CITY OF NEW BRAUNFELS, TEXAS
CITY COUNCIL MEETING

CITY HALL - COUNCIL CHAMBERS
550 LANDA STREET

MONDAY, AUGUST 23, 2021 at 6:00 PM

Rusty Brockman, Mayor
Shane Hines, Councilmember (District 1)
Justin Meadows, Mayor Pro Tem (District 2)
Harry Bowers, Councilmember (District 3)
Lawrence Spradley, Councilmember (District 4)
Jason E. Hurta, Councilmember (District 5)
James Blakey, Councilmember (District 6)
Robert Camareno, City Manager

Please click the link below to join the webinar:
https://us02web.zoom.us/j/89332004990 or call
(833) 926-2300 Webinar ID: 893 3200 4990

MISSION STATEMENT
The City of New Braunfels will add value to our community by planning for the future, providing quality services, encouraging community involvement and being responsive to those we serve.

AGENDA

CALL TO ORDER

CALL OF ROLL: CITY SECRETARY

REQUEST ALL PHONES AND OTHER DEVICES BE TURNED OFF, EXCEPT EMERGENCY ON-CALL PERSONNEL.

INVOCATION: COUNCILMEMBER HURTA

PLEDGE OF ALLEGIANCE & SALUTE TO THE TEXAS FLAG

CITIZENS' COMMUNICATIONS

This time is for citizens to address the City Council on issues and items of concerns not on this agenda. There will be no City Council action at this time.

PRESENTATIONS:

A) Presentation regarding the New Braunfels Public Library Long Term Master Plan 21-841
Gretchen Pruett, Library Director

1. MINUTES

A) Discussion and or possible action to approve the minutes of the general city council meeting August 9, 2021, the 21-798

special budget workshop August 9, 2021, the special budget workshop August 10, 2021, the special budget workshop August 12, 2021, and the special budget workshop August 16, 2021.
Caitlin Krobot - City Secretary

2. CONSENT AGENDA

All items listed below are considered to be routine and non-controversial by the City Council and will be approved by one motion. There will be no separate discussion of these items unless a Councilmember or citizen so requests, in which case the item will be removed from the consent agenda and considered as part of the normal order of business. Citizens must be present to pull an item.

Resolutions & Action Items

A) Approval of a resolution regarding a request from the Heritage Society of New Braunfels to waive the application fee for a rezoning to apply a Special Use Permit to allow short term rental of a single-family residence in the C-1 Local Business District at 1370 Church Hill Drive. 21-779
Christopher J. Looney, AICP, Planning and Development Services Director

B) Approval of amendments to the agreement between the City of New Braunfels, Texas and the Humane Society of the New Braunfels Area, Inc. 21-753
Christopher J. Looney, AICP, Planning & Development Services Director

C) Approval of and authorization for the City Manager to execute a contract with the Texas Commission on Environmental Quality to accept grant funding to continue implementation of the Dry Comal Creek and Comal River Watershed Protection Plan 21-751
Mark Enders, Watershed Program Manager

D) Approval of a purchase from Chastang Autocar, Chastang Ford, and Rush Truck Centers of Texas, LP for heavy equipment collection vehicles and service vehicles for the Solid Waste Division and to declare the replaced vehicles as surplus. 21-799
Mike Mundell, Solid Waste Manager

E) Approval of annual routine recurring expenditures for FY 2021 in accordance with City Charter Section 9.17. 21-806

Barbara Coleman, Purchasing Manager

F) Approval of a Professional Services Agreement with Clarion Associates LLC to create a Unified Development Code for the City of New Braunfels. 21-809

Christopher J. Looney, AICP, Planning and Development Services Director

G) Approval to renew the following annual contracts, as allowed for by their contract language: Purchase of Vehicles, Pavement Marking Services, Auditing Services, EMS Medical Supplies, 3rd Party Assistance with Permit Application Review, 3rd Party Building Permit Application Plan Reviews, 3rd Party Engineering Development Permit Reviews and Administrative Support for Community Development Block Grants. 21-810

Debbie Kimball, Contract Administrator, Finance Department

H) Approval of continuation of golf concessionaire services with River Hofbrau through a new lease agreement for the Landa Park Golf Course. 21-811

Stacey Dicke, Director of Parks and Recreations Department

I) Approval of a purchase increase with GTS Technology Solutions, Inc. for additional networking equipment at Fire Station #2, Fire Station #3 and Police Station, and a 5% owners' contingency with permission for the City Manager to execute change orders up to the contingency amount. 21-773

Tony Gonzalez, Director of Information Technology

J) Approval of a purchase with Chastang Ford for three Fire Department vehicles to support operations and emergency services. 21-812

Patrick O'Connell, Fire Chief

Ordinances

(In accordance with Section 3.10 of the City Charter, a descriptive caption of each ordinance shall be read on two separate days.)

K) Approval of the first reading of an ordinance amending Section 126-136 of the City of New Braunfels Code of Ordinances to extend the existing school zone on Avery Parkway. 21-719

Garry Ford, Jr., Assistant Public Works Director/City Engineer

L) Approval of the second and final reading of an ordinance 21-828

amending Section 2-130 of the City of New Braunfels Code of Ordinances to align with the City Charter.
Jared Werner, Chief Financial Officer

M) Approval of the second and final reading of an ordinance amending Section 2-56 of the City of New Braunfels Code of Ordinances to align all terms for city board and commissions to begin December 1 or June 1. 21-789
Caitlin Krobot, City Secretary

3. INDIVIDUAL ITEMS FOR CONSIDERATION

A) Discuss and consider a resolution consenting to the issuance of unlimited tax bonds by Comal County Water Improvement District No. 1A, a water improvement district located within the Extraterritorial Jurisdiction of the City. 21-823
Jeff Jewell, Director of Economic and Community Development

B) Discuss and consider approval of proposed amendments to the City of New Braunfels Drainage and Erosion Control Manual. 21-769
Melissa Reynolds, First Assistant City Engineer

C) Public hearing and first reading of an ordinance amending Chapter 58, Floods, Article II. - Flood Damage Prevention. 21-768
Melissa Reynolds, First Assistant City Engineer

D) Public hearing and first reading of an ordinance regarding a proposed rezoning to apply a Special Use Permit to allow a duplex on a lot less than 8,000 square feet in area, in the R-2 Single and Two-family District addressed at 2662 Second Street. 21-772
Jean Drew, AICP, CNU-A; Planning & Development Services Assistant Director

E) Public hearing and first reading of an ordinance regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family house and garage apartment in the C-1 Local Business District addressed at 556 N. Union Avenue. 21-771
Jean Drew, AICP, CNU-A, Planning & Development Services Assistant Director

F) Public hearing and first reading of an ordinance regarding a proposed rezoning of approximately 7,406 square feet (0.17-acre) being parts of Lots 6 & 7, Block 21-775

46, New City Block 4002, Guenther Addition, addressed at 157 S. Guenther Ave., from "SND-1" Special Neighborhood District - 1 to "C-2A" Central Business District.

Christopher J. Looney, AICP, Planning & Development Services Director

4. EXECUTIVE SESSIONS

In accordance with Texas Government Code, Subchapter D, the City Council may convene in a closed session to discuss any of the following items; any final action or vote taken will be in public.

A) Deliberate issues regarding economic development negotiations in accordance with section 551.087 of the Texas Government Code; and, Deliberate pending/contemplated litigation, settlement offers, and matters related to privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with Section 551.071 of the Texas Government Code, specifically: 21-794

· HD Supply Facilities Maintenance, Ltd.

B) Deliberate issues regarding economic development negotiations in accordance with section 551.087 of the Texas Government Code. 21-822

- Project Origin
- Project Encore

NOTE: The City Council reserves the right to retire into executive session concerning any of the items listed on this Agenda whenever it is considered necessary and legally justified under the Open Meetings Act (Chapter 551 of the Texas Government Code).

5. RECONVENE INTO OPEN SESSION AND TAKE ANY NECESSARY ACTION RELATING TO THE EXECUTIVE SESSION AS DESCRIBED ABOVE.

ADJOURNMENT

CERTIFICATION

I hereby certify the above Notice of Meeting was posted on the bulletin board at the New Braunfels City Hall.

_____

Caitlin Krobot, City Secretary

NOTE: Persons with disabilities who plan to attend this meeting and who may need auxiliary aids or services such as interpreters for persons who are deaf or hearing impaired, readers, or large print, are requested to contact the City Secretary's Office at 221-4010 at least two (2) work days prior to the meeting so that appropriate arrangements can be made.

PRESENTER:
Gretchen Pruett, Library Director

SUBJECT:
Presentation regarding the New Braunfels Public Library Long Term Master Plan

DEPARTMENT: Library

COUNCIL DISTRICTS IMPACTED: All Council Districts

BACKGROUND INFORMATION:
The New Braunfels Public Library commissioned a plan to look at the future expansion of the public library on Common St. The plan projects the facility's capacity and site needs for an ultimate expansion of the facility, should that occur. This report will be helpful for future bond program planning.

Until an expansion occurs, a reconfiguration of the current Library space will provide a more efficient use of the space for current programs and needs. Included in the 2022 proposed budget is a request for $54,840 to renovate the teen area, which is one of the first components of the space reconfiguration. Other components will be addressed as funding becomes available through the City, the Foundation or through the Library's various trust funds.

ISSUE:
Projecting the future needs for the public library main location facility.

FISCAL IMPACT:
There is no fiscal impact to this item. As projects are addressed from the Master Plan, funding will be identified.

