway and powerhouse.

6. **NORRIS DAM**

□ Upstream side of dam under construction showing trashracks.

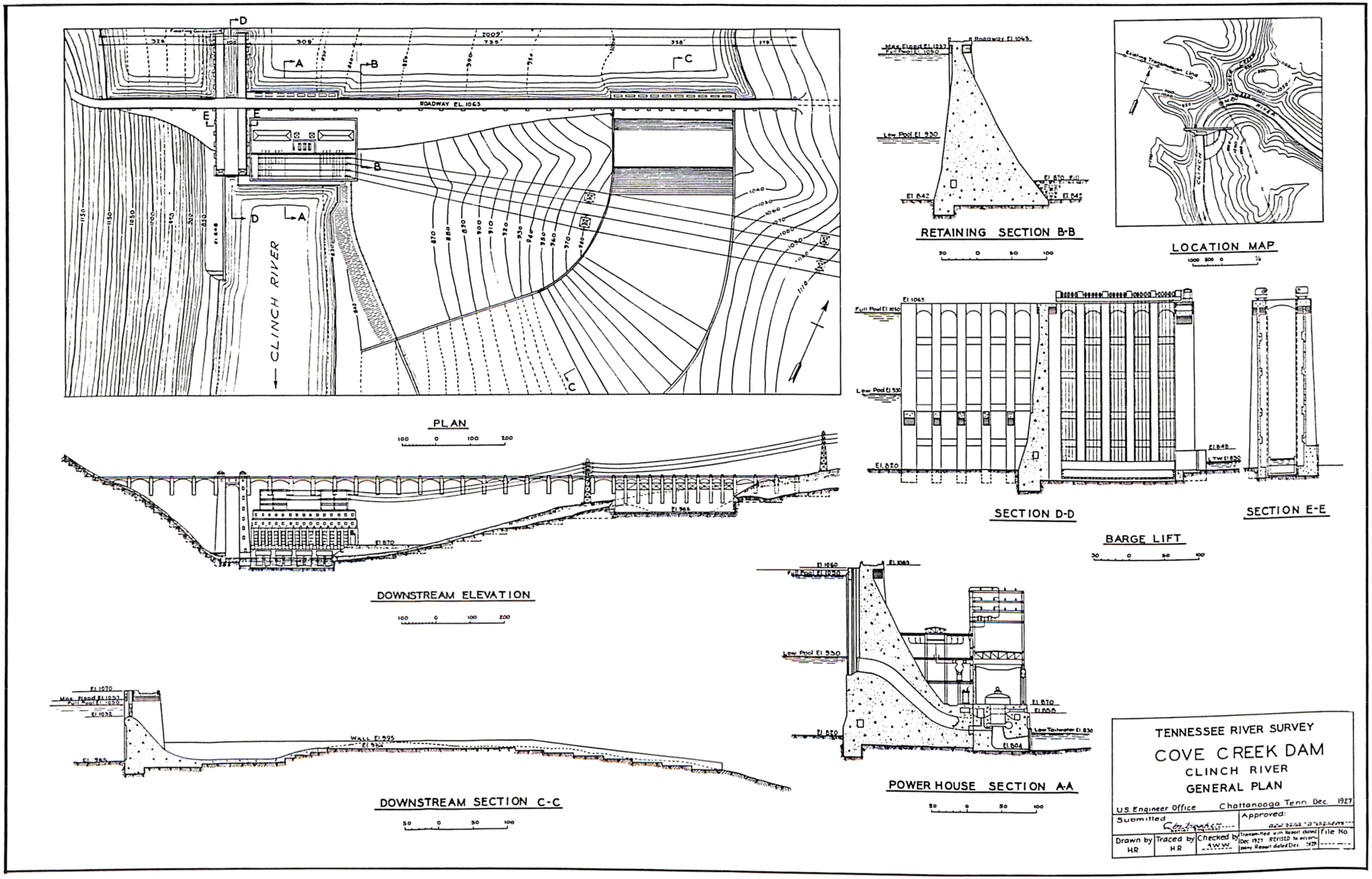
7. **NORRIS DAM**

• Aerial view.

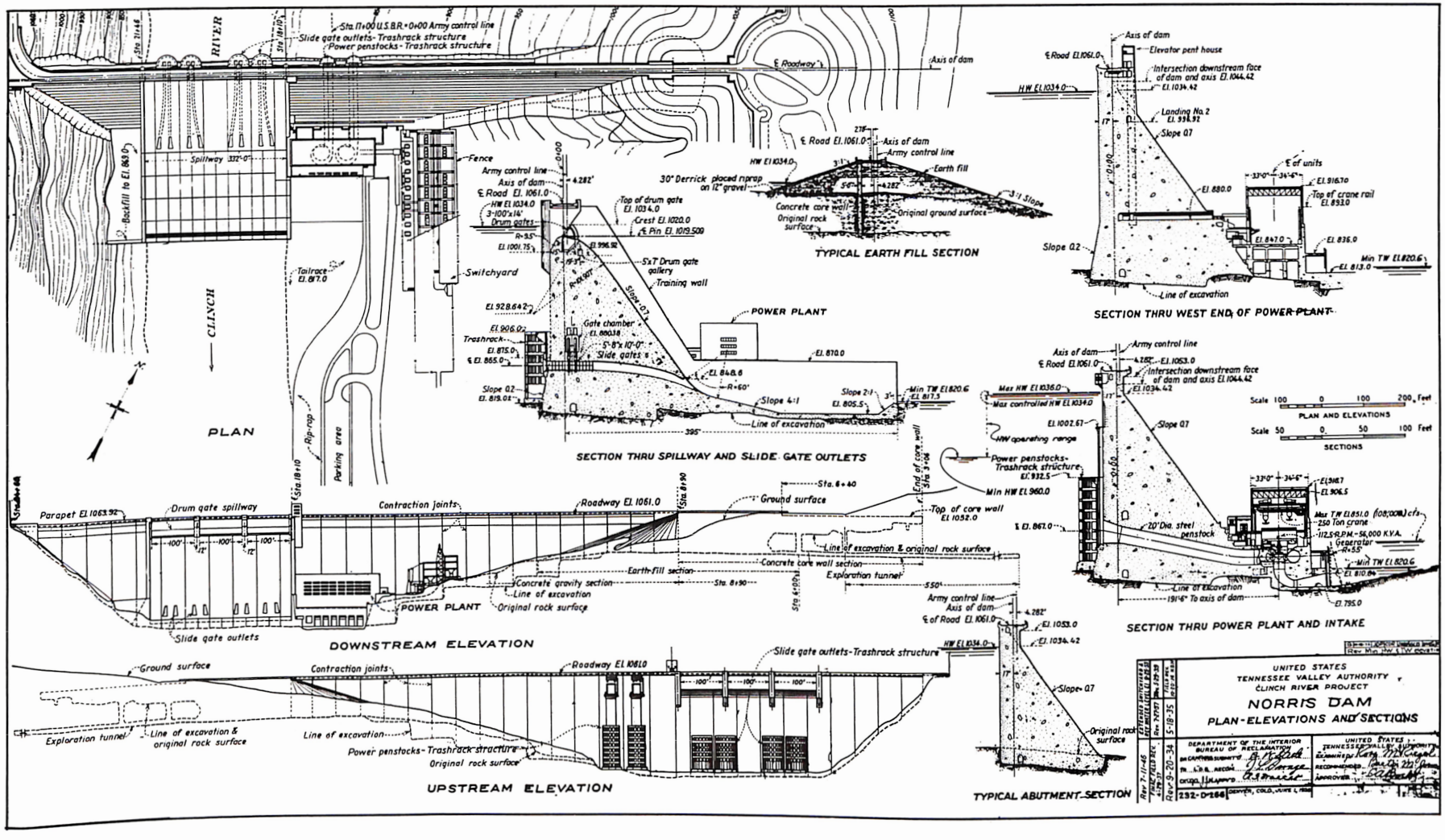
• Dam and powerhouse.
Charcoal on tracing paper, 16½" x 20".
Drawn by S.H. Gurnee.

□ Mural showing cross-section through dam.

This mural from the reception room illustrates how a hydro-electric dam generates power. Water from the lake is screened by trashracks to exclude debris before entering the penstock intakes



• Corps of Engineers design for Cove Creek Dam (now Norris), 1927.



• Record drawing by the TVA of Norris Dam, 1937.

at the base of the dam. The water is directed against turbine blades, causing them to turn, and is then discharged below the dam. The spinning turbine blades rotate a shaft that, at the top of the unit, has an assembly of coils (a rotor) which revolves past a fixed permanent magnet (the stator). The rotor serves as a conductor, inducing electric current as it passes through the magnetic field. It is the depth of water behind the dam which determines the force of the falling water; the greater this force, the larger the generating potential of the dam. At Norris, there are two 50,000 kilowatt generating units. The dam is 265 feet high and 1,860 feet long.

8. TOWN OF NORRIS

- General plan, Town of Norris.
  Drawn by the Division of Land Planning and Housing, 1931.

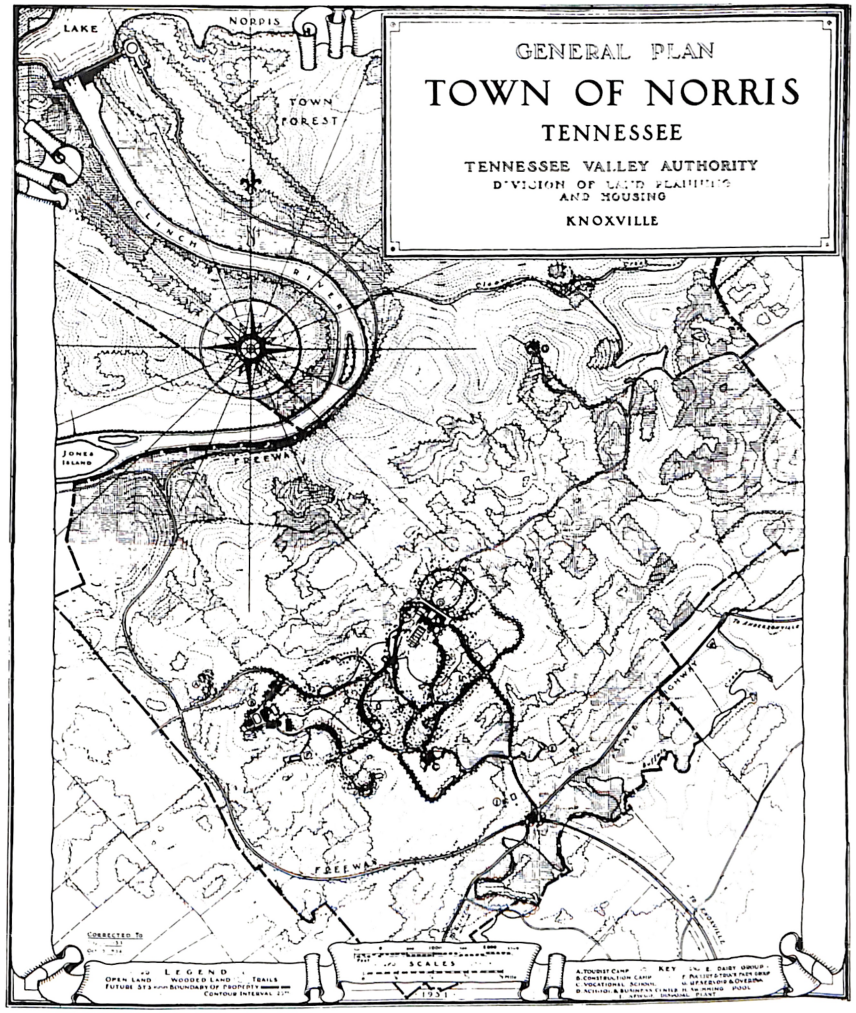
- Street in Norris.

- □ Exterior perspective of house, type 57.
  Pencil and charcoal on tracing paper, 14½" x 10".
  Drawn by S.H. Gurnee.

Because Norris Dam was remote from any established community,



• Street in Norris.



• Town of Norris.

the Town of Norris was planned to provide workers' quarters during construction and to remain as a permanent city once the dam was built. Chairman A. E. Morgan, all too familiar with the transitory character of temporary construction camps from his engineering experience, sought here to establish an alternative settlement incorporating many classes of people in a subsistence community embracing agricultural, industrial, and intellectual pursuits. While this proved to be too ambitious a program for the circumstances, Norris did emerge as an experiment in new town development. Its layout, the work of Earle S. Draper and Tracy B. Augur, conforms to the irregular character of the landscape; the

houses, designed by Charles A. Barber, Louis A. Cernay, Louis Grandgent, and Roland A. Wank, have simple exterior features that reflect the regional vernacular so local people would feel comfortable living there. On the interior, the houses have compact, modern plans and include a number of experimental materials used as finishes. The Town of Norris is today largely intact, a suburban community of 1200 people.

9. **MAP OF THE TVA AREA**

- ▫ Tennessee Valley Region.

Main River Dams

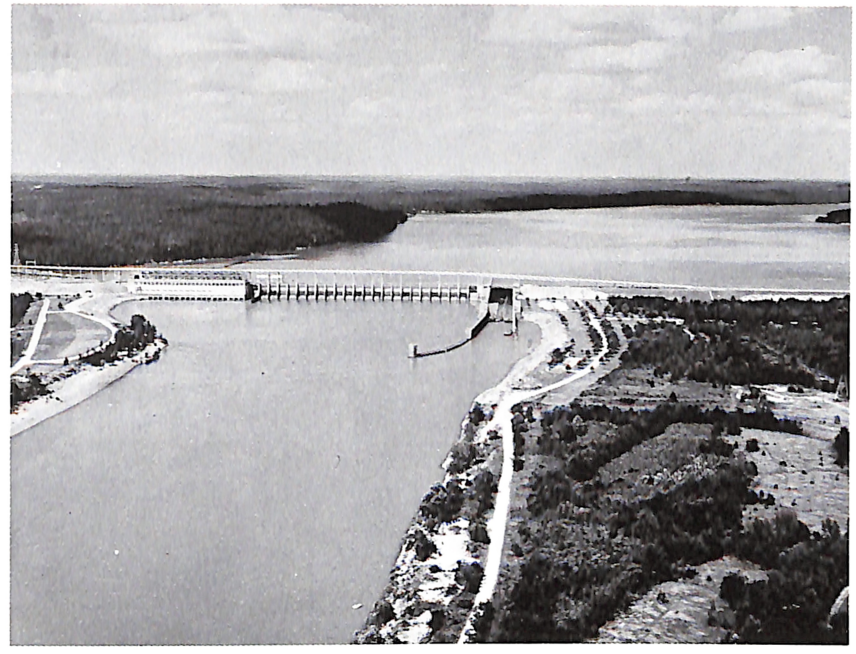
10. **WHEELER DAM** (November 21, 1933 to October 3, 1936)

- • Panoramic photograph, downstream side.
  Rell Clements #609, March 24, 1937.
- ▫ Turbine gantry crane.
- ▫ Crane and turbine.
- ▫ Gantry crane placement of runner blade in turbine.
- ▫ Placement of rotors in generator.

This was the second dam built by the TVA, begun and completed in the same period as Norris. Like Norris, much of the preliminary engineering design was completed by the Corps of Engineers and the Bureau of Reclamation; like all main river dams, Wheeler is relatively long and low, measuring 72 feet in height and 6,342 feet in length. Its location is just above Wilson Dam, the only non-TVA-designed dam left on the Tennessee River. (Wilson Dam still has the largest hydroelectric generating capacity in the system, 629,840 kilowatts, due to its location at a sharp drop in the river.) Wheeler Dam is distinctive for its lack of an enclosed generator room. Its eleven generating units, which have a capacity of 359,100 kilowatts, are protected from the weather by individual steel cowlings.



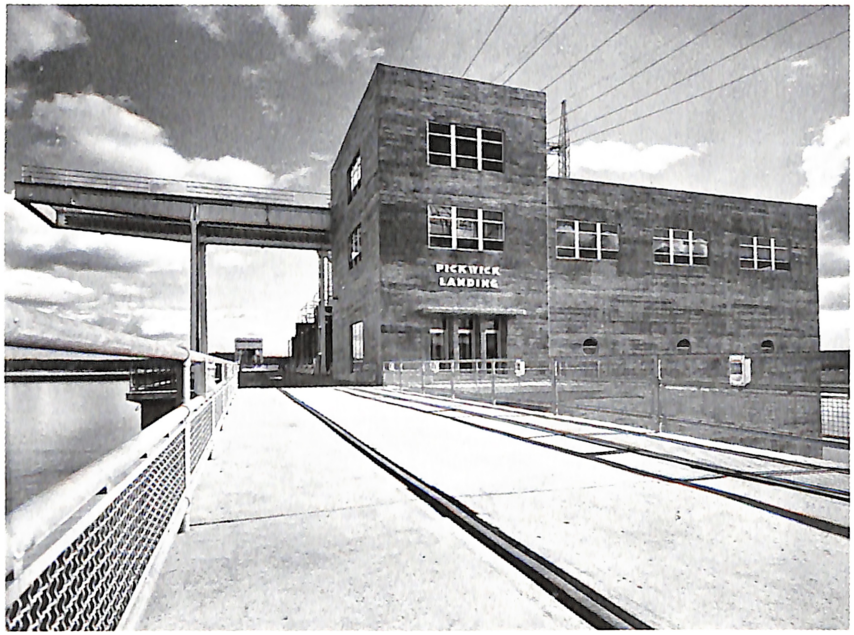
• Wheeler Dam.



• Pickwick Landing Dam.

11. **PICKWICK LANDING DAM** (December 20, 1934 to February 8, 1938)

- ▫ Panoramic photograph, downstream side.
  Rell Clements #819, March 24, 1937.
- • Aerial view.
- • Powerhouse.



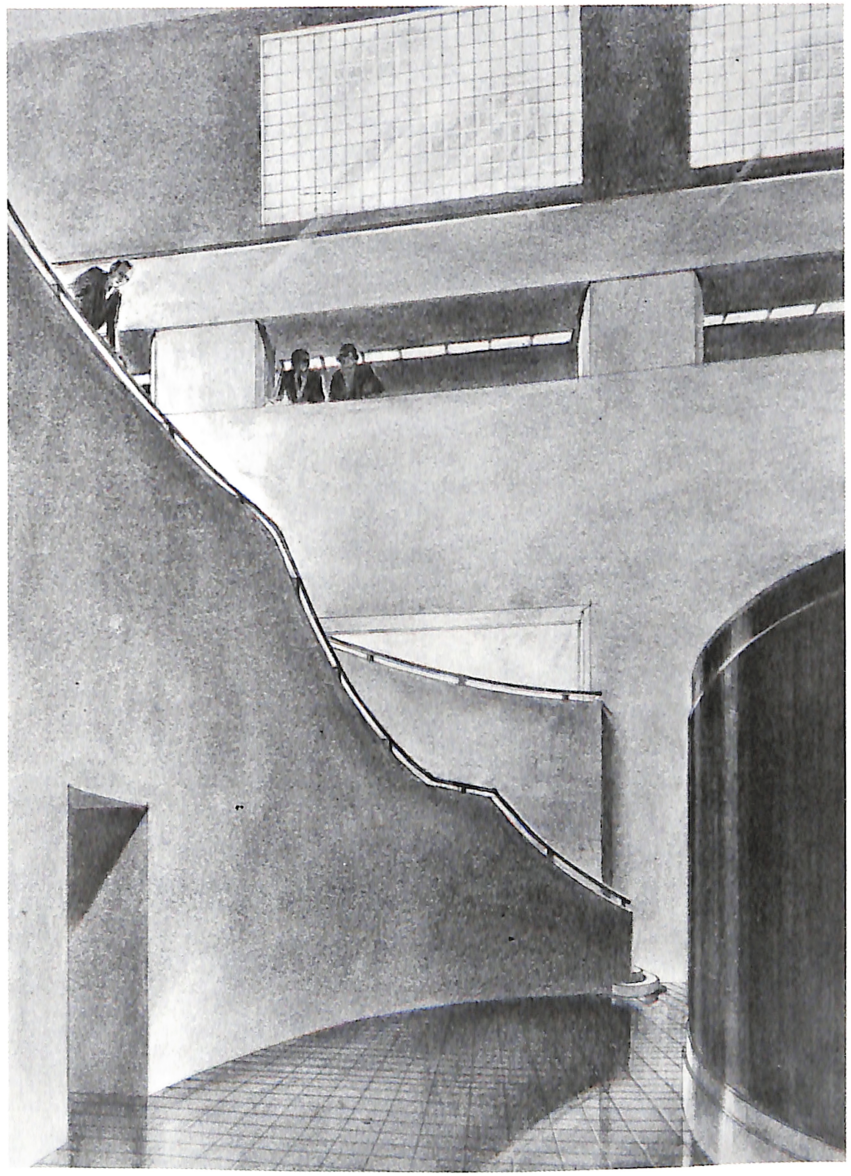
• Pickwick Landing Dam powerhouse.

• (opposite) Guntersville Dam powerhouse interior.

The dam at Pickwick Landing is 113 feet high and 7,715 feet long; for much of that length, the dam is made of earth and rock fill. As with all the main river dams, Pickwick Landing has a navigation lock which allows the entire 640-mile length of the Tennessee River to be used for water transportation. The drawing and photograph of the gauge house illustrate the care taken by TVA architects in considering small detail. Very little finish hardware was available ready-made, so almost all the fittings needed for ladders, handrails, door pulls, and the like were custom designed and fabricated for the early TVA projects. Aluminum was a favorite trim material.

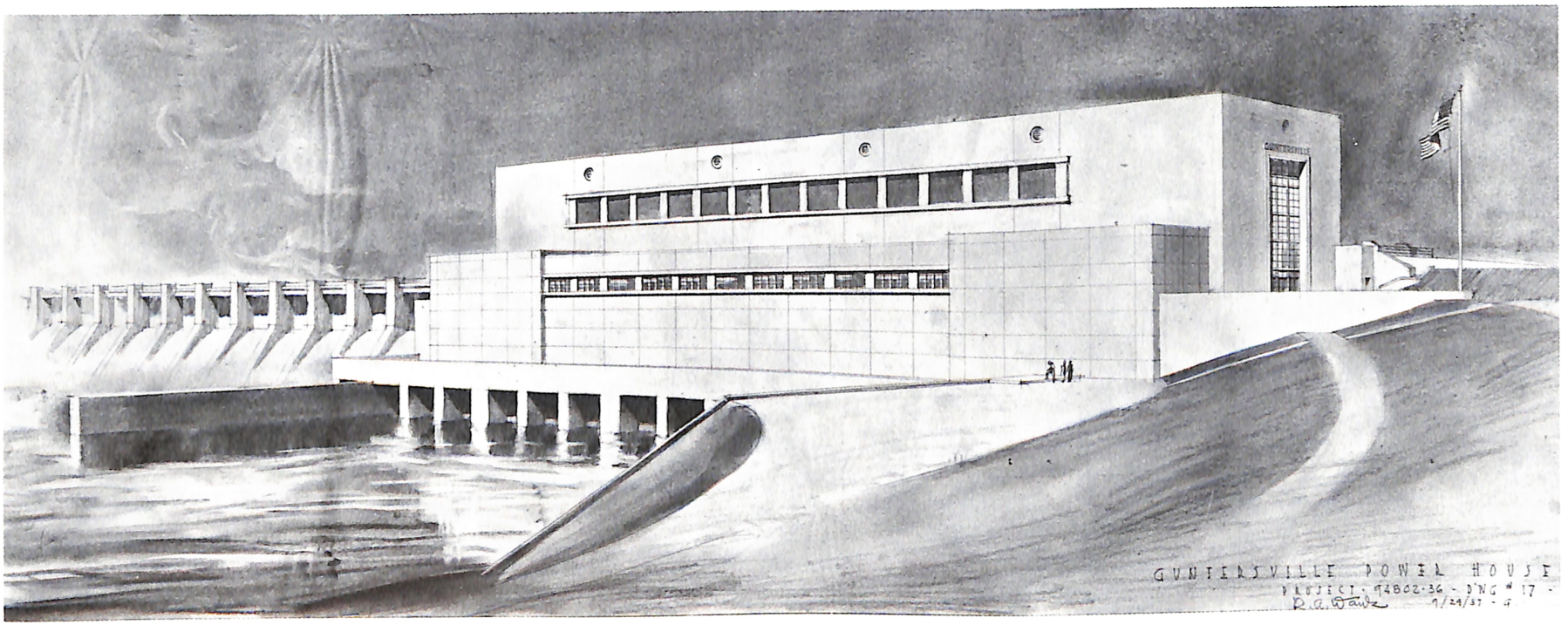
12. PICKWICK LANDING DAM

- ▫ "Proposed treatment of intersection of dam and lock"
  Pencil on tracing paper, 26" x 14", September 5, 1935.
- ▫ "Suggested treatment of gauge house"
  Pencil on tracing paper, 13¼" x 19½", September 5, 1935.
- ▫ Gauge house.



13. GUNTERSVILLE DAM (December 4, 1935 to January 16, 1939)

- Interior of powerhouse.
  Pencil on tracing paper, 9½" x 13½", September 20, 1937.
  Drawn by S.H. Gurnee.



• Guntersville Dam powerhouse.

- Exterior of powerhouse.
  Pencil on tracing paper, 30" x 11½", September 24, 1937.
  Drawing signed by R. A. Wank.

- Aerial view.

- Lock.

Guntersville Dam is slightly smaller than Pickwick Landing Dam, being 94 feet high and 3,979 feet long. The interior and exterior of the powerhouse are represented here in sensitive pencil drawings, one of which is signed by Seth Harrison Gurnee, a TVA architect widely regarded by fellow architects as an excellent renderer. Given the small size of the architectural staff, Gurnee must have been the designer as well as the delineator of many of the works in this exhibition signed by him.

14. **CHICKAMAUGA DAM** (January 13, 1936 to January 15, 1940)

- "Visitor's building"
  Pencil on tracing paper, 11" x 14".
  Drawn by S.H. Gurnee.

- Aerial view.

Chickamauga Dam, 129 feet high and 5,800 feet long, works with upstream dams to provide flood control for the city of Chattanooga, whose low-lying downtown once had one of the most serious flood problems in the country. The Chickamauga Reservoir creates an extended recreational area rather close to the city center. The appearance of the boldly scaled concrete work on the exterior of the Chickamauga powerhouse has been somewhat diminished by the steel highway bridge, built later over the top of the dam.



• Chickamauga Dam powerhouse.

15. **CHICKAMAUGA DAM**

▫ "South elevation of powerhouse"
Pencil on tracing paper, 19½" x 15", December 1, 1937.

• Powerhouse.

16. **KENTUCKY DAM** (July 1, 1938 to August 30, 1944)

• Powerhouse and gantry crane.

