



Technical Memorandum ECO-3

To: Woody Frossard, TRWD

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TX PE 80771*

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Subject: Project Impacts on Evaporative Losses

Status: Final

1.0 Executive Summary

This technical memorandum summarizes the water surface area and volume characteristics associated with the Central City project. The water surface area and volume for both existing conditions (before project) and post-project conditions are provided. In addition, evaporation and precipitation characteristics and the relative difference in evaporative losses between the existing and post-project conditions are detailed.

2.0 Introduction and Background

The Central City project area (shown in Figure 1) will place a dam at or about Samuels Avenue. This will cause water to be impounded to a water surface elevation (WSEL) of between 524 and 525 feet. In addition to the dam, a bypass channel will also be created to route flood flows around the Central City waterfront.

One area of interest is the impact of the proposed project on water losses via evaporation which translates to additional water rights that may need to be acquired. Also of interest is the desire to maintain the WSEL as close to 525 feet as is practicable during dry to drought conditions. Replacement of evaporative losses from other water sources would be necessary in such cases.

3.0 Methodology

The currently approved hydraulic model created for the Upper Trinity Study by the US Army Corps of Engineers (USACE 1998) was used to establish water surface area and volumes for the existing condition. The current proposed project hydraulic model was used to establish water surface area and volumes for the post-project condition

The extent of water surface impacts by the proposed project is shown in Figure 1. Those extents were used for determining the water surface area and volumes for both the existing and post-project conditions in order to compare the relative differences between the two.

For both conditions, low flow of 5 cfs per tributary was used in the model to establish WSELs. The hydraulic model (HEC-RAS) calculated surface area and volumes from these WSELs.

Evaporation characteristics were obtained from the Texas Water Development Board (TWDB 2004) for the station closest to the project area, Benbrook Dam. Those characteristics are shown in Table 1. Table 2 provides precipitation characteristics for the same location.

4.0 Results

Results of the water surface area and volumes calculations are shown in Table 3.

5.0 Discussion and Conclusions

The proposed project creates an additional 113 acres of water surface and an additional 2,114 ac-ft of volume within the system. Using the mean annual evaporation (59.32 inches, 4.94 feet), the project will result in an additional 558 ac-ft of evaporative losses. This is offset by 283 ac-ft of mean annual precipitation (30 inches, 2.5 feet) that falls on the water surface directly. Therefore, the additional loss of water that results from the proposed project is 558 ac-ft minus 283 ac-ft, or 275 ac-ft.

6.0 References

USACE, Upper Trinity HEC-RAS Model, Upper Trinity Study - 22 May 1998

TWDB, Surface Water Data: Lake Evaporation and Precipitation Data,
http://www.twdb.state.tx.us/data/surfacewater/surfacewater_toc.asp

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Table 1 - Monthly and annual evaporation statistics for Quadrangle 509 (TWDB 2004).

Monthly Evaporation Statistics							
	n	Min	Max	Median	Mean	10%ile	90%ile
	588	1.24	11.54	4.8	4.94	2.23	7.99
Month	n	Min	Max	Median	Mean	10%ile	90%ile
Jan	49	1.24	3.94	2.2	2.28	1.66	2.98
Feb	49	1.25	4.69	2.5	2.65	2.04	3.79
Mar	49	2.47	6.39	4.21	4.29	3.13	5.47
Apr	49	2.94	7.21	5.17	5.19	4.11	6.44
May	49	3.06	7.49	5.25	5.25	4.14	6.17
Jun	49	4.79	8.95	7.07	7.08	5.67	8.46
Jul	49	5.01	11.54	8.14	8.37	6.63	10.33
Aug	49	5.5	10.52	7.76	7.71	6.38	9.26
Sep	49	4.1	8.66	5.92	5.91	4.66	7.02
Oct	49	3.2	7	4.79	4.84	3.76	5.87
Nov	49	2.24	4.52	3.21	3.31	2.7	4.01
Dec	49	1.54	4.14	2.41	2.45	1.74	3.2
Annual Evaporation Statistics							
	n	Min	Max	Median	Mean	10%ile	90%ile
	49	46.93	73.6	58.34	59.32	52.99	65.63

Table 2 - Monthly and annual precipitation statistics for Quadrangle 509 (TWDB 2004).

Monthly Precipitation Statistics							
	n	Min	Max	Median	Mean	10%ile	90%ile
	756	0	14.1	2.06	2.5	0.48	5.03
Month	n	Min	Max	Median	Mean	10%ile	90%ile
Jan	63	0	7.21	1.4	1.55	0.19	3.04
Feb	63	0.1	7.78	1.56	1.89	0.38	3.69
Mar	63	0.15	5.1	1.63	2.03	0.47	4.2
Apr	63	0.55	9.51	2.46	2.89	1.12	5
May	63	1.03	12.48	4.08	4.3	2.01	7.09
Jun	63	0.24	7.34	2.76	3.16	0.91	6.35
Jul	63	0	6.92	1.67	2.16	0.42	4.47
Aug	63	0	7.46	2.04	2.2	0.47	4.24
Sep	63	0.31	7.16	2.73	2.96	0.73	5.85
Oct	63	0.03	14.1	2.32	3.21	0.74	6.61
Nov	63	0	7.03	1.42	1.91	0.16	4.46
Dec	63	0.04	8.5	1.49	1.72	0.32	3.29
Annual Precipitation Statistics							
	n	Min	Max	Median	Mean	10%ile	90%ile
	63	17.01	45.27	30.17	30	20.76	38.04

Table 3 - Water surface and volumes for the existing conditions and post-project conditions

Existing Conditions				
Reach	Reach Limits		Volume (ac-ft)	Surface area (ac)
	Downstream Station	Upstream Station		
Clear Fork	0	6707	98.2	19.6
West Fork 3	241255	254346	360.6	61.3
West Fork 4	254346	281871	429.2	62.2
Total			888.0	143.0
Post-Project Conditions				
Reach	Reach Limits		Volume (ac-ft)	Surface area (ac)
	Downstream Station	Upstream Station		
Lower Bypass	0	3656	490.85	28.11
Upper Bypass	4096	8421	206.07	18.68
Clear Fork	3590	6707	70.18	10.88
West Fork 3	241255	244898	696.94	40.19
West Fork 4	257426	281871	641.47	74.18
Interior area			896.26	83.89
Total			3001.77	255.93



Figure 1 - Project area, features, and extent of water surface impacted by proposed project.