## CONTENTS

1.0	TRAFFIC ANALYSIS	1
1.1	Crash Analysis	6
1.2	Future Characteristics	8
1.3	Traffic Operations Analysis	8
1.4	Traffic Modeling Results	10
2.0	DRAINAGE STUDY	15
2.1	Existing Drainage Conditions and Issues	15
2.2	Proposed Drainage Improvements	16
2	2.1 On-site Detention in Medians	16
2	2.2 Upsize Adirondack Pond – Regional Stormwater Management Program	18
2.3	Detention Cost Estimates	19
2.4	Life Cycle Cost Estimates	21
2.5	Project Schedule	21
3.0	PERMITTING REQUIREMENTS	22
4.0	PRELIMINARY ENGINEERING PHASE RECOMMENDATIONS	24
5.0	CONSTRUCTION COST INDEX	

# List of Tables

Table 1-1	Design Alternatives and Traffic Study Alternatives	2
Table 1-2	Collision Severity Summary	7
Table 1-3	Collision Type Summary	7
Table 1-4	Total traffic volume along Spicewood Springs Road	8
Table 1-5	LOS General Description	9
Table 1-6	LOS for Signalized Intersection	9
Table 1-7	LOS for Two-way Stop-controlled intersection (driveways)	9
Table 1-8	LOS for Arterial Segments 1	10
Table 1-9	Conflict Point Analysis Summary 1	10
Table 1-1	D Peak Hour Arterial Level of Service for Spicewood Springs Road1	13
Table 1-1	1 Peak Hour Intersection Level of Service for Spicewood Springs Road	14
Table 2-1	Alternative C Preliminary Cost Estimate (on-site detention in medians)	19
Table 2-2	Alternative C Preliminary Cost Estimate (off-site detention at upsized pond)	20

Spicewood Springs Road Regional Mobility Program 2016 Mobility Bond

Table 2-3	Alternative A Preliminary Cost Estimate (on-site detention in medians) 20
Table 2-4	Total Project Budget Estimate
Table 2-5	Alternative C (Detention in Medians) Life Cycle Maintenance Cost Estimate
Table 2-6	Alternative C (Upsize Adirondack Pond) Life Cycle Maintenance Cost Estimate 22
Table 2-7	Schedule for Alternative C – Detention in Medians 22
Table 2-8	Critical Path Schedule for Alternative C – Detention in Upsized Adirondack Pond 22

# List of Figures

Figure 1-1	Alternatives 1 and 7	3
Figure 1-2	Median Cut Locations for Alternatives 1, 3, 7 and 8	4
Figure 1-3	Alternative 2	5
Figure 1-4	Alternative 3 and 8 – Traffic Study Recommendation	5
Figure 1-5	Crash locations 2012-2017 provided by ATD	6
Figure 2-1	City owned property along Spicewood Springs Road1	L7

## 1.0 TRAFFIC ANALYSIS

The City of Austin contracted with CobbFendley & Associates to perform a traffic study for Spicewood Springs Road from Loop 360 to Mesa Drive. A final traffic analysis report was submitted on March 23, 2018 and a supplemental technical memo was submitted on May 25, 2018. The report and memo are available on the Spicewood Springs Regional Mobility Project (https://austintexas.gov/sites/default/files/files/SWS Traffic Analysis.pdf website and https://austintexas.gov/sites/default/files/files/SWS Technical Memo Traffic Study.pdf). The study evaluates impacts to vehicular safety, delay time at intersections or driveways and roadway travel speed for existing conditions and proposed alternatives. Traffic simulation models evaluate roadway design alternatives, no build options and potential future changes to the roadway system outside the project area. The potential future projects are grade separation at Loop 360 and Spicewood Springs Road and closure of Old Spicewood Springs Road. Ten different scenarios were analyzed, as listed below. Analysis includes 2017 traffic rates and predicted 2027 rates. Alternative typical sections with dimensions are pictured in Figures 1-1, 1-3 and 1-4. Median cut locations for Alternatives 1, 3, 7 and 8 are shown in Figure 1-2 and in greater detail in the preliminary plans in **Appendix A**. The list below describes the traffic study alternatives.

- Alternative 1 (2027): One traffic lane in each direction with raised median and left turn bays at limited locations
- Alternative 2 (2027): Two traffic lanes in each direction, no center turn lane
- Alternative 3 (2027): Two traffic lanes in each direction with raised median and left turn bays at limited locations
- Alternative 4: Eliminated from traffic study based on staff project meetings
- Alternative 5 (2027): TxDOT proposed grade separation of Spicewood Springs Road and Loop 360 combined with existing roadway geometry
- Alternative 6 (2027): Existing roadway geometry combined with the closure of Old Spicewood Springs Road
- Alternative 7 (2027): Combination of Alternatives 1 and 5 TxDOT proposed grade separation of Spicewood Springs Road and Loop 360 combined with one traffic lane in each direction with raised median and left turn bays at limited locations
- Alternative 8 (2027): Combination of Alternative 3 (Traffic Study Recommendation) and Alternative 5 – TxDOT proposed grade separation of Spicewood Springs Road and Loop 360 combined with two traffic lanes in each direction with raised median and left turn bays at limited locations
- Existing roadway geometry (2017)
- No Build (2027): Existing roadway geometry

The relationship between roadway design alternatives evaluated in the Preliminary Engineering Report and traffic study alternatives is summarized in Table 1-1. Alternative A is represented by traffic study Alternatives 1 and 7 and Alternative C is represented by traffic study Alternatives 3 and 8. Preliminary engineering phase recommendations are based on Alternatives 7 and 8, which include TxDOT's proposed improvements at Loop 360.

