2019 STREET ASSESSMENT AND

3-YEAR MAINTENANCE PLAN

Prepared for:

The City of Kirby, Texas



Prepared by:



M&S Engineering Project Number: 7219COKIR.003

Main Office:

Mailing:

Post Office Box 970 Spring Branch, Texas 78070

Telephone: 830.228.5446 Fax: 830.885.2170

Physical: 6477 FM 311

Spring Branch, Texas 78070 *Web:* www.msengr.com

JEROD MOTT

113132

CENSE

SONALENG

07/08/2019

Prepared by: Jerod Mott., PE, CFM Craig Wilson, PE Evan Calhoun Austin Leddy Branch Office:

376 Landa Street New Braunfels, TX 78130 Telephone: 830.629.2988

Fax: 830.228.4197



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II. STREET CONDITION ASSESSMENT

Introduction

The City of Kirby authorized M&S Engineering to provide engineering support for a citywide street condition assessment and an accompanying 3-year street maintenance plan beginning in 2020 and ending in 2022. The deliverables included an assessment of all streets in the City of Kirby, rating the condition of each street, and providing tabulated results for each street and logical street segment(s). Visually apparent drainage conditions/issues were also identified as well as a recommended maintenance approach based on the street condition assessment. This report summarizes the results of the street assessment.

Data Collection Efforts

The data collection for all public streets within the City of Kirby was conducted by M&S Engineering on May 13th, 2019 using the RoadBotics RoadSense data collection app which collected roadway images at 10-foot intervals. Each image was geolocated and timestamped. The RoadBotics RoadNav application provided the driving route and turn-by-turn navigation to ensure full coverage of every street. This data was then uploaded to RoadBotics for analysis.

Street Ratings

Each of the collected images was evaluated by RoadBotics using an algorithm that assigned an objective rating from 1 to 5 for the road surface shown in each individual image. A value of 1 was assigned to roadways in very good condition. A value of 5 was assigned to the roadways showing severe deterioration of the pavement surface. The individual ratings for each 10-foot section were then averaged to provide an overall rating for logical roadway segments. Exhibit A – Street Condition Map shows the roadway segments highlighted with the color which corresponds to the average rating of that segment.

Color Rating Range Percentage of Segments Dark Green 1.0 to 1.5 (Excellent Condition) 7.9% Light Green 1.5 to 2.5 (Good Condition) 19.4% 56.1% Yellow 2.5 to 3.5 (Fair Condition) 3.5 to 4.5 (Poor Condition) 16.1% Orange 4.5 to 5 (Very Poor Condition) Red 0.6%

Table 2-1: Rating Colors and Values

RoadBotics provides their analysis in a web-based format that can be accessed securely by M&S and city staff. All data collected in this effort is available for viewing on their web portal and can be downloaded as GIS data. The following images show various ways to view the data.



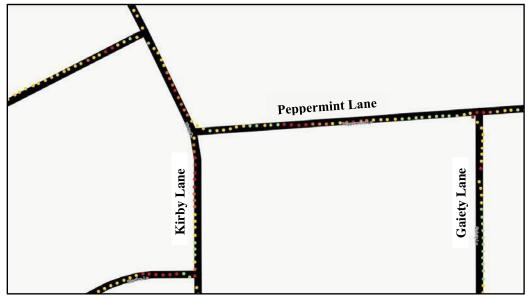


Figure 2-1

Each dot in the image above represents a single location where a photograph was taken and an evaluation was generated. Notice the high variability in condition within a short length of roadway.

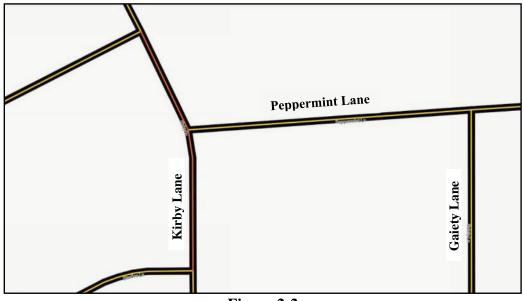


Figure 2-2

The individual segments are averaged over a logical length, usually between two intersecting streets, and an overall rating for that segment is shown as a line in a color representing the average condition.



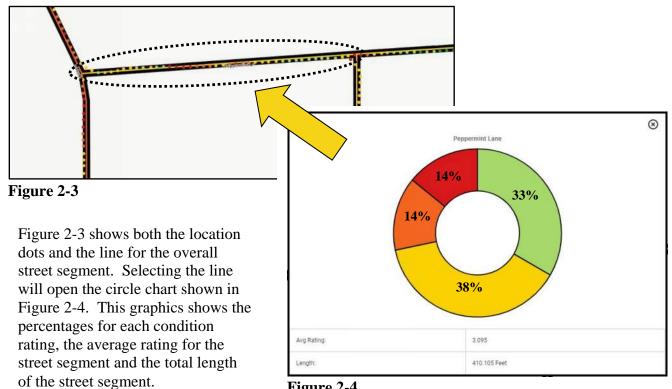


Figure 2-4

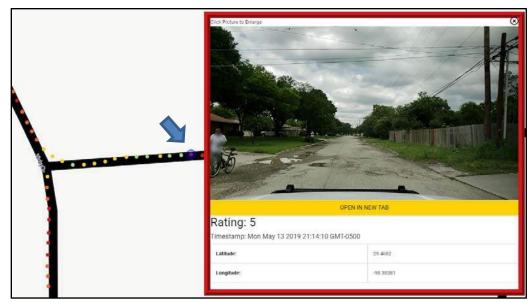


Figure 2-5

Selecting each dot location opens the dialog box outlined in red that shows the rating, location, data collection date and the associated image. The selected dot is highlighted in blue.



Typical Rating Examples



Figure 2-6: Example Street Rated 1 (Excellent Condition)



Figure 2-7: Example Street Rated 2 (Good Condition)



Typical Rating Examples



Figure 2-8: Example Street Rated 3 (Fair Condition)



Figure 2-9: Example Street Rated 4 (Poor Condition)



Typical Rating Examples



Figure 2-10: Example Street Rated 5 (Very Poor Condition)



Figure 2-11: Example of Street with Potholes



The images above demonstrate the pavement condition for each rating. Images rated as 1 (figure 2-6) had little to no defects of any kind. Those rated as 2 (figure 2-7) showed minor surface cracks with few other defects. Images that received a rating of 3 (figure 2-8) had more pronounced surface cracks with some pothole. Images with a 4 (figure 2-9) had surface cracks throughout and more significant deterioration in the form of potholes, base failures and edge damage. Images rated as 5 (figure 2-10) showed severe surface cracking, edge damage, potholing and base failures causing major ponding of stormwater.

