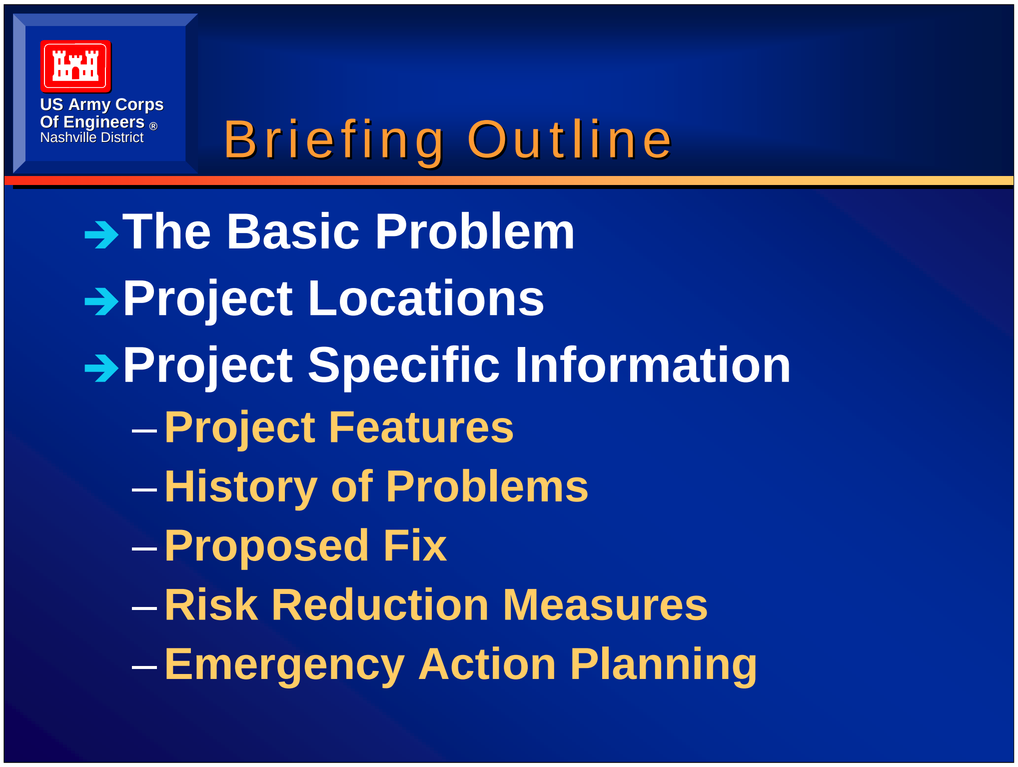
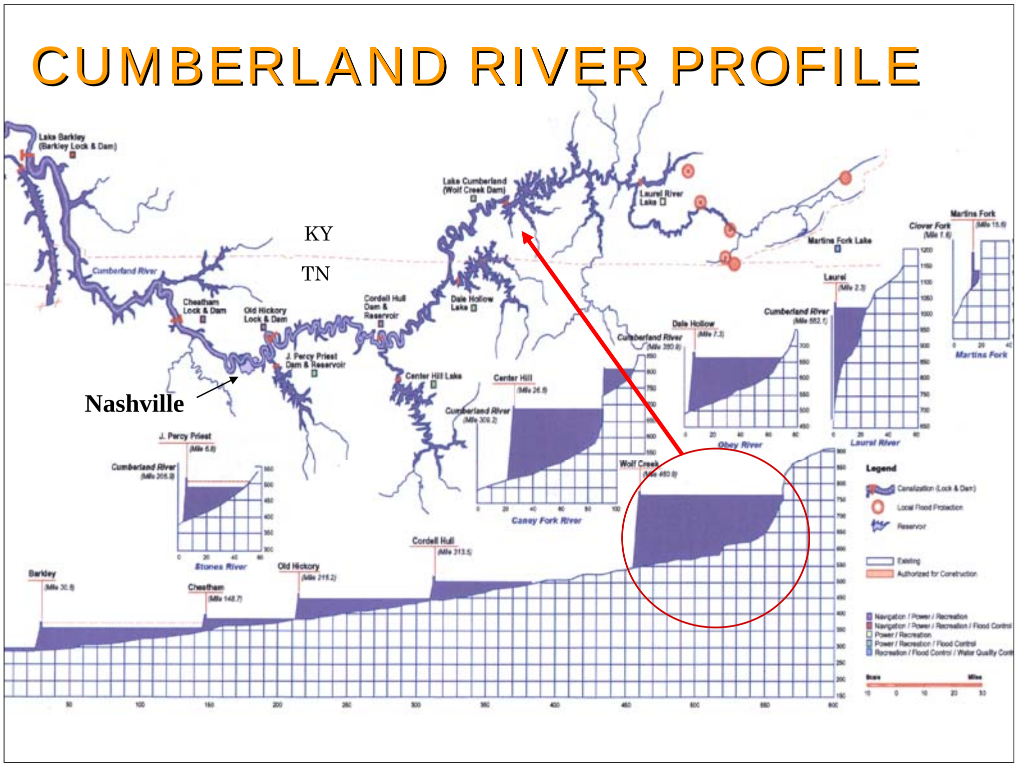
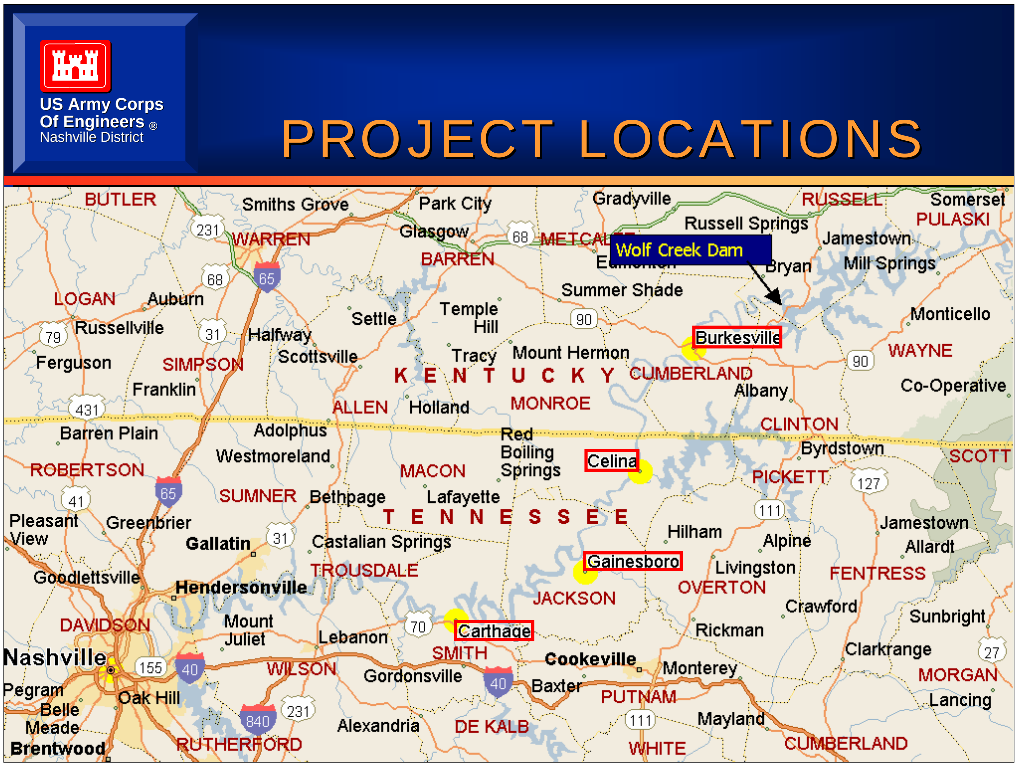
•The next several slides are actual construction photos taken in the cutoff trench. They highlight the poor condition of the rock and the inadequate procedures used in constructing the cutoff trench.



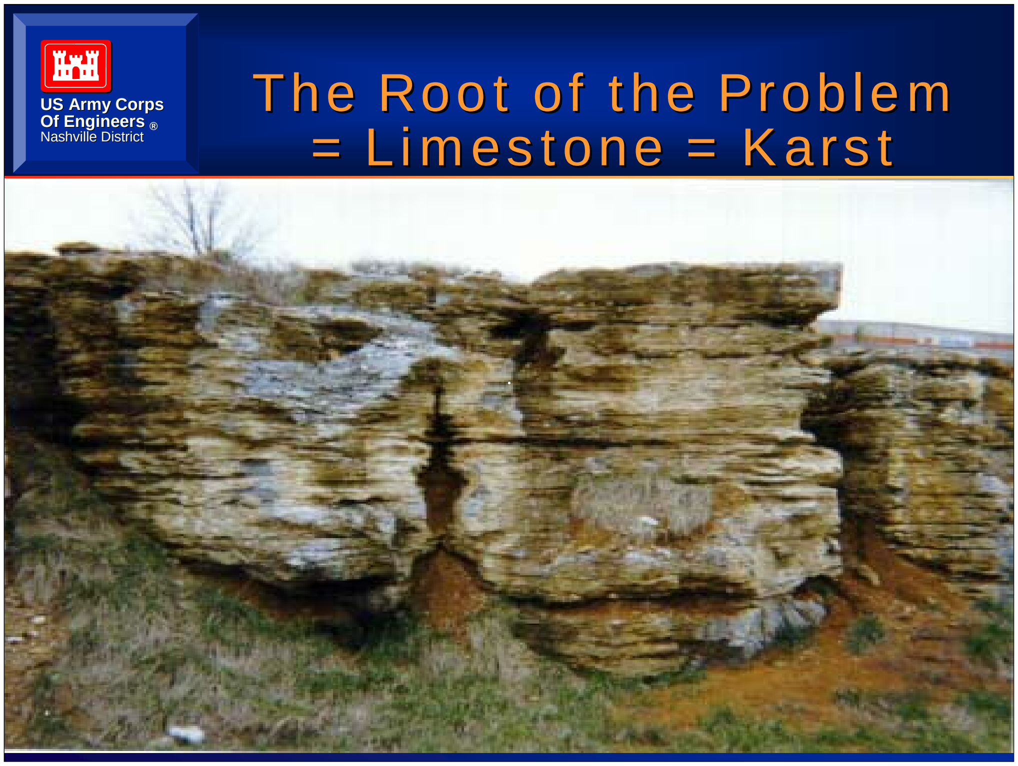
This is the basic outline of the Wolf Creek briefing.