Preliminary Engineering	Traffic Study	Description
Report - Roadway Design	Alternative	
Alternative		
Alternative A	Alternative 1 (2027)	One traffic lane in each direction with raised median and left turn bays at limited locations (no improvements at Loop 360)
	Alternative 7 (2027)	Same as Alternative 1, except with improvements at Loop 360
Alternative B	Alternative 2 (2027)	Two traffic lanes in each direction, no center turn lane (no improvements at Loop 360)
Alternative C – Traffic Study Recommendation	Alternative 3 (2027)	Two traffic lanes in each direction with raised median and left turn bays at limited locations
	Alternative 8 (2027)	Same as Alternative 3, except with improvements at Loop 360

**Table 1-1** Design Alternatives and Traffic Study Alternatives



Figure 1-1 Alternatives 1 and 7

Spicewood Springs Road Regional Mobility Program 2016 Mobility Bond



#### Figure 1-2 Median Cut Locations for Alternatives 1, 3, 7 and 8

#### Figure 1-3 Alternative 2



Figure 1-4 Alternative 3 and 8 – Traffic Study Recommendation



Spicewood Springs Road Regional Mobility Program 2016 Mobility Bond

#### 1.1 Crash Analysis

CobbFendley analyzed crash data provided by ATD for 2012 through 2016. A map of crash locations is shown in Figure 1-5. ESD obtained crash data for 2017 and updated the collision analysis summaries to include the new data. See Tables 1-2 and 1-3 below. The full collision analysis is included in the traffic study. Collisions with injury comprised 47% of the total crashes between 2012 and 2017. As noted in the traffic study, crashes involving vehicles traveling in opposite directions could be caused by unsafe left turns. Opposite direction crashes were 24% of the total for 2012 through 2017.



Figure 1-5 Crash locations 2012-2017 provided by ATD

Table 1-2 Collision Severity Summary	Table 1-2	Collision	Severity	Summarv
--------------------------------------	-----------	-----------	----------	---------

Collision Severity		
Severity Category	2012 - 2017 No. of Collisions	Percent
Fatal	0	0%
Incapacitating	5	6%
Non-capacitating	13	15%
Possible injury	23	26%
Not injured	43	49%
Unknown	3	4%
Total collisions	87	100%
Total Collisions with Injury	41	47%

Note: Percentages vary slightly from the traffic study to include collisions in 2017.

Collision Type			
Туре	2012 - 2017 No. of Collisions	Percent	
One Motor Vehicle	17	20%	
Angle	18	21%	
Same Direction	31	35%	
Opposite Direction	21	24%	
Total collisions	87	100%	

 Table 1-3
 Collision Type Summary

Note: Percentages vary slightly from the traffic study to include collisions in 2017.

Spicewood Springs Road residents expressed concern about deer crossing the road and causing accidents. ESD obtained a record of 3-1-1 calls reporting dead or injured deer and other animals along Spicewood Springs Road between Loop 360 and Mesa Drive. The 3-1-1 report lists 236 separate calls over the last 5 years. The incidents occurred mainly between Mesa Drive and the top of the steep slope near 4926 Spicewood Springs Road. The mapped incident points are distributed evenly along the road and do not cluster at any particular location. In addition, seven instances occurred between Loop 360 and Old Spicewood Springs Road/Adirondack Trail. Additional lighting along Spicewood Springs Road could improve nighttime visibility and deter animals from approaching the road at night. ESD recommends requesting a light study from Austin Energy to assess the need for additional lights. The 3-1-1 report and map are included in *Appendix E*.

The traffic study recommends several improvements to existing signage that could improve safety. Additional signage and a flashing beacon could be installed at the top of the steep hill to warn westbound drivers of the steep grade and traffic signal at Loop 360. A portable message

sign with "Your Speed XX MPH" could be added to the speed limit sign to increase awareness. Additional analysis is needed to confirm if signage warrants are met.

#### 1.2 Future Characteristics

Existing traffic count data was collected in May 2017 and projected to 2027 based on a growth rate calculated by CobbFendley. Historical Annual Average Daily Traffic (AADT) data available from TxDOT was evaluated in order to determine a growth rate appropriate for the specific project area. Growth rate calculations used TxDOT AADT data from two locations near Spicewood Springs Road that was collected between 2010 and 2016. The two locations are Loop 360 at Champion Grandview Way and Loop 360 at Wildridge Drive. Growth rates for each year and location were averaged to determine the final growth rate of 3.20%. CobbFendley provided a memo outlining the growth rate determination process that can be found in *Appendix E*. CobbFendley anticipates that the 3.20% growth rate will account for future development of the Austin Oaks PUD (Spicewood Springs Road and Mopac/Loop1) and the Junior League of Austin Community Impact Center (Loop 360 and Bluffstone Drive). The present and future AADT traffic volumes for Spicewood Springs Road are shown in Table 1-4.

Road

	1
Table 1-4 Total traffic volume alon	g Spicewood Springs

Average AADT		
Year	AADT	
2017	16,435	
2027	22,520	

#### 1.3 Traffic Operations Analysis

SimTraffic 9 (Trafficware) software was used to perform a Level of Service (LOS) analysis of Spicewood Springs Road. The program computed average travel speed along Spicewood Springs Road as well as average delay for signalized and stop controlled intersections. Driveways are modeled as two-way stop controlled intersections. SimTraffic9 performs traffic analysis based on *Highway Capacity Manual* (HCM 2010) methodologies. LOS thresholds recommended in HCM 2010 are used to evaluate design alternatives. LOS is a quantifiable and nationally accepted metric that measures how well a given roadway configuration functions in terms of congestion and mobility. Traffic study results are used to evaluate which design alternatives reduce congestion and improve mobility. LOS categories range from A to F and are described in Table 1-5. Pertinent LOS tables from HCM 2010 are included as Tables 1-6, 1-7 and 1-8.