Tabulated Results

The individual roadway segments were combined to create logical construction project lengths and sorted by rating in descending order in Exhibit G. The overall street rankings were developed for each street by calculating a weighted average of all segments along each individual street. These rankings have been provided in an alphabetical list in Exhibit H and sorted by rating in Exhibit I.

Excluded Roadways

Several roadway sections within the City are scheduled for rehabilitation or reconstruction. These sections will be in excellent condition after their scheduled reconstruction and have been excluded from evaluation in this assessment. There were also streets included in the data collection and evaluation that are not maintained by the City. These sections were removed from the assessment. Table 2-2 below lists the segments of streets that are scheduled for rehabilitation or reconstruction.

Table 2-2

Street Name	Beginning Intersection	Ending Intersection
Ackerman Road	Binz-Engleman Road	Seguin Road
Gibbs Sprawl Road	Old Seguin Road	Seguin Road
Hedwig Street	Ackerman Road	Bauman Street
Bauman Street	Hedwig Street	Old Seguin Road
Peppermint Lane	Ackerman Road	Gaiety Lane
Sparkling Lane	Ackerman Road	Gaiety Lane
Taube Road	Ackerman Road	Gaiety Lane
Binz-Engleman Road	Western City Limit	Kirby City Park Road
Hickory Hill Drive	Harris Road	Terminus



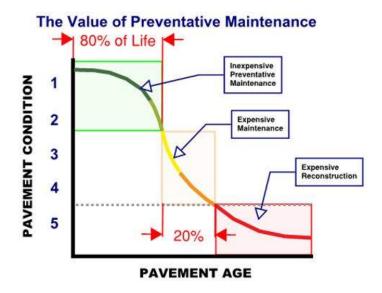
III. 3-YEAR STREET MAINTENANCE PLAN

Introduction

The data collected by M&S Engineering and analyzed by RoadBotics provides the foundational elements needed to plan roadway maintenance in the City of Kirby for the next three years. The selection of street segments to include in the 3-year maintenance plan was based on current condition (rating) of the pavement surface, location within the city, anticipated level of usage, budget, and ability to pair with other potential projects in a localized area. The Appendix includes several maps and tables describing the results of the analysis and planned improvements.

Maintenance Approach

Due to the diverse conditions of the individual roads and roadway segments within the City, it is necessary to employ a variety of techniques to achieve an effective maintenance program. Ideally, maintenance is performed on a roadway routinely to extend the useable life of the roadway. The cost of routine preventative maintenance is cheaper in the long run as it lengthens the lifespan of the road and delays expensive maintenance and the need for complete reconstruction.



The maintenance plan prepared specifically for the City attempts to balance repairing heavily damaged roads with preventative maintenance. We gave more priority to collector and arterial streets since many more residents will benefit from these improvements versus repairing local streets that will benefit fewer homeowners. Finally, the plan also attempts to group street sections together to save on construction costs. While there are several maintenance and reconstruction methods available, the proposed maintenance plan was pared down successful and widely used methods in this region of Texas.



Maintenance Options

The methods described below are generally accepted typical approaches to roadway maintenance operations throughout most of the State. The list begins with the method having the fastest construction time and least expense with each following method increasing the time and cost for construction.

Crack Seal – (\$)

Road surfaces that are still in reasonably good condition will develop minor cracks. Performing crack sealing can extend the usable lifetimes significantly. Sealing existing cracks helps to prevent them from growing larger allowing water to penetrate the pavement surface and damage the structural base material underneath.

Slurry Seal – (\$\$)

A slurry seal is a feasible option for roadway segments that are experiencing raveling, weathering and/or frictional degradation, without showing signs of base or subbase damage, full-depth cracks, deformation or severe rutting. A slurry seal is composed of an asphalt emulsion containing finely graded aggregates, filler and additives that can be spread over the existing road surface. This slurry, upon curing, will create a new wearing surface on the roadway and improve its frictional characteristics as well as sealing and bonding the existing pavement.

<u>Level Up and Overlay</u> – (\$\$\$)

Roadways that begin to experience base failures, rutting or other deformations are suitable for level up and overlay. Base failures should be removed and repaired. Surface deformities may only require a leveling course of pavement to fill in low areas. After one or both of these processes, a new layer of pavement will be installed over the prepared surface. This type of road maintenance is commonly referred to as "mill and overlay," or "level up and overlay."

Potholes are one of the most common forms of roadway deterioration. Many of the streets within the City require pothole repairs in conjunction with other maintenance techniques. Potholes can be repaired by squaring the perimeter of the patch section, removing loose material, applying a tack coat to facilitate adhesion, filling the hole with asphalt in lifts no greater than 3 inches and compacting with available equipment.

Rehabilitation - (\$\$\$)

The process of rehabilitation for pavements is performed in two parts: improving the existing structural base material and installing a driving surface that will provide adequate traction and wearing characteristics for 15-20 years of use. An existing asphalt pavement of four inches or less can be pulverized and mixed into the existing base material to increase the aggregate composition. The strength of the base material can be further improved with the addition of lime, cement or asphalt emulsion. Selection of the proper additive can be from previous experience in an area or a mix design based on geotechnical testing. Mixing the additive with the prepared base and adding water to reach the desired density and moisture content will complete the base work. To finish the pavement section, the desired driving surface course is installed, usually two inches of a surface quality asphalt.



Proposed Maintenance Plan

The streets segments selected for each year are composed of logical groupings whose maintenance costs total just over the \$400,000 annual budget amount provided by the City. The street segments selected for improvement in the 3-year plan are listed in Exhibit F along with their probable construction costs. Construction costs typically increase annually as a result of inflation. The costs of the proposed projects are adjusted for inflation at a rate of 3% per year.

The table below provides a basis for the construction costs used in the selection of street segments to include in the 3-year plan. All street segments considered were assigned an appropriate maintenance method using the factors discussed previously. Unit prices for each method are shown as linear foot (LF) or square yard (SY). The typical local street width in the City of Kirby is 30 feet. To simplify the quantity calculation, consider that one foot of pavement 30 feet wide equates to 3.33 square yards.

