August 22 Dam Leak Committee Meeting Summary

by Rich Hirsch

The meeting was held at the Sales Office at 7 p.m.

1) Clarue Holland summarized material she had culled from the volumes of material related to the dam. Clarue's report with comments added by various Committee members can be found in Appendix A. *[Comments added by the committee are bracketed and in italics.]*

Based on her reading Clarue felt that dam maintenance has been neglected lately and the group agreed that we need to correct this problem. The dam needs to cut as soon as possible. Ken Jost noted that there are willow trees growing on the back of the dam and these are particularly bad since they are deep rooted. Instead of mowing the back of the dam, it could be burned, but if burned in the fall, there would be no ground cover throughout the winter months to prevent erosion. Spring is a better time to burn, but is usually too wet.

2) Mike Leiweke has done preliminary work on installing a weir box to measure the flow rate of the leak. A weir box contains a weir plate that has a V-notch in it. The V-notch can be 22.5, 45, or 90 degrees. A commercially available weir box is available from Free Flow Inc. For the flow rate we are interested in measuring (50 to 300 GPM) they recommend a 45 degree V-notch plate. Mike is getting prices for a commercial custom made unit. He also felt we could make one without too much difficulty or expense. We would probably place the weir box below the leak pool and use a flexible connector to connect the weir box to an existing pipe. The weir box could be made from steel plate or concrete. There was some discussion about using a used oil tank to hold the weir plate. All agreed that the installation of a weir box was long overdue.

Appendix A.
Preliminary History Report
by Clarue Holland,
Lake Tishomingo Dam Committee,
17 August 2006

This has been a very interesting and educational search of our lake's dam history. While I have gathered and sorted through a lot of information, there is much that needs to be discovered and investigated.

In the box of files I found the original (undated) dam building specifications for bid written by Oliver C. Sheley, professional engineer of Independence, MO. The dam size was to be 900 feet long on the crest with a crown *[width at top of dam]* of 16 feet, from North side to South side. The waterside slope was to be built at a drop of three to one and the backside slope of two to one *[considered to be steep for the back of a dam]*. The maximum height in the creek channel was to be 65 feet and the width at the middle was to be 341 feet (upstream to downstream width). The dam will contain approximately 210,000 cu.yds. of earth embankment. In the center of the dam for the full length of the dam, a puddle ditch was to be built that would be 12 feet wide. This puddle ditch was to be dug to a depth to be determined by the engineer in charge. If stone was encountered in this core ditch, a core shall be dug into the stone base to a depth of three (3) feet and a width of five (5) feet minimum and a width of 13 feet maximum to act as a key in the core wall. All work to be completed in eight (8) months. *[What is a puddle ditch? Just a key?]*

The specifications seem to be extremely thorough, citing type of fill, compacting, how excavations are to be accomplished, etc. From another source I learned that the lake was laid out and platted in 1948. The dam was impounding water by 1950.

1952, Jul 28, from an unsigned, typed paper:
"During the winter and early spring the lake filled rapidly, almost to the spillway. Shortly after Easter the water from the spring on the *[downstream side]* north side of the dam began to run murky and the management immediately asked in the Army Engineers to help determine the source of the trouble." *[May or may not be at the site of our current leak]*

"Immediately thereafter a large volume of water began to find it's way through a new opening. Dr. Clark, state geologist, at Rolla, MO was consulted and recommended that Washington University be called in as they had a very noted department of Geology and Geological Engineering and had worked all over the US and abroad."

"Their Geophysicists made extensive tests and it was determined that the dam was not leaking and that the water was finding it's way through a fracture in the rocks down to an old solution channel *[possibly a channel carved by a solution?]* and considerable distance underneath the dam." Prof. Arthur Cleaves, of the Geological Engineering Department of Washington University, was consulted as to the procedure to correct the condition. "The problem was one of reducing the flow of water sufficiently to enable pressure grouting in order to obtain a permanent seal. This has been done to the extent that a temporary seal has been made at the opening where the largest amount of lake water was being discharged below the dam."

"The closing of the old original opening which has always carried a large percentage of spring water is a somewhat different problem. This is because of the increased pressure due to spring water originating at a considerably higher level."

"The drilling which as been going on behind the dam has been done to locate and cut off some of the water from the springs feeding into the old original opening, thereby reducing the pressure to where grouting can be introduced successfully into the main channel and a temporary seal made similar to that made at the opening where the large volume of water was being discharged".

This work was done by Wabash Drilling Co. which was recommended by Washington University, Army Engineer Corp and several firms of consulting engineers. *[Wabash Drilling became Subsurface Constructors]*

1965, Jun 8, from a letter by Harold Herd (Lake Development Enterprises) to Don Parrot (Lake Tishomingo) regarding the owners' concern of the dam's "leak problem." Included in this letter is a rough drawing of the Development's work which had blocked off some of the seepage and apparently did not slow down one spot where the largest concentration of water was coming out. (see Figures 1 and 2.)

Four holes were drilled from the top of the dam through the core rock and beyond. Each hole was 6.25 inches wide lined with a casing. Inside this casing was 2 inches of cement grout surrounding a 2 inch pipe. The 2 inch pipe was fitted to a reducing bell which allowed the pipe size to increase to 4 inches without any surrounding casings. The four sites were drilled to a depth of 41 feet, 45 feet, 53 5/6 feet and 102 feet which was through the rock base. Into these pipes 100, 1000, 800 and 1450 gallons, respectively, of pure asphalt was pumped. Each drill site pipe was capped.