#### Table 1-5 LOS General Description

LOS	General Description	
A	Free Flow	
В	Reasonable Unimpeded (some delays)	
С	Stable Operation (acceptable delays)	
D	D Approaching Unstable Operation	
E Unstable Flow (severe delays)		
F	Extremely Low Speed Flow (severe congestion)	

**Table 1-6** LOS for Signalized Intersection(HCM 2010, Exhibit 18-4)

LOS	Control Delay/Vehicle (s/veh)
А	≤ 10
В	> 10 and ≤ 20
С	> 20 and ≤ 35
D	> 35 and ≤ 55
E	> 55 and ≤ 80
F	> 80

**Table 1-7** LOS for Two-way Stop-controlled intersection (driveways)(HCM 2010, Exhibit 19-1)

LOS	Control Delay/Vehicle (s/veh)
A	≤ 10
В	> 10 and ≤ 15
С	> 15 and ≤ 20
D	> 20 and ≤ 35
E	> 35 and ≤ 50
F	> 50

# **Table 1-8** LOS for Arterial Segments(HCM 2010, Exhibit 17-2)

LOS	Travel Speed as a Percentage of Base Free-Flow Speed (%)
А	> 85
В	> 67 and ≤ 85
С	> 50 and ≤ 67
D	> 40 and ≤ 50
E	> 30 and ≤ 40
F	≤ 30

#### 1.4 Traffic Modeling Results

CobbFendley recommends Alternative 3 based on the traffic safety and congestion analysis documented in their report. The raised medians with left turn bays improve safety by reducing potential conflict points between vehicles. Alternatives 1 and 3 are the design options that include raised medians and meet the goal of improving safety. Of these two, Alternative 3 provides a higher level of service in terms of traffic flow and intersection delay.

CobbFendley performed an analysis of the conflict points along Spicewood Springs Road for the existing roadway and the different design alternatives. Traffic engineers first laid out the proposed median in a manner that allows adequate left turn storage and sight distance. The presence of a raised median reduces the number of conflict points by eliminating some turning options. The reduction in conflict points between existing and proposed conditions is a quantifiable metric that measures the improved safety benefits of proposed roadway design alternatives. Alternatives 1 and 3 are recommended from a traffic safety perspective. Both options provide a 47% reduction in conflict points. A schematic diagram of the conflict points (diverging, merging or crossing) is included in Appendix I of the traffic study and a plan view of proposed median cut locations is included in *Appendix A*. The conflict point analysis is summarized in Table 1-9.

Design Alternative	Includes median?	Total Number of Conflict Points	Percent Reduction in Conflict Points from Existing Conditions
Existing Roadway	No	323	N/A
Alternative 1	Yes	178	45%
Alternative 2	No	323	0%
Alternative 3	Yes	178	45%

**Table 1-9** Conflict Point Analysis Summary

The roadway design alternatives recommended in terms of traffic safety improvement (Alternatives 1 and 3) are compared in the charts below based on level of service. Table 1-10 summarizes the arterial level of service for Spicewood Springs Road in terms of travel speed for existing and future conditions. Alternative 7 is the combination of Alternative 1 roadway geometry and proposed Loop 360 improvements. Alternative 8 is the combination of Alternative 3 roadway geometry and proposed Loop 360 improvements. Vehicles travel closer to the posted speed limit (30 miles per hour) in scenarios with a better level of service rating, as defined in Table 1-8.

Table 1-10 demonstrates that Alternative 3 performs better than Alternative 1 in terms of arterial traffic flow. An LOS of "F" indicates that the transportation system is gridlocked. Alternative 1 roadway geometry with or without Loop 360 improvements results in gridlock on Spicewood Springs Road during the PM peak hour.

Grade separation at Loop 360 allows for quicker entry of vehicles onto eastbound Spicewood Springs Road, which increases the volume of vehicles on Spicewood Springs Road and also increases the number of vehicles turning off Spicewood Springs Road. Eastbound vehicles turning left off of Spicewood Springs Road must wait for a break in the westbound traffic. Left-turning vehicles queued beyond the turn bays due to the long wait for a break in the heavy westbound PM traffic. The result is that gridlock occurs much faster when Alternative 1 roadway geometry is combined with Loop 360 improvements as compared to Alternative 1 roadway geometry combined with the existing signalized Loop 360 intersection. Alternative 3 roadway geometry performs much better than Alternative 1 when combined with Loop 360 improvements. The traffic study concludes that the additional vehicle lanes in Alternative 3 provide capacity for the increased number of vehicles exiting the improved Loop 360 intersection and traveling eastbound on Spicewood Springs Road.

Table 1-11 summarizes intersection level of service for the existing roadway configuration in 2017 and 2027 in comparison to Alternatives 1 and 3 with and without TxDOT improvements at Loop 360. The chart demonstrates that Alternative 3 is the preferred option in terms of average intersection delay. Most intersections and driveways operate at an acceptable LOS for Alternative 3 roadway geometry and a future overpass at Spicewood Springs Road and Loop 360. The LOS for the intersection of Old Spicewood Springs Road and Spicewood Springs Road remains unacceptable (F) for all scenarios considered.

Delay time experienced by an individual accessing driveways on Spicewood Springs Road is expected to vary according to individual travel patterns. For example, those entering or leaving Spicewood Springs Road during non-peak commute hours may not experience a reduction in travel time. However, all roadway users benefit from safety improvements regardless of the individual travel patterns.

Traffic signal timing revisions at Mesa Drive could help improve flow through the intersection and should be evaluated further. Future revisions to the intersection geometry could also be considered.

The Federal Highway Administration maintains a clearing house of information on roadway features and expected crash rates. The addition of a raised median is expected to reduce the head-on crash rate by 70% and the overall crash rate by 40%. Pedestrian and bicyclist crash rates are expected to reduce by 25% due to the shared use path that is separated from the roadway by curb and/or buffer zone. See <u>http://www.cmfclearinghouse.org/index.cfm</u>

	Arterial LOS <sup>1</sup>																									
Roadway Design Alternative:		Existing/No Build			ild	Alternative A					Alternative C															
Traffic Study Scenario:	Exis	ting	No E	Build	Al	t 5	Al	t 1	Al	t 7	Al	t 3	Al	t 8												
Traffic Volume:	20	17	2027		2027		.027 2027		2027 202		2027 2027		2027		2027		2027		2027		2027 202		20	27	20	27
Number of Lanes:	1 eac	h way	1 eac	h way	1 eac	h way	1 each way		1 each way		2 eac	h way	2 eac	h way												
Center Lane:	no	ne	no	none none raised median raise		raised median		raised median raised median		median	raised	median	raised	median												
Loop 360 Intersection:	exis	ting	exis	ting	over	pass	existing overpass		pass	existing		overpass														
Peak Hour:	AM	PM	AM	РМ	AM	PM	AM	PM	AM	РМ	AM	PM	AM	PM												
Westbound	С	D	F	F	С	F	F	F	С	F	С	F	С	D												
Eastbound	С	С	С	С	С	С	С	F	С	F	С	D	С	С												

**Table 1-10** Peak Hour Arterial Level of Service for Spicewood Springs Road

1. Table 1-10 is based on information in the traffic study performed by CobbFendley. See Traffic Study Appendix K (p. 416) and Alternative 8 Technical Memo (Table 1).

