



Traffic Noise Technical Memorandum

MoPac (State Loop 1) Intersections, Austin District

From North of Slaughter Lane to South of La Crosse Avenue

CSJ: 3136-01-015

Travis County, Texas

June 2015

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated December 16, 2014, and executed by FHWA and TxDOT.

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Appendix A: Preliminary Layout

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1.0 TRAFFIC NOISE

This technical memorandum presents the findings of a traffic noise analysis performed for proposed improvements to the intersection of Loop 1 (MoPac) and Slaughter Lane and the intersection of MoPac and La Crosse Avenue (CSJ: 3136-01-015). In addition to grade separations at the intersections, the proposed improvements would include construction of a shared use path for bicycles and pedestrians extending from Slaughter Lane to La Crosse Avenue (**Appendix A**).

This analysis was accomplished in accordance with Texas Department of Transportation's (TxDOT) (Federal Highway Administration [FHWA] approved) Guidelines for Analysis and Abatement of Roadway Traffic Noise (2011).

1.1 BACKGROUND INFORMATION

Sound from highway traffic is generated primarily from a vehicle's tires, engine and exhaust. It is commonly measured in decibels and is expressed as "dB."

Sound occurs over a wide range of frequencies. However, not all frequencies are detectable by the human ear; therefore, an adjustment is made to the high and low frequencies to approximate the way an average person hears traffic sounds. This adjustment is called A-weighting and is expressed as "dB(A)."

In addition, because traffic sound levels are never constant due to the changing number, type and speed of vehicles, a single value is used to represent the average or equivalent sound level and is expressed as "Leq."

The traffic noise analysis typically includes the following elements:

- ▶ Identification of land use activity areas that might be impacted by traffic noise.
- ▶ Determination of existing noise levels.
- ▶ Prediction of future noise levels.
- ▶ Identification of possible noise impacts.
- ▶ Consideration and evaluation of measures to reduce noise impacts.

The FHWA has established the following Noise Abatement Criteria (NAC) for various land use activity areas (**Table 1**) that are used as one of two means to determine when a traffic noise impact would occur.

Table 1: FHWA Noise Abatement Criteria

Activity Category	FHWA dB(A) (Leq)	Description of Land Use Activity Areas
A	57 (exterior)	Lands on which serenity and quiet are of extra-ordinary significance and serve an important public need and where the preservation of those qualities is essential if the area is to continue to serve its intended purpose.
B	67 (exterior)	Residential
C	67 (exterior)	Active sport areas, amphitheaters, auditoriums, campgrounds, cemeteries, day care centers, hospitals, libraries, medical facilities, parks, picnic areas, places of worship, playgrounds, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, recreation areas, Section 4(f) sites, schools, television studios, trails, and trail crossings
D	52 (interior)	Auditoriums, day care centers, hospitals, libraries, medical facilities, places of worship, public meeting rooms, public or nonprofit institutional structures, radio studios, recording studios, schools, and television studios
E	72 (exterior)	Hotels, motels, offices, restaurants/bars, and other developed lands, properties, or activities not included in A-D or F
F	--	Agricultural, airports, bus yards, emergency services, industrial, logging, maintenance facilities, manufacturing, mining, rail yards, retail facilities, shipyards, utilities (water resources, water treatment, electrical), and warehousing.
G	--	Undeveloped lands that are not permitted

A noise impact occurs when either the absolute or the relative criterion is met:

Absolute criterion - the predicted noise level at a receiver approaches, equals or exceeds the NAC. "Approach" is defined as one dB(A) below the NAC. For example: a noise impact would occur at a Category B residence if the noise level is predicted to be 66 dB(A) or above.

Relative criterion - the predicted noise level substantially exceeds the existing noise level at a receiver even though the predicted noise level does not approach, equal or exceed the NAC. "Substantially exceeds" is defined as more than 10 dB(A). For example: a noise impact would occur at a Category B residence if the existing level is 54 dB(A) and the predicted level is 65 dB(A).

When a traffic noise impact occurs, noise abatement measures must be considered. A noise abatement measure is any positive action taken to reduce the impact of traffic noise on an activity area.

The FHWA traffic noise modeling (TNM Version 2.5) software was used to calculate existing and predicted traffic noise levels that represent the land use activity areas adjacent to the proposed MoPac Intersection Improvements that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement. The model primarily considers the number, type and speed of vehicles; highway alignment and grade; cuts, fills and natural berms; surrounding terrain features; and the locations of activity areas likely to be impacted by the associated traffic noise. The existing year for this evaluation is 2013. The design year (the future year used to estimate the probable traffic volume for which a highway is designed) is 2035. The traffic data used in this analysis was developed by the Central Texas Regional Mobility Authority (Mobility Authority) and reviewed by TxDOT's Transportation Planning and Programming Division. **Table 2** shows the peak hour intersection volumes for existing and the 2035 Build Alternative.

Table 2: Peak Hour Intersection Volumes

Intersection	Existing (2013) # of vehicles entering intersection	2035 Build Alternative	
		# of vehicles entering intersection	# of vehicles passing under the intersection
Slaughter Lane and MoPac	8,664	8,979	4,500
La Crosse Avenue and MoPac	2,750	2,811	4,658

Source: CAMPO Travel Demand Model 2035; CDM Smith, 2014

1.2 AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

Existing and predicted traffic noise levels were modeled at 44 receiver locations (**Table 3** and **Figures 1a – 1d**) that represent the land use activity areas adjacent to the proposed project that might be impacted by traffic noise and potentially benefit from feasible and reasonable noise abatement.

Table 3: Noise Impacts for MoPac Intersections

Representative Receiver	Description	NAC Category	FHWA NAC dB(A)	Existing dB(A)	Predicted 2035 dB(A)	+/- Change dB(A)	Noise Impact	Equivalent Receivers Represented (#)
R1	Legacy at Western Oaks Apartments	B	67	63	63	0	No	30
R2	Legacy at Western Oaks Apartments	B	67	67	66	-1	Yes	24
R3	Legacy at Western Oaks Apartments	B	67	64	61	-3	No	36
R4	Legacy at Western Oak Apartments	B	67	67	62	-5	No	24
R5	Legacy at Western Oak Apartments	B	67	67	62	-5	No	6
R6	Parkside Village Trail - North	C	67	69	68	-1	Yes	4
R7	North by Northwest Restaurant Outdoor Seating	E	72	61	63	2	No	1
R8	Parkside Village Trail - South	C	67	66	66	0	Yes	7
R9	Circle C Ranch Metro Park	C	67	64	66	2	Yes	4
R10	Circle C Ranch Metro Park	C	67	64	67	3	Yes	6
R11	Circle C Ranch Metro Park	C	67	62	66	4	Yes	6
R12	Circle C Ranch Metro Park	C	67	63	67	4	Yes	7
R13	Circle C Ranch Metro Park	C	67	67	71	4	Yes	3
R14	Residence in Circle C on the Park	B	67	61	66	5	Yes	1
R15	Residence in Circle C on the Park	B	67	63	67	4	Yes	3
R16	Residence in Circle C on the Park	B	67	62	65	3	No	4
R17	Residence in Circle C on the Park	B	67	62	63	1	No	5
R18	Residence in Circle C on the Park	B	67	66	63	-3	No	4
R19	Deer Park at Maple Run Preserve	C	67	57	61	4	No	8

