



**REITZ & JENS, INC.**  
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December 8, 2010

Lake Tishomingo POA  
c/o Mrs. Clarue Holland  
8625 Moran Place  
St. Louis, MO 63114

Re: Site Visit / Spillway Inspection – December 2, 2010

Gentlemen:

The undersigned met with several members of the property owners association and dam committee on the afternoon of December 2, 2010. The meeting was called to observe the condition of the present spillway control sill, and discuss the desired location of a sewer force main that had to cross the spillway. This meeting also discussed the consequences of the downstream dam classification changing from the present Class II to a more stringent Class I downstream classification.

### Existing Spillway

The photo on the right shows the existing spillway control crest. The crest has been undermined on the downstream side and there is evidence of seepage under the concrete crest slab. The protective apron on the downstream side has been washed out, probably over the location of the unknown backfill used to plug the trench cut into the spillway in 1981 when the lake had to be lowered at the request of the State Dam Safety Engineer. The field measured effective length of the spillway is about 58 feet, the concrete slabs are about 4 feet wide and appear to be no more than 12 to 15 inches thick. There is no visible evidence of a cutoff wall below any part of the spillway control crest.



The undermining of the spillway crest and the lack of a cutoff wall below the crest apron should be improved by replacement of a new spillway crest with a minimum 6 foot deep cutoff wall. We have prepared a typical section of the recommended replacement; these plans are attached to this memo and were previously sent to the committee. The top width of the spillway is not fixed, it can be varied to suit the needs of the membership. The spillway **MUST** be rebuilt no higher than the elevation of the present spillway, in order to avoid obtaining a permit from the MO Dam and Reservoir Safety Council. Replacement of the deteriorated spillway crest at the same elevation is considered routine maintenance and will not require a permit.

While inspecting the spillway I noted that some woody vegetation is established in the spillway channel. We recommend that all woody vegetation be removed from the spillway channel. The only recommended channel vegetation is the herbaceous form.

### *Sewer Crossing*

Discussion with the sewer contractor indicated that the sewer is planned to cross the spillway area downstream of the spillway control crest. We have included a suggested method of crossing through the rock if the contractor intends to trench the sewer across the spillway. If he intends to tunnel or bore the sewer across the spillway then the carrier pipe should be grouted into the rock. It is our opinion that either method of installing the sewer below the present spillway channel grades will not require a permit from Missouri Dam Safety.

We strongly recommend that any sewer crossing of the dam alignment be at an elevation above the permanent pool elevation, to avoid the probability of creating a seepage path through the dam.

It is important to recognize that the placement of the sewer across the spillway will effectively eliminate the possibility of cutting a trench into the spillway to lower the lake. The reinforced replacement spillway can be built with cold joints in it at selected locations to allow removal of part of the spillway, although it will not necessarily be the easiest task since the cutoff wall is cast into the rock.

### **Class I Implications**

The comparison between the present Class II design requirements and the same Class I requirements that would affect the completed dam are shown in the following table.

	<b>Seismic Design</b>	<b>Spillway Design Flood</b>
Class II	0.5 x PMA *	0.5 x PMP **
Class I	0.75 x PMA	0.75 x PMP

\* PMA for Jefferson County is 23% of gravity

\*\* PMP = Probable Maximum Precipitation

6 hour storm rainfall mass = 28.1 inches

24 hour storm rainfall mass = 35.2 inches

### *Seismic*

We have used the dam embankment soil properties from the 1987 permit application to analyze the effect of the changes in the seismic shaking. The factor of safety for the full reservoir, steady seepage condition during the design earthquake is required to be 1.0. The class I earthquake loads on the existing dam calculate to be a factor of safety of 1.03, therefore no changes to the dam embankment will be required for any seismic upgrade.

### *Spillway Capacity*

We have calculated flows for both the 6 hour and the 24 hour storms. Since the time of concentration for the reservoir basin is one hour, the 6 hour storm creates the more severe results.