RECOMMENDATION:
None

New Braunfels Public Library:
Main Library Master Plan

720 design

City of New Braunfels


Non-Fiction
Fiction

TABLE OF CONTENTS

PART ONE

Main Library Facility Master Plan

INTRODUCTION: The city and library staff's primary goal for expanding services at the existing Main Library is to expand the public's understanding of what a library can be and fulfill roles including but beyond those that are traditional library services. The library's role in the community is to provide access to information but also to be a place that facilitates making connections – between library users, information and technology (IT) and beyond that to connections between neighbors, teachers and students. The library of today recognizes that it provides the physical space that promotes learning, sharing information and promotes social ties within its neighborhood. The expanded Main Library is planned to increase from 25,000-square feet to nearly 58,000-square feet.

The new space will allow the library to:

- Expand the meeting from seating 80 to seating 200 at a lecture style program.
- Expand the children's and teen area to include more collections, a dedicated story room, and a family place area.
- Lower the adult collection shelving from 90" tall to 66" tall. This will create an easier to browse collection, create greater visibility for staff control and security, and give the space a more "retail" feel for library guests.
- Increase adult seating including tables with power, an enclosed quiet reading room, and increased "garden" seating with a view of the site amenities.
- Increased study and conference room capacity.
- Increase the efficiency and functionality of the staff work areas.

The expanded Main Library will transform into a place with a space everyone to feel welcome from a variety of seating and technology to collaborative spaces and program rooms to quiet, contemplative spaces, the library is as much about "people space" as it is for storing a physical collection of books.

(CONTINUED)

OVERVIEW AND INTRODUCTION

PROJECT DESCRIPTION: This document represents the findings of an information gathering phase from the city, the library staff, and the Library's Long-Range Plan as prepared by the Komatsu Architecture/ Godfrey's Associates team in 2000. Data from the previous Long-Range Plan indicates the need for the expansion and renovation of the Main Library to more than double its current size, with a corresponding paring increase. This recommendation, and 720 design, agrees, was based on real and projected population increases as well as the total usage of the library – which is 34x greater than the population increase.

The vision for the Main Library is presented here as a guideline to be used for the design of the new New Braunfels Main Library. In addition to the benefits gained from increased space the renovation will allow the library to:

- Re-evaluate the public service model including the location, size, and function of staff interaction stations.
- Create a better division between quiet and active spaces.
- Provide for better visual control.
- Update the aesthetics with color, finishes, and a focal point.
- Expand drive up service.
- Relocate and expand planned new automated materials handling (AMH).
- Provide functional space for the bookmobile services.
- Take advantage of more views of the existing site amenities.

In addition to viewing the library as a place to get information, the community views the library a central hub, a gathering space to meet neighbors and future friends. Community participants called for the new library to support the message that libraries are an important aspect of their quality of life and the location should duplicate the success of the current library.

A. PROJECT SUMMARY

NEW BRAUNFELS GROWTH

The City of New Braunfels was the 13th fastest growing city in the nation according to the most recent census numbers – growing 4.7 percent in the last 12 months. Projections have New Braunfels growing another 36.47% in the next 15 years. The current library has experienced this explosion in growth and demand for services first hand.

CURRENT LIBRARY USE

The community currently boasts 34,244 active library card users – nearly 50% of the population. In addition, FY2017 saw 253,221 people enter the library to use the collection, technology or attend a program. The intensity of the use supports the need for a new library offering equal service to the current location.

The city recently recognized the importance of library services and expanded the free card privilege to the ETJ and people with any New Braunfels address. In the first two weeks of the expanded free card service over 450 people took advantage of the opportunity as additional card holders. Thirty-four (34) people a day came in to get a new or convert an existing card. If this trend continues, along with the increase in city population, strongly supports the increase from 54,000-square feet in the Master Plan to 58,000-sqquare feet as determined by this need's assessment.

PROGRAMMING SPACES

In 2018, the library offered 925 programs and welcomed over 22,000 attendees. Based on this data, the library plans to increase the size and quantity of library and community programming spaces in the renovated Main Library.

COLLECTION SPACES

The library staff carefully determined size of the collection for the Main Library to:

- Increase the adult collection by 20%.
- Increase Picture Books, Easy Readers, Juvenile Fiction and Graphic Novels by 20%.
- Decrease Media and Reference to reflect changing uses in the collection.
- Increase the number of books per capita from 1.32 to over 2 books per capita (not including increases expected at the new Westside Branch).

LIBRARY SEATING

Library seating is at a premium in the Main Library. The community meetings and survey support the notion that additional "people" space is required for a successful community library. A variety of seating types was deemed important: spaces for families to sit together, individual study spaces, rooms for groups, technology friendly/supportive seating and larger library computer tables.

(CONTINUED)

A. PROJECT SUMMARY

UNIQUE FEATURES

Expanded Children's Area: The demographics of the Main Library/downtown area of the city point to an area that is heavily families with young children. The conceptual plan reflects this with a dedicated youth services multi-purpose room that incorporates flexibility in moveable walls, dividable spaces and open floor area for a "family place."

YOUNG ADULT AREA

The teen space is considered a critical goal for the renovation. The new space should be glass enclosed for both acoustics and visibility into the space. The furniture should encourage places to study and socialize. The functionality of the booths is well liked and should include outlets. There should be places to display artwork and projects.

EXTENDED HOURS SPACE

The community has expressed an interest in expanding the hours the library is accessible. This could mean book lockers, Amazon style, that allow a book to be requested and placed in a locker for pick up any time. It could mean expanding WiFi outside the building for extended hours or even a place to check out books. In addition, the conceptual design reflects the possibility of having the lobby/vestibule space available for patron use beyond the hours of the library if desired or during peak use times.

QUIET SPACE

21st century library spaces are active and exciting collaboration spaces and the New Braunfels Public Library is no exception. That said, there remains a need for a traditional "Quiet Reading Room" that supports intense study and quiet reading. A space that supports these traditional, quiet library functions is planned for the building with soft seating, individual tables and shelving for newspapers and magazines.

DRIVE THROUGH SERVICE

The library has a planned drive through service window for the convenience of the patron. This service will allow library users to call or go online to reserve a book on hold and indicate that they will pick the materials up from the service window. Located in the staff work room, the window will allow library staff to have the book ready for pick up.

BOOK RETURN

The new configuration will allow the AMH to serve both drive up and walk up (interior) materials returns on a single conveyor directly into the work room without bisecting the work area. The expanded parking area can be designed to accommodate the drive without intersecting the new library entrance and accommodate a service window if desired.

STUDY ROOMS

Six small group study rooms and one large conference room (shared for both public and staff functions) have been planned in the new space. Two are adjacent to the youth/teen spaces and four located in the adult area. Study Rooms should include adequate ventilation.

LIBRARY TECHNOLOGY

The New Braunfels Main Library will be designed to be a dynamic facility throughout its useable lifetime, with the opportunity to adapt to community needs as they emerge naturally over time. Since technology is in a state of constant change, library technology will be designed or chosen that has the highest potential for flexibility, adaptability and scalability over time – intended to meet the current, emerging and future needs of both library patrons and library staff.

Technology design includes a powerful WiFi system for current and future use of mobile technology; improved Audio/Visual systems throughout the library; better self-service options for those who wish it; technology that helps extend the hours of the library; and automated technology assistance for patrons to improve experiences for patrons and staff alike including the use of Radio Frequency Identification - RFID - for materials and Automated Materials Handling and other technologies that allow staff to spend less time on repetitive tasks and more time directly serving patrons.

OUTDOOR AMENITIES

Based on community input, the new library is planned to expand the library services from being held within the walls to incorporating spaces for library functions on the site. Site amenities include:

- Semi-enclosed space for programs, outdoor seating, “zen spaces
- Outdoor classroom
- Teaching learning garden with outdoor classroom space
- Bike racks
- Expanded parking spaces

BUILDING SPACE NEEDS PROGRAM

This building program is the result of a careful space needs assessment based on detailed library staff data questionnaire and interviews, input from city departments. The consultants developed the program in response to a series of meetings with city management, related or interested city departments, representatives from the school district, and of course, the public, who took part in opportunities for input.

The library staff provided extensive data including current and forecasted collection information (from which the shelving space allocation was derived), program and event attendance over the previous year (from which meeting, study and event spaces were planned) and a detailed evaluation of staff work flow and the most efficient methods for completing tasks.

As a result of the total input from the library staff, city departments and the Long Range Plan, the consultants recommend a division of space based on the planned 58,000 SF.

SUMMARY OF SPACE ALLOCATIONS: A chart summarizing facility space requirements including each area in the proposed library showing square footage, size and type of materials collections, furniture and equipment and number of seats for staff and public:

SUMMARY OF SPACE ALLOCATIONS

City of New Braunfels

720 design

		Building Program Summary NEW BRAUNFELS PUBLIC LIBRARY . NEW BRAUNFELS . TEXAS	Quantity	Square Feet	Total Square Feet			Volumes per Single Face Sections	Total Volumes Housed	% in Circulation	Collection Total Capacity		
A.	**Lobby**						**2,899 SF**						
	1.	Pre-function Space/Gallery	1	1,000	1,000								
ex	2.	Foyer with community information	1	229	229								
	3.	Public Restrooms and drinking fountain	2	480	960			double for expansion					
	4.	Reception/Greeter Kisok	1	60	60								
	5.	Café Vending				310							
		Vending Machines	3	50	150								
		Bistro Seating	2	60	120								**6**
		Vending Storage	1	40	40								
ex	6.	Friends Sale Area				340							
		Sale Area	1	340	340								
	7.	Friends Work Area	1	115	115								
B.	**Multi-purpose Activity/Meeting Space**						**4,770 SF**						
	1.	Meeting Room (divisible)	200	3,000	3,000	3,810							**200**
	2.	Table/Chair /Stage storage	1	150	150								
		Adult Service Storage	1	80	80								
		Youth Service Storage	1	80	80								
		Teen Services Storage	1	80	80								
		AV Storage	1	80	80								
		Catering/Teaching/Learning Kitchen	1	160	160			combined kitchenette/teaching learning					
		Maker Space Secure Storage Cabinets	2	40	80								
		Maker Space Secure Storage	1	100	100								
	3.	Conference Room	20	15	300								**20**
	4.	Small Group Study Rooms				660							
		4-6 People	6	110	660								**36**
C.	**Browsing**						**1,725 SF**						
	1.	New Materials				320							
		New Books-Adult 66" high	3	20	60			**60**	**180**	**51%**	**272**		
		New Books-Junior's/Children's 48" high	3	20	60			**108**	**324**	**40%**	**454**		
		New Media 66" high	3	20	60			**108**	**324**	**40%**	**454**		
		Staff Picks	1	20	20			**108**	**108**	**40%**	**151**		
	2.	Holds	6	20	120			**60**	**360**	**0%**	**360**		
	3.	Business Area				160							
		Copy/Print/Scan	1	40	40								
		Color Printer	1	20	20								
		Fax	1	20	20								
		Layout Table	1	60	60								
		Change Machine	1	20	20								
	4.	Technology Commons				1,245							
		Library PC (includes 4 stand up)	24	50	1,200								**24**
		PAC	3	15	45								
D.	**Main Service Desk**						**380 SF**						
	1.	Service Kiosk											
		Staff Stations with computer	2	100	200			height adjustable					
		Cash Register	1	20	20								
		Self Checks (one in youth?)	4	40	160								
E.	**Adult Services**						**12,475 SF**						
	1.	Collections				8,775							
		Non Fiction											
		21248 Non-fiction 5 shelves high - 66"	190	12	2,277			**112**	**21,248**	**12%**	**23,798**		
		913 Spanish 5 shelves high - 66"	8	12	98			**112**	**913**	**12%**	**1,023**		
		Fiction											
20%		36722.4 Adult Fiction - 66" 5 shelves high	399	12.5	4,989			**92**	**36,722**	**10%**	**40,395**		
		Reference											
decrease		1232 Reference - 48" 3 shelves high	25	12.5	308			**50**	**1,232**	**10%**	**1,355**		
		106 Pre-professional Collection - 48" 3 shelve	2	12.5	27			**50**	**106**	**10%**	**117**		
		Adult Media											
decrease		4663 Audiobooks 10 shelves - 66" high	17	15	259			**270**	**4,663**	**34%**	**6,248**		
		14725 DVD 10 shelves - 66" high	55	15	818			**270**	**14,725**	**34%**	**19,732**		
	2.	Seating				2,940							
		Seating in shelving areas	4	40	160								**4**
		Collaboration Seating	4	120	480								**16**
		"Zen Zone" Seating	4	40	160								**4**
		Lounge Seating	8	40	320								**8**
		Tables for 2	20	80	1,600								**40**
		Tech Tables for 6 (like Seguin)	2	110	220								**12**
	4.	Quiet Reading Room				759							
		80 Magazines- 66" high	5	13	67			**15**	**80**	**0%**	**80**	Magboxes	Flipster #/s going up
		6 Newspapers - 66" high	1	13	13			**15**	**15**	**0%**	**15**	Magboxes	
		Tables for one	5	80	400							**5**	
		Lounge Seating	5	40	200							**5**	
	5.	Everybody Restroom	1	80	80								

City of New Braunfels

720 design

Building Program Summary NEW BRAUNFELS PUBLIC LIBRARY . NEW BRAUNFELS . TEXAS	Quantity	Square Feet	Total Square Feet			Volumes per Single Face Sections	Total Volumes Housed	% in Circulation	Collection Total Capacity		
F. Staff Work Area					**7,544 SF**						
1. Administration Area											
P03 Library Director	1	120	120								
P03 Library Assistant Director	1	120	120								
Admin Assistant	1	70	70			close to director					
2. Technical Services											
WS4 FT Librarian Workstation	1	70	70								
WS4 Volunteer	1	70	70								
WS4 Technician Workstation	2	70	140								
cart at each workstation	4	20	80								
90" Wall shelving	8	12	96								
3. Public Services											
WS4 FT Librarian Workstation	1	70	70								
WS4 PT Clerks	2	56	112								
WS4 Shared Workstations	2	70	140								
cart at each workstation	4	20	80								
90" Wall shelving	8	12	96								
4. Children's Services											
WS4 FT Librarian Workstation	3	70	210								
WS4 Technician Workstation	1	56	56								
WS4 PT Aides	1	56	56								
cart at each workstation	7	20	140								
90" Wall shelving	8	12	96								
Work Island cabinet storage	1	80	80								
90"h Library Shelving	2	12	24								
5. Outreach Services											
WS4 FT Librarian Workstation	3	70	210								
WS4 Circulation Workstation	1	56	56								
WS4 PT Clerks	2	56	112								
cart at each workstation	2	20	40								
90" Wall shelving	8	12	96								
6. Staff Support											
Copy/Scan/Print-shared	1	80	80								
Storage	1	100	100								
7. AMH											
Interior AMH w/7 bins	1	1200	1,200								
Exterior Book Return	1	96	96								
Exterior Service Window	1	100	100								
Cart Sorting - 7 standard size carts	7	20	140								
90" Wall shelving	4	12	48								
8. Book Mobile					3,340						
Staff Processing Area	2	70	140								
Garage	1	2800	2,800			transit van and book mobile, with raised staging area to lift carts, shelving 4 sections (inside wor					
Storage	1	400	400								
G. Youth Services					**11,960 SF**						
1. Service Kiosk				180							
Staff Stations	1	80	80								
Display	1	20	20								
Self Check Stand alone units	2	40	80								
2. PAC	2	15	30								
2. Self Check	1	15	15								
3. Juv Area (Pre-school) Collection				7,480					**0**		
211 Bluebonnet - 3 shelves high - 48"	2	20	35			**120**	**211**	**77%**	**373**		
615 Board Book Bins	3	20	60			**120**	**360**	**77%**	**637**		
20% 16440 Easy (Picture Books) - 3 shelves high - 48	137	20	2,740			**120**	**16,440**	**25%**	**20,550**		
20% 3720 Easy Readers - 3 shelves high - 48"	31	20	620			**120**	**3,720**	**25%**	**4,650**		
20% 9000 JFic (Chapter Books) - 3 shelves high - 48	75	20	1,500			**120**	**9,000**	**25%**	**11,250**		
11097 Non Fiction - 5 shelves high - 66"	92	20	1,850			**120**	**11,097**	**15%**	**12,762**		
1601 Spanish - 5 shelves high - 66"	13	20	267			**120**	**1,601**	**15%**	**1,841**		
20% 1680 J/GN (Graphic Novels) - 5 shelves high - 6	20	20	400			**84**	**1,680**	**42%**	**2,386**		
10 Magazines- 66" high	1	13	8			**15**	**10**	**0%**	**10**	Magboxes	Flipster #/s going up
4. Media				335							
902 Audiobook/DVD 10 shelves - 60" high	3	20	67			**270**	**902**	**21%**	**1,091**		
3145 DVD 10 shelves - 60" high	12	20	233			**270**	**3,145**	**21%**	**3,805**		
480 Music 10 shelves - 60" high	2	20	36			**270**	**480**	**21%**	**581**		
Seating				1,840							
Round Activity Tables	4	80	320							**16**	
Lounge Seating	22	40	880							**22**	
Tables for 4 with power	8	80	640							**32**	
5. Technology				660							
Parent/Child Station	4	40	160							**8**	
AWE Station	4	40	160							**4**	

Building Program Summary NEW BRAUNFELS PUBLIC LIBRARY . NEW BRAUNFELS . TEXAS			Quantity	Square Feet	Total Square Feet			Volumes per Single Face Sections	Total Volumes Housed	% in Circulation	Collection Total Capacity	
		Tablet Station	2	40	80							2
		Youth Stations	6	40	240							6
		Printer	1	20	20							
6.	Family Place					650						
		Floor Space	8	40	320							
		Collection/Parenting	3	20	60							
		Lounge Seating	6	40	240							6
		Brochures	1	30	30							
7.	Dedicated Story/Activity Room (with mobile wall like		30	15	450	610						30
		AV /Storage	1	120	120							
		Cabinets with sink	1	40	40							
8.	Family Restroom		1	80	80							
9.	Comfort Room (sensory certified)		1	80	80							
H.	**Young Adult (Youth) Services Room (glass enclosed)**						**1,624 SF**					
1.	Collections					859						
		New Collection display	2	12	24							
4200	Fiction - 5 shelves high - 66"		44	12	525			96	4,200	18%	4,956	
800	Non Fiction - 5 shelves high - 66"		5	12	60			160	800	20%	960	
2000	Graphic Novels - 5 shelves high - 66"		21	12	250			96	2,000	18%	2,360	
2.	Seating					765						
		Technology Bar	1	110	110							6
		PAC	1	15	15							
		Lounge Seating	4	40	160							4
		Booths	2	80	160							8
		Study Pods	2	80	160							2
		Tables for 4	2	80	160							8
J.	**Library Staff Support**				**1,295**		**1,295 SF**					
1.	Storage											
		Seasonal Storage	1	100	100							
		Tech Services Storage	1	100	100							
		Youth Services Storage	1	100	100							
2.	ex Centralized Staff Lounge											
		Kitchen	1	100	100							
		Seating at 4 top tables	2	75	150							
		Soft Seating	2	30	60							
		Vending	0	33	0							
	ex Lockers		10	5	50							
3.	Staff Mail area											
		Meter	1	5	5							
		Delivery/sorting	1	75	75							
4.	Gender Neutral Staff Restrooms		2	80	160							
5.	Loading/Delivery/Receiving Area											
		Table	2	100	200							
		Shelving	4	20	80							
6.	ex T/Comm		1	115	115							
K.	**Building Support**						**600 SF**					
1.	ex Janitor Closet		1	100	100							
2.	Janitor Storage		1	120	120							
2.	ex Fire Sprinkler		1	40	40							
3.	Recycling Bins		2	20	40							
4.	Mechanical		0	240	0							
5.	Electrical		3	100	300							
		Assignable Square Feet -Public Areas					**46,682 SF**			total collection		seating
		TOTAL ASSIGNABLE SQUARE FEET					**46,682 SF**			**162,665**		**534**
		Gross Square Footage (75%)					**58,352 SF**					
		Available Space					**24,000**	**SF**				
		Difference					34,352	**SF**				
		Master Plan needs					**54,000**	**SF**				
		Difference					-4,352	**SF**				

