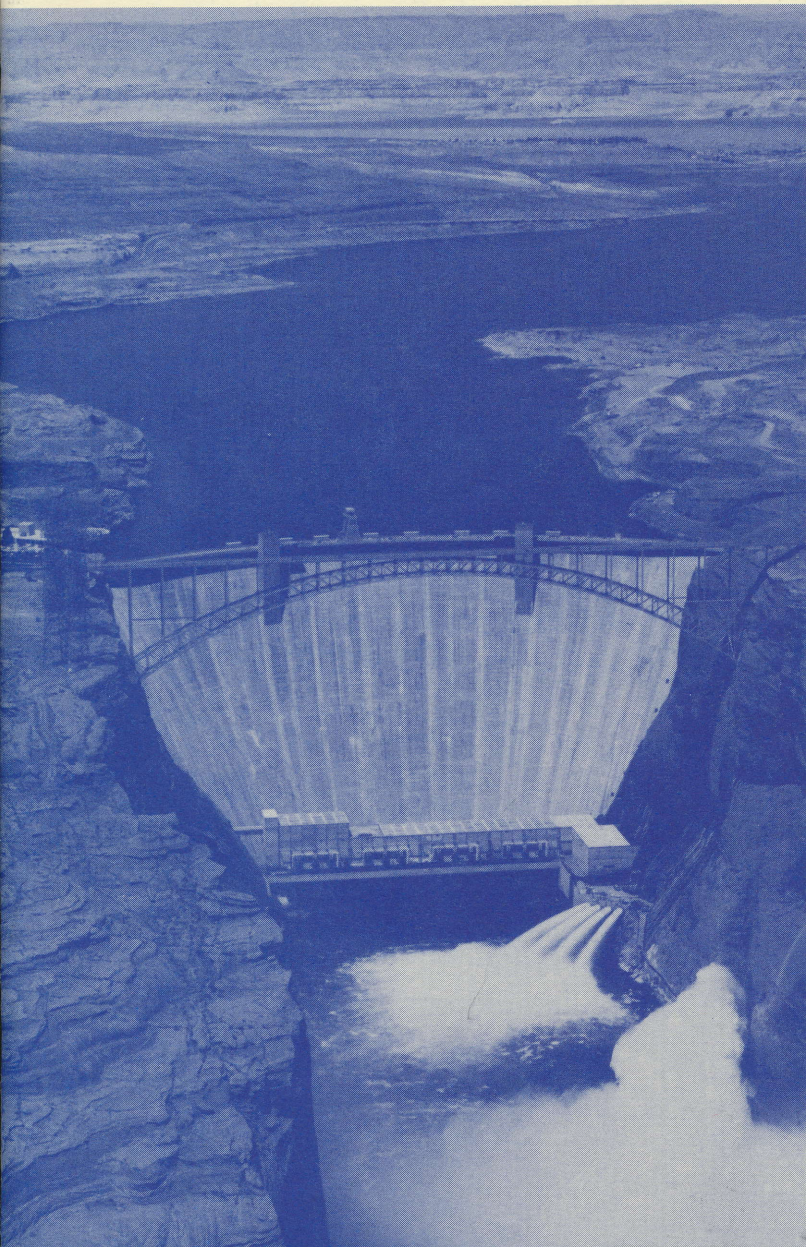
U.S. Department of the Interior

Bureau of Reclamation

Glen Canyon Dam and Powerplant

Self-Guided Tour



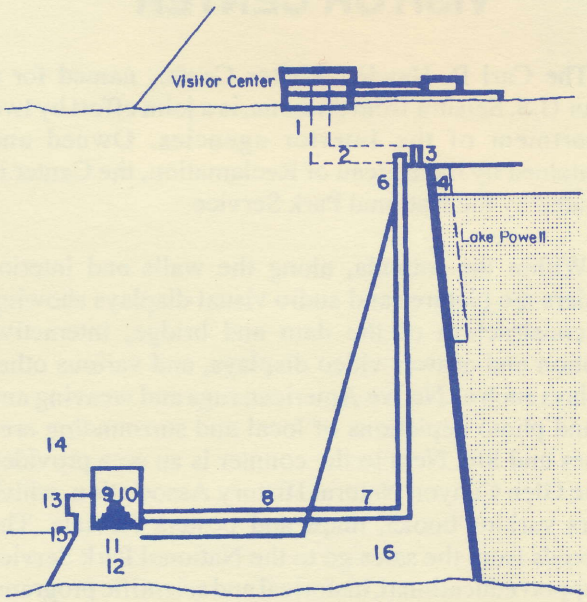
THE CARL B. HAYDEN VISITOR CENTER

The Carl B. Hayden Visitor Center, named for a senior U.S. Senator from Arizona, is a joint effort by two Department of the Interior agencies. Owned and maintained by the Bureau of Reclamation, the Center is operated by the National Park Service.