The table below shows the results of several different spillway possibilities with the resultant maximum flow and corresponding maximum lake water surface elevation. The present spillway elevation is 547.5 and the top of dam is 555.5. Computations that created water elevations above the top of dam were made assuming that no water was allowed to flow over the top of the dam.

	<b>Calculated flow</b>	<b>Maximum Water Surface Elevation</b>
Class II 14.05 " rain in 6 hours 56 foot spillway	2538 cfs	553.61
Class I 21.07 " rain in 6 hours 56 foot spillway	4493 cfs	556.84
Class I - 100 foot long straight spillway	5876 cfs	555.3
Class I - approximation of a 120 foot labyrinth spillway in a 61 foot wide channel	5876 cfs	555.3

During the preparation of the 1987 permit, the spillway routing computations showed that the spillway hydraulics are controlled by the elevation of the spillway channel about 150 to 200 feet downstream of the spillway crest. To allow any of the class I flow to be conveyed through the spillway channel the channel will have to be improved by steepening the channel, which will require removing rock. I have not calculated the required channel hydraulic needs, but I would not be surprised that up to 10 feet of rock will have to be removed at the first waterfall location with a constant slope down to that point to create the required channel capacity.

A detail sheet of a labyrinth spillway is shown on the next page, this sheet was handed out at the meeting. This spillway type is a way to effectively lengthen a narrow spillway without significantly widening the actual spillway location, however to make these work the spillway channel will have to be deepened, preliminary computations show that the deepening may be as much as 8 feet. The planned presence of the sewer crossing may affect the constructability of this labyrinth option.

Note that the existing spillway, if improved to convey the flow, will back up water to elevation 556.84, which is only 1.34 feet (16 inches) above the present top of the dam. The dam safety engineer has conveyed to me that there is no freeboard requirement for this computation, therefore the most likely choice for improving the spillway flood capacity to the Class I requirement is to improve the spillway channel and build a minimum 16 inch high flood wall on top of the dam.

#### **Likelihood of Downstream Classification Change.**

I have reviewed the most recent aerial photo mapping to see if there are any new residences in the breach inundation flood zone. In 1987 there was only one house that was considered "flooded" by the calculated breach flood wave. The April, 2010 aerial photo shows no new construction in the flood inundation zone between the dam and Highway 30 on the Big River. In order to require the change to Class I there have to be more than 9 "flooded" residences.


The MO Dam Safety Office is currently mapping the breach inundation zones below all registered dams in the state, the timetable depends on when the new aerial topographic maps are available. Mr Bob Clay, the chief engineer, told me that he expects to have the Lake Tishomingo mapping distributed in 16 to 18 months from now.

I would expect that the Jefferson County floodplain administrator could be easily convinced to require that no construction of permanent residences, campgrounds, or industrial buildings be allowed in the probable flood inundation zone, and the enforcement would not require much effort after the maps are made available by the state. I would recommend that your association actively pursue this avenue of self-protection from the need to upgrade.

If you have any questions, please contact us at your convenience.

Sincerely,

REITZ & JENS, INC.