Another drilling was to be done close to the #4 location (the largest concentration of water area) to attempt to seal that area in the same manner.

Figure 1. 1965 Dam drilling

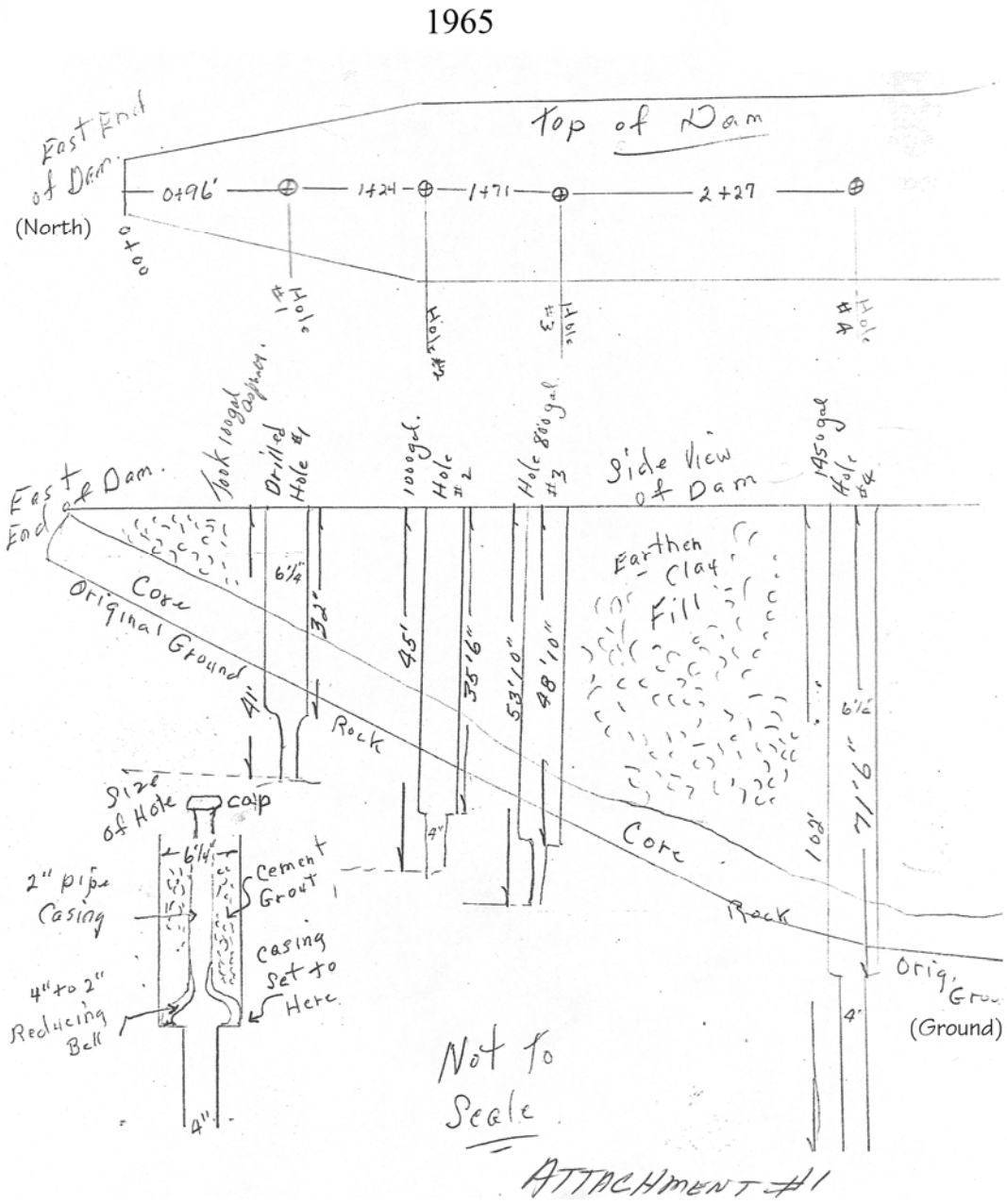
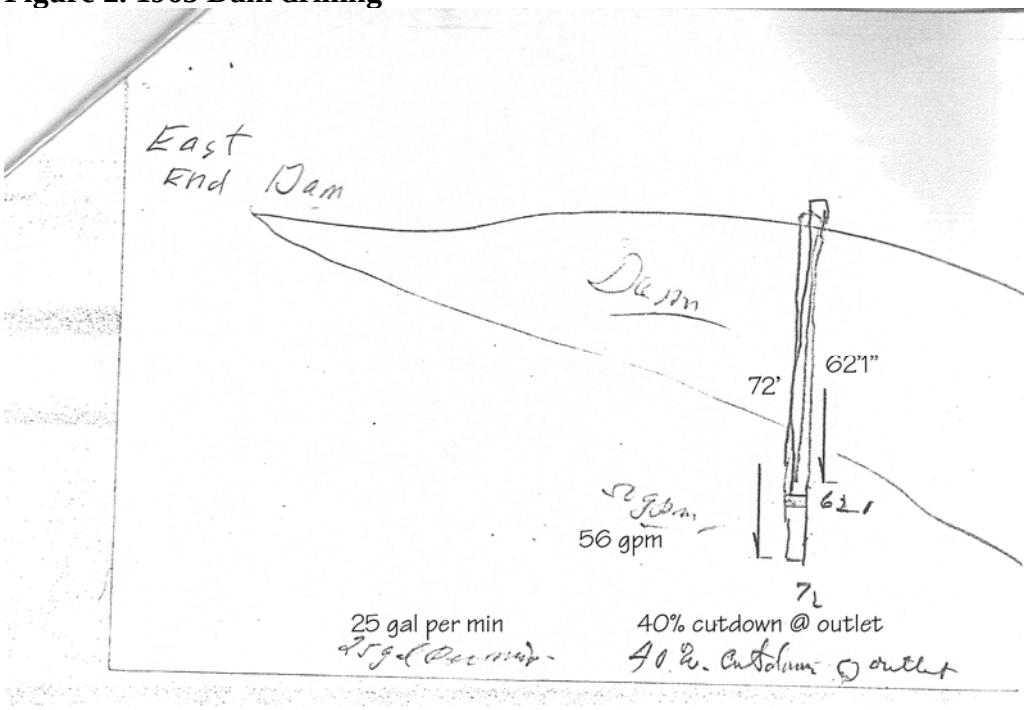