#### Color Code for Tables 1-10 and 1-11



LOS within acceptable range (D or higher) Unacceptable LOS (E or F)

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	Intersection LOS <sup>1</sup>														
Roadway Design Alternative: Existing/No Build							Altern	ative A			Altern	ative (	2		
	Traffic Study Scenario:	Exis	ting	No E	Build	Al	t 5	Alt 1		Al	t 7	Alt 3		Alt 8	
5	Traffic Volume:	20	17	20	27	20	27	20	27	20	27	20	27	20	27
ectic	Number of Lanes:	1 eac	h way	1 eac	h way	1 eac	n way	1 eac	h way	1 eac	h way	2 eac	h way	2 eac	h way
erse	Center Lane:	no	ne	no	ne	no	ne	raised	median	raised I	median	raised	median	raised	median
Int	Loop 360 Intersection:	exis	ting	exis	ting	over	pass	exis	ting	over	pass	existing		ovei	pass
	Peak Hour:	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
1	Loop 360	F	F	F	F	С	В	F	F	С	E	F	F	С	С
2	Old Spicewood Springs Rd	D	С	F	E	F	F	F	F	F	F	F	F	F	E
3	4926	А	А	Α	Α	А	А	А	C	А	E	А	Α	А	А
4	4901	А	А	В	А	А	В	В	C	А	D	А	В	А	А
5	4900 - west drive	А	А	А	А	А	А	А	С	А	D	А	А	А	А
6	drive to single family houses	А	А	А	А	А	А	А	В	А	С	А	А	А	A
7	4900 - east drive	А	А	А	А	А	А	А	В	А	С	А	А	А	A
8	4810 - west drive	А	А	А	А	А	А	А	C	А	С	А	А	А	А
9	4807 west drive, 4810 east drive	А	С	А	С	А	С	А	D	А	D	А	А	А	А
10	4800 west drive, 4807 east drive	А	С	А	D	А	D	А	F	А	E	А	А	А	А
11	4801 - Stillhouse Exec. Park	А	А	А	В	А	В	А	С	А	С	А	А	А	А
12	4711 - Stillhouse Cnyn, 4800 - east drive	А	А	А	А	А	А	А	C	А	D	А	А	А	А
13	4701, 4705	А	А	А	В	А	В	А	В	А	С	А	А	А	А
14	4411 - Marquis west drive	А	А	В	D	А	D	А	F	А	F	А	А	А	А
15	4601 - Stillhouse II	А	А	А	D	А	D	А	E	А	F	А	А	А	А
16	4501 - Spicewood Plaza west drive	А	А	А	А	А	А	А	С	А	В	А	А	А	A
17	4501 - Spicewood Plaza east drive	А	А	А	D	А	D	А	F	А	F	А	А	А	A
18	4411 - Marquis east drive	А	А	А	F	А	F	А	F	А	F	А	А	А	А
19	Mesa Drive	С	D	D	F	D	F	D	F	D	F	D	F	D	F

 Table 1-11
 Peak Hour Intersection Level of Service for Spicewood Springs Road

1. Table 1-11 is based on information in the traffic study performed by CobbFendley. See Traffic Study Appendix K and Alt 8 Technical Memo (SimTraffic Performance Reports, Total delay/vehicle for all turning movements).

### 2.0 DRAINAGE STUDY

#### 2.1 Existing Drainage Conditions and Issues

The project area is located within the Bull Creek Watershed, which is classified by the City of Austin as Water Supply Suburban. Watershed Engineering Division has no record of street or building flooding complaints along Spicewood Springs Road between Loop 360 and Mesa Drive.

The Critical and Transitional Water Quality Zones for Furtato Creek, a Bull Creek tributary, cross Spicewood Springs Road between Loop 360 and Old Spicewood Springs Road. The Transitional Water Quality Zone for a tributary to Furtato Creek extends across Spicewood Springs east of Old Spicewood Springs Road. Critical water quality zones for major waterways may be crossed by an arterial street identified in the Transportation Plan (LDC 25-8-262). Furtato Creek at Spicewood Springs Road is classified as a major waterway since the drainage area exceeds 640 acres. Spicewood Springs Road is included in the 2025 Austin Metropolitan Area Transportation Plan as shown in a map in *Appendix E*. Impervious cover in the Transitional Water Quality Zone is limited to 18% and impervious cover in the uplands zone is limited to 40%. ESD recommends requesting variances from WPD for crossing the CWQZ and impervious cover limits.

Storm water runoff in the project area follows two general drainage patterns. Topography for the eastern half of the project generally slopes toward Spicewood Springs Road from the south side and away from the Spicewood Springs Road on the north side. Steep ravines on the north side capture runoff from the road as well as runoff from off-site development on the south side of Spicewood Springs Road. Topography for the western half of the project slopes down and away from the project area on both sides of Spicewood Springs Road. Shallow bar ditches are present along portions of the road with periodic outfalls where storm water leaves the right-of-way. Storm water discharge is mainly concentrated at points such as storm drain outfalls but storm water also exits the right-of-way as sheet flow distributed across flat grassy areas. There are no curb inlets within the project limits. A map of drainage areas is included in **Appendix A**.

An existing detention pond is located at the northeast corner of Spicewood Springs Road and Adirondack Trail. The pond captures runoff from a portion of Spicewood Springs Road including approximately 125 acres north of Spicewood Springs Road and west of Mesa Drive. The 100-year floodplain appears to be contained within the existing drainage easement and below grade for Adirondack Trail.