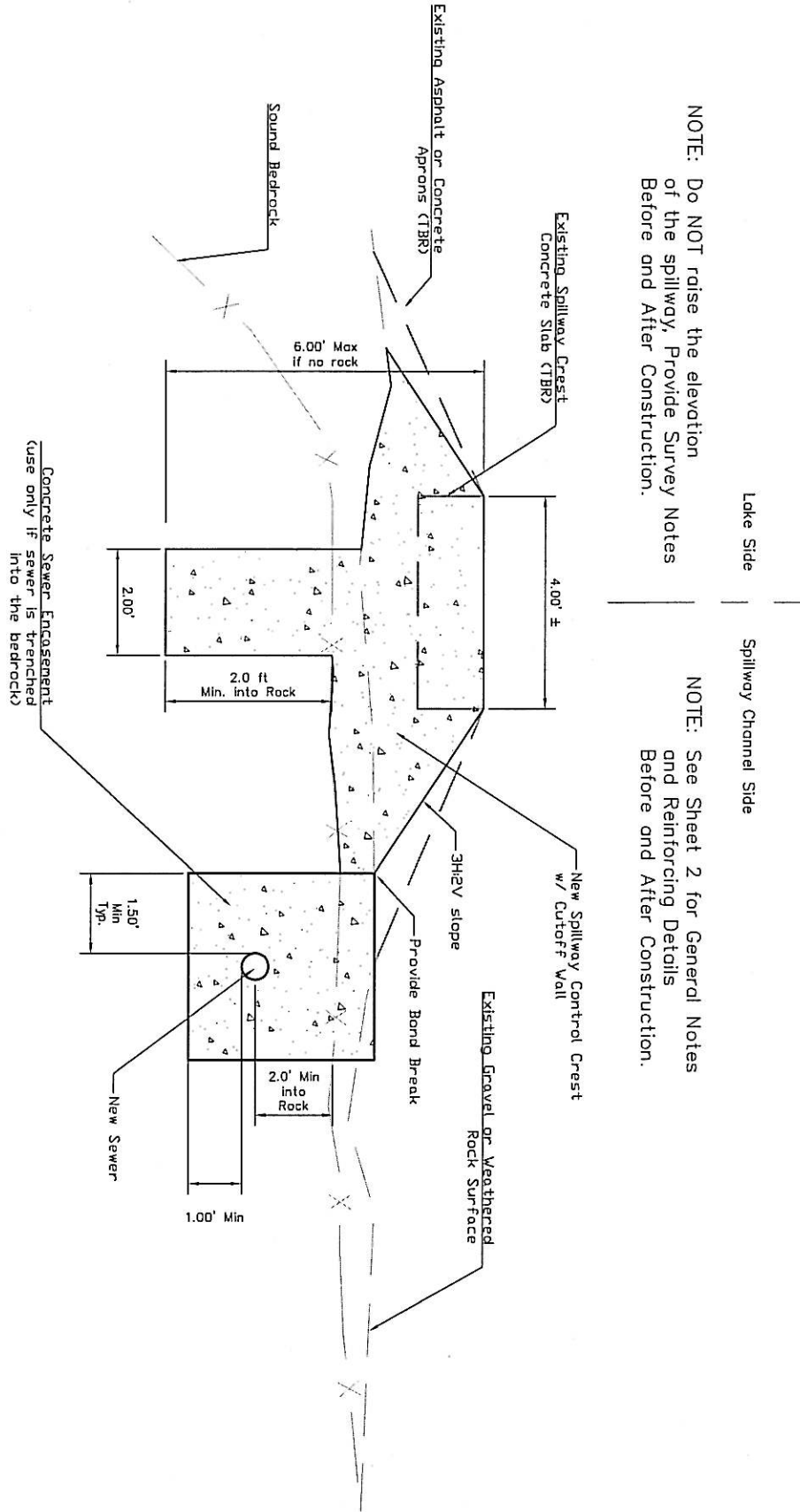


Donald S. Eskridge, PE  
Principal

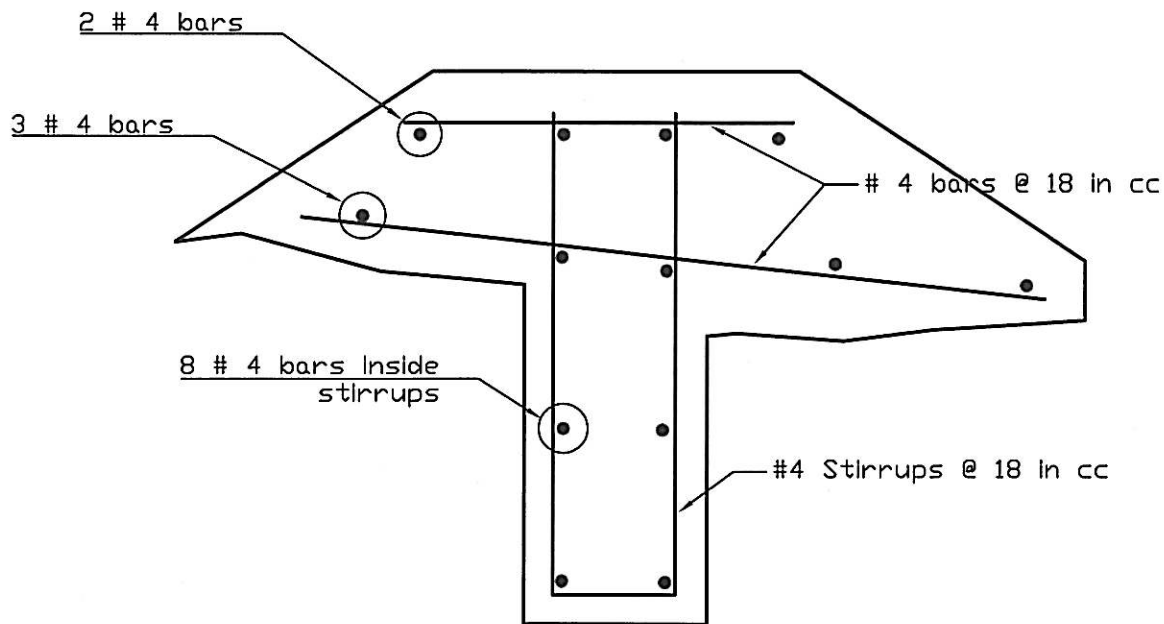
Attachment – Labyrinth Spillway  
Spillway Section

NOTE: Do NOT raise the elevation of the spillway, Provide Survey Notes Before and After Construction.

NOTE: See Sheet 2 for General Notes and Reinforcing Details Before and After Construction.



