DISCUSSION OF KIMBLE LAKE LEVEL CONTROL

DEVELOPING AN OPERATIONS PROTOCOL

MODIFIED 7/10/2019 AFTER 48” PIPE WAS REMOVED IN JUNE 2019

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SYSTEM DESCRIPTION

Kimble Lake was designed to be a constant level reservoir. It was not designed for or intended to be utilized as a means of flood control. The spillway system includes the 200' wide emergency spillway at the southern most end of the lake, the 100' wide secondary spillway north of the main spillway, and a 35' wide set of overflow culverts just north of there.

At its lowest point, the top of the emergency spillway is at 93.5ft above mean sea level. This elevation is the normal maximum level of the lake.

As flow into the lake increases from the 70 square mile watershed to the north, the lake level rises and water flows over the spillway to remove the excess in the lake.

Should flows increase and the lake level rises from that point, the secondary spillway, whose lowest point is approximately 94ft above mean sea level, begins to function to alleviate the more of the excess.

Additionally, there is an auxiliary spillway whose lowest point is 95ft above mean sea level.

There is one pipe, 36" in diameter, to the east of the emergency spillway that may be utilized to control lake level. The flowline of the 36" intake in the lake is down at "creek level". The 36" pipe has a manually operated valve accessed by WPOA crew via a footbridge extending into the reservoir. The 36" pipe was installed strictly to lower the lake level, and/or drain the lake.

It must be noted here that this pipe was not designed for or is intended to be utilized for *control* of water flow into the lower basin.

FACTORS

Factors driving the creation of this protocol are twofold:

- Kimble Lake is an important amenity enjoyed by all residents and visitors due to its beauty and the activities it affords. Keeping the lake level constant to enable the views and activities is paramount to the operation of Wildwood;
- During Hurricane Harvey, more than 30 homes were flooded by rising water. Due to this fact, these residents are very concerned when water rises due to heavy rains. It must be noted here that, other than during the Harvey flooding, the only other time in recent history that any of our homes have flooded is in 2006, when 2 houses experienced water influx during a 16” rain event.

DISCUSSION

Lake Kimble, formed by capturing the water in Kimble Creek, at normal lake level, holds approximately 200 acre-feet of water with water level at the crest of the spillway, which is 93.5 ft-msl.

As water rises in the lake due to rain events, at 97 ft-msl lake level (3.5 ft above the crest of the spillway), the volume of water in the lake is at 750 acre-feet. Per Freese and Nichols 2016 study, at this point, the water being discharged by the spillway system is approximately 7,000 cubic feet per second (cfs). (To put this in perspective, this is equivalent to 3,142,000 gallons per minute (gpm)). At this flow rate, the water in the lake is completely changed every 78 minutes.

Normal design flow, calculated at 10 feet per second, through a 36” pipe is around 32,000gpm. Adding this total to that of the spillway system gives us a total approximate flow of 3,174,000gpm. At this rate, the water in the lake is completely changed every 77 minutes…

So, taking these things into consideration, lowering, or even emptying the lake prior to an anticipated heavy rain event will do little other than to delay the rising water situations experienced in the past by a little more than an hour. Were the lake completely empty, and the heavy rain events occurred that created flows equivalent to the 7,000 cfs flow mentioned above, it would take, with the 36” pipe open, approximately 20 minutes for it to fill to normal lake level of 93.5 ft-msl…

Innovative approaches
Practical results
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Lake Kimble Dam (TX03743)

Preliminary Engineering Report
Prepared for:
Wildwood Property Owners Association

July 2016
Prepared by:
FREESE AND NICHOLS, INC. 10497 Town and Country Way, Suite 600 Houston, Texas 77024
(713) 600-6800

The hydrologic model for Lake Kimble Dam was created using the U.S. Army Corps of Engineers hydrologic modeling software, HEC-HMS 4.1, with additional routing performed in HEC-RAS 5.0.1. The model is comprised of **eight drainage basins representing the contributing area of approximately 70 square miles to Lake Kimble Dam.** Figure 6 shows the location of basins K1 through K8 used to develop the hydrologic model in HEC-HMS.