Within the rotunda, along the walls and interior dividers are pictures and audio visual displays showing the construction of the dam and bridge, interactive question and answer video displays, and various other displays such as Native American rugs and weaving and art and photo depictions of local and surrounding area scenes and life. Next to the counter is an area provided to the Glen Canyon Natural History Association, which offers various books, maps and posters for sale. The proceeds from the sales go to the National Park Service to support educational, historical and scientific programs for the benefit of Glen Canyon National Recreation Area.

Down the long hall and to the right of the Gift Shop is the auditorium, where a slide montage and movie presentation are shown on a scheduled basis. Other movies are available upon request.

CROSS SECTION OF GLEN CANYON DAM SHOWING TOUR STATION



1. Elevator from Visitor Center to Crest of Dam Access Tunnel
2. Tunnel to Crest of Dam
3. Crest of the Dam
4. Penstock Gate Chamber
6. Elevator into Dam
7. Gallery from Elevator to Powerplant
8. Bridge from Dam to Powerplant
9. Visitor Gallery
10. Power Generating Room
11. Turbine Pit and Shaft-Governor
12. Governor Gallery
13. Powerplant Transformer Deck
14. Rock Bolts
15. The Colorado River
16. Glen Canyon Dam

1 ELEVATOR FROM VISITOR CENTER TO CREST OF DAM ACCESS TUNNEL

The tour begins on this elevator which will take you 110 feet (34 meters) down to the level of the crest of the dam.

For the protection of all who take the tour and for the facility itself, at this point security guards will ask you to open all bags large enough to contain devices that might harm people or do damage to the dam or powerplant.

Push the button marked: "Tour".

2 TUNNEL TO CREST OF THE DAM

Upon leaving the Visitor Center elevator you will enter a short tunnel through which you will walk to the crest of the dam.

3 CREST OF THE DAM

The crest length of Glen Canyon Dam is 1560 feet (476 meters). The width of the roadway and sidewalks totals 35 feet (11 meters). Imbedded in the concrete are rails for the 165-ton (150 metric ton) traveling gantry crane, the high steel structure you see on top of the dam. The gantry crane is used to install stop logs and remove underwater gates for maintenance.

4 PENSTOCK GATE CHAMBER

The 8 small buildings (penstock gate houses) on the upstream side of the dam contain machinery to operate a gate on each of the 8 penstock intakes. The penstock is a 15-foot (5-meter) diameter steel tube, 500 feet (152 meters) long, which carries water from the lake to the turbine in the powerplant. The top of each structure is removable to permit the gantry crane to raise the heavy penstock gate for inspection and maintenance.

From the top of the dam, the lake elevation at any particular time may be read on a scale on the upstream side of the dam near the unit 2 penstock gate house.

On each side of the dam, about 1/3 mile (1/2 kilometer) upstream, you can see channels cut into the canyon walls, creating a spillway intake. The spillways are used to bypass water around the powerplant when necessary.

5 GEOLOGY OF GLEN CANYON

The portion of Glen Canyon you can observe downstream from the dam is typical Navajo sandstone, a thick formation that extends downward about 500 feet (152 meters) below the riverbed. Navajo sandstone is principally solidified sand dunes, perhaps 150 million years old. In this section of the canyon, the cliffs are sheer and high, while the cliffs upstream from the dam along most of Lake Powell were eroded over the ages into many picturesque formations.

This site was chosen for the dam because the canyon is narrow, the rocks are stable with no nearby faults, and an ample supply of hard rock aggregate for concrete was located nearby in the bed of Wahweap Creek. Consequentially, the cost of building the dam here was much less than other sites.

6 ELEVATOR INTO DAM

The west side elevator (right side facing downstream) will descend 528 feet (161 meters) to a landing deep in the interior of the dam. The trip will take just over 1 minute.