Watershed Engineering Division anticipates revising design rainfall depths according to an upcoming report by the National Oceanic and Atmospheric Administration (NOAA). A draft NOAA report is currently available and is expected to be finalized in late 2018. The report analyzes historical rainfall data through Hurricane Harvey in August 2017 and provides updated rainfall

depth contours for Texas. Rainfall depths in the draft report for the Austin area are higher than depths in the current Drainage Criteria Manual (DCM). The draft NOAA rainfall depth for the 100-year storm event in Austin is approximately 12-13 inches, which is similar to the 500-year rainfall depth in the current DCM. Watershed Engineering Division (WED) anticipates starting the process of revising DCM rainfall depths as soon as the NOAA report is published. A memo from the WPD director outlining the anticipated revisions is included in *Appendix E*. As an interim measure, WED recommends using current DCM 500-year rainfall depths for design.

The 100-year floodplain is shown on the drainage map sheet in **Appendix A** and the Federal Emergency Management Agency's Flood Insurance Rate Maps for the project area are included in **Appendix E**.

#### 2.2 Proposed Drainage Improvements

The Comprehensive Watershed Ordinance requires mitigation for the impact of additional impervious cover associated with roadway improvements. Impervious cover increases the amount of water running off the project area by reducing infiltration into the ground and also increases runoff speed. The result is a higher peak flow that can be mitigated through detention. ESD investigated two options for Alternative C: 1) on-site detention in the proposed medians and, 2) off-site detention at an existing pond. Results of analysis indicate that on-site detention in the medians is feasible and would cost less than upsizing the existing pond. Both options are summarized below.

#### 2.2.1 On-site Detention in Medians

Proposed Alternative C includes 25-foot wide medians for approximately two thirds of the roadway length. Preliminary analysis using Hydrologic Modeling System (HMS) software indicates that detention in the medians is feasible. Proposed median ponds would be approximately two to four feet deep. Existing runoff patterns can be maintained for the eastern half of proposed Spicewood Springs Road when detention is provided in the medians along with area inlets that allow off-site runoff to bypass the median detention ponds. A detention pond is also proposed at the southeast corner of Old Spicewood Springs Road and Spicewood Springs Road. The proposed drainage areas are shown in *Appendix A*. The required detention volume is approximately 1.0 acre-feet. Proposed detention ponds meet the DCM requirement that peak flow from the site does not increase under proposed conditions. If needed, there are also two small City owned properties along Spicewood Springs Road that could potentially include small detention ponds or rain gardens. This option could be investigated further in design phase if additional area is needed. See map in Figure 2-1.

ESD met with representatives from Development Services Department (DSD) to discuss impervious cover calculations and DCM requirements. DSD staff clarified that existing road pavement is not considered redeveloped impervious cover if the drainage area peak outflow for proposed conditions is the same or less than existing and excavation is less than 18-inches. Additionally, "micro" flow patterns within the project area do not need to remain exactly the same as existing conditions. Revising the roadway cross slope would be considered a "micro" flow pattern change.

ESD met with the City supervisor for water quality pond maintenance. The proposed median rain gardens and combined shallow detention ponds differ from the standard pond design. Maintenance crews need access drives at the end of the median rain garden/ponds, but some DCM requirements for maintenance do not apply. ESD should continue to coordinate with maintenance staff during design phase.



Figure 2-1 City owned property along Spicewood Springs Road

#### 2.2.2 Upsize Adirondack Pond – Regional Stormwater Management Program

ESD also evaluated the feasibility of upsizing the existing pond at the northeast corner of Old Spicewood Springs Road and Adirondack Trail. The pond is located on private property owned by the Spicewood Vista Condominiums at 8540 and 8546 Adirondack Trail. Although the pond is located within a drainage easement, the City of Austin would need to purchase the land through the right-of-way acquisition process. The drainage easement is adjacent to an outdoor patio with picnic tables and grills that is part of the condominium complex. Preliminary conversations with WED indicate that upsizing this pond could be considered a Regional Stormwater Management Program (RSMP) contribution. The RSMP program is a City of Austin initiative that allows alternatives to on-site detention for flood control purposes. A watershed wide approach is used to analyze potential flooding problems and to identify appropriate mitigation measures with the recognition that the most feasible approach may not be on-site detention. An agreement with Spicewood Vista Condominium owners would be needed in order to upside the existing pond.

ESD created an HEC-HMS model of the existing pond and existing impervious cover and compared it to a proposed pond in the same location with impervious cover from the Alternative 3 design concept. Preliminary analysis using HMS software indicates that the existing pond does not contain runoff from the DCM 500-year storm. A proposed pond was sized that meets WED requirements for RSMP participation, as outlined below, and maintains the water surface elevation below grade for Adirondack Trail. The proposed pond volume is larger and includes a new outlet structure. Preliminary engineering indicates that an upsized pond would fit within existing drainage easement. An upsized pond is approximately 9 acre-feet larger than the existing pond. The extra volume, as compared to the on-site detention volume, is needed to meet WED requirements outlined in the following paragraph and to accommodate the draft NOAA rainfall depths.

Preliminary conversations with DAC and WED resulted in the following list of requirements for upsizing the pond:

- The City of Austin would need to take ownership of the pond and perform maintenance.
- The existing pond captures runoff from private property. Typically, runoff from private and public land is not mixed, but the City of Austin's Development Assistance Center would consider allowing it on a case-by-case basis.
- Demonstration of "no adverse impact" downstream of the project would be necessary.
   WED defines "no adverse impact" as 0.00 foot rise in water surface elevation. WED indicated that "no adverse impact" should be demonstrated at the following locations:
  - Pond outlet structure
  - Low water crossings on Old Spicewood Springs Road

- Backwater north of Spicewood Springs Road and between Loop 360 and Adirondack Trail
- First downstream junction with Bull Creek.
- A Federal Emergency Management Agency (FEMA) Letter of Map Revision (LOMR) would be required for upsizing the existing pond.
- A proposed pond would need maintenance access as described in DCM Section 1.2.4
- In-channel basins are required by ECM Section 1.7.3.C to be evaluated for impact to downstream sediment transport. In-channel basins shall not capture excess bed material such that a "hungry water" effect results in additional erosion downstream.