Table 3: Noise Impacts for MoPac Intersections

Representative Receiver	Description	NAC Category	FHWA NAC dB(A)	Existing dB(A)	Predicted 2035 dB(A)	+/- Change dB(A)	Noise Impact	Equivalent Receivers Represented (#)
R20	Deer Park at Maple Run Preserve	C	67	58	58	0	No	5
R21	Deer Park at Maple Run Preserve	C	67	61	62	1	No	9
R22	Deer Park at Maple Run Preserve	C	67	58	60	2	No	9
R23	Deer Park at Maple Run Preserve	C	67	64	64	0	No	5
R24	Taco Bueno Outdoor Seating	E	72	60	61	1	No	1
R25	Circle C Metro Park	C	67	61	63	2	No	9
R26	Circle C Metro Park	C	67	51	55	4	No	5
R27	Circle C Metro Park	C	67	59	63	4	No	7
R28	Circle C Metro Park	C	67	61	65	4	No	8
R29	The Veloway at Circle C Metro Park	C	67	61	65	4	No	7
R30	Residence in Circle C Wildflower Park	B	67	62	66	4	Yes	3
R31	Residence in Circle C Wildflower Park	B	67	63	67	4	Yes	4
R32	Residence in Circle C Wildflower Park	B	67	61	66	5	Yes	4
R33	Residence in Circle C Wildflower Park	B	67	62	66	4	Yes	4
R34	Residence in Circle C Wildflower Park	B	67	62	64	2	No	4
R35	Residence in Circle C Wildflower Park	B	67	61	63	2	No	4
R36	Residence in Circle C Wildflower Park	B	67	60	62	2	No	2
R37	Lady Bird Johnson Wildflower Center	C	67	58	56	-2	No	13
R38	Lady Bird Johnson Wildflower Center	C	67	52	58	6	No	12
R39	Lady Bird Johnson Wildflower Center	C	67	58	64	6	No	6
R40	Lady Bird Johnson Wildflower Center	C	67	54	59	5	No	8
R41	Lady Bird Johnson Wildflower Center	C	67	51	58	7	No	8
R42	Lady Bird Johnson Wildflower Center	C	67	65	69	4	Yes	6
R43	Lady Bird Johnson Wildflower Center	C	67	63	67	4	Yes	6
R44	Lady Bird Johnson Wildflower Center	C	67	61	66	5	Yes	9