Push the button marked: "Tour".

7 GALLERY FROM ELEVATOR TO POWERPLANT

As you exit from the elevator, you will enter one of the dam's many galleries.The 50 degrees F (10 degrees C) temperature remains constant year-round.

Galleries are necessary in concrete dams for inspection purposes. In this gallery, over 100 feet (30 meters) of concrete lie between you and Lake Powell.

A display at the end of the gallery leading from the elevator shows a portion of the maze of galleries throughout the dam.

The polished concrete cylinder below is a core sample taken from the dam. It displays the unusual hardrock aggregate taken from Wahweap Creek bed.

Follow The Signs To The Powerplant

8 BRIDGE FROM DAM TO POWERPLANT

86,000 square feet (8000 square meters) of grassed area lies between the dam and the powerplant, almost 2 full acres (.8 hectares). The grass provides a cooling effect, much the same as an evaporative cooler, which aids in reducing temperatures inside the powerhouse.

The square manholes are access points used to periodically inspect expansion joints in the penstocks which are 20 feet (9.6 meters) below the grass.

A water trough at the base of the dam returns water to the river which seeps through the dam.

The water running down the face of the canyon wall is normal seepage through the porous Navajo sandstone.

9 VISITOR GALLERY

To your left is a digital counter which registers the money collected from the sale of power. This money pays for the cost of operation and maintenance, and for repayment to the U.S. Treasury of the original construction cost, as well as costs of other authorized Project features.

Also on your left is an audio-visual display illustrating a hydroelectric powerplant with a time delay film clip showing the removal of one of the generator rotors for repair. Push the button to start the film.

Continuing clockwise, on the right, is a display board containing pictures of the staff necessary to operate and maintain the dam and powerplant.

Next is a piece of the cable from the cableway cranes used during construction to lower concrete and materials to the worksite below.

To the right of the entrance door is a step by step display of the process of producing and transmitting electricity from the generator to the consumer.

Push The Button To Start The Display.

10 POWER GENERATING ROOM

Glen Canyon Powerplant has eight electric generators that were originally installed from 1964 to 1966. The plant was uprated during major maintenance programs during the early 1980's and can now operate at an output of about 1,350,000 kilowatts.

The generators at Glen Canyon are called hydroelectric generators because water flowing from Lake Powell provides the initial energy. Water flowing in the penstock passes through a Francis-type reaction turbine before it reaches the river. As the water moves quickly through the turbine it pushes against the blades of the turbine runner causing the runner to rotate like a pinwheel. The runner is connected by a large vertical shaft to the rotating assembly of the generator. The generator converts mechanical energy produced by the turbine to electrical energy or electricity.

Looking through the glass into the big generator room, you will see two overhead cranes each with a capacity of 300 tons (273 metric tons). On the floor of the generator room, the large, orange lifting beam assembly connects the two cranes to lift the 507 ton (436 metric ton) rotor during disassembly and assembly of the generators.

11 TURBINE PIT AND SHAFT-GOVERNOR GALLERY

Take the powerplant tour elevator to the lower level of the plant to view the shaft, turbine, wicket gates control, governor gallery, and other operating equipment.

Push the button marked: "Tour".

The steel shaft rotates at 150 revolutions per minute and connects the turbine runner located below the metal cover at the bottom of the turbine pit to the generator rotor above. Weighing 40 tons (36 metric tons) the shaft transmits the turbine's mechanical energy obtained from the falling water -- nearly 200,000 horsepower -- to the generator for conversion to electrical energy. The turbine requires about 3600 cubic feet per second (102 cubic meters) of water from Lake Powell to operate the generator at its full capacity of 173 million watts. With all eight generators operating at full output, over 15 million gallons (60 million liters) of water pass through the powerplant's penstocks each minute.

The amount of water flowing through the turbine is controlled by precise positioning of the two large hydraulic pistons you see on the downstream wall of the turbine pit. One piston pushes while the other piston pulls on the shift ring around the center of the turbine causing the shift ring to rotate. The shift ring is connected by mechanical linkages, seen below, to 24 equally sized wicket gates. The wicket gates, 3 feet (1 meter) in length, look very similar to a section of airplane wing standing on its end and are arranged in a circle around the turbine runner. Movement of the shift ring is transferred to the wicket gates causing all the gates to move at the same time either in the open or closed direction. As the gates open more water flows through the turbine increasing the amount of energy produced by the turbine.