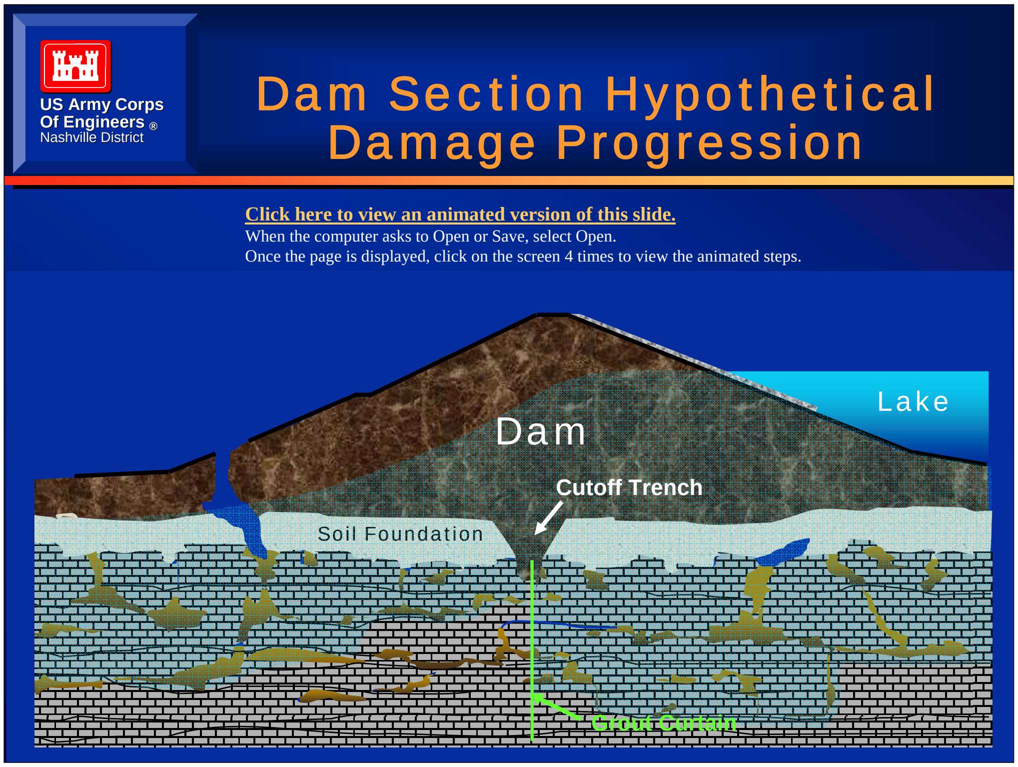
Cumberland River Plan and Profile showing the location of Lake Cumberland and its relative size. Wolf Creek Dam was constructed in the 1940s to provide flood damage reduction, hydro-power production and recreation. At 6,000,000 acre-feet maximum capacity, Lake Cumberland is the largest reservoir east of the Mississippi River.



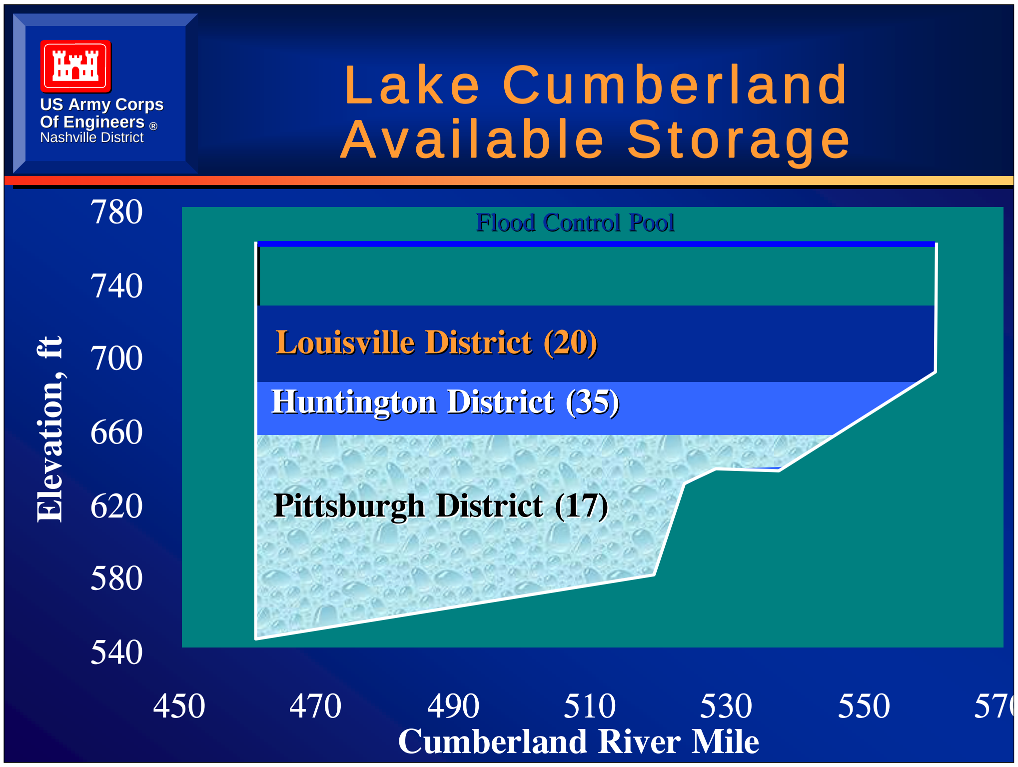
Project location map. Wolf Creek Dam is at River mile 460.9 approximately 269 miles upstream from Nashville in Russell County in South-Central Kentucky.



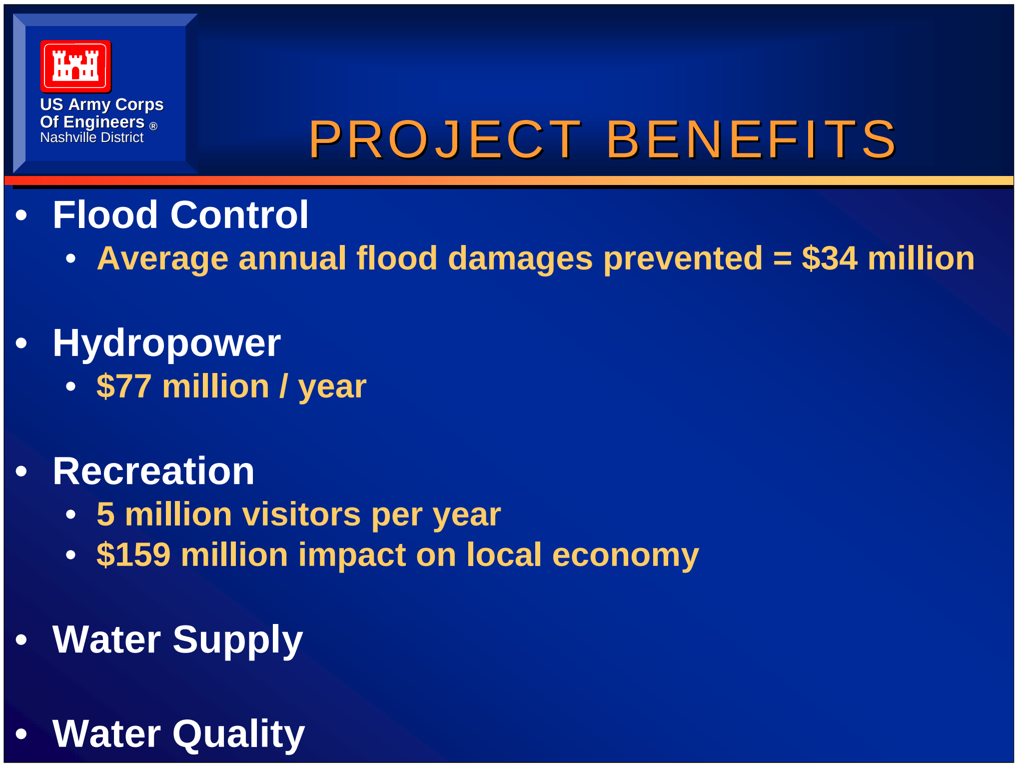
The underlying problem results from caves and cavities in the limestone foundation. Limestone is soluble in weak acid resulting in the formation of openings in the rock. As the limestone dissolves impurities are left behind as clay filling in these openings. Most road-cuts in this part of the country show some evidence of this process.



Treatment of foundations for dams under these conditions involve excavation of a cutoff trench and placement of a grout curtain by drilling a line or lines of closely spaced drill holes in the rock and backfilling these under pressure with a mixture of cement and water called grout. Over time, under the influence of the reservoir pressures grout curtains may lose their effectiveness allowing high pressures to impact the clay filling in the cavities. If this pressure is sufficient, erosion of the clay infilling may begin and progress upstream toward the reservoir. This process is called piping and if left untreated can lead to a breach of the embankment and failure.



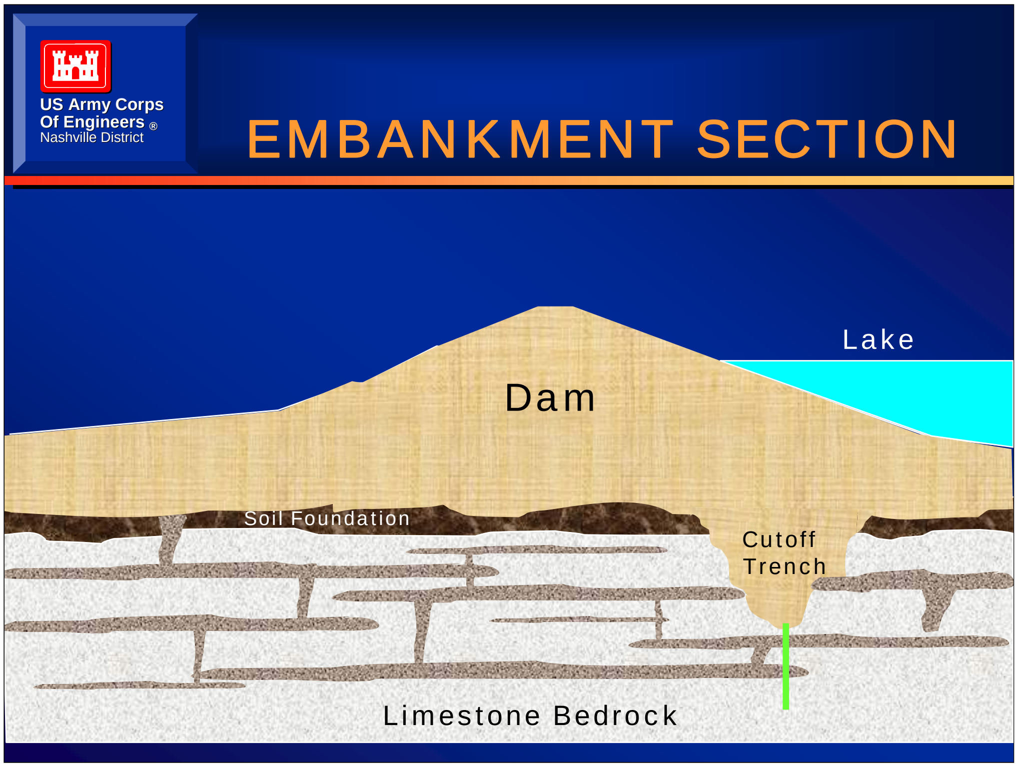
The reservoir is 101 miles in length and has 1,255 miles of shoreline, providing a total storage capacity of 6,089,000 acre feet (1 acre foot=1acre, 1 foot deep or 325,850 gallons.