Figure 1a: Representative Receiver and Evaluated Noise Barrier Locations

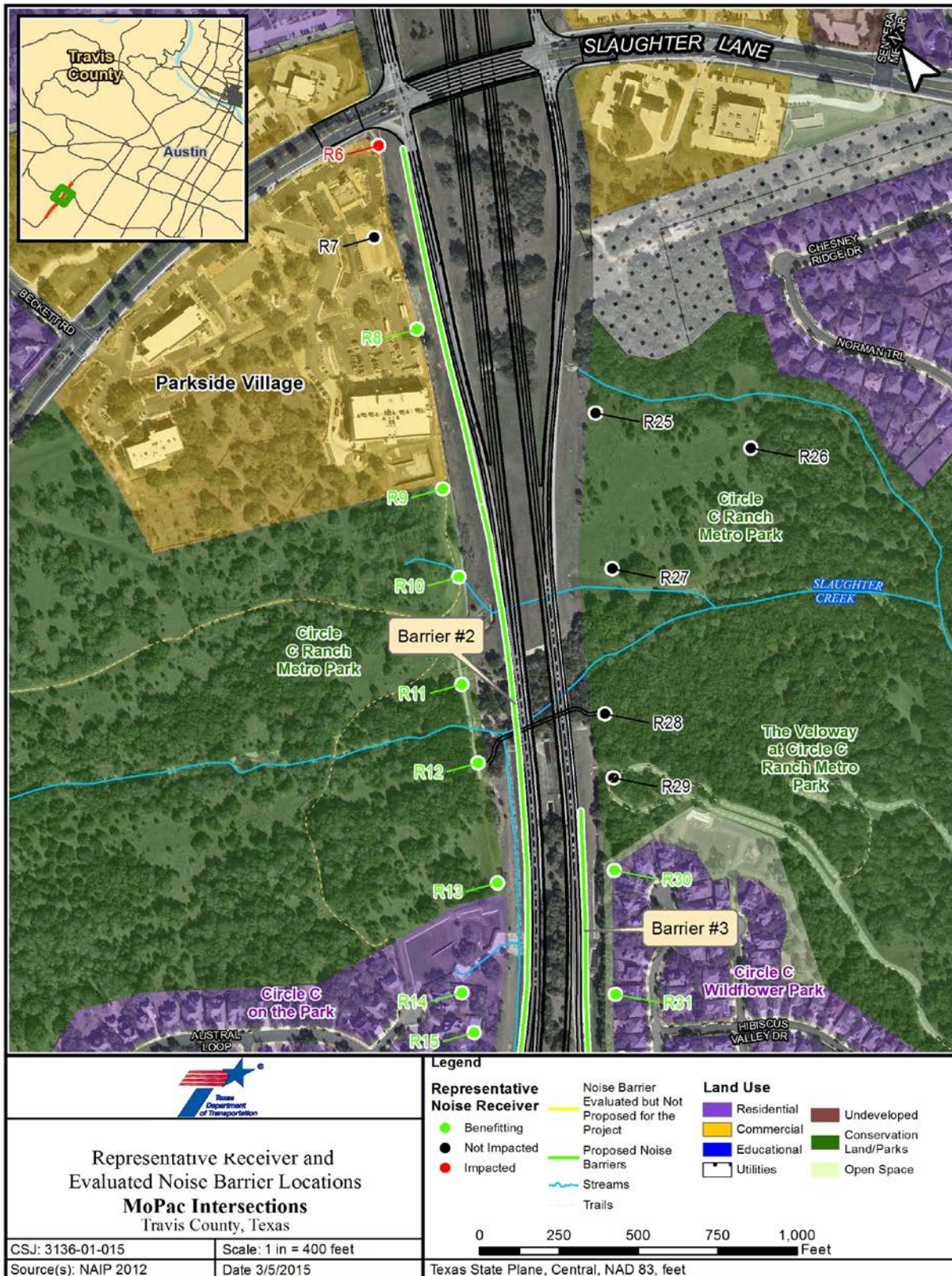


Figure 1b: Representative Receiver and Evaluated Noise Barrier Locations

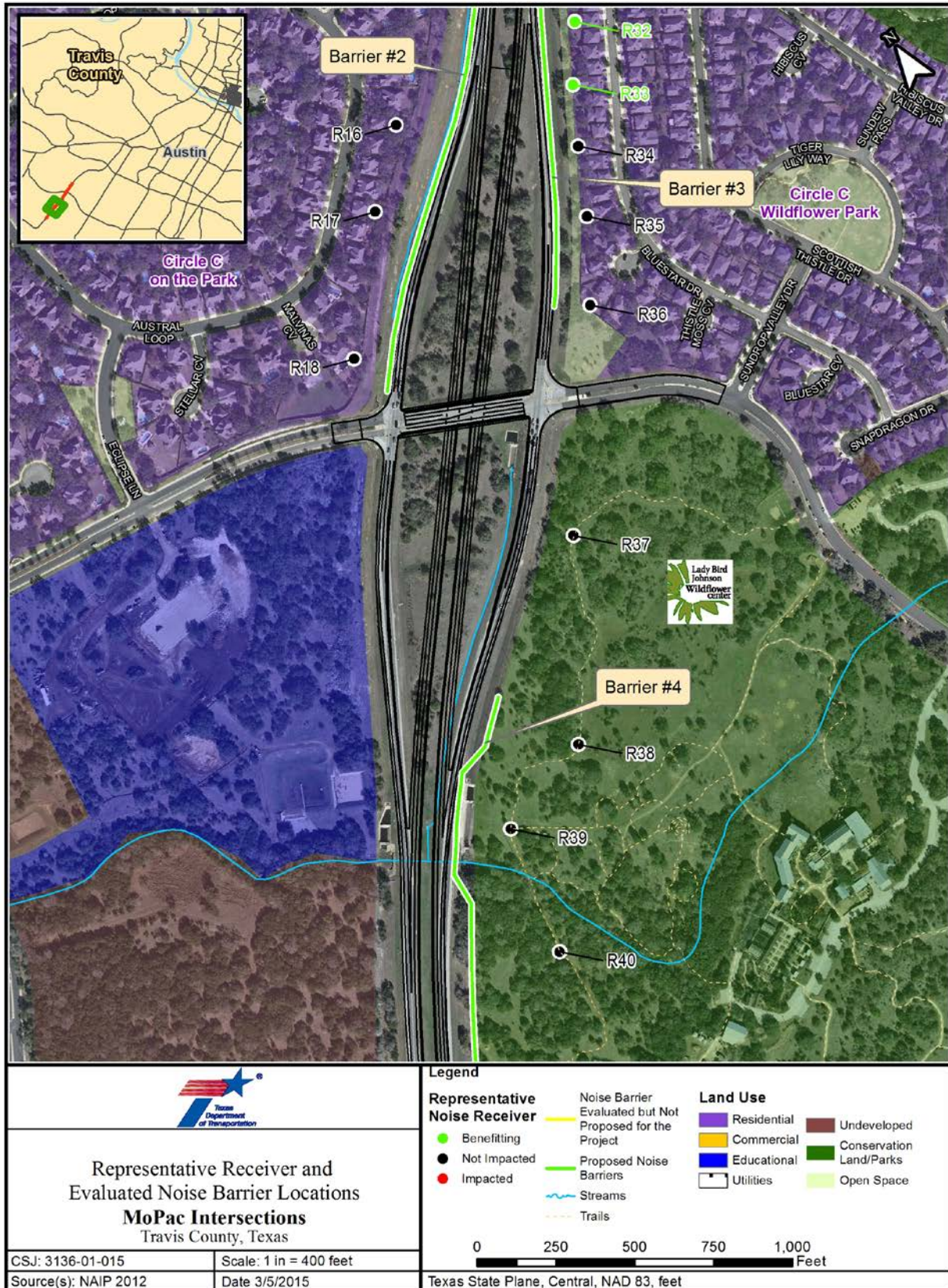


Figure 1c: Representative Receiver and Evaluated Noise Barrier Locations

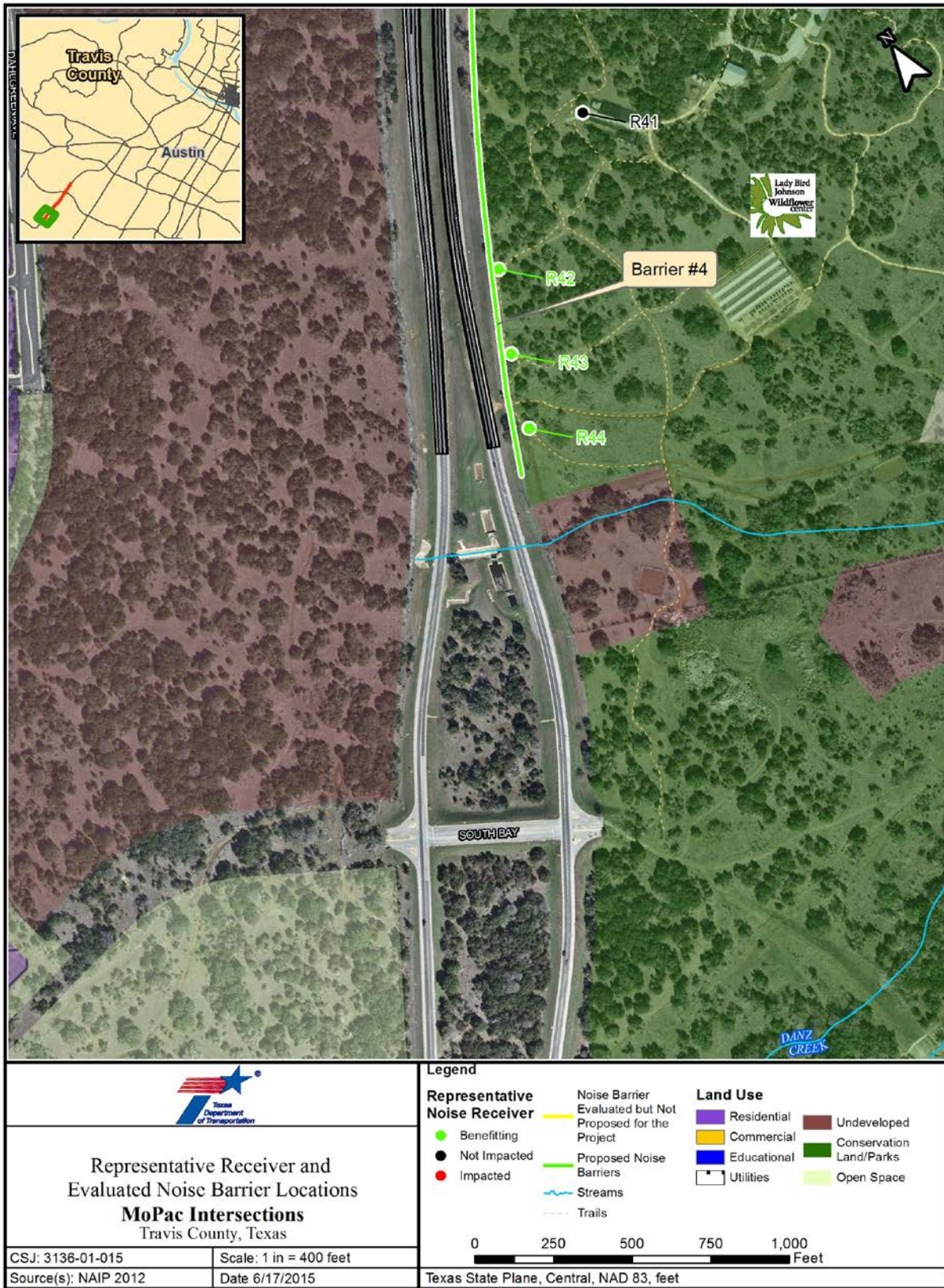


Figure 1d: Representative Receiver and Evaluated Noise Barrier Locations

As indicated in **Table 3**, the proposed project would result in a traffic noise impact at 17 of the 44 representative receivers and the following noise abatement measures were considered:

- ▶ traffic management,
- ▶ alteration of horizontal and/or vertical alignments,
- ▶ acquisition of undeveloped property to act as a buffer zone and
- ▶ the construction of noise barriers.

Before any abatement measure can be proposed for incorporation into the project, it must be both feasible and reasonable. In order to be "feasible," the abatement measure must be able to reduce the noise level at greater than 50% of impacted, first row receivers by at least five dB(A); and to be "reasonable", it must not exceed the cost-effectiveness criterion of \$25,000 for each receiver that would benefit by a reduction of at least five dB(A) and the abatement measure must be able to reduce the noise level at least one impacted, first row receiver by at least seven dB(A).

Traffic management - Control devices could be used to reduce the speed of the traffic; however, the minor benefit of one dB(A) per five mph reduction in speed does not outweigh the associated increase in congestion and air pollution. Other measures such as time or use restrictions for certain vehicles are prohibited on state highways.

Alteration of horizontal and/or vertical alignments - Any alteration of the existing alignment would displace existing businesses and residences, require additional right of way and not be cost effective/reasonable.

Buffer zone - the acquisition of undeveloped property to act as a buffer zone is designed to avoid rather than abate traffic noise impacts and, therefore, is not feasible.

Noise barriers - This is the most commonly used noise abatement measure. Noise barriers were evaluated for each of the impacted receiver locations.

In order to assess the cost effectiveness of impacted Category C (parks/preserves) land activity areas (R6, R8-R13, and R42-R44 in **Table 2**), procedures outline in the TxDOT *Guidelines for Analysis and Abatement of Roadway Traffic Noise* (TxDOT, 2011) were followed. A land area calculation was used to determine the equivalent number of residences. This was accomplished by dividing the impacted adjacent areas in Category C by a representative single-family residential lot size development within the study area.

The following is a list of impacted receivers where noise barriers were determined to not be feasible and reasonable, therefore, are not proposed for incorporation into the proposed project.