I. GENERAL LIBRARY PLANNING CONSIDERATIONS

ACOUSTICS

21st Century Libraries are not quiet spaces; however, certain strategies should be employed to help control the sound. The following should be considered to address noise issues:

- Consider reducing the amount of hard flooring and utilize carpet or other soft flooring.
- Include landscaping the ceiling to buffer noise in louder areas like the service desks and Teen Area.
- Include quiet rooms like small group and individual study spaces, shared huddle spaces and quiet reading rooms. Ensure their walls extend to structure.
- Restrooms walls should extend to the structure and have two layers of staggered gypsum board on the restroom wall side.

FLOORING

- *Lobby/Entry* – Walk off carpet to remove dirt and water prior to entering the library, through color porcelain tile with dark grout, stained and scored concrete or other durable surface for ease of maintenance.
- *Library* – Carpet Tile with base (wood, ceramic tile, luxury vinyl tile (without deep grooves) or rubber base throughout
- *Staff* – Carpet Tile
- *Meeting Rooms* - carpet tile, luxury vinyl tile or marmoleum
- *Family Place* – mop able surface
- *Restrooms* - through color porcelain tile on the floors and full height walls with Schluter trim at coves and all edges

WALLS

- *Quiet and Group Study Rooms* - Special acoustical wall treatment. Also consider writable glass marker board. Ensure walls are constructed with two layers of gypsum board that extend to the bottom of structure or include high performance ceiling tiles such as Kinetics ACT tile.

- *Restrooms* – porcelain ceramic tile with dark grout from floor to ceiling.

- Minimum Level 4 drywall finish at all locations unless wall covering is utilized that requires Level 5.

- *Storage Rooms and Book Return Areas* – fiber reinforced panels (FRP) to 4’ (one standard panel height). One hour rated in exterior book return rooms.

- *Bumper Rails* – study rooms at chair back height. Along corridors with high book cart traffic.

- *Corner Guards* – on any gypsum board exposed corner. Should extend from the floor to a minimum of 4’.

- *All Other Areas* - Painted drywall (Benjamin Moore Scuff X or similar) in lower traffic areas. Consider durable, low maintenance wall covering in high traffic areas. Include perforations in vinyl wall covering at all outside wall conditions.

- *Main Collection Area, Meeting Room, Lobby* - Provide picture hanging track (5’6” high) on all walls not covered by single faced shelving.

- All vinyl wall covering located on exterior walls must be perforated to prevent mold and mildew.

CEILING

- Generally, provide high performance acoustical tile with a minimum of 12' high ceiling clear in public areas. Use 2x2 tiles with antimicrobial treatment where ceiling tile is required but make attempts to be more creative in the ceiling landscaping and acoustical treatment.

- *Service Desks* - Special acoustical treatment in the ceiling to minimize ambient noise.

LIGHTING

- All lighting must avoid glare on table/ counter surfaces, and on terminal screens. Consider daylight and nighttime lighting variations. Indirect lighting is preferred if foot-candle levels are maintained at the minimum listed below. Consider ceiling levels as well as table levels.

- *LED Lamps/Fixtures* - these should be incorporated in the library as well if budget allows. Incandescent lighting should not be used.

- LED requires few foot-candles (fc) of light to adequately light a library. If LED's are being used provide a minimum:
  - *Stack Areas:* 30 fc vertical
  - *Reading Area:* 30 fc horizontal
  - *Private office:* 50 fc horizontal, 5 fc vertical
  - *Open office:* 30 fc horizontal, 5 fc vertical
  - *Video Conferencing:* 50 fc horizontal, 30 fc vertical

- Provide 50-70 fc if fluorescent lamps are being used at table level in all areas. Storage, utility rooms, and corridors may vary from 15 to 30 fc.

- Led surge protection should be included.

- The New Braunfels Main Library must meet Texas Energy code requirements including daylighting.

- Ideally lighting fixtures in public areas should be of a type and arrangement that the requested light level can be achieved regardless of the arrangement of shelving or seating, however if certain areas are judged to have a fairly certain long term use, then a more specific lighting solution may be used. Lighting should be zoned in public areas to permit lights to be turned off in banks.

- The selection of lighting fixtures, tubes and bulbs should be made with a view to low continuing cost and ease of maintenance (locally available lamps). Fixtures should be placed so that they can be easily serviced without special equipment. The number and types of fixtures should be minimized. Ease of re-tubing is a major consideration in fixture selection.

- Emergency and security (night) lighting systems should be separate from the general lighting pattern and switched separately. Security (night) lights should not be in closed areas with projection screens. Night lighting should illuminate the building during closed hours and provide for safe staff egress after hours.

"The expanded Main Library will transform into a place with a space everyone to feel welcome..."

FENESTRATION/WINDOWS

- Provide new clear Low E 1" insulated glass at all exterior locations if the budget allows. Exterior windows are desired for natural light, but care should be taken to limit glare and sun damage to books, carpet, and fabrics.
- Windows should be aluminum frame storefront or curtainwall as required.

DOORS

- For easy, safe transport of loaded book trucks and audiovisual equipment on carts, as well as for A.D.A. requirements, all interior doors should be installed without threshold. Doors to staff areas and book returns should be 42" wide to accommodate book trucks and include security/automatic openers.
- Coordinate POE hardware with City.
- Doors to the library should be automatic sliders.

ENERGY EFFICIENCY: ELECTRICAL AND MECHANICAL

- Electric outlets shall be installed regularly along all walls for library technology, housekeeping and library users who bring their own devices.
- Floor outlets should be recessed floor outlets with 8 ports for electrical or data use – like Legrand Wiremold Evolution Floor boxes. Covers should be flush with inserts for floor finishes.
- All other electrical switches, alarm controls, thermostats, and other electrical controls should be concentrated vertically to use as little wall space as possible. No control unit should be located behind shelves. Thermostats should include lockable covers when located in public areas.
- The copy machine location should have a 120-volt outlet with a 30 ampere dedicated circuit.
- Provide separate dedicated circuits under the checkout desk for the library's RFID book security system, cash register and other equipment and at the front doors. Provide infrastructure only. Coordinate with RFID provider.
- *Staff Work Area* - 120-volt strip outlets at 12" intervals are to be installed the full length of all counters. Outlets are to be excluded within one foot on either side of sinks.
- All outlets in proximity (within 2') of water sources must be GFI outlets.
- All wall outlets in public areas and study spaces should include USB ports.
- Power should be provided in or near all library tables and seating.
- *Clocks* - Provide clocks with battery back up in locations as directed by librarian staff.
- Mechanical and Electrical systems shall be designed to increase energy efficiency and decrease energy consumption/utility bills. Consider energy efficient systems like geothermal heat pump systems.
- Plumbing fixtures should be low flow. Hose bibs will be required.
- Mechanical systems should include ionization and air scrubbers for anti-microbial treatment.

- The city uses Innotech with Yates Company, LLC to install for energy monitoring in the city building.

SAFETY AND SECURITY/VISUAL SUPERVISION

- When fire extinguishers are being installed, give the same consideration as is given to electrical controls to conserve wall space for wall shelving.
- As noted under "A.D.A. Requirements", emergency alarm systems must be provided to alert hearing impaired persons of emergency conditions, including strobe lights visible from all areas of the building, and an emergency notification board near the information/reference desk.
- An RFID book security system is currently planned that allows self-check-out automatic book check in and an automatic book sorting system (AMH) with conveyors and a minimum of 7 bins.
- Security cameras will be used by the library for both interior and exterior locations.
- The library should be designed for visual control from the service desk on each floor. However, in keeping with current library trends, library staff should be roaming the floor plan to assist patrons.

SHELVING - all shelving 66" high (or lower for reference and easy books) with 42" aisles. All shelving should be mobile.

Retail feel, no canopy tops (except at 48" high shelving units). No base shelf – bottom shelf should be sloped and open for ease of access. Some shelving should be curved for browsing.

End Panels: Where budget allows the library would like to utilize end panels as display opportunities and incorporate slat will with metal slats and other display features.

New Books: New Books should be mobile, have a prominent location on the public floor with face out display.

Magazines: Magazines should be housed in acrylic boxes (MagBox or similar) on standard library shelving.

Multi-Media: Multi-media shelving should be housed on shelving that allows face out or spine out retail type shelving.

Checkout Area: Provide 12" deep 48"-66" mobile, height adjustable shelving in 3' wide near the Checkout Desk for holds.

Public Area Library Shelving: All free-standing shelving in the library shall be in standard 3' lengths. Avoid single faced wall attached shelving as much as possible within the general collection. Distance between free-standing shelving units and/or between shelving units and furniture must be a minimum of 42." In areas of volume traffic, a minimum of 5' between rows of furniture and shelving. Free-standing island shelving shall not exceed 27 feet in length (9 sections).