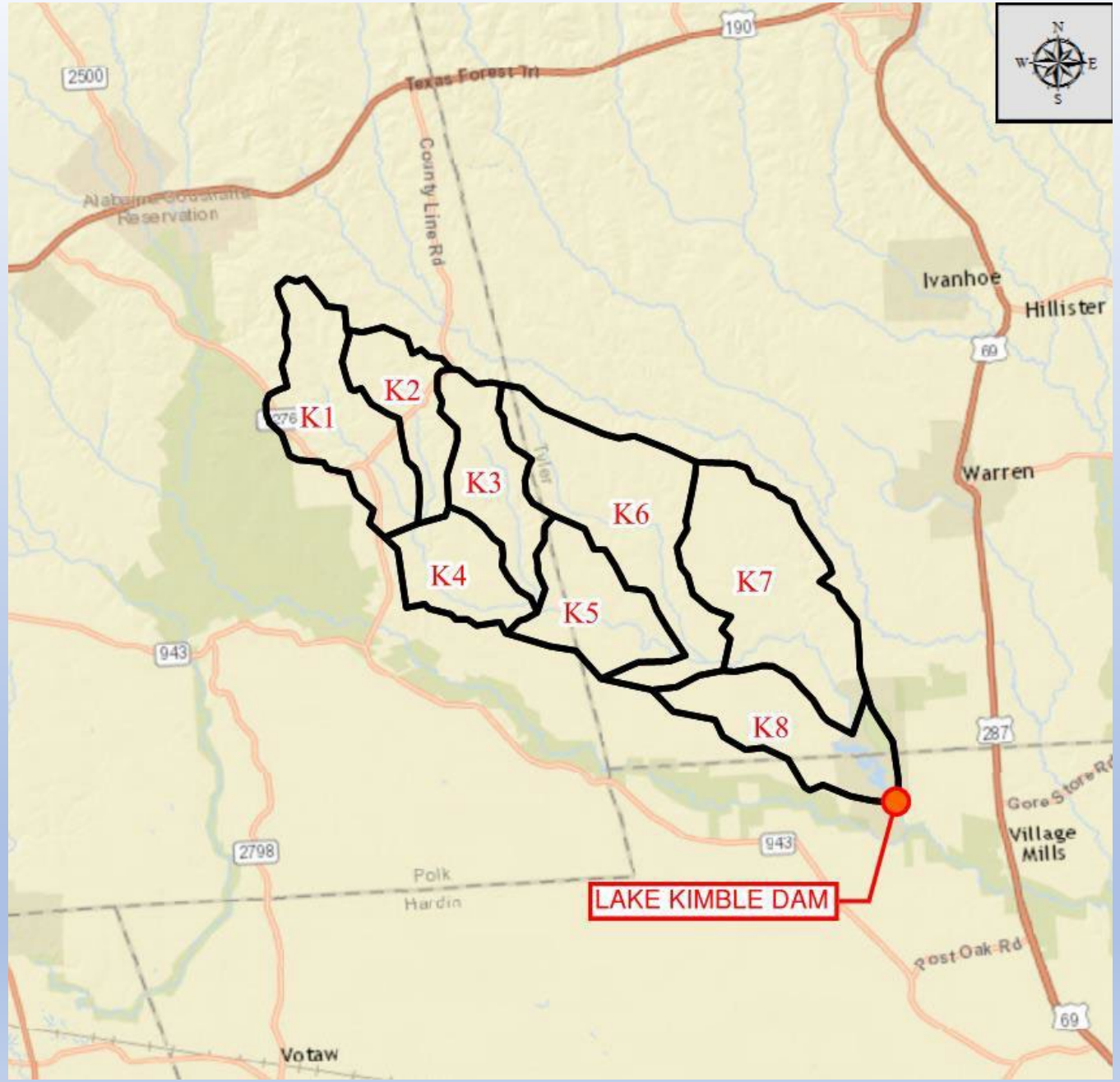


Figure 6 - Contributing Drainage Basins

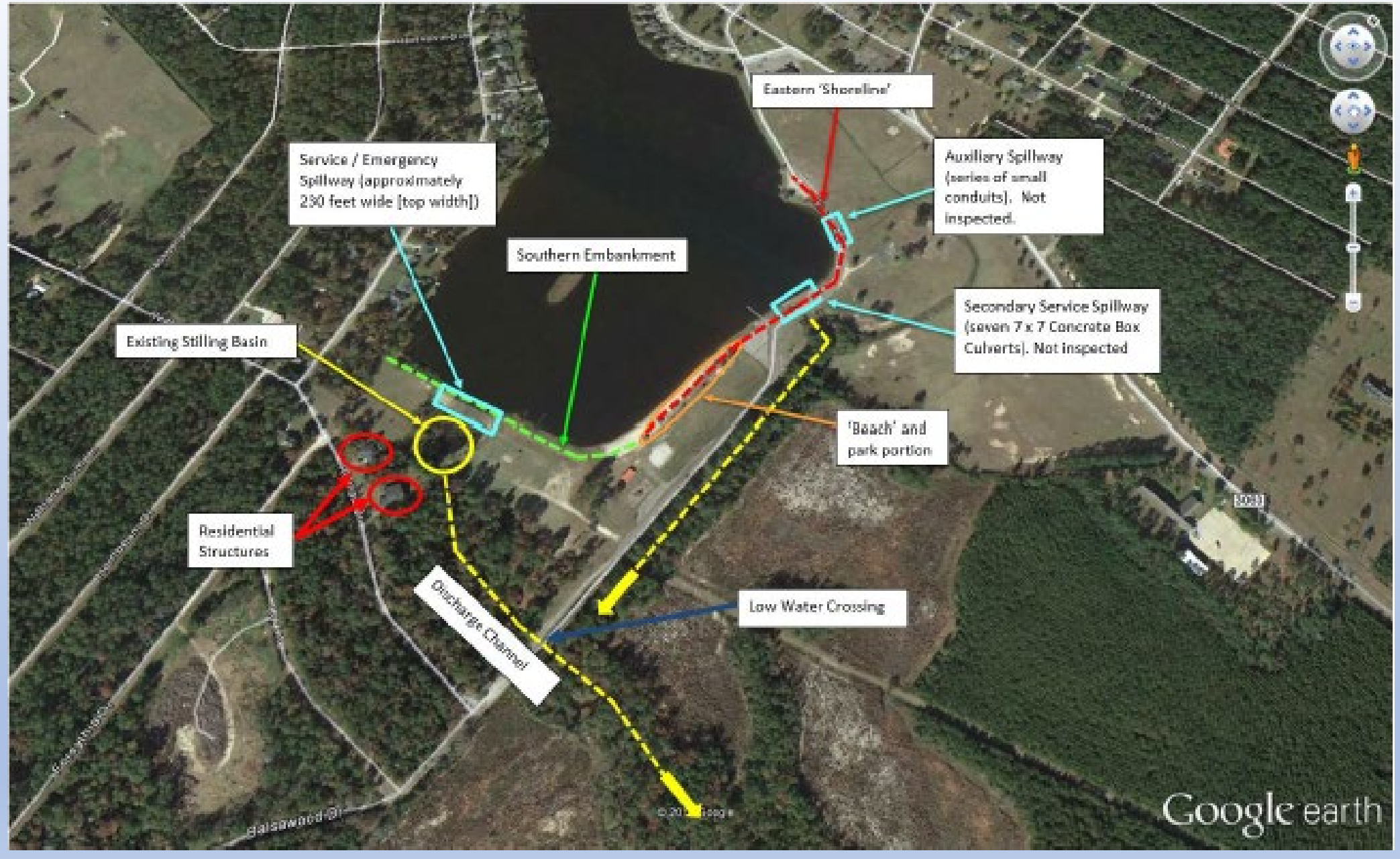


Figure 1 - Aerial View of Lake Kimble Dam and its General Components

TCEQ Guidelines and Definitions were utilized in order to determine the normal and maximum storage capacities. Normal storage capacity is calculated at the lowest uncontrolled spillway crest elevation. FNI understands the normal water surface elevation of the reservoir to be approximately 93.3 ft-msl based on survey data of the existing concrete spillways. TCEQ Guidelines state that the maximum storage capacity is calculated at the effective crest of the dam. The effective crest of a dam is defined as the elevation of the lowest point on the top of dam, excluding spillways. Although the highest elevation associated with Lake Kimble Dam is 101.6 ft-msl on the west side of the emergency spillway, the top of dam elevation steadily decreases to as low as 98 ft-msl. Therefore, the top of dam is defined as 98 ft-msl for the purpose of assessing the hydraulic capacity of the dam. Storage capacities above the elevation of the effective crest were also calculated in order to evaluate potential modifications to the crest elevation.

