Appendix D: Supplemental Water Quality Documentation & Agency Coordination

K·FRIESE
+ ASSOCIATES
PUBLIC PROJECT ENGINEERING

MEMORANDUM

TO: Heather Beatty, P.G.
District Geologist, TxDOT – Austin District

FROM: Craig Hebbe, P.E. Craig L Hebbe, P.E.

SUBJECT: Oak Hill Parkway Project TSS Load Removal

DATE: 12/10/2018

The water quality design for the Oak Hill Parkway Project Schematic Alternative A (Project) was based on the Texas Commission on Environmental Quality (TCEQ) Edwards Aquifer Technical Guidance Manual and applicable addenda (RG-348). The Edwards Aquifer Protection Program Rules (EAPP Rules) require a reduction of 80% of the increase in annual Total Suspended Solids (TSS) load resulting from development (Title 30 Texas Administrative Code (TAC) Chapter 213.5(b)(4)(D)(ii)(I)). The required TSS Removal is calculated using RG-348 Equation 3.2, and is based on the net increase in impervious area within the total project limits.

An additional commitment is to provide stormwater treatment that will result in a net decrease in TSS annual loading over the entire project. A variation of RG-348 Equation 3.7 (Equation 3.7) was used to calculate the loads produced by the Project in existing and proposed conditions. The proposed best management practices (BMP's) TSS removal was then subtracted from the proposed load produced to get a proposed annual TSS load discharged. The difference between the proposed annual TSS load discharged and existing conditions load produced is compared to find the net decrease.

Attachment B Water Quality Calculation Summaries (Attachment B) contains four (4) sets of water quality calculations following TCEQ RG-348. All scenarios are updates to the final report (March 2017 Preliminary Water Quality Analysis and Design report by K Friese + Associates) calculations:

1. WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 1 SAND FILTRATION, BIORETENTION & BATCH DETENTION which is an update to the final report calculations with extended detention changed to batch detention and permeable friction course pavement (PFC) added as a BMP.
2. WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 2 SAND FILTRATION & BIORETENTION which is an update to the final report calculations with extended detention changed to sand filtration and PFC added as a BMP.
3. WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 3 SAND FILTRATION, BIORETENTION & BATCH DETENTION which is an update to the final report calculations with extended detention changed to batch detention, larger pond volumes and PFC added as a BMP.

4. WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 4 SAND FILTRATION & BIORETENTION which is an update to the final report calculations with extended detention changed to sand filtration, larger pond volumes and PFC added.

This memo presents the results from Alternative A. Ultimately, it will be the Contractor's responsibility to meet this commitment and the means (BMP's used, BMP placement, etc.) to meet the commitment may change in final design.

Two additional design criteria were added at the suggestion of the City of Austin (COA). The first criteria is that all ponds shall have a minimum water quality capture volume of the first one-half (0.5) inch of runoff plus an additional one-tenth (0.1) inch for each ten (10) percent increase of impervious cover over twenty (20) percent within the contributing drainage area calculated for each BMP. This pond criteria is represented in columns titled COA Calculated Capture Depth, COA Required Capture Depth, COA Required Capture Volume and Controlling Capture Volume of Attachment B. The Controlling Capture Volume lists whether COA or TCEQ capture volume results in the larger volume. The second, is that all ponds shall have an equivalent effluent removal rate to that of sand filtration to the extent possible. In order to keep both of these criteria attainable, the COA suggested sand filter pond design modifications including more shallow sand media depth and/or flatter underdrain piping to maintain positive drainage and increase pond volumes. Both of these suggestions would require a deviation from permanent BMP design criteria to be included and approved as part of the Water Pollution Abatement Plan (WPAP). This will be a contract provision to make this the Contractor's responsibility.

The total project area for the Project is approximately 245.06 acres. This area encompasses ROW to ROW for the total project limits and is the same from existing to proposed conditions. The total project area was defined in the March 2017 Preliminary Water Quality Analysis and Design report by K Friese + Associates and has not been modified for this analysis and as a result does not include the portion of the total project limits from station 415+00 to the eastern terminus of the project. Attachment A Water Quality Site Plan (Attachment A) shows the Project limits, proposed impervious cover and BMP's. The stated commitments of the project, however, will apply to the overall project. The following sections present results from WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 1 SAND FILTRATION, BIORETENTION & BATCH DETENTION.

EXISTING LOAD LEAVING PROJECT

Within the project limits, existing impervious area was calculated to be approximately 79.96 acres and pervious area was calculated to be approximately 165.10 acres. For Equation 3.7, the existing load produced = .226 x P x (Ai x .9 x 170 + Ap x .03 x 80) where Ai is impervious area in acres, Ap is pervious area and P is the average annual precipitation in inches (32" for Travis County). Using the calculated areas, the TSS load produced by the Project in existing conditions is 91,341 lbs/yr. There is however an area of 18.89 acres of impervious cover that currently has PFC which is removing 18,428 lbs/yr of TSS. This results in an **existing load leaving the Project of 72,914 lbs/yr** (91,341 lbs/yr - 18,428 lbs/yr).

PROPOSED LOAD PRODUCED

Within the project limits, proposed impervious area was calculated to be approximately 148.89 acres and pervious area was calculated to be approximately 96.17 acres. Equation 3.7 was again used to calculate the load produced by the project. Using the calculated areas, the load produced **by the project is 166,416 lbs/yr.**

TCEQ REQUIRED REMOVAL

As stated above, the EAPP Rules require a reduction of 80% of the increase in annual TSS load resulting from development. The TCEQ required removal for the project is calculated using RG-348 Equation 3.3. The TCEQ required removal = 27.2 x An x P where An is the net increase in impervious cover. Using the calculated areas, the required removal is 59,997 lbs/yr. However, the previously mentioned 18,428 lbs/yr removed by existing PFC must be accounted for so **the required removal is 78,425 lbs/yr** (59,997 lbs/yr+18,428 lbs/yr).

RESULTS

In order to remove TSS, PFC, vegetated filter strips (VFS), sand filtration ponds, bioretention ponds and batch detention ponds were proposed as BMP's. For BMP locations, see Attachment A. All proposed BMP's are allowed by TCEQ per RG-348. All BMP's were used as standalone treatment devices with the exception of PFC in some locations.

In some locations PFC was combined with VFS in series to achieve greater load removals and in other locations PFC was used as a standalone BMP. The removal rate for BMP's in a series was calculated using Equation 3.6 from RG-348. For the purposes of this analysis, pavement areas that were already treated by ponds were not reviewed for potential placement of PFC. In all locations where PFC was used the roadway cross slope is less than or equal to 2.7%.

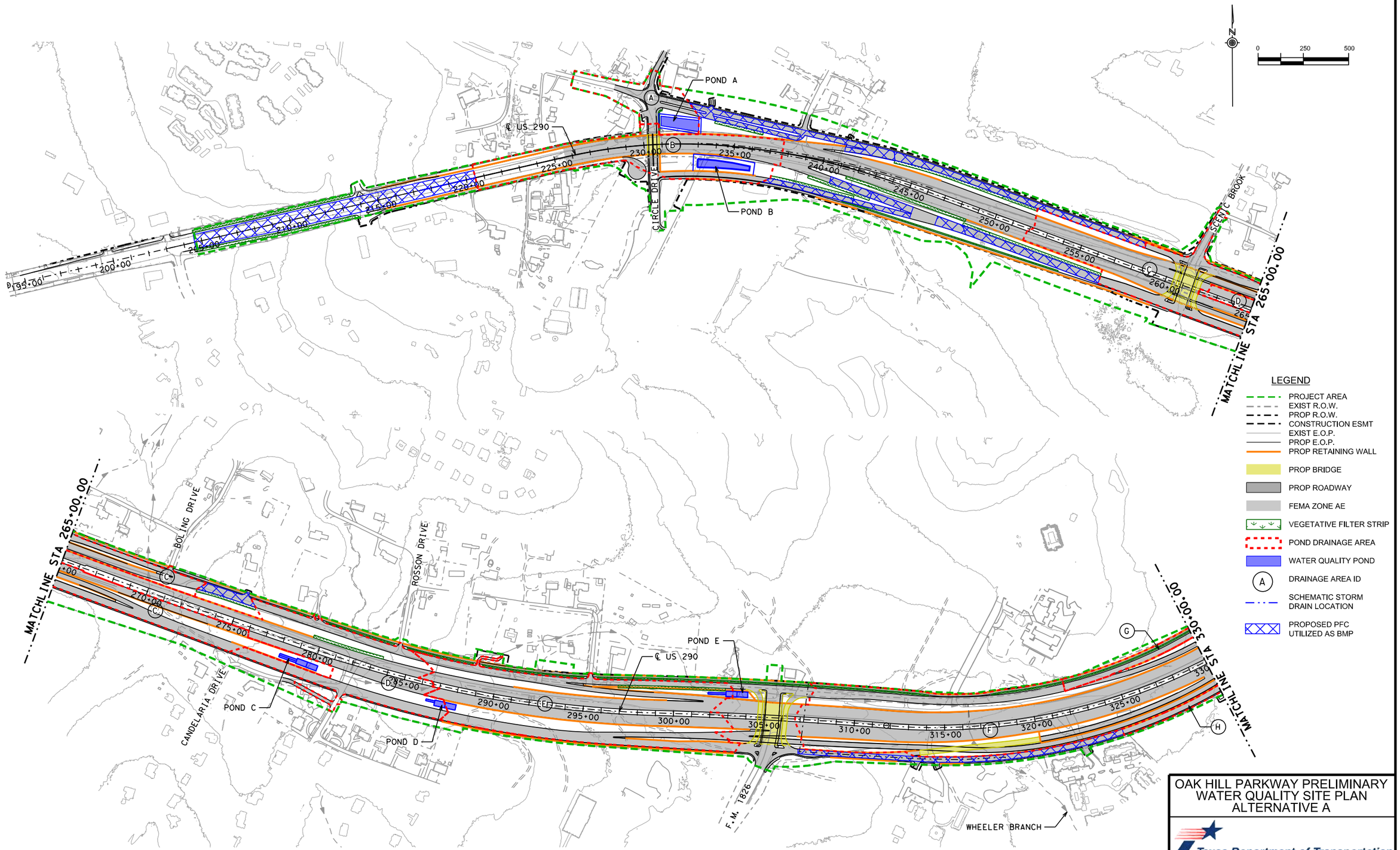
Totaling all BMP's proposed, the annual TSS load removed is **94,074 lbs/yr** which exceeds the TCEQ required removal by **15,649 lbs/yr** (94,074 lbs/yr-78,425 lbs/yr).