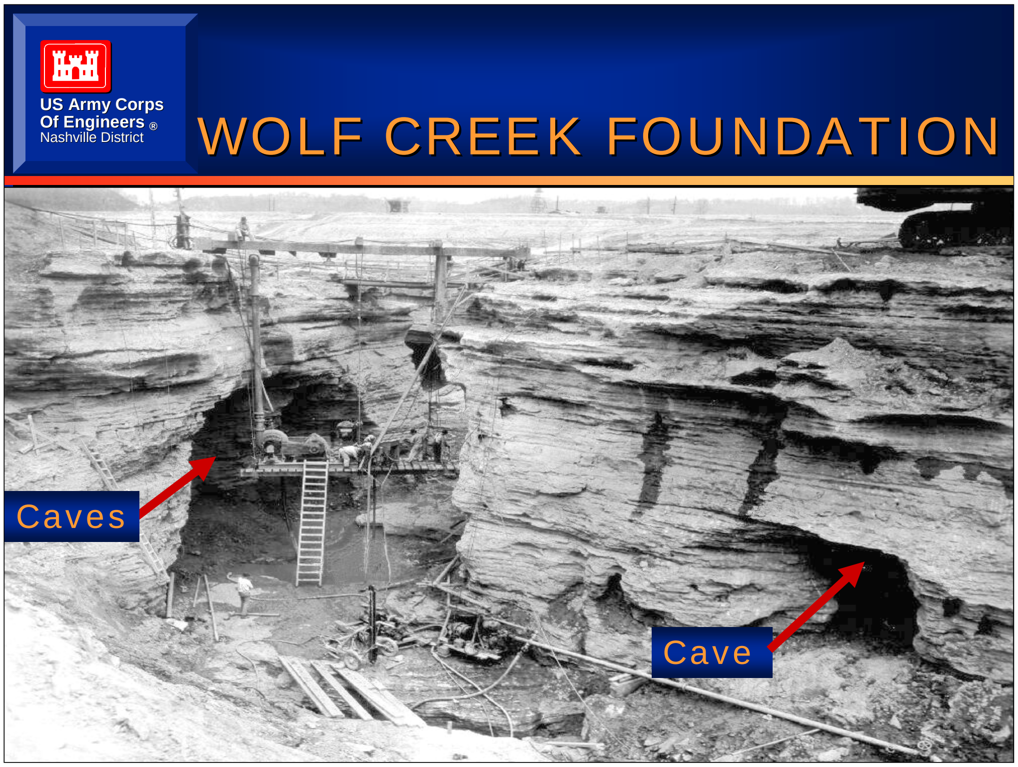
Benefits provided by operation of Wolf Creek Dam and Lake Cumberland are listed.

The visitation at Lake Cumberland is 5 million visitors per year which is more than the visitation at Yellowstone Park (3 million) or the Grand Canyon (4 million).

- Designed and constructed from 1938 to 1952
- Provides flood control, hydropower, recreation, navigation, water supply & water quality benefits
- Dam consists of 1796 ft concrete section and 3940 ft compacted clay embankment. Max height above streambed is 258 ft.
- Concrete section consists of:
    - Spillway section with 10 37 ft x 50 ft tainter gates
    - Power intake section with 6 penstocks
    - 2 non-overflow sections on either end.
    - 6 low level 4 ft x 6 ft sluices in the spillway section.
- Powerhouse with 6 generators with a capacity of 270,000 kW
- Switchyard, fish hatchery, and campgrounds also located D/S
- US Hwy 127 across top of dam
- First filled in 1950, largest reservoir east of Mississippi, ninth largest in US. Impounds 6,089,000acre-ft at flood storage pool elev. 760.
- Point out Cone or Wraparound Section – critical area where embankment ties in to concrete section
- Developed serious seepage problems in 1968. Wet areas D/S near the right abutment, muddy flows in the tailrace, 2 large sinkholes in the embankment just above the switchyard
- All these indicated dam and foundation material was being washed away due to seepage

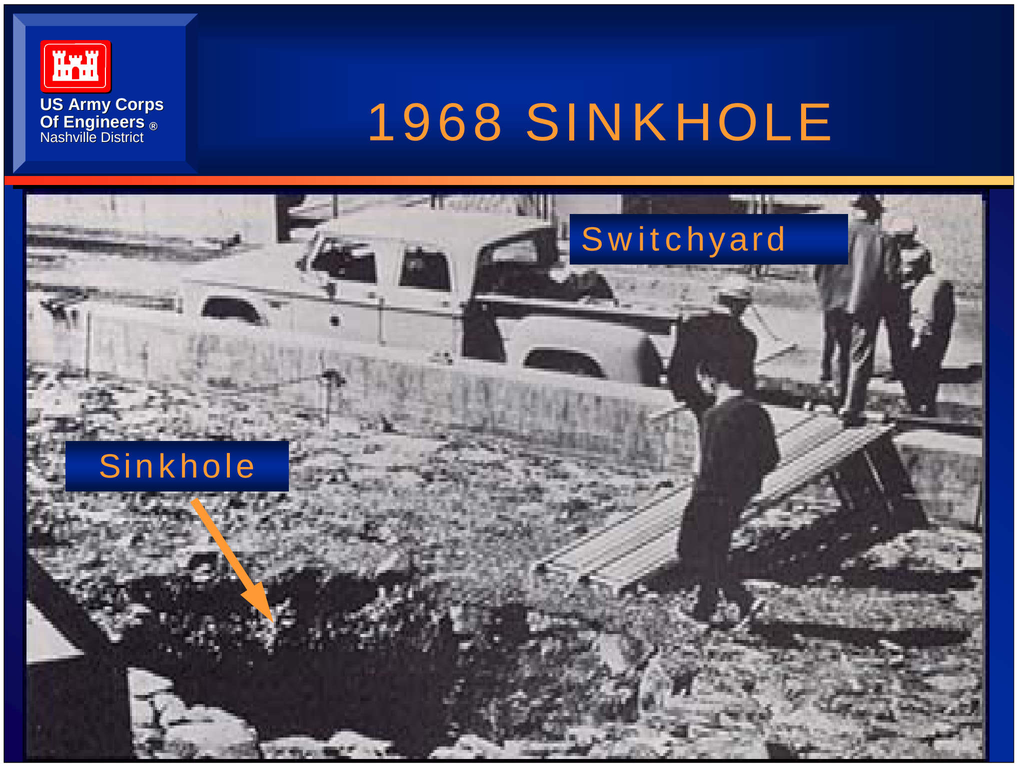


A typical section through Wolf Creek Dam showing the location of the cut-off trench.



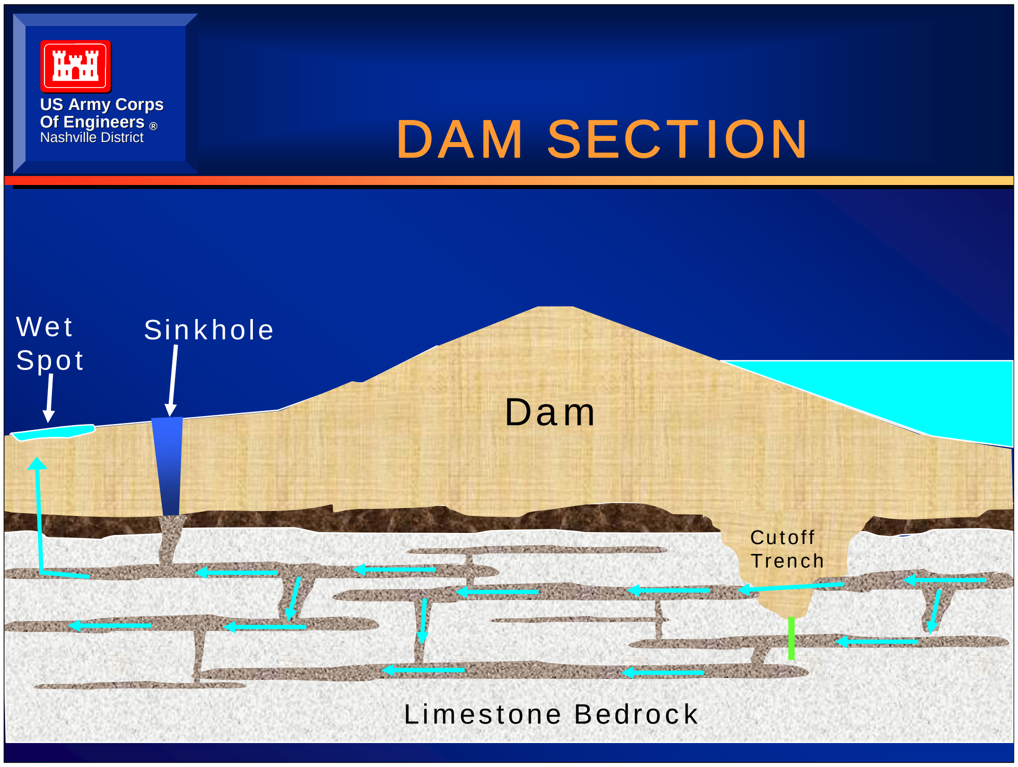
This photo was taken during construction showing conditions that were exposed by the cut-off trench. Many things depicted by this photograph do not meet current construction standards for dam foundation treatment.

In the 1960s Wolf Creek started exhibiting signs of distress that grew progressively worse until muddy flows and sinkholes triggered an emergency remedial action in 1968 and '69.

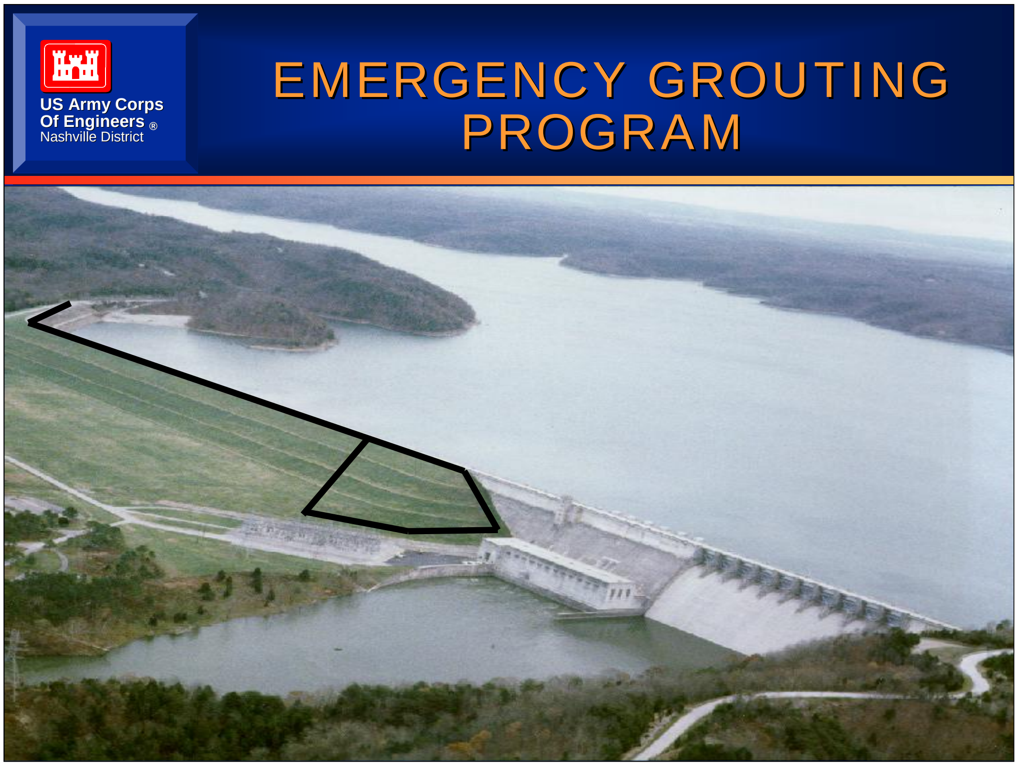


This is what happened at Wolf Creek back in the late 60's

This is a photo of one of the 1968 sinkholes. It was about 13 feet in diameter at the surface and extended to top of rock about 40 feet below the surface.