Lake Kimble Dam	
Elevation (ft-msl)	Storage (acre-feet)
87.0	0.00
93.0	198.24
93.3	203.60
94.0	219.79
95.0	361.90
96.0	546.39
97.0	752.54
98.0	973.22
99.0	1,223.45
100.0	1,492.81
101.0	1,802.83

3.2.2 Discharge Rating Curve

The emergency spillway at Lake Kimble Dam consists of an approximately 230-foot wide broad-crested concrete weir discharging onto a concrete apron. The secondary spillway consists of an approximately 100-foot broad-crested concrete weir discharging through seven (7) 7-feet by 7-feet concrete box culverts.

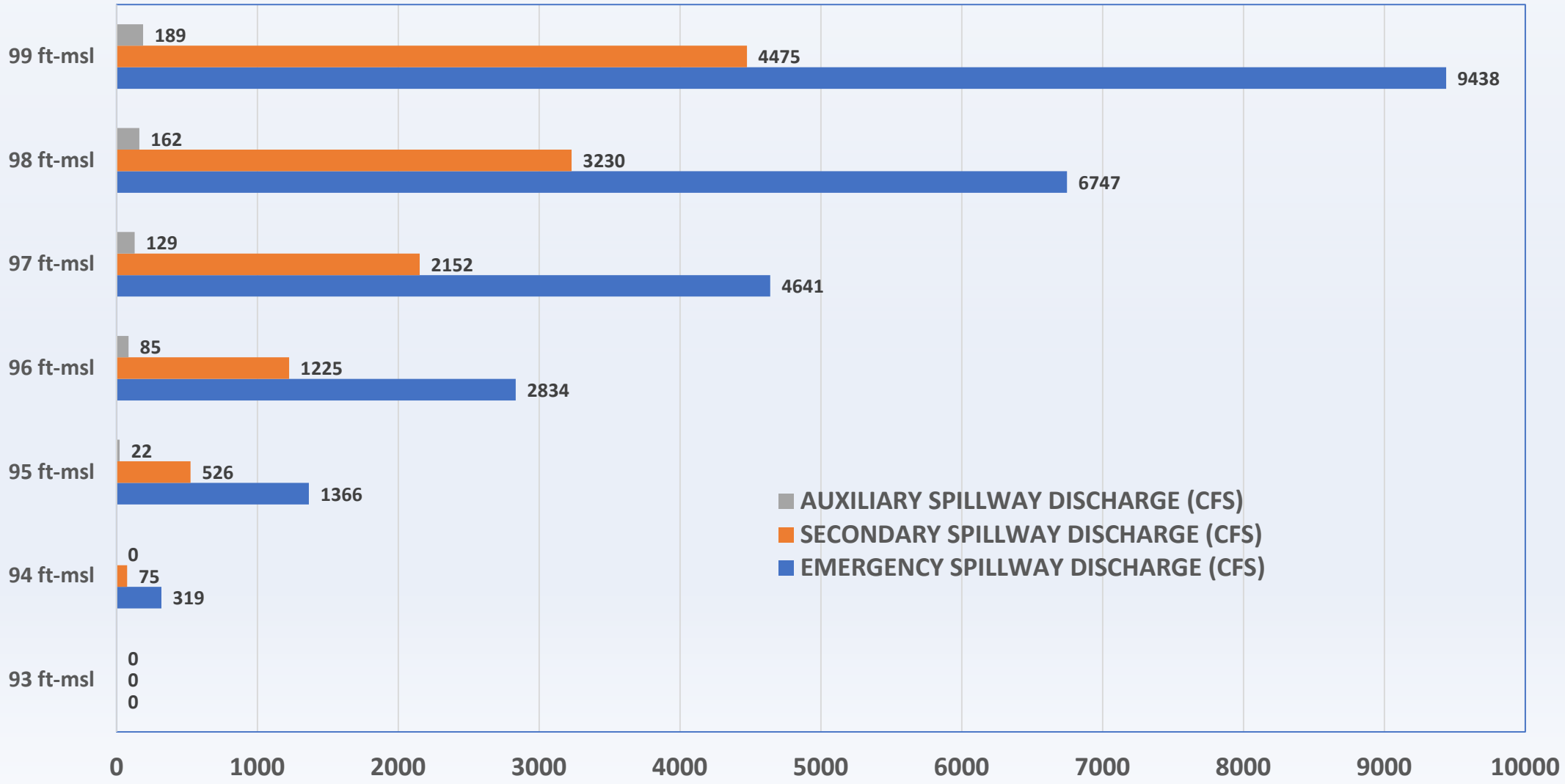
The discharge rate, measured in cubic feet per second (cfs), for all spillways was calculated using the HEC-RAS model and structures representing each dam component, weirs were defined with a discharge coefficient of 3.3, which is appropriate for the size and shape of the spillways. The discharge rating curve for the emergency spillway, secondary spillway, and auxiliary spillway are provided in Table 5.