Additionally, if the proposed removal is subtracted from the proposed load produced, the proposed load leaving the project can be calculated. This calculation results in **72,342 lbs/yr** (166,416 lbs/yr - 94,074 lbs/yr) leaving the project in proposed conditions. Consequently, the Project results in a net decrease in annual TSS leaving the Project of **571 lbs/yr** (72,342 lbs/yr - 72,914 lbs/yr) when comparing existing conditions to proposed conditions. For water quality calculations, see Attachment B.

Enclosures:

Attachment A Water Quality Site Plan
Attachment B Water Quality Calculation Summaries

ATTACHMENT A
WATER QUALITY SITE PLAN



OAK HILL PARKWAY PRELIMINARY WATER QUALITY SITE PLAN ALTERNATIVE A

Texas Department of Transportation

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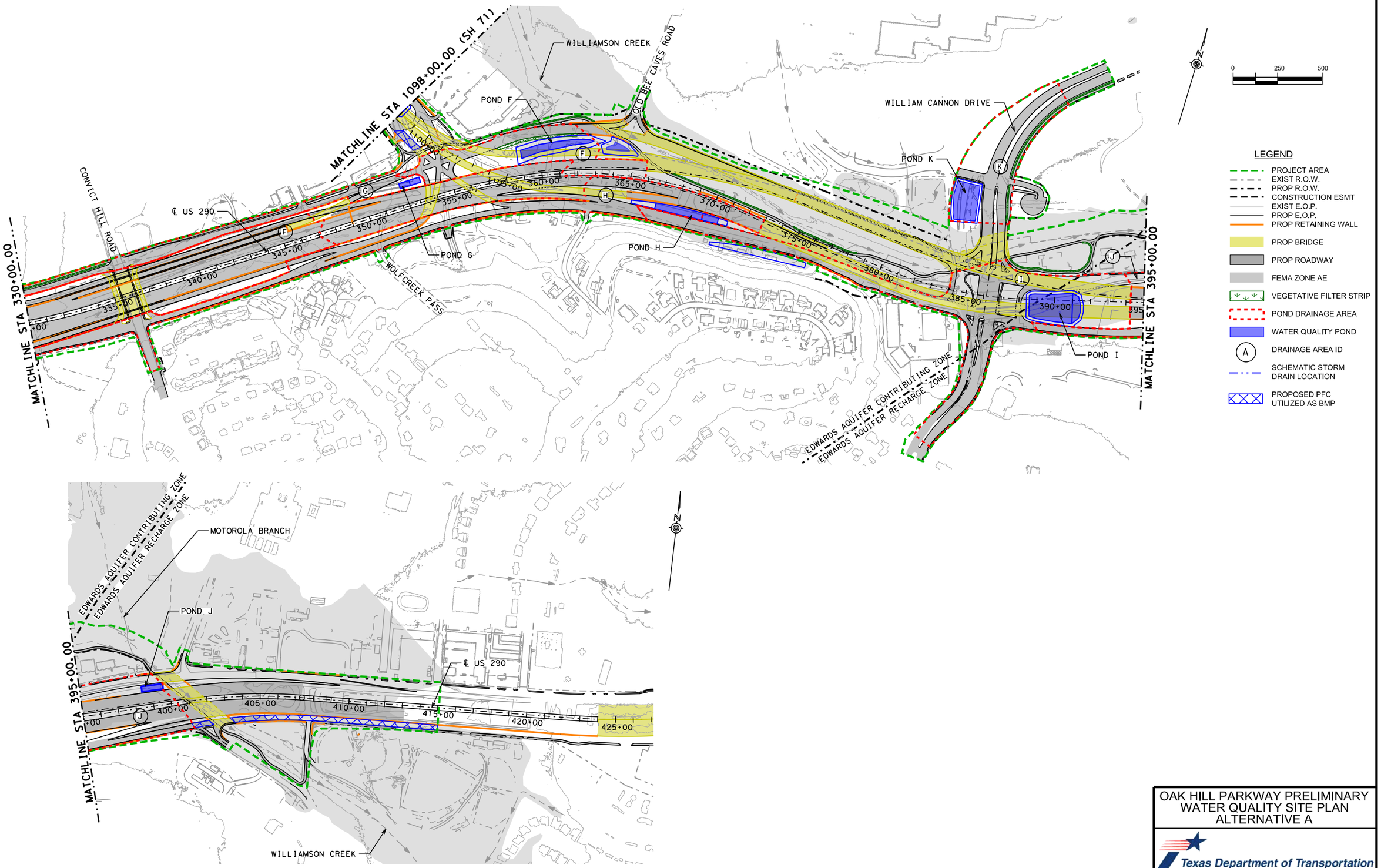

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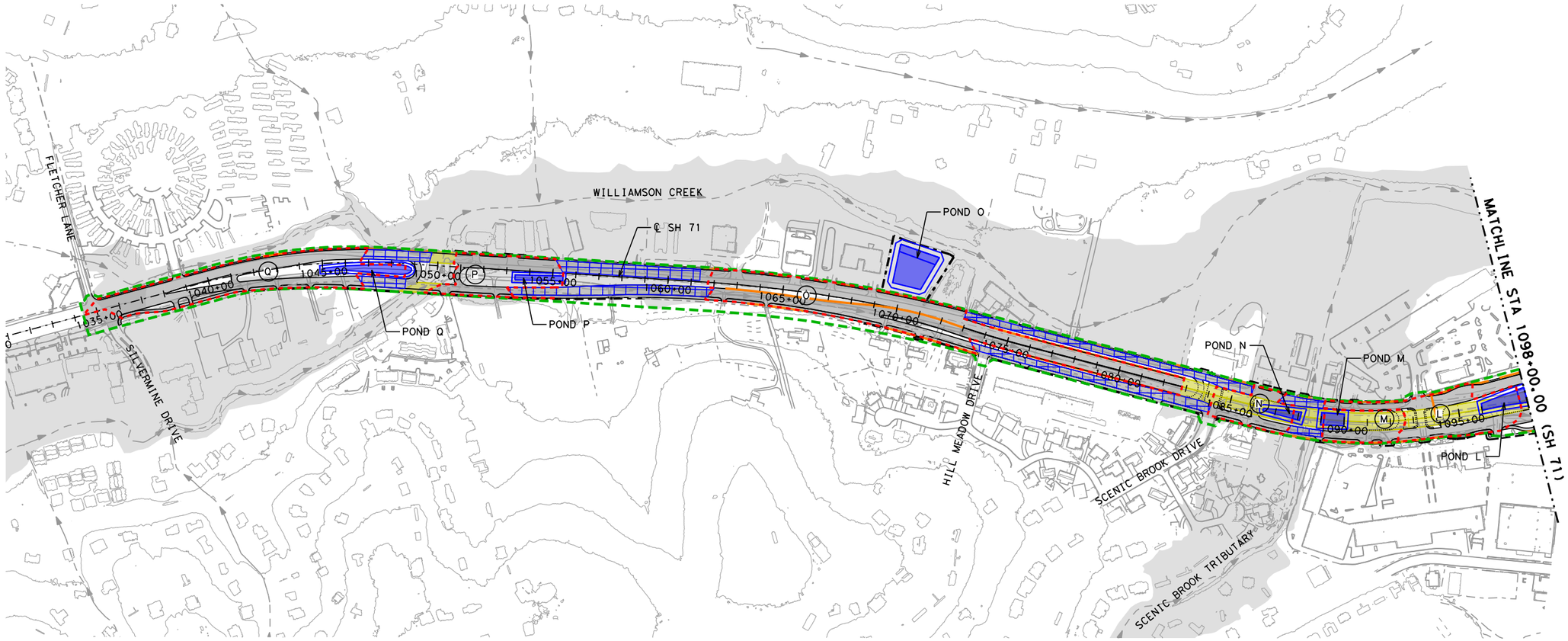

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LEGEND

- PROJECT AREA
- EXIST R.O.W.
- PROP R.O.W.
- CONSTRUCTION ESMT
- EXIST E.O.P.
- PROP E.O.P.
- PROP RETAINING WALL
- PROP BRIDGE
- PROP ROADWAY
- FEMA ZONE AE
- VEGETATIVE FILTER STRIP
- POND DRAINAGE AREA
- WATER QUALITY POND
- (A) DRAINAGE AREA ID
- SCHEMATIC STORM DRAIN LOCATION
- PROPOSED PFC UTILIZED AS BMP