- ▶ R2: this receiver represents 24 residences at a three-story multi-family complex called the Legacy at Western Oak Apartments. Based upon the modeling, a noise barrier (**Figure 1a** - Barrier #1) in front of the Legacy at Western Oak Apartments, 800 feet in length and 16 feet in height would reduce noise levels by at least seven dB(A) for eight benefitted receivers at R2. Of the 24 impacted first-row receivers, 33 percent (8 of 24 receivers) are benefitted. Total cost of the noise barrier would be \$230,400 or \$28,800 for each benefitted receiver. Therefore, it was determined a noise barrier in front of Legacy at Western Oak Apartments is not acoustically feasible or reasonable for the proposed project.

Noise barriers would be feasible and reasonable for the following impacted receivers and, therefore, are proposed for incorporation into the proposed project (**Table 4**).

- ▶ R6, R8-R15: these receivers represent a total of 41 receivers on the west side of MoPac. Four residential receivers are located in Circle C on the Park and 37 equivalent residences receivers for the Circle C Ranch Metro Park and the Parkside Village trail. A noise barrier 4,159 feet in length and varying in height from 10 feet on the bridge over Slaughter Creek to 14 feet, would reduce noise levels at 37 of the 41 receivers (90 percent are benefited) by five dB(A). It would achieve the seven dB(A) noise reduction design goal at 22 of the 41 receivers at a total cost of \$923,544 or \$24,961 for each benefited receiver. Therefore, it was determined that the noise barrier (**Figures 1b and 1c - Barrier #2**) near on the west side of the MoPac corridor at Circle C on the Park, the Circle C Ranch Metro Park, and the Parkside Village trail is acoustically feasible and reasonable for the proposed project.
- ▶ R30-R33: these receivers represent a total of 15 residential receivers at Circle C Wildflower Park neighborhood on the eastside of MoPac. A noise barrier 1,700 feet in length and with a height 12 feet, would reduce noise levels at all receivers (100 percent are benefited) by five dB(A). It would achieve the seven dB(A) noise reduction design goal at 8 of the 15 receivers at a total cost of \$367,200 or \$24,480 for each benefited receiver. In addition, non-impacted receivers R34 and R35 would receive a five dB(A) reduction by extending the barrier the length of the neighborhood. Therefore, it was determined that the noise barrier (**Figures 1b and 1c - Barrier #3**) near on the eastside of the MoPac corridor at Circle C Wildflower Park is acoustically feasible and reasonable for the proposed project.
- ▶ R42-R44: these receivers represent a total of 21 equivalent residential receivers for Lady Bird Johnson Wildflower Center. A noise barrier approximately 2,400 feet in length and a height of 12 feet, would reduce noise levels at all 21 receivers (100 percent are benefited) by seven dB(A) at a total cost of \$518,400 or \$24,686 for each benefited receiver. Therefore, it was determined that the noise barrier (**Figures 1c and 1d - Barrier #4**) near Lady Bird Johnson Wildflower Center is acoustically feasible and reasonable for the proposed project.