Table 5 - Discharge Rating Curve

Lake Kimble Dam				
Elevation (ft-msl)	Emergency Spillway Discharge (cfs)	Secondary Spillway Discharge (cfs)	Auxiliary Spillway Discharge (cfs)	Total Discharge (cfs)
93.0	0	0	0	0
94.0	319	75	0	394
95.0	1,366	526	22	1,914
96.0	2,834	1,225	85	4,144
97.0	4,641	2,152	129	6,922
98.0	6,747	3,230	162	10,139
99.0	9,438	4,475	189	14,103

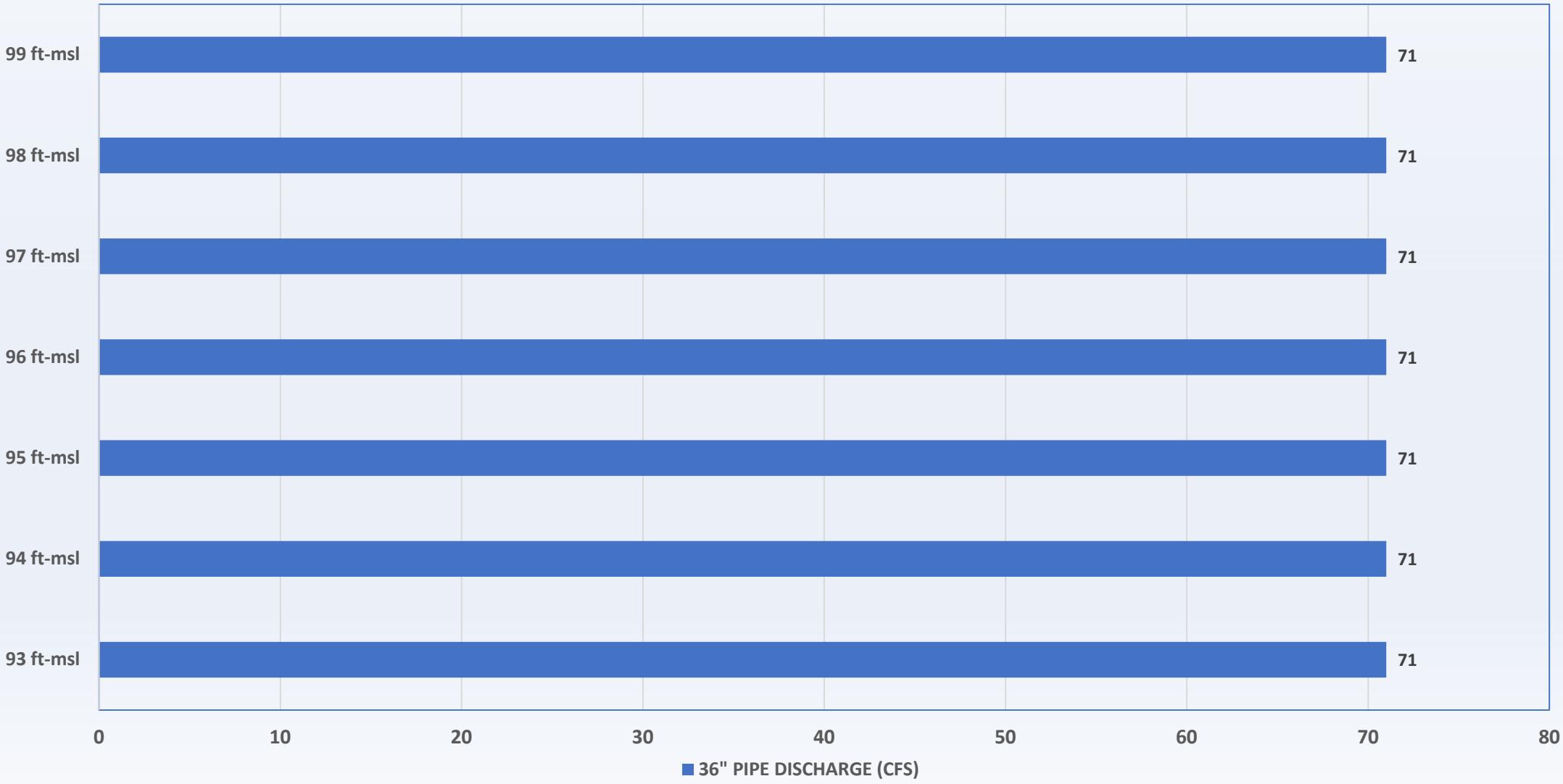
ELEVATION (FT-MSL)	TOTAL DISCHARGE (CFS)	EMERGENCY SPILLWAY DISCHARGE (CFS)	SECONDARY SPILLWAY DISCHARGE (CFS)	AUXILIARY SPILLWAY DISCHARGE (CFS)	*36" PIPE DISCHARGE (CFS)*	*48" PIPE DISCHARGE (CFS)* REMOVED FROM SERVICE IN JUNE 2019
93 ft-msl	71	0	0	0	71	~~126~~
94 ft-msl	465	319	75	0	71	~~126~~
95 ft-msl	1985	1366	526	22	71	~~126~~
96 ft-msl	4215	2834	1225	85	71	~~126~~
97 ft-msl	6993	4641	2152	129	71	~~126~~
98 ft-msl	10210	6747	3230	162	71	~~126~~
99 ft-msl	14173	9438	4475	189	71	~~126~~