OAK HILL PARKWAY PRELIMINARY WATER QUALITY SITE PLAN ALTERNATIVE A

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ATTACHMENT B
WATER QUALITY CALCULATION SUMMARIES

WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 1 SAND FILTRATION, BIORETENTION & BATCH DETENTION

	BASIN ID	TCEQ EDWARDS AQUIFER ZONE	PROPOSED BMP	BASIN DRAINAGE AREA (AC)	EXISTING IMPERVIOUS COVER (AC)	PROPOSED IMPERVIOUS COVER (AC)	TCEQ CALCULATED CAPTURE VOLUME (CU FT)	TCEQ RAINFALL CAPTURE DEPTH (IN) [5]	PROVIDED POND VOLUME (CU FT)	COA CALCULATED CAPTURE DEPTH (IN) [5]	COA REQUIRED CAPTURE DEPTH (IN)	COA REQUIRED CAPTURE VOLUME (CU FT)	CONTROLLING VOLUME REQUIREMENT	EXISTING ANNUAL TSS LOAD PRODUCED (LBS)	PROPOSED ANNUAL TSS LOAD PRODUCED (LBS)	ANNUAL TSS LOAD REMOVED (LBS)	TCEQ REQUIRED TSS LOAD REMOVAL (LBS)	ANNUAL TSS LOAD DISCHARGED (LBS)	% OF TOTAL TSS LOAD TREATED
	DEVIL'S PEN CREEK WATERSHED																		
	POND A	Contributing	Bioretention Pond	2.78	0.94	1.16	12,710	3.33	13,009	1.29	0.72	7,238	TCEQ	1,072	1,312	1,150	191	162	88%
6	POND B	Contributing	Batch Detention	7.38	2.86	4.95	61,433	4.00	76,267	2.85	0.97	26,005	TCEQ	3,243	5,519	5,026	1,819	493	91%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.40	0.00	1.40	N/A	4.00	N/A	N/A	1.30	6,617	N/A	24	1,552	1,320	1,220	232	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	0.35	0.00	0.35	N/A	4.00	N/A	N/A	1.30	1,638	N/A	6	384	327	302	57	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	3.74	0.00	3.74	N/A	4.00	N/A	N/A	1.30	17,664	N/A	65	4,142	3,959	3,258	183	96%
1/11	PFC	Contributing	Permeable Friction Course	3.40	0.00	3.40	N/A	4.00	N/A	N/A	1.30	16,047	N/A	59	3,763	3,389	2,960	374	90%
	UNTREATED AREA	Contributing	N/A	19.31	5.94	4.82	0	0.00	N/A	N/A	0.55	38,506	N/A	6,800	5,580	0	-975	5,580	0%
															0				
	TOTAL FOR DEVIL'S PEN CREEK WATERSHED - CONTRIBUTING ZONE			**38.36**	**9.74**	**19.82**	**N/A**	**N/A**	**89,276**	**0.64**	**0.82**	**113,716**		**11,270**	**22,251**	**15,170**	**8,776**	**7,081**	**68%**
	WILLIAMSON CREEK WATERSHED																		
	POND C	Contributing	Sand Filter Pond	13.59	2.34	9.64	22,293	0.73	22,800	0.46	1.01	49,782	COA	2,782	10,732	6,501	6,354	4,231	61%
	POND D	Contributing	Sand Filter Pond	10.11	2.91	5.98	13,683	0.75	13,800	0.38	0.89	32,713	COA	3,349	6,689	4,110	2,669	2,579	61%
	POND E	Contributing	Sand Filter Pond	13.28	3.07	8.53	16,661	0.64	16,800	0.35	0.94	45,416	COA	3,572	9,517	5,339	4,751	4,178	56%
	POND F	Contributing	Sand Filter Pond	29.13	9.84	19.77	88,605	1.44	88,733	0.84	0.98	103,478	COA	11,221	22,034	17,000	8,641	5,034	77%
	POND G	Contributing	Sand Filter Pond	4.56	1.06	3.34	10,725	1.00	10,800	0.65	1.03	17,082	COA	1,235	3,716	2,581	1,983	1,135	69%
	POND H	Contributing	Sand Filter Pond	9.44	2.38	7.56	46,290	1.80	50,978	1.49	1.10	37,742	TCEQ	2,756	8,402	6,840	4,512	1,562	81%
	POND K	Contributing	Bioretention Pond	5.56	1.89	2.42	28,679	3.66	29,030	1.44	0.73	14,821	TCEQ	2,159	2,727	2,400	453	327	88%
	POND L	Contributing	Sand Filter Pond	2.41	1.15	2.21	15,734	2.00	17,243	1.97	1.22	10,653	TCEQ	1,291	2,451	2,015	927	436	82%
	POND M	Contributing	Sand Filter Pond	1.08	0.60	0.99	10,563	3.00	11,022	2.80	1.21	4,773	TCEQ	671	1,097	950	340	147	87%
	POND N	Contributing	Sand Filter Pond	1.19	0.69	1.11	7,074	1.80	7,758	1.80	1.23	5,304	TCEQ	767	1,224	990	366	234	81%
	POND O	Contributing	Sand Filter Pond	5.52	3.70	4.89	38,265	2.20	40,810	2.04	1.19	23,766	TCEQ	4,126	5,422	4,500	1,036	922	83%
	POND P	Contributing	Bioretention Pond	1.73	0.94	0.99	5,118	1.70	5,412	0.86	0.87	5,462	COA	1,052	1,104	880	42	224	80%
	POND Q	Contributing	Bioretention Pond	3.79	2.45	2.62	11,334	1.38	12,275	0.89	0.99	13,647	COA	2,737	2,922	2,250	147	672	77%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.46	0.00	1.46	N/A	4.00	N/A	N/A	1.30	6,901	N/A	25	1,618	1,376	1,273	242	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	2.23	0.00	2.23	N/A	4.00	N/A	N/A	1.30	10,503	N/A	39	2,463	2,095	1,937	368	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	0.30	0.00	0.30	N/A	4.00	N/A	N/A	1.30	1,436	N/A	5	337	322	265	15	96%
1/11	PFC	Contributing	Permeable Friction Course	5.88	0.00	5.88	N/A	4.00	N/A	N/A	1.30	27,730	N/A	102	6,502	5,856	5,115	646	90%
	UNTREATED AREA	Contributing	N/A	59.24	14.96	23.89	0	0.00	N/A	N/A	0.70	151,231	N/A	17,325	27,047	0	7,769	27,047	0%
7	**EXISTING LOAD REMOVAL**	Contributing	Permeable Friction Course	18.49	18.49	N/A	N/A	4.00	N/A	N/A	N/A	N/A	N/A	20,142	N/A	18,428	N/A	1,714	**91%**
9	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - CONTRIBUTING ZONE**			**170.51**	**47.98**	**103.79**	**N/A**	**N/A**	**327,459**	**0.53**	**0.91**	**562,440**	**N/A**	**36,785**	**116,002**	**66,004**	**67,008**	**49,997**	**57%**
9	**TOTAL FOR CONTRIBUTING ZONE**			**208.87**	**57.71**	**123.61**	**N/A**	**N/A**	**416,735**	**0.55**	**0.89**	**676,156**	**N/A**	**48,055**	**138,253**	**81,174**	**75,784**	**57,079**	**59%**
2	POND I	Recharge	Sand Filter Pond	12.30	8.50	10.47	67,035	1.80	77,272	1.73	1.15	51,400	TCEQ	9,466	11,616	9,400	1,718	2,216	81%
6	POND J	Recharge	Batch Detention	5.51	1.56	4.04	17,142	1.32	21,600	1.08	1.03	20,675	COA	1,797	4,498	3,500	2,159	998	78%
	UNTREATED AREA	Recharge	N/A	18.38	7.13	10.77	0	0.00	N/A	N/A	0.89	59,113	N/A	8,084	12,050	0	3,169	12,050	0%
3	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - RECHARGE ZONE**			**36.19**	**17.19**	**25.28**	**N/A**	**N/A**	**98,872**	**0.75**	**1.00**	**131,189**	**N/A**	**19,347**	**28,164**	**12,900**	**7,046**	**15,264**	**46%**
	TOTAL FOR WILLIAMSON CREEK WATERSHED - ALL ZONES			**206.70**	**65.16**	**129.07**	**N/A**	**N/A**	**426,331**	**0.57**	**0.92**	**693,629**	**N/A**	**56,132**	**144,165**	**78,904**	**74,054**	**65,261**	**55%**
	SUBTOTALS FOR PROJECT			**245.06**	**74.90**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**67,402**	**166,416**	**94,074**	**82,830**	**72,342**	**57%**
3	**STORAGE AREA FROM JUNE 2013 MEMO FROM TXDOT TO TCEQ**			**5.06**	**5.06**	**0.00**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5,600**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TOTALS FOR PROJECT			**245.06**	**79.96**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**72,914**	**166,416**	**94,074**	**78,425**	**72,342**	**57%**
																NET INCREASE IN TSS LOADING FOR PROJECT [10] =		**-571**	**lbs**

4 **ANNUAL PRECIP TRAVIS CO= 32 in**

NOTES:

1 COA minimum VFS width is 25-feet versus the TCEQ 15-feet for roadway runoff. A VFS width of 5.2' was used for SUP VFS. COA does not require treatment of SUP's located within public ROW or easement.
2 Pond I is located in the Recharge Zone, but discharges in the Contributing Zone.
3 Recharge zone boundary drawn with respect to TCEQ boundary and Pond I drainage area.
4 Annual Precipitation value based on guidance in RG-348.
5 Rainfall Capture Depth within the TCEQ spreadsheet is calculated differently than described in the COA ECM.
6 COA capture volumes are based on the efficiency of a Sedimentation Filtration (Sand Filter) BMP. Volumes for BMPS with lower efficiencies would need to be larger than shown.
7 Annual load produced, removed and discharged based on existing condition. This PFC will be removed and the loading added to the requirement.
8 The maximum pond volume was chosen for each basin between the final and draft report.
9 The existing annual TSS load produced is the total existing annual TSS load produced minus the existing treatment provided by PFC. TCEQ required removal inclues existing load removal from existing PFC.
10 Net increase in TSS load discharged for the project = (Annual TSS Load Discharged) - (Existing Annual TSS Load Produced)

WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 2 SAND FILTRATION & BIORETENTION