Table 4: Proposed Noise Barriers for MoPac Intersections

Barrier	Impacted Representative Receivers	Total # Benefited	Length (feet)	Height (feet)	Total Cost	\$/Benefited Receiver
Parkside Village, Circle C Ranch Metro Park, and Circle C on the Park - Westside of MoPac (Barrier #2)	R6, R8-R15	37	4,159	10-14	\$923,544	\$24,961
Circle C Wildflower Park – Eastside of MoPac (Barrier #3)	R30-R33	15	1,700	12	\$367,200	\$24,480
Lady Bird Johnson Wildflower Center (Barrier #4)	R42-R44	21	2,400	12	\$518,400	\$24,686

Any subsequent project design changes may require a reevaluation of this preliminary noise barrier proposal. The final decision to construct the proposed noise barrier will not be made until completion of the project design, utility evaluation and polling of adjacent property owners during a traffic noise workshop that would occur after the environmental finding for the project.

Traffic noise workshops will be offered to property owners adjacent to the proposed noise barriers. At the workshops, property owners adjacent to proposed noise barrier may provide input on the traffic noise abatement to be included in the final design, including whether the abatement measures are desirable (TxDOT Environmental Handbook – Traffic Noise, April 2014).

To avoid noise impacts that may result from future development of properties adjacent to the project, local officials responsible for land use control programs must ensure, to the maximum extent possible, no new activities are planned or constructed along or within the following predicted (2035) noise impact contours (**Table 4**). Two undeveloped properties adjacent to the MoPac Intersections are within the project area. One is on the west side south of La Crosse Avenue and the second is on the eastside north of Slaughter Lane.

Table 5: Noise Impact Contours for Category G (Undeveloped Land)

Land Use	Impact Corridor	Distance from ROW	
		Westside	Eastside
NAC category B&C	66 dB(A)	75 feet	66 dB(A) contour does not occur on the property
NAC category E	71 dB(A)	At the ROW Line (0 feet)	71 dB(A) contour does not occur on the property

1.3 HIGHWAY CONSTRUCTION NOISE

Noise associated with the construction of a project is difficult to predict. Heavy machinery (a major source of noise in construction) is constantly moving in unpredictable patterns. However, construction normally occurs during daylight hours when occasional loud noises are tolerable. None of the receivers are expected to be exposed to construction noise for a long duration; therefore, any extended disruption of normal activities is not expected. Provisions will be included in the plans and specifications that require the contractor to make every reasonable effort to minimize construction noise through abatement measures such as work-hour controls and proper maintenance of muffler systems.

1.4 CONCLUSION

A noise analysis was performed to determine predicted impacts from future traffic-generated noise levels at sites affected by the proposed project. Impacts are predicted to occur along the project corridor at 17 receivers, both individual and in groups of residential, park and the Lady Bird Johnson Wildflower Center properties.

Abatement measures were analyzed for impacted receiver locations within the project area. During this analysis of abatement measures, primary consideration was given to exterior areas where frequent human use occurs and lower noise levels would be of benefit. Noise barriers are proposed near Parkside Village, Circle C Ranch Metro Park, Circle C on the Park, Circle C Wildflower Park, and the Lady Bird Johnson Wildflower Center, for the proposed project. The final decision to construct these noise barriers will not be made until after the environmental finding, during final design, utility evaluation and polling of adjacent property owners at the traffic noise workshops.

A copy of this *Traffic Noise Technical Memorandum* will be available to local officials to ensure, to the maximum extent possible, future developments are planned, designed and programmed in a manner that would avoid traffic noise impacts. In addition, this memorandum is available at the TxDOT-Austin District and Central Texas Regional Mobility Authority offices as well as www.MoPacSouth.com. On the date of approval of the environmental finding (Date of Public Knowledge), TxDOT is no longer responsible for providing noise abatement for new development adjacent to the proposed project.

2.0 REFERENCES

- TxDOT 2011. Guidelines for Analysis and Abatement of Highway Traffic Noise. <http://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/730-02-gui.pdf> (accessed August 12, 2014).
- _____. 2014 Environmental Handbook for Traffic Noise. <http://ftp.dot.state.tx.us/pub/txdot-info/env/toolkit/730-01-gui.pdf> (accessed August 12, 2014).