12 GOVERNOR GALLERY

From this point, it is 550 feet (168 meters) to the other end of the gallery, or hallway. Equally spaced along the gallery are eight identical hydraulic governors, one for each turbine. The governors, by operating the large pistons in the turbine pit and controlling the wicket gates to adjust water flow through the turbine, regulate the power output of the turbine generator units. Signals from a computer, located in the control center on the eighth floor of the plant, are sent to the governors which respond with movement of the wicket gates in accordance with the needs of the electrical power system in the Southwest.

Proceed To The Elevators. Enter The Elevator And Push The Button Marked: "RETURN".

13 POWERPLANT TRANSFORMER DECK

From this outside platform you can view the massive transformers that raise the electrical energy from the generating voltage of 13,800 volts to 230,000 and 345,000 volts for transmission to distant markets. The higher voltage decreases transmission line losses.

Each of the transformers weighs about 90 tons (82 metric tons) and includes a heavy metal core and windings surrounded by special insulating oil.The large cylindrical pipes between the powerplant wall and the transformers contain the buswork connecting the generators to the transformers. The arrangement of the buswork connects each pair of generators to a bank of three single-phase transformers.

Sitting on the base of the nearest structure is a red and white can mounted on a spindle. When generator 1 is running, the electricity passing through the electrical buss creates a magnetic field that causes the can to spin.

14 ROCK BOLTS

To your right, on the canyon wall, are many "rock bolts" which prevent rock slabs from falling. These bolts are 2 inches (5.2 centimeters) in diameter, extend from 45 to 75 feet (14 to 23 meters) into the canyon wall, and are cement grouted.

Mounted on the parapet wall is a sample "rock bolt" with the standard type anchor and the 14 inch-square (36 centimeter) steel plate which is 2 inches (5 centimeters) thick.

15 THE COLORADO RIVER

Below the powerplant, the river resumes its journey, winding through the lower reaches of Glen Canyon to pass Lees Ferry, 15 miles (24 kilometers) below here and continuing through Marble Canyon and Grand Canyon for a distance of 270 miles (430 kilometers) to reach Hoover Dam where this same water is used again to generate more electricity.

Below Hoover Dam are a series of Reclamation dams and reservoirs which furnish irrigation water for Arizona and California, as well as additional hydroelectric power.

As you look at the canyon from this point, you see it much the same as Major John Wesley Powell viewed it when he named Glen Canyon in 1869.

Glen Canyon Dam has improved water quality in the river by causing sediment to settle. In the channel below the dam, rainbow trout thrive in the clear, cold water.

On the left canyon wall you will see the service access tunnel. This tunnel is 21 feet high (6.3 meters) and 22 feet (6.6 meters) wide with a two-lane road running a length of 2 miles (3.2 kilometers) to the canyon rim. The tunnel is used to bring heavy equipment into the powerplant.

Also on the left are the outlet valves connected to 8 foot (2.4 meter)outlet tubes designed to discharge water around the powerplant, similar to the spillways, should the necessity arise.

This Completes The Tour

Please return to the Visitor Center by proceeding through the powerplant and back to the elevator in the dam by following the yellow and blue signs marked "Return". We sincerely hope that you have enjoyed your visit! If you have any questions or comments, stop by the information desk in the visitor center.

The self-guided tour has been made available through the efforts of the Bureau of Reclamation, United States Department of the Interior.

16 GLEN CANYON DAM

Glen Canyon Dam was constructed in 26 separate vertical blocks by placing successive 7.5 foot (2.3 meter) layers known as "lifts" on top of each other. You can still see the faint horizontal lines between each layer. The first concrete was placed in June 1960; the dam was topped out in September 1963.

In 1964 the American Society of Civil Engineers voted Glen Canyon Dam to be the outstanding engineering achievement of that year. A commemorative plaque is mounted on the wall to the left of the elevator entrance at the top of the dam. To the right of the entrance is a second plaque placed during 25th anniversary ceremonies held in 1988.

Total cost of the Glen Canyon Project, including the dam, powerplant, access roads, bridge and facilities in the town of Page, was about $272 million. Most of the money is being repaid, amortized over a period of years at interest, to the Treasury of the United States through the sale of electricity.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.