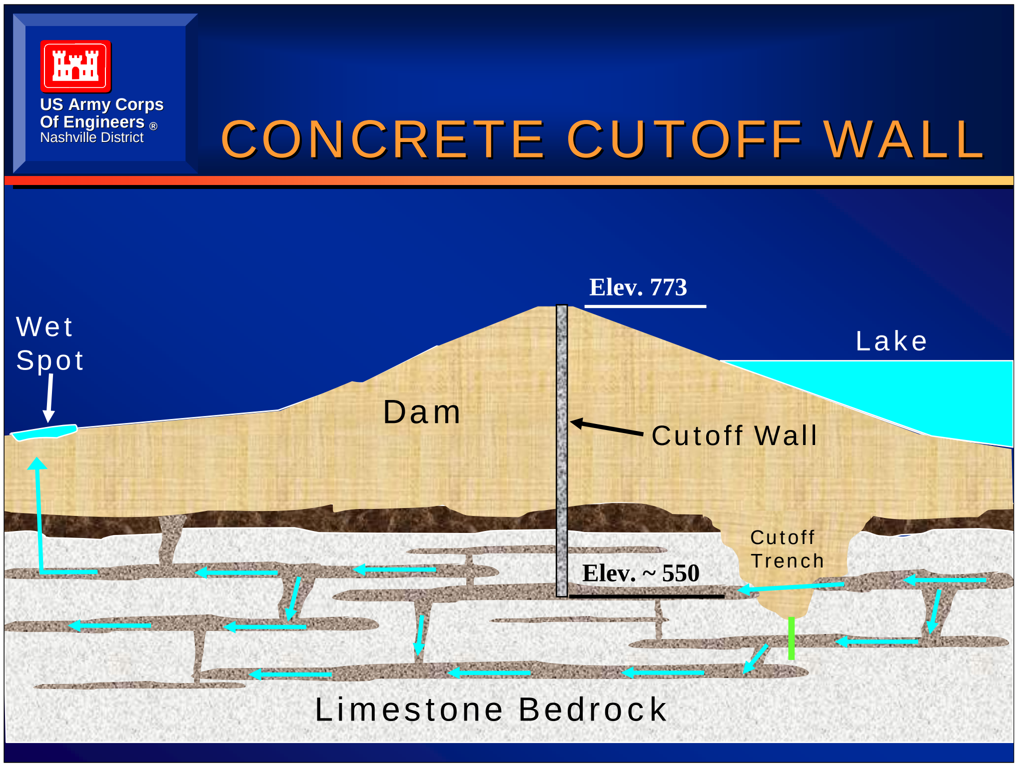
Cross section of the dam showing the presence of sink hole in relation to foundation rock.



Following the sinkholes, detailed studies and emergency drilling, grouting, and instrumentation program were begun. The Pool was lowered to elevation 680 for about 8 months.

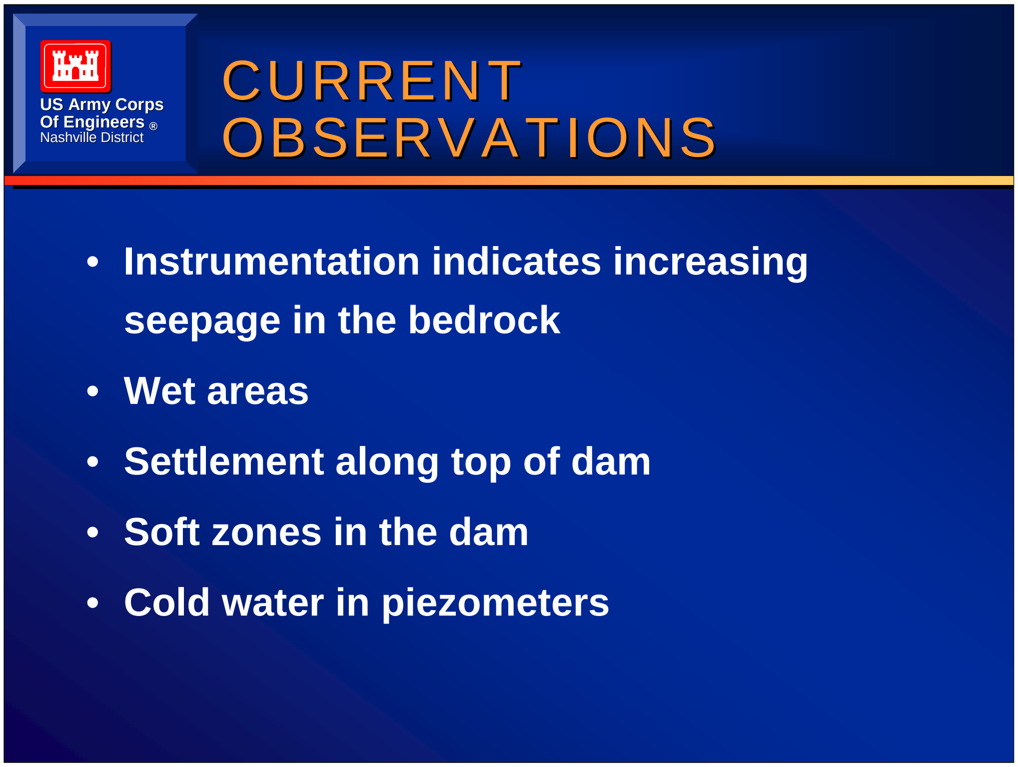
Initial grouting program concentrated in area of embankment/concrete tie-in. Completed in June 1970. Nearly 300,000 ft^3 grout solids injected. To put that in perspective, enough to pave a road 6 inches thick, 20 feet wide, and 5.5 miles long Pz levels reduced, muddy flows stopped Generally credited with preventing failure

Additional grouting extended along crest to right abutment between 1970 and 1975



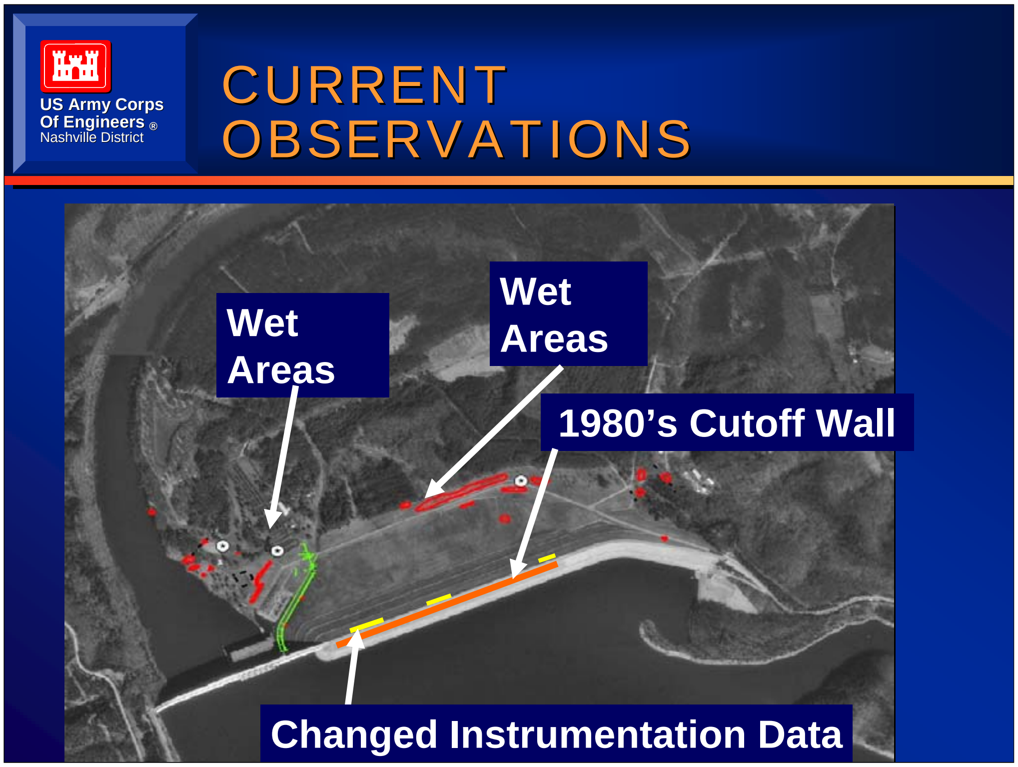
Given the seriousness of the foundation problems at Wolf Creek and the lower reliability of grouting as a permanent solution a panel of world recognized experts advised the Corps to construct a concrete cut-off wall located along the axis of the dam under the embankment.

Based on information from the earlier grouting and the high cost of construction it was decided that only two-thirds of the embankment required a cut-off wall as shown on this aerial view. Some members of the expert panel felt this was a short sighted cost saving measure and expressed the opinion that eventually a wall would be required for the entire length of the embankment.

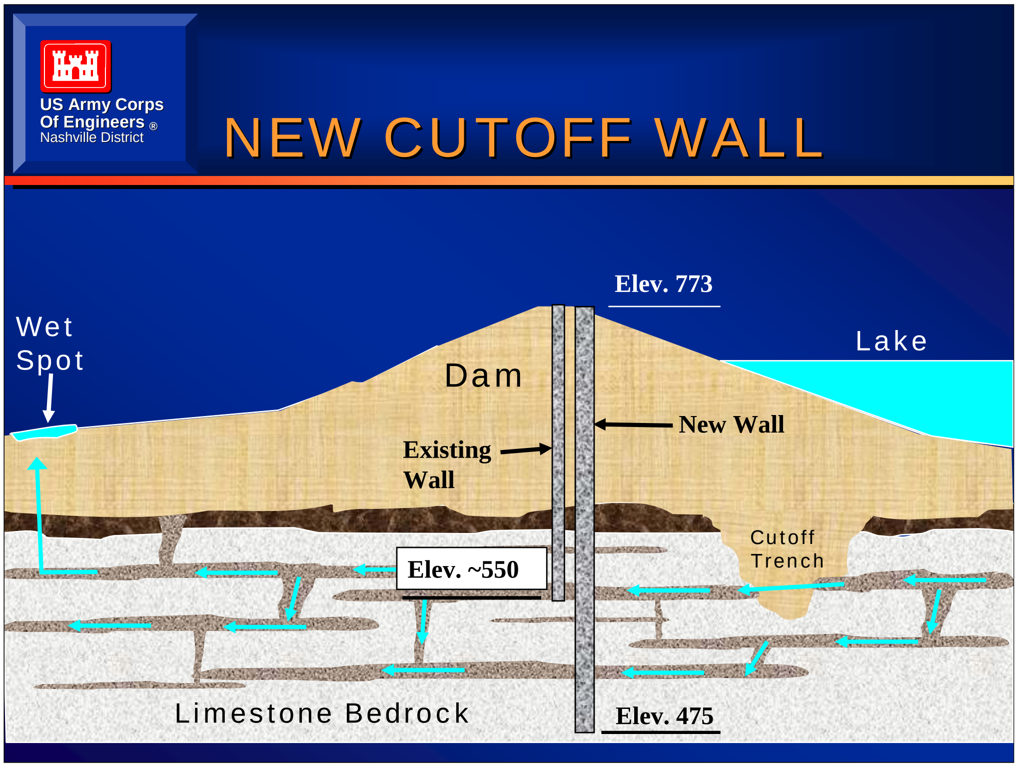


The district has been monitoring the project closely since the problems of the 60's.