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Appendix A


Preliminary Layout

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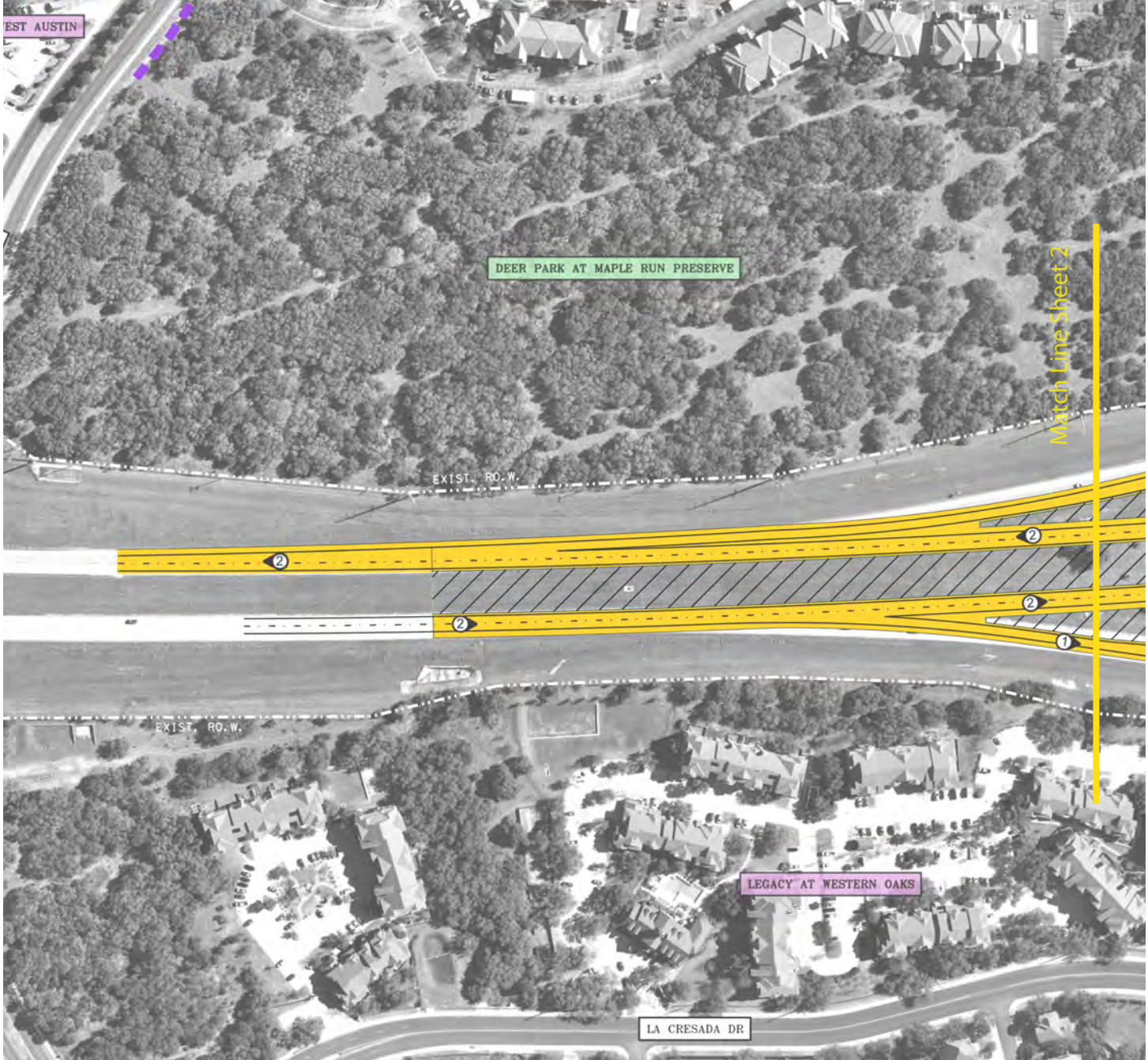
LEGEND

-  EXISTING RIGHT-OF-WAY
-  GENERAL PURPOSE LANES
-  AUXILIARY LANES
-  GENERAL PURPOSE LANES & RAMPS
-  SHARED USE PATH
-  PROPOSED VIOLET CROWN TRAIL
-  CITY OF AUSTIN TRAIL
-  PRELIMINARY NOISE BARRIER

0 50 100 200



**PRELIMINARY
SUBJECT TO CHANGE**



**MOPAC INTERSECTIONS
ENVIRONMENTAL STUDY**

CSJ: 3136-01-015
NET LENGTH OF PROJECT = 10,929 FT = 2.07 MI

TRAVIS COUNTY

LIMITS: NORTH OF SLAUGHTER LANE
TO SOUTH OF LA CROSSE AVENUE

SHEET 1 of 7

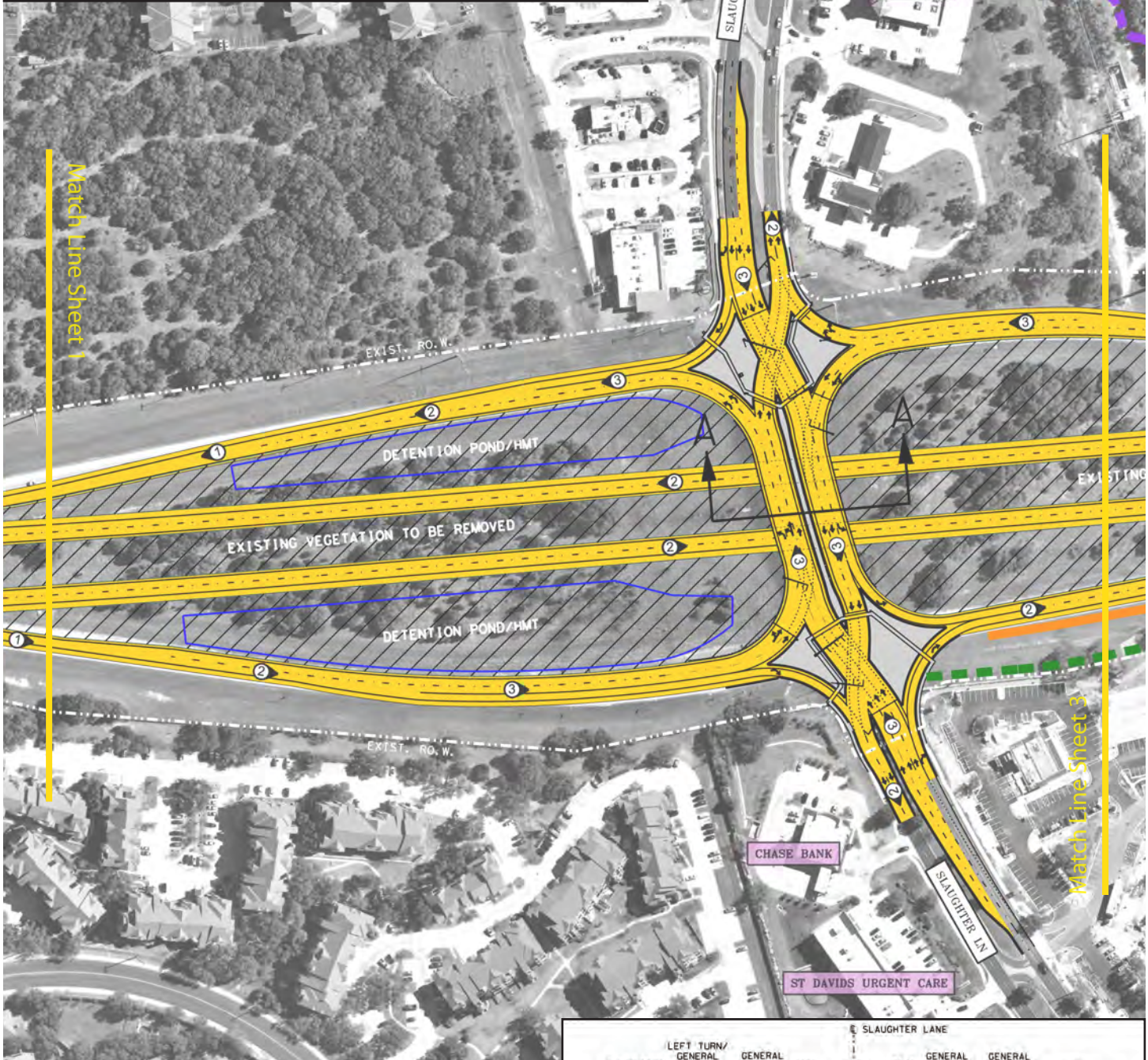


LEGEND

- EXISTING RIGHT-OF-WAY
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- AUXILIARY LANES
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- CITY OF AUSTIN TRAIL
- PRELIMINARY NOISE BARRIER