#### 2.3 Detention Cost Estimates

Alternative C with on-site detention in the proposed medians is recommended in terms of cost since median ponds are less expensive than upsizing the existing Adirondack Trail pond. Upsizing the pond is more expensive since the existing pond is not sized for anticipated revisions to rainfall data. Draft NOAA rainfall data for the 100-year storm is similar to current DCM rainfall for the 500-year storm event, as discussed in Section 2.1. Additionally, cost savings are realized by placing rain gardens at the bottom of relatively shallow median detention basins. Constructing combined detention and water quality features is less expensive than building separate facilities.

Upsizing the existing pond requires right-of-way acquisition, while median detention ponds fit within exiting right-of-way. The right-of-way acquisition cost is based on 2017 Travis Central Appraisal District land values. The cost does not include Real Estate Division fees.

Construction costs for Alternative A are provided for the purpose of evaluating the cost to add additional capacity to Spicewood Springs Road.

Alternative C – Detention in Medians						
Street Improvements	\$	6,007,000				
Austin Energy Relocation	\$	600,000				
On-site Stormwater Detention	\$	1,733,000				
Rain Gardens for Water Quality	\$	895,000				
Roadway Items	\$	9,235,000				
Mobilization (4%)	\$	369,000				
Preliminary Roadway Construction Cost Estimate (no additional right-of-way needed)	\$	9,604,000				

#### Table 2-1 Alternative C Preliminary Cost Estimate (on-site detention in medians)

Alternative C - Detention in Upsized Adirondack Trail Pond						
Street Improvements	\$	6,007,000				
Austin Energy Relocation	\$	600,000				
Off-site Stormwater Detention	\$	2,874,000				
Rain Gardens for Water Quality	\$	895,000				
Roadway Items	\$	10,376,000				
Mobilization (4%)	\$	415,000				
Preliminary Roadway Construction Cost Estimate	\$	10,791,000				
Area to acquire for upsizing existing Adirondack Pond		2.0 Acres				
Cost per Acre	\$	264,000				
Preliminary Right-of-Way Acquisition Cost Estimate	\$	528,000				
Preliminary Roadway Construction Cost Estimate (with right-of-way acquisition)	\$	11,499,000				

**Table 2-2** Alternative C Preliminary Cost Estimate (off-site detention at upsized pond)

**Table 2-3** Alternative A Preliminary Cost Estimate (on-site detention in medians)

Alternative A – Detention in Medians						
Street Improvements	\$	4,833,000				
Austin Energy Relocation	\$	440,000				
On-site Stormwater Detention	\$	1,493,000				
Rain Gardens for Water Quality	\$	575,000				
Roadway Items	\$	7,341,000				
Mobilization (4%)	\$	294,000				
Preliminary Roadway Construction Cost Estimate (no additional right-of-way needed)	\$	7,635,000				

#### Table 2-4 Total Project Budget Estimate

Total Project Budget Estimate <sup>1</sup>							
Alternative C – detention in medians	\$ 16.7 Million						
Alternative C – detention in upsized Adirondack Trail pond	\$ 18.9 Million						
Alternative A – detention in medians	\$ 13.4 Million						

1. Includes soft costs such as design, project management, testing and inspection.

#### 2.4 Life Cycle Cost Estimates

Life cycle maintenance costs for Alternative C with on-site detention and with off-site detention are summarized in Tables 2-5 and 2-6. Maintenance for off-site detention at the Adirondack pond is more expensive since the pond and rain gardens both need maintenance. Detention ponds in the medians are combined with rain gardens resulting in lower shared maintenance costs. Pavement maintenance cost information was provided by Public Works' Infrastructure Management Group. Rain garden maintenance assumes a full landscape plan with a variety of high aesthetic plants. A simplified landscape plan could have lower maintenance costs.

	Life Span	Annual Maintenance Cost		N	Total Life Cycle laintenance Cost Estimate
Rain Gardens/Median Detention Ponds	25 vears	\$	16,800	Ś	420.000
Storm Drains	80 years	\$	5,400	\$	432,000
Pavement	80 years	\$	30,000	\$	2,400,000
Annual Maintenance Cost Estimate			52,200		

 Table 2-5
 Alternative C (Detention in Medians) Life Cycle Maintenance Cost Estimate

#### Table 2-6 Alternative C (Upsize Adirondack Pond) Life Cycle Maintenance Cost Estimate

	Life Span	Annual Maintenance Cost		N	Total Life Cycle Aaintenance Cost Estimate
Rain Gardens	25 years	\$	16,800	\$	420,000
Storm Drains and Adirondack Detention Pond	80 years	\$	67,300	\$	5,384,000
Pavement	80 years	\$	30,000	\$	2,400,000
Annual Maintenance Cost Estimate			114,100		

#### 2.5 Project Schedule

Alternative C with detention in the proposed medians is preferred in terms of schedule. Project schedules are provided in Tables 2-7 and 2-8 for Alternative C with detention in the medians and Alternative C with an upsized Adirondack pond. Right-of-way acquisition for upsizing the pond is the critical path and adds at least 9 months to the project schedule.

Phase	Minimum (Months)	Maximum (Months)
Design and Permitting	24	30
Contract Procurement	6	6
Construction	24	36
TOTAL	54 Months (4.5 Years)	72 Months (6.0 Years)

**Table 2-7** Schedule for Alternative C – Detention in Medians

Table 2-8
 Critical Path Schedule for Alternative C – Detention in Upsized Adirondack Pond

Phase	Critical Path	Minimum (Months)	Maximum (Months)
60% Design	Critical path	15	27
100% Design		6	18
Permitting		9	18
Right-of-way Acquisition <sup>1</sup>	Critical path	24	36
Contract Procurement	Critical path	6	6
Construction	Critical path	24	42
TOTAL <sup>2</sup>		69 Months (5.8 Years)	111 Months (9.3 Years)

1. Right-of-way acquisition begins after 60% design is complete. Right-of-way acquisition is the critical path, as shown in the Microsoft Project schedule in Appendix C.