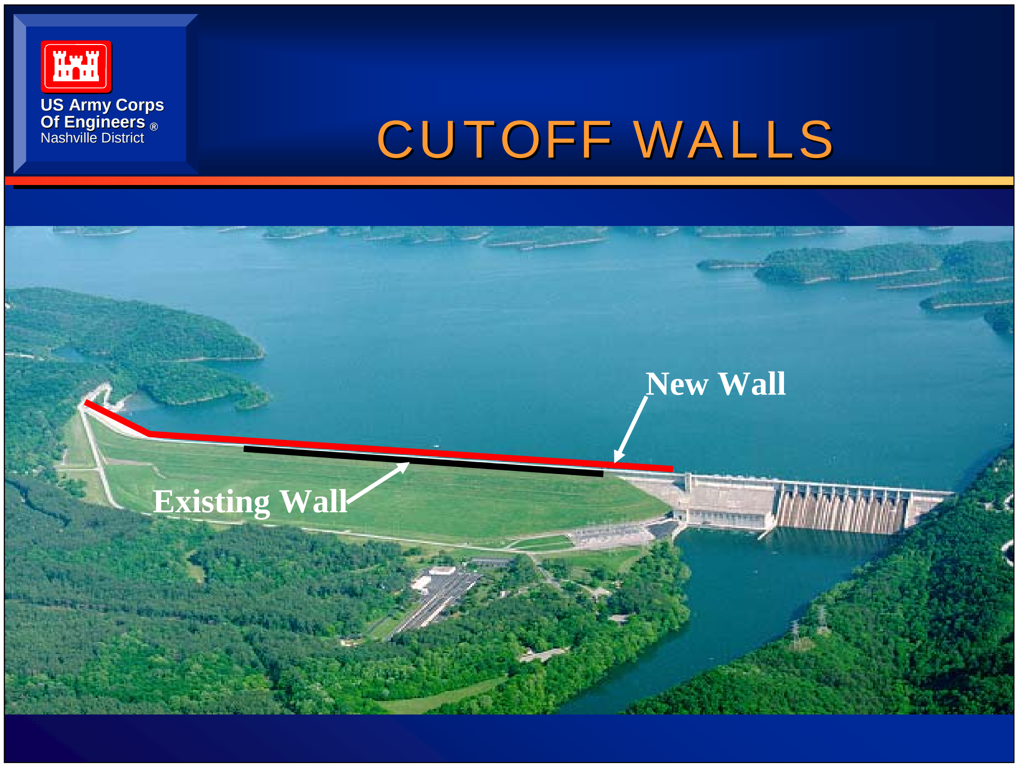
Over the last several years, instrumentation readings (piezometers, settlement monuments), visual observations (wet areas, seepage), and borings (soft zones) have led us to conclude seepage is still occurring and if left untreated will threaten the integrity of the dam.



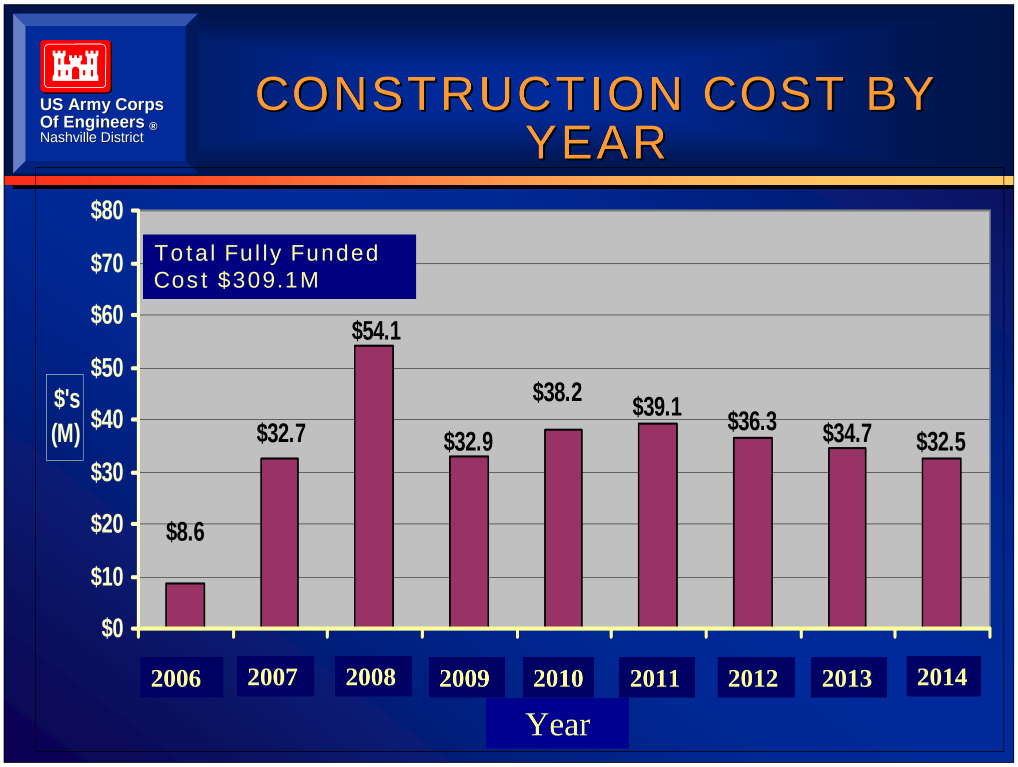
This aerial view shows the present distribution of distress indicators. These have advanced to the point where a major rehabilitation of the project is justified. A new cutoff wall is planned to accomplish this.



A cross section of the dam showing the location of the old and new cut-off walls. The old wall was a pioneering construction effort. The technology for installing these walls has advanced considerably in the past 25 years. The new wall will be superior to the old wall.



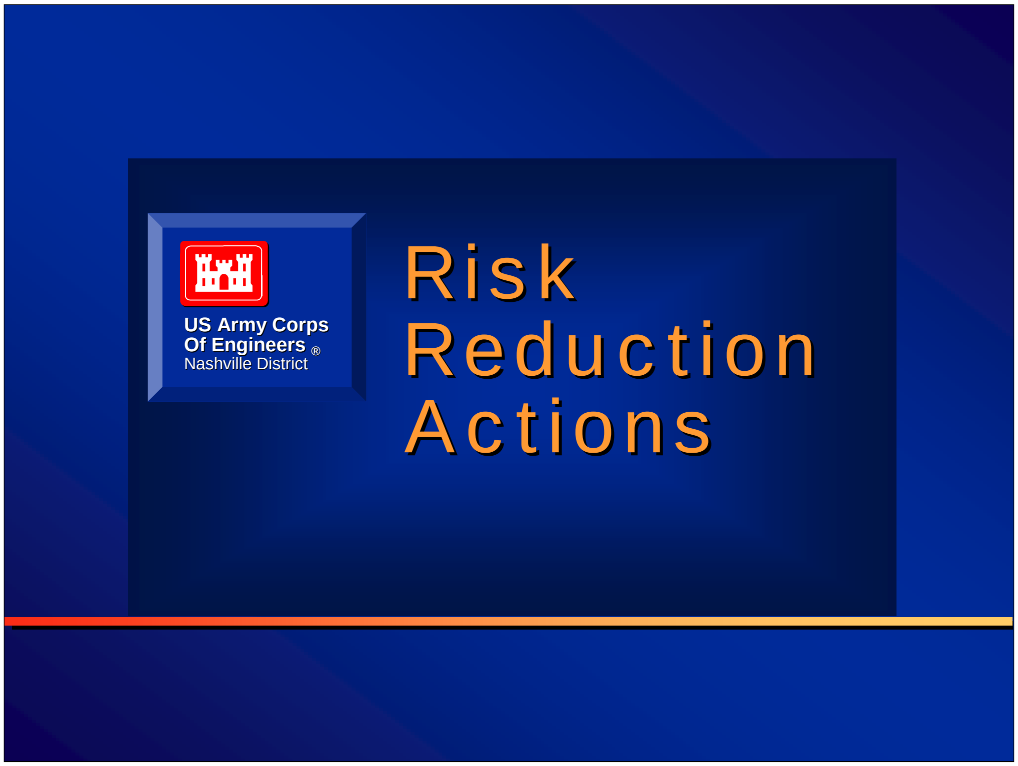
As shown in the view the new wall will extend the entire length of the project and as indicated on the previous slide will go deeper into the foundation.



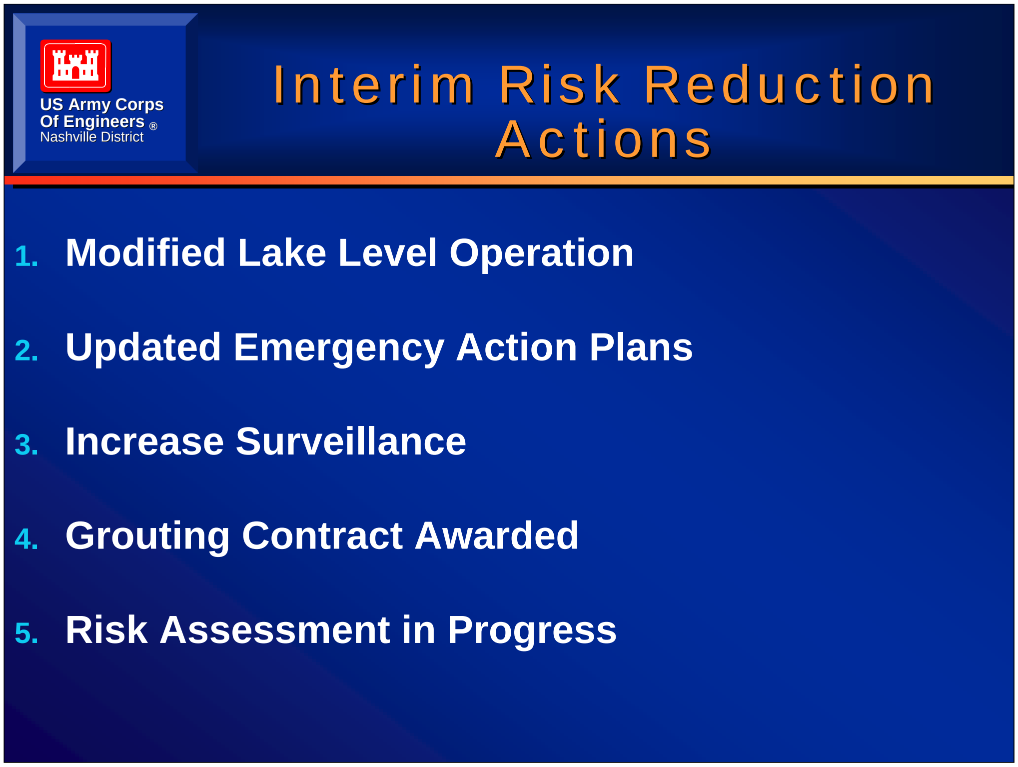
Current estimate of the time for construction and the total cost. Both will vary depending on the actual amount of funding we get each year.

We prepared the design and contract acquisition package in 2006 and the construction started in 2007.

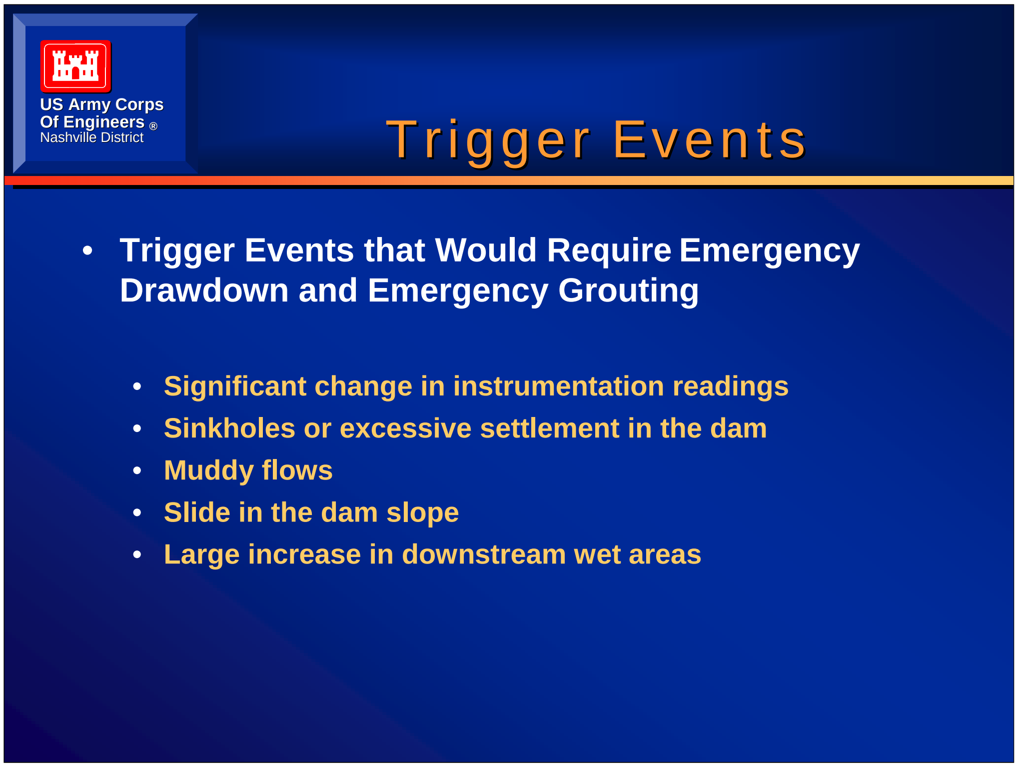
Two preliminary contracts have already been awarded. One for 52 million was awarded to perform grouting required to facilitate the construction of the new wall. The other is for preparation of future contractor work areas.