Section thru Spillway & ForceMain



## Reinforcing Detail

### General Notes:

All reinforcing shall be ASTM A615-60, and shall be epoxy coated

All reinforcing shall have a minimum of 3 inches of cover.

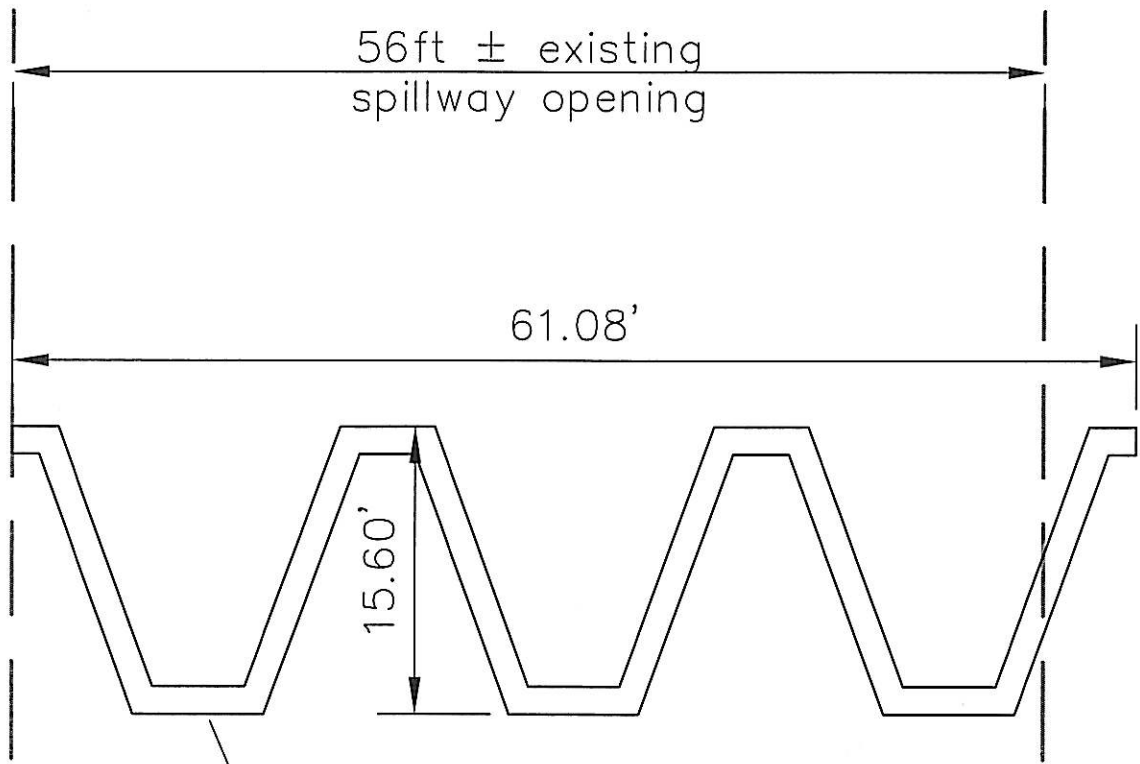
All concrete shall be air-entrained with 5.5%  $\pm$  1.5% air content