Table 3-1: Opinion of Probable Unit Costs

Type of	TT 24	Year		
Maintenance	Unit	2020	2021	2022
Crack Seal	LF	\$0.60 * Rating	\$0.62 * Rating	\$0.64 * Rating
Slurry Seal	SY	\$3.60	\$3.71	\$3.82
Overlay	SY	\$15.00	\$15.45	\$15.91
Rehabilitation	SY	\$24.00	\$24.72	\$25.46



IV. DRAINAGE CONDITIONS/ISSUES

In the week leading to the assessment, the City of Kirby received 0.73" to 1.5" of total rainfall aiding in street drainage assessment. During data collection, we observed approximately 60-75% of the pavement was free of standing water. The remaining portion showed limited drainage capabilities with water ponding due to rutting and depressions. Ponding was frequently observed within street intersections.

Ponding typically indicates base or subbase failure. These failures can be the result of vehicular overloading, inadequate pavement design, structural base/subgrade degradation, poor drainage, or other reasons. Ponding water can lead to significant pavement deterioration if the surface is cracked enabling water and street contaminants to infiltrate the base. Without proper maintenance or repair, the structural capacity of the pavement section will be compromised and shorten the useful life of the roadway. Curbs and sidewalks in the immediate area of roadway failures will also be impacted.

Table 4-1: Locations of Identified Drainage Issues

ID Number	Street or Intersection	Begin/Cross Street	End/Cross Street
1	Intersection	Hedwig Street	Jaenke Street
2	Intersection	Old Seguin Road	Ackerman Road
3	Lehman Drive	Harris Road	Hoeneke Drive
4	Peppermint	Vinecrest Drive	Kirby Drive
5	Peppermint Lane	Kirby Drive	Gaiety Lane
6	Hoeneke Drive	Harris Road	Pfeil Road
7	Hickory Hill Drive	Harris Road	Hoeneke Drive
8	Starfire Street	Vinecrest Drive	Daffodil Lane
9	Intersection	Starfire Street	Kirby Street
10	Intersection	Kazen Drive	Petry Drive
11	Diadem Lane	Coral Mist Street	Cinderella Street
12	Cinderella Street	Gaiety Lane	Ackerman Road
13	Intersection	Crown Lane	Crest Lane
14	Intersection	Happiness Lane	Crest Lane
15	Happiness Lane	Crest Lane	Kirby Drive
16	Aspen Wood	Buzz Aldrin Drive	Alan Shepard Drive
17	Intersection	Charles Conrad Drive	Thomas Paine Drive
18	Walt Schirra Street	Charles Conrad Drive	Terminus
19	Deer Grove Drive	Borchers Drive	Featherrock
20	Intersection	Featherrock	French Sea
21	Crest Lane	Swann Lane	Wheatland Drive
22	Foxcross Drice	Crest Lane	Shamrock Street
23	Swaann Lane	Crest Lane	Scotsman Drive
24	Borchers Drive	Scotsman Drive	Blue Jay Drive

Figure 4-1 below shows the locations of drainage issues listed in table 4-1.



Figure 4-1 – Locations of Identified Drainage Issues



APPENDIX A - MAPS AND EXHIBITS

Exhibit A	Street Condition Assessment Map
Exhibit B	Three Year Street Maintenance Plan Map
Exhibit C	Proposed Street Maintenance Plan for 2020 Map
Exhibit D	Proposed Street Maintenance Plan for 2021 Map
Exhibit E	Proposed Street Maintenance Plan for 2022 Map
Exhibit F	Proposed Maintenance Projects 2020 - 2022
Exhibit G	Alphabetical Listing of Streets and Rankings by Segment
Exhibit H	Alphabetical Listing of Streets and Rankings
Exhibit I	Listing of Streets by Rating

RoadBotics Assessment Rating

4.51 - 5.00 (Very Poor)

- 3.51 - 4.50 (Poor)

2.51 - 3.50 (Fair)

1.51 - 2.50 (Good)

■ 1.00 - 1.50 (Excellent)

→ Planned Projects



CITY OF KIRBY 2019 STREET CONDITION ASSESSMENT

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AWN	: JCM	JCM	PM:		
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EXH A					

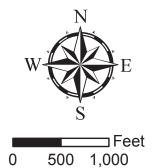
Street Maintenance

Year

2020

2021

CITY LIMITS





Maintenance Year	Estimated Cost
2020	\$421,200
2021	\$426,250
2022	\$448,500

2019 2019 THREE YEAR STREET MAINTENANCE PLAN

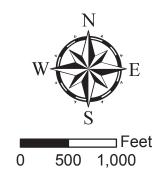
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EXH B

STREET MAINTENANCE 2020 MAINTENANCE TYPE

----- Rehabilitation

Slurry Seal
CITY LIMITS



REHABILITATION	Limits	Est Total Cost
Borchers Drive	Deer Grove Drive to Ackerman Road	\$353,000
SLURRY SEAL		
Boatman Road	Wheatland Drive to Ackerman Road	\$32,700
Blue Jay Drive	Pageland Drive to Borchers Drive	\$15,300
Buzz Aldrin Drive	Swann Lane to Binz-Engleman Road	\$20,200
	TOTAL	\$421,200

CITY OF KIRBY PROPOSED STREET MAINTENANCE FOR 2020

ENGINEERING CTRICAL I STRUCTURAL | MEP

	_				
OB: 72	19CO	KIR.003			
DATE:	JUNE	2019			
DRAWN	: JCM	JCM	PM:		
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HEET:					
EXH C					

STREET MAINTENANCE 2021 MAINTENANCE TYPE

Rehabilitation

Crack Seal

Binz-Engleman Road

Alan Shepard Drive

Foxcross Drive

Featherrock Drive

French Sea

Wheatland Drive

Theodor Drive

Telegraph Street

Scottsman Drive

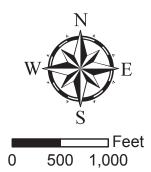
Rutledge Street Pageland Drive

Arneson Drive

Duffek Drive

Buzz Aldrin Drive

CITY LIMITS



ENGINEERING TRICKLISTER MED

Limits	Est Total Cost
Bridge to East City Limits	\$56,050
Swann Lane to Binz-Englemen Road	\$131,950
Threadway Drive to Shamrock Drive	\$107,750
Deer Grove Drive to French Sea	\$65,300
Featherrock Drive to Swann Lane	\$49,150
.0	***
Rutledge Street To Shamrock Drive	\$2,800
Sir Robert Drive to Pageland Drive	\$500
Wheatland Drive to Swann Lane	\$1,600
Arneson Drive to Swann Lane	\$800
Full Length	\$400
Theodor Drive to Ackerman Road	\$1,450
Scottsman Drive to Blue Jay Drive	\$800
Full Length	\$2,100
Binz-Englemen Road to Old Seguin Road	\$5,600
TOTAL	\$426,250