The largest of the main river dams, Kentucky Dam is 206 feet high and 8,422 feet long; it contains nearly 1.4 million cubic yards of concrete and 5.6 million cubic yards of earth- and rock-fill. Water leaving Kentucky Dam flows into the Ohio River, which soon joins the Mississippi. The capacity of Kentucky's reservoir, the largest man-made lake in the eastern United States, together with other lakes in the TVA system, is thus important for flood control on the lower Mississippi.

17. **KENTUCKY DAM**

▫ "Preliminary study of control building"
Pencil on tracing paper, 19" x 18½", January 18, 1939.
Drawn by Mario Bianculli.

• "Kentucky Dam at Gilbertsville"
Drawn by H. H. Ostrander

▫ Aerial view.

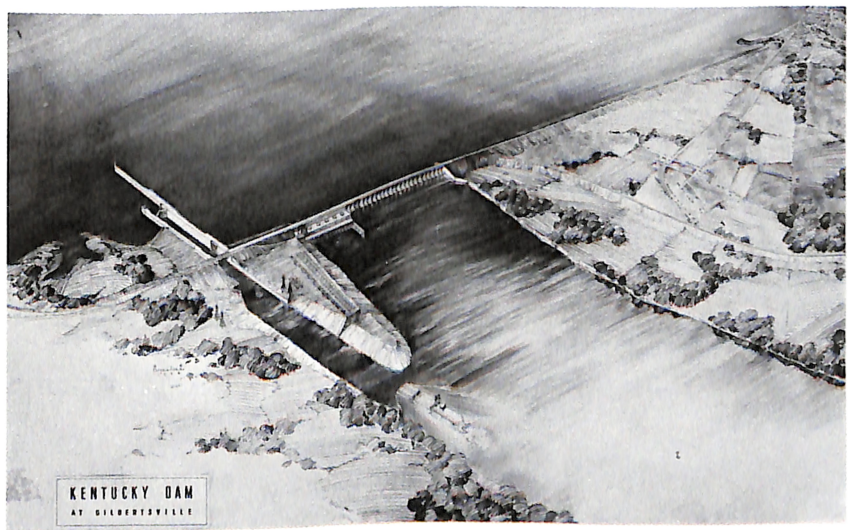
18. **WATTS BAR DAM** (July 1, 1939 to January 1, 1942)

▫ Aerial view.

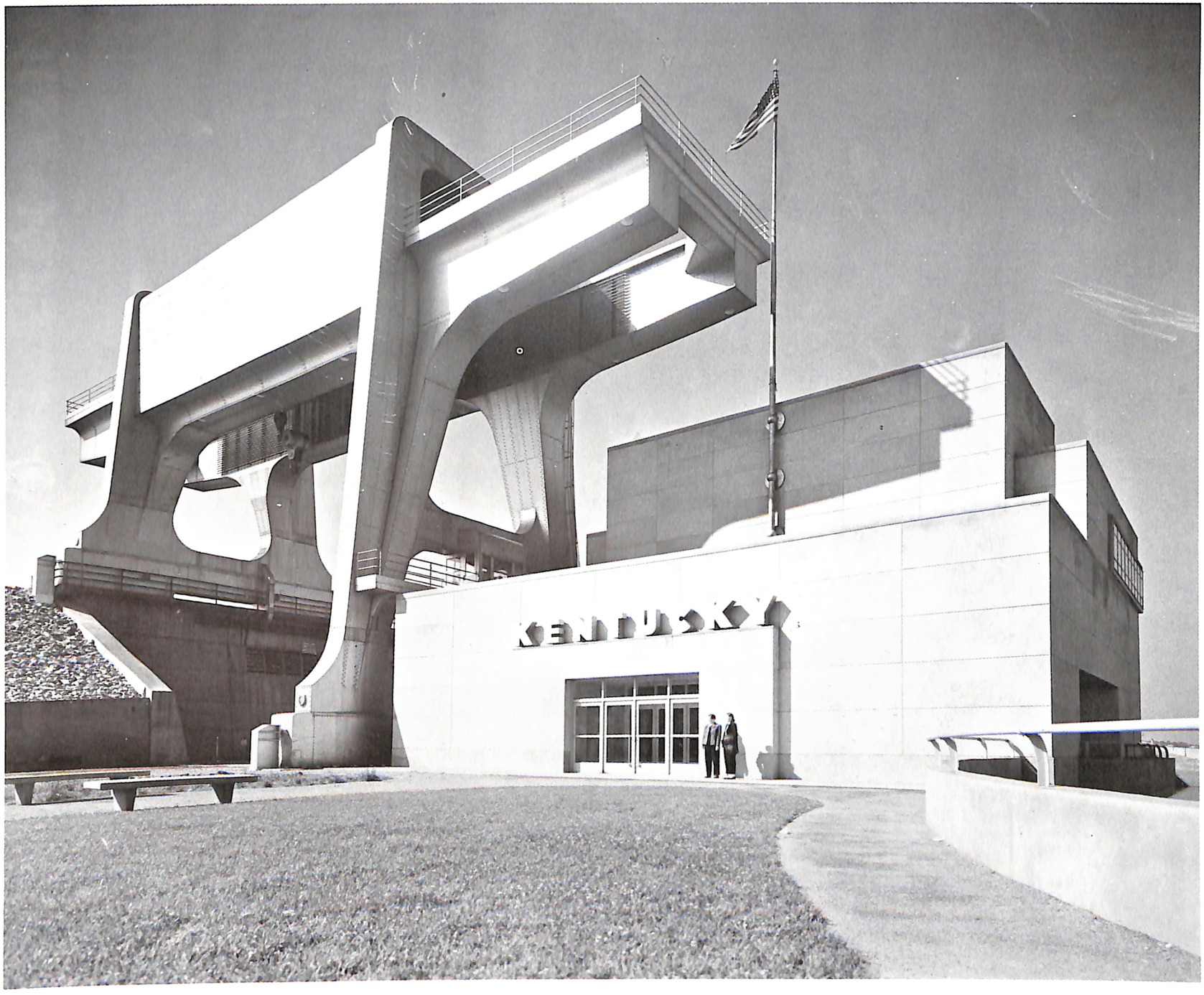
• Powerhouse under construction.

▫ Control building, gantry crane, and powerhouse.

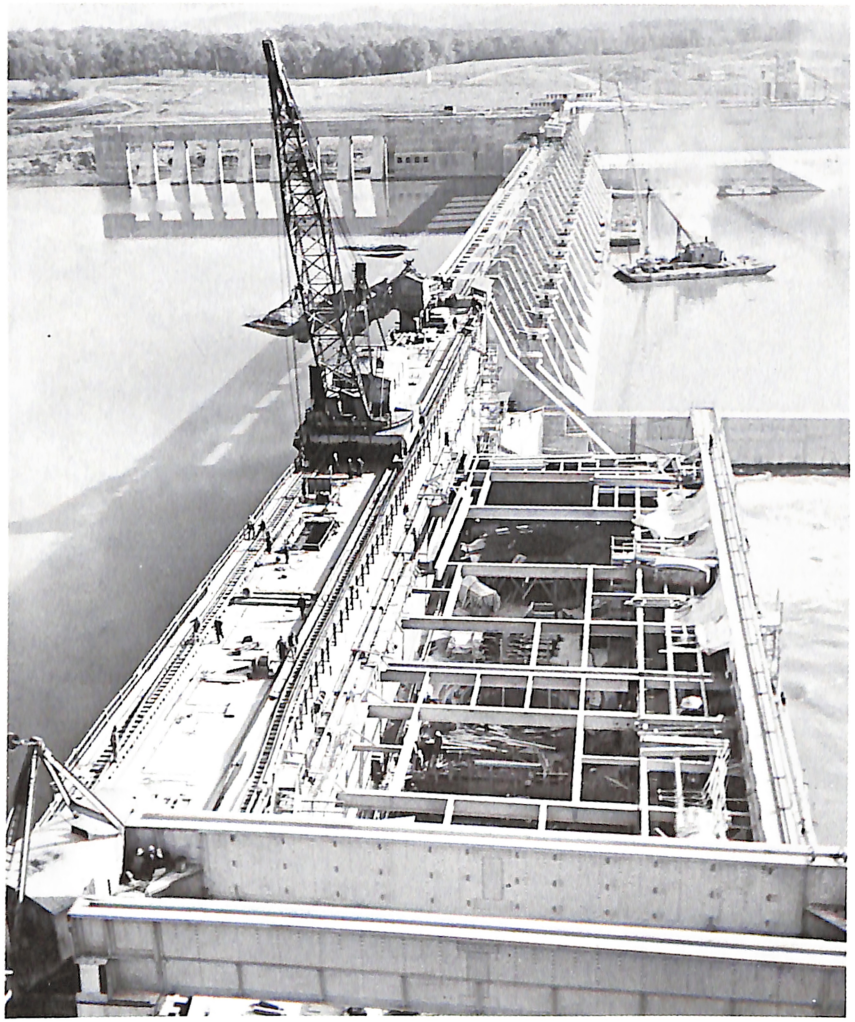
Watts Bar is the shortest of the main river dams, measuring 112 feet in height and 2,960 feet in length. TVA today has at Watts Bar three separate generating facilities: a hydroelectric plant, a coal-fired steam plant (contemporary with the dam), and a nuclear-powered steam plant (still under construction).



• Kentucky Dam.



• Kentucky Dam powerhouse and gantry crane.



• Watts Bar Dam powerhouse under construction.

19. **WATTS BAR DAM**

□ Elevation drawings of control building.
Pencil on tracing paper, 22½" x 17", March 18, 1940.
Signed by R. A. Wank.

□ Preliminary study drawing of west and east elevations.
Pencil on tracing paper, 22½" x 17", March 18, 1940.
Signed by R. A. Wank.

20. **WATTS BAR DAM**

□ Lock operating building.

□ Control building.

21. **FORT LOUDOUN DAM** (July 8, 1940 to August 2, 1943)

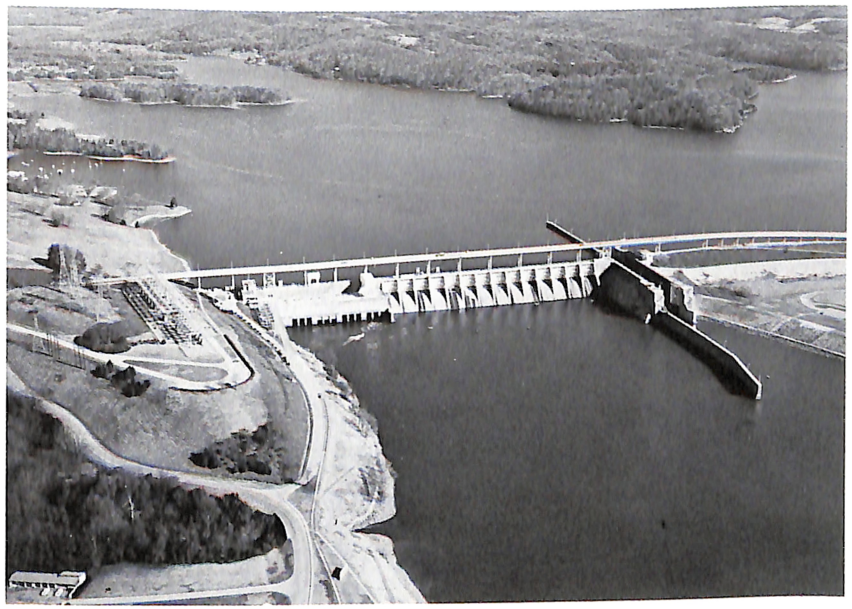
• Aerial view.

□ Visitor's center.

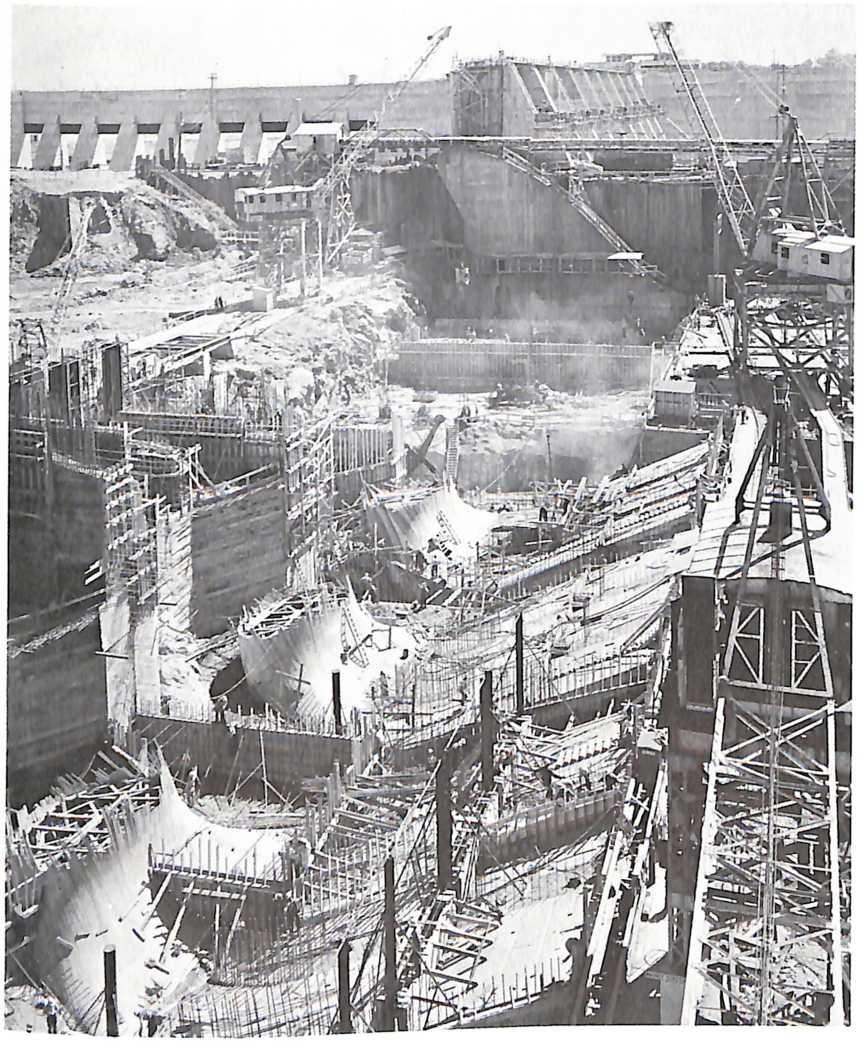
Fort Loudoun Dam, 122 feet high and 4,190 feet long, creates a reservoir which extends over sixty miles upstream, to the point where the Holston and French Broad Rivers join to form the Tennessee.

22. **FORT LOUDOUN DAM**

• Dam under construction, September 18, 1942.



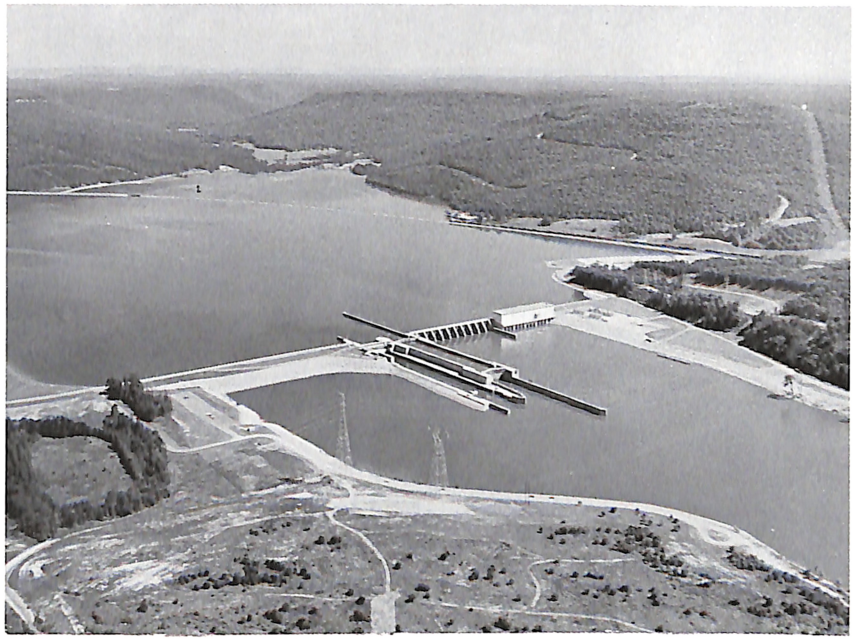
• Fort Loudoun Dam.



23. **NICKAJACK DAM** (April 1, 1964 to December 14, 1967)

- Aerial view.

Nickajack Dam, the most recent main river project, enabled TVA to retire the old Hales Bar Dam, completed in 1913, which it had acquired from the Tennessee Electric Power Company in 1940. Inferior work in the original construction of Hales Bar made the old dam impossible to repair adequately; the closing of Nickajack Dam flooded out the Hales Bar site.



- Nickajack Dam
- (opposite) Fort Loudon Dam under construction.

Tributary River Dams

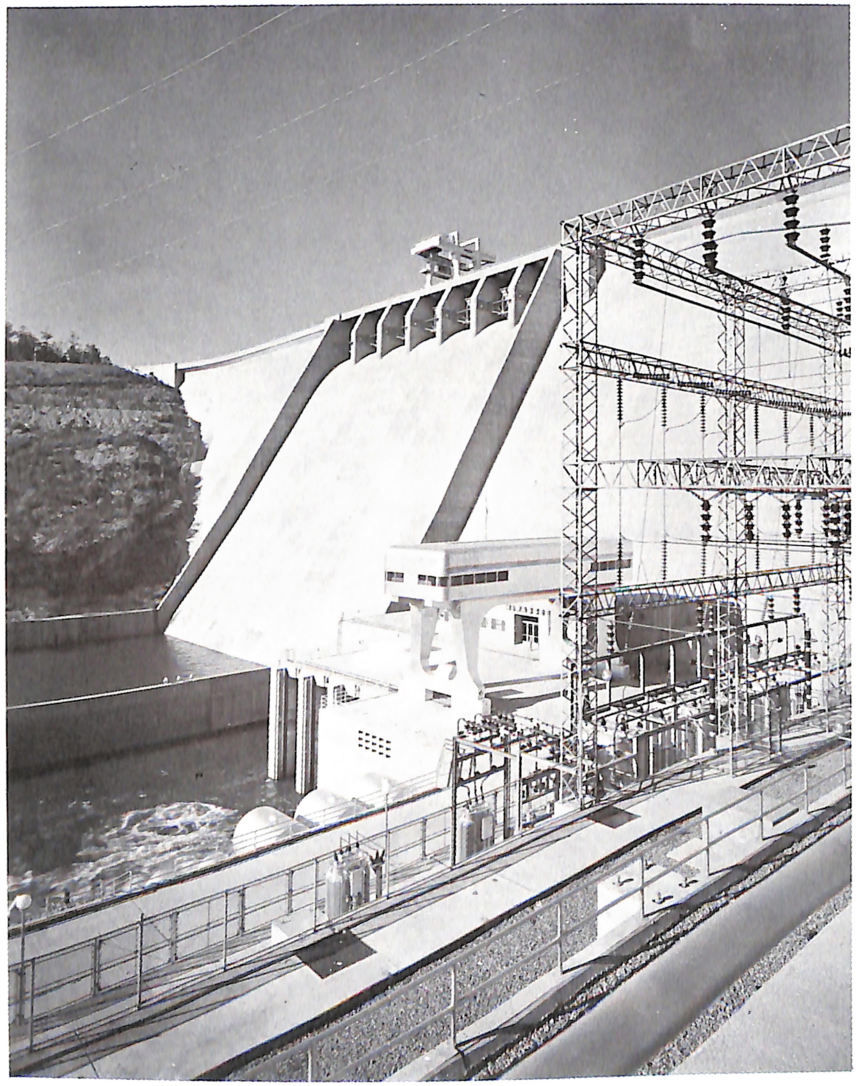
24. **HIWASSEE DAM** (July 15, 1936 to February 8, 1940)

- ▫ Study drawing of downstream elevation.
  Pencil on tracing paper, 46" x 29", February 9, 1938.
  Drawn by Mario Bianculli; signed by R.A. Wank.

Widely regarded as being the equal of Norris Dam in terms of design, Hiwassee is one of the five big storage dams on the five major tributaries of the Tennessee. Along with the other four, Norris, Cherokee, Fontana, and Douglas, Hiwassee generates significant amounts of power and contributes substantially to flood control; unlike the main river dams, the tributary dams have no accommodation for navigation, as the steep descent their rivers make from the mountains precludes anything but white-water rafting. The splendid study drawings of Hiwasee show the architects' concern for proportion in their designs. Hiwassee measures 307 feet high by 1,376 feet long.

25. **HIWASSEE DAM**

- ▫ Study drawing of downstream elevation.
  Pencil on tracing paper, 45½" x 29", April 15, 1938.



• Hiwassee Dam.

26. **HIWASSEE DAM**

- ▫ Drawing of north and west elevations.
  Pencil on tracing paper, 29" x 15½", May 27, 1938.
  Signed by R.A. Wank.

- ▫ Panoramic photograph.
  Rell Clements #1039, November 2, 1938.

- ▫ Distant view of downstream side.

- ▫ Interior of reception lobby.

27. **HIWASSEE DAM**

- • Downstream side.

28. **HIWASSEE VILLAGE**

- • Aerial perspective.
  Pencil on tracing paper, 21" x 24".
  Drawn by S. H. Gurnee.

As with Norris, Wheeler, Pickwick Landing, and Guntersville Dams, employee housing was a concern in the construction of Hiwassee. A self-contained village, consisting of forty-two permanent houses (similar in design to Norris residences), seventy-three temporary houses, six dormitories for single workers, and community facilities for water supply, health, food services, recreation, and education, was built on the left bank of the river within walking distance of the dam site. Additional small private homes were built nearby as the labor force employed on the dam reached 1100. The permanent houses were used for operations and maintenance staff after construction was completed, and the temporary buildings were either sold or relocated to other construction projects.

29. **CHEROKEE DAM** (August 1, 1940 to December 5, 1941)

- • Aerial view of dam under construction, September 1941.

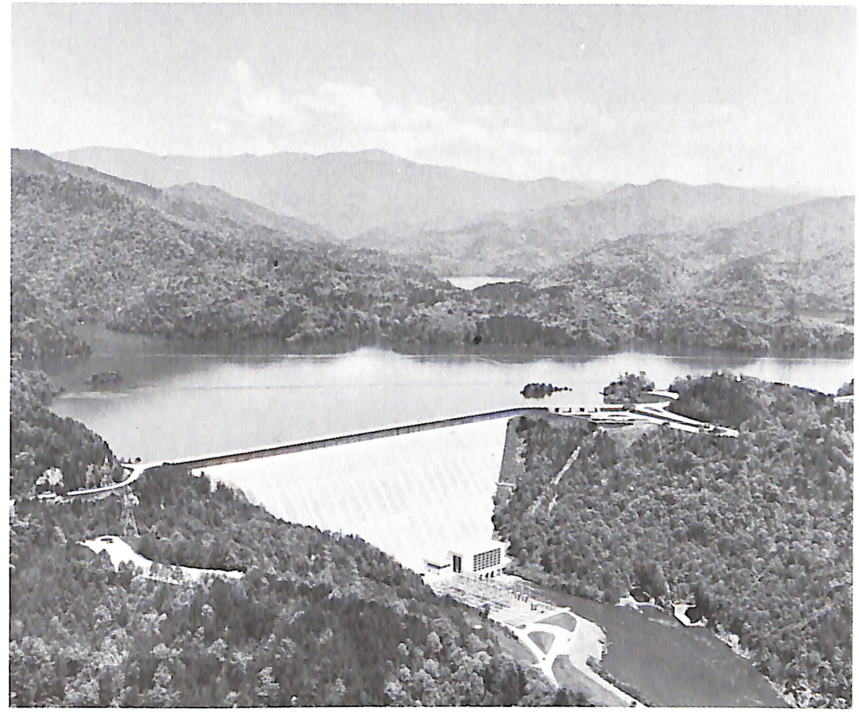
- ▫ Aerial view.

Cherokee Dam's dimensions - 175 feet in height by 6,760 feet in length - give it the general size of a main river dam. Much of Cherokee is composed of earth- and rock-fill which forms the rim of the lake. The detail photographs illustrate the inner construction which channels water through the dam and accelerates it towards one set of turbine blades.



30. **CHEROKEE DAM**

- ▫ Draft tube liner unit.
- ▫ Scroll case liner being assembled.
- ▫ Scroll case liner being assembled.
- ▫ Scroll case liner being assembled.
- ▫ Scroll case liner being assembled.
- ▫ Penstock.
- ▫ Draft tube.



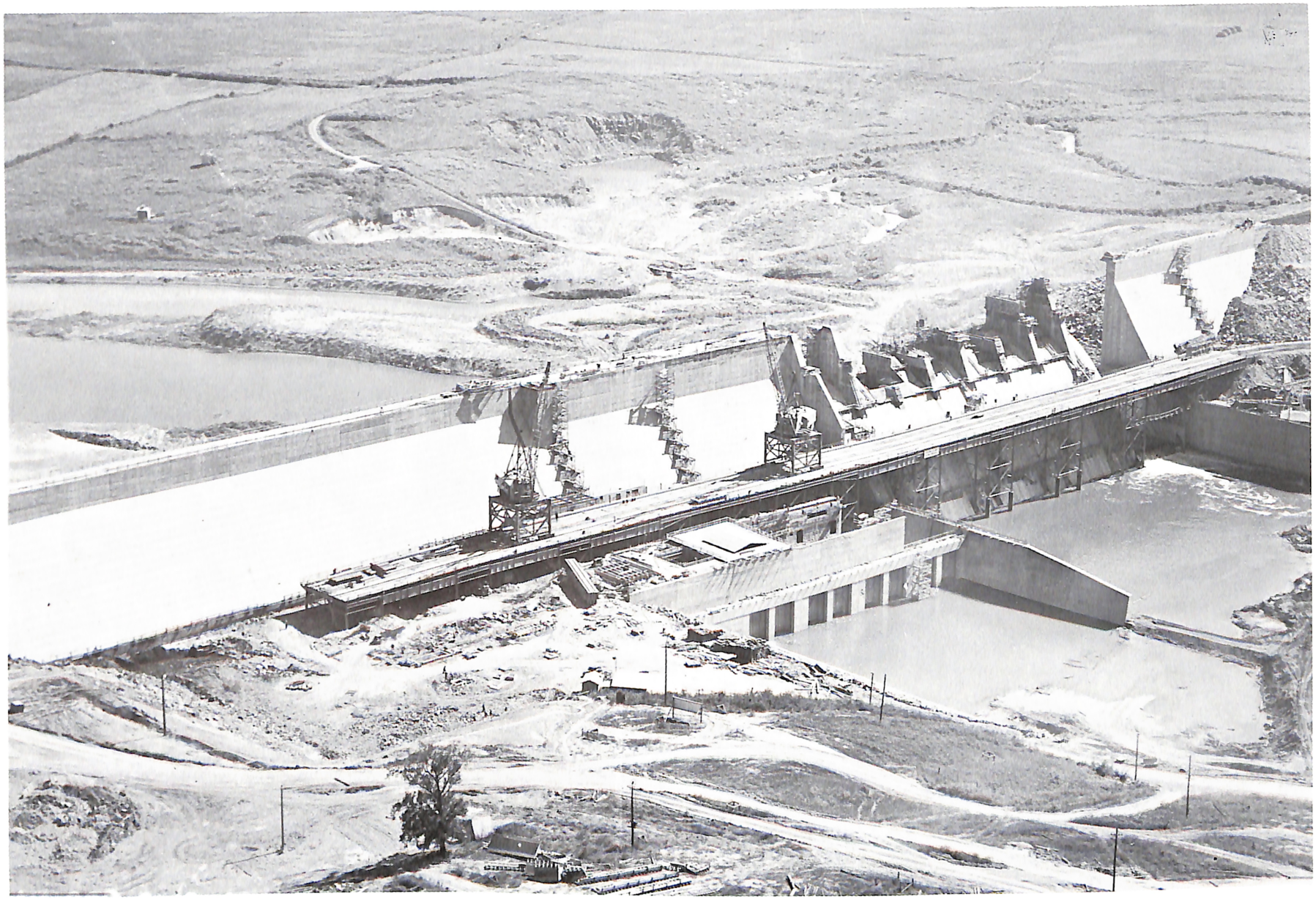
• Fontana Dam.