Figure 2. 1965 Dam drilling



1973, Oct 15, Engineering Geologic Report by J. Haldley Williams (Geologist and Chief Applied Engineering & Urban Geology of Missouri Geological Survey):
In response to correspondence regarding the Dam Safety Inspection Program and a request made by Carl Twesten of Lake Tishomingo the following report was made:

"The lake has been constructed in the Jefferson City dolomite, a firm bedrock formation having some solution enlarged cavities. Typically, the Jefferson City is a thin to medium bedded rock formation with the layers uniform in thickness and lateral persistence. Frequently, very thin shale seams are present between individual dolomite beds."

"The dam is a sound structure inspite of the overly steep backslope. **This excessive steepness has resulted in the soil slip (not a slide) upslope from the former stream valley**. Here the dam is the highest from natural ground as on any part of the structure. That together with excessive moisture, as well as slope steepness, as mentioned, resulted in the slip."

"While the movement of dirt on the backslope does not pose an immediate threat to the safety of the dam, repair of the slippage is needed on an immediate basis…**Repair should be completed by constructing a berm at the downstream toe of the dam below the slippage**. This would be in the headwater portion of the water pool."

"The berm could not be constructed too large…A minimum of width of the berm would be 15 ft. A wider berm of 20 or 30 feet, of course, would be preferred. The height should be at least 20 feet, preferably 30."

I have no information indicating that this repair was ever completed. *[The Committee did not know if the berm exists. This will be confirmed.]*

1974, May, from David Rath (Associate Geologist of the Missouri Geological Survey and Water Resources) to the LTPOA asking for permission to measure the dam in accordance with the National Dam Safety Act of 1972. That act requires all structures 25 feet of more and/or impounding 50 acre feet of more be inventoried. Tishomingo apparently has qualified under this law.

1976, Jan, Metropolitan Engineering Company of Arnold, MO completed an Engineering Study of the lake. This report is very extensive in regard to the silting of the lake and methods of dredging and ridding the lake of the growth of weeds in the water. It does speak of the annual draw downs of the lake level for repair of docks and sea walls. This draw down is accomplished by excavating out a plug at the spillway. It also mentions that "a few years ago, part of the downstream face of the dam, near the south end, developed cracks and began to slide. Stiff, impervious clay was hauled in to rebuild the area that had failed. The cracking and sliding subsided and no known problems exist at the dam."

1978, July, a memo from L Chitwood (Lake Tish) to John Samuel speaks of the first meeting of the DAC (Dam Advisory Committee) citing the observations of the dam:
a) Trees on dam,
b) tree growth beginning,
c) ponding of water at base,
d) leak (north section of dam, approximately ¾ distance down from top of dam),
e) seepage on south area slope of dam,
f) overgrowth of foliage, weeds,
g) erosion gullies on downward slope,
h) trees from previous cuttings scattered on slope.
The summary of this report: "It is opinion that technical consul and advice is needed in order to properly justify other additional recommendations in establishing a preventative maintenance type dam program."

1978, Sep 6, Leon McKenney (District engineer of the Department of the Army Corps of Engineers) wrote the LTPOA referencing the final Phase I Inspection Report previously furnished to the LTPOA. "As a result of recent changes in methodology for performing hydraulic/hydrologic analysis, Lake Tishomingo Dam has been classified in the unsafe, non-emergency category."
"…the spillway on the dam must be capable of passing 50 percent of the Probable Maximum Flood without overtopping the dam. Analysis indicates that the spillway will pass only 30 percent of the Probable Maximum Flood…….

[Was anything done to the spillway here?]