Standard free-standing shelving units in the Main Study/Collection Area are to be double-faced, not more than 66" high, ten inches actual/eleven inches nominal depth. Free-standing units shall not exceed 24' in length. Reference materials will be interfiled with non-fiction so shelving in those areas should accommodate both. Shelving with integral lights should be considered should budget allow.

(CONTINUED)

I. GENERAL LIBRARY PLANNING

Multi-media shelving should be gondola retail type as manufactured by The Professional Design Store, LIFT and others. Include 9 dividers per shelf and a rubber mat to prevent slippage.

Standard adjustable library shelving for processing/holding of returned library materials prior to re-shelving in the staff work area should be double-faced 90" high x 10" deep units or equivalent single-faced units.

Industrial Shelving for general storage in Staff Storage and Supply Room should be single faced 84" high x 18" deep x 84" wide units.

Casters should be added to library shelving in the Teen Area, Children's Area and browsing collection.

Librarian's Offices: Standard adjustable library shelving to accommodate books. Two (2) 66" High SF Units.

Specifically, sized tack/markerboards will be called out in the Furniture/Equipment lists within each individual space description for the Lobby, and Staff Work Area, and the Staff Rest Area.

RESTROOMS

- One gender neutral/family restroom should be provided for each bank of restrooms and in the youth services area. A comfort/lactation room should be provided.
- Plumbing chases should be provided. Provide a recessed space about each water closet for backpacks, brief cases or purses.
- No stainless steel in restrooms. Tile should be provided from floor to ceiling with dark colored epoxy grout. Toilet partitions should be phenolic type. Standard restroom accessory schedule to be provided by the city.

OFFICE WORKSTATIONS

- Library staff is collaborative by nature and work areas should encourage collaboration. New workstations should be lower and allow for staff interaction in the seated position.
- Landscaped Workstations called for in the Furniture/Equipment List for each space, shall provide the following features: L shaped work areas with box/box/file, pencil drawer and lateral file below with overhead open and closed cabinets. Actual components may vary from these dimensions as long as equivalent functionality remains. One section of the L should be height adjustable.
- Landscaped office components within the Librarian's Office's shall include a U or L shaped desk, one 48" long legal lateral file unit below the side return, two open shelves above the desk surface, three box drawers, one pencil drawer. Layout space is the priority. Height adjustability may be included.
- A shared, high tech "huddle" space will be provided for staff at one per floor. This area will include a small conference table for four, LED screens for video conferencing, webinars etc.

SIGNAGE

- Interior Code related, and library specific signage should be included in the one bid package to ensure graphic coordination.

- Attractive, contemporary, and legible signage, both informational and directional, should be incorporated into the building design at time of design development. The signage should be part of the FF&E contract to ensure all signs match in style but coordinated to install in two phases -the first for building completion/certificate of occupancy and the second to coordinate with furniture.

- All interior signage (Doors, hanging, wall, and book stacks) should be coordinated and maintain good contrast between background and lettering. Standardize the typeface for all signage. Individual room and book stack signs (end panels) shall have 8.5 x 11 paper insert sizes.

- All alarmed emergency exit doors shall be signed in 1" white letters on a red background with "Emergency Exit Only, Alarm Will Sound."

AMERICANS WITH DISABILITIES ACT COMPLIANCE

- The facility shall be designed to be compliant with U.S. Public Law 101-336 (Americans with Disabilities Act of 1990), and with Federal Rules and Regulations as promulgated in the Federal Register, Vol. 56, No 144, Friday, July 26, 1991. Where A.D.A. facility requirements vary from state and local accessibility requirements, the more restrictive requirement shall apply. A.D.A. requirements go beyond previous accessibility requirements to include increased life safety equipment, signage, desk heights, and carpet pile thickness. This project will meet or exceed Texas Accessibility Standards 2017.

- Consider and ADA path to access the trail system.

BUILDING MATERIALS AND FINISHES: MAINTENANCE CONSIDERATIONS

- The facility should be designed throughout to minimize ongoing maintenance requirements. Use Scuff Proof paints (Benjamin Moore Scuff X) and type II vinyl wall coverings which are durable and easily cleaned. Wherever possible use stock catalog products from suppliers or manufacturers for items such as flooring, ceiling tiles, paints, wall coverings, upholstery, and counter laminates.

- Require the general contractor or subcontractors to provide preventative maintenance manuals giving timetables for maintenance of mechanical/plumbing/electrical equipment (including supplier contacts and parts manuals), and for care and cleaning of furniture/equipment/fixtures. Contractors or subcontractors should be required to provide training in the operation and maintenance of installed systems by professionals who are familiar with those systems.

- Require contractors to provide "attic stock" of certain building materials for maintenance or repair, including wall coverings, ceiling tile, carpet, carpet tiles, vinyl tile, and ceramic tile (3-5% suggested). Space for storage of attic stock is included in the building program.

COMPUTER/DATA COMMUNICATION NEEDS

- Interior Code related, and library specific signage should be included in the one bid package to ensure graphic coordination.

COMPUTER/DATA COMMUNICATION NEEDS

- Fiber is part of a separate project IT plan and will be required for the SE Branch.

- *Cable:* Spectrum
  Phone: VOIP AT&T U-verse or Spectrum.
  Security Alarm Monitoring: Tess, Inc.

- Robust wireless should be available throughout the library. Lounge chairs should be located near power ports. Public reader tables and computer benching should include pop ups for power and wire management.

- Interior Code related, and library specific signage should be included in the one bid package to ensure graphic coordination.

EXTERIOR CONSIDERATIONS

The exterior should be landscaped and include benches and other seating for those waiting for rides, using Wi-Fi. A space for outside programming should be considered. Bike racks and trash bins should be provided.

Additional Exterior Amenities:

- Outdoor program spaces
- Benches and/or picnic area
- Adequate Parking for public and staff
- Drive-up Book Return and/or Service Window

COVID-19 Considerations:

- Provide ionization and air scrubbers at mechanical room.
- Provide excellent ventilation for the entire space.
- Provide sanitizing stations at the entry and key points in the library.
- All fabric should be scrubbable, moisture proof, and anti-microbial.
- Provide de-mountable screens at the computer stations.
- Provide space in the staff area for materials quarantine.
- Provide touchless fixtures in the restrooms.
- Provide service points that are mobile with demountable screens.

"The library's role in the community is to provide access to information but also to be a place that facilitates making connections."

RENOVATION/EXPANSION PROBABLE COST ESTIMATE

New Braunfels Public Library Renovation/Expansion

PROBABLE COST ESTIMATE

Notes:

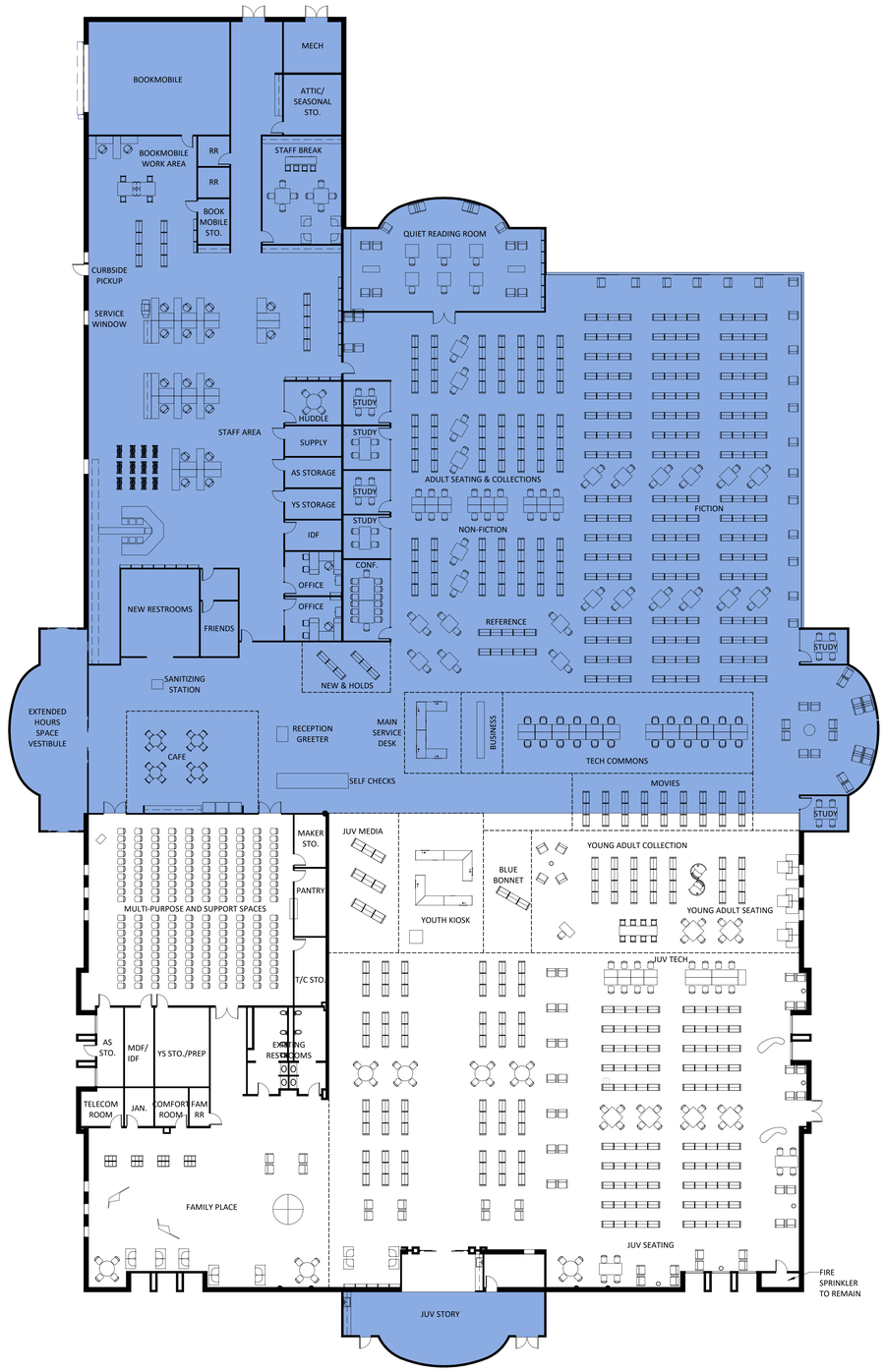
All costs are listed in 2020 Dollars

Projected Budget	Square Feet		Cost/SF		Subtotal
Sitework	48,000	$	10.00	$	480,000.00
Detention Pond	25,000	$	6.00	$	150,000.00
Renovation	25,000	$	200.00	$	5,000,000.00
New Construction	35,570	$	390.00	$	13,872,300.00
Subtotal				**$**	**19,502,300.00**
Design Contingency (10%)				$	1,950,230.00
Subtotal				**$**	**21,452,530.00**
Utility Connection Fees				$	60,000.00
Other Permit Fees Permit Fees				$	18,000.00
Construction Subtotal				**$**	**21,530,530.00**
GC General Conditions (4.5%)				$	968,873.85
GC Fees (5.5%)				$	1,237,467.21
Construction Total				**$**	**23,736,871.06**
Soft Costs	10%			$	2,373,687.11
A/E Fees	12%			$	2,848,424.53
Owner/Construction Contingency	10%			$	2,373,687.11
Audio/Visual Systems				$	3,800,000.00
Furniture, Fixtures and Equipment Costs				$	2,422,800.00
New Book Collection				$	1,000,000.00
Total Project Budget				**$**	**35,707,045.27**
Escalation to 2021 @ 6% / Year	6%		per year	$	37,849,467.99
Escalation to 2022 @ 6% / Year	6%		per year	$	40,120,436.07

SCHEMATIC FLOOR PLAN

FLOOR PLAN LEGEND

- 35,570 SF ADDITION
- ORIGINAL FOOTPRINT



FIRST FLOOR FURNITURE PLAN 1/16" = 1'-0" (1)

720 design
www.720design.net
9003 Oakpath Lane
Dallas. TX 75243
214.770.2320
Maureen Arndt Wertzberger

NEW BRAUNFELS PUBLIC LIBRARY

PROJECT ADDRESS:

700 EAST COMMONS ST.
NEW BRAUNFELS, TX 78130

DESIGN ARCHITECT:

720 DESIGN, INC.

.

SEAL:

PROGRESS PRINT
THIS DOCUMENT IS INCOMPLETE AND MAY NOT BE USED FOR REGULATORY APPROVAL, PERMITTING, OR CONSTRUCTION. RELEASED UNDER AUTHORITY OF:
MAUREEN WERTZBERGER, AIA
TEXAS LIC. #16617

PROJECT NUMBER:

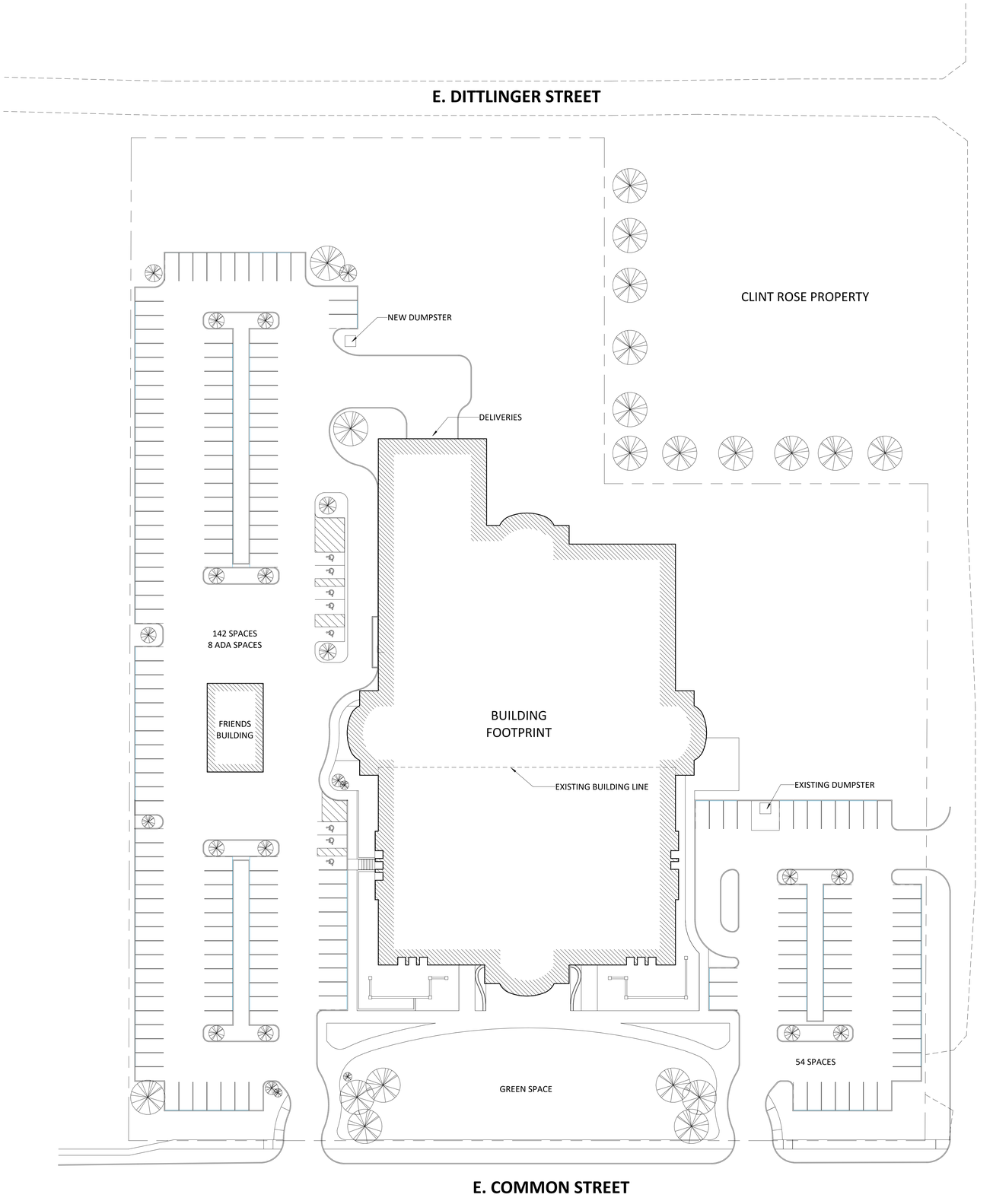
DATE: 2/25/21

ISSUE: .

FIRST FLOOR PLAN

I3.01

CONCEPTUAL SITE PLAN



SITE PLAN 1" = 30'-0" (1)

PARKING SUMMARY

OVERALL BUILDING SQUARE FOOTAGE	59,739 SF
REQUIRED PARKING SPACES - 3 SPACES/1000 SF	180
TOTAL PARKING SPACES	204
ADA PARKING SPACES	8
VAN ACCESSIBLE ADA PARKING SPACES	3

720 design
www.720design.net
9003 Oakpath Lane
Dallas. TX 75243
214.770.2320
Maureen Arndt Wertzberger

NEW BRAUNFELS PUBLIC LIBRARY

PROJECT ADDRESS:

700 EAST COMMONS ST.
NEW BRAUNFELS, TX 78130

DESIGN ARCHITECT:

720 DESIGN, INC.

.

SEAL:

PROGRESS PRINT
THIS DOCUMENT IS INCOMPLETE AND MAY NOT BE USED FOR REGULATORY APPROVAL, PERMITTING, OR CONSTRUCTION. RELEASED UNDER AUTHORITY OF:
MAUREEN WERTZBERGER, AIA
TEXAS LIC. #16617

PROJECT NUMBER:

DATE: 2/25/21
ISSUE: .

CONCEPTUAL SITE PLAN

A1.00

PART TWO

Main Library AMH Reconfiguration

DEMOLITION AND CONSTRUCTION PLANS

SCOPE OF WORK SUMMARY

1. DEMOLISH OR REMOVE ELEMENTS INDICATED ON DEMOLITION PLAN
2. PREP FLOOR AND INSTALL NEW FLOORING FROM LIBRARY EXISTING CARPET TILE ATTIC STOCK AS INDICATED ON FLOOR FINISH PLAN
3. PREP WALLS AND INSTALL NEW WALL TREATMENTS AS INDICATED ON WALL FINISH PLAN
4. PATCH, PRIME, & PAINT WALLS AS INDICATED ON WALL FINISH PLAN
5. INSTALL NEW CASEWORK AS INDICATED ON CONSTRUCTION PLAN
6. RECONFIGURE EXISTING GLASS SECTIONS FROM EXISTING CONFERENCE ROOM WALL

LEGEND

- MATERIAL TO BE REMOVED
- EXISTING TO REMAIN
- NEW CONSTRUCTION
- HATCHING DENOTES AREA OF SCOPE OF WORK

GENERAL DEMOLITION KEY NOTES

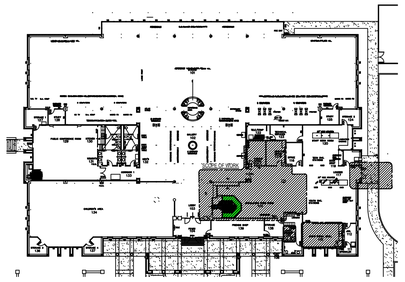
1. ALL WALLS ARE EXISTING TO REMAIN U.N.O.
2. ALL CEILINGS AND POWER RECEPTACLES ARE EXISTING TO REMAIN U.N.O.; PATCH AND REPAIR EXISTING GRID AS REQUIRED
3. REMOVE MILLWORK AS INDICATED ON PLAN
4. REMOVE SINK AS INDICATED ON PLAN
5. REMOVE PORTION OF GLASS WALL AT CONFERENCE ROOM AS INDICATED ON PLAN AND RETAIN FOR REUSE