• (opposite) Hiwassee construction village.

31. **FONTANA DAM** (January 1, 1942 to November 7, 1944)

- Aerial view.
- Aerial view of upstream side during construction.
- Powerhouse exterior.

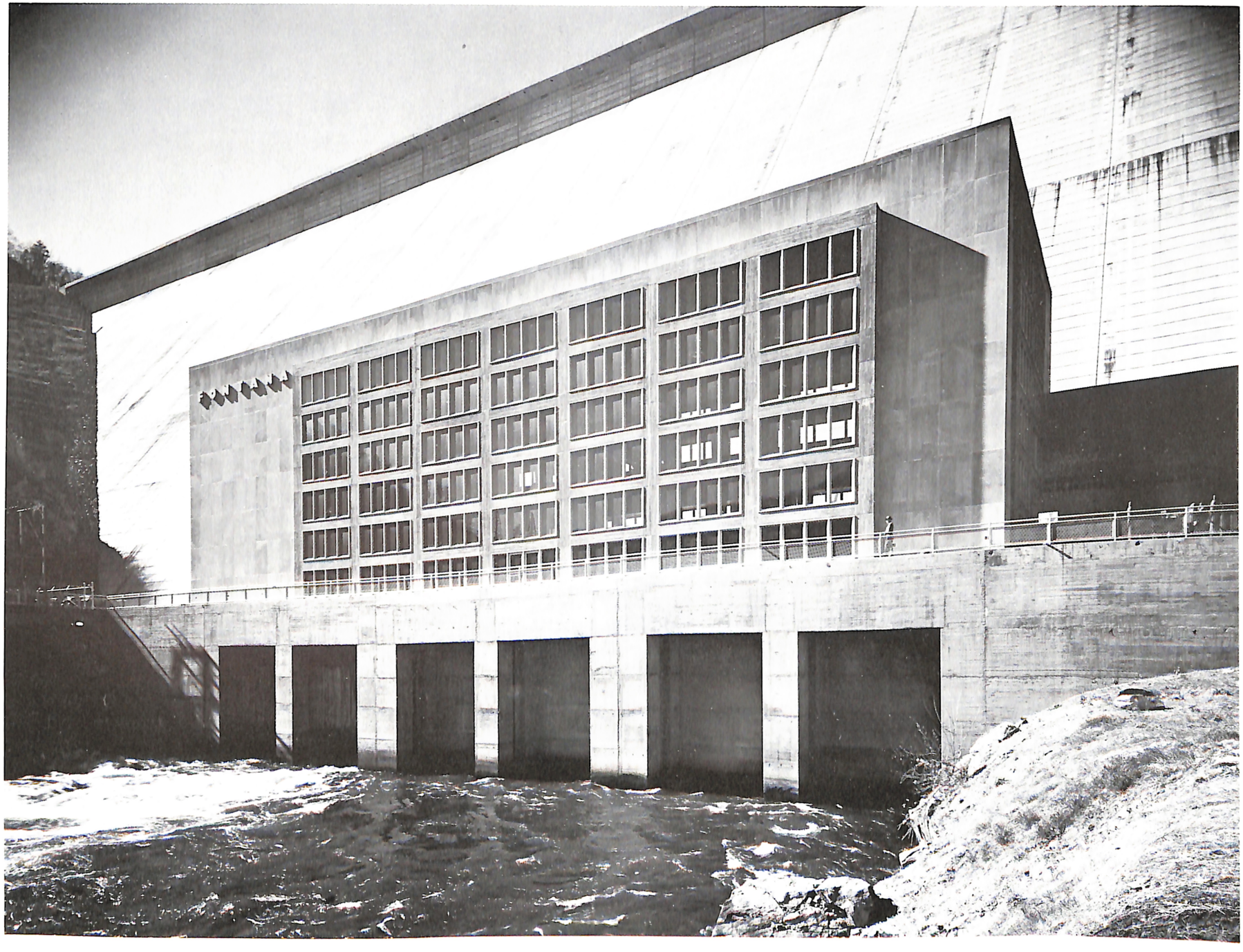
Fontana is the most spectacular of the TVA dams, due in part to its mountain setting and in part to its tremendous height, 480 feet, which qualifies it as the highest dam east of the Rocky Mountains. It was built with remarkable speed under the constraints of wartime construction. Crews worked in three shifts, twenty-four hours a day, to finish the dam, for its power was needed to supply plants making aluminum for aircraft and to supply the super-secret uranium enrichment plant at Oak Ridge. A shortage of structural steel resulted in an all-concrete powerhouse, a striking design whose boldness is dwarfed by the massive



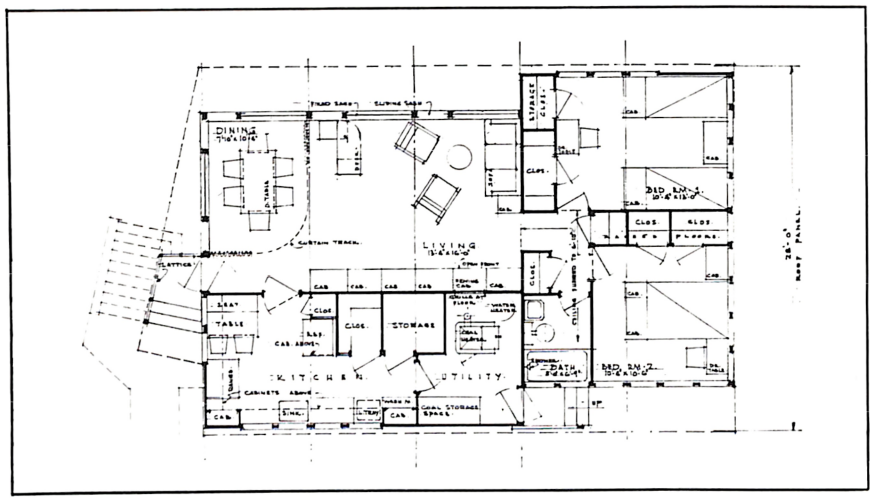
• Cherokee Dam under construction.



• Fontana Dam under construction.



• Fontana Dam powerhouse.



• Prefabricated housing studies, plan of house E-2.

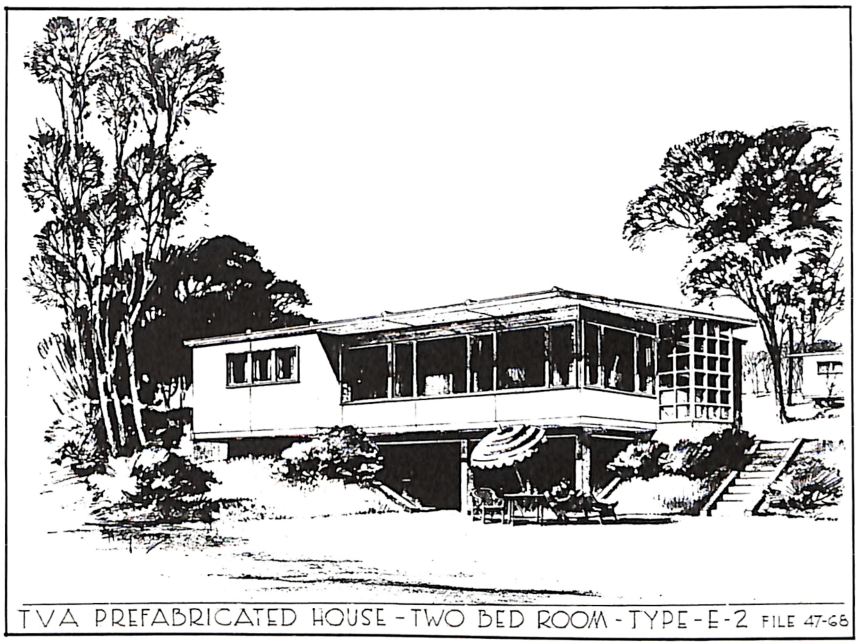
The construction camp for Fontana was more elaborate than most because the site, even by TVA standards, was extremely remote. (More recent road construction has done little to change its isolation.) TVA-designed demountable houses, fabricated elsewhere, were trucked to the site to provide instant residences for workers and their families, and the camp developed community amenities - schools, churches, recreational and medical facilities, and the like - to enhance the retention of scarce labor. Many of the prefabricated houses remain in use today as part of a vacation resort.

36. PREFABRICATED HOUSING STUDIES DONE DURING SECOND WORLD WAR

- ▫ Perspective view, three bedroom house, type C-1.
  Pencil on tracing paper, 20" x 15½".
  Drawn by S. H. Gurnee.

- ▫ Plan of house C-1.
  Pencil on tracing paper, 20" x 15½".

These drawings are excerpted from studies commissioned by the Department of War. TVA has long maintained an interest in prefabricated housing - whether demountable, sectional, or trailer - since worker accommodations have been important to the construction of many dams beginning with Norris. This interest and experience proved especially valuable during the war, when the armed forces and defense industries needed housing on short



• Prefabricated housing studies, exterior of house E-2.

notice. TVA-designed units were supplied to Oak Ridge and shipped as far as England to provide housing during and after the Blitz. The houses shown here possess a high degree of architectural merit, regardless of their fabrication methods.

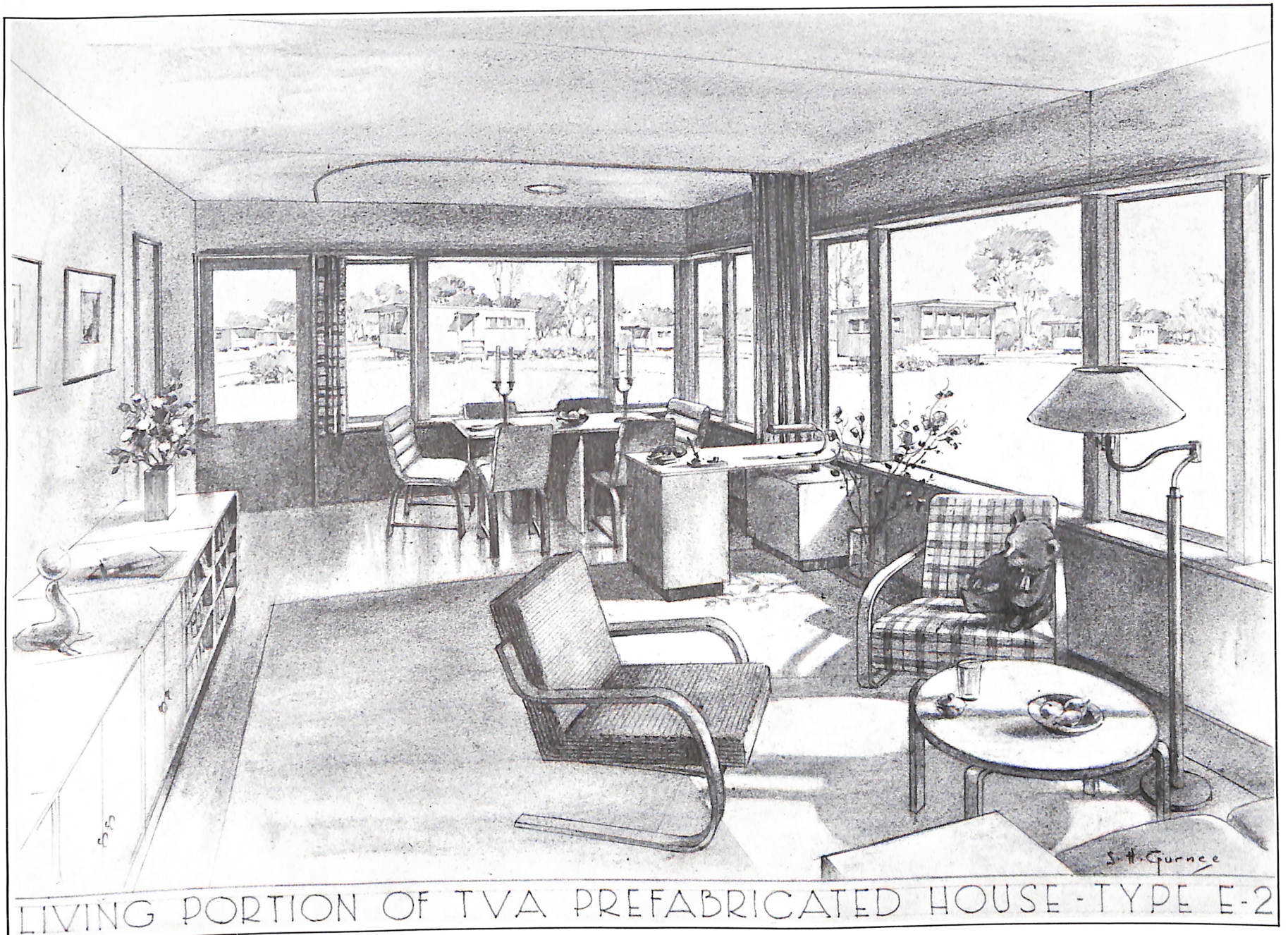
37. PREFABRICATED HOUSING STUDIES DONE DURING SECOND WORLD WAR

- Interior perspective of two bedroom house, type E-2.
  Pencil on tracing paper, 19" x 15½", 1943.
  Drawn by S. H. Gurnee.

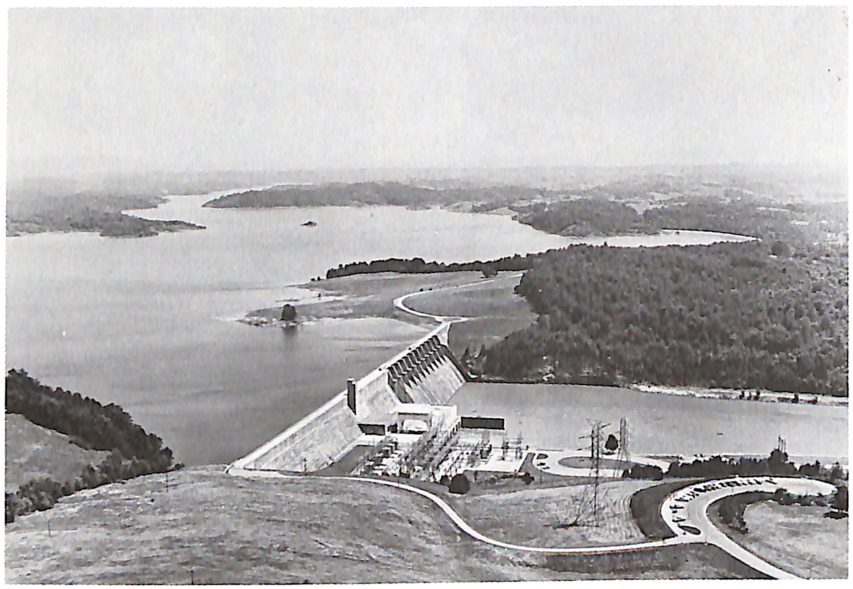
- Plan of house E-2.
  Pencil on tracing paper, 23" x 16½", 1943.
  Drawn by S. H. Gurnee.

38. PREFABRICATED HOUSING STUDIES DONE DURING SECOND WORLD WAR

- Exterior perspective of two bedroom house, type E-2.
  Pencil on tracing paper, 21" x 17", 1943.
  Drawn by S. H. Gurnee.



• Interior perspective of two bedroom house.



• Douglas Dam.

▫ Suggested grouping of houses, aerial perspective.
Pencil on tracing paper, 20½" x 13", 1943.
Drawn by S. H. Gurnee.

39. **DOUGLAS DAM** (February 2, 1942 to February 19, 1943)

• Aerial view.

▫ Visitor's overlook building, exterior perspective.
Pencil on tracing paper, 25½" x 17½".
Drawn by S. H. Gurnee.

As was the case with Fontana Dam, Douglas was built with the urgency of wartime construction. To conserve design time, many features of Douglas were based on the plans made for Cherokee Dam. Work on the dam was begun moments after a telephone call from Washington verified that President Roosevelt had signed the bill authorizing construction, and from then until the closure of the dam, fewer than thirteen months elapsed, a world record for construction speed. Completion of Douglas in February allowed the reservoir to fill with winter rainfall which was used to generate electricity by late March 1943. Douglas measures 202 feet high and 1,705 feet long.

40. **WATAUGA DAM** (July 22, 1946 to December 1, 1948)

• Aerial view.

Construction of Watauga Dam actually began February 16, 1942, but work was discontinued in December of that year to conserve essential materials during the war. Watauga Dam is of earth- and rock-fill construction, rather than the concrete gravity design of preceeding TVA dams. Water does not spill over it's face but is discharged over a concrete spillway and through a connecting sluiceway in a 1,472-foot tunnel to the right of the dam. The water intake for power generation, on the left abutment, is connected by a tunnel to the powerhouse below the dam. Watauga is 318 feet high and 900 feet long.

41. **WATAUGA DAM**

• Site photograph showing location of dam.

▫ Tunnel.

▫ Dam under construction.

42. **SOUTH HOLSTON DAM** (August 4, 1947 to November 20, 1950)

• Aerial view.

▫ Interior perspective of generator room in powerhouse.
Pencil on tracing paper, 22" x 28½", February 15, 1945.
Drawn by S.H. Gurnee.

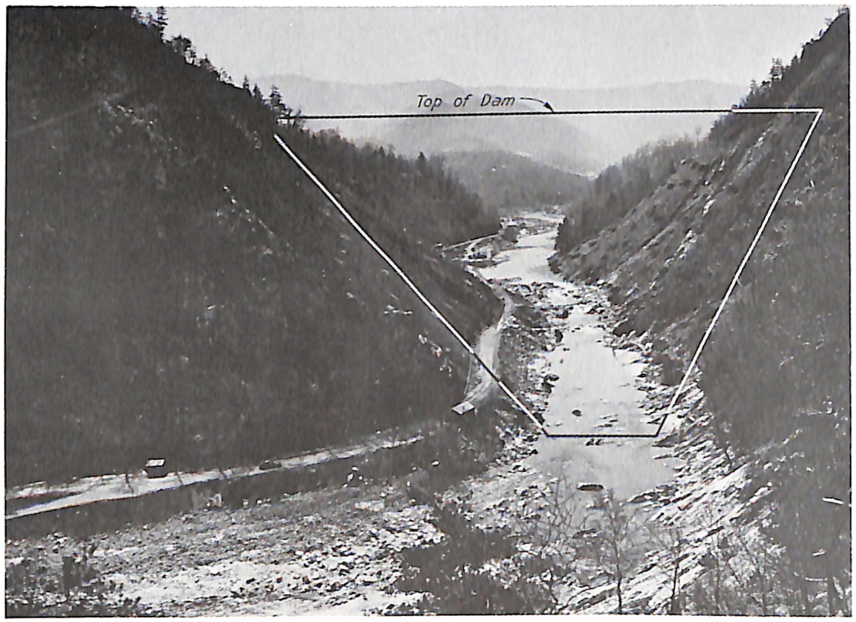
South Holston Dam, like Watauga, was begun in February 1942, with work halted in April 1943 because the power potential of the dam did not justify the expenditure of scarce resources during wartime. (The projects at Fontana and Douglas were given priority instead.) Watauga and South Holston were completed after the war, with overlapping schedules to permit transfer of workmen and equipment from one site to the other. Both dams are of similar construction, earth- and rock-fill; they provide flood protection for Elizabethton and Kingsport, Tennessee. South Holston Dam has a maximum height of 285 feet and is 1,600 feet long.

43. **SOUTH HOLSTON DAM**

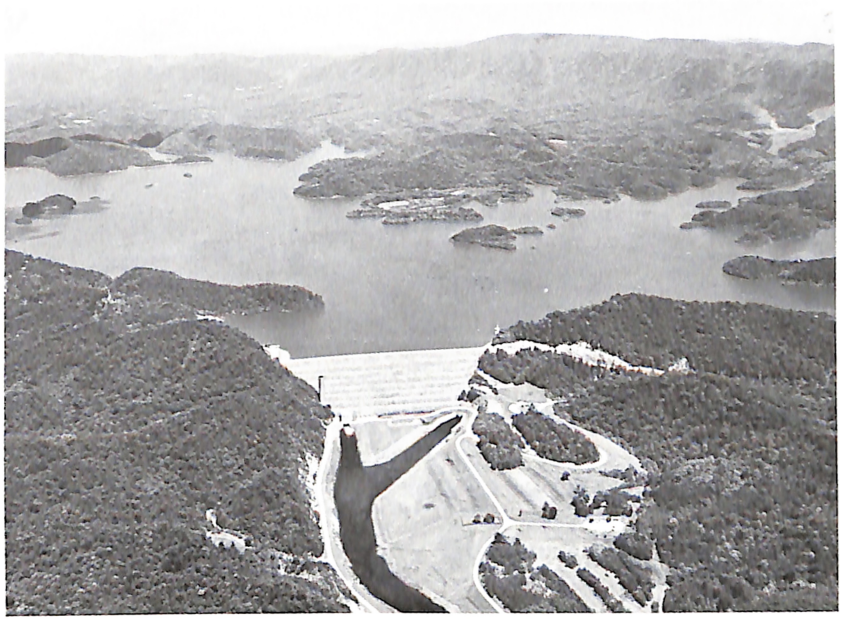
▫ Exterior perspective of powerhouse.
Pencil on tracing paper, 21" x 15½".
Drawn by S. H. Gurnee.



• Watauga Dam.



• Watauga Dam site before construction.



• South Holston Dam

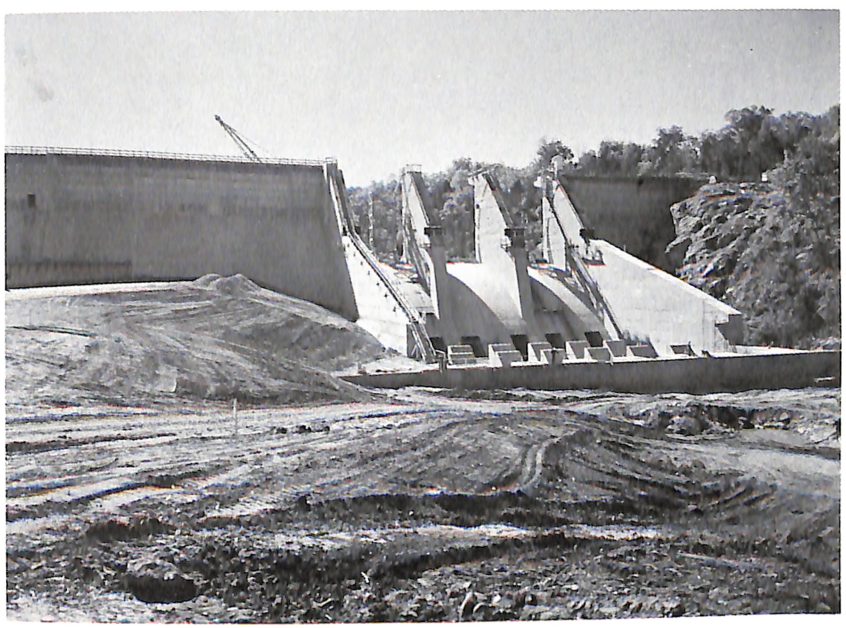
▫ Powerhouse and switchyard.
Pencil on tracing paper, 27½" x 20½".
Drawn by S.H. Gurnee.

44. **TELLICO DAM** (March 7, 1967 to November 29, 1979)

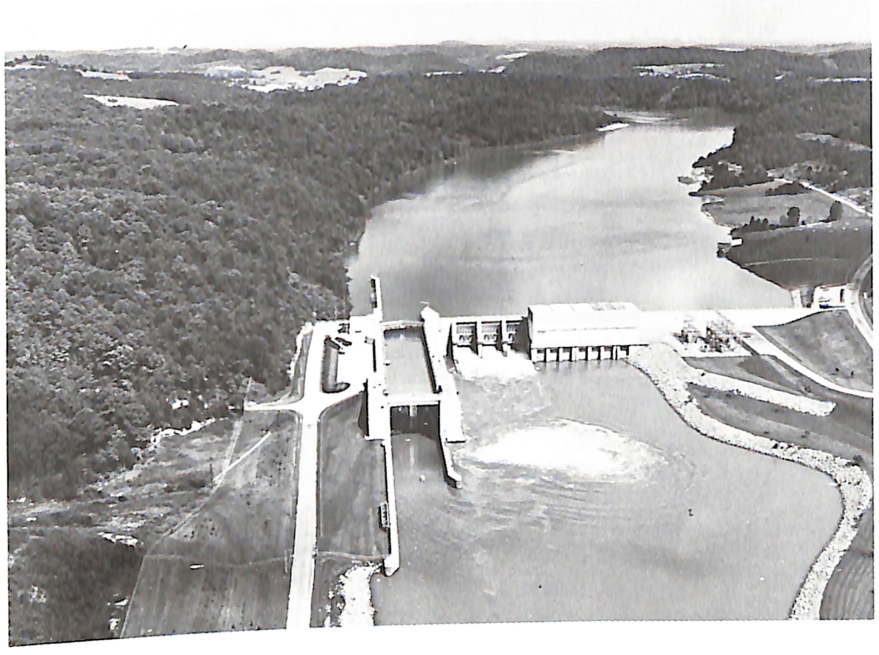
• Aerial view before closing.

▫ Downstream side seen during construction, October 21, 1968.