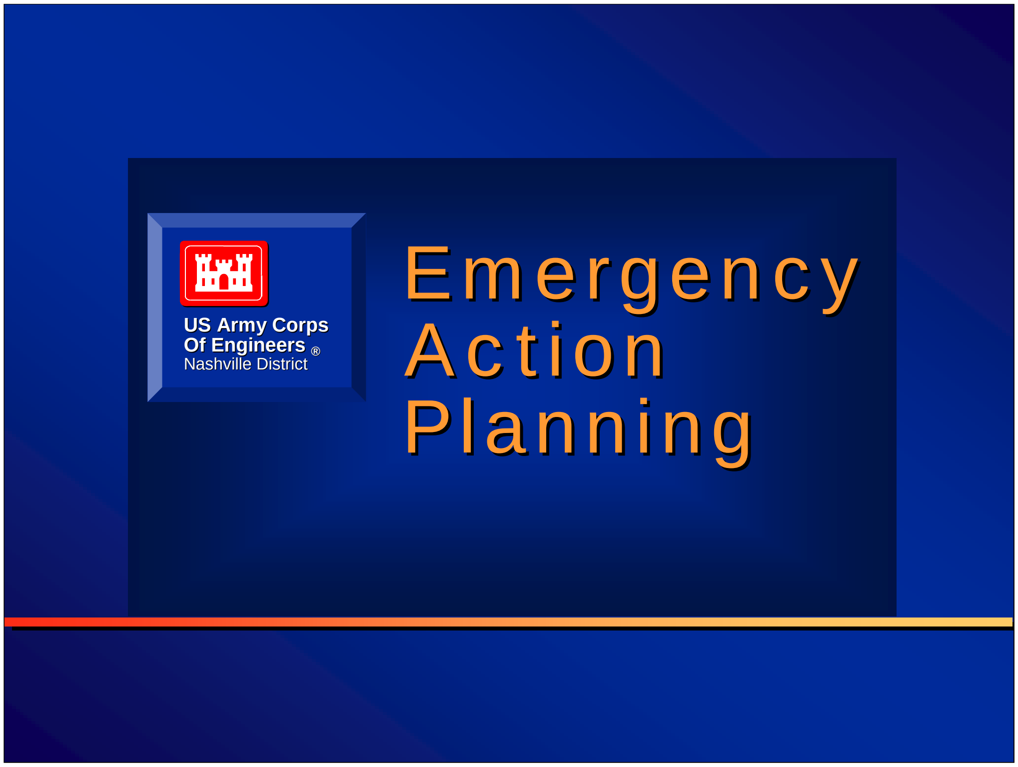
We’ve taken some interim actions to try and mitigate the risk until we have a remedy in place.



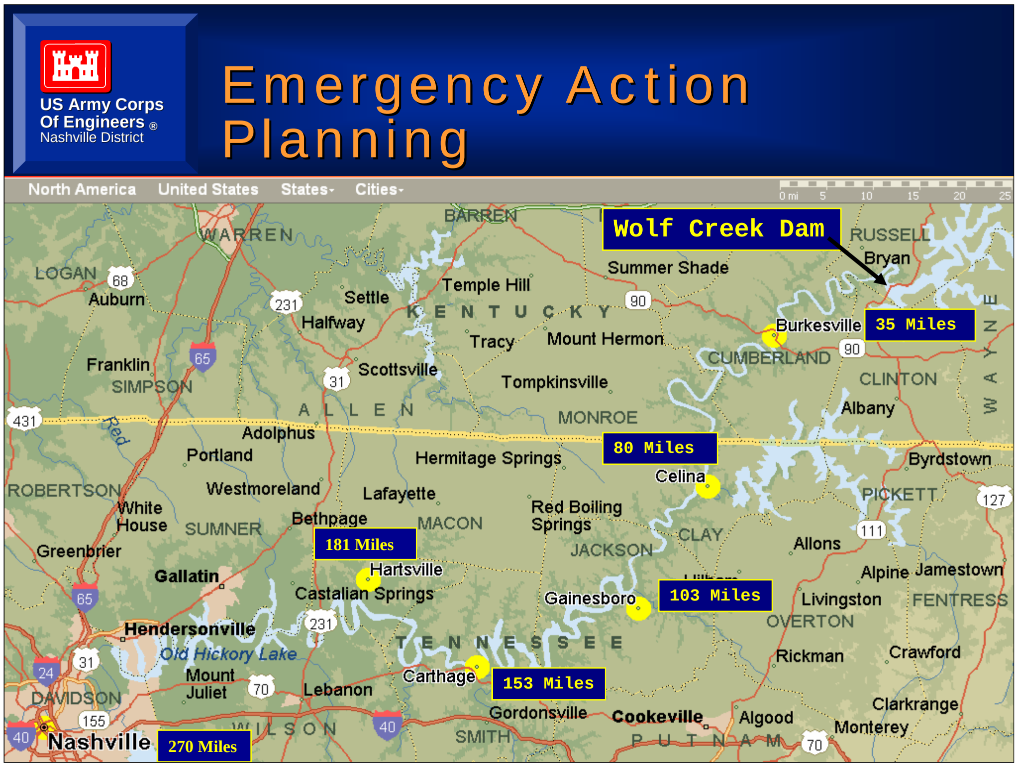
Between the present and the completion of the remedial work the Corps has instituted a risk reduction plan consisting of these listed components. Under the present circumstances these have been formulated to minimize the risk to populations downstream of the dam.



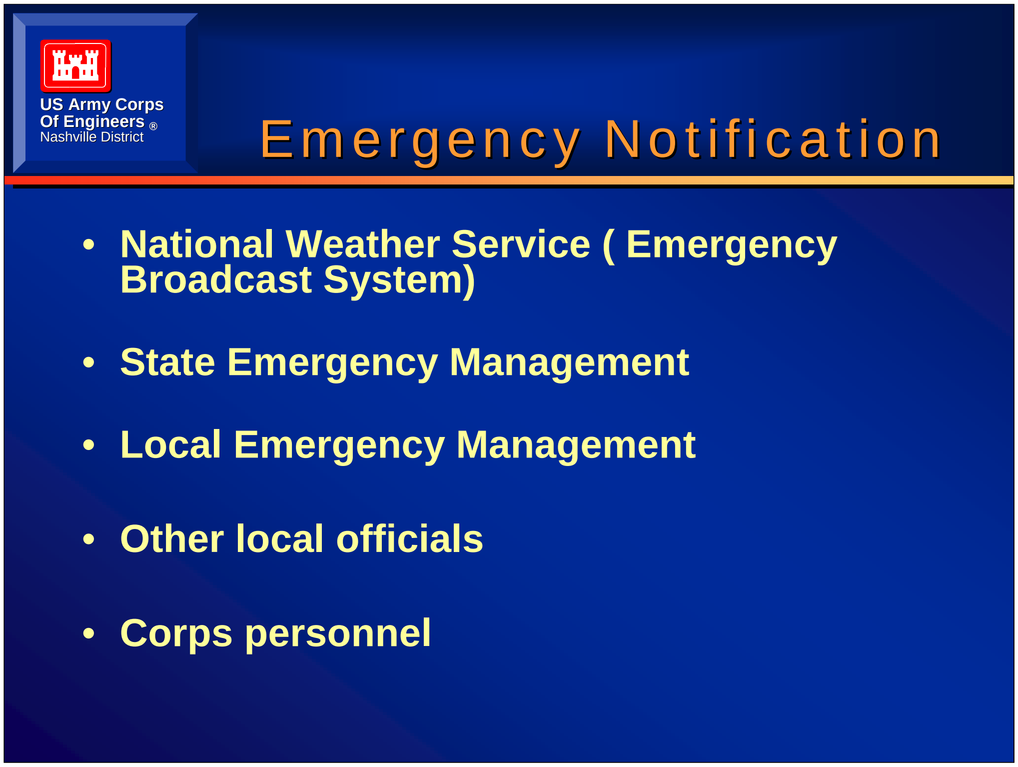
However, several events may occur that would constitute an emergency and trigger a more rapid response.



The Emergency Action Planning title.



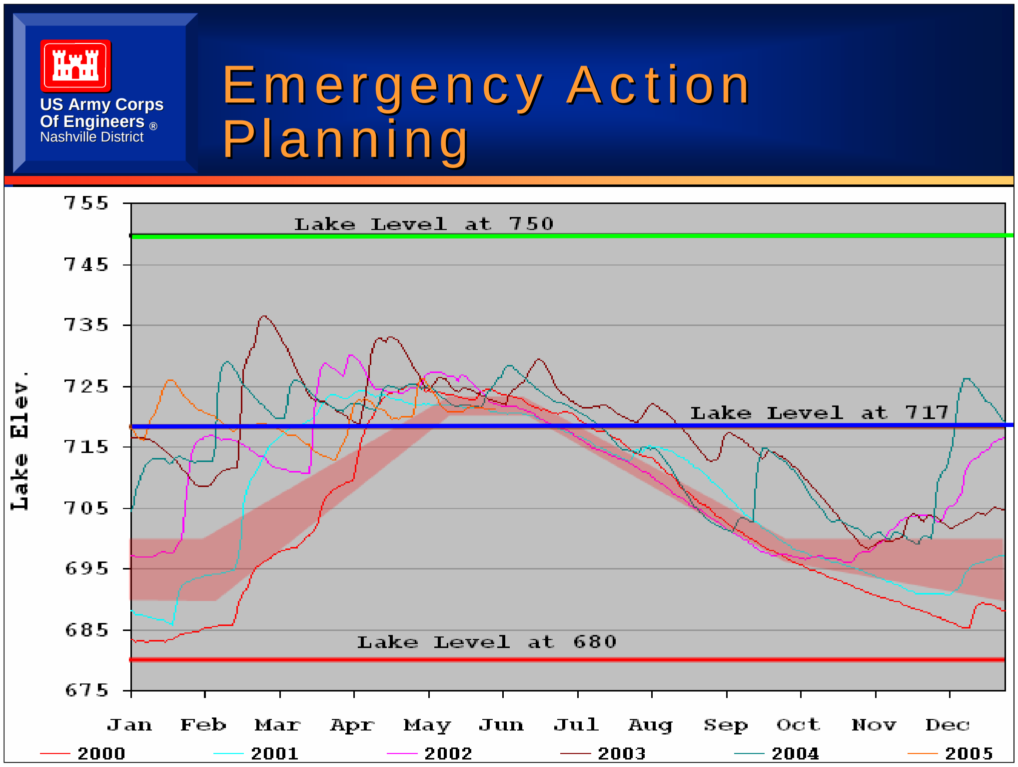
Emergency Action Planning is a key component of our risk reduction plan. Identification and inventory of population centers is a focus of this activity.