	BASIN ID	TCEQ EDWARDS AQUIFER ZONE	PROPOSED BMP	BASIN DRAINAGE AREA (AC)	EXISTING IMPERVIOUS COVER (AC)	PROPOSED IMPERVIOUS COVER (AC)	TCEQ CALCULATED CAPTURE VOLUME (CU FT)	TCEQ RAINFALL CAPTURE DEPTH (IN) [5]	PROVIDED POND VOLUME (CU FT)	COA CALCULATED CAPTURE DEPTH (IN) [5]	COA REQUIRED CAPTURE DEPTH (IN)	COA REQUIRED CAPTURE VOLUME (CU FT)	CONTROLLING VOLUME REQUIREMENT	EXISTING ANNUAL TSS LOAD PRODUCED (LBS)	PROPOSED ANNUAL TSS LOAD PRODUCED (LBS)	ANNUAL TSS LOAD REMOVED (LBS)	TCEQ REQUIRED TSS LOAD REMOVAL (LBS)	ANNUAL TSS LOAD DISCHARGED (LBS)	% OF TOTAL TSS LOAD TREATED
	DEVIL'S PEN CREEK WATERSHED																		
	POND A	Contributing	Bioretention Pond	2.78	0.94	1.16	12,710	3.33	13,009	1.29	0.72	7,238	TCEQ	1,072	1,312	1,150	191	162	88%
6	POND B	Contributing	Sand Filter Pond	7.38	2.86	4.95	61,433	4.00	76,267	2.85	0.97	26,005	TCEQ	3,243	5,519	4,915	1,819	604	89%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.40	0.00	1.40	N/A	4.00	N/A	N/A	1.30	6,617	N/A	24	1,552	1,320	1,220	232	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	0.35	0.00	0.35	N/A	4.00	N/A	N/A	1.30	1,638	N/A	6	384	327	302	57	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	3.74	0.00	3.74	N/A	4.00	N/A	N/A	1.30	17,664	N/A	65	4,142	3,959	3,258	183	96%
1/11	PFC	Contributing	Permeable Friction Course	3.40	0.00	3.40	N/A	4.00	N/A	N/A	1.30	16,047	N/A	59	3,763	3,389	2,960	374	90%
	UNTREATED AREA	Contributing	N/A	19.31	5.94	4.82	0	0.00	N/A	N/A	0.55	38,506	N/A	6,800	5,580	0	-975	5,580	0%
															0				
	TOTAL FOR DEVIL'S PEN CREEK WATERSHED - CONTRIBUTING ZONE			**38.36**	**9.74**	**19.82**	**N/A**	**N/A**	**89,276**	**0.64**	**0.82**	**113,716**		**11,270**	**22,251**	**15,059**	**8,776**	**7,192**	**68%**
	WILLIAMSON CREEK WATERSHED																		
	POND C	Contributing	Sand Filter Pond	13.59	2.34	9.64	22,293	0.73	22,800	0.46	1.01	49,782	COA	2,782	10,732	6,501	6,354	4,231	61%
	POND D	Contributing	Sand Filter Pond	10.11	2.91	5.98	13,683	0.75	13,800	0.38	0.89	32,713	COA	3,349	6,689	4,110	2,669	2,579	61%
	POND E	Contributing	Sand Filter Pond	13.28	3.07	8.53	16,661	0.64	16,800	0.35	0.94	45,416	COA	3,572	9,517	5,339	4,751	4,178	56%
	POND F	Contributing	Sand Filter Pond	29.13	9.84	19.77	88,605	1.44	88,733	0.84	0.98	103,478	COA	11,221	22,034	17,000	8,641	5,034	77%
	POND G	Contributing	Sand Filter Pond	4.56	1.06	3.34	10,725	1.00	10,800	0.65	1.03	17,082	COA	1,235	3,716	2,581	1,983	1,135	69%
	POND H	Contributing	Sand Filter Pond	9.44	2.38	7.56	46,290	1.80	50,978	1.49	1.10	37,742	TCEQ	2,756	8,402	6,840	4,512	1,562	81%
	POND K	Contributing	Bioretention Pond	5.56	1.89	2.42	28,679	3.66	29,030	1.44	0.73	14,821	TCEQ	2,159	2,727	2,400	453	327	88%
	POND L	Contributing	Sand Filter Pond	2.41	1.15	2.21	15,734	2.00	17,243	1.97	1.22	10,653	TCEQ	1,291	2,451	2,015	927	436	82%
	POND M	Contributing	Sand Filter Pond	1.08	0.60	0.99	10,563	3.00	11,022	2.80	1.21	4,773	TCEQ	671	1,097	950	340	147	87%
	POND N	Contributing	Sand Filter Pond	1.19	0.69	1.11	7,074	1.80	7,758	1.80	1.23	5,304	TCEQ	767	1,224	990	366	234	81%
	POND O	Contributing	Sand Filter Pond	5.52	3.70	4.89	38,265	2.20	40,810	2.04	1.19	23,766	TCEQ	4,126	5,422	4,500	1,036	922	83%
	POND P	Contributing	Bioretention Pond	1.73	0.94	0.99	5,118	1.70	5,412	0.86	0.87	5,462	COA	1,052	1,104	880	42	224	80%
	POND Q	Contributing	Bioretention Pond	3.79	2.45	2.62	11,334	1.38	12,275	0.89	0.99	13,647	COA	2,737	2,922	2,250	147	672	77%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.46	0.00	1.46	N/A	4.00	N/A	N/A	1.30	6,901	N/A	25	1,618	1,376	1,273	242	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	2.23	0.00	2.23	N/A	4.00	N/A	N/A	1.30	10,503	N/A	39	2,463	2,095	1,937	368	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	0.30	0.00	0.30	N/A	4.00	N/A	N/A	1.30	1,436	N/A	5	337	322	265	15	96%
1/11	PFC	Contributing	Permeable Friction Course	5.88	0.00	5.88	N/A	4.00	N/A	N/A	1.30	27,730	N/A	102	6,502	5,856	5,115	646	90%
	UNTREATED AREA	Contributing	N/A	59.24	14.96	23.89	0	0.00	N/A	N/A	0.70	151,231	N/A	17,325	27,047	0	7,769	27,047	0%
7	**EXISTING LOAD REMOVAL**	Contributing	Permeable Friction Course	18.49	18.49	N/A	N/A	4.00	N/A	N/A	N/A	N/A	N/A	20,142	N/A	18,428	N/A	1,714	**91%**
9	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - CONTRIBUTING ZONE**			**170.51**	**47.98**	**103.79**	**N/A**	**N/A**	**327,459**	**0.53**	**0.91**	**562,440**	**N/A**	**36,785**	**116,002**	**66,004**	**67,008**	**49,997**	**57%**
9	**TOTAL FOR CONTRIBUTING ZONE**			**208.87**	**57.71**	**123.61**	**N/A**	**N/A**	**416,735**	**0.55**	**0.89**	**676,156**	**N/A**	**48,055**	**138,253**	**81,063**	**75,784**	**57,189**	**59%**
2	POND I	Recharge	Sand Filter Pond	12.30	8.50	10.47	67,035	1.80	77,272	1.73	1.15	51,400	TCEQ	9,466	11,616	9,400	1,718	2,216	81%
6	POND J	Recharge	Sand Filter Pond	5.51	1.56	4.04	20,778	1.60	21,600	1.08	1.03	20,675	TCEQ	1,797	4,498	3,550	2,159	948	79%
	UNTREATED AREA	Recharge	N/A	18.38	7.13	10.77	0	0.00	N/A	N/A	0.89	59,113	N/A	8,084	12,050	0	3,169	12,050	0%
3	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - RECHARGE ZONE**			**36.19**	**17.19**	**25.28**	**N/A**	**N/A**	**98,872**	**0.75**	**1.00**	**131,189**	**N/A**	**19,347**	**28,164**	**12,950**	**7,046**	**15,214**	**46%**
	TOTAL FOR WILLIAMSON CREEK WATERSHED - ALL ZONES			**206.70**	**65.16**	**129.07**	**N/A**	**N/A**	**426,331**	**0.57**	**0.92**	**693,629**	**N/A**	**56,132**	**144,165**	**78,954**	**74,054**	**65,211**	**55%**
	SUBTOTALS FOR PROJECT			**245.06**	**74.90**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**67,402**	**166,416**	**94,013**	**82,830**	**72,403**	**56%**
3	**STORAGE AREA FROM JUNE 2013 MEMO FROM TXDOT TO TCEQ**			**5.06**	**5.06**	**0.00**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5,600**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TOTALS FOR PROJECT			**245.06**	**79.96**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**72,914**	**166,416**	**94,013**	**78,425**	**72,403**	**56%**
																NET INCREASE IN TSS LOADING FOR PROJECT [10] =		**-511**	**lbs**

4 **ANNUAL PRECIP TRAVIS CO= 32 in**

NOTES:

1 COA minimum VFS width is 25-feet versus the TCEQ 15-feet for roadway runoff. A VFS width of 5.2' was used for SUP VFS. COA does not require treatment of SUP's located within public ROW or easement.
2 Pond I is located in the Recharge Zone, but discharges in the Contributing Zone.
3 Recharge zone boundary drawn with respect to TCEQ boundary and Pond I drainage area.
4 Annual Precipitation value based on guidance in RG-348.
5 Rainfall Capture Depth within the TCEQ spreadsheet is calculated differently than described in the COA ECM.
6 COA capture volumes are based on the efficiency of a Sedimentation Filtration (Sand Filter) BMP. Volumes for BMPS with lower efficiencies would need to be larger than shown.
7 Annual load produced, removed and discharged based on existing condition. This PFC will be removed and the loading added to the requirement.
8 The maximum pond volume was chosen for each basin between the final and draft report.
9 The existing annual TSS load produced is the total existing annual TSS load produced minus the existing treatment provided by PFC. TCEQ required removal inclues existing load removal from existing PFC.
10 Net increase in TSS load discharged for the project = (Annual TSS Load Discharged) - (Existing Annual TSS Load Produced)

WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 3 SAND FILTRATION, BIORETENTION & BATCH DETENTION

	BASIN ID	TCEQ EDWARDS AQUIFER ZONE	PROPOSED BMP	BASIN DRAINAGE AREA (AC)	EXISTING IMPERVIOUS COVER (AC)	PROPOSED IMPERVIOUS COVER (AC)	TCEQ CALCULATED CAPTURE VOLUME (CU FT)	TCEQ RAINFALL CAPTURE DEPTH (IN) [5]	PROVIDED POND VOLUME (CU FT)	COA CALCULATED CAPTURE DEPTH (IN) [5]	COA REQUIRED CAPTURE DEPTH (IN)	COA REQUIRED CAPTURE VOLUME (CU FT)	CONTROLLING VOLUME REQUIREMENT	EXISTING ANNUAL TSS LOAD PRODUCED (LBS)	PROPOSED ANNUAL TSS LOAD PRODUCED (LBS)	ANNUAL TSS LOAD REMOVED (LBS)	TCEQ REQUIRED TSS LOAD REMOVAL (LBS)	ANNUAL TSS LOAD DISCHARGED (LBS)	% OF TOTAL TSS LOAD TREATED
	DEVIL'S PEN CREEK WATERSHED																		
	POND A	Contributing	Bioretention Pond	2.78	0.94	1.16	12,710	3.33	13,009	1.29	0.72	7,238	TCEQ	1,072	1,312	1,150	191	162	88%
6	POND B	Contributing	Batch Detention	7.38	2.86	4.95	61,433	4.00	76,267	2.85	0.97	26,005	TCEQ	3,243	5,519	5,026	1,819	494	91%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.40	0.00	1.40	N/A	4.00	N/A	N/A	1.30	6,617	N/A	24	1,552	1,320	1,220	232	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	0.35	0.00	0.35	N/A	4.00	N/A	N/A	1.30	1,638	N/A	6	384	327	302	57	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	3.74	0.00	3.74	N/A	4.00	N/A	N/A	1.30	17,664	N/A	65	4,142	3,959	3,258	183	96%
1/11	PFC	Contributing	Permeable Friction Course	3.40	0.00	3.40	N/A	4.00	N/A	N/A	1.30	16,047	N/A	59	3,763	3,389	2,960	374	90%
	UNTREATED AREA	Contributing	N/A	19.31	5.94	4.82	0	0.00	N/A	N/A	0.55	38,506	N/A	6,800	5,580	0	-975	5,580	0%
															0				
	TOTAL FOR DEVIL'S PEN CREEK WATERSHED - CONTRIBUTING ZONE			**38.36**	**9.74**	**19.82**	**N/A**	**N/A**	**89,276**	**0.64**	**0.82**	**113,716**		**11,270**	**22,251**	**15,169**	**8,776**	**7,082**	**68%**
	WILLIAMSON CREEK WATERSHED																		
	POND C	Contributing	Sand Filter Pond	13.59	2.34	9.64	36,595	1.20	22,800	0.46	1.01	49,782	COA	2,782	10,732	7,935	6,354	2,797	74%
	POND D	Contributing	Sand Filter Pond	10.11	2.91	5.98	22,987	1.26	13,800	0.38	0.89	32,713	COA	3,349	6,689	5,000	2,669	1,689	75%
	POND E	Contributing	Sand Filter Pond	13.28	3.07	8.53	30,388	1.16	16,800	0.35	0.94	45,416	COA	3,572	9,517	6,950	4,751	2,567	73%
	POND F	Contributing	Sand Filter Pond	29.13	9.84	19.77	88,605	1.44	88,733	0.84	0.98	103,478	COA	11,221	22,034	17,000	8,641	5,034	77%
	POND G	Contributing	Sand Filter Pond	4.56	1.06	3.34	17,159	1.60	10,800	0.65	1.03	17,082	TCEQ	1,235	3,716	2,950	1,983	766	79%
	POND H	Contributing	Sand Filter Pond	9.44	2.38	7.56	46,290	1.80	50,978	1.49	1.10	37,742	TCEQ	2,756	8,402	6,840	4,512	1,562	81%
	POND K	Contributing	Bioretention Pond	5.56	1.89	2.42	28,679	3.66	29,030	1.44	0.73	14,821	TCEQ	2,159	2,727	2,400	453	327	88%
	POND L	Contributing	Sand Filter Pond	2.41	1.15	2.21	15,734	2.00	17,243	1.97	1.22	10,653	TCEQ	1,291	2,451	2,015	927	436	82%
	POND M	Contributing	Sand Filter Pond	1.08	0.60	0.99	10,563	3.00	11,022	2.80	1.21	4,773	TCEQ	671	1,097	950	340	147	87%
	POND N	Contributing	Sand Filter Pond	1.19	0.69	1.11	7,074	1.80	7,758	1.80	1.23	5,304	TCEQ	767	1,224	990	366	234	81%
	POND O	Contributing	Sand Filter Pond	5.52	3.70	4.89	38,265	2.20	40,810	2.04	1.19	23,766	TCEQ	4,126	5,422	4,500	1,036	922	83%
	POND P	Contributing	Bioretention Pond	1.73	0.94	0.99	5,118	1.70	5,412	0.86	0.87	5,462	COA	1,052	1,104	880	42	224	80%
	POND Q	Contributing	Bioretention Pond	3.79	2.45	2.62	11,334	1.38	12,275	0.89	0.99	13,647	COA	2,737	2,922	2,250	147	672	77%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.46	0.00	1.46	N/A	4.00	N/A	N/A	1.30	6,901	N/A	25	1,618	1,376	1,273	242	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	2.23	0.00	2.23	N/A	4.00	N/A	N/A	1.30	10,503	N/A	39	2,463	2,095	1,937	368	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	0.30	0.00	0.30	N/A	4.00	N/A	N/A	1.30	1,436	N/A	5	337	322	265	15	96%
1/11	PFC	Contributing	Permeable Friction Course	5.88	0.00	5.88	N/A	4.00	N/A	N/A	1.30	27,730	N/A	102	6,502	5,856	5,115	646	90%
	UNTREATED AREA	Contributing	N/A	59.24	14.96	23.89	0	0.00	N/A	N/A	0.70	151,231	N/A	17,325	27,047	0	7,769	27,047	0%
7	**EXISTING LOAD REMOVAL**	Contributing	Permeable Friction Course	18.49	18.49	N/A	N/A	4.00	N/A	N/A	N/A	N/A	N/A	20,142	N/A	18,428	N/A	1,714	**91%**
9	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - CONTRIBUTING ZONE**			**170.51**	**47.98**	**103.79**	**N/A**	**N/A**	**327,459**	**0.53**	**0.91**	**562,440**	**N/A**	**36,785**	**116,002**	**70,308**	**67,008**	**45,693**	**61%**
9	**TOTAL FOR CONTRIBUTING ZONE**			**208.87**	**57.71**	**123.61**	**N/A**	**N/A**	**416,735**	**0.55**	**0.89**	**676,156**	**N/A**	**48,055**	**138,253**	**85,478**	**75,784**	**52,775**	**62%**
2	POND I	Recharge	Sand Filter Pond	12.30	8.50	10.29	72,563	2.00	77,272	1.73	1.14	50,751	TCEQ	9,466	11,421	9,400	1,562	2,021	82%
6	POND J	Recharge	Batch Detention	5.51	1.56	4.04	18,700	1.44	21,600	1.08	1.03	20,675	COA	1,797	4,498	3,550	2,159	948	79%
	UNTREATED AREA	Recharge	N/A	18.38	7.13	10.95	0	0.00	N/A	N/A	0.90	59,763	N/A	8,084	12,245	0	3,325	12,245	0%
3	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - RECHARGE ZONE**			**36.19**	**17.19**	**25.28**	**N/A**	**N/A**	**98,872**	**0.75**	**1.00**	**131,189**	**N/A**	**19,347**	**28,164**	**12,950**	**7,046**	**15,214**	**46%**
	TOTAL FOR WILLIAMSON CREEK WATERSHED - ALL ZONES			**206.70**	**65.16**	**129.07**	**N/A**	**N/A**	**426,331**	**0.57**	**0.92**	**693,629**	**N/A**	**56,132**	**144,165**	**83,258**	**74,054**	**60,907**	**58%**
	SUBTOTALS FOR PROJECT			**245.06**	**74.90**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**67,402**	**166,416**	**98,428**	**82,830**	**67,989**	**59%**
3	**STORAGE AREA FROM JUNE 2013 MEMO FROM TXDOT TO TCEQ**			**5.06**	**5.06**	**0.00**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5,600**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TOTALS FOR PROJECT			**245.06**	**79.96**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**72,914**	**166,416**	**98,428**	**78,425**	**67,989**	**59%**
																NET INCREASE IN TSS LOADING FOR PROJECT [10] =		**-4,925**	**lbs**

4 **ANNUAL PRECIP TRAVIS CO= 32 in**

NOTES:

1 COA minimum VFS width is 25-feet versus the TCEQ 15-feet for roadway runoff. A VFS width of 5.2' was used for SUP VFS. COA does not require treatment of SUP's located within public ROW or easement.
2 Pond I is located in the Recharge Zone, but discharges in the Contributing Zone.
3 Recharge zone boundary drawn with respect to TCEQ boundary and Pond I drainage area.
4 Annual Precipitation value based on guidance in RG-348.
5 Rainfall Capture Depth within the TCEQ spreadsheet is calculated differently than described in the COA ECM.
6 COA capture volumes are based on the efficiency of a Sedimentation Filtration (Sand Filter) BMP. Volumes for BMPS with lower efficiencies would need to be larger than shown.
7 Annual load produced, removed and discharged based on existing condition. This PFC will be removed and the loading added to the requirement.
8 The maximum pond volume was chosen for each basin between the final and draft report.
9 The existing annual TSS load produced is the total existing annual TSS load produced minus the existing treatment provided by PFC. TCEQ required removal inclues existing load removal from existing PFC.
10 Net increase in TSS load discharged for the project = (Annual TSS Load Discharged) - (Existing Annual TSS Load Produced)