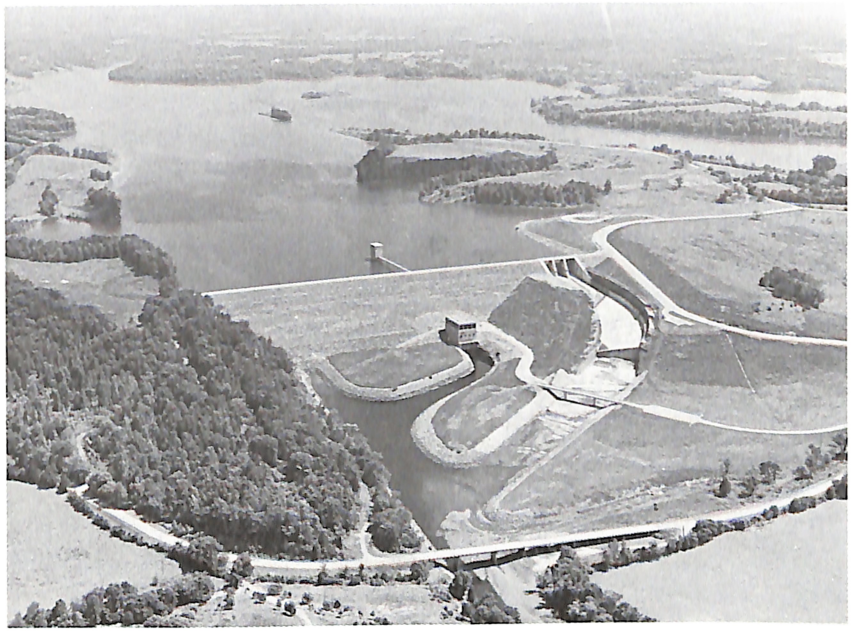
Tellico Dam must rank among the most controversial projects in the history of the TVA, where controversy has long been a fact of life. Known as Fort Loudoun Extension, the dam was first planned when the adjacent Fort Loudoun Dam was designed in 1939; in the mid-1960s, it was initiated as a project to aid in flood control and assist recreational, economic, and industrial development in a depressed area. Boeing Aircraft was involved in proposals for Timberlake, a new community on the shores of the Tellico Reservoir. In time, the initial interest declined; Timberlake never materialized; and local citizens' groups joined environmentalists supporting the snail darter and Cherokee Indians objecting to the flooding of ancestral gravesites to protest the closure of Tellico, by then 90% finished. President Carter finally



• Tellico Dam.



• Melton Hill Dam.



• Tims Ford Dam.

signed a bill authorizing completion of the project in 1979. Tellico Dam has neither powerhouse nor locks. It forms a reservoir on the Little Tennessee River just above its junction with the main river below Fort Loudoun Dam, where a channel connects the two lakes, thereby providing for navigation and increasing the generating capacity of Fort Loudoun's powerhouse. Tellico is 129 feet high and 3,238 feet long.

45. **MELTON HILL DAM** (September 6, 1960 to May 1, 1963)

- Aerial view.

Located below Norris Dam on the Clinch River, Melton Hill Dam has a generating capacity nearly 75% that of Norris as the waters of the Clinch are put to work once again before entering the Tennessee River. Melton Hill Dam is 103 feet high and 1,020 feet long; it is equipped with a navigation lock, the only tributary dam to have this feature.

TIMS FORD DAM (March 28, 1966 to December 1, 1970)

- Aerial view.

Tims Ford Dam, an earth- and rock-fill project, is located on the Elk River, a tributary which joins the Tennessee River near Wheeler Dam. This dam is 175 feet high and 1,484 feet long.

COLUMBIA DAM (August 27, 1973 to)

- Aerial view during construction, October 26, 1979.

This project, the most recent of TVA dams included in this exhibition, is still under construction on the Duck River. Columbia Dam was designed to provide water supplies for the cities of Lewisburg, Shelbyville, and Columbia, Tennessee, communities that presently rely on diminishing groundwater sources; these cities are contributing to the cost of construction. The entire project is under fire from environmentalists who are seeking to preserve the habitat of the pearly-faced mussel; and, as the outcome of their protest is to be decided by the courts, no completion date can now be given.

46. **RACCOON MOUNTAIN PUMPED STORAGE** (July 1, 1970 to July 11, 1978)

- Aerial photograph.



• Columbia Dam.

□ Site plan and section.
Ink on tracing paper, 19¼" x 19", 1981.
Drawn by David Joyner.

Raccoon Mountain is not, strictly speaking, a tributary dam; it is a pumped storage facility designed to supply electricity for peak load conditions. An earth- and rock-fill dam, 8,500 feet long and at a maximim 230 feet high, was built to enclose a lake on top of Raccoon Mountain, a thousand feet above the Nickajack Reservoir. Connected to the lake are thirty-five-foot-diameter waterway tunnels that extend 2,450 feet through the rock of the mountain to an underground generator room and thence through another 1,575 feet of tunnels to the discharge portals on Nickajack Lake. During the periods of slack demand, usually in the early morning hours, the four powerful reversible turbines pump water into the upper lake, where it can later be released to provide electricity during periods of heaviest use. The generating capacity of Raccoon Mountain is colossal: 1,530,000 kilowatts can be generated here, and the power plant can go from standby to full load in less than four minutes. The tempera presentations of this and other recent TVA projects are the work of David Joyner, an architect who specialized in rendering while working in offices in New York and Oklahoma prior to joining TVA in 1970. Mr. Joyner has also served as unofficial architectural archivist, preserving many of the old drawings used in this exhibition.

47. **RACCOON MOUNTAIN PUMPED STORAGE**

• Analytic section drawing.
Tempera rendering, 20" x 29½", 1976.
Drawn by David Joyner.

48. **RACCOON MOUNTAIN PUMPED STORAGE**

□ Visitor overlook facility.
Tempera rendering, 18½" x 29½", 1976.
Drawn by David Joyner.

49. **RACCOON MOUNTAIN PUMPED STORAGE**

□ Lower portal area.
Tempera rendering, 18½" x 29½", 1976.
Drawn by David Joyner.

50. **RACCOON MOUNTAIN PUMPED STORAGE**

• Interior of power plant chamber under construction.

□ Interior of power plant chamber as completed.

□ Interior showing rock excavation.

RACCOON MOUNTAIN PUMPED STORAGE

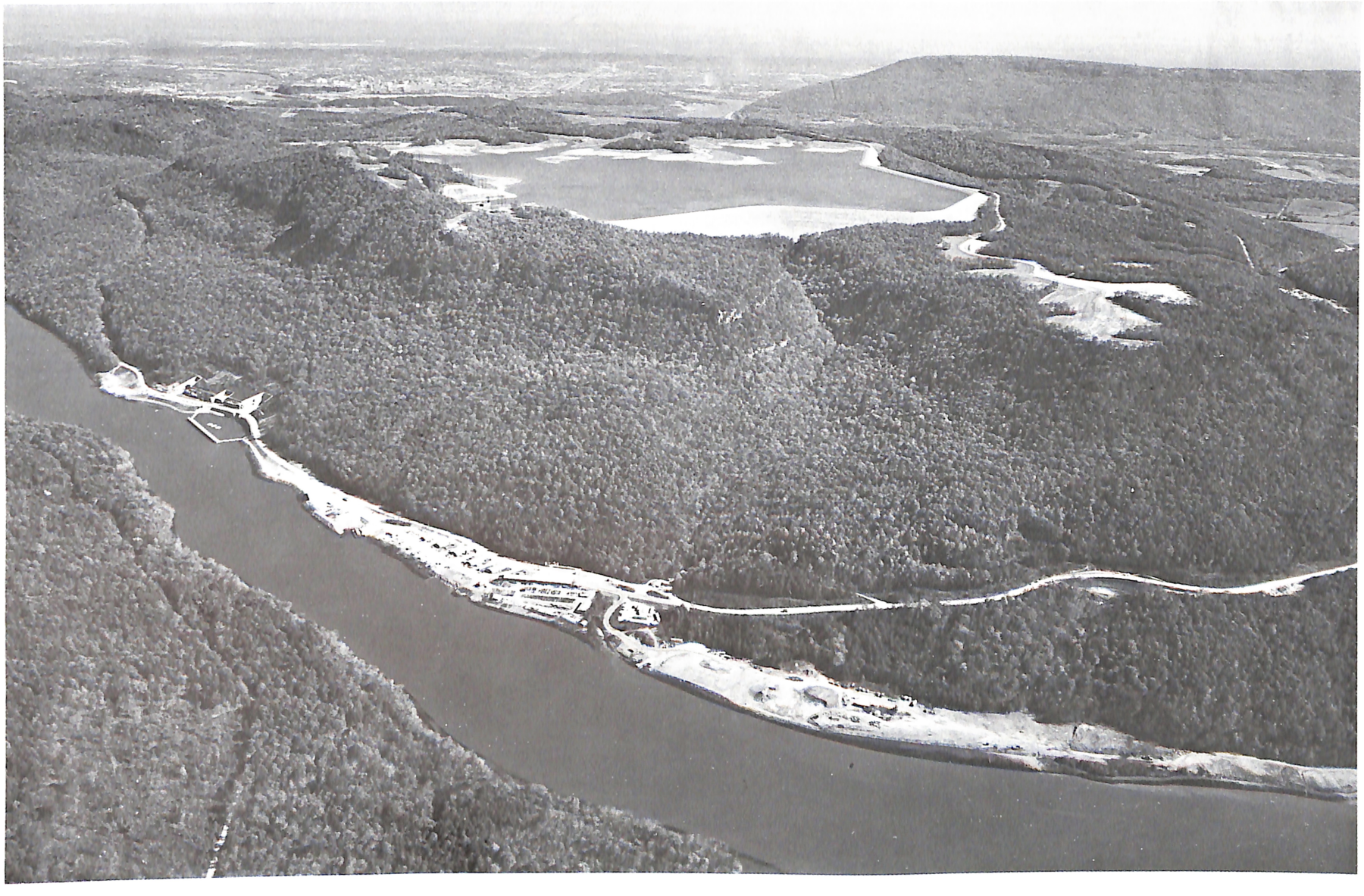
□ Model of the visitor overlook facility.
Scale 1" = 10'; 40½" long x 32" wide x 16" high.

Coal-fired Steam Plants

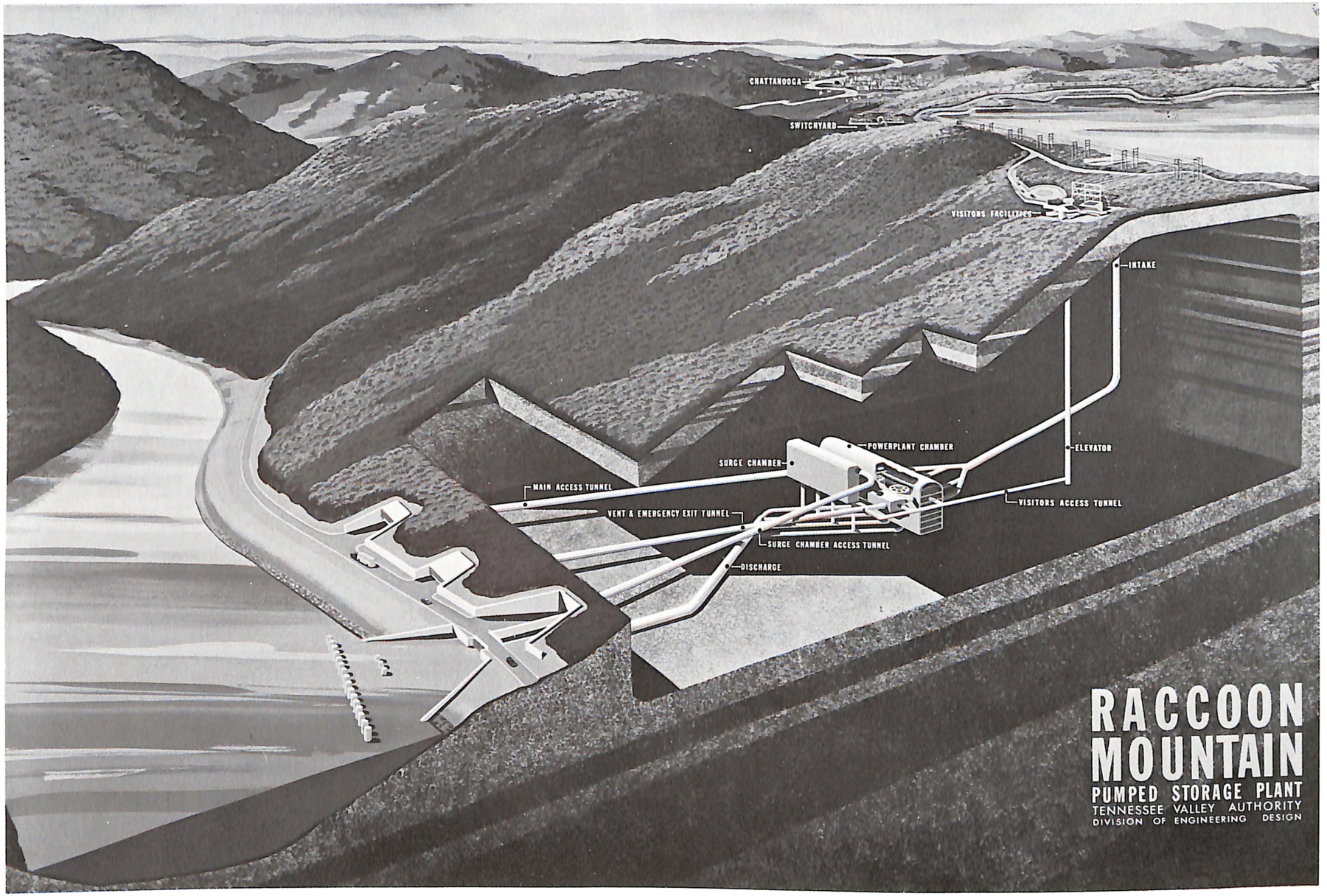
51. **WATTS BAR STEAM PLANT** (August 8, 1940 to February 15, 1942)

• Suggested design.
Pencil on tracing paper, 28½" x 18½", September 4, 1940.
Drawn by Mario Bianculli.

The steam plant at Watts Bar dates from the same period as the nearby dam; it was built to generate a steady electric supply to complement the hydroelectric sources, which tended to fluctuate seasonally. The power capacity of Watts Bar Steam Plant, 240,000 kilowatts (about the same as a main river dam), has long since been dwarfed by the steam plants constructed by TVA in the



• Raccoon Mountain.



• Raccoon Mountain analytic section.



• Raccoon Mountain powerhouse under construction.

1950s and 1960s. Interior provisions for coal bunkers account for the largely windowless boiler wing.

52. **JOHNSONVILLE STEAM PLANT** (May 12, 1949 to October 27, 1951; enlarged July 2, 1956 to November 30, 1958)

• General view.

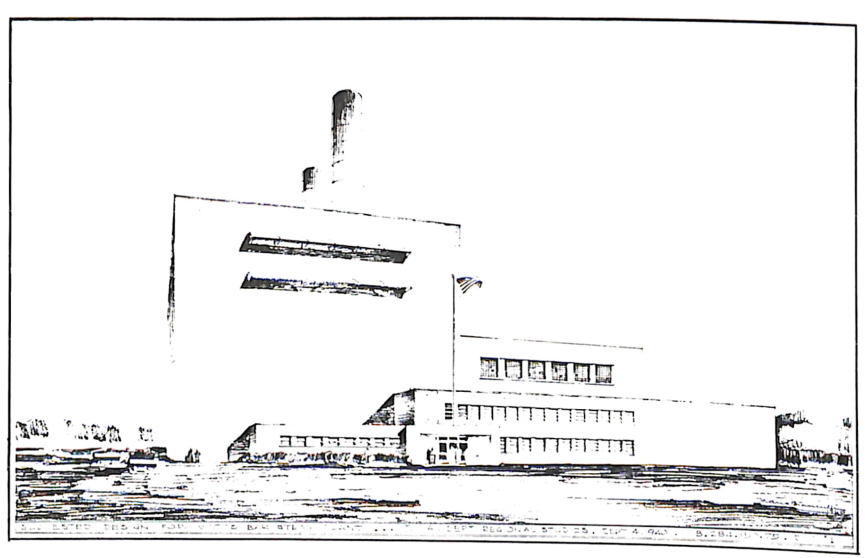
Johnsonville illustrates the general design approach to steam plants taken by TVA in its postwar facilities. The enormous boilers, ten at this plant, are housed in an aluminum-clad structure which dominates the project, Other elements, including the generators, offices and control rooms, shops and laboratories, are built in brick to reflect their smaller scale. The incoming coal is unloaded by crane from barges and taken by conveyors to be crushed and then burned in the furnaces of the boilers; the steam thus produced runs turbine generators which make electricity.

SHAWNEE STEAM PLANT (January 6, 1951 to April 9, 1953)

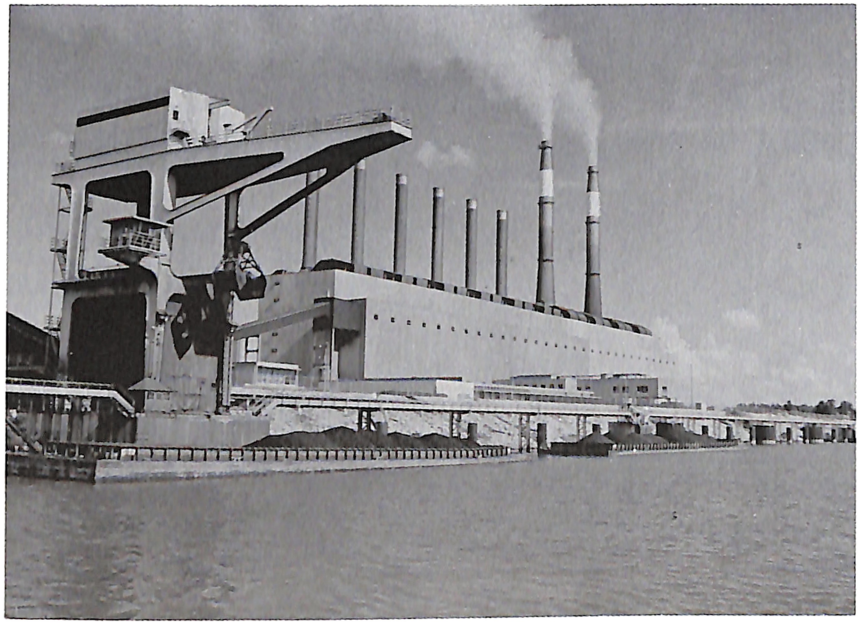
- Aerial view.

• Close aerial view.

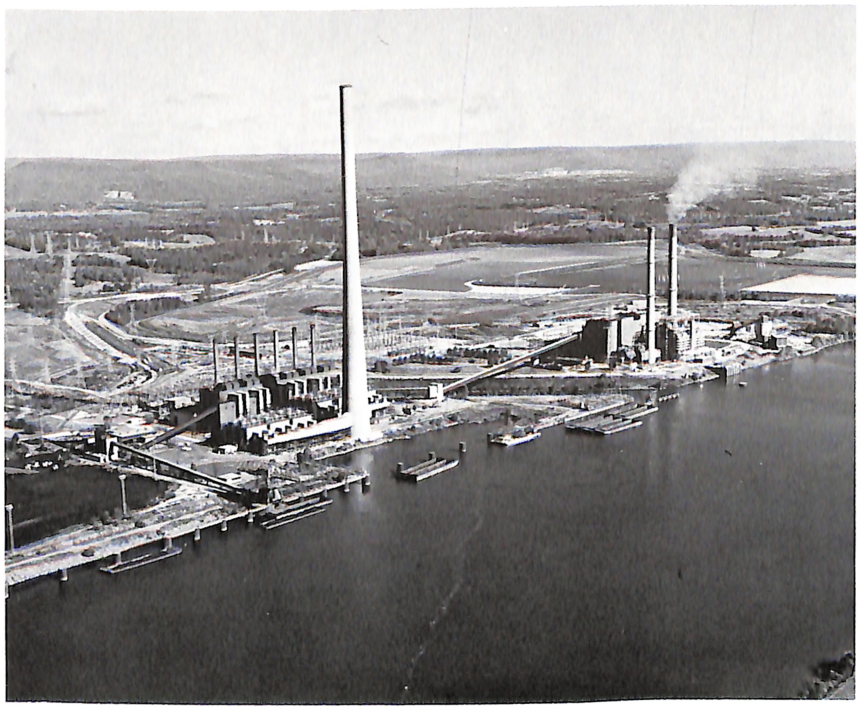
Shawnee was built in friendly competition with nearby Joppa Steam Plant, a project built by a consortium of private utilities; both installations were to serve the Atomic Energy Commission's new gaseous diffusion plant at Paducah, Kentucky. By completing its facility first and maintaining lower operating costs per kilowatt generated, TVA "won" the race, a measure of the Authority's ability to work efficiently in design, construction, and power production. Each of the ten generating units at Shawnee has a single smokestack, and their combined capacity is 1.75 million kilowatts.

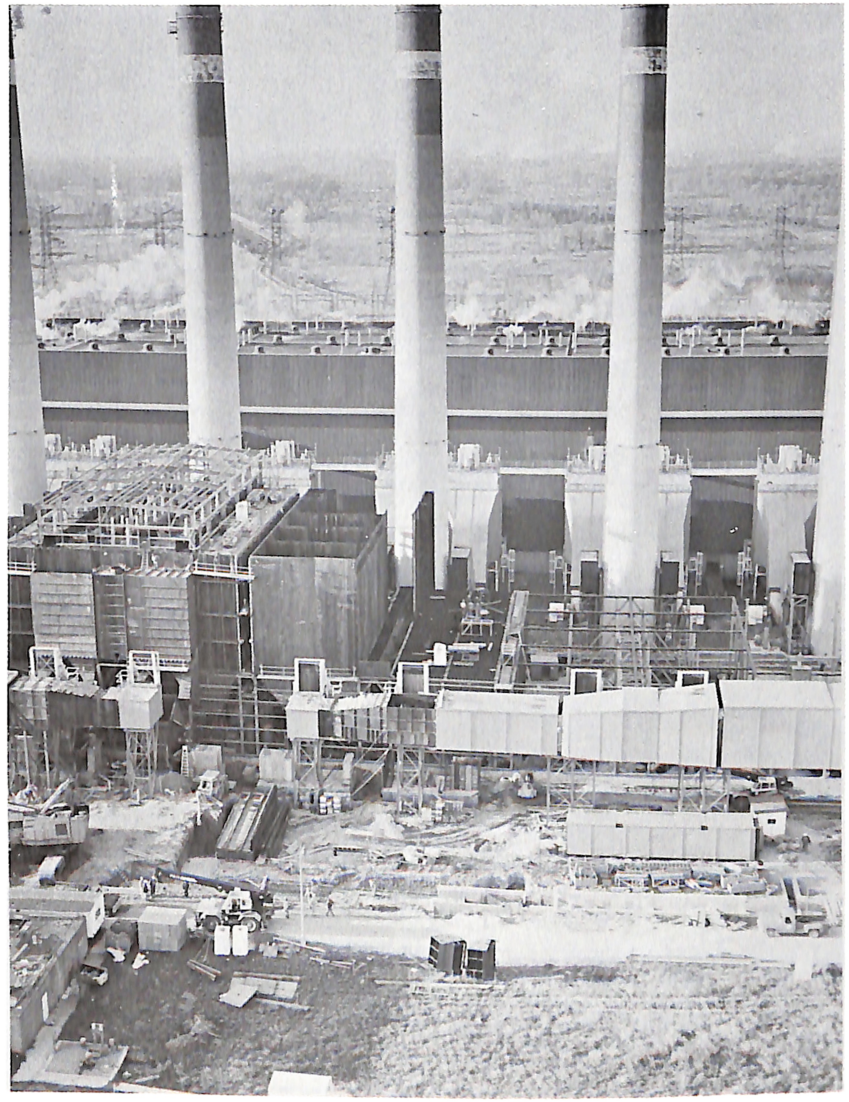


• Watts Bar Steam Plant.



• Johnsonville Steam Plant.



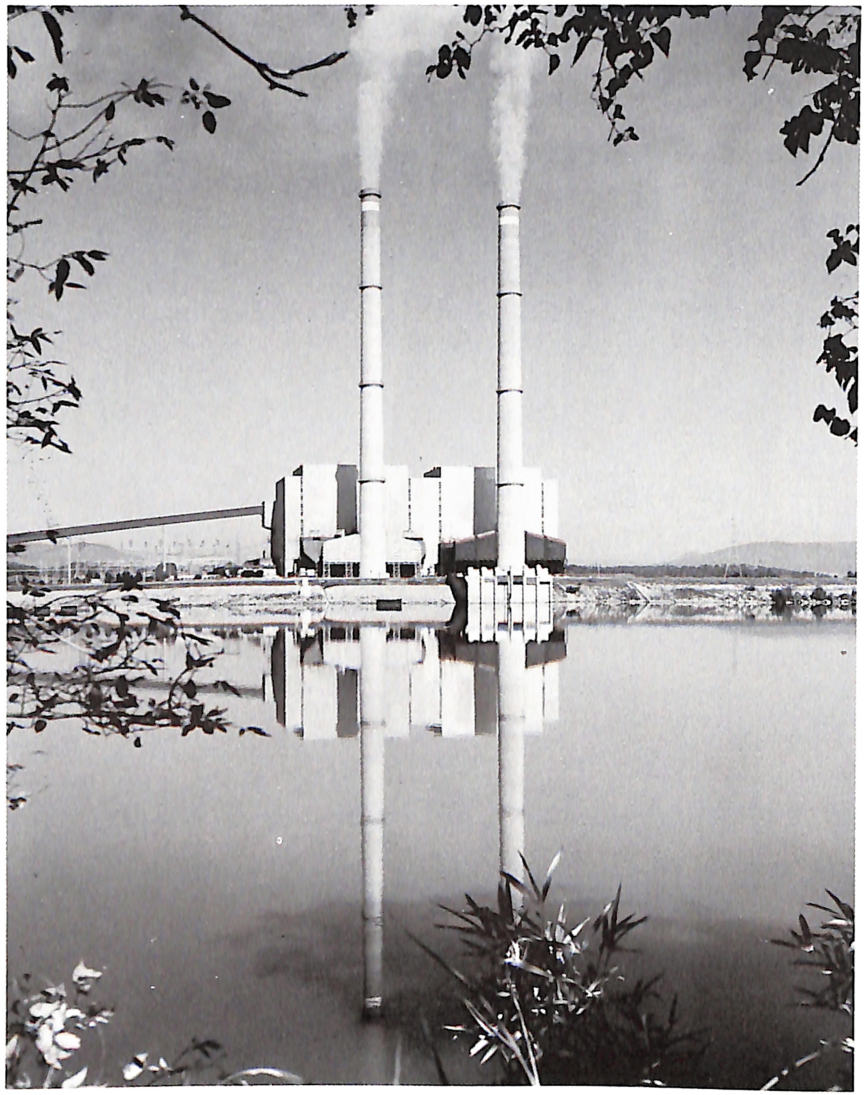


• Shawnee Steam Plant.