0 50 100 200

**PRELIMINARY
SUBJECT TO CHANGE**



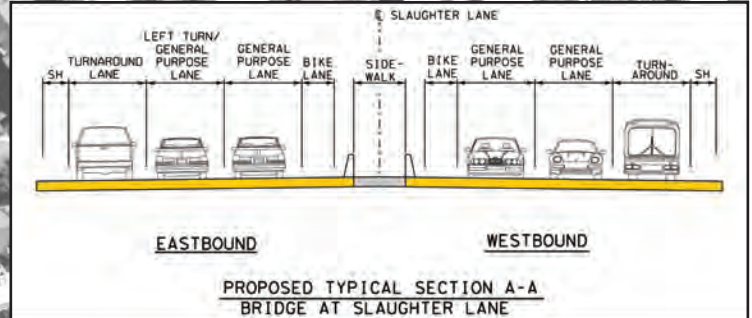
**MOPAC INTERSECTIONS
ENVIRONMENTAL STUDY**

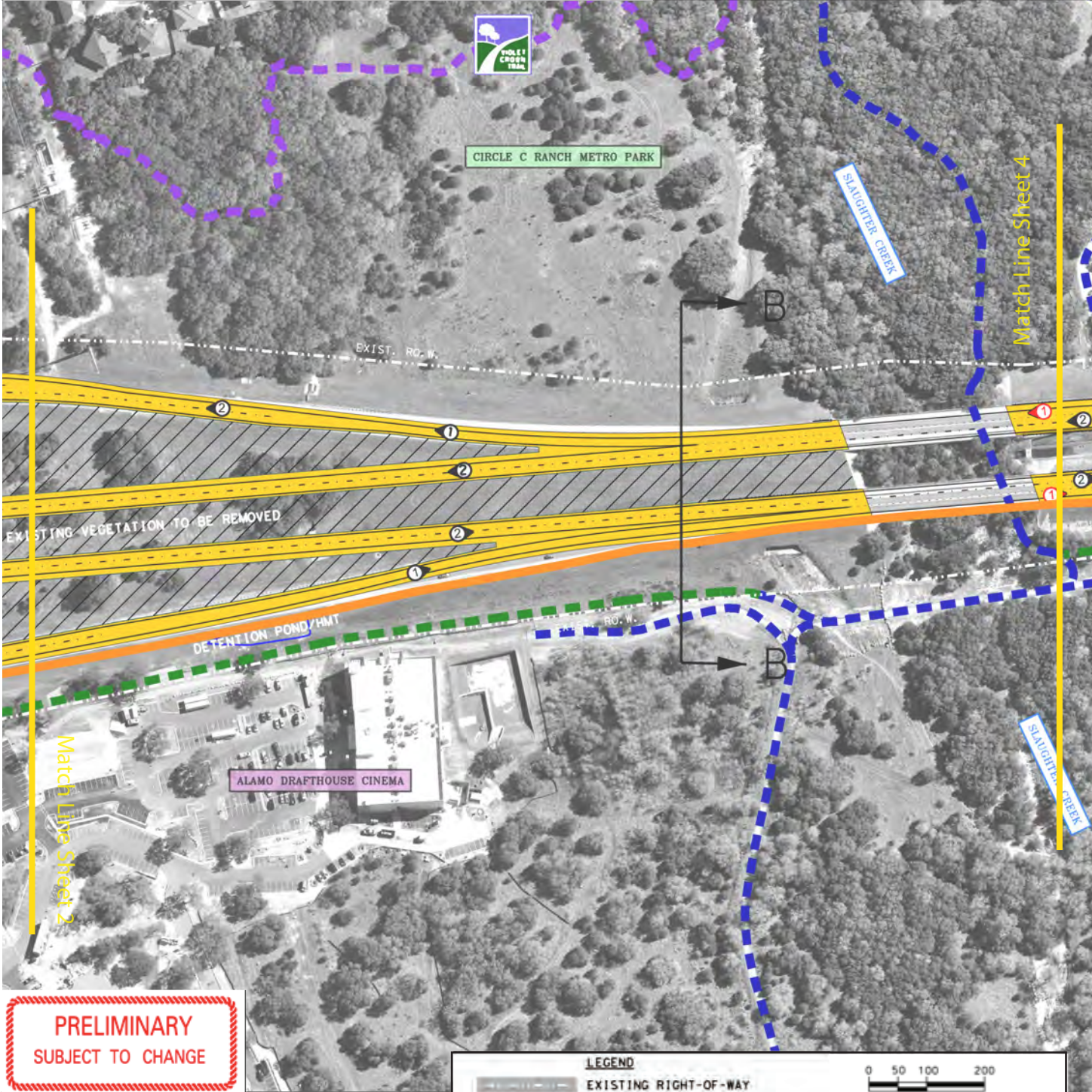
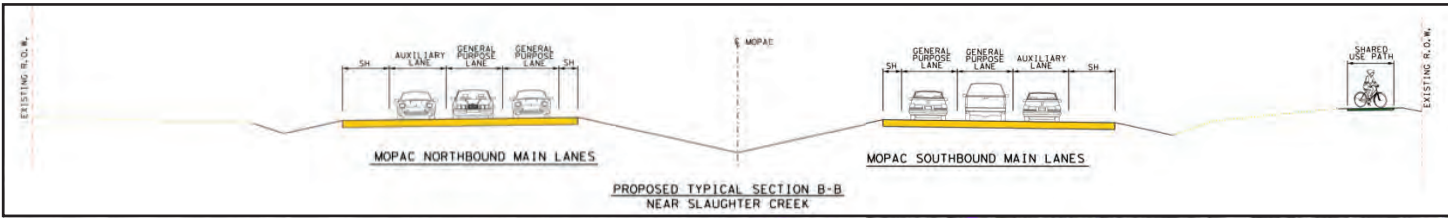
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TRAVIS COUNTY

LIMITS: NORTH OF SLAUGHTER LANE
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SHEET 2 of 7





MOPAC INTERSECTIONS ENVIRONMENTAL STUDY

CSJ: 3136-01-015
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TRAVIS COUNTY