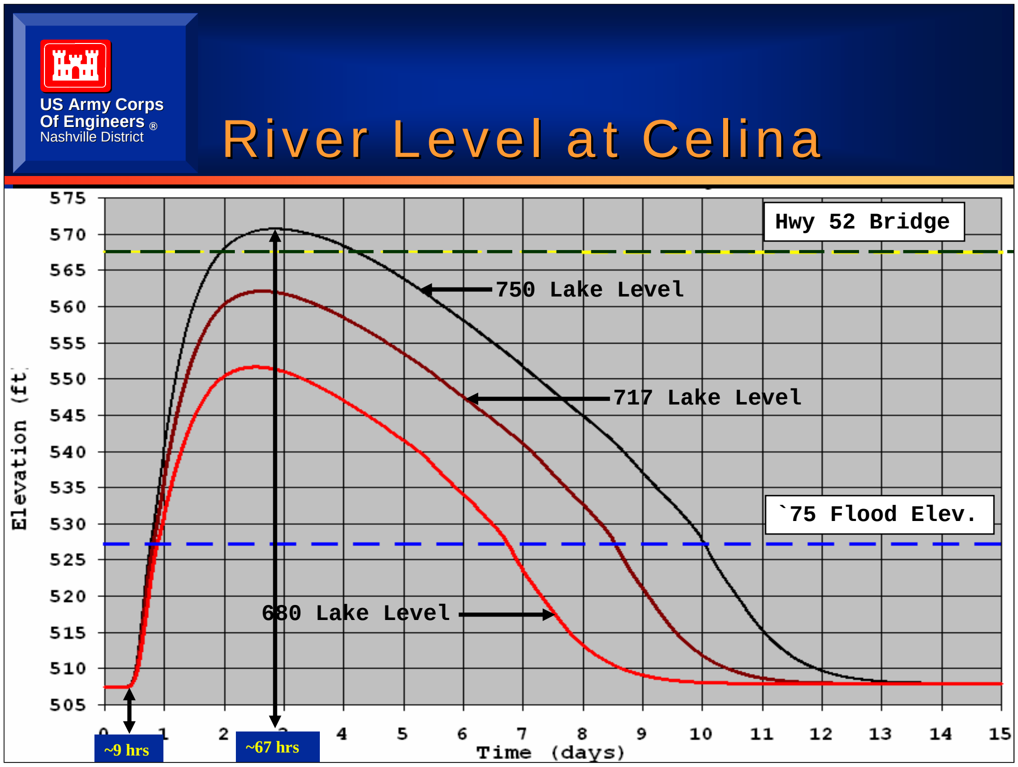
Emergency Broadcast System gets the word out quickly. These public service announcements will go out to weather radios, radio and TV stations, emergency management offices

Then a follow up with state and local Emergency Management officials starting with those closest to dam and working downstream.

Local EM's are responsible for activating local notification and evacuation plans.

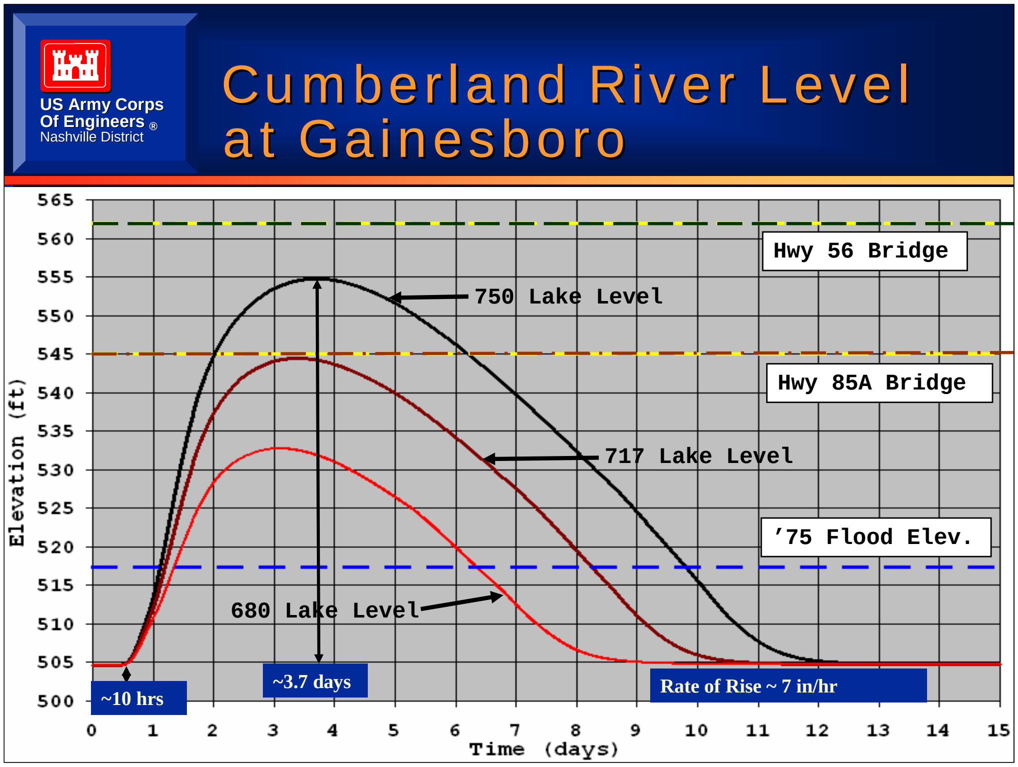


Evaluating the impacts of a failure downstream require consideration of various lake levels. Three levels were selected. Low pool at elevation 680 representing a minimal lake level. Normal pool at 717 representing a rough median lake level. And maximum lake level at elevation 750. The wavy lines show the actual variation of the lake level over the course of each year for 2000 through 2005.



Flood routings downstream result in different flood heights for each pool elevation at time of failure and for each community downstream. This is an example for Celina Tennessee. These curves also show how long it will take for the flood waters to arrive at the particular location and how long it will take to recede.

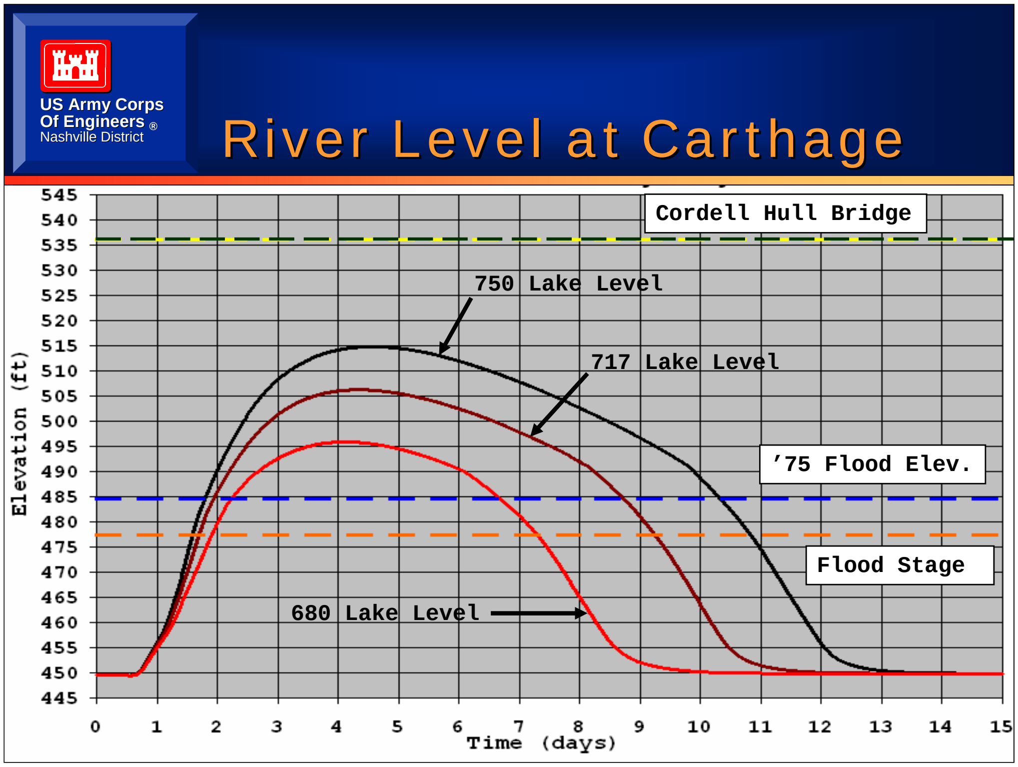
Failure of the dam starts at time 0 and the curves show the rise in the Cumberland River level over time.



These are plots of the results for Gainesboro from the failure modeling.

Failure of the dam starts at time 0 and the curves show the rise in the Cumberland River level over time

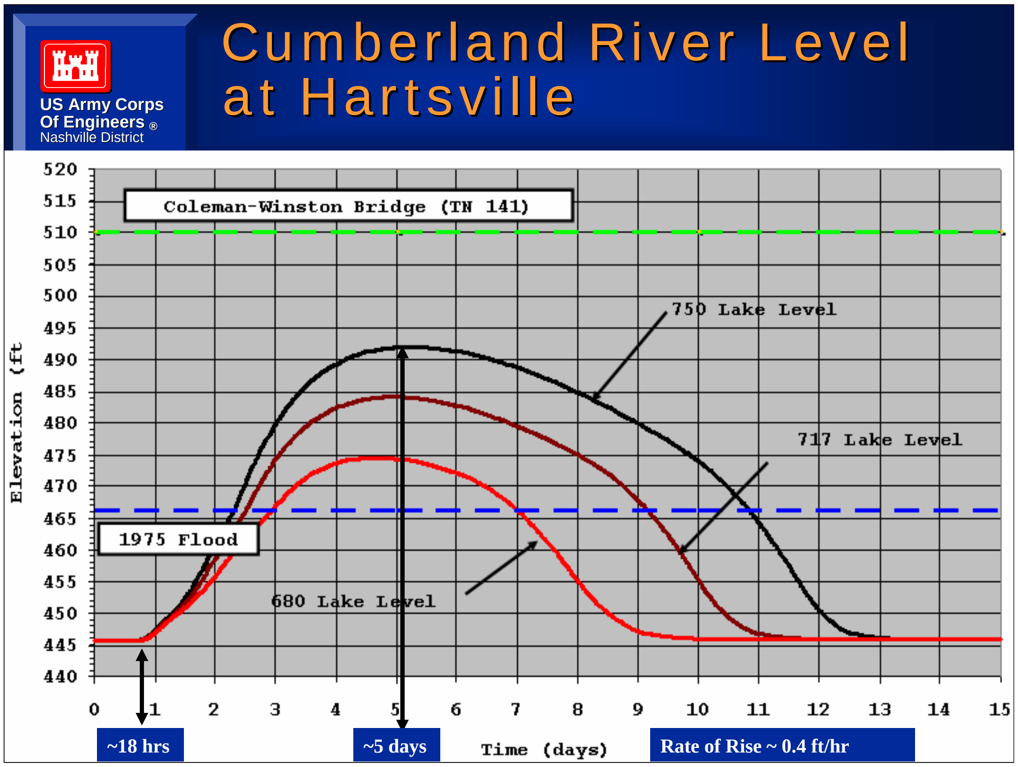
The Hwy 56 and 85A bridge and '75 flood level are added for reference purposes to give someone a feel for how high these water levels will be in this scenario.