2. Total duration is the sum of critical path durations.

# 3.0 PERMITTING REQUIREMENTS

The Spicewood Springs Road project requires the following permits:

• Site Plan Development Permit from the City of Austin

- It is recommended requesting a waiver from ATD for the steep roadway slope. Existing grade is 16% for approximately 1000 feet, but TCM Table 1-8 lists 9% as the maximum slope that can be sustained for 1000 feet on 4 lane divided major arterials.
- It is recommended requesting a variance for crossing the Critical Water Quality Zone, 18% impervious cover limit in the Water Quality Transition Zone and 40% impervious cover limit in the uplands zone.
- A variance from the standard 150-foot Critical Environmental Feature buffer may be needed depending on results of further field investigation by WPD staff.
- It is recommended coordinating with WPD field operations regarding maintenance access to rain gardens and ponds.
- A Hydrogeologic report signed and sealed by a registered Professional Geologist is required as part of the ERI since the project area is within the Edwards Aquifer Recharge Zone (ECM 1.3.B.5) as defined by the City of Austin.
- An erosion hazard zone analysis is needed due to the project's proximity to the banks of a Bull Creek tributary.
- Oak wilt prevention restrictions on tree trimming apply from February 1 to June 30.
- The site plan review process includes tree mitigation. Removal of heritage trees requires an administrative variance and possibly a variance issued by the Land Use Commission.
- The site plan review process includes a floodplain review. The floodplain may need to be re-drawn based on upcoming revisions to rainfall data, as described in Section 7.
- Austin Fire Department requires a minimum 11-foot wide travel lane (excluding gutter width) if there are two lanes in one direction and a minimum 13-ft wide travel lane if there is one lane in each direction. The widths exclude the gutter. These dimensions provide adequate turning radii for fire trucks and are based on Land Development Code (LDC) Article 7, Sections 202.1, 503.1, 503.2.4, 503.2.1. Median modifications at the turning bay could be necessary to provide adequate turning radii.
- The City of Austin is currently developing new land development code. Permitting requirements could change when or if new code is adopted.
- Zoning categories for lots adjacent to Spicewood Springs Road include Multifamily-Low, Medium and Highest Density (MF-2, MF-3, MF-6), Single Family-Standard Lot (SF-2), Family Residence (SF-3), Townhouse and Condominium (SF-6), Planned Unit Development (PUD), Neighborhood Office (NO), Limited Office (LO), General Office (GO) and Public (P).

- Permit from and coordination with TxDOT regarding Spicewood Springs Road connection to Loop 360 and temporary traffic control.
- Balcones Canyon Conservation Plan (BCCP) Permit (Determination Letter)
  - The project is entirely within the BCP permit area. Part of the project area is within Endangered Cave Species habitat and/or Golden-cheeked Warbler confirmed habitat.
  - The south side of Spicewood Springs Road between Loop 360 and Old Spicewood Springs Road is adjacent to Balcones Canyon Preserve land (Lower Bull Creek Greenbelt).
  - Clearing of woody vegetation shall be completed between September and February. Such work can continue between March 1 and September 1 only after a bird-monitoring program demonstrates that there are no nesting birds within 300 feet of the project bounds.
- US Fish and Wildlife Service (USFWS)
  - Endangered Species Act Section 10A permit and/or coordination with the regional USFWS office regarding critical subsurface habitat for the Jollyville Plateau salamander.
  - The extent of mitigation measures for incidental take of the salamander habitat is currently unknown.
  - City staff specializing in Jollyville salamanders reviewed the project area and see low potential for impacting the salamander. They recommend hiring an environmental consultant to conduct a formal Biological Assessment documenting the potential for impacting salamander habitat.
- Texas Department of Licensing and Regulation (TDLR)
  - Compliance with the Texas Accessibility Standards (TAS) is required. A TAS review should be conducted during design phase. A TAS compliance inspection is required after construction.
  - Alternative compliance for the running slope requirement could be needed.
- A Stormwater Pollution Prevention Plan (SWPPP) under TCEQ Construction General Permit (TXR150000) is needed prior to construction phase.
- Water Pollution Abatement Plan (WPAP) and Sewage Collection System (SCS) applications are not needed from the Texas Commission on Environmental Quality (TCEQ) since the project is outside the Edwards Aquifer Recharge and Transition Zones per TCEQ.

## 4.0 PRELIMINARY ENGINEERING PHASE RECOMMENDATIONS

The following list summarizes additional recommendations from the preliminary engineering phase:

- Coordinate with property owner at 4615 Spicewood Springs Road regarding the existing rock wall located in the right-of-way. Provide adequate protection and or mitigation for the wall.
- Consider additional investigation of the rock retaining wall at 4612 Spicewood Springs Road. The wall is outside the right-of-way but needs to retain structural integrity during and after roadway construction.
- Address environmental recommendations in Preliminary Engineering Report Section 6.2:
  - Coordinating with City staff and the environmental consultant to finalize ERI (<u>https://austintexas.gov/sites/default/files/files/SWS Environmental Resource</u> <u>Inventory.pdf</u>) and CEFs and boundaries. Administrative and/or Land Use Commission variances from standard buffer distances could be necessary.
  - Coordination with the consultant to finalize the Phase I Environmental Site Assessment (<u>https://austintexas.gov/sites/default/files/files/SWS Phase I Environmental Si</u> <u>te Assessment.pdf</u>).
  - Requesting variances from the impervious cover limits in the transitional and critical water quality zones.
  - Including a special provision in the construction contract that stipulates tree clearing activities must begin before March 1<sup>st</sup> and proceed continuously until completed. This complies with BCCP bird nesting season restrictions. Construction can only being between March 1<sup>st</sup> and September 1<sup>st</sup> if a bird survey is conducted and concludes that there are no nesting birds within 300 feet of the project bounds.
  - Including a special provision in the construction contract that stipulates trimming or pruning of Live Oaks and Red Oaks should not occur between February 1<sup>st</sup> and June 30<sup>th</sup>, in compliance with the Oak Wilt Prevention Policy.
  - Meeting with the BCCP Infrastructure Coordinator early in design phase to determine mitigation measures that may be required.
  - Hiring an environmental consultant to conduct a Biological Assessment and coordinate with USFWS regarding the Jollyville Plateau salamander critical subsurface habitat and any necessary mitigation measures to include in construction documents.
  - Routing the Shared Use Path around existing trees to the greatest extent possible.
- Coordinate with TxDOT regarding SSRD approach to 360. Alternative C includes two eastbound lanes, but the approach currently has one wide eastbound lane.