1979, Apr 5, a letter from Dr J Hadley Williams (Chief Engineering Geology Section of the Missouri DNR) to John Samual (LTPOA) compliments the LTPOA for their plans to retain a professional engineer experienced in hydrology to evaluate possible needs for changes in the spillway dimensions and/or raising the dam in response to the inspection report. It further states, **"It is important to observe on a scheduled basis the rate of flow from the leak that flows from the downstream toe of the dam on the east *[north]* side (near the right abutment). The flow rates of the leak should be recorded as you have in the past. Also, your past procedure to retain samples of water and check for sediment should be continued. Temperature measurements also made at the time of sampling can be valuable historical**

"The plans to improve drainage downstream of the dam will, of course, aid in maintenance. information." … "I would suggest that you discuss procedures for the best means of fertilizing and seeding the backslope of the dam so that a vigorous grass can be developed."

1981, Apr, the LTPOA reactivated the dam committee to study and inspect the dam with the knowledge that the state of Missouri would require dams to be inspected for a permit to be issued. (The thinking was that it would be about four (4) years.) The committee began their meetings in May 1981 with an inspection, temperature and flow measurements. The "guesstimates" were **42 degrees and a 5 gallon flow per 4 seconds**. *[This is 75 GPM.]* The report reads that "this compares with a 5 gallon flow in 6 seconds *[This is 50 GPM.]* which was obtained on a fairly regular basis in the past". **They were advised by the Geology Section of the Corp of Engineers that Missouri's springs vary from 55 to 62 degrees.** *[In July 2006 leak temp was 50 deg which is more evidence that the leak's source of water is the lake rather than a natural spring.]*

The meetings, and inspections, were held through November that year. They attempted to clear the back side of the dam and had quite a bit of trouble cutting the dam themselves and finding a contractor to do the work. Temperature readings were recorded at 50 degrees on several occasions and the flow at 5 gallons per 5 seconds. There is mention of a "smaller diameter pipe should be used to carry the water away from the original pool to connect with the 8" diameter pipe in order to prevent erosion." The pipe was donated and installed with a cold patch around it. The need for "an elbow pipe to get all of the water properly channeled into the ditch".

Also reported in October 1981 as work items, "Connect the pipes so that a flow measurement can be taken. There is standing water in the flat area in back of the dam. It is felt that this is probably the result of the water not being channeled into the ditch because the pipes are not connected."

In a report November 1981 from S. D. Prater, Dam Committee Member, wrote that after an inspection behind the dam, there were evident animal burrows, vegetation was out of control and continued signs of seepage. He later contacted John Lath the engineer who had been charge of the Dam Safety Program for the state, who in turn contacted Mark Haynes and Oran Boathook, both soil engineers with Engineering Consultants of Colorado for their opinion.

The summary of their opinions: 1. "The requirements for a seepage and soil stability analysis are as follows: a) What are the foundation and abutment conditions. B) What are soil conditions within the dam-shear strength, density permeability. Note – The permeability can be estimated from the soil type. c) A seepage flownet can be developed from the above information if the above information is available. 2. Is the seepage occurring across the entire dam? 3. Has the seepage been sampled for the fines content to check if the embankment is being eroded." A letter was quickly sent to Reitz & Jens Engineers engaging them to a soils and seepage analysis and evaluate the dam.

Much was also reported regarding the clearing of the back side of the dam, the problems encountered and the proper way to handle such a large task.

1981, Nov 25, Lake Tish dam visit by David Hoffman (Chief Engineer of the Missouri Dam and Reservoir Safety Program of the DNR):
"……At first glance the leakage appeared similar to what was noted on a previous visit. However, closer examination revealed that the center of the small basin, where the water comes to the surface and is confined for measurement and piping away from the dam, was clogged with material**. The material turned out to be tar and gravel** that had bulged upward from the bottom of the basin. It had bulged enough to block flow into the outlet pipe of the basin causing the basin to overflow. Mr. Kitchell *[maintenance man at the time]* removed the tar and gravel to restore flow into the outlet pipe. He also mentioned he has done this before….The bulging of the basin bottom due to hydraulic pressure is

potentially very serious as it indicates conditions are no longer stable at this leak. This needs serious investigation soon."

"I was then shown a blob of concrete with some pipes protruding from it which is located perhaps 50-100 feet downstream from the right abutment-toe contact. There appeared to be a valve on the downstream end of the concrete and a 10-12 inch pipe elbow going into the ground on the upstream end. I do not remember having seen this concrete and pipe on my previous visit, probably due to it being hidden by vegetation. This may be the end of a pipe passing under the dam. If so, it looks like it may pass under the dam below and slightly offset from the area of leakage near the right abutment. **If, there is a pipe under the dam, it could be associated with the leak.** Assuming the pipe exists, the upstream end in the lake is open and the downstream end is closed by a valve, the entire pipe would contain water under high pressure. Then if a break or leak exists in the pipe under the dam, the high pressure water escaping could form the concentrated leak that exists on the dam." *[Clarue indicated the original detailed drawings of the dam did NOT show a pipe.]*

"The slide turned out to be much more significant than anticipated. The upper slide scarp was 100 feet, plus or minus, long, located about 2/3 of the distance up from the dam toe toward the dam crest and had a maximum height of about 5 feet. Many fresh cracks were noted in the sliding mass and there were some very damp, soft spots in the material. The first impression was that of a deep rotational slide. Lower on the slope some overriding of the soil mass was found suggesting the possibility of a shallow slide parallel to the slope. Vegetation at the toe of the dam and darkness prevented a careful examination to see if bulging was occurring in this area which would indicate a deep rotational slide. One wet, soft spot was found."