These are plots of the results for Carthage from the failure modeling.

Failure of the dam starts at time 0 and the curves show the rise in the Cumberland River level over time

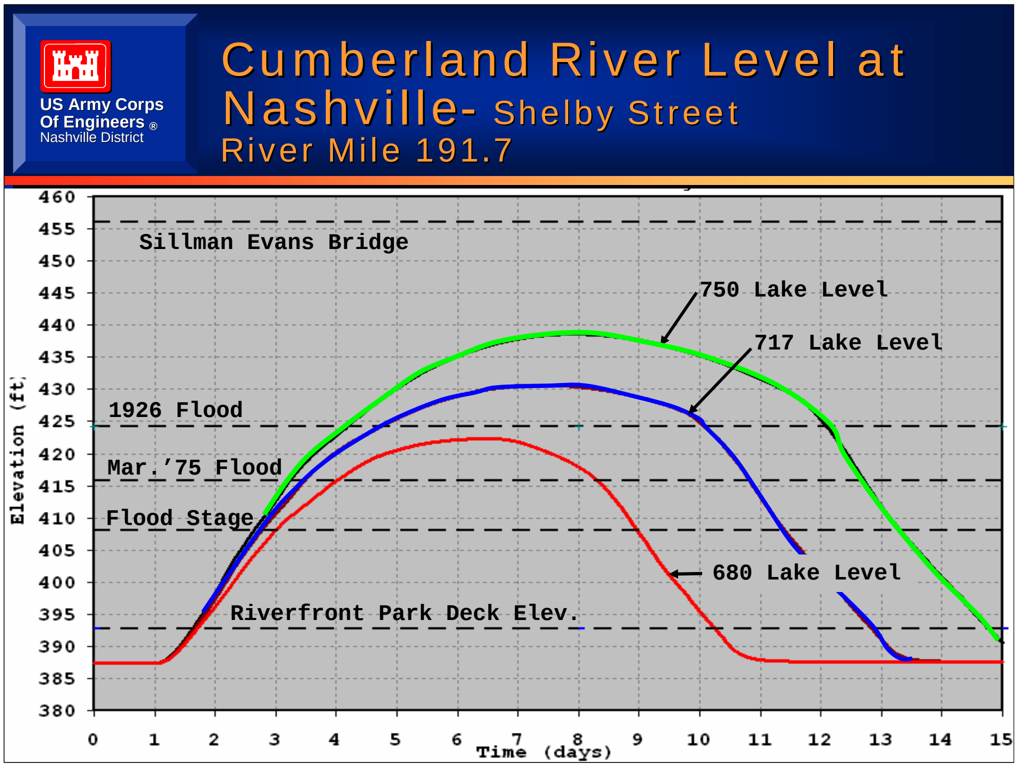
The Cordell Hull bridge, flood stage, and '75 flood level are added for reference purposes to give someone a feel for how high these water levels will be in this scenario.



These are plots of the results for Hartsville from the failure modeling.

Failure of the dam starts at time 0 and the curves show the rise in the Cumberland River level over time

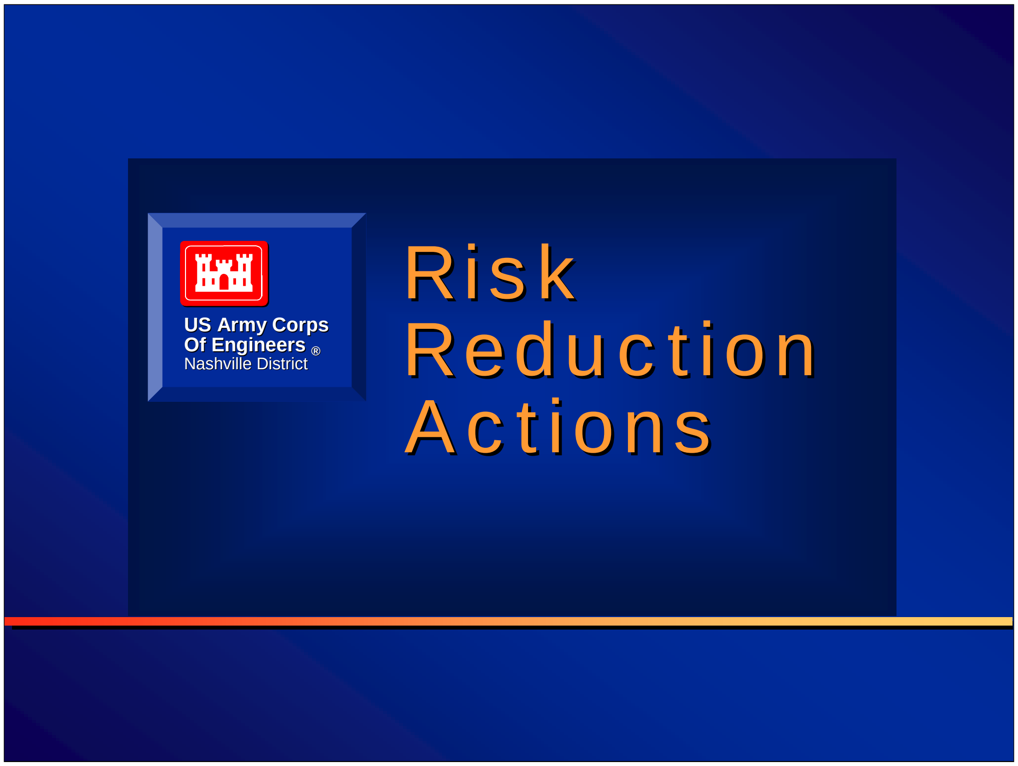
The Coleman-Winston Bridge (TN 141) and ’75 flood level are added for reference purposes to give someone a feel for how high these water levels will be in this scenario.



These are plots of the results for Nashville from the failure modeling.

Failure of the dam starts at time 0 and the curves show the rise in the Cumberland River level over time

The Sillman Evans Bridge and '26 /'75 flood level are added for reference purposes to give someone a feel for how high these water levels will be in this scenario.



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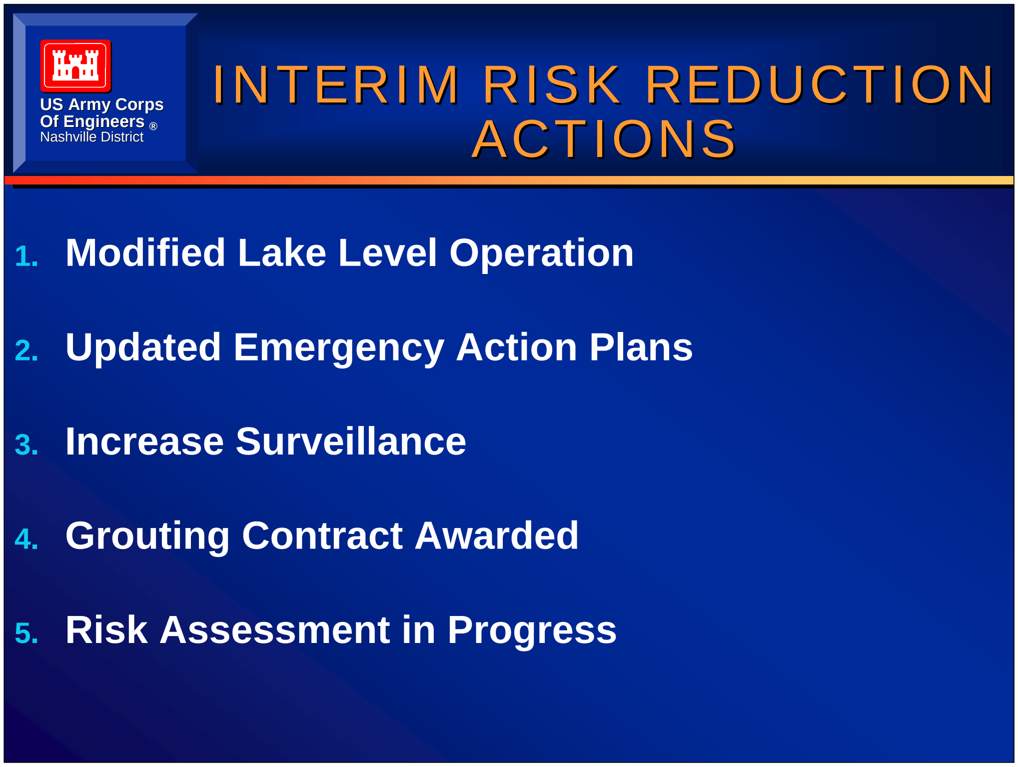
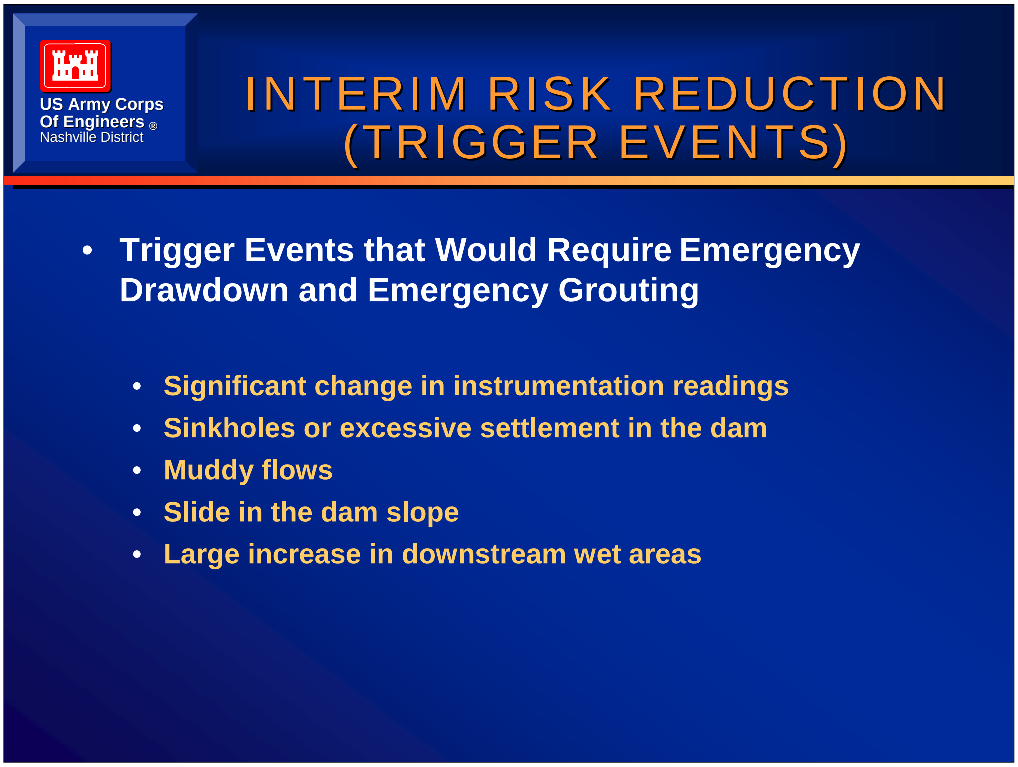


A couple of actions pertinent to our discussion here today are modifying the levels at which we will attempt to operate the lake level and the possibility of drawing down the pool should certain events occur at the project

As time passes, the risk we will have an event, such as occurred back in the late 60's, that would cause us to draw down the pool increases

Talk first about what we've done to modify how we will operate the pool then briefly discuss the impacts if we have to go into an emergency drawdown of the pool.



Slide explaining trigger events that would require Emergency Drawdown and Emergency Grouting.

Web site for more info. and to submit questions