• (opposite) Widows Creek Steam Plant.

WIDOWS CREEK STEAM PLANT (March 29, 1950 to July 1, 1952; enlarged March 3, 1958 to February 1, 1961; enlarged again October 12, 1960 to February 7, 1965)

• Aerial view of the plant with additions.



• Widows Creek Steam Plant addition.

With two major enlargements since its initial construction, Widows Creek now has the third largest generating capacity of TVA steam plants, nearly two million kilowatts. The original plant, seen at the left in the aerial photograph, shared many design features with Johnsonville. Extensive use of smooth surface materials, such as aluminum siding, at this and other steam plants reduces the accumulation of coal dust on the exterior of the buildings.

53. **WIDOWS CREEK STEAM PLANT**

- General view of second addition.

54. **KINGSTON STEAM PLANT** (April 30, 1951 to February 8, 1954)

- General view.

Kingston was the largest coal-fired steam plant in the world at the time of its completion, capable of generating 1.6 million kilowatts intended primarily to supply the Atomic Energy Commission's installations at Oak Ridge. Since 1955, several TVA plants have been built which exceed the capacity of Kingston (the plant itself has been modified to increase its output to the current 1,723,250 kilowatts), and the external appearance of the facility has been changed by the addition of two one-thousand-foot tall stacks built as part of the air pollution control system.

55. **KINGSTON STEAM PLANT**

- Aerial view.

56. **KINGSTON STEAM PLANT**

- Lobby interior.
- Lobby mural by Robert Birdwell.
- Lobby mural by Robert Birdwell.

57. **JOHN SEVIER STEAM PLANT** (October 14, 1952 to July 12, 1955)

- General view.

John Sevier is in many respects one of TVA's most successful architectural solutions for steam plants: the large scale elements of the boilers and powerhouses are covered simply with insulated aluminum panels, while a Miesian porcelain enamel curtain wall is used on the attached office wing to provide a sense of human scale. Coal for the boilers at the plant is delivered by rail, rather than barge; the plant has a capacity of 846,500 kilowatts in its four generating units.

58. **BULL RUN STEAM PLANT** (April 2, 1962 to June 12, 1967)

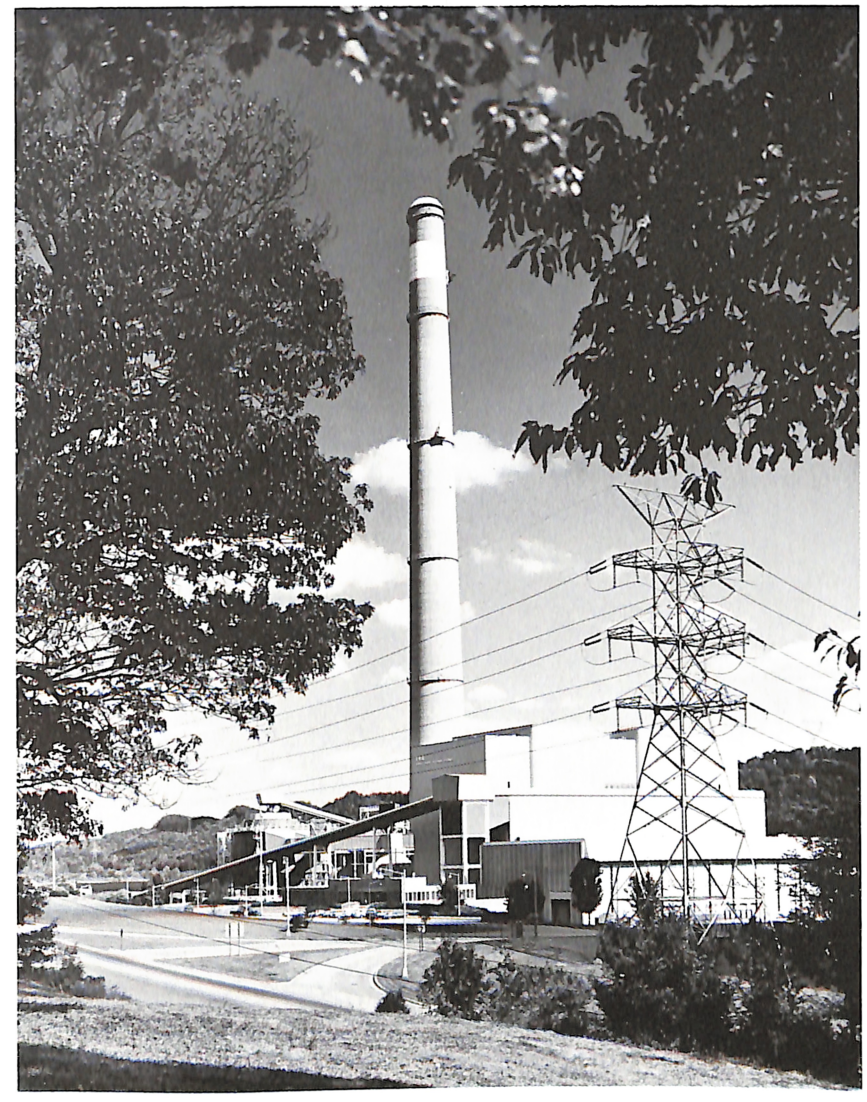
- Aerial view.
- Interior view showing coal pulverizers.
- General view.



• Kingston Steam Plant.

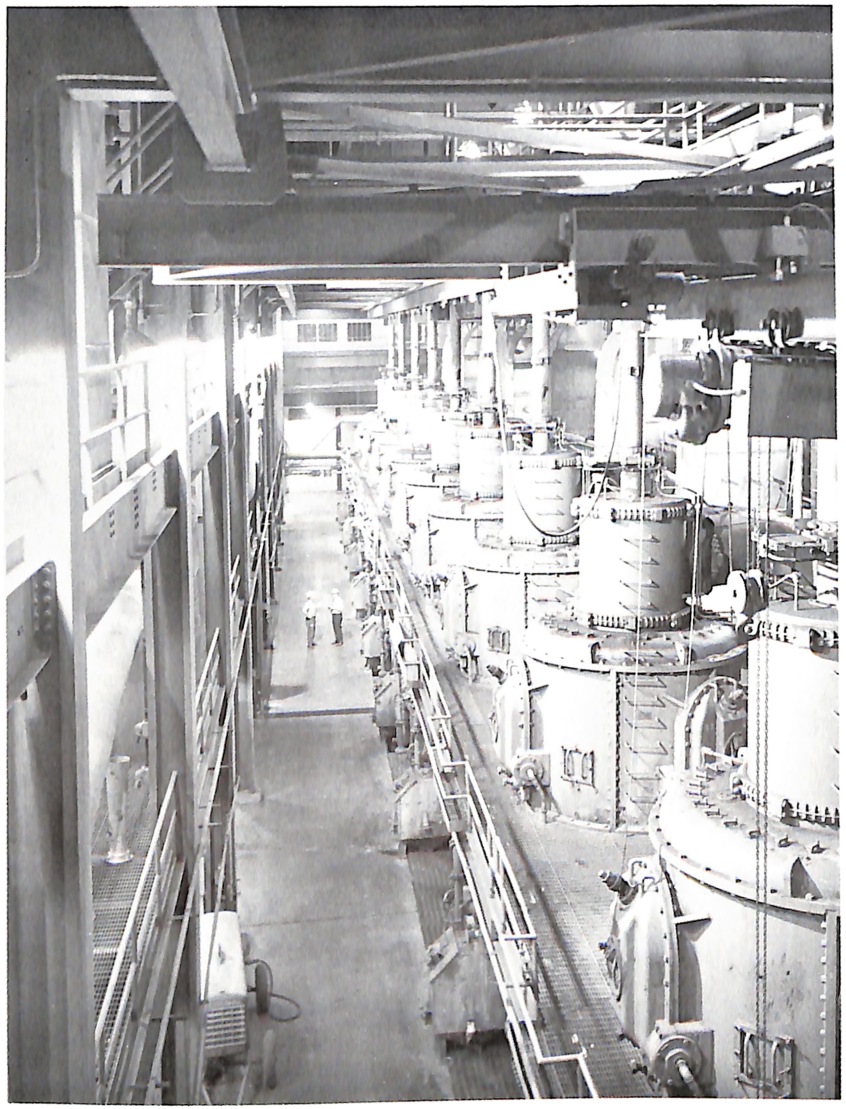


• Bull Run Steam Plant.



• Bull Run Steam Plant.

The solitary 800-foot stack at Bull Run towers over the only TVA plant to have just one unit, a giant turbogenerator that operates on supercritical pressure steam to produce 950,000 kilowatts of electricity. The tall boiler unit houses two furnaces, each 162 feet high, which consume over 8,000 tons of coal every twenty-four hours when operating at capacity. Coal enters the plant on the conveyor and is loaded into the tripping gallery that runs across the central section. From here, it is fed into ten pulverizers and reduced to fine particles before being burned in the furnaces. Exhaust gases are expelled through the stack, while steam is piped to the lower turbogenerator room. Windows in the office wing give the best indication of scale.



• Bull Run Steam Plant coal pulverizers.

59. **CUMBERLAND STEAM PLANT** (March 4, 1968 to March 1, 1973)

- East elevation.
  Colored pencil on sepia print, 33½" x 21".
  Drawn by W. Prelogger.

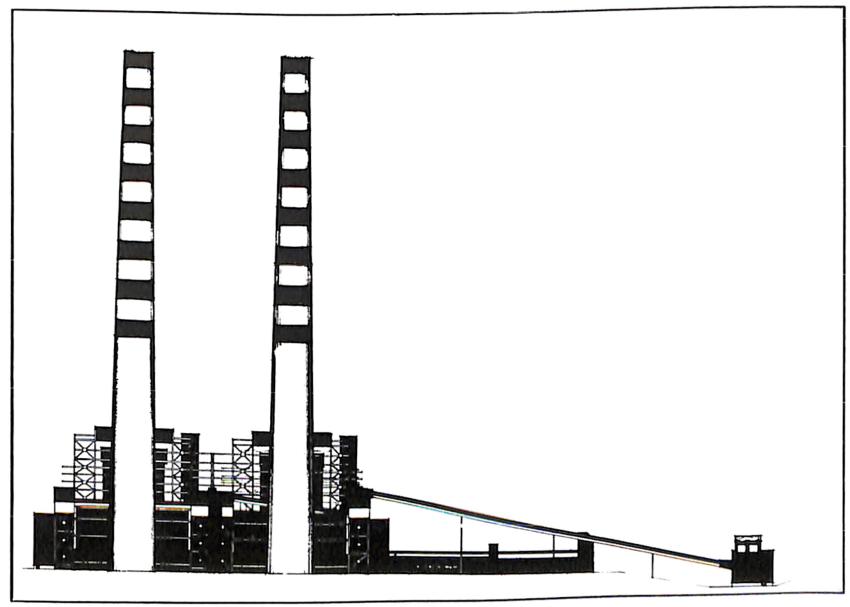
Cumberland Steam Plant has the largest capacity of any coal-fired facility in the TVA system; its two enormous turbines can generate 2.6 million kilowatts while its boilers consume over a thousand tons of coal an hour. Cumberland must also be ranked among the most colorful of steam plants anywhere. Boldly striped smokestacks tower over yellow ochre metal panels on the generator buildings and brilliant red glazed brick on the office wing. By leaving the framing exposed around the boilers (which are 136 feet high), the architects have minimized the massiveness of the ensemble, preventing lower buildings from appearing totally insignificant.

60. **CUMBERLAND STEAM PLANT**

- ▫ West and north elevations.
  Colored pencil on sepia print, 33½" x 21".
  Drawn by W. Prelogger.

61. **CUMBERLAND STEAM PLANT**

- ▫ Conveyors.
  Colored pencil on sepia print, 33½" x 21".
  Drawn by W. Prelogger.



• Cumberland Steam Plant, east elevation.

62. **CUMBERLAND STEAM PLANT**

□ Perspective view.
Tempera rendering, 19" x 30", 1971.
Drawn by David Joyner.

CUMBERLAND STEAM PLANT

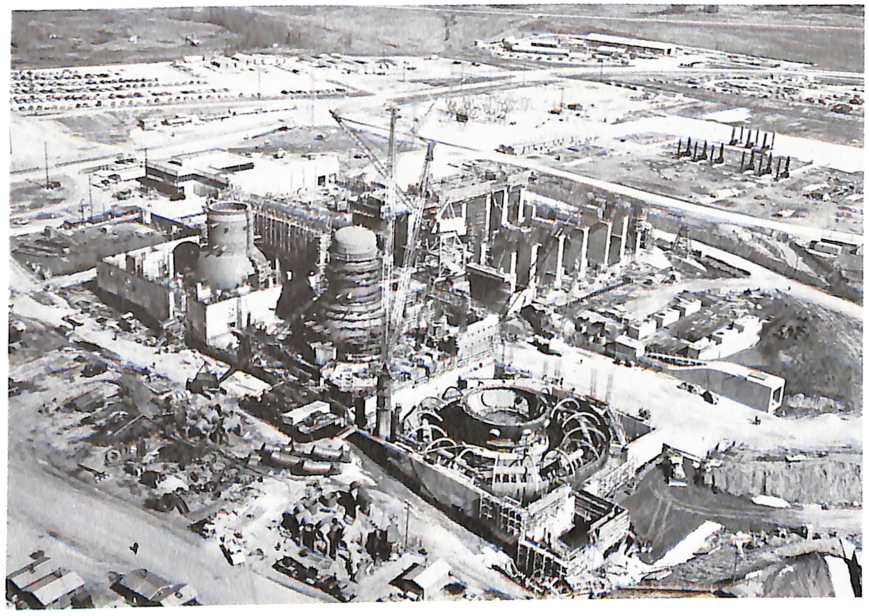
□ Model of the plant.
Scale 1" = 32 feet; 60½" long x 36½" wide x 36" high.

Nuclear-powered Steam Plants

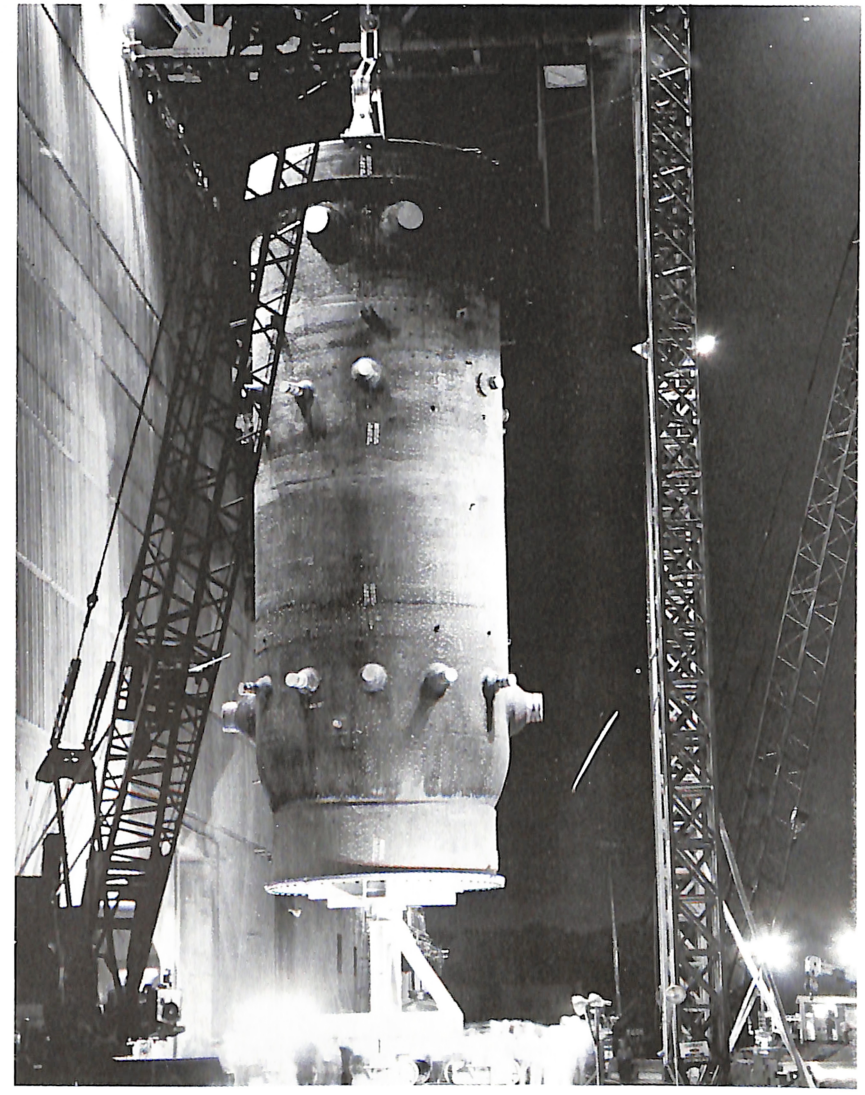
63. **BROWNS FERRY NUCLEAR PLANT** (September 12, 1966 to August 1, 1974)

• Aerial perspective.
Ink on mylar, 24" x 32½", 1981.
Drawn by James Cagle.

Browns Ferry, the first TVA nuclear-powered steam plant, derives much of its architectural character from the coal-fired steam plants of the late 1960s: the reactor units are housed in a common

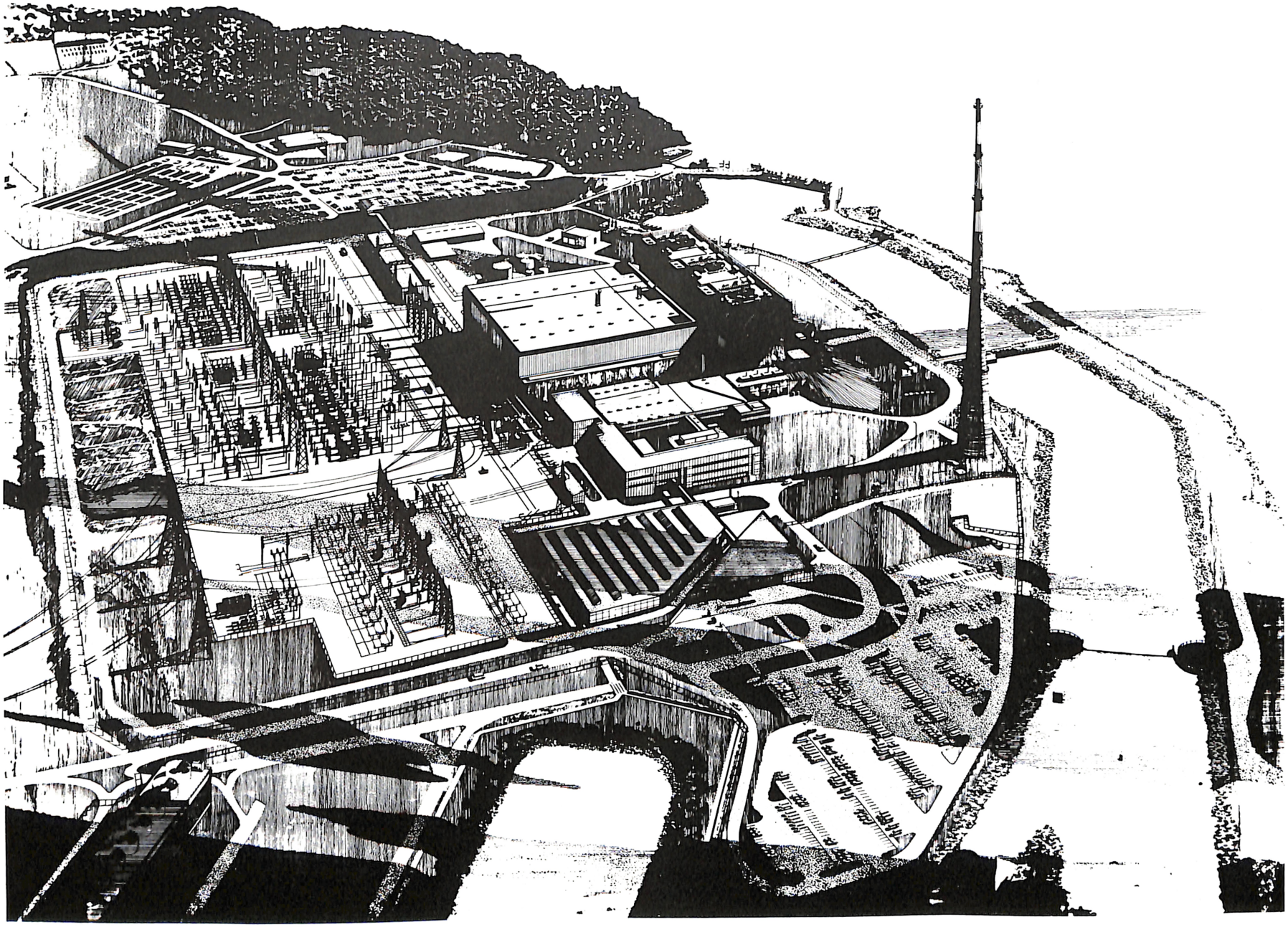


• Browns Ferry Nuclear Plant.



• Browns Ferry reactor vessel.

block, with the boilers and generators articulated separately. The three reactors here produce steam which in turn operates turbines that generate 3,456,000 kilowatts of electricity with greater economy than could be attained in a coal-fired plant. Aerial photographs of the site under construction convey the enormity of the enterprise more effectively than do ground-level views of the completed project. For security reasons, the nuclear-powered plants are not open to the public.



• Browns Ferry Nuclear Plant.

64. **BROWNS FERRY NUCLEAR PLANT**

- Aerial view showing primary containment of units 1 and 2 and partially completed torus ring and containment of unit 3.
- Installation of torus ring girders.
- Torus ring girders of unit 3 with primary containment of unit 2 in background.
- Interior of 30′ diameter torus ring.

65. **BROWNS FERRY NUCLEAR PLANT**

- Reactor vessel being lifted into final position.
- Reactor vessel being connected to crane.
- Turbine foundations.
- Turbine foundations.

66. **WATTS BAR NUCLEAR PLANT** (December 26, 1972 to)

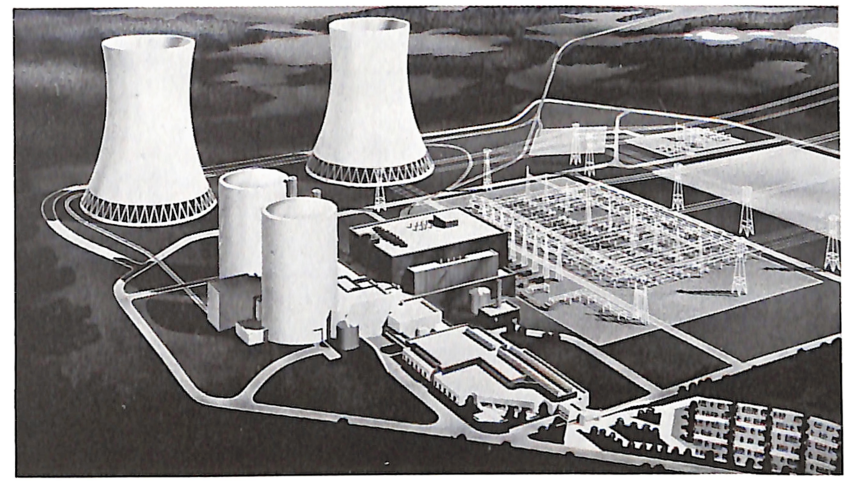
- Aerial photograph.

Planned for completion in 1984-85, Watts Bar Nuclear Plant will have two reactor units to power two 1,269,900 kilowatt generators. The circular form of the reactors and their containment buildings is visible in the exterior form; the whole site is overshadowed by the two hyperbolic paraboloid cooling towers needed to treat the condensing water before returning it to Chickamauga Lake.

67. **BELLEFONTE NUCLEAR PLANT** (September 18, 1974 to)

- Aerial rendering.
  Pen and ink with airbrush, 32″ x 21″, 1972.
  Drawn by David Joyner.

Bellefonte is still under construction, with its first unit scheduled for completion late in 1986. More than in other nuclear plants, the architects here were able to articulate the various components on the site: the cooling towers, reactor buildings, powerhouse, office wing, and switchyard as distinct elements have been integrated into an overall composition. A proposed visitor overlook would, if built, allow at least this massing to be appreciated from a safe distance. Bellefonte's two generating units will have a combined capacity of 2,664,000 kilowatts when in full operation.



• Bellefonte Nuclear Plant.

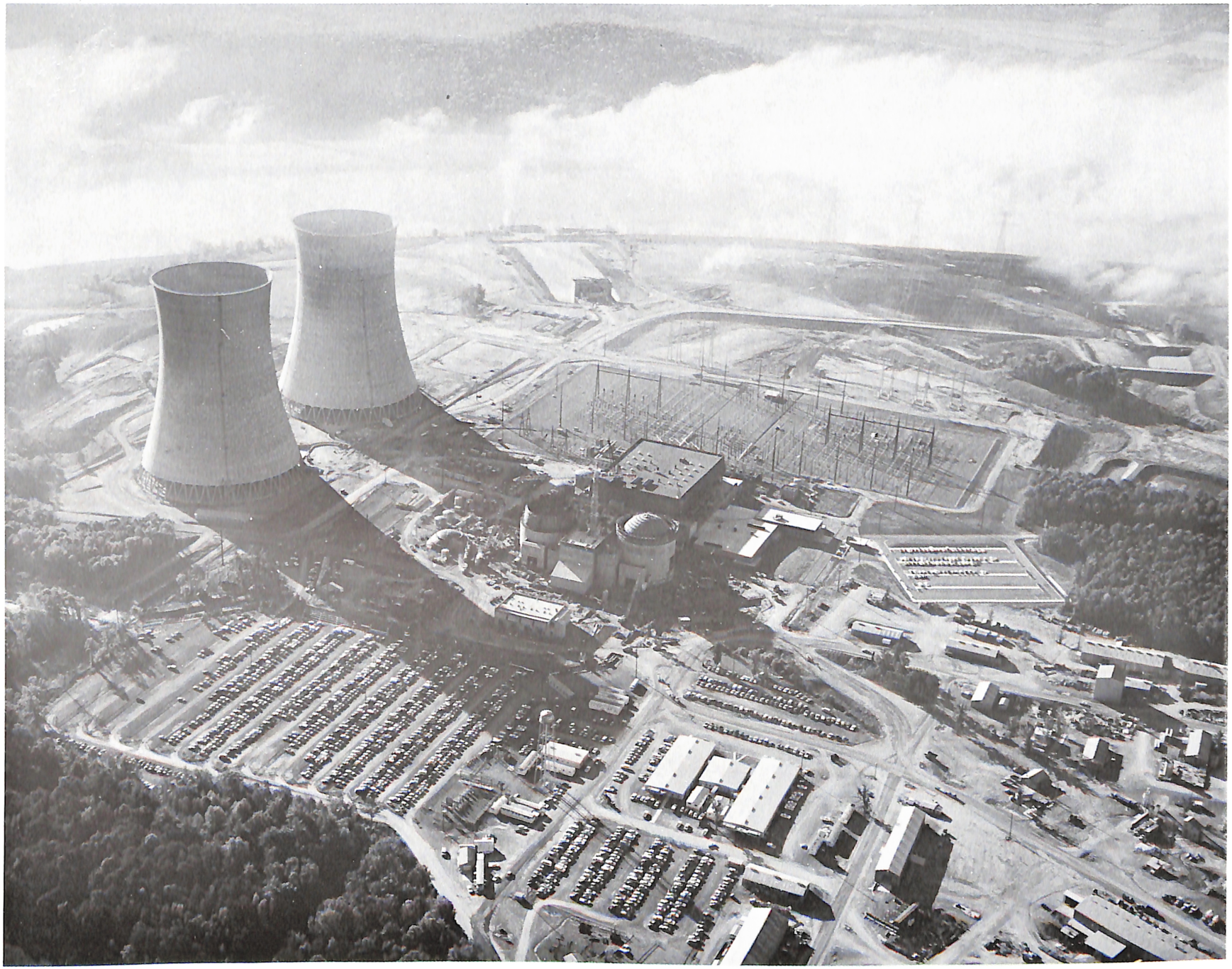
68. **BELLEFONTE NUCLEAR PLANT**

- Aerial view, March 2, 1982.
- Elevated view of main turbine bay.
- Floor level view of main turbine bay.
- Corridor in office and service building.
- Transformer yard.