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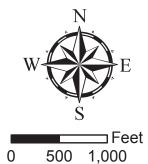
STREET MAINTENANCE 2022 MAINTENANCE TYPE

Rehabilitation

Overlay

CITY LIMITS





REHABILITATION	Limits	Est Total Cost
Fred Haise Drive	Tom Stafford Drive to Binz-Engleman Road	\$25,550
Deer Grove Drive	Featherrock Drive to Swann Lane	\$50,550
Swann Lane	Springfield Road to French Sea	\$240,400
OVERLAY		
Swann Lane	French Sea to Scottsman Drive	\$132,000
	TOTAL	\$448,500

CITY OF KIRBY PROPOSED STREET MAINTENANCE FOR 2022

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EXHIBIT F

Proposed Maintenance Projects 2020 - 2022

2020

REHABILITATION	Limits	Est Total Cost
Borchers Drive	Deer Grove Drive to Ackerman Road	\$353,000
SLURRY SEAL		
Boatman Road	Wheatland Drive to Ackerman Road	\$32,700
Blue Jay Drive	Pageland Drive to Borchers Drive	\$15,300
Buzz Aldrin Drive	Swann Lane to Binz-Engleman Road	\$20,200
	TOTAL	\$421,200

2021

REHABILITATION	Limits	Est Total Cost
Binz-Engleman Road	Bridge to East City Limits	\$56,050
Alan Shepard Drive	Swann Lane to Binz-Englemen Road	\$131,950
Foxcross Drive	Threadway Drive to Shamrock Drive	\$107,750
Featherrock Drive	Deer Grove Drive to French Sea	\$65,300
French Sea	Featherrock Drive to Swann Lane	\$49,150
CRACK SEAL		
Wheatland Drive	Rutledge Street To Shamrock Drive	\$2,800
Theodor Drive	Sir Robert Drive to Pageland Drive	\$500
Telegraph Street	Wheatland Drive to Swann Lane	\$1,600
Scottsman Drive	Arneson Drive to Swann Lane	\$800
Rutledge Street	Full Length	\$400
Pageland Drive	Theodor Drive to Ackerman Road	\$1,450
Arneson Drive	Scottsman Drive to Blue Jay Drive	\$800
Duffek Drive	Full Length	\$2,100
Buzz Aldrin Drive	Binz-Englemen Road to Old Seguin Road	\$5,600
	TOTAL	\$426,250

2022

REHABILITATION	Limits	Est Total Cost
Fred Haise Drive	Tom Stafford Drive to Binz-Engleman Road	\$25,550
Deer Grove Drive	Deer Grove Drive Featherrock Drive to Swann Lane	
Swann Lane	Swann Lane Springfield Road to French Sea	
OVERLAY		
Swann Lane	French Sea to Scottsman Drive	\$132,000
	TOTAL	\$448,500



EXHIBIT G

Alphabetical Listing of Streets and Rankings by Segment

Street	Rating	Segment Start	Segment End	Length (ft)
Ackerman Road	3.579	Seguin Road	Hedwig Street	647
Ackerman Road	3.000	Landis Drive	Terminus	2103
Ackerman Road	2.590	Duffek Drive	Landis Drive	158
Ackerman Road	1.217	Binz-Engleman Road	Duffek Drive	165
Agena Drive	2.591	Lunar Street	Surveyor Drive	221
Agena Drive	2.083	Laura Lane	Lunar Street	222
Agena Drive	2.045	Julie Drive	Laura Lane	220
Alan Bean Drive	2.574	Crest Lane	James Lovell Drive	908
Alan Bean Drive	2.025	Crest Lane	Terminus	394
Alan Shepard Drive	3.923	Blue Spruce Drive	Swann Lane	1028
Alan Shepard Drive	3.833	Dick Gordon Drive	Cinderella Street	294
Alan Shepard Drive	3.774	Neil Armstrong Drive	Michael Collins Drive	292
Alan Shepard Drive	3.355	Michael Collins Drive	Scott Carpenter Drive	293
Alan Shepard Drive	3.138	Bill Anders Drive	Blue Spruce Drive	273
Alan Shepard Drive	2.933	Cinderella Street	Neil Armstrong Drive	289
Alan Shepard Drive	2.875	Binz-Engleman Road	Bill Anders Drive	300
Alan Shepard Drive	2.727	Scott Carpenter Drive	Binz-Engleman Road	326
Arneson Drive	1.015	Scottsman Drive	Blue Jay Drive	659
Aspen Wood	3.119	Buzz Aldrin Drive	Alan Sheppard Drive	1029
Autumn Lane	3.500	Redding Drive	Cinderella Street	386
Autumn Lane	3.400	Coral Mist Street	Crown Lane	293
Autumn Lane	3.400	Cinderella Street	Coral Mist Street	301
Autumn Lane	3.355	Kazen Drive	Redding Drive	305
Autumn Lane	2.767	Petry Drive	Kazen Drive	595
Autumn Lane	2.565	Crown Lane	Kirby Drive	608
Autumn Lane	1.733	Starfire Lane	Petry Drive	300
Bauman Street	4.317	Edalyn Street	Hedwig Street	412
Bill Anders Drive	3.012	Buzz Aldrin Drive	Alan Sheppard Drive	837
Binz-Engleman Road	3.715	Ackerman Road	City Limit	1934
Binz-Engleman Road	3.330	Fred Haise Drive	Crest Lane	1017
Binz-Engleman Road	2.916	Crest Lane	James Lovell Drive	926
Binz-Engleman Road	2.689	Buzz Aldrin Drive	City Limit	148
Binz-Engleman Road	2.629	James Lovell Drive	Ackerman Road	107
Binz-Engleman Road	1.808	Charles Conrad Drive	Fred Haise Drive	975
Binz-Engleman Road	1.243	Alan Sheppard Drive	Charles Conrad Drive	367