- Coordinate study results of cultural/historical study with the State Historical Commission (<u>https://austintexas.gov/sites/default/files/files/SWS Historic Resources Survey Repor</u> <u>t-compressed.pdf</u>).
- Include fault verification in design phase geotechnical services.
- Use 500-year rainfall data for design as an approximation of upcoming rainfall depth revisions by NOAA.
- Speed limit should remain 30 mph.
- Refine U-turn locations. Investigate driveway to 5005/5003 Spicewood Springs Road. The driveway is currently a dirt road with a metal gate and is located just west of the cell tower site.
- Revise signal timing at Mesa Drive and Spicewood Springs Road to optimize traffic flow after Mobility Bond improvements are complete. Consider future geometry revisions at the intersection that could further improve traffic flow.
- Add additional signage ahead of the steep hill and Loop 360 intersection to help slow traffic and reduce rear end collisions.
- Keep deer crossing signage and investigate lighting to deter animals from roadway.
- Start the process of relocating Austin Energy power poles at the beginning of design phase.
- Meet with the City of Austin BCCP Infrastructure Coordinator early in design phase to determine mitigation measures that may be required.
- Incorporate BCCP best management practices such as planting native species, adhering to the City of Austin's Oak Wilt Prevention Policy (minimize trimming from February 1 to June 30) and avoiding vegetation disturbance during critical nesting season (March 1 – September 1).
- Hire an environmental consultant to coordinate with USFWS regarding the Jollyville Plateau salamander, 10A permit and special specifications for habitat mitigation.
  - Have consultant develop a special specification for void mitigation within the salamander subsurface critical habitat.
- Water quality facilities in the Edwards Aquifer Recharge Zone should be full filtration and include a liner.
- Include the City of Austin void and water flow mitigation specification (658S) in the construction contract. Clearly describe in construction documents when 658S is used and when a special specification in the salamander habitat is used.
- Don't increase the volume of storm water runoff to drain pipe on the west side of the Board of Realtors building because the outflow eventually flows over Rim Rock (RR-4 in the ERI).
- Consider a bird survey during design phase, as suggested by ERM staff.

- Develop a landscape, irrigation and Integrated Pest Management Plan.
- Add sidewalk along south side of Spicewood Springs Road from roadway construction limits to existing sidewalk at 4501 Spicewood Springs Road.
- Coordinate with ADT's Active Transportation and Street Design Division (ATSD) in order to address gaps in pedestrian and bicycle facilities that are outside the Mobility Bond project area but are needed to complete connectivity of the systems. ATSD recommends designing and installing the additional pedestrian/bicycle facilities as one comprehensive mobility solution, even if funded separately. Construction challenges at these locations include the need to build retaining walls, remove/replace retaining walls, move power poles and design around existing utility appurtenances. Specific locations to address and coordinate with ATSD are:
  - Construction of sidewalk on the southeast side of Old Spicewood Springs Road to complete walking path to Lower Bull Creek greenbelt from proposed shared use path along Spicewood Springs Road.
  - Conversion of sidewalk along Spicewood Springs Road between 0.2 miles west of Mesa Drive and Spicewood Lane to shared use path in order to close the gap of missing bike lane. Pavement striping and "shared lane" symbols could be considered as an alternate solution.
  - Infill sidewalk along the south side of Spicewood Springs Road between Greenslope Drive and Hart Lane.
- Consider small city owned parcels for water quality, if needed.
- Coordinate with Art in Public Places.
- Request a light study from Austin Energy.
- Consider closing Old Spicewood Springs Road after TxDOT improvements at Loop 360 and Spicewood Springs Road.
- Consider installing video monitoring cameras at the Old Spicewood Springs Road low water crossings to assist City staff in monitoring road conditions and provide the public with a close-to-real time information about water levels at each crossing.
- Investigate tree varieties that could help mitigate noise.
- Use deer resistant plants and trees.
- Add signage to notify drivers that deer are present in the area.
- Contact a wildlife specialist regarding ways to reduce deer related crashes.

The following recommendations, along with proposed improvements for Spicewood Springs Road, would complete continuous bicycle and pedestrian facilities along Spicewood Springs Road from Mopac/Loop 1 to Loop 360. Sidewalk would also connect the shared use path along Spicewood Springs Road to the Lower Bull Creek Greenbelt hiking trails. The project team should notify ATD's Active Transportation Department.

- Infill sidewalk on the south side of Spicewood Springs Road between Greenslope Drive and Hart Lane. Beaten pedestrian paths are visible through the grass and adding this sidewalk in combination with the 2016 Mobility Bond improvements would complete continuous sidewalk along both sides of Spicewood Springs Road from Mopac to Loop 360. Infill sidewalk is outside the Mobility Bond scope and would need to be funded separately.
- Infill sidewalk on Old Spicewood Springs Road near the Lower Bull Creek Greenbelt and bicycle lane on Spicewood. See Figure 8-1.
- Converting the sidewalk along both sides of Spicewood Springs Road from Mesa Drive to Spicewood Lane to Shared Use Path or adding "shared lane" symbols and striping to the pavement. This recommendation is outside the Mobility Bond scope and would need to be funded separately.

## 5.0 CONSTRUCTION COST INDEX

The Engineering News Report's Construction Cost Index for the cost estimate preparation timeframe is 10737. The index can be used in the future to update cost estimates provided in this report using the formula below. A Class 4 (Preliminary Engineering Report) cost estimate that is updated using the index should be considered a Class 5 (Concept Screening) cost estimate due to the general nature of the cost index.

 $future \ Class \ 5 \ cost \ estimate = \frac{future \ index \ value}{10737} \times \ Class \ 4 \ cost \ estimate$