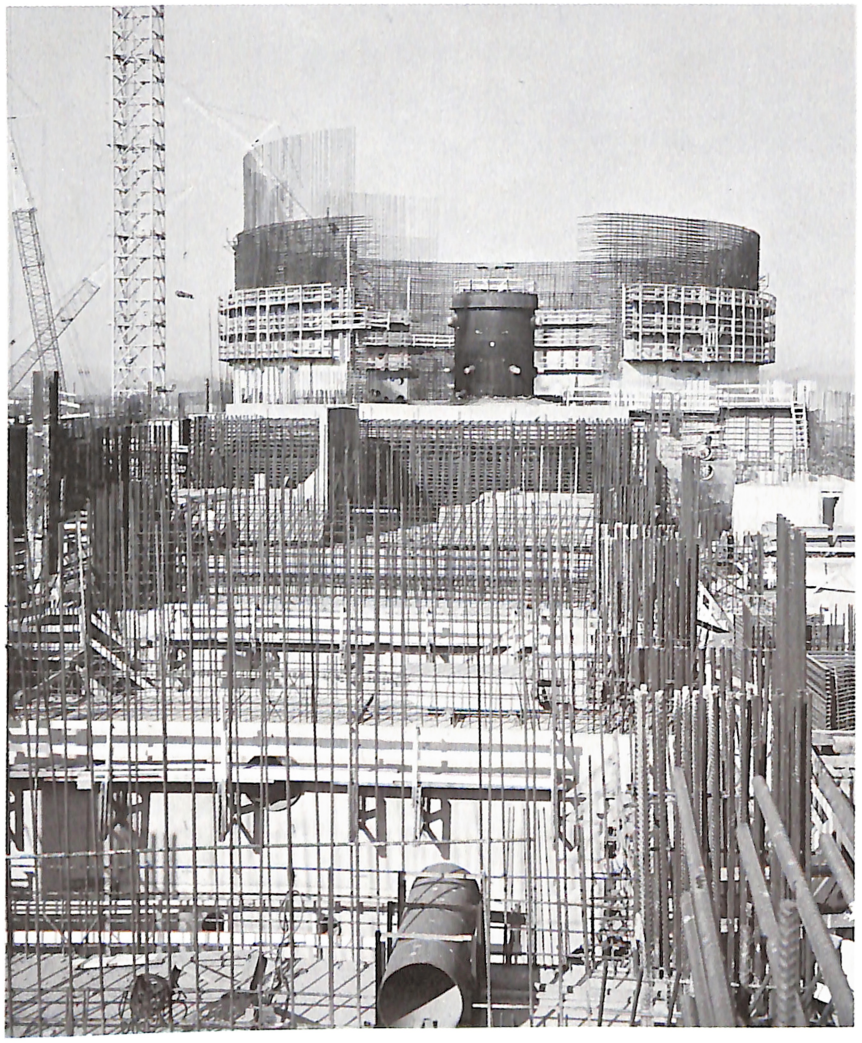
69. **HARTSVILLE NUCLEAR PLANT** (April 26, 1976 to)

- Aerial view during construction, October 10, 1978.
- Unit 1 reactor, July 18, 1978.
- Unit 1 reactor building containment liner and shield building wall, September 16, 1980.
- Turbine room foundations with unit 1 reactor building in background, September 16, 1980.

Two units are under construction at Hartsville. The photographs show some of the immensity and complexity of these constructions; the intricate webs of reinforcing rods in the containment buildings and turbine foundations will disappear as the buildings are finished. This plant has now been deferred.



• Watts Bar Nuclear Plant.

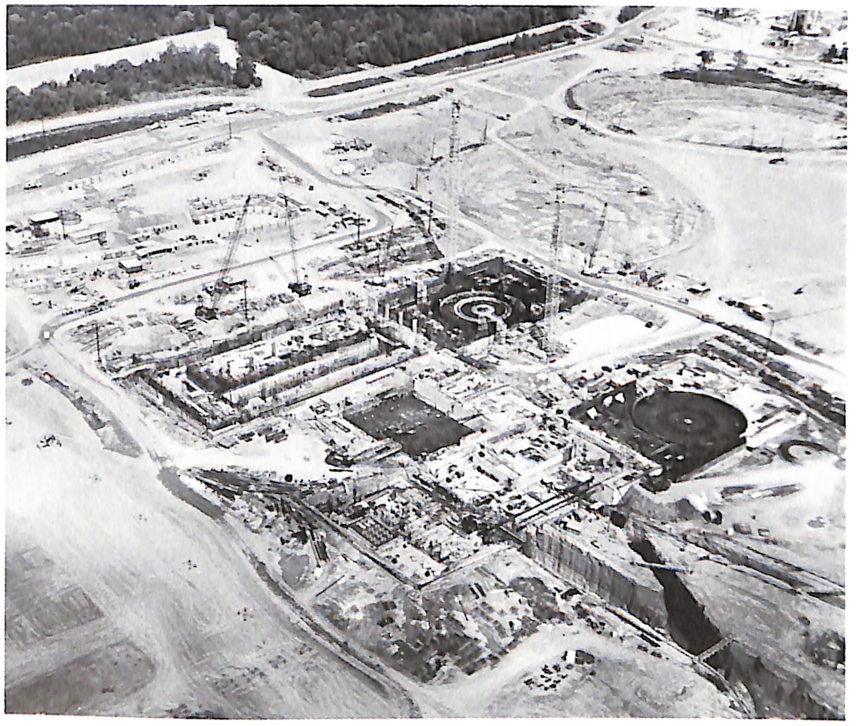


• Hartsville Nuclear Plant turbine room.

YELLOW CREEK NUCLEAR PLANT

□ Engineering model of the reactor building; scale ½" = 1 foot. Eight sections, each measuring 68¾" long by 36½" wide by 66" high. This model is not in the traveling exhibit.

This model, used as a design tool by the TVA engineers, proved more effective in coordinating the three-dimensional configuration than customary orthographic drawings. Arrangements worked out in model form were translated into construction drawings. The Yellow Creek plant has now been deferred.



• Hartsville Nuclear Plant.

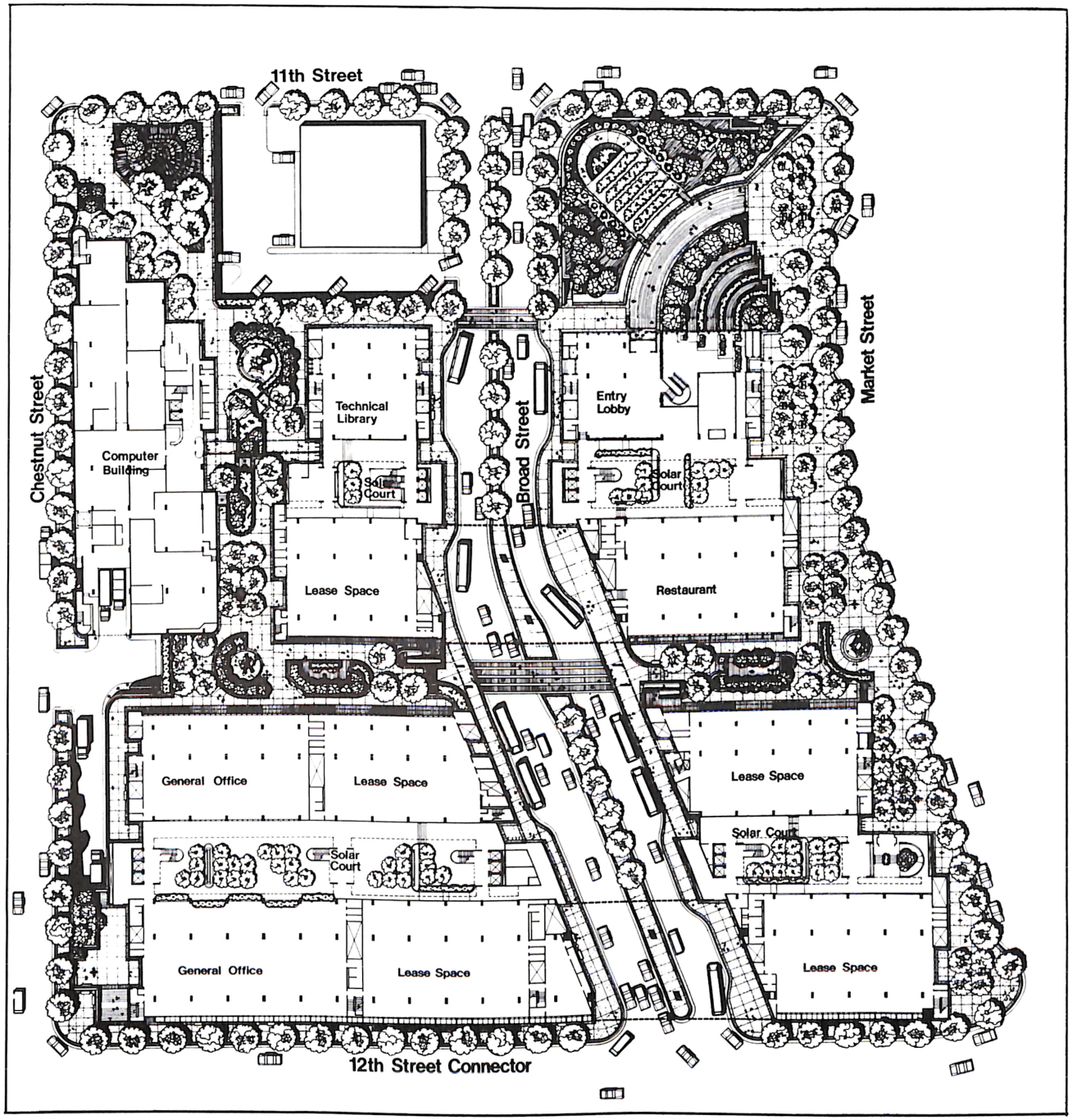
70. CHATTANOOGA OFFICE COMPLEX (December 1980 to)

• Plan.

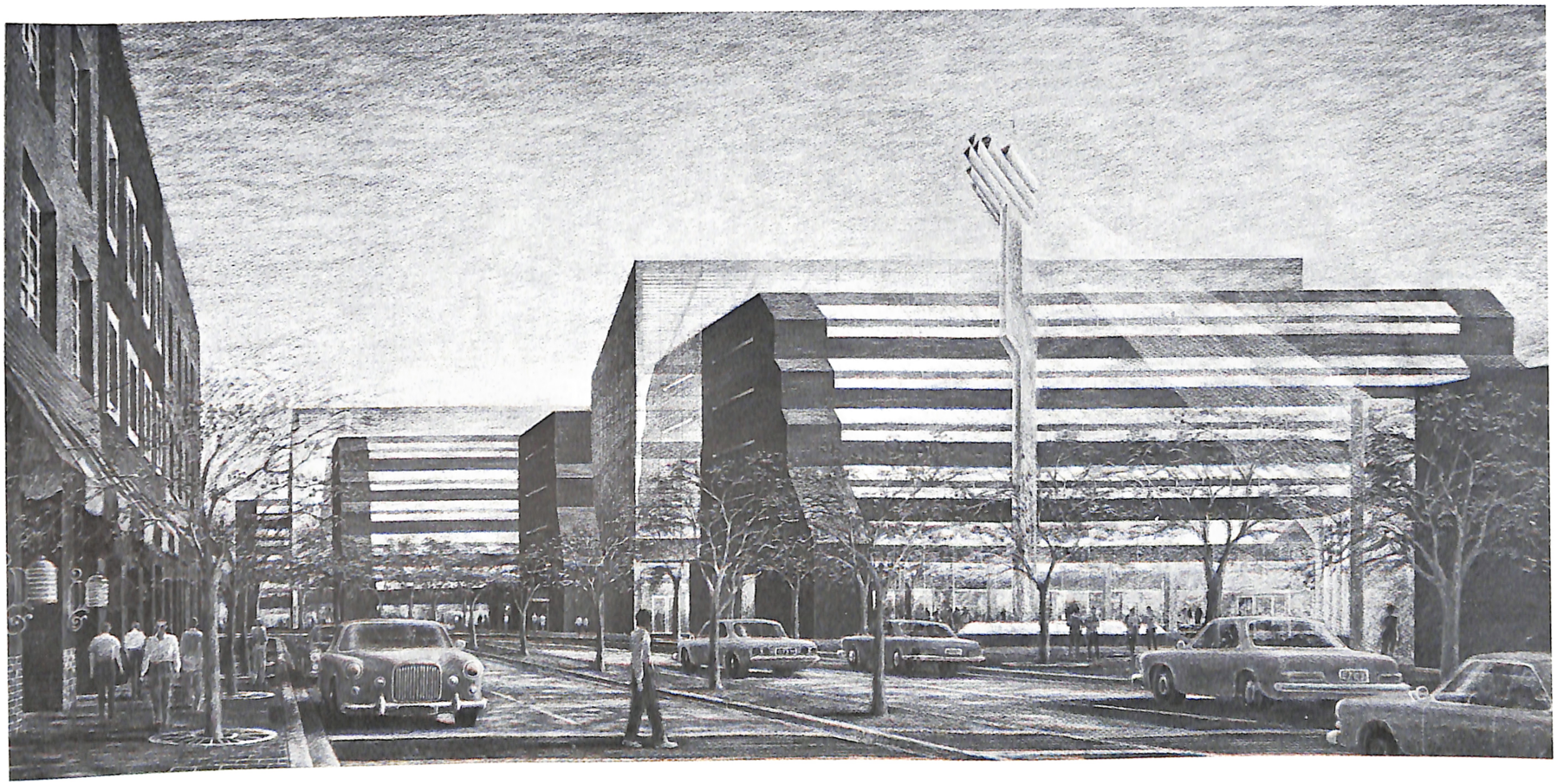
□ Model photograph of interior section.

• Model photograph of interior court.

TVA has come in recent years to emphasize energy conservation, and the design for new TVA offices in Chattanooga reflects this concern. The buildings incorporate state-of-the-art techniques for solar design and daylighting in commercial buildings, thus continuing the long tradition of TVA buildings which were conceived as experimental projects. The Architectural Design Branch has been responsible for programming and design of the buildings, scheduled for completion in 1984, in conjunction with The Architects' Collaborative and Caudill/Rowlett/Scott.



• Chattanooga Office Complex, plan.



• Chattanooga Office Complex perspective.

71. CHATTANOOGA OFFICE COMPLEX

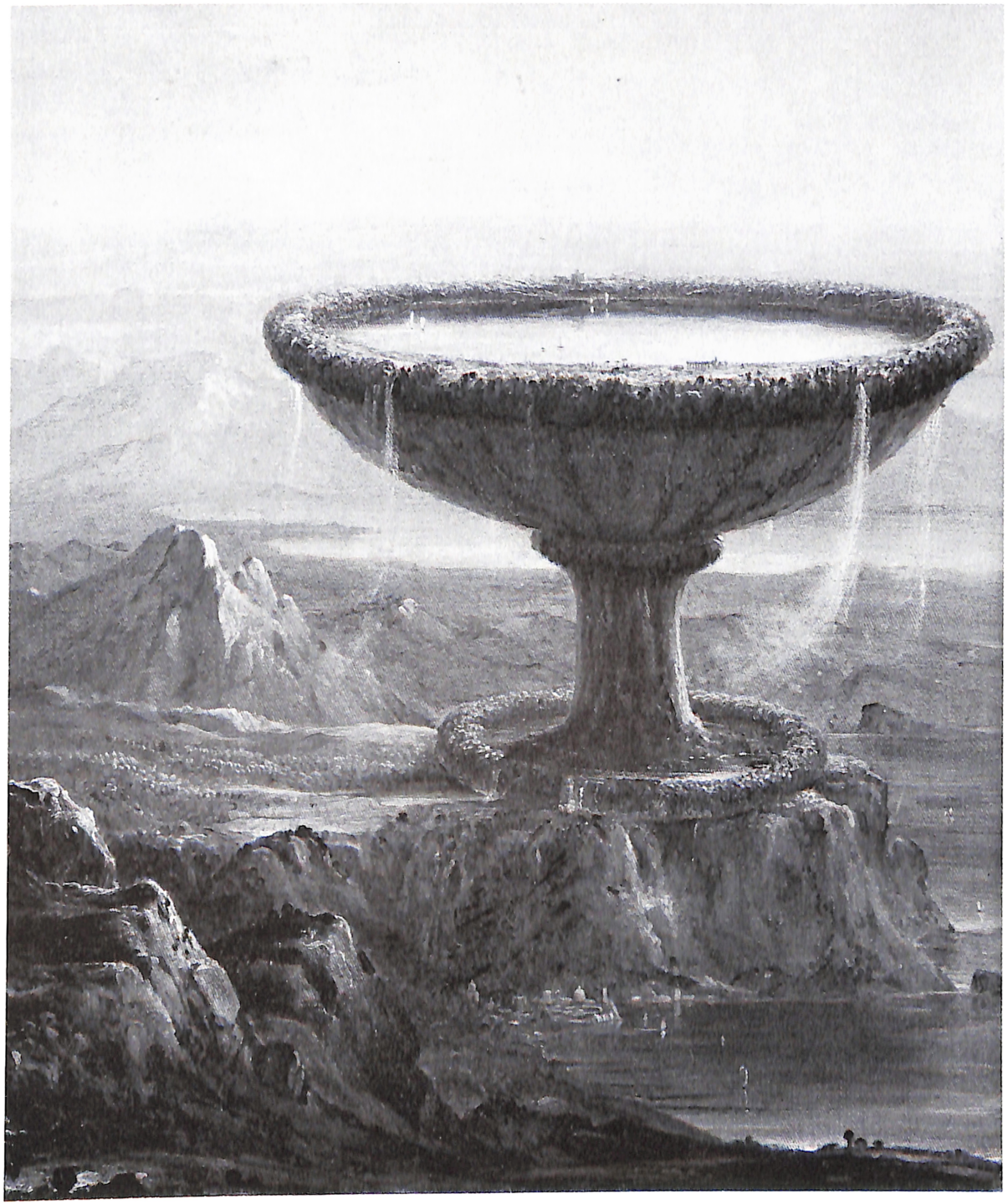
- Exterior perspective.
  Colored pencil on board, 40″ x 20″, 1979.
  Commissioned by The Architects' Collaborative.

CHATTANOOGA OFFICE COMPLEX

- ▫ Model showing major portions of the buildings.
  40″ long x 30″ wide x 12″ high.



• Chattanooga Office Complex, model of interior.



1. Thomas Cole (1801-1848), "The Titan's Goblet," Oil on canvas, 19⅜" x 16⅛", dated 1833. (Courtesy of The Metropolitan Museum of Art, Gift of Samuel Avery, Jr., 1904.)

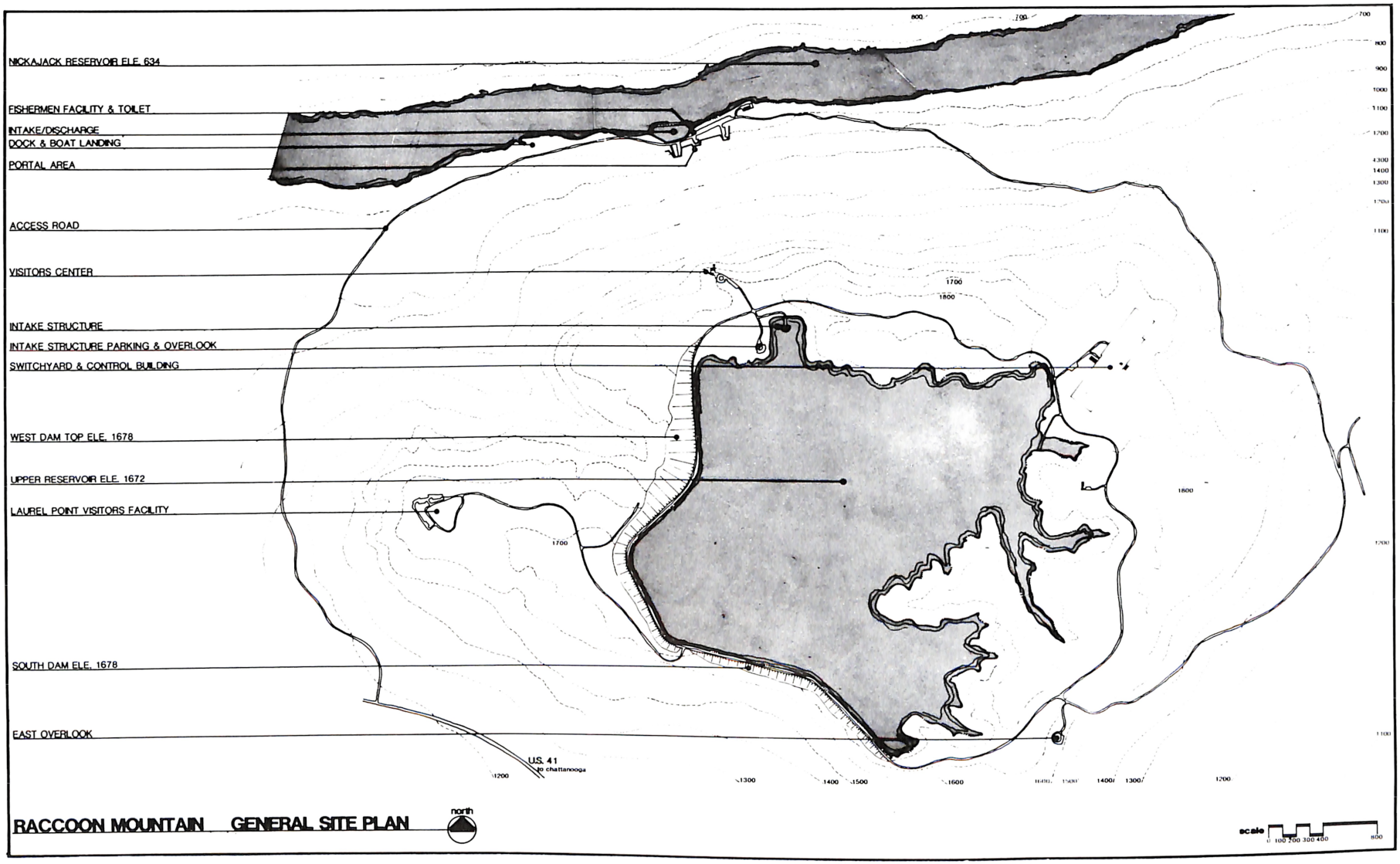
RACCOON MOUNTAIN

William H. Jordy

In his "The Titan's Goblet" (Fig. 1) of 1833 the American landscape painter Thomas Cole showed a giant goblet on a formidable escarpment raising its artificial lake to the heavens, with some of its contents seeping as wispy waterfalls through its porous rim. At the same fabulous scale the Tennessee Valley Authority has fitted an artificial lake into one side of a mountain top at Raccoon Mountain (Pl. 46). A rock- and clay-filled brim around the "outside" half of the lake's perimeter (really an earth dam against the side of the mountain) seems to carry a roadway right off the mountain in a sweeping curve against the sky, making the analogy with Cole's goblet fantasy the more apt. Not that TVA's lake matches the extravagance of Cole's cantilevering, nor the startlement of his imagery. But, to compensate, Raccoon Mountain may go Cole one better in offering not only an artificial lake on the mountain top but a huge artificial cavern with turbines whirling away in its bowels as well. Moreover, if "The Titan's Goblet" provides a sublime setting for recreation, what with barely discernible sailboats floating on its waters and a domed pleasure palace on axis with a porticoed garden structure concealed in the foliated brim, so in a different way does Raccoon Mountain. As with all major TVA hydro installations, technology is beautifully integrated with public recreation.

Although pumped storage plants are exceptional in power production, they have a reasonably long and (to the non-expert at least) inconspicuous history extending back to the 1920s. Designed to meet peak demand, turbines in pumped storage plants are engineered with reversible function, not only for standard generation from the fall of the water, but also for pumping water up to a high reservoir (Pl. 47). During periods of slack demand for electricity, usually in the late night and early morning hours, the pumping action fills the reservoir. Come those daytime and early evening hours when extra power is needed, the generating action flushes the reservoir to complete the cycle. The drop of the "waterfall" inside this mountain is close to the height of the Empire State Building. It falls with a volume and force sufficient to generate more than three times as much electricity as the total produced by the three biggest mountain storage dams combined (Norris, Hiwassee and Fontana); its four generators have a capacity more than twice that of the twenty-one units at Wilson Dam, which is the largest hydro facility on the main river. The grandiosity of the project in itself testifies to the rapacious demand for power in the Valley. It is common wisdom that TVA power comes from its major dams, almost forty in all on the Tennessee River and its tributaries, plus better than ten in the nearby Cumberland River Basin. (Six of these are owned by the Aluminum Company of America, but operated by and integrated into the TVA system. All except one of the Cumberland River dams were built and are operated by the Army Corps of Engineers, but coordinated with the TVA system which also markets the electricity.) Today, however, barely eighteen per cent of TVA energy production originates in falling water. Even before the enormous power needs of World War II, the Authority had so successfully attracted industry with the promise of cheap and plentiful electricity that it was necessary to supplement hydro generation with its first steam plant at Watts Bar in 1939. Then among the largest steam plants in the world, it is now dwarfed by ten successors, all large; the largest boasting two generators each with a capacity five and one-half times that of the original Watts Barr plant. Nuclear plants followed, beginning in the sixties (eight in various stages of completion, and presently so controversial that construction on all but what is nearly done has, for the time at least, been halted). The largest of these, in turn, contains four reactors, each with a capacity equivalent to that of the largest steam plant. It was during the sixties, too, in this context of a seeming insatiable demand for power (and prior to the moderating efforts toward conservation which is now a major emphasis in TVA) that the Authority made a survey of possible sites for pumped storage facilities to augment its potential for water generation. Of all possible sites Raccoon Mountain was by far the best.