1981, Nov 25, from an unsigned note re Dave Hoffman (Mo DNR) inspection:
"He was not qualified to judge if it (wet spot) was a septic field leak. He did state oily film and iron stain is often present in leakage from dams." "…pointed out old pipe and gate valve below the dam. Mr. Hoffman felt it and it was possible this could be the source of our leak. He stated that usually these pipes are fitted with valves at both ends which are both closed when the dam is completed to relieve the pressure against the valve below the dam and protect the pipe inside the dam. Perhaps the valve in the lake was not closed or has failed and the pipe has developed a leak inside the dam and is traveling up and out at an angle."

"….pointed out burrowing animal holes as we walked the backside of the dam. Mr. Hoffman stated that this should of course not be permitted……..He did state that removing all weed, brush and stumps would lessen the attraction and hiding places for these animals."

""He indicated the slide was very recent. While inspecting the uppermost slide area water was found to be possibly bleeding out of the slope." Due to the late hour and shortness of visit, Mr. Hoffman was unable to make a definite evaluation. "It was apparent that he will recommend several core drillings at locations on the slope near the slide area".

"Bill Kitchell pointed out a constant wet spot in the corner between the dam and spillway area or S.W. corner. Mr. Hoffman stated this could be seepage, however, the distance from the actual slope causes no real concern only a maintenance problem. Be aware of the wet are and monitor regularly for change."

"The following conclusions and things to be done were arrived at during Mr. Hoffman's visit:

1) Locate the large pipe under the dam and trace its location with a metal detector to find its proximity to the leak.

2) Have a scuba diver find the end of the pipe to determine if there is a valve and see if it is open. If can be closed – close it. (Careful of current into pipe.)
3) Research the materials in John Samuels files concerning construction of the dam for any info on the pipe and valves and also manner in which the clay was layered on the entire dam. Mr. Hoffman may be able to use this info to determine type of failure.
4) Physically observe the slide as frequently as possible and report any change or movement. At lease two times per week or daily if weather changes occur. Heavy rain will accumulate behind slides and soak in, thus lubricating the area under the slide mass causing it to move easier and faster. Set up line of sight reference stakes to determine ground movement and shifting.
5) Our maintenance man should remove all weed and brush from the entire slide area so it can be inspected and monitored. Do not remove any grass and do not try to repair or grade any of the slide as yet.
6) Wait until spring to burn off dam just before ready to seed. A bulldozer may be used to smooth the backside of the dam before planting. Try not to disturb more than a foot deep of the surface. Large stumps and stumps tight with a tap root should be dug around and cut out before grading. Use grasses with short root systems."

"……..if he concludes this is a deep failure, he <u>will</u> issue an order to remove the water from the lake."

During the early days of December 1981, Mr. David Hoffman of the DNR recommended lowering the lake to relieve the pressure. The LTPOA unanimously voted to hire the Reitz and Jens Consulting Engineers firm that was confirmed by Mr. Hoffman as very highly qualified to perform the studies. The first order of business was to lower the lake.

1981, Dec 10, in an article in the Jefferson County Democrat Pilot:
"Some water will be drained from Lake Tishomingo as a precautionary safety measure, following a soil slippage on the downstream face of the earthen dam, it was announced Wednesday by the Missouri Department of Natural Resources." The article went on to say "David Hoffman, chief engineer of the DNR dam and reservoir safety program, said that the LTPOA decided to drain the reservoir on the recommendation of DNR and of an engineering firm which the LTPOA retained to look at the problem." The decision was termed as "no emergency action".

"It'll take a little while to study this soil slippage and we are removing the water strictly as a precautionary measure." Mr. Hoffman said he is also concerned about leakage that has been occurring for years near the right abutment of the dam. He said he believes that some change has occurred in the conditions in the small basin where the water comes to the surface."

1981, Dec 17, from a St. Louis Post Dispatch article:
"Lake Tishomingo drawn down to protect dam". "……being drained of thousands of gallons of water to prevent further erosion of its earthen dam." "The water level will drop about 10 feet because of the draining. About five feet will be drained in the first week and a half, by opening the spillway. The remainder of the water will be drained with a siphon." "……the full extent of damage to the dam is unknown and the draining is a necessary precaution. The DNR and Reitz and Jens engineers are closely monitoring the problems at the dam and will provide a comprehensive analysis to the property owners." "The dam probably will need to undergo full renovation before the department will issue an operating permit for the dam when the current permit expires in 1984, Hoffman said". (Dave Hoffman, chief engineer of the DNR).

I have found no information of what was done as a result of all of the above. This needs to be researched and expanded . Following may be the final result, but the time difference is 5 years.

1986, May 20, from a letter from Donald Eskridge (Reitz & Jens, Inc) to Mr. Whiteman (LTPOA): References a letter proposal of December 10, 1985, has discussed their findings with the State Dam & Reservoir Safety Council and the proposal from our office to submit the same to the State for review as a Class II Hazard Classification. While they had not finally determined whether the berm along the right side of the spillway is sufficient and not anticipating major rock work, they did not anticipate "a major cost increase over that shown as the anticipated berm work on the main dam embankment".