Binz-Engleman Road	1.000	Buzz Aldrin Drive	Alan Sheppard Drive	799
Blue Jay Drive	3.172	Boatman Road	Sir Robert Drive	309
Blue Jay Drive	3.097	Borchers Drive	Arneson Drive	306
Blue Jay Drive	3.065	Arneson Drive	Boatman Road	312
Blue Jay Drive	2.724	Sir Robert Drive	Pageland Drive	307
Blue Jay Drive	1.545	Blue Jay Drive	Ackerman Road	383
Blue Spruce Drive	3.739	Buzz Aldrin Drive	Alan Sheppard Drive	925
Blue Spruce Drive	2.553	Corian Glen Drive	Buzz Aldrin Drive	385
Boatman Road	3.500	Wheatland Drive	Terminus	141
Boatman Road	3.312	Wheatland Drive	Shamrock Drive	487
Boatman Road	3.274	Shamrock Drive	Blue Jay Drive	931
Boatman Road	2.974	Blue Jay Drive	Ackerman Road	386
Borchers Drive	4.494	Deer Grove Drive	French Sea	784
Borchers Drive	3.807	Telegraph Street	Scottsman Drive	2195
Borchers Drive	3.303	French Sea	Telegraph Street	305
Borchers Drive	3.280	Scottsman Drive	Blue Jay Drive	740
Borchers Drive	3.026	Blue Jay Drive	Ackerman Road	387
Buzz Aldrin Drive	3.296	Corian Oak Drive	Swann Lane	261
Buzz Aldrin Drive	3.261	Explorer Street	Dick Gordon Drive	222
Buzz Aldrin Drive	3.161	Binz-Engleman Road	Bill Anders Drive	299
Buzz Aldrin Drive	3.029	Bill Anders Drive	Blue Spruce Drive	321
Buzz Aldrin Drive	2.967	Dick Gordon Drive	Cinderella Street	288
Buzz Aldrin Drive	2.926	Aspen Wood	Cobb Valley	253
Buzz Aldrin Drive	2.821	Cobb Valley	Corian Oak Drive	266
Buzz Aldrin Drive	2.533	Blue Spruce Drive	Aspen Wood	285
Buzz Aldrin Drive	2.419	Scott Carpenter Drive	Binz-Engleman Road	338
Buzz Aldrin Drive	2.097	Neil Armstrong Drive	Michael Collins Drive	292
Buzz Aldrin Drive	1.871	Cinderella Street	Neil Armstrong Drive	295
Buzz Aldrin Drive	1.871	Michael Collins Drive	Scott Carpenter Drive	294
Buzz Aldrin Drive	1.667	Old Seguin Road	Explorer Street	255
Celestial Drive	2.000	Laura Lane	Entrance	131
Celestial Drive	2.000	Julie Drive	Laura Lane	224
Celestial Drive	1.650	Lunar Street	Surveyor Drive	225
Charles Conrad Drive	2.192	Ed White Street	Frank Borman Drive	288
Charles Conrad Drive	2.034	Frank Borman Drive	John Young Drive	291
Charles Conrad Drive	2.033	Old Seguin Road	Gene Cernan Road	598
Charles Conrad Drive	2.000	Gene Cernan Drive	David Scott Drive	282
Charles Conrad Drive	2.000	Cinderella Street	Ed White Street	293
Charles Conrad Drive	2.000	David Scott Drive	Cinderella Street	293



Charles Conrad Drive 2.000 Thomas Paine Drive Gordon Cooper Drive Charles Conrad Drive 1.812 John Young Drive Binz-Engleman Road Charles Conrad Drive 1.793 Binz-Engleman Road Tom Stafford Drive Cinderella Street 2.846 Vinccrest Drive Kirby Drive Cinderella Street 2.793 Diadem Lane Autumn Lane Cinderella Street 2.244 Kirby Drive Gaeity Lane Cinderella Street 2.113 Gaeity Lane Ackerman Road Cinderella Street 2.104 Charles Conrad Drive Diadem Lane Cinderella Street 2.000 Alan Sheppard Drive Charles Conrad Drive Cinderella Street 2.000 Buzz Aldrin Drive Alan Sheppard Drive Cobb Valley 3.130 Buzz Aldrin Drive Alan Sheppard Drive Coral Mist Street 3.129 Diadem Lane Autumn Lane Corian Glen Drive 3.378 Blue Spruce Drive Terminus Corian Glen Drive 3.082 Buzz Aldrin Drive Alan Sheppard Drive Corian Glen Drive 2.524 Blue Spruce Drive Swann Lane Corian Oak Drive 3.082 Buzz Aldrin Drive Alan Sheppard Drive Crest Lane 2.969 Crown Lane Happiness Lane Crest Lane 2.947 Foxcross Drive Wheatland Drive Crest Lane 2.954 Alan Bean Drive Gordon Cooper Drive Swann Lane Crest Lane 2.694 Happiness lane Binz-Engleman Road Crest Lane 2.634 Alan Bean Drive Gordon Cooper Drive Crest Lane 2.533 Binz-Engleman Road Tom Stafford Drive Crest Lane Crest Lane 2.533 Binz-Engleman Road Tom Stafford Drive Crest Lane Crest Lane 2.533 Binz-Engleman Road Tom Stafford Drive Crest Lane	303 301 325 296 401 1494 405 520 959 366 654 1060 1562
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Crown Lane 3.367 Diadem Lane Crest Lane	403
	280
	989
Crown Lane 3.260 Crest Lane Autumn Lane	773
Daffodil Lane 2.788 Starburst Circle Kirby Drive	328
Daffodil Lane 2.158 Starfire Lane Starburst Circle	577
David Scott Drive 2.953 Charles Conrad Drive Terminus	635
Deer Grove Drive 3.581 Swann Lane Featherrock Drive	596
Diadem Lane 3.375 Coral Mist Street Crown Lane	308
Diadem Lane 3.094 Cinderella Street Coral Mist Street	307
Diadem Lane 3.090 Old Seguin Road Starfire Lane	651
Diadem Lane 3.049 Starfire Lane Kazen Drive	393
Diadem Lane 2.667 Crown Lane Happiness Lane	305
Diadem Lane 2.375 Kazen Drive Redding Drive	303
Diadem Lane 2.312 Redding Drive Cinderella Street	