Raccoon Mountain is one of a cluster of mini-peaks that rise abruptly around the bowl-like valley containing Chattanooga. Aside from a couple of insistently-advertised "natural wonders" which bring droves of tourists to one of the peaks, they are mostly dotted with expensive houses perched on outcroppings for views over the city or down the gorge through which the Tennessee River snakes a spectacular course at this point toward the flatter country of northern Alabama and western Tennessee. Raccoon Mountain was less accessible than neighboring peaks and owned by a single family who left it in a wild state largely because steep slopes would have made development expensive. It remained the rugged haunt of Tennessee hunters and hounds until TVA bought the entire mountain with the pledge to adapt its technology to the scenery.

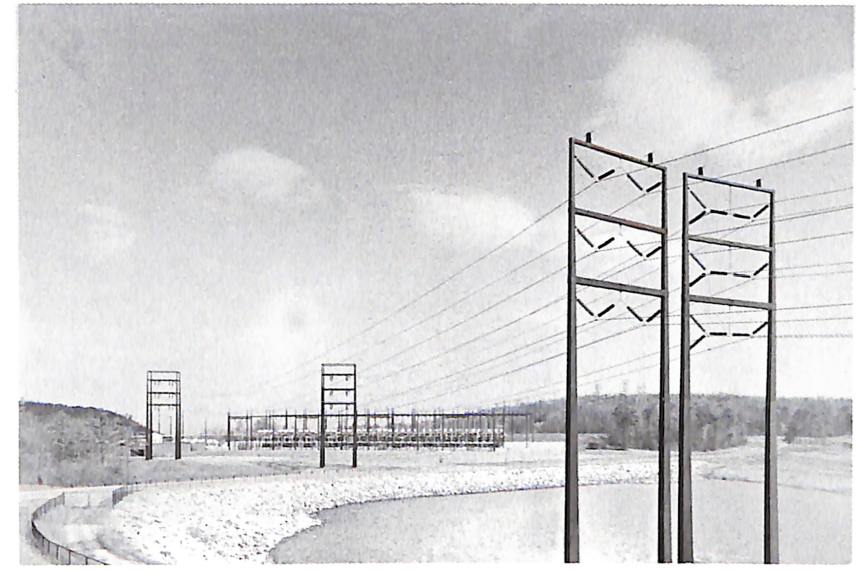

NICKAJACK RESERVOIR ELE. 634
FISHERMEN FACILITY & TOILET
INTAKE/DISCHARGE
DOCK & BOAT LANDING
PORTAL AREA
ACCESS ROAD
VISITORS CENTER
INTAKE STRUCTURE
INTAKE STRUCTURE PARKING & OVERLOOK
SWITCHYARD & CONTROL BUILDING
WEST DAM TOP ELE. 1678
UPPER RESERVOIR ELE. 1672
LAUREL POINT VISITORS FACILITY
SOUTH DAM ELE. 1678
EAST OVERLOOK
U.S. 41
to chattanooga
RACCOON MOUNTAIN GENERAL SITE PLAN
north
scale

2. Site plan.

What originally served as carefully sited construction roads now connect the major components of the installation with much sympathy for the landscape. For TVA it is an old story extending back to Norris Dam, its first major project completed in the mid-thirties. There the Authority established a policy with respect to the integration of landscape with high technology, roadways, and recreation which has resulted, especially around the mountain hydro projects, in some of the finest American examples of large-scale landscape planning in which a naturalistic park merges with wilder nature. At Norris, for example, roads bring the visitor in sweeping curves to vantage points all around the looming concrete structure: to a parking place below the dam by the powerhouse; then in an easy wind up to another parking vantage point at the top of the dam, looking down its face; finally, across its brim and up the opposite bank to look down on the dam with a panorama of the lake dotted with boats behind (Pl. 7). The visitor's car becomes a kind of helicopter, swooping and hovering at different altitudes to take in the three-dimensional experience of the great structure in its landscape setting.

At Raccoon Mountain this three-dimensional experience is more sequential in character. Each of the principal components of the project exists as an isolated element and the parts come together in the journey through space, up the side of the mountain and around the summit loop of the lake. This loop connects switchyard, visitor's reception complex, intake tower, picnic and recreation area, plus the descent from the reception aerie down into the bowels of the mountain (Fig. 2). On reaching the summit, stretches of water show through the trees, but in the approved "picturesque" fashion disappear with dips in the road and intervening woods. Only at the switchyard (Fig. 3), with its parking turn-off (the customary first stop of the circuit), does the full extent of the lake become evident, the far edge sharp against distant mountains, with tiny cars creeping around the big curve of the brim, foretelling the path to be traveled.

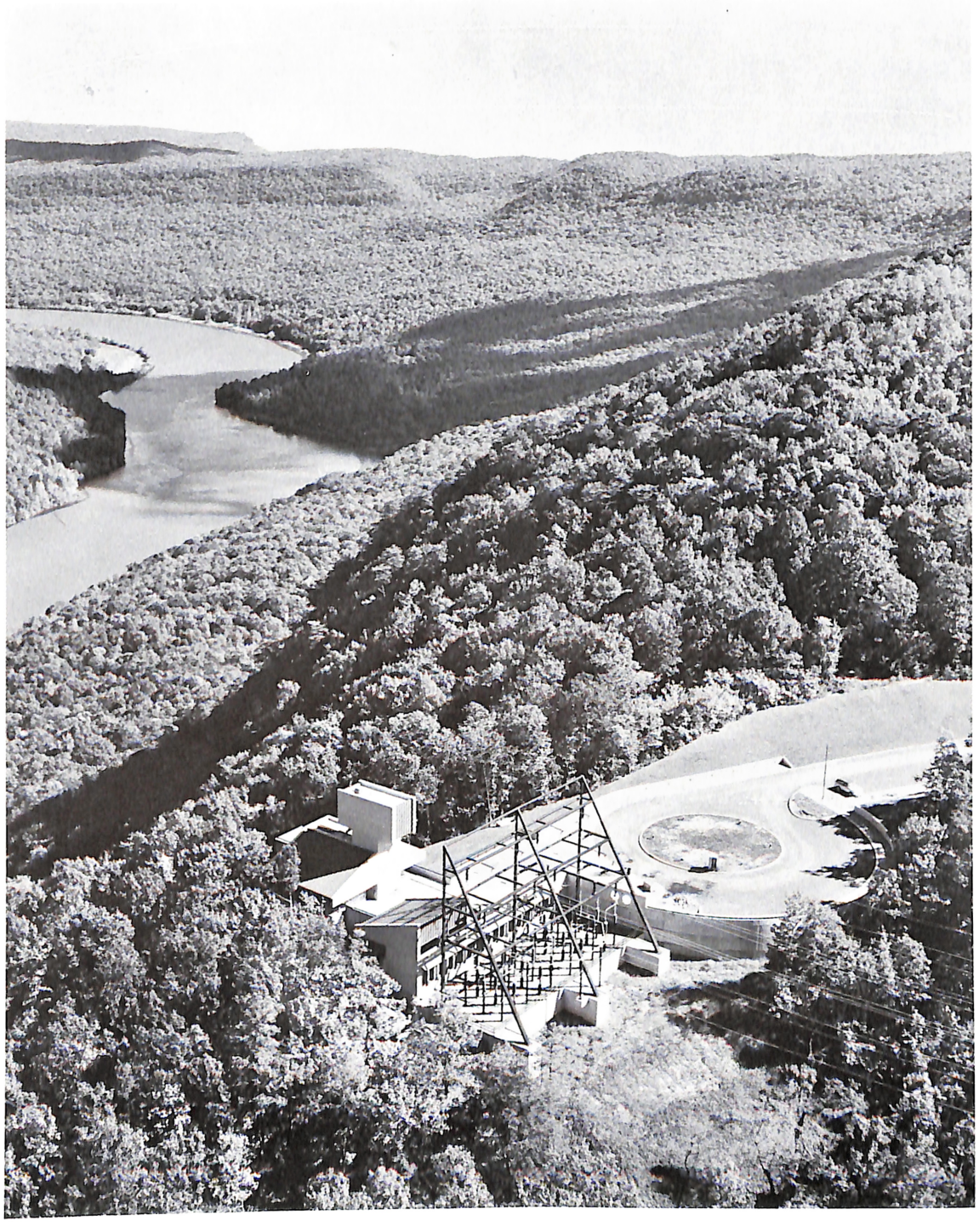
The color of the switchyard is meant more for display than for functional discrimination, although it serves this latter purpose too. The dark green encasements of the transformers lined up beneath the grid of tapered, rust-brown, tubular-pole supports in weathering steel for overhead wires provide chromatic "weight" for the lively yellows, oranges, and reds of subordinate parts, and for the functional fantasy of the white globular insulators. Traditionally, TVA switchyards, like switchyards almost everywhere, have simply accepted as given the gray-silver non-color of the customary aluminum triangulated "lacework" of the supports for overhead wires. Although TVA designers were aware of design developments in switchyard equipment and transmission towers in Houston and California, no precedent existed for the



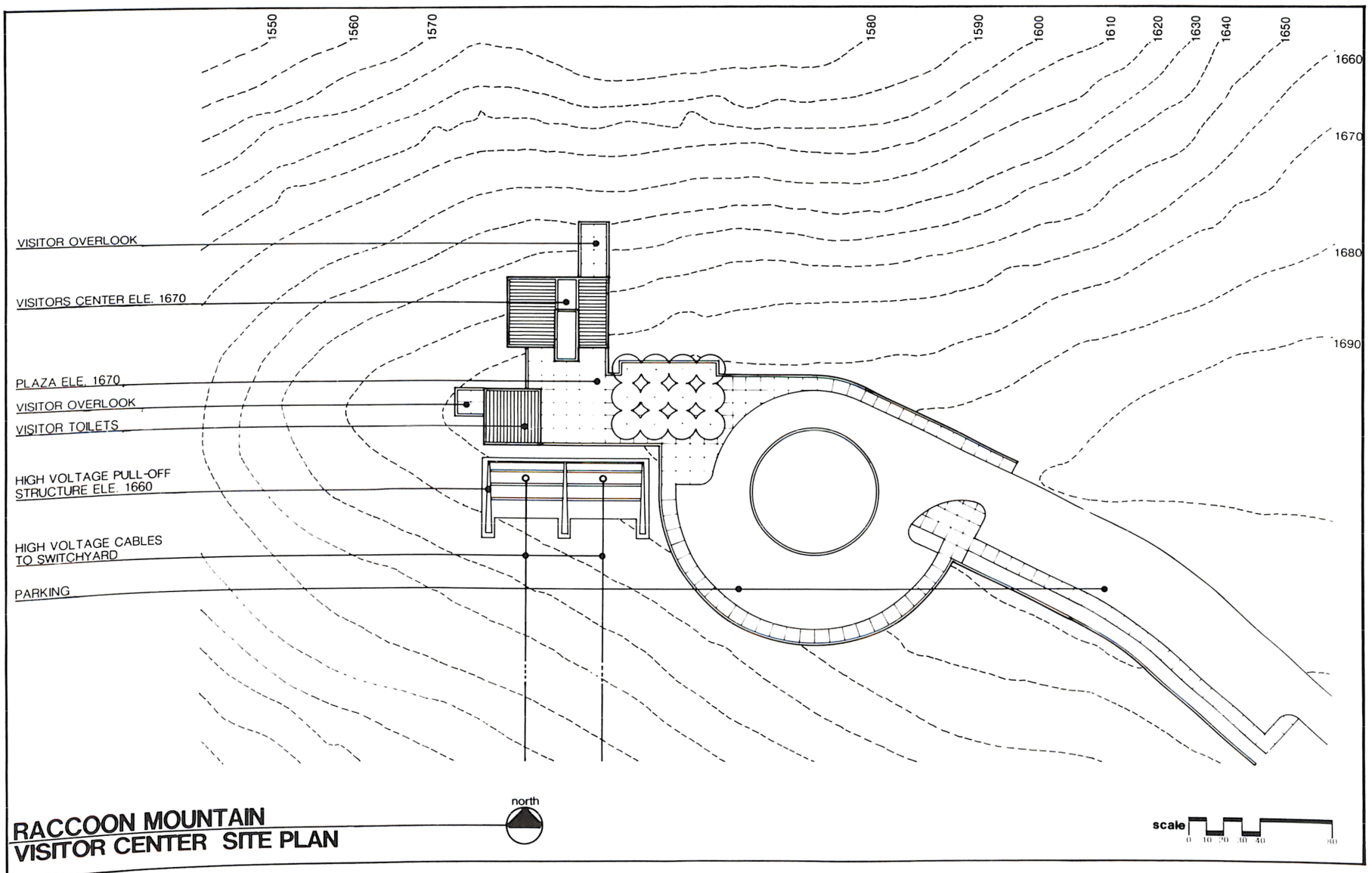
3. Switchyard.

extent of the radical transformation of this equipment effected at Raccoon Mountain. If soft-colored Purism influenced the equipment design of the early dams, and the high-pitched brightness familiar to modern construction machinery appeared in the late steam plants like Cumberland, here, in the switchyard at Raccoon Mountain, there is a stridency of color intensified by fantasy of shape which recall high-tech refineries or space-age gimmickry. The same qualities also appear in comparable equipment at the nuclear plants, where even more extreme shapes are chastened beside the sombre giantism of the hyperbolic paraboloid cooling towers. So innovations in TVA machine design have succeeded one another. The neat, vaguely Miesian reticence of the brick control station at Raccoon Mountain is all but eclipsed in competition from the strident yard.

At Raccoon Mountain, however, it is the tubular, rust-red towers that steal the show in this redesign of power equipment. Where a radical change in direction in the high voltage lines creates lateral stresses, the strutted bents are doubled to make a square-legged plan; where the run of the lines is reasonably straight, they march in pairs with processional pomp across one end of the lake, bringing power to the switchyard from the "pull-off" adjacent to the visitor's reception complex.



4. Reception Center.



5. Reception Center plan.



6. Reception Center.

It is here between the switchyard and the reception area where the road runs around the edge of the lake that one especially senses the care with which the lake was fitted to the site. The lake nestles into the top of the mountain. The peak is preserved. The dammed west and south sides of the lake follow the curve of the slope on which they are built. The construction quarry became the lake bottom so as to disturb forest cover minimally. Whereas ham-fisted bulldozing could well have annihilated the drama of the outcropping on which the visitor's center is poised, here the sizeable facility is nicely adjusted to retain some sense of the hiker's clambering to the top of an out-thrusting ledge in order to survey the panorama of the river gorge below. The landscape designers even tried to eliminate the swath cutting of trees for power lines, requesting that trees come as close to the transmission lines as practical, and that forest edges along the lines be irregular. In general, and somewhat in contrast to the Capability Brown sort of manicuring of landscape around earlier dams, the present tendency in all projects inclines more toward naturalistic wildness. This is surely appropriate for Raccoon Mountain.

The ruggedness of the natural setting accords with the angular sculptural forms of the buildings of the reception center (Fig. 4). They accord as well with the assertive logic of the immediately adjacent angled pull off structure (Fig. 5) where the power cables exit from their subterranean shaft from the powerhouse to begin the first segment of the transmission line to the switchyard. It could also be argued that the angularity of the reception center is to a degree *à la mode* stylistically, which is not unknown at other TVA hydraulic installations (Fig. 6). The design of most visitor reception areas at hydro sites appropriately echoes, and is indeed often wedded to, the chunky cubism of the dams as, for example, at Watts Bar or Kentucky (Pl. 16). But there are stylistic variants elsewhere from design norms recalling modern favorites of the moment: Oud's curved store canopies at Den Hague art-decoized at Norris, for instance (and unhappily demolished a few years ago to be replaced by a structure both gaudy and flimsy, surfaced in colored tiles reminiscent of a bathroom); or, at Fontana, a pavilion part-Wright, part-Mies. At Raccoon Mountain it is the ubiquitous modern version of gabled houses popular among architects in the seventies, sliced and skewered into a fragmented graphic symbol of itself.

The slashes at the ground for bands of windows and doors make a floating T of the gable and accentuate the structural bridge of the roof and cantilever of the floors. One of the roof slopes extends further and flatter than the other, nicely responding to the flatter slope of the mountain beneath it as compared to the steeper, shorter slope of the other half above a more precipitous drop. The more spreading half of the gable also balances, at right angles, the viewing platform projected out toward the gorge under the shorter half of the gable. Hence the house as a whole makes a cantilevered corner out into the space, to oppose the cornered circle for parking, providing at once a sense of termination at the point and expansive view from it. Thrusting above the bridged structure of the main building, the T of the elevator machinery occurs at right angles again to the T-shape beneath it.

The entrance court off the automobile turn-around creates a corridor plaza relating the four major compositional elements of the visitor's complex; pull-off for the transmission line on one side, reception center on the other, at the entrance a double row of trees in a rectangular planting area, at the rear and behind the pull-off the shed-roofed toilet building, The toilet building works with the opposed angle of the transmission structure to evoke a second, more fragmented, image of the gabled house, at right angles once more to the first. Along the way, a concrete wall enclosing the pull-off displays an abstract relief of undulant linear forms and circles realized by simple formwork and bush-hammered textures. The relief both intensifies the sense of movement along the corridor and recalls the flow and spin of the generating process below.

Into the reception center: the basic structure of reinforced concrete is set off against the wood purlins and planking of the underside of the roofing, as brick panels and copper-colored, seamed sheet metal roofing relieve the concrete surfaces outside. The continuous interior space of the visitor's center is semi-compartmentalized by the construction of the supporting bridge structure for the roof into the place of entry and the place of the view. A spectacular view, it is made more so by the thrust of the cantilevered balcony out toward the gorge of the river.

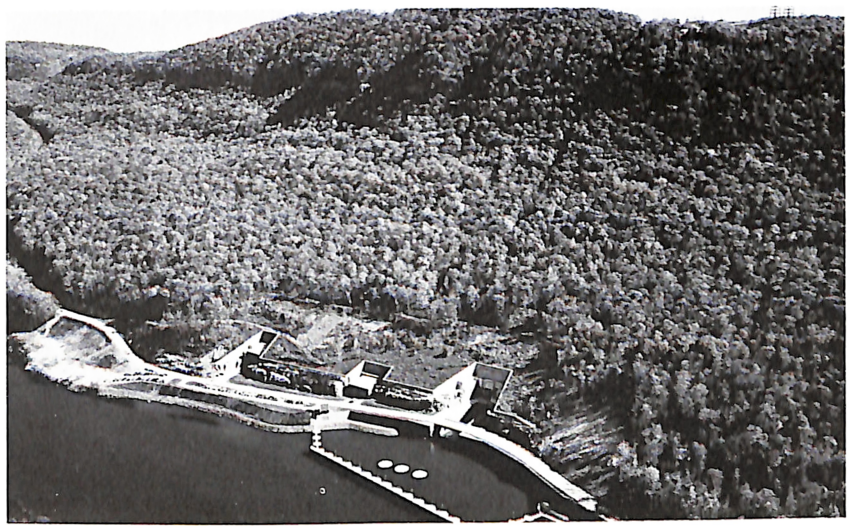
From such elevation, such light, such panorama, one goes down the elevator to the cavern. It is another example of the dramatic experience of the grand spatial design of these TVA installations vertically as well as horizontally. There is a specific precedent for the elevatored descent at Fontana Dam, where an elevator connecting the power house with the visitor's center at the top of the dam was considered, then discarded in favor of the more dramatic solution of a three-tiered aluminum and glass cable car making the trip by an incline between the visitor's reception area and the powerhouse. At Raccoon Mountain the exterior descent of Fontana is internal.

Inside Raccoon Mountain, the visitor's tunnel from the elevator, 500 feet in length, is calculatedly bare and a little oppressive, the better to magnify the climax at the end. A dogleg in the corridor with a domed circular sitting area at the bend provides both relief

and suspense. At the end, a glazed lounge with projecting balcony overlooks the powerhouse chamber. Counting the lounge (with the control room beneath it) the powerhouse is 490 feet long, 165 feet high, 72 feet wide: in short, it is huge, although the size of the machinery reduces the full sense of the scale. So perhaps does the press of the exposed rock face behind the skeletal framing for the gantry crane, although it is the omnipresence of the rock against the machinery which is especially awesome (Pl. 50). Colors less heavy than the green on the cylindrical sides of the turbines, or even the saturated yellow of their tops, and especially the purple for the gantry frame, might have enlivened the contrast between the enveloping presence of the rock and the alien geometries it contains. The visual spectacle and reverberant hum of this industrial grotto have the eerie unreality of some high-tech movie set. But cavils aside, the scale, the fantasy of contrast and situation, and the impact of the burst of this spectacle as the visitor steps out onto the lofty balcony into this buried plant are all impressive.

Here, in the lounge overlooking the turbines, as in all major TVA installations open to visitors, there is the inevitable motto, "Built for the People of the United States," flanked by the starting and completion dates of the project, 1970 and 1977. Here, too, is the inevitable map of the system indicating just how Raccoon Mountain meshes with all the other dams, steam plants, and nuclear plants. Photographs and captions - a legacy of the thirties penchant for the "documentary" - proclaim the symbiosis of technology and nature. No public monuments, none in the United States at least, more compellingly celebrate the virtues of regional resource planning and the vast automated system making it all possible. In the powerhouse crypt, the actual experience of the large-scale integration of technological, natural, and human resources is intensified by the "message."

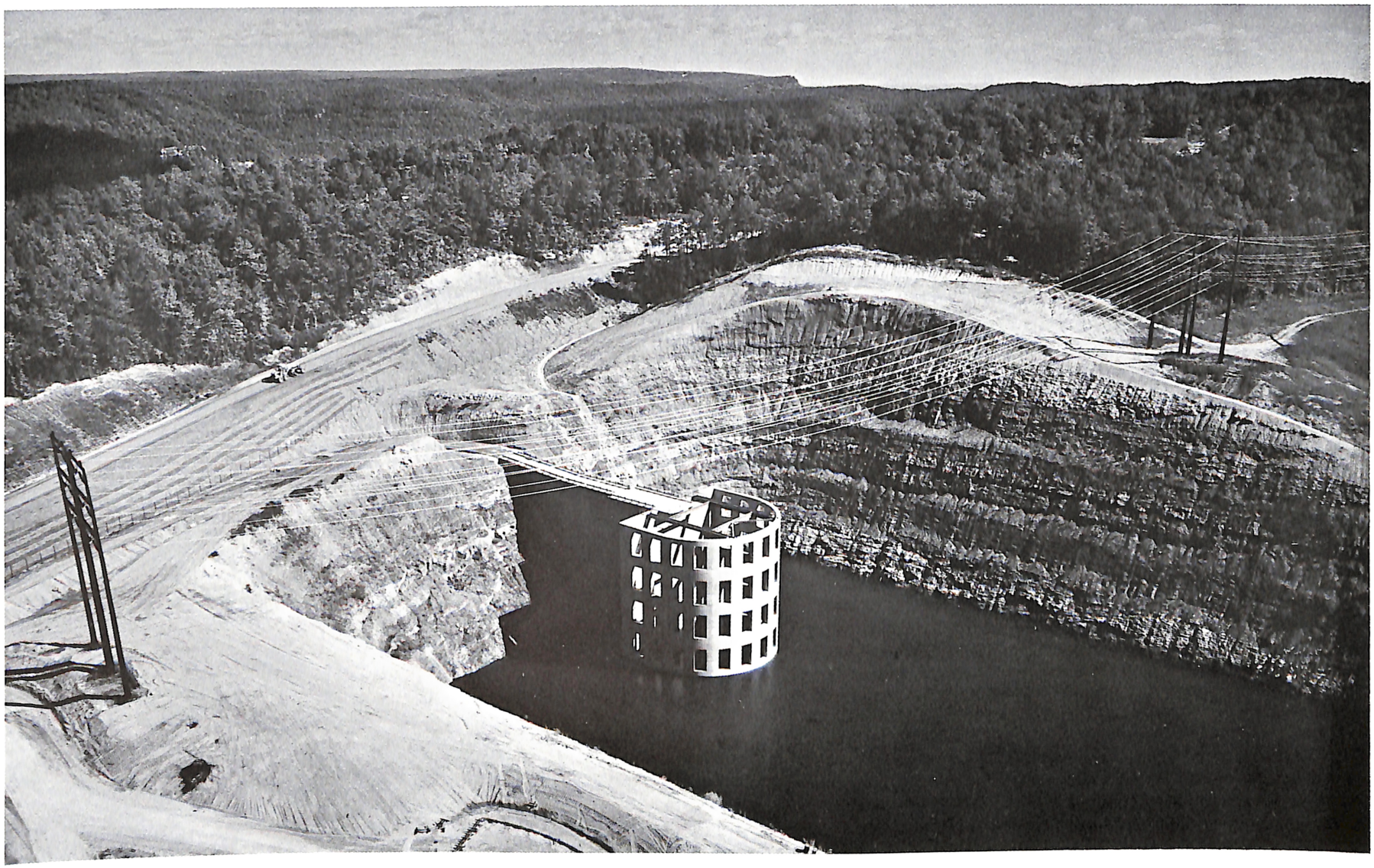
What the visitor cannot see is a parallel, more confined cavern beside the power chamber for the transformers, and from these chambers two parallel tunneled roadways. One provides roadway access for trucks and operating personnel; the other serves as a vent and emergency exit. Both rise in a gradual incline from the level within the mountain below that of the river for three-tenths of a mile to the outside face of the mountain, a safe height above water level. A third tunnel, thirty-five feet in diameter, serves as intake and discharge from and to the river. Three gravel-filled reinforced concrete cylindrical cells out from the mouth of this opening baffle the force of the water as it returns to the river (Fig. 7). Beyond these a pallisade of twenty-two more such cells reinforce the baffling action. Bridging and decking over these provide a place for fishermen, with a toilet building at hand, as further proof of the breadth of TVA concerns.



7. River Intake/Discharge Area, which includes (left to right) vehicular/emergency vent, two water intake/discharge tunnels, discharge baffles, and fishing dock.

From the cavern, one comes back up the elevator to the light and view. The typical journey for the visitor now carries him the rest of the loop road, along the outside rim of the lake. A little beyond the visitor's center he is invited to stop at another turnout, through a bermed wall of the lake for the best view of the tower at the intake/outlet of the lake (Fig. 8). A silo structure, 220 feet high, with nine rows of "windows" each eight by sixteen feet, when unemersed recalls one of Louis Kahn's ruins, or the roofless, unglazed window walls of Aldo Rossi's building of emptiness for his scheme for the Modena Cemetery. This serves to mitigate the vortex action of the water as it is sucked from the reservoir down the drop to the turbines, the height of the cylindrical building gradually revealed story by story as the level of the lake falls.