1986, May 21, from a letter to all property owners from Robert Whiteman (LTPOA):
"……..today received the attached letter (see above) confirming that the Tishomingo dam may be considered a Class II dam and so registered under the applicable Dam Registration Statute of the Sate of Missouri". "…….the necessary alterations to the dam will cost approximately $105,000." "Originally the State required that all work on the dams be completed by August 1, 1985. the State has extended this deadline for all lakes that were making an effort to comply with the Statute. This we have been doing…….". "We need your vote FOR the special assessment on June 21st……" (from the ballot – "one time special assessment of two dollars ($2.00) per front foot") Note: State Permit #R-156 was issued October 6, 1988.

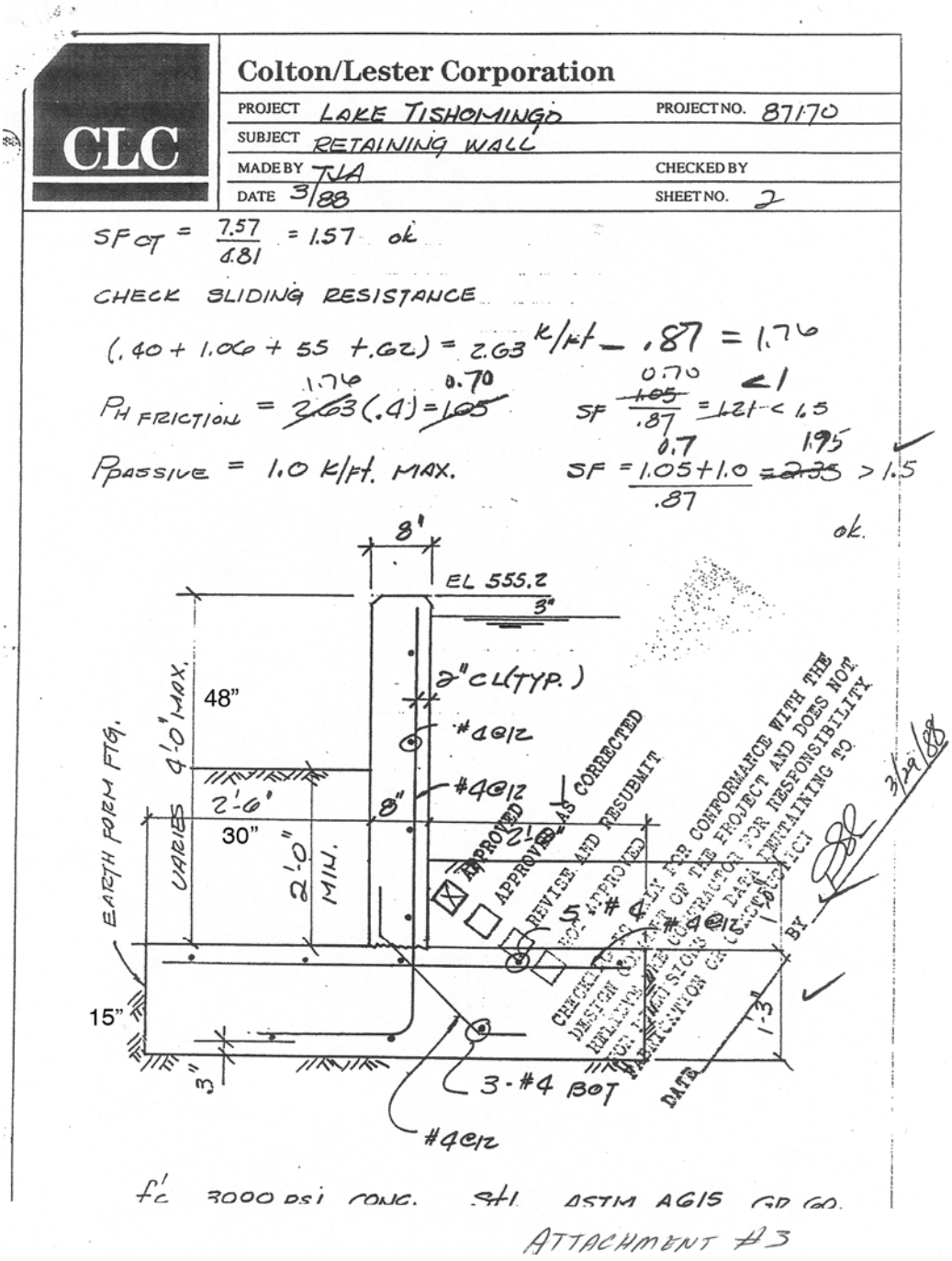
1987, Apr 28, from a letter from Brian Swenty (Chief Engineer of the Dam and Reservoir Safety Program of the DNR) to Donald Eskridge (Reitz & Jens, Inc):
"……completed review of the construction permit application for the Lake Tishomingo Dam with the following comments: Speaks of environmental Class II, the depth of the breach and time to breach, dam has experienced stability problems in the past, breach time greater than two hours being unacceptable, no owner and engineer certification, need for lab results, additional information on how the crest will be raised, details of the drain system including slope and elevation of the pipes where the two drains systems are to be connected, specifications for foundation preparation, and fill placement. "Once we receive an adequate response to these comments, a construction permit will them be issued".

1988, Mar 21, notice of Award of Contract for bids received from your firm for "Embankment and Spillway Repair" from Reitz & Jens, Consulting Engineers Donald Eskridge (letter dated 4/7/1988) to Byrnesville Construction of High Ridge, MO.
"The work of this contract – Repair of dam embankment and spillway containing wall"
"Installation of spring interceptor, and subdrains."
"Installation of wall raising the crest of dam".
"All as shown on the plans or enumerated in the contract documents".