WATER QUALITY CALCULATION SUMMARIES - ALTERNATIVE A (FINAL REPORT) - SCENARIO 4 SAND FILTRATION & BIORETENTION

	BASIN ID	TCEQ EDWARDS AQUIFER ZONE	PROPOSED BMP	BASIN DRAINAGE AREA (AC)	EXISTING IMPERVIOUS COVER (AC)	PROPOSED IMPERVIOUS COVER (AC)	TCEQ CALCULATED CAPTURE VOLUME (CU FT)	TCEQ RAINFALL CAPTURE DEPTH (IN) [5]	PROVIDED POND VOLUME (CU FT)	COA CALCULATED CAPTURE DEPTH (IN) [5]	COA REQUIRED CAPTURE DEPTH (IN)	COA REQUIRED CAPTURE VOLUME (CU FT)	CONTROLLING VOLUME REQUIREMENT	EXISTING ANNUAL TSS LOAD PRODUCED (LBS)	PROPOSED ANNUAL TSS LOAD PRODUCED (LBS)	ANNUAL TSS LOAD REMOVED (LBS)	TCEQ REQUIRED TSS LOAD REMOVAL (LBS)	ANNUAL TSS LOAD DISCHARGED (LBS)	% OF TOTAL TSS LOAD TREATED
	DEVIL'S PEN CREEK WATERSHED																		
	POND A	Contributing	Bioretention Pond	2.78	0.94	1.16	12,710	3.33	13,009	1.29	0.72	7,238	TCEQ	1,072	1,312	1,150	191	162	88%
6	POND B	Contributing	Sand Filter Pond	7.38	2.86	4.95	61,433	4.00	76,267	2.85	0.97	26,005	TCEQ	3,243	5,519	4,915	1,819	604	89%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.40	0.00	1.40	N/A	4.00	N/A	N/A	1.30	6,617	N/A	24	1,552	1,320	1,220	232	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	0.35	0.00	0.35	N/A	4.00	N/A	N/A	1.30	1,638	N/A	6	384	327	302	57	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	3.74	0.00	3.74	N/A	4.00	N/A	N/A	1.30	17,664	N/A	65	4,142	3,959	3,258	183	96%
1/11	PFC	Contributing	Permeable Friction Course	3.40	0.00	3.40	N/A	4.00	N/A	N/A	1.30	16,047	N/A	59	3,763	3,389	2,960	374	90%
	UNTREATED AREA	Contributing	N/A	19.31	5.94	4.82	0	0.00	N/A	N/A	0.55	38,506	N/A	6,800	5,580	0	-975	5,580	0%
															0				
	TOTAL FOR DEVIL'S PEN CREEK WATERSHED - CONTRIBUTING ZONE			**38.36**	**9.74**	**19.82**	**N/A**	**N/A**	**89,276**	**0.64**	**0.82**	**113,716**		**11,270**	**22,251**	**15,059**	**8,776**	**7,192**	**68%**
	WILLIAMSON CREEK WATERSHED																		
	POND C	Contributing	Sand Filter Pond	13.59	2.34	9.64	36,595	1.20	22,800	0.46	1.01	49,782	COA	2,782	10,732	7,935	6,354	2,797	74%
	POND D	Contributing	Sand Filter Pond	10.11	2.91	5.98	22,987	1.26	13,800	0.38	0.89	32,713	COA	3,349	6,689	5,000	2,669	1,689	75%
	POND E	Contributing	Sand Filter Pond	13.28	3.07	8.53	30,388	1.16	16,800	0.35	0.94	45,416	COA	3,572	9,517	6,950	4,751	2,567	73%
	POND F	Contributing	Sand Filter Pond	29.13	9.84	19.77	88,605	1.44	88,733	0.84	0.98	103,478	COA	11,221	22,034	17,000	8,641	5,034	77%
	POND G	Contributing	Sand Filter Pond	4.56	1.06	3.34	17,159	1.60	10,800	0.65	1.03	17,082	TCEQ	1,235	3,716	2,950	1,983	766	79%
	POND H	Contributing	Sand Filter Pond	9.44	2.38	7.56	46,290	1.80	50,978	1.49	1.10	37,742	TCEQ	2,756	8,402	6,840	4,512	1,562	81%
	POND K	Contributing	Bioretention Pond	5.56	1.89	2.42	28,679	3.66	29,030	1.44	0.73	14,821	TCEQ	2,159	2,727	2,400	453	327	88%
	POND L	Contributing	Sand Filter Pond	2.41	1.15	2.21	15,734	2.00	17,243	1.97	1.22	10,653	TCEQ	1,291	2,451	2,015	927	436	82%
	POND M	Contributing	Sand Filter Pond	1.08	0.60	0.99	10,563	3.00	11,022	2.80	1.21	4,773	TCEQ	671	1,097	950	340	147	87%
	POND N	Contributing	Sand Filter Pond	1.19	0.69	1.11	7,074	1.80	7,758	1.80	1.23	5,304	TCEQ	767	1,224	990	366	234	81%
	POND O	Contributing	Sand Filter Pond	5.52	3.70	4.89	38,265	2.20	40,810	2.04	1.19	23,766	TCEQ	4,126	5,422	4,500	1,036	922	83%
	POND P	Contributing	Bioretention Pond	1.73	0.94	0.99	5,118	1.70	5,412	0.86	0.87	5,462	COA	1,052	1,104	880	42	224	80%
	POND Q	Contributing	Bioretention Pond	3.79	2.45	2.62	11,334	1.38	12,275	0.89	0.99	13,647	COA	2,737	2,922	2,250	147	672	77%
1/11	VFS AREA	Contributing	Vegetated Filter Strip	1.46	0.00	1.46	N/A	4.00	N/A	N/A	1.30	6,901	N/A	25	1,618	1,376	1,273	242	85%
1/11	VFS SUP	Contributing	Vegetated Filter Strip	2.23	0.00	2.23	N/A	4.00	N/A	N/A	1.30	10,503	N/A	39	2,463	2,095	1,937	368	85%
1/11	PFC to VFS in Series	Contributing	PFC/VFS	0.30	0.00	0.30	N/A	4.00	N/A	N/A	1.30	1,436	N/A	5	337	322	265	15	96%
1/11	PFC	Contributing	Permeable Friction Course	5.88	0.00	5.88	N/A	4.00	N/A	N/A	1.30	27,730	N/A	102	6,502	5,856	5,115	646	90%
	UNTREATED AREA	Contributing	N/A	59.24	14.96	23.89	0	0.00	N/A	N/A	0.70	151,231	N/A	17,325	27,047	0	7,769	27,047	0%
7	**EXISTING LOAD REMOVAL**	Contributing	Permeable Friction Course	18.49	18.49	N/A	N/A	4.00	N/A	N/A	N/A	N/A	N/A	20,142	N/A	18,428	N/A	1,714	**91%**
9	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - CONTRIBUTING ZONE**			**170.51**	**47.98**	**103.79**	**N/A**	**N/A**	**327,459**	**0.53**	**0.91**	**562,440**	**N/A**	**36,785**	**116,002**	**70,308**	**67,008**	**45,693**	**61%**
9	**TOTAL FOR CONTRIBUTING ZONE**			**208.87**	**57.71**	**123.61**	**N/A**	**N/A**	**416,735**	**0.55**	**0.89**	**676,156**	**N/A**	**48,055**	**138,253**	**85,367**	**75,784**	**52,886**	**62%**
2	POND I	Recharge	Sand Filter Pond	12.30	8.50	10.29	72,563	2.00	77,272	1.73	1.14	50,751	TCEQ	9,466	11,421	9,400	1,562	2,021	82%
6	POND J	Recharge	Sand Filter Pond	5.51	1.56	4.04	20,778	1.60	21,600	1.08	1.03	20,675	TCEQ	1,797	4,498	3,550	2,159	948	79%
	UNTREATED AREA	Recharge	N/A	18.38	7.13	10.95	0	0.00	N/A	N/A	0.90	59,763	N/A	8,084	12,245	0	3,325	12,245	0%
3	**SUBTOTAL FOR WILLIAMSON CREEK WATERSHED - RECHARGE ZONE**			**36.19**	**17.19**	**25.28**	**N/A**	**N/A**	**98,872**	**0.75**	**1.00**	**131,189**	**N/A**	**19,347**	**28,164**	**12,950**	**7,046**	**15,214**	**46%**
	TOTAL FOR WILLIAMSON CREEK WATERSHED - ALL ZONES			**206.70**	**65.16**	**129.07**	**N/A**	**N/A**	**426,331**	**0.57**	**0.92**	**693,629**	**N/A**	**56,132**	**144,165**	**83,258**	**74,054**	**60,907**	**58%**
	SUBTOTALS FOR PROJECT			**245.06**	**74.90**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**67,402**	**166,416**	**98,317**	**82,830**	**68,099**	**59%**
3	**STORAGE AREA FROM JUNE 2013 MEMO FROM TXDOT TO TCEQ**			**5.06**	**5.06**	**0.00**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**5,600**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
	TOTALS FOR PROJECT			**245.06**	**79.96**	**148.89**	**N/A**	**N/A**	**515,608**	**0.58**	**0.91**	**807,345**	**N/A**	**72,914**	**166,416**	**98,317**	**78,425**	**68,099**	**59%**
																NET INCREASE IN TSS LOADING FOR PROJECT [10] =		**-4,814**	**lbs**

4 **ANNUAL PRECIP TRAVIS CO= 32 in**

NOTES:

1 COA minimum VFS width is 25-feet versus the TCEQ 15-feet for roadway runoff. A VFS width of 5.2' was used for SUP VFS. COA does not require treatment of SUP's located within public ROW or easement.
2 Pond I is located in the Recharge Zone, but discharges in the Contributing Zone.
3 Recharge zone boundary drawn with respect to TCEQ boundary and Pond I drainage area.
4 Annual Precipitation value based on guidance in RG-348.
5 Rainfall Capture Depth within the TCEQ spreadsheet is calculated differently than described in the COA ECM.
6 COA capture volumes are based on the efficiency of a Sedimentation Filtration (Sand Filter) BMP. Volumes for BMPS with lower efficiencies would need to be larger than shown.
7 Annual load produced, removed and discharged based on existing condition. This PFC will be removed and the loading added to the requirement.
8 The maximum pond volume was chosen for each basin between the final and draft report.
9 The existing annual TSS load produced is the total existing annual TSS load produced minus the existing treatment provided by PFC. TCEQ required removal inclues existing load removal from existing PFC.
10 Net increase in TSS load discharged for the project = (Annual TSS Load Discharged) - (Existing Annual TSS Load Produced)

USFWS Coordination 2018

Texas Department of Transportation

125 East 11th Street, Austin, Texas 78401-2483 | 512.463.8588 | WWW.TXDOT.GOV

December 4, 2018

Mr. Adam Zerrenner
Field Supervisor
United States Fish and Wildlife Service
10711 Burnet Road, Suite 200
Austin, Texas 78758

Re: Oak Hill Parkway Project
Austin, Travis County, Texas
(CSJs: 0113-08-060 and 0700-03-077)

Dear Mr. Zerrenner:

The purpose of this letter is to document recent discussions between the Texas Department of Transportation (TxDOT) and the U.S. Fish and Wildlife Service (Service) regarding TxDOT's proposed Oak Hill Parkway project (CSJs: 0113-08-060 and 0700-03-077), which underwent section 7 consultation in 2017. During the consultation, TxDOT provided a statement to the Service in a November 29, 2017 email that the Oak Hill Parkway project, including all proposed water quality control measures considered at that time, would result in a net decrease in annual Total Suspended Solids (TSS) loading. The Service's December 20, 2017 concurrence letter restated this conclusion as supporting information for the Service's concurrence that the proposed project was not likely to adversely affect the Austin blind salamander and Barton Springs salamander.

During TxDOT's final review of the Final Environmental Impact Statement (FEIS) for this project, an inadvertent error was found in the TSS loading calculation that TxDOT had provided to the Service in a November 29, 2017 email communication. Using the TSS loading calculation for the project as it was presented in the consultation actually results in a net increase in annual TSS loading, which is inconsistent with the conclusion in the concurrence letter.

Once TxDOT became aware of this inconsistency, we reached out to the Service to discuss whether it would be necessary to re-initiate section 7 consultation for the project. A brief outline of communications between TxDOT and the Service regarding this issue follows:

- November 19, 2018 – email from D. Palafox (TxDOT) to C. Kucera (Service) disclosing the inadvertent calculation error;
- November 20, 2018 – email response from C. Kucera to D. Palafox regarding the November 19, 2018 email;
- November 26, 2018 – conference call between C. Kucera and TxDOT staff to discuss the TSS loading issue;

- November 28, 2018 – follow up email from A. Blair (TxDOT) to C. Kucera responding to questions presented in the November 20 USFWS email and to follow up with the November 26 conference call;
    - Presented TSS load distribution between Williamson and Devil's Pen creeks;
    - Presented narrative description of potential impacts of TSS to salamander critical habitat; and,
    - Proposed study to monitor the performance of water quality ponds in the project area;
- November 29, 2018 – follow up email from D. Palafox to C. Kucera forwarding additional information about TSS loading;
- November 29, 2018 – follow up email from A. Blair to C. Kucera responding to questions regarding draw down times for water quality ponds and the frequency of water quality pond maintenance events; and,
- November 30, 2018 – phone call between D. Palafox and C. Kucera asking whether the Service had a response to the information in the November 29, 2018 email.

Since the last email communication between TxDOT and the Service, TxDOT has been evaluating changes that could be made to the design of proposed water quality controls with a goal of achieving a net decrease in TSS loading. These changes include measures such as increasing the capture volumes of some or all of the 17 proposed water quality ponds, changing less efficient extended detention ponds to a more efficient pond type (e.g., batch detention or sand filter), and adding permeable friction course (PFC) pavement in areas where it would be allowable. By including various combinations of these additional water quality control measures, TxDOT has determined that it is possible to achieve a net decrease in annual TSS loading for the Oak Hill Parkway project. While the precise combination of water quality control measures is not yet determined, TxDOT is hereby committing that the final design of the Oak Hill Parkway project will result in a net decrease in TSS loading compared with the existing condition. Thus, the following statement from the December 20, 2017 concurrence letter for this project remains valid, "*There is a net reduction in the amount of TSS leaving the project area under the proposed condition, which represents a net improvement or net zero over current baseline conditions as a result of the proposed action.*" Later, as project design is finalized, TxDOT will prepare a Water Pollution Abatement Plan demonstrating in detail compliance with this commitment. TxDOT will provide the Service a complete copy of the plan and any supporting calculations.

Based on our commitment to a net decrease in TSS loading along with the additional conservation measure to monitor the performance of water quality ponds in the project area proposed in the November 28, 2018 email, we believe that our initial conclusion that the proposed project may affect, but is not likely to adversely affect the Austin blind salamander and Barton Springs salamander remains valid. We would like for the Service to re-affirm its concurrence with this effect determination.

If you have any questions or require additional information, you may contact Dennis Palafox with the Environmental Affairs Division at Dennis.Palafox@txdot.gov or (512) 416-2633, or Andy Blair with the Austin District at Andrew.Blair@txdot.gov or (512) 832-7004.

Sincerely,

Jodi Bechtel
Director of Natural Resources Management Section
Environmental Affairs Division

cc Shirley Nichols - Austin District, TxDOT
Andy Blair - Austin District, TxDOT
Dennis Palafox – ENV, TxDOT

From: Zerrenner, Adam
To: Dennis Palafox; Charlotte Kucera
Cc: Jodi Bechtel; Shirley Nichols; Andrew Blair
Subject: Re: FW: [EXTERNAL] FW: Oak Hill Parkway Project
Date: Monday, December 10, 2018 8:44:26 AM

Hi Dennis,

Thanks for checking in on this question. As we discussed, since the proposed project has no net increase in TSS and the new salamander site is approximately 7 miles in distance away, I agree that our concurrence letter remains unchanged.

Best,

Adam

On Fri, Dec 7, 2018 at 2:20 PM Dennis Palafox <Dennis.Palafox@txdot.gov> wrote:

> Hi Adam,
>
> I just left you a voice about this email that summarizes the new scientific information we provided to Charlotte on November 7 regarding the new occurrences of the Barton Springs Salamander (BSS) available since the release of the Draft EIS and the USFWS concurrence letter for this project. I've attached a copy of the study. Charlotte stated in her November 7 response that she was going to talk to you about this when you returned to the office the following week. As you know we've all been very busy addressing the TTS loading issue but we have not received a response from Charlotte regarding the new BSS information. So, we'd like to follow up with you to determine if the Service concurs that this new information would not impact TxDOT's effect determinations for this project because the range expansion of this species serves to increase the environmental baseline for the BSS.
>
> Please let me know if you have any questions or need additional information
>
> Regards,
>
> Dennis

From: Kucera, Charlotte [mailto:charlotte_kucera@fws.gov]
Sent: Wednesday, November 07, 2018 1:15 PM
To: Jodi Bechtel
Cc: Dennis Palafox; Andrew Blair; Clover Clamons
Subject: Re: [EXTERNAL] FW: Oak Hill Parkway Project

Thanks Jodi and Dennis.

I'll take a look and discuss with Adam when he is back in the office next week.

We'll let you know if we have any questions or need anything else.

Thanks,

Charlotte Kucera

Texas Transportation Liaison

U.S. Fish and Wildlife Service

10711 Burnet Rd., Ste. 200

Austin, TX 78758

phone: 512-490-0057 ext. 224

On Wed, Nov 7, 2018 at 12:15 PM, Jodi Bechtel <Jodi.Bechtel@txdot.gov> wrote:

Hi Charlotte –

Below is an email from Dennis on the Oak Hill Parkway consultation. Once you've had a chance to review, can you please respond to us with a concurrence or if FWS has any concerns so we can put this documentation in the project file? As Dennis notes, let us know if you have any questions.

Thank you!

-Jodi

From: Dennis Palafox
Sent: Wednesday, November 07, 2018 10:28 AM
To: Jodi Bechtel
Subject: Oak Hill Parkway Project

Charlotte,

The purpose of this email is to follow up on the meeting you, Clover, Andy, and I had on September 26 regarding the Oak Hill Parkway (OHP) Project. As you recall, in a letter dated December 20, 2017, the Service concurred with TxDOT's conclusion that the project may affect, but is not likely to adversely affect, the Austin blind salamander and the Barton Springs salamander (BSS).