Concrete 28 day compressive strength shall be a minimum of 4000 psi.

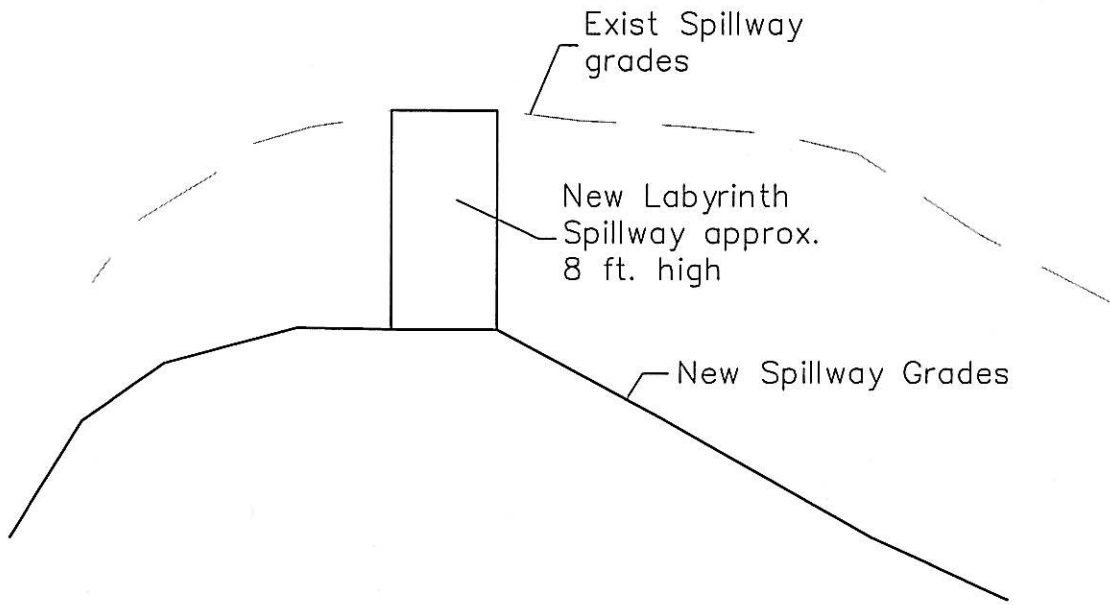
Concrete slump shall be 4 inches  $\pm$  1 inch when placed.

During excavation of cutoff wall, if any loose soil is encountered below cutoff wall, it should be removed and backfilled with extra concrete.

If concrete sewer encasement is used, it should be a minimum of 5 feet from the spillway cutoff trench.



Plan View



Section

Lake Tishomingo  
Approx Weir Geometry