1) 50' solid 12" PVC drain pipe *[from collector to leak pool?]*
2) 250' perforated 4" or 6" PVC drain *[where was this used?]*
3) Spring interceptor manhole w/all contingent items
4) 910' Concrete median barrier
5) Size 1 fill
6) Size 2 fill – 6359 cubic yards
7) Mobilization
8) $4,000,000 Insurance coverage

Total of Bid (without alternates) $109,440.00

Figure 1. 1965 Dam drilling



1988, Sep 20, letter from Ralph Hess (Engineering Tech. of the Dam and Reservoirs Safety Program of the DNR) to LTPOA:
"In response to recent notification that the construction work at Lake Tishomingo Dam had been completed, I would like to schedule a site visit to the dam on October 3, 1988". "…..visit is normal procedure prior to the issuance of a registration permit."

1988, Oct 5, from a letter to Brian Swenty (LTPOA) from R C Adams (DNR):
"On October 3, 1988 Ralph Hess and I made as site visit to the Lake Tishomingo Dam to observe the condition of the dam prior to issuing a registration permit. We were met at the dam by Don Eskridge, the

engineer of record, Joe Vuichard, Jack Folluo and W D Tindall……." Apparently a number of property owners are greatly dissatisfied with the way the dam was modified and the nearly 50% overrun in construction costs."

"…None of the earth work had been seeded because the homeowners wanted to be certain that the fill had been brought up to final elevation. The addition of fill at the lower portion of the dam appeared to match the plans. It differs from the fill added in 1982 in that there is no transition from the gentler slope of the new fill to the steeper slope of the upper part of the dam. In addition, the toe of the 1982 fill addition changes to a steeper slope at the base of the dam where as the new fill has a uniform slope throughout."

"The spillway discharge channel berm has been repaired; however, it appears that this will be a continuing maintenance problem because of turbulence generated at this point caused by changes in spillway grade and the direction of the channel."

The crest of the dam has been raised by constructing a concrete wall along the entire length of the dam. Soil fill has been added on both sides of the wall so that only the crest is visible. As this wall is different from what was originally approved for the construction permit, I asked Don to submit as-built plans and design calculations for our files. Using the north east end of the spillway pavement as a temporary bench mark of elevation of 547.2, I determined that the lowest elevation of the wall was 555.2."

"The seepage collection system had been installed and the lake committee members had recently **measured the rate of flow in the manhole at 50 gpm (5 gallons in 6 seconds)**. Don stated that the **preparations for placement of the drain exposed a bedding plane discharging the bulk of the flow collected**." *[Bedding plane: Surface separating layers of sedimentary rocks. Each bedding plane marks termination of one deposit and beginning of another of different character, such as surface separating a sand bed from a shale layer. Rock tends to separate, or break, readily along bedding planes.]*

"The only problem observed was the transition between the new fill and the upper part of the dam where it appears to be rough. This may develop into a maintenance problem at some time in the future but I see no reason why a permit cannot be issued at this time……."

1988, Oct 3, from a report by the Dam Committee of the inspection:
"Areas inspected were the spillway, the wall atop the dam, the back of the dam, the spring interceptor box and the piping from that box. The state engineers used surveying instruments to take measurements."

"……more rock fill was needed on the inside north wall of the spillway where a curve occurs, as during heavy water flow, this area receives much pressure.. Mr. Hess and Mr. Adams both said that chipping or blasting on the opposite wall of the spillway, to straighten out this curve, will eventually be needed……. Also questioned the type of fill used on the spillway, that it should have contained more rock……the aforementioned conditions have no direct effect on the integrity of the dam itself……

"The spring interceptor and piping was inspected and found to be in order. **Mr. Hess says that a device known as a Wier box should be installed in the piping so that regular and accurate measurements of the flow could be taken."**

"The state engineers told us that we have one of the better dams in the state, but that all dams require continued maintenance and frequent inspections by the owners of them. This includes the measuring of the flow from the pipe, visual inspection of the entire dam at regular intervals and close monitoring for obstructions in the spillway during heavy rain fall."

1988, Dec 12, from a report by Elmer Richars (LTPOA):
Regarding the approximate $600 bill recently submitted to the LTPOA from Reitz and Jens. There seems to be a dispute over the charges and the quality of grading and finish work done on the dam by Byrnesville Construction. The final recommendation was "should we ever do business with Reitz & Jens again, I believe this (require the contractor to complete the job in a more workmanlike manner) be spelled out in the contract."

1989, Jan 24, in a letter to Joe Vuichard (Lake Tishomingo) from Russell Adams (Civil Engineer, DNR):
"During my recent site visit to the Lake Tishomingo Dam, we discussed the erosion of the spillway discharge channel training berm and possible solutions. Not only was the recently repaired section eroding, but several other areas were being eroded as well." Among the items mentioned for redo and/or repair was the accumulated gravel and rock deposited adjacent to the rock wall on the left, water forced over against the training berm causing erosion, use of gabion wire baskets to prevent erosion of the berm and to buttress the fill and stabilize it, the cracking of the fill due to lack of compaction during placement, the use of filter cloth to prevent the washing of soil and the amount of rock in the original creek reducing it's capacity so that during heavy flows the water overtops the berm and floods the area below the dam.