Dick Gordon Drive	3.662	Buzz Aldrin Drive	Alan Sheppard Drive	638
Duffek Drive	1.989	Ackerman Road	Terminus	855
Eclipse Lane	2.537	Vinecrest Drive	Kirby Drive	525
Ed White Street	3.612	Charles Conrad Drive	Terminus	656
Edalyn Street	3.598	Jaenke Street	Terminus	1202
Edalyn Street	3.203	Jaenke Street	Terminus	621
Edalyn Street	2.141	Otto	Terminus	712
Edalyn Street	2.089	Otto	Old Seguin Road	433
Explorer Street	3.035	Buzz Aldrin Drive	Telstar Drive	545
Featherrock Drive	3.545	Deer Grove Drive	French Sea	792
Foxcross Drive	3.823	Threadway Drive	Shamrock Drive	1307
Frank Borman Drive	2.956	Charles Conrad Drive	Terminus	675
Fred Haise Drive	3.562	Binz-Engleman Road	Tom Stafford Drive	301
Fred Haise Drive	3.000	Tom Stafford Drive	Gordon Cooper Drive	14
French Sea	3.695	Swann Lane	Featherrock Drive	596
Gaiety Lane	3.417	Peppermint Lane	Sparkling Lane	1054
Gaiety Lane	3.073	Sparkling Lane	Cinderella Street	1058
Gaiety Lane	2.906	Cinderella Street	Terminus	510
Gene Cernan Drive	2.721	Charles Conrad Drive	Terminus	683
Gordon Cooper Drive	3.031	Crest Lane	James Lovell Drive	958
Gordon Cooper Drive	3.000	Rod Schaffe Road	Fred Haise Drive	333
Gordon Cooper Drive	2.970	Fred Haise Drive	Von Braun Drive	317
Gordon Cooper Drive	2.926	Charles Conrad Drive	Rod Schaffe Drive	692
Gordon Cooper Drive	2.697	Von Braun Drive	James Webb Drive	315
Gordon Cooper Drive	2.027	James Webb Drive	Crest Lane	357
Happiness Lane	3.190	Diadem Lane	Crest Lane	990
Happiness Lane	3.188	Crest Lane	Kirby Drive	1316
Harris Drive	2.810	Harris Road	Lehman Drive	208
Harris Road	3.432	Ackerman Road	Hickory Hill Drive	550
Hauck Drive	3.280	Starfire Lane	Kazen Drive	501
Hoeneke Drive	4.348	Seguin Road	Old Seguin Road	691
Hoeneke Drive	3.175	Pfeil	Harris Road	620
Hoeneke Drive	3.123	Hickory Hill Drive	Pfeil	636
Hoeneke Drive	2.632	Old Seguin Road	Lehman Drive	749
Hoeneke Drive	1.958	Hickory Hill Drive	Lehman Drive	224
Jaenke Street	3.341	Edalyn Street	Old Seguin Road	786
Jaenke Street	2.565	Seguin Road	Edalyn Street	242
James Lovell Drive	3.897	Tom Stafford Drive	Alan Bean Drive	277
James Lovell Drive	3.143	Alan Bean Drive	Gordon Cooper Drive	272



James Lovell Drive	3.086	Binz-Engleman Road	Tom Stafford Drive	330
James Webb Drive	2.889	Gordon Cooper Drive	Terminus	164
John Young Drive	2.943	Charles Conrad Drive	Terminus	680
Julie Drive	2.387	Celestial Drive	Agena Drive	1550
Kazen Circle	3.462	Kazen Drive	Terminus	122
Kazen Drive	3.875	Diadem Lane	Petry Drive	302
Kazen Drive	2.564	Petry Drive	Kazen Circle	376
Kazen Drive	2.447	Kazen Circle	Autumn Lane	370
Kirby City Park Road	3.147	Binz-Engleman Road	Terminus	1891
Kirby Drive	3.678	Daffodil Lane	Eclipse Lane	611
Kirby Drive	3.652	Peppermint	Starfire Lane	360
Kirby Drive	3.391	Cinderella Street	Vinecrest Drive	469
Kirby Drive	2.821	Starfire Lane	Daffodil Lane	655
Kirby Drive	2.645	Old Seguin Road	Peppermint	315
Kirby Drive	2.323	Autumn Lane	Happiness Lane	302
Kirby Drive	2.311	Eclipse Lane	Cinderella Street	618
Kirby Drive	2.047	Vinecrest Drive	Autumn Lane	214
Landis Drive	3.344	Ackerman Road	Terminus	634
Laura Lane	3.119	Clelestial Drive	Agena Drive	1573
Lehman Drive	2.933	Hoeneke Drive	Harris Drive	1183
Lunar Street	2.851	Celestial Drive	Agena Drive	1595
Mac Rae Lane	4.288	Seguin Road	Old Seguin Road	568
Michael Collins Drive	3.400	Buzz Aldrin Drive	Alan Sheppard Drive	713
Neil Armstrong Drive	3.424	Buzz Aldrin Drive	Alan Sheppard Drive	677
None	3.375	Wexford Drive	Terminus	451
None	3.000	Seguin Road	Terminus	111
None	2.154	Springfield Road	Celestial Drive	146
Old Seguin Road	3.937	Bauman Street	Ackerman Road	165
Old Seguin Road	3.427	Charles Conrad Drive	Edalyn Street	1533
Old Seguin Road	3.203	Seguin Road	Charles Conrad Drive	766
Old Seguin Road	2.963	Seguin Road	Buzz Aldrin Road	269
Old Seguin Road	2.851	Summer Fest Road	City Limit	605
Old Seguin Road	2.727	Ackerman Road	Hoeneke Drive	1078
Old Seguin Road	2.526	Edalyn Street	Vinecrest Drive	938
Old Seguin Road	2.151	Hoeneke Drive	Summer Fest Drive	1177
Old Seguin Road	1.648	Jaenke Street	Bauman Street	697
Old Seguin Road	1.586	Vinecrest Drive	Kirby Drive	1252
Old Seguin Road	1.417	Kirby Drive	Jaenke Street	462
Otto	2.071	Seguin Road	Edalyn Street	144



Pageland Drive	1.093	Theodor Drive	Blue Jay Drive	526
Peppermint	2.875	Vinecrest Drive	Kirby Drive	1257
Peppermint Lane	3.095	Kirby Drive	Gaeity Lane	410
Petry Drive	3.062	Autumn Lane	Kazen Drive	324
Pfeil	3.419	Ackerman Road	Hoeneke Drive	298
Redding Drive	3.434	Diadem Lane	Autumn Lane	1423
Redding Drive	2.250	Vinecrest Drive	Terminus	146
Redding Drive	1.558	Autumn Lane	Vinecrest Drive	441
Rod Schaffe Drive	3.127	Gordon Cooper Drive	Terminus	617
Roseville Street	3.071	Wheatland Drive	Terminus	139
Rutledge Street	1.375	Wheatland Drive	Terminus	233
Scott Carpenter Drive	2.539	Buzz Aldrin Drive	Alan Sheppard Drive	752
Scottsman Drive	1.167	Swann Lane	Borchers Drive	287
Scottsman Drive	1.000	Borchers Drive	Arneson Drive	286
Seguin Road	3.000	Summer Fest Drive	City Limit	363
Seguin Road	3.000	Mac Rae Lane	Otto	171
Seguin Road	3.000	Old Seguin Road	Mac Rae Lane	2138
Seguin Road	3.000	Hoeneke Drive	Summer Fest Drive	1157
Seguin Road	2.892	Ackerman Road	Hoeneke Drive	717
Seguin Road	2.833	COSA	COSA	47
Seguin Road	2.779	Jaenke Street	Ackerman Road	1589
Seguin Road	2.151	Kirby Middle School	Jaenke Street	914
Seguin Road	2.113	Otto	Kirby Middle School	1594
Shamrock Drive	3.483	Foxcross Drive	Boatman Road	283
Shamrock Drive	3.128	Boatman Road	Wheatland Drive	475
Sir Robert Drive	4.058	Theodor Drive	Blue Jay Drive	508
Starburst Circle	2.000	Daffodil Lane	Terminus	155
Starfire Lane	3.419	Diadem Lane	Hauck Drive	294
Starfire Lane	3.017	Autumn Lane	Hauck Drive	588
Starfire Lane	2.767	Daffodil lane	Kirby Drive	835
Starfire Lane	2.417	Vinecrest Drive	Daffodil Lane	343
Starfire Lane	1.729	Autumn Lane	Vinecrest Drive	129
Summer Fest Drive	2.690	Seguin Road	Summer Fest Drive (South)	282
Summer Fest Drive	2.545	Fork	Old Seguin Road	104
Summer Fest Drive (South)	3.536	Seguin Road	Summer Fest Drive (North)	279
Surveyor Drive	3.630	Celestial Drive	Agena Drive	1617
Swann Lane	3.793	Springfield Road	French Sea	2743
Swann Lane	3.312	Telegraph Street	Crest Lane	1069
Swann Lane	3.067	Crest Lane	Scottsman Drive	1028
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Swann Lane	2.812	French Sea	Telegraph Street	310
Swann Lane	2.667	Scottsman Drive	Terminus	169
Telegraph Street	1.796	Borchers Drive	Wheatland Drive	487
Telegraph Street	1.303	Swan Lane	Borchers Drive	317
Telstar Drive	2.692	North Terminus	South Terminus	110
Theodor Drive	1.303	Sir Robert Drive	Pageland Drive	314
Thomas Paine Drive	4.081	Charles Conrad Drive	Terminus	362
Threadway Drive	2.786	Foxcross Drive	Wheatland Drive	279
Tom Stafford Drive	3.168	Charles Conrad Drive	Crest Lane	1985
Tom Stafford Drive	3.055	Crest Lane	James Lovell Drive	911
Velvet Lane	2.698	Vinecrest Drive	Kirby Drive	625
Vinecrest Circle	1.950	Vinecrest Drive	Terminus	190
Vinecrest Drive	2.789	Cinderella Street	Kirby Drive	692
Vinecrest Drive	2.588	Redding Drive	Cinderella Street	320
Vinecrest Drive	1.935	Peppermint	Starfire Lane	298
Vinecrest Drive	1.455	Old Seguin Road	Vinecrest Circle	315
Vinecrest Drive	1.455	Eclipse Lane	Redding Lane	314
Vinecrest Drive	1.370	Starfire Lane	Velvet Lane	707
Vinecrest Drive	1.034	Velvet Lane	Eclipse Lane	279
Von Braun Drive	3.226	Gordon Cooper Drive	Terminus	505
Walt Schirra Street	3.550	Charles Conrad Drive	Terminus	383
Wexford Drive	3.350	Ackerman Road	Terminus	617
Wheatland Drive	3.320	Telegraph Street	Rutledge Street	306
Wheatland Drive	1.846	Crest Lane	Roseville Street	275
Wheatland Drive	1.357	Roseville Street	Boatman Road	147
Wheatland Drive	1.341	Boatman Road	Shamrock Drive	425
Wheatland Drive	1.226	Rutledge Street	Threadway Drive	315
Wheatland Drive	1.000	Threadway Drive	Crest Lane	581



EXHIBIT H

Alphabetical Listing of Streets

Street Name	Rank	Weighted Average Rating
Ackerman Road	58	2.93
Agena Drive	88	2.24
Alan Bean Drive	84	2.41
Alan Shepard Drive	21	3.43
Arneson Drive	102	1.02
Aspen Wood	47	3.12
Autumn Lane	60	2.91
Bauman Street	11	3.65
Bill Anders Drive	51	3.01
Binz-Engleman Road	76	2.69
Blue Jay Drive	77	2.67
Blue Spruce Drive	26	3.39
Boatman Road	34	3.24
Borchers Drive	8	3.74
Buzz Aldrin Drive	79	2.60
Celestial Drive	96	1.86
Charles Conrad Drive	92	1.99
Cinderella Street	87	2.37
Cobb Valley	43	3.13
Coral Mist Street	44	3.13
Corian Glen Drive	70	2.79
Corian Oak Drive	48	3.08
Crest Lane	68	2.84
Crown Lane	31	3.32
Daffodil Lane	86	2.39
David Scott Drive	53	2.95
Deer Grove Drive	14	3.58
Diadem Lane	62	2.89
Dick Gordon Drive	10	3.66
Duffek Drive	93	1.99
Eclipse Lane	81	2.54
Ed White Street	13	3.61
Edalyn Street	54	2.95
Explorer Street	49	3.04
Featherock Drive	16	3.55
Foxcross Drive	5	3.82
Frank Borman Drive	52	2.96
Fred Haise Drive	24	3.41
French Sea	9	3.70

		Weighted
Street Name	Rank	Average
		Rating
Gaiety Lane	37	3.18
Gene Cernan Drive	72	2.72
Gibbs Sprawl Road	83	2.52
Gordon Cooper Drive	67	2.85
Happiness Lane	36	3.19
Harris Drive	69	2.81
Harris Road	20	3.43
Hauck Drive	32	3.28
Hedwig Street	4	3.95
Hickory Hill Drive	17	3.50
Hoeneke Drive	65	2.86
Jaenke Street	38	3.16
James Lovell Drive	27	3.36
James Webb Drive	63	2.89
John Young Drive	55	2.94
Julie Drive	85	2.39
Kazen Circle	19	3.46
Kazen Drive	39	3.15
Kirby City Park Road	40	3.15
Kirby Drive	61	2.90
Landis Drive	30	3.34
Laura Lane	46	3.12
Lehman Drive	57	2.93
Lunar Street	66	2.85
Mac Rae Lane	1	4.29
Michael Collins Drive	25	3.40
Neil Armstrong Drive	22	3.42
Old Seguin Road	82	2.53
Otto	89	2.07
Pageland Drive	100	1.09
Peppermint	64	2.88
Peppermint Lane	59	2.93
Petry Drive	41	3.14
Pfeil	23	3.42
Redding Drive	56	2.94
Rod Schaffe Drive	45	3.13
Roseville Street	90	2.01
Scott Carpenter Drive	80	2.54
Scottsman Drive	101	1.08



		Weighted
Street Name	Rank	Average
		Rating
Seguin Road	74	2.70
Shamrock Drive	33	3.26
Sir Robert Drive	3	4.06
Sparkling Lane	6	3.79
Starburst Circle	91	2.00
Starfire Lane	78	2.65
Summer Fest Drive	50	3.02
Surveyor Drive	12	3.63
Swann Lane	18	3.46
Taube Road	7	3.77
Telegraph Street	97	1.60
Telstar Drive	75	2.69
Theodor Drive	99	1.30
Thomas Paine Drive	2	4.08
Threadway Drive	71	2.79
Tom Stafford Drive	42	3.13
Unnamed Sections	28	3.36
Velvet Lane	73	2.70
Vinecrest Circle	94	1.95
Vinecrest Drive	95	1.88
Von Braun Drive	35	3.23
Walt Schirra Street	15	3.55
Wexford Drive	29	3.35
Wheatland Drive	98	1.59



EXHIBIT I

Listing of Streets by Rating (Worst-5 to Best-1)

		Weighted
		Average
Rank	Street Name	Rating
1	Mac Rae Lane	4.29
2	Thomas Paine Drive	4.08
3	Sir Robert Drive	4.06
4	Hedwig Street	3.95
5	Foxcross Drive	3.82
6	Sparkling Lane	3.79
7	Taube Road	3.77
8	Borchers Drive	3.74
9	French Sea	3.70
10	Dick Gordon Drive	3.66
11	Bauman Street	3.65
12	Surveyor Drive	3.63
13	Ed White Street	3.61
14	Deer Grove Drive	3.58
15	Walt Schirra Street	3.55
16	Featherock Drive	3.55
17	Hickory Hill Drive	3.50
18	Swann Lane	3.46
19	Kazen Circle	3.46
20	Harris Road	3.43
21	Alan Shepard Drive	3.43
22	Neil Armstrong Drive	3.42
23	Pfeil	3.42
24	Fred Haise Drive	3.41
25	Michael Collins Drive	3.40
26	Blue Spruce Drive	3.39
27	James Lovell Drive	3.36
28	Unnamed Sections	3.36
29	Wexford Drive	3.35
30	Landis Drive	3.34
31	Crown Lane	3.32
32	Hauck Drive	3.28
33	Shamrock Drive	3.26
34	Boatman Road	3.24
35	Von Braun Drive	3.23
36	Happiness Lane	3.19
37	Gaiety Lane	3.18
38	Jaenke Street	3.16
39	Kazen Drive	3.15

		Weighted
		Average
Rank	Street Name	Rating
40	Kirby City Park Road	3.15
41	Petry Drive	3.14
42	Tom Stafford Drive	3.13
43	Cobb Valley	3.13
44	Coral Mist Street	3.13
45	Rod Schaffe Drive	3.13
46	Laura Lane	3.12
47	Aspen Wood	3.12
48	Corian Oak Drive	3.08
49	Explorer Street	3.04
50	Summer Fest Drive	3.02
51	Bill Anders Drive	3.01
52	Frank Borman Drive	2.96
53	David Scott Drive	2.95
54	Edalyn Street	2.95
55	John Young Drive	2.94
56	Redding Drive	2.94
57	Lehman Drive	2.93
58	Ackerman Road	2.93
59	Peppermint Lane	2.93
60	Autumn Lane	2.91
61	Kirby Drive	2.90
62	Diadem Lane	2.89
63	James Webb Drive	2.89
64	Peppermint	2.88
65	Hoeneke Drive	2.86
66	Lunar Street	2.85
67	Gordon Cooper Drive	2.85
68	Crest Lane	2.84
69	Harris Drive	2.81
70	Corian Glen Drive	2.79
71	Threadway Drive	2.79
72	Gene Cernan Drive	2.72
73	Velvet Lane	2.70
74	Seguin Road	2.70
75	Telstar Drive	2.69
76	Binz-Engleman Road	2.69
77	Blue Jay Drive	2.67
78	Starfire Lane	2.65



	T	
		Weighted
		Average
Rank	Street Name	Rating
79	Buzz Aldrin Drive	2.60
80	Scott Carpenter Drive	2.54
81	Eclipse Lane	2.54
82	Old Seguin Road	2.53
83	Gibbs Sprawl Road	2.52
84	Alan Bean Drive	2.41
85	Julie Drive	2.39
86	Daffodil Lane	2.39
87	Cinderella Street	2.37
88	Agena Drive	2.24
89	Otto	2.07
90	Roseville Street	2.01
91	Starburst Circle	2.00
92	Charles Conrad Drive	1.99
93	Duffek Drive	1.99
94	Vinecrest Circle	1.95
95	Vinecrest Drive	1.88
96	Celestial Drive	1.86
97	Telegraph Street	1.60
98	Wheatland Drive	1.59
99	Theodor Drive	1.30
100	Pageland Drive	1.09
101	Scottsman Drive	1.08
102	Arneson Drive	1.02