Now around the outer rim of the lake. There are no enlivening boats as on the usual TVA lake, nor as in Cole's Goblet. Too bad the lake had to be fenced because of the fluctuation of its level and the danger of the vortex at the intake tower, but the fencing is relatively innocuous as a wide aluminum band held close to the road. The road winds between the low fencing, with the lake on one side and an awesome drop down the boulder front of the dam on the other, as it makes a new slope for the mountain. Movement around the rim is exhilarating and a little frightening.



8. Vortex Tower.

As the loop road leaves the brim and regains the actual slope of the mountain a fork takes off from the loop, drops below the level of the dam and down a slope off to one side. Here, where some of the impermeable clay came for making the core of the rock-faced dam, the bulldozed area is, like all other areas of borrow, returned to landscape. It serves as an open clearing for picnicking and games (as well as for wildlife, which flourishes best and with more variety where the forest breaks out into occasional clearings). Typically, TVA provides park-like recreation areas at all its major hydro facilities, which are appropriately set off to one side in their own enclave, so that one leaves the monumental precinct to relax in a more informal manner.

Scattered about the picnic area are more triangulated structures. There is a corrugated metal box for restrooms floated off the slope on stilts and entered over a bridge (shades of post-World War II Breuer!); but the bridge relates to the box on a diagonal, and enters it at a corner into a diagonal slot. There are clusters of picnic tables set on stepped concrete terraces, with floating triangular roofs above some serving as shelters. They mean to pick up, in a muted manner, the scissored, angular image of the handsome visitor's observation building; but here in the woods, for such modest purposes, they seem somewhat assertive. Better, one feels, the simple, almost invisible, wooden rusticity of earlier projects for this kind of purpose.

In fact, the architectural and equipment design is, if handsome and appropriate piece by piece, a bit discordant as a remembered whole: the Miesian control station in the midst of the crisp, star-warred switchyard; the rusty, red ruggedness of the towers for the power line; the exploded, graphics-sort of house image for the visitor's center, with more outer-space allusion underground, and the thin reverberation of its triangularity in the picnic structures; all mingle with remnants of the large-scale Purist geometry typical for the original TVA dams, in such incidents as the vortex tower in the lake and the colony of cylindrical baffles in the river. This variety indicates an admirable freedom in "coming up with new ideas," and a willingness to experiment. But the sense of the unification of all parts of the project as an entity is dimmed, and, to a degree, the sense of the larger unification of each project with the entire system which was so vividly present in most of what the Authority built during its first decade and a half.

At Raccoon Mountain that sense of visual identity which should be carried in mind as one moves from part to part of the project, and reinforced with each encounter, is muffled, as though no controlling designer had been sufficiently forceful to hold the big concept fully in mind. Certainly the disparity between steam and nuclear facilities which predominated in later construction, contrasts with the homogeneity of the hydro-system earlier, and partially accounts for some diminution of the old sense of identity in the largest TVA installations. The very nature of these more radically changing technologies, their independence of the natural environment, and even the desire to give each of the plants its own identity, all acted against the older design tradition, as perhaps did a larger design bureaucracy, and possibly feebler, less continuous leadership in design. But here, at Raccoon Mountain, it should be added, the appropriateness of the design of all the pieces, and the awesomeness of the colossal nature of the integration of the projects as a whole diminish awareness of the patchwork quality of some of the detailed design decisions.

The picnic field fans down to the woods below. Far down the slope, at the toe of the dam, where a stream once rushed down a cleft in the mountain side, and where the dam wall as a huge V of piled boulders is consequently highest, there once was a waterfall. It was another aim of the landscapists to preserve a recollection at least of this waterfall and its stream, as a wispy seepage from the bowl above, like the spill through the porous lip of "The Titan's Goblet."

Thinking on this grandiose union of nature and technology conjures up two strata of history. The first, and deeper, is the eighteenth-century garden with its man-made lakes and waterfalls, its grottoes and gazeboes, its drives and picnic places, its rambles and panoramas. How tempting, in fact, to find parallels between Raccoon Mountain and the eighteenth-century garden "folly" - but inverted, with the delight in the artificial and fanciful manipulation of nature barely submerged by the technological reasons for its use. Raccoon Mountain also conjures up this ancient meaning of folly if one thinks of the extremes to which the insatiable demand for energy can drive us.

The second stratum of history lies closer to the present. It is of course the promise of the "clean" electrical age with its integration of landscape and technology which is enshrined in the temple deep in the mountain's interior. The vision of such as Tony Garnier and Lewis Mumford, it was the vision in which TVA was born and to which, deficiencies notwithstanding, it has remained truer than any other enterprise in America. This, after all, was the way the modern world was supposed to happen.

THE T V A AS AN ALLEGORY

Walter L. Creese

> When a man or people of tremendous energy and vitality appear, with a feeling of manifest destiny, great *power* of action is not necessarily associated with a correspondingly great *pattern* of action.
> - Arthur Morgan, *Nowhere Was Somewhere*

The Tennessee Valley Authority was a means by which the federal government set out to improve the arrangement of a segment of the environment for a group of its own people. It did not address only a phase of their difficulties through indirection, as with the less imaginative and more familiar devices of tax concessions or fiscal guarantees, but attempted instead to provide an actual physical model for the enhancement of the whole of community life. Architecture and engineering were regarded as singularly important for this undertaking, because they were *prima facie* evidence of good intent.

The architect would hence be asked to apply his creative attention directly to the task at hand, rather than to retreat romantically from it, even though the enterprise itself was a romantic gesture to begin with. His ideas were promised implementation.

Nevertheless, we will be unable to find an adequate niche in American history for the TVA unless we are also ready to acknowledge it as an allegorical, as well as an actual, enterprise. There are three reasons for this. First, it has been the American habit to consider noteworthy landscapes as existing half in and half out of reality - the "middle landscape" of Leo Marx's *Machine in the Garden*, where the TVA is not discussed - largely due to the influences of Puritanism, Romanticism, and Transcendentalism. Religion furnished the ethical incentive: the two naturalistic movements supplied the impulses for projecting such an abstract frame of thought onto a very remote horizon, as has always been the volition of the American when he found himself in larger geographic spaces. These were exploratory impulses toward nature, deriving not from anti-urbanism as much as from a search for the ideal city that had so far never existed. The complementary second reason is that the TVA buildings and dams turned up in the somnolent valleys and coves of the Tennessee River, apart from the tighter social systems of the more urbanized northeast and middle west, where its reform might more logically have been expected to appear. Allegorically, the TVA was an anxiety expressed over the chronic condition of cities and big time industry - but somewhere out in the country, similar to what the much earlier utopian settlements of New Harmony, Indiana; the Shaker colonies of Kentucky; and the Nashoba and Rugby villages in Tennessee represented in reaction against the early nineteenth century urbanism and industrialism of northern England. The third reason, aligned with the first two, is that such a complex order, on a major physical scale, was to be executed, not out of an expansive wave of prosperity, as if from the 1870s and early 80s, the teens and 1920s in the north, or as if from the much more universally prosperous and free atmosphere of the 1950s and 60s, but out of the anxious, inhibiting, and impoverished era of the 1930s and 1940s. The 1930s were rich in human decency and basic resourcefulness, perhaps, but not in soaring, masterful, or well crystallized visions. These negative circumstances made the TVA that much more vivid as an allegory.

The thrill of dealing with reality came from envisioning a great shaping power arising from a big, private corporation, backed by the authority of a national government, exactly the two-barreled effect Franklin Roosevelt said he wanted most for TVA. This combination of capital sources was actually to work for the subsequent mobilization of money and skills during World War II, when America was able to regroup, but it did not happen in 1933. The disconcerting reality then was that the senior corporations were paralyzed by the Depression, and the federal government was not able to extend many credits either. TVA grandeur turned out somehow pinched, and precious little of the all-encompassing "authority" mentioned in the title was ever really exercised, despite the TVA's oft-announced interest in daring experimentation and liberation from interference from Washington in general and Congress in particular. Other intellectual or artistic causes have sometimes been employed to explain the TVA in reverse - *ex post facto*. Popular texts sometimes ascribe the priority themes upon which the effort was based to the contemporary New York City intellectual movement known as Technocracy, when investigation shows there was no such intensity of intellectualization in the build-up of the TVA. Its evolution tended instead to progress by intuition, to be very action-oriented, and to be slightly anti-intellectual.

The International Style in architecture has been used as an explanation for how the TVA constructions first appeared, but the time sequence makes that difficult, if not impossible, as far as the effectiveness of the cast of characters is concerned. The TVA was begun in 1933. While the famous Museum of Modern Art exhibit on Internationalism took place in 1932, there was at that time no Internationalist-CIAM architect poised and ready in this country for executing large projects in the public domain. Walter Gropius came to the U. S. only in 1937, and Mies van der Rohe arrived in 1938. Yet the Museum of Modern Art furthered the impression that there must be some underlying derivation from the International Style when it mounted a major exhibit of TVA buildings in New York City in 1941, when the oncoming war made the regional experiment suddenly appear that much more significant nationally. The job of directing the project architecturally had gone to non-Internationalist Roland Wank because he gave concrete evidence of being able to handle large-scale commissions well - most recently, the large trackage and complicated circulation of the modernistic Cincinnati Railroad Terminal, begun in 1929 and completed in 1933. That was a grandiose accomplishment, available to the direct scrutiny of the organizers of the nearby TVA.

Whatever the ultimate stylistic appearance of the TVA was to be, it took on a much more substantial look to those in Washington, D.C., when World War II broke out, because by then it had developed a cache of hydroelectric power, which had a large potential benefit for the manufacture of aluminum for military airplanes, in which Senator Harry Truman was greatly interested; later for the enrichment of uranium; and later still for the levitation of rockets, under the guidance of captured, and then imported, expert Werner von Braun. Its significance thus mutated from regional to international, and from a philanthropic enterprise to an eminently pragmatic one in an extremely short time. This is another reason why the TVA has been reckoned as having been executed in the Internationalist vein: it took on international political overtones so abruptly. What had been instigated to make immediate work and to draw a desperately needed amenity closer to the present and real surroundings now generated electricity for a distant, overseas emergency instead. At the outset of the TVA, houses in the Town of Norris were designed to emulate the folk architecture of the Tennessee uplands and foothills. Arts, crafts, and woodworking skills for resident families were taught. Initially there was a turning back of the clock, rather than setting ahead as to the future war, in order to regain stability for the local society. Although twenty experimental concrete block houses were erected by Earle Draper at the behest of Chairman Arthur Morgan, they resulted from the latter's empirical interest in the building material and had nothing to do with international design theory. The Norris houses, most thoughtfully planned, were criticized thereafter for not having flat roofs, instead of for being far too small, which was their real failing. The endorsement of minima became a government obsession during the 1930s. When another of the minima, the flat-roofed, prefabricated house delivered in two halves, was finally evolved by the TVA in the early 1940s, with lots of glass girdling it in Internationalist fashion, forecasting many of the manufactured prefab houses of the post-war period, it was conceived again primarily for an empirical rather than a consciously stylistic reason - portability. In a like manner, labor teams were organized so that they might easily progress from site to site as dam projects sprang up. The ingenious system of keeping TVA work teams together on succeeding sites, rather than turning to new contractors each time, was called "force account." The motifs, methods, and terminology were homegrown, although hundreds of the prefabs were to be shipped without fanfare to England during the Blitz to provide emergency housing around London; and five thousand, costing $1700 apiece, went to Oak Ridge to get the atomic city started. The empirical aspect of what the TVA idealistically attempted, rather than the theoretical, marked it again and again as American, as with the choice of building types and architects, which in a few cases brought about brilliant solutions that worked well, and which also collected superior talents in a time of professional underemployment of architects and engineers.

There were urgent concerns over cultural nutrition which would not favor either a stylistic or a theoretical uniformity. One was the previously mentioned need to restimulate the atrophied folk roots, which came out most clearly at the Town of Norris, but also continued as an undercurrent in the other dam and recreational settlements, even as far and late as at Land Between The Lakes at Kentucky Dam at the end of the Tennessee River. The rustic drift was likewise to be felt in the day to day administrative policy, described in the early and excellent study by Philip Selznick, *TVA and the Grass Roots*. An accompanying, but unfortunately much vaguer, goal was to restore a general amnesty and hegemony for the whole of southern society, which had previously so lacked personal dignity because of reduced dollar income following the Civil War. This was the source of much of the ad-libbing which went on in the TVA almost from the start. Both David Lilienthal and Arthur Morgan, although diametrically opposed as to how this end ought to be wholesomely pursued, nevertheless sensed its symbolic necessity. In the architecture and engineering, therefore, an unusual altruism and earnestness began to appear. Beginning with Norris Dam, people were invited into the TVA buildings to enjoy them. The powerhouses had reception vestibules. As with the Early Christian basilicas, the very warmth of the surface materials, the veneers - marble, cork, chrome,

terrazzo, and colored ceramic tile - were calculated to mysteriously nourish the habit of denial and asceticism for the ever-present faith, this time in technology, as often happens in distress periods in the U. S. The chambers for housing the machinery came close to looking like shrines without priests, with the hum and vibration of the turbines and generators in the shadows offering the invocation. The sheen of the more sumptuous materials in the gloaming also provided an intimation of better private housing to come. This was where the local housewife was to get an inkling of that, the chief architect said. Although the internal and external visions were so positive, even emphatic at times, it was always the quieter atmosphere, the twilight mood, the lingering effect of geographic isolation, which made the dams, the interiors of their auxiliary buildings, and their outdoor sites so haunting and memorable. When one comes upon them even today, as when he turns the corner on the lower road to Norris Dam and suddenly finds himself dramatically confronting a great concrete cliff, 265 feet high, he is still more struck by the serenity of the two valley hillsides it conjoins. Harmony and order, validated and fused by the forces of concrete and electricity, were to be organized by "efficient" managers, who appeared in unacknowledged contrast to the disorganized and inefficient hard-scrabble dirt farmers and mountain miners beyond. People tended to fall more easily and colorfully into regional categories then, and to be seen as cameos more by and for themselves. They were kept small and discreet and had little or no power and influence, except in photographs. This screening effect was greatly enhanced, especially for the south, through the sensitive photographs of artists like Walker Evans or Lewis Hine. There was a bite to this etching of the local characters that somewhat offset the blandness of the middle management, necessarily imported. What was also very American about the enterprise was that it contained the allegory of a setting about to be rejuvenated, phoenix-like, as in Chicago after the 1871 fire, or San Francisco after the 1906 earthquake and fire. Technology would overcome! This therapeutic incitement is further illuminated when it is realized that while European dictators were rattling their sabers and spinning their propellers getting their land and air forces ready, Franklin Roosevelt was going to some lengths to create and display conspicuous emblems of peace. He held to a similar vision for national parks and forests. It was a type of postscript on the older American Agrarianism. Visible art was supposed to offer an affidavit for peaceful intentions, whatever else the art of propaganda was preparing for the European continent. That native organizational capability was well understood by those European intellectuals who were not already in America or still sympathetic with disheveled democracy. The Englishman Julian Huxley typified their response when he wrote *TVA: Adventure in Planning*, declaring that the TVA retained the assurance for "how to integrate human construction and its natural environment into a planned whole, and to do so in a way which shall conduce to better living, including aesthetic satisfaction." It was that last measure which was so praiseworthy.

The Tennessee hills were far from the buiding war clouds, but not quite far enough. Eventually those hills were to be commandeered to furnish actual physical protection against spying and sabotage at Oak Ridge, with its dark military secret. It had nothing to do with the TVA, except for its location near the dams because of their ready power supply. The folk flavor disappeared entirely in Oak Ridge, leaving only the transient, impermanent effects, combined with the older efficiency, stepped up. The ambient turned from one of dreamy expectancy into another of crushing urgency and anxiety.

The persistent impression that the TVA ultimately depended for its larger imagery upon European, rather than vernacular houses or American industrial prototypes, was not completely without foundation, however. The dams and powerhouses used the Internationalist material of concrete, but they were also highly symbolic expressions: substantial, large, and monumental in appearance, and as such would never have been much approved by the Internationalists. There was a degree of nobility in them. The explanation for this basic disparity lies in the fact that the chief architect of the TVA during the first decade, the aforementioned Roland Wank, was brought up architectonically on the reform measures of Otto Wagner and his Viennese Secession pupils, Hoffmann and Olbrich. Wank had arrived in New York City from Vienna and Budapest in 1924, over a decade before the advent of Gropius and van der Rohe. Wank's obvious satisfaction in employing shiny and luxurious materials in his rooms, with metal banding and edging, together with checkerboarding on the concrete walls outside, all having to do with surface animation, had much in common with Otto Wagner's approach to public works for Vienna. Wagner's designs for the Postal Savings Bank, begun in 1904, his railroad stations for the Stadtbahn, and the Ferdinand Bridge Project (1905) with pylons of reinforced concrete covered with white and gold tiles and anchored with bolts, were rendered in successive layers, much as in the TVA projects. More specifically, Wank's designs are related in spirit to Wagner's Nussdorf (1894-98) and Kaiserbad (1904-08) Dams on the Danube Canal, where the control buildings were decorated by white marble slabs and cobalt blue tiles, with very precise regulating machinery within. Both architects displayed a preoccupation with succeeding layers of solid wall-planes, which would disappear with the advent of Internationalism, with its preference for the thinnest, most transparent, and delicate curtain walls of glass. Yet both architects were admirers of the latest technology, utility, and efficiency, just as the later Internationalists were, and used

aluminum to garnish the ensemble, a material which was not turned out in any quantity until after World War II, as far as buildings were concerned. What is basically represented is a sophisticated cycle of civic adjustment and readjustment. Its Viennese panach may appear out of place in this rural valley, unless one recognizes the qualifying value of similar good intentions on the part of both architects on the two sides of the Atlantic - Wagner or Wank. Wank significantly revealed that he conceived of the Norris Dam design as if it would someday be surrounded by a city.

If the difficult-to-identify eclecticism, the circumstance in the U.S. of always having to create in crisis, and the lack of discernible traditions following one another in public architecture can be assimilated, then the TVA comes at last alive as a great and productive experiment, boldly aspiring to bring dignity and monumentality into a place where they had not been seen since the Civil War, thus planting a seed of meaning for all the rest of American life. What made it so unusual in government patronage in the U. S. was that it was meant to be seen rather than merely verbalized or confined to paper documents. It was a comprehensive backdrop by intention. But the implementation of the broader scheme was all too brief, weak, and indeterminate in relation to the size of the Roosevelt ambition and vision, even in the 1930s, when adversity in the national life gave it all the moral "authority" it would ever need. Its peculiar drive lasted no more than four years, until 1937, just when the International Style was beginning to get a grip on the northern imagination. Within those later years of the decade the regional planning office of the TVA was abolished and its function handed over to state and local agencies, a move which brought with it much less motivation for integrating architecture with the landscape on a broader scale. The principle of the national government retaining land around the shores of manmade lakes for many purposes, including recreation, was diminished. The moments of visible truth or triumph were all too brief, and the available budget had never really come up to those moments anyway. It was as if one splendid lost cause were generating another. The finale was that a long range plan was to be carried out as if it were a brief charitable impulse. It may be more helpful, therefore, to regard the fruit of the TVA architecture and engineering as a series of smaller effects achieved, to be assessed largely on their own merits, rather than one great trunk of a tree of success, whatever the original intent.

Can there be any greater ghost tradition building up, despite the intrinsic fragmentation? What stands behind the whole apparition, it would seem, in addition to turn-of-the-century Vienna, is the midwestern fantasy of Daniel Burnham, as first played up in his Chicago Columbian Exposition of 1893 (the same year as Wagner's winning competition design for a master plan for Vienna), followed by his Chicago Beautiful Plan of 1909. Of course the 1893 exposition was an epic vision of a new civic order out of the extremes of Victorian urban chaos, while the TVA was absorbed in a bucolic regionalism, surrounded by trees; but there is nevertheless something wanting definition to be discerned in the latter from the former. Burnham wished a great surprise to surface out of his revelation of what the ideal American city might be. He kept the drawings of his Chicago scheme of 1909 under curtains on the wall of his office all the time he was working on them. Roosevelt wanted a similarly sensational effect to explode from his sudden vision of a well-modulated and better-balanced countryside. Essentially, therefore, both Burnham's and Roosevelt's dreams were short *and* long termed. The impact of the visual revelation was supposed to convince for the long term in each case. This is the explanation of the seeming paradox. The TVA was thus in its way an exposition or fair also, only it lasted a few years longer.

The expressive inhibition in architecture in each instance arose from the fact that so far no patois of classicism had been accumulated with which to formulate quickly the messages of dignity in public performance, in a way worthy enough of the noble end in view. Instead, the messages were "canned," like singing telegrams. This was at the heart of the complaint of Louis Sullivan against Burnham's exposition, that it set American architecture back half a century because it expressed no well-evolved, native, public style. Both the exposition and the TVA represented an "instant," capsuled classicism. While the political Progressive Movement and the wellspring of Conservatism could be fiercely literal and esthetic at the same time, when looking at a given set of natural resources in the Far West, their tastes in architecture were far from being as well-educated or focused, perhaps only inadvertently because their ideal areas had little or no ideal architecture in them and were preferred to be virtually without inhabitants. The great radicalism of the TVA in the conservationist context was that it paid so much attention to buildings.

America, through a lack of concentration, patience, or failure to sustain enough visual research and cultural discussion - undertakings as important as scientific and engineering research for a national sense of proportion, direction, and general well-being, as Finland, Holland, and Britain should have taught us by now - has never been ready enough with the right architecture when the next great moment, billed as a surprise by its originators, arrived. Even beauty has customarily been reviewed in the court of last

resort in this country; the interest in it has always been there, but the long ranged support has been apt to falter and wither, since our attention span is so short. In contrast, it was the strength and goodwill invested by the federal government directly, practically, and immediately in the service of a distressed people (unique in the 1930s because they were not a displaced people like the European refugees or the Okies and Arkies of the southwest), which made the TVA so remarkable at the start. The place itself was to be upgraded, while the people remained resident in it. This hands-on-the-site approach, and the innovative and non-threatening way in which it applied technology newly available (like long distance electrical transmission), were the original novelties, which really have not been equalled since in good intentions. Operationally, the TVA stood for a gentle comforting, with a reassuring flourish and local gesture: a humane touch. Its weaknesses were also its virtue. It was an apology to a particular region for the fact that it had been left outside so long.

Yet the TVA also demonstrated through the means of a much more farflung national and international allegory that the romantic and always migratory dream of the U. S. Eldorado, the ideal, shining, utopian, better place apart, was expected to have a peculiar morale-building effect nationally too, even in the twentieth century during dire emergencies and under unnaturally harsh social and economic conditions; indeed, it was to be once more cogently and poetically engaged then. The caring is what makes the design of sophisticated dam or rustic cottage bloom.

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7. The Cherokee Project (1946)
8. The Watts Bar Steam Plant (1948)
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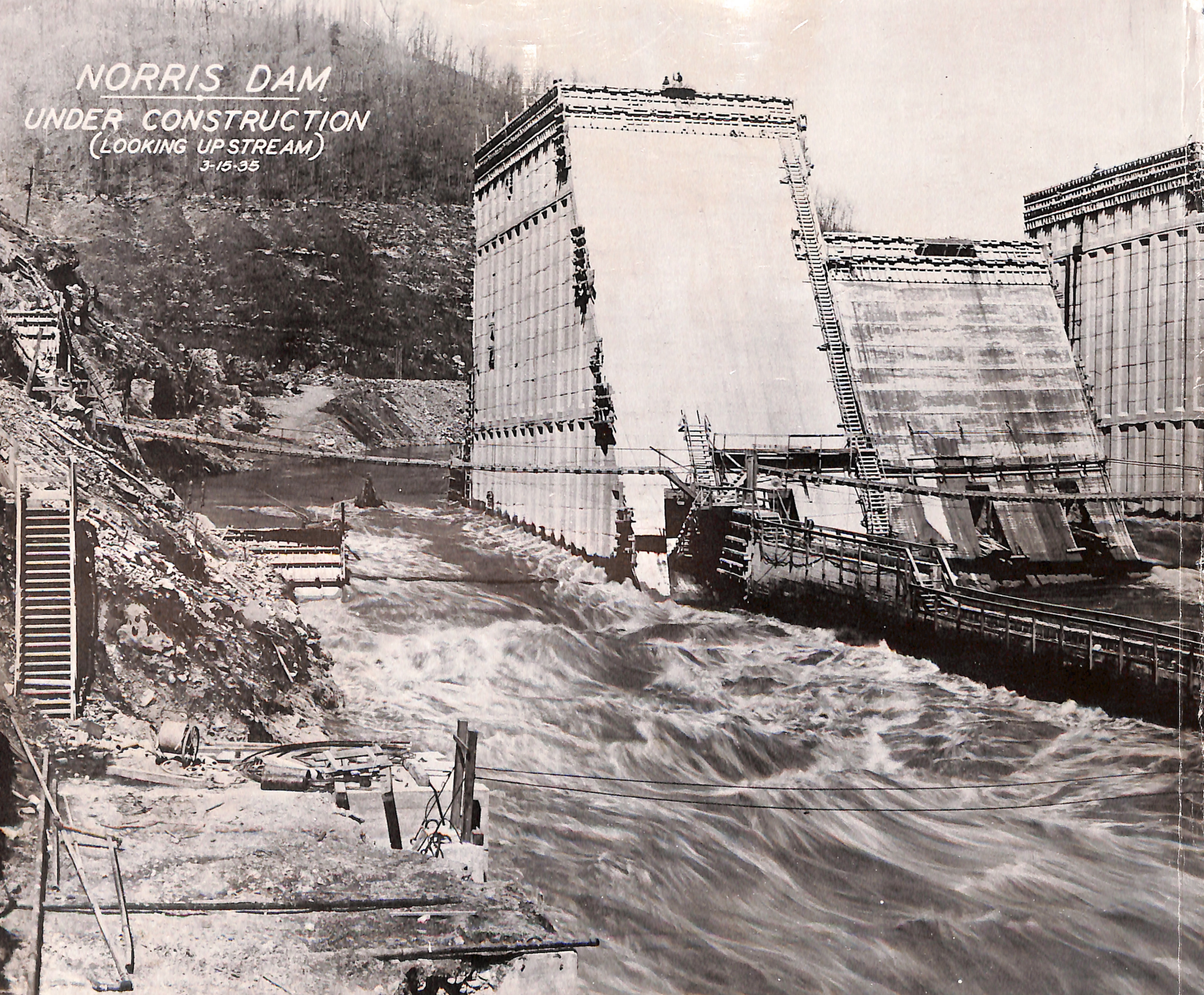
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NORRIS DAM
UNDER CONSTRUCTION
(LOOKING UPSTREAM)
3-15-35