On March 2, 1989 Elmer Richars forwarded the letter to Byrnesville Construction Company, who had recently completed the extensive repairs to the dam and spillway as prescribed by the engineering firm of Reitz and Jens, Inc. "As you know, according to our contract, Article 18, Correction of Work, there is a one year period of time under which the contractor is required to promptly correct work that fails to conform to the requirements of the contract."

1998, Mar 13, from a letter from Rick Hannick (LTPOA) to Russell Adams (Civil Engineer, DNR, Dam and Reservoir Safety Program):
"Attached you will find the engineering study performed by Dr Greg Hempen and Ron Dieckman concerning the repair of the spillway at Lake Tishomingo"

"…….You had indicated to us in the past you would be willing to review any plans we develop concerning the spillway so that we may be assured that we are on the right track before we begin the work."

"You indicated also at that meeting that we could be recertified on a two year basis until such time as the work was totally completed. We are currently struggling to find new sources of assessment revenue in order to have a more realistic budget to work with here at the lake".

1998, Apr, from the Long-term Solutions to Lake Tishomingo's Spillway and Reservoir Drainage issues (not formally dated but penciled in as 4/98):
"The LTPOA had entered into an agreement with Mr. Dieckmann and Dr Hempen to conduct an evaluation of the problematic reservoir elements. The report evaluates and recommends solutions for the following issues:

1)Review current Class II design documents, evaluate ditches to remove water at the dam's toe, determine potential berm corrections, provide long term berm improvement recommendation.
2) Assess models for drawing down the reservoir, evaluate present spillway overflow conditions, recommend a permanent system to temporarily lower the reservoir in a controlled manner for presentation to MDRSC.
3) Assess Class I storms for the subject lake, resolve impacts of various actions, recommend an action to improve the facility to safely pass the required storm for presentation to MDRSC."

After several visits for field evaluations and surveys, it was found that the lake was adequately maintained but improvements should be made. Evaluation of soil and rock conditions were limited to the spillway and floodplain below the dam. Intact carbonate rock is vertically very strong. Horizontal bedding of the rock allows freeze and thaw lifting when exposed to standing water. Erodability is found in the spillway. The cherty clay residual soil can be well compacted. The soil is relatively resistant to erosion when it is compact.

The spillway control section was investigated and found to have a small amount of leakage at a location on the left side of the spillway where at some time in the past a 3-4 foot section of the spillway was removed and later replaced.

Figures were developed to show the areas of concern. The ditches at the dam's toe were adequate to remove heavy precipitation from the downstream face of the dam's embankment. Ditch maintenance could allow greater and more efficient flow volumes. On the spillway berm, several reaches were severely eroded which would continue to deteriorate. Also the current concrete spillway control section had leakage through a previously removed plug.

The recommendations included improvement to the outlet channel's (right side containment) berm and to the overflow section's sloping asphalt seal, semiannual inspection of the ditches should be made to assess sloughing of walls or debris fill and permanently correct the erodability of the berm and raise it's height. Gabion walls are the lowest cost and most easily constructed correction measure along with proper placement of granular fill, native soils and filter fabric. Installation of a box weir with stop logs. (These stop logs could be removed to lower the reservoir.)

Also included in this study are many pages of Spillway Gabion Volume Estimates (with elevations, etc), Construction Estimates, Survey Data, Water Surface Profiles, etc.

1998, Jun 2, from a letter from Rich Ortmann (Larry Ortmann Contracting Inc) to Mr. Karl Kloster (McCarty):
"I have signed the contracts and await your execution. I wish to clarify that we will not begin or continue to work on the spillway when the lake is above summer pool and/or there is a heavy flow."
The attached contract between LTPOA and Ortmann Contracting, Architect (Engineer?) Gregory L. Hempen, PE. – start work on or before July 15, 1998.

"Excavate for gabion wall only, supply and install gabion terramesh system with 6'0" tails, dowel baskets one per cell where founded on rock, supply and install filter fabric and granular fill behind wall for reinforced backfill compacted to 90% standard proctor (testing by others). Shape slopes above wall to 2:1 using over-excavated materials only, place filter fabric on grade and cover with rip-rap to depth of 12"."
Contract sum - $65,668.00. (Change orders reduced this amount somewhat)

Materials & Rock	$33,600.00
Equipment	21,162.00
Labor	10,118.00
Extra #1	788.00
Extra #2	840.00
Cmemo	(40.72)
Invoice	561.02
Cmemo	(840.00)
Total	$66,188.30

1999, Sep 18, from a letter from Gregory Hempen PhD, PE, RG to LTPOA:
"Re: Final Payment Request for Spillway design and construction oversight, $750. The state made inspection demands upon the LTPOA and myself requiring added services. ……..provided construction permit information and contractor guidance…….positive review by the staff of the Dam &Reservoir Safety Council……..relative to inspection and review work activities from 31 July 1998 through 29 July 1999…….included signing for some responsibilities on your state application."

From handwritten note – undated – unsigned:
Spillway/Dam Project – need to move electrical and telephone wires.
Maintenance men – will put rip-rap rock in the thin areas – dress it up.
Urgent problem – cutting path thru rock below.