LIMITS: NORTH OF SLAUGHTER LANE
 TO SOUTH OF LA CROSSE AVENUE


SHEET 3 of 7

LEGEND	
	EXISTING RIGHT-OF-WAY
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	GENERAL PURPOSE LANES & RAMPS
	SHARED USE PATH
	PROPOSED VIOLET CROWN TRAIL
	CITY OF AUSTIN TRAIL
	PRELIMINARY NOISE BARRIER

LEGEND

-  EXISTING RIGHT-OF-WAY
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-  GENERAL PURPOSE LANES & RAMPS
-  SHARED USE PATH
-  PROPOSED VIOLET CROWN TRAIL
-  CITY OF AUSTIN TRAIL
-  PRELIMINARY NOISE BARRIER

0 50 100 200



**PRELIMINARY
SUBJECT TO CHANGE**



THIS PROPOSED NOISE BARRIER MAY BE CONSIDERED AS THREE DIFFERENT BARRIERS (ONE FOR PARKSIDE VILLAGE, ONE FOR CIRCLE C RANCH METRO PARK, AND ONE FOR CIRCLE C ON THE PARK).

**MOPAC INTERSECTIONS
ENVIRONMENTAL STUDY**

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 TRAVIS COUNTY
 LIMITS: NORTH OF SLAUGHTER LANE
 TO SOUTH OF LA CROSSE AVENUE
 SHEET 4 of 7

LEGEND

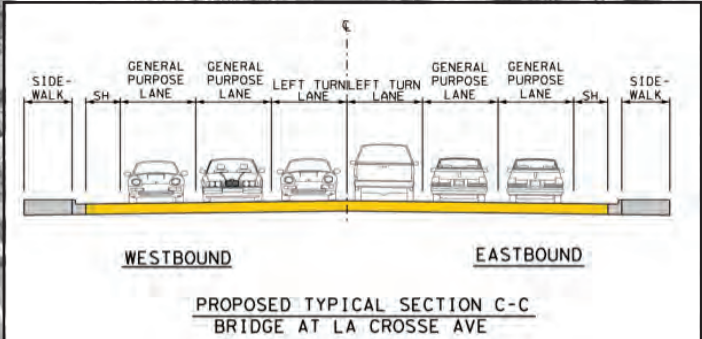
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- CITY OF AUSTIN TRAIL
- PRELIMINARY NOISE BARRIER

0 50 100 200









**PRELIMINARY
SUBJECT TO CHANGE**




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 TRAVIS COUNTY
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 SHEET 5 of 7



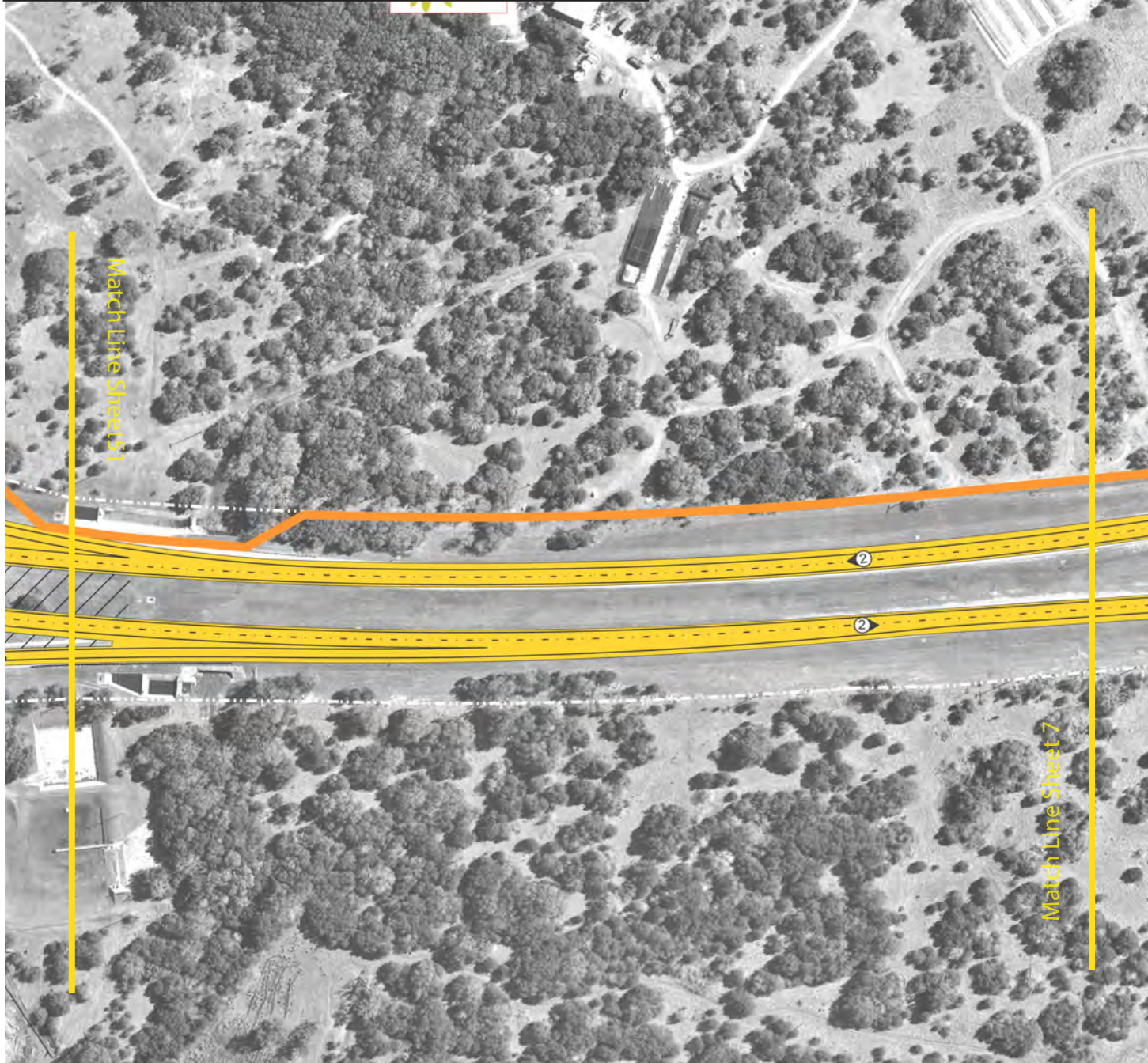
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**PRELIMINARY
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**MOPAC INTERSECTIONS
ENVIRONMENTAL STUDY**









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TRAVIS COUNTY


LIMITS: NORTH OF SLAUGHTER LANE
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SHEET 6 of 7

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