At this meeting we discussed the new scientific information[1] regarding the species distribution of the BSS (attached) available since the release of the Draft EIS and the USFWS concurrence letter for this project. TxDOT has determined that this information would not impact the effect determinations previously proposed for this project because the range expansion of this species serves to increase the environmental baseline for the BSS. Only one of the new sites, site 7—Backdoor Spring on Barton Creek, is within the Recharge Zone located northeast of and potentially downgradient from the project site. No recent flow-path modeling or groundwater basin delineation maps for this spring are available; however, in 1997 the COA estimated that the Backdoor Spring groundwater basin roughly included all of the area between the spring on Barton Creek and US 290, which is approximately two square miles in size (COA, 1997)[1]. Although a portion of the *Preferred Alternative* may lie upgradient from Backdoor Spring, the proposed BMPs would protect surface water and groundwater in the OHP Project area by minimizing erosion, reducing TSS, and reducing the rate and velocity of discharged stormwater, which would decrease flood potential and thus reduce the amount of roadway contaminants potentially reaching the Barton Creek watershed during storm events. Accidental void discovery plans, void mitigation measures, and water quality protection BMPs would further protect the Edwards Aquifer, including downgradient springs (Barton Springs, Cold Springs, and Backdoor Spring) from TSS during construction. Additionally, TxDOT has determined that it is not necessary to re-initiate consultation for this project because none of the re-initiation triggers presented in the USFWS concurrence letter have been met.

Please let me know if you have any questions.

Regards,

Dennis Palafox

Environmental Specialist

Texas Department of Transportation

Environmental Affairs Division

Mailing Address

125 E. 11th St.

Austin, TX 78701-2319

512-416-2633

dennis.palafox@txdot.gov

[1] City of Austin (COA) 1997. The Barton Creek Report. Water Quality Report Series COA-ERM/1997. Drainage Utility Department, Environmental Management Division.

From: Shirley Nichols
To: Jon Geiselbrecht
Subject: FW: [EXTERNAL] Oak Hill Parkway Project TSS Loading
Date: Friday, December 07, 2018 4:01:33 PM

From: Zerrenner, Adam [mailto:adam_zerrenner@fws.gov]
Sent: Friday, December 07, 2018 9:05 AM
To: Dennis Palafox
Cc: Charlotte Kucera; Jodi Bechtel; Clover Clamons; Shirley Nichols; Andrew Blair
Subject: Re: [EXTERNAL] Oak Hill Parkway Project TSS Loading

Hi Dennis,

Thank you for providing us with the additional information and being so transparent in your design process.

If the proposed project does not result in a net increase in TSS loading as was described in the original BA, the Dec. 20, 2017, concurrence letter still applies.

Regards,

Adam

On Tue, Dec 4, 2018 at 3:42 PM Dennis Palafox <Dennis.Palafox@txdot.gov> wrote:

> Adam,
>
> Attached to this email is a letter summarizing TxDOT's latest efforts to reduce TSS loading from the proposed Oak Hill Parkway project. We would be happy to discuss this letter with you after you've had a chance to review it. Please be aware that state agencies will be closed tomorrow, December 5, with a minimal skeletal crew as an official day of mourning for President George Hebert Walker Bush.
>
> Regards,
>
> Dennis Palafox
>
> Environmental Specialist
> Texas Department of Transportation
> Environmental Affairs Division
> Mailing Address
> 125 E. 11th St.
> Austin, TX 78701-2319
> 512-416-2633
> dennis.palafox@txdot.gov

TCEQ Coordination 2018

From: Lindsey Kimmitt
To: Jon Geiselbrecht; Meghan P. Lind
Subject: FW: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX
Date: Tuesday, August 28, 2018 8:31:29 AM

From: Mary Herrington
Sent: Thursday, May 24, 2018 11:23 AM
To: Carlos Swonke; Lindsey Kimmitt
Subject: FW: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX

Please see the email I received today ..thank you.

Mary
Mary Herrington
Environmental Affairs Division
Texas Department of Transportation
Office (512) 416-2734
Email: Mary.Herrington@txdot.gov

From: NEPA [mailto:NEPA@tceq.texas.gov]
Sent: Thursday, May 24, 2018 10:46 AM
To: Mary Herrington
Subject: RE: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX

Re: Response to Request for TCEQ Environmental Review

The Texas Commission on Environmental Quality (TCEQ) received a request from the Texas Department of Transportation (TxDOT) regarding the following project: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX.

In accordance with the Memorandum of Understanding between TxDOT and TCEQ addressing environmental reviews, which is codified in Chapter 43, Subchapter I of the Texas Administrative Code (TAC) and 30 TAC § 7.119, TCEQ is responding to your request for review by providing the below comments.

This project is in an area of Texas designated by the United States Environmental Protection Agency as unclassifiable or in attainment of the National Ambient Air Quality Standards for all six criteria air pollutants. Air Quality staff has reviewed the document in accordance with transportation and general conformity regulations codified in 40 Code of Federal Regulations Part 93 Subparts A and B. We concur with TxDOT's assessment.

We are in support of the project. The environmental assessment addresses issues related to surface and groundwater quality.

TxDOT will still need to follow all other applicable laws related to this project, including applying for applicable permits.

If you have any questions, please feel free to contact the NEPA Coordinator at (512) 239-3500 or NEPA@tceq.texas.gov.

Violet Mendoza
NEPA Coordinator
TCEQ, MC-119
NEPA@tceq.texas.gov

From: Mary Herrington [mailto:Mary.Herrington@txdot.gov]
Sent: Friday, May 4, 2018 2:54 PM
To: al.alonzi@dot.gov; gregory.budd@dot.gov; robert.patrick@fta.gov; Justin Ham <Justin.Ham@dot.gov>; smith.rhonda@epa.gov; charlotte_kucera@fws.gov; salvador.salinas@tx.usda.gov; vence.haggard@fra.dot.gov; FRAGA@dot.gov; Michaela_Noble@ios.doi.gov; Stephen_Spencer@ios.doi.gov; Calvin.C.Hudson@usace.army.mil; carter.smith@tpwd.texas.gov; WHAB <TxDOT@tpwd.texas.gov>; Mark.Wolfe@thc.state.tx.us; justin.kockritz@thc.texas.gov; NEPA <NEPA@tceq.texas.gov>; Richard Hyde <richard.hyde@tceq.texas.gov>; Adam Zerrenner (adam_zerrenner@fws.gov) <adam_zerrenner@fws.gov>; publicassist@rrc.texas.gov; gpb@glo.texas.gov; superintendent@austinisd.org; carter.scherff@hayscisd.net; president@ohan.org; District8@austintexas.gov; mike.personett@austintexas.gov; rob.spillar@austintexas.gov; kevin.shunk@austintexas.gov; sarah.eckhardt@traviscountytx.gov; gerald.daughtery@traviscountytx.gov; tnrweb@traviscountytx.gov; jon.white@traviscountytx.gov; miranda.gomez@co.hays.tx.us; mayor@cityofdrippingsprings.com; cmurphy@beecavetexas.gov; bseacd@bseacd.org; clara.tuma@Lcra.org; ashby.johnson@campo.org; todd.hemingson@capmetro.org; kirk.watson@senate.state.tx.us; dawn.buckingham@senate.texas.gov; donna.campbell@senate.texas.gov; paul.workman@house.texas.gov; donna.howard@house.texas.gov; gina.hinojosa@house.texas.gov; jason.isaac@house.texas.gov; sue.reilly@tpwd.texas.gov; David Brymer <david.brymer@tceq.texas.gov>; Donna Huff <donna.huff@tceq.texas.gov>; David Van Soest <David.Vansoest@tceq.texas.gov>; steve.adler@austintexas.gov
Cc: Carlos Swonke <Carlos.Swonke@txdot.gov>; Lindsey Kimmitt <Lindsey.Kimmitt@txdot.gov>; Jon Geiselbrecht <Jon.Geiselbrecht@txdot.gov>; Shirley Nichols <Shirley.Nichols@txdot.gov>; Diann Hodges <Diann.Hodges@txdot.gov>; Adeliza Ramirez <Adeliza.Ramirez@txdot.gov>; Bradley Wheelis <Bradley.Wheelis@txdot.gov>; osolis@ctrma.org; jhayter@ctrma.org; Sshelton@ctrma.org; dheath@ctrma.org; WStrong@rtg-texas.com; shane.valentine@hdrinc.com; bubba.needham@atkinsglobal.com; randall@nancyledbetter.com; kerry@nancyledbetter.com; carol.faikus@atkinsglobal.com; irife@rifeline.com
Subject: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX

From The Office Of Carlos Swonke, Director of Environmental Affairs Division:

Subject: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX

From the Office of Carlos Swonke:

Subject: Notice of Availability/Notice of Public Hearing for Oak Hill Parkway; Travis County, TX
(CSJ: 0113-08-060 and 0700-03-077)

The Texas Department of Transportation (TxDOT) and the Central Texas Regional Mobility Authority would like to invite you to review the Oakhill Parkway Draft Environmental Impact Statement (DEIS). The Oakhill Parkway project involves improvements to US 290 and SH 71 West through Oak Hill extending along US 290 from State Loop 1 (MoPac) to RM 1826, a distance of approximately 6.15 miles, with a transition west to Circle Drive as well as along approximately one mile of SH 71, from US 290 north to Silvermine Drive.

The DEIS, maps showing the project location and design, and other information relative to the project are available for review at the following website:

http://www.oakhillparkway.com/environmental/deis.php

A Public Hearing will be held Thursday, May 24, 2018, at Bowie High School, located at 4103 W. Slaughter Ln. Austin, TX 78749 for public review of the document and project materials. Displays will be available for viewing at 6:15 p.m. with the formal hearing starting at 7:00 p.m. The purpose of the hearing is to present the recommended preferred alternative and to receive public and agency comment on the proposed project.

Verbal and written comments regarding the project are requested and may be presented at the hearing or submitted in person or by mail to the TxDOT Austin District Environmental Coordinator, Texas Department of Transportation, P.O. Drawer 154276, Austin, Texas, 78761-5426. In addition, written comments may be submitted by fax to 512-832-7157, or via the www.OakHillParkway.com website on the “Contact Us” page. Comments must be received on or before Monday, June 18, 2018, to be part of the official hearing record.

If you have any general questions or concerns regarding the proposed project or hearing, please contact Jon Geiselbrecht, Austin District Environmental Specialist, 512-832-7218, jon.geiselbrecht@txdot.gov.