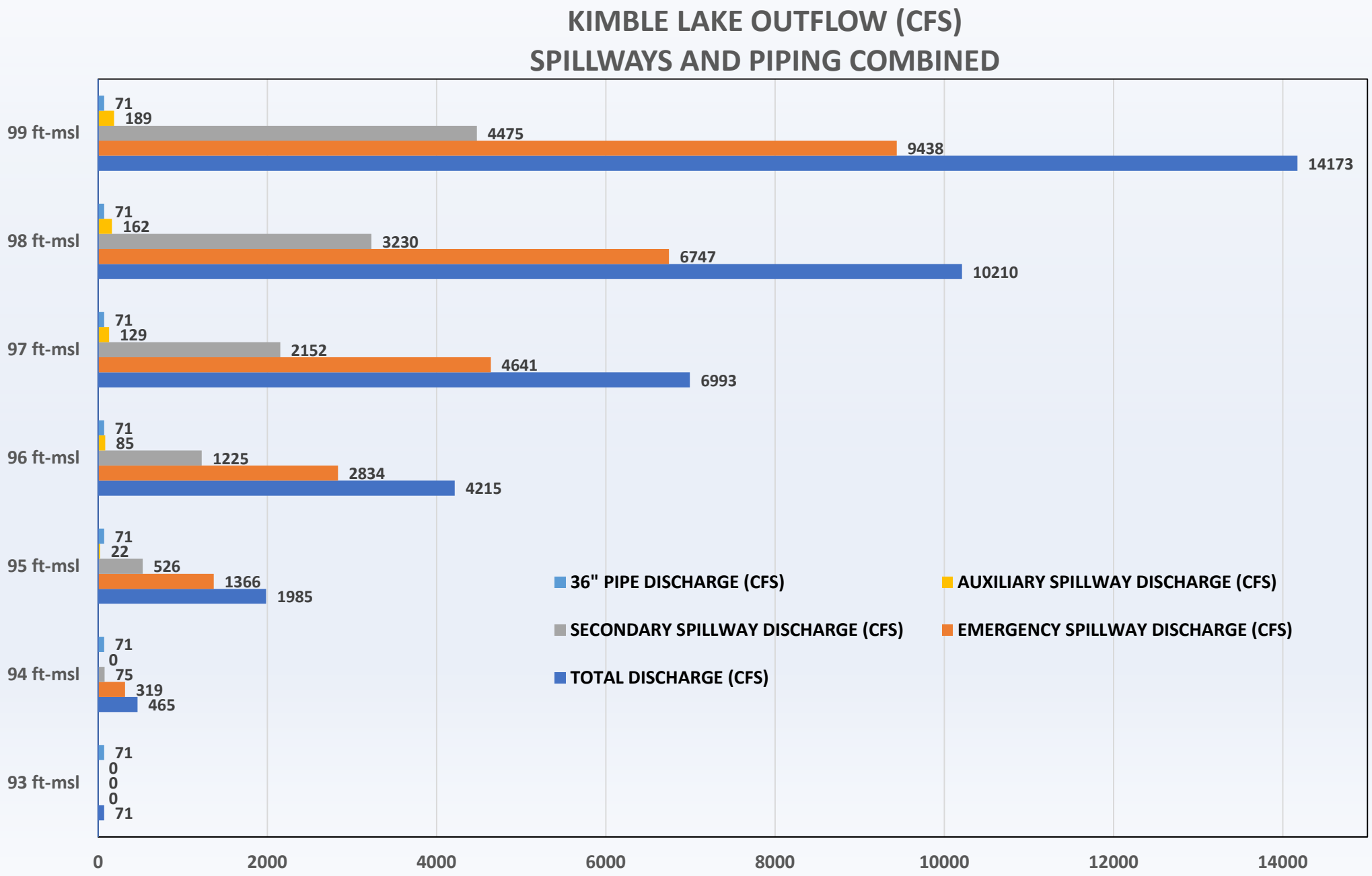
KIMBLE LAKE OUTFLOW (CFS)
SPILLWAY SYSTEM ONLY



KIMBLE LAKE DISCHARGE THROUGH PIPING (CFS)

(ASSUMED HERE TO BE A CONSTANT – IN REALITY FLOW DECREASES AS WATER LEVEL BEHIND DAM INCREASES)




KIMBLE LAKE OUTFLOW (CFS)
SPILLWAYS AND PIPING COMBINED
99 ft-msl
71
189
4475
9438
14173
98 ft-msl
71
162
3230
6747
10210
97 ft-msl
71
129
2152
4641
6993
96 ft-msl
71
85
1225
2834
4215
95 ft-msl
71
22
526
1366
1985
94 ft-msl
71
0
75
319
465
93 ft-msl
71
0
0
0
71
0
2000
4000
6000
8000
10000
12000
14000
36" PIPE DISCHARGE (CFS)
AUXILIARY SPILLWAY DISCHARGE (CFS)
SECONDARY SPILLWAY DISCHARGE (CFS)
EMERGENCY SPILLWAY DISCHARGE (CFS)
TOTAL DISCHARGE (CFS)

36" PIPE
RADIUS = 18"
AREA = 1018 SQ IN
7 SQ FT

48" PIPE
RADIUS = 24"
AREA = 1810 SQ IN
13 SQ FT

SURFACE AREA OF THE 36” PIPE IS 7 SQUARE FEET

PUTTING THAT INTO PERSPECTIVE –
THE 36” PIPE’S EQUIVALENT AREA DIMENSIONS SPREAD ACROSS THE SPILLWAY WOULD BE 200 FT X 0.42 INCHES.
THE 48” PIPE WAS REMOVED FROM SERVICE IN JUNE 2019.

OPENING THE 36” VALVE HAS THE EQUIVALENT EFFECT OF LOWERING THE ELEVATION OF EMERGENCY SPILLWAY BY LESS THAN ½ INCH…

After review of the data discussed above, the following procedures will be adhered to:

1. **The lake level will be maintained as close to its normal maximum level of 93.5 ft-msl at all times.**
2. **Normal valve status for the 36” pipe will be in the closed position.**
3. **Valve will be opened and lake level will be lowered as required for maintenance operations as determined by WPOA Management.**
4. **In no case shall the 36” valve be opened in anticipation of a severe rain event.**
5. **In no case shall the lake be completely drained prior to an anticipated severe rain event.**