CONSTRUCTION GENERAL NOTES

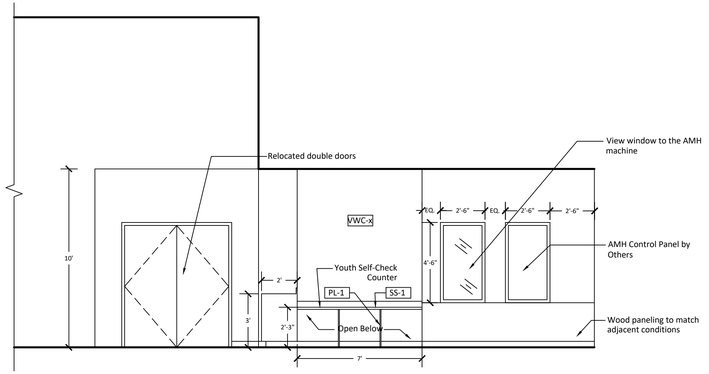
1. PROVIDE FIRE TREATED BLOCKING WITHIN WALL AS REQUIRED TO SUPPORT ANY ATTACHMENTS
2. PATCH & REPAIR WALLS AS NEEDED TO PROVIDE A FINISH READY SURFACE.
3. ENSURE EXISTING WALL TEXTURE IS SMOOTH & PREPARED TO RECEIVE NEW PAINT FINISH WHERE APPLICABLE.

CONSTRUCTION KEY NOTES

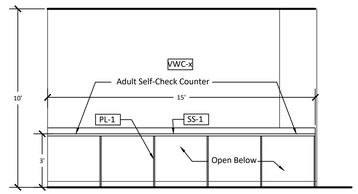
- A CIRCULATION WORK ROOM 107: REBALANCE LIGHTING - UPGRADE TO LED AS ADD ALTERNATE.
- B STAFF WOMEN 109 AND STAFF BREAK ROOM 110: UPGRADE VENTILATION.
- C PATCH AND REPAIR WITH EXISTING CARPET TILE FROM EXISTING ATTIC STOCK.
- D ESTIMATE 4 DUPLEX AND 5 DATA RECEPTACLES.
- E ADD A 24"x24" WINDOW KIT TO EACH EXISTING EXTERIOR DOOR.
- F DRIVE TO BE "ONE WAY" - CITY SIGN DEPARTMENT TO APPROVE



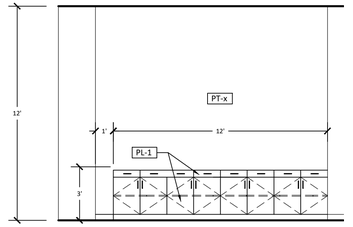
6 Scope Key Plan
Scale: NTS



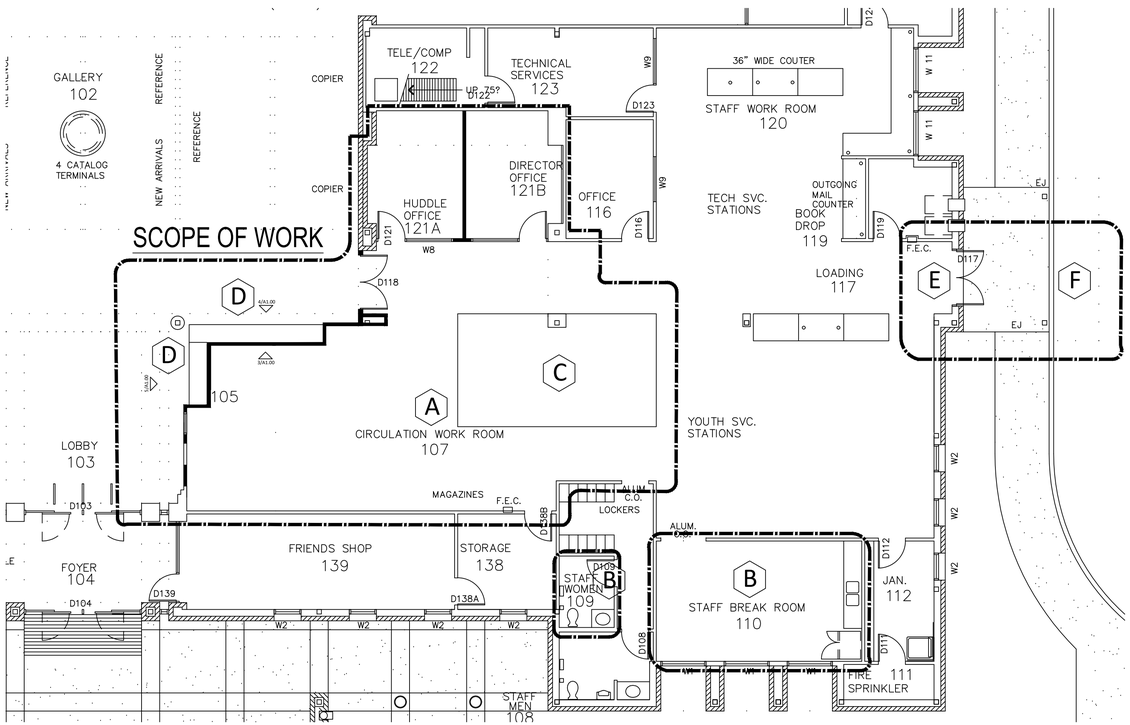
5 Elevation - Youth Self-Check
Scale: 1/4" = 1'



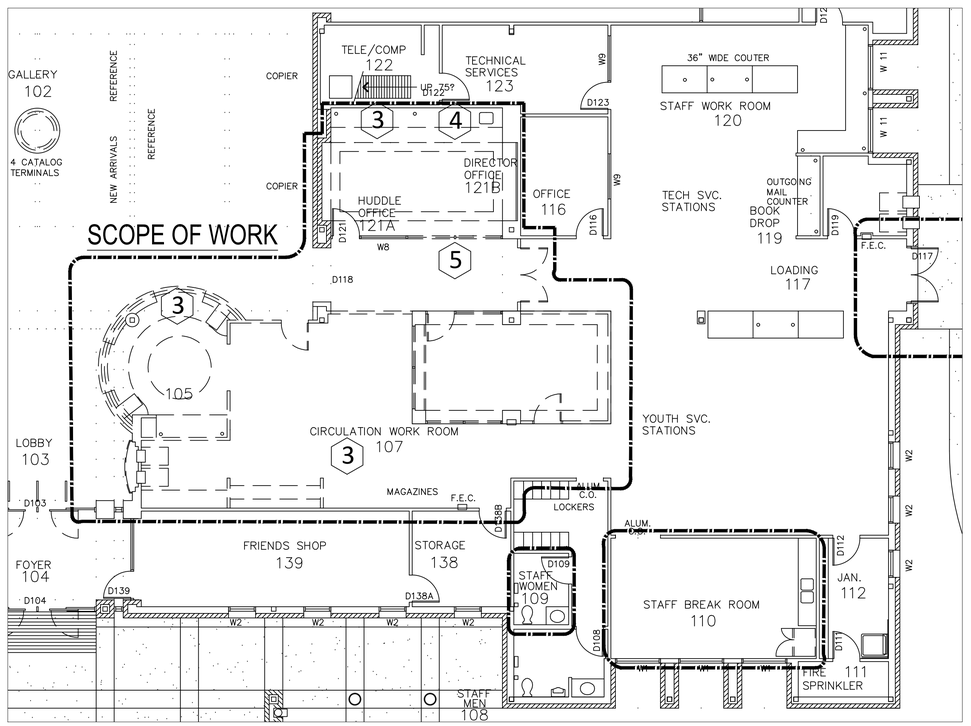
4 Elevation - Adult Self-check
Scale: 1/4" = 1'



3 Elevation - Circulation Workroom
Scale: 1/4" = 1'



2 Construction Plan
Scale: 1/8" = 1'



1 Demolition Plan
Scale: 1/8" = 1'

720 design
www.720design.net
9003 Oakpath Lane
Dallas. TX 75243
214.770.2320
Maureen Arndt Wertzberger

NEW BRAUNFELS PUBLIC LIBRARY

Location:
700 Block of East Commerce Street
New Braunfels, Texas

Architect:
720 Design Inc.

Project Number:
00152

DATE:	ISSUE:
17 Apr 20	Issue for Client Review

Scope of work , Demolition Plan and Construction Plan

A1.00

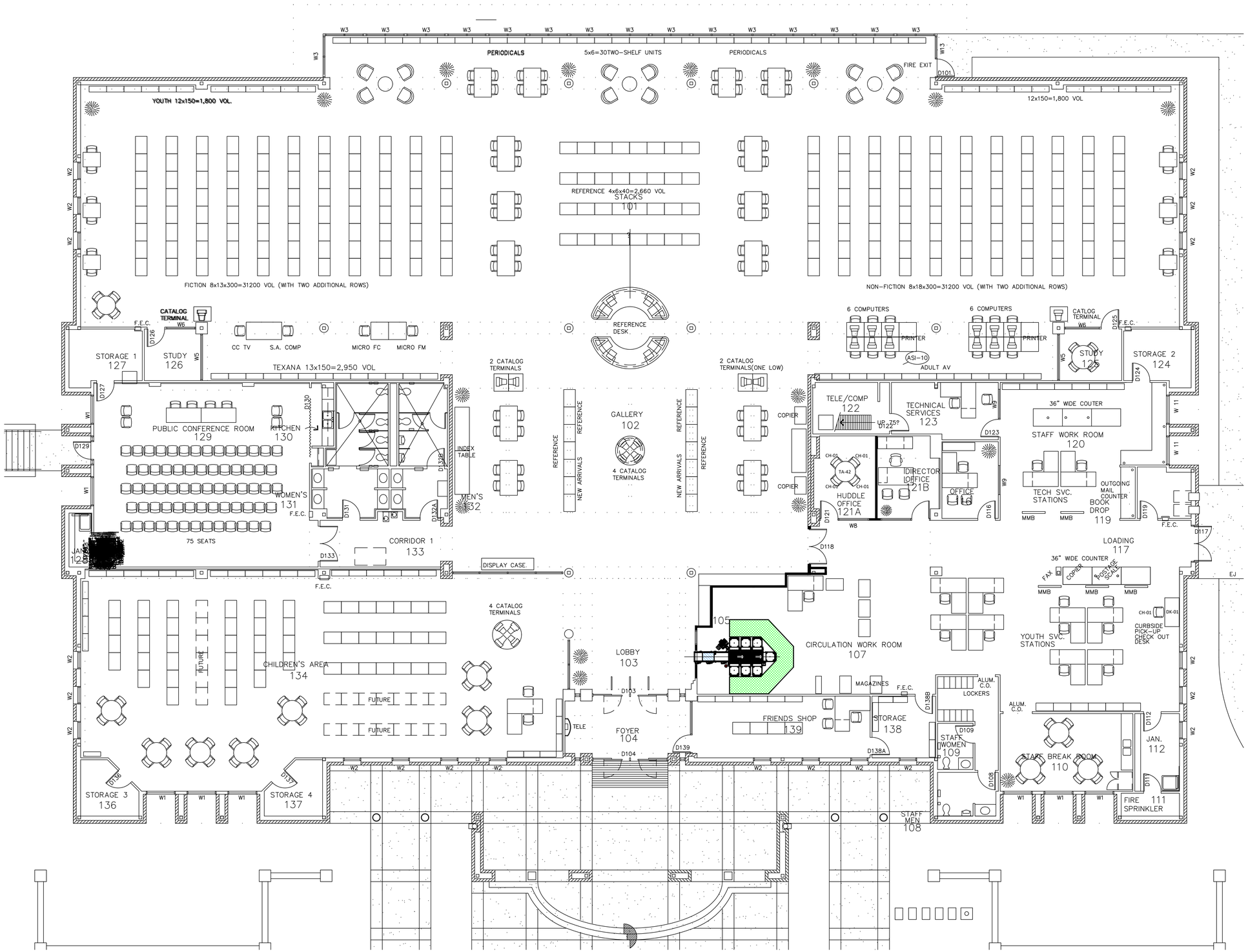
FURNITURE PLANS

720 design
www.720design.net
9003 Oakpath Lane
Dallas. TX 75243
214.770.2320
Maureen Arndt Wertzberger

NEW BRAUNFELS PUBLIC LIBRARY

Location:
700 Block of East Commerce Street
New Braunfels, Texas

Architect:
720 Design Inc.



1 **Schematic Plan**
Scale: 1/8" = 1'

Project Number:
00152

DATE:	ISSUE:
17 Apr 20	Issue for Client Review

Schematic Plan

SCH-1

City of New Braunfels

720 design
www.720design.net

FURNITURE TEST FIT
MAY 15, 2020

635.13 IPF
S 59°00'00"W GUY/WIRE
304.28'
652.32 IPF
TWIN/TREES
CLINT ROSE PROPERTY
222.22'
N 31°00'00"W
D.C.O.
CLEAN/OUT. 636.49
NEW 6" SANITARY SEWER PVC (SDR-35) @ 1% SLOPE, MINIMUM
IPF 645.30
S 59°00'00"W 208.72'
IPF
662.12 EP
18IN/MESQUITE
24IN/PECAN
SERV.POLE 638.32
GUY WIRE
645.00'
CATHOLIC CEMETERY
S 31°00'00"E
CLEAN OUT 639.36
P.POLE
FRIENDS STORAGE
6.531 ACRES
BOOKMOBILE 3340 SF
MECH
ATTIC/ SEASONAL STO
BOOK MOBILE WORK AREA
RR
RR
BOOK MOBILE STO
STAFF BREAK
QUIET READING ROOM 780 SF
STUDY 110 SF
STUDY 110 SF
STUDY 110 SF
STUDY 110 SF
SUPPLY
AS STO
YS STO
IDF
STAFF 4204 SF
CONF 300 SF
ADULT SEATING & COLLECTIONS
FICTION
NON FICTION
NEW RESTROOMS
FRIENDS 455 SF
REF
NEW & HOLDS
STUDY 110 SF
VESTIBULE
RECEP GREETER
BUSINESS 160 SF
MAIN SERVICE DESK 380SF
TECH COMMONS 1254 SF
CAFE 310 SF
MOVIES
MAKER STO
PANTRY
JUV MEDIA 335 SF
BLUE BON
YOUNG ADULT COLLECTION 860 SF
YOUNG ADULT SEATING 769 SF
YOUTH KIOSK
MULTI-PURPOSE AND SUPPORT SPACES 3810 SF
TABLE CHAIR STO
JUV TECH 1000SF
AS STO
MDF/ IDF
YS STO/PREP 351.79 sf
EXISTING RESTROOMS
STO
JAN
COMF
FAM RR
FAMILY PLACE 650 SF
JUV STORY 610 SF
JUV SEATING 1840 SF
STONE RETAINING WALL
JUV COLLECTION 7480 SF
2' WIDE FLUME
GUY WIRE
842.56 16IN/TREE
14IN/TREE
ENTEL TO EXTEND GAS SERVICE TO BUILDING
GAS METER
WATER FAUCET
DUMPSTER
WATER VALVE
WATER METER
20IN/MESQUITE
NG 656.33
SSMH TOP EL. 658.0 INV. EL. 649.5
PP
GUY/WIRE
422.78'
EP 654.56
650.50 EP
SSMH TOP EL. 649.93 INV. EL. 645.03
3"DOMESTIC WATER, COPPER
NEW FIRE HYDRANT
2' WIDE FLUME
648.29 22IN/MESQUITE
648.94 EP
NEW WATER METERS-2
6" FIRE LINE DUCTILE IRON, CLASS 50
6" VALVES W/BOXES
6"x 6" TEE
6"x 4" TEE
W 6"
N 59°00'00"E 513.00'
IPF 642.89
644.75 F/L
643.47 F/L
NBU/MON/NO.14 BENCH MARK ELEV. 644.48
CL/2 TREES
648.21 22IN/MESQUITE
F/L 645.79
648.08 14IN/MESQUITE
647.08 22IN/MESQUITE
647.88 F/L
22IN/MESQUITE
24IN/MESQUITE
IPF
F/L 648.11
TELE/SIGN
PP 648.22
NEW BRAUNFELS UTILITIES TO TAP MAIN AND PROVIDE PIPING TO PROPERTY LINE

AMH RECONFIGURATION
PROBABLE COST ESTIMATE

PROPOSED PROJECT COST BUDGET

OWNER PROJECT NO	City of New Braunfels Library	DATE PREPARED	7/3/2020
PROJECT TITLE	AMH Reconfiguration @ the Library	ANTICIPATED BID DATE	2020
PROJECT LOCATION	New Braunfels, TX	GROSS SQUARE FEET AREA	2,300
ARCHITECT/ENGINEER	720 design, Inc.	NET ASSIGNABLE SQUARE FEET	2,300
OWNER'S PROJECT MGR	Mr. Charlie Blue	EFFICIENCY %	
PREPARED BY	Maureen Arndt	SITE ACREAGE	0.00

1. LAND ACQUISITION COST 0.00

2. COST OF CONSTRUCTION

	$/Sq. Ft.	Cost
a. General Construction/Demo	10.00	23,000
b. Mechanical Systems Reconfig/ventilation	10.00	23,000
c. Electrical power reconfiguration	6.00	13,800
d. Flooring - repair with attic stock	3.00	6,900
e. Ceiling Repairs/reconfiguration	4.00	9,200
f. Millwork - 22 lf	200.00	4,400
g. Fire Sprinkler Reconfiguration	1.25	2,875
h. Interior walls - 720 SF	10.00	7,200
i. Add lites to existing doors	200.00	400
j. New Doors	1500.00	1,500
k. Storefront- 312 SF	75.00	23,400
l. Misc finishes (VWC, paneling)	8.00	18,400
m. Plumbing	0.00	0
n. Painting	2.00	13,600
o.		
p.		
Subtotal		189,075
l. 5% Design Contin (f)		9,454
m. 5% Constr Contin (f)		9,454
TOTAL		**207,983**

BUILDING CONSTRUCTION COSTS

3. ADD ALTERNATES

a. LED Lighting Upgrades (ALT #1)	16.00	36,800
TOTAL		**36,800**

4. FURNISHINGS & SIGNAGE - OWNER PROVIDED 24,000

a. Furnishing Allowance	20,000
b. Signage/Graphics	4,000

5. ESTIMATED ARCHITECTURE AND ENGINEERING (A/E) FEES

a. Programming Verification	0
b. Architectural Fee	25,518
c. MEP fee	10,000
d. Landscape Fee	0
e. Furniture & Signage	2,880
TOTAL A/E FEE	**38,398**

6. A/E REIMBURSABLE EXPENSES - OWNER

a. Facility Survey & Measured Drawings	0
b. Programming	0
c. Rendering/Model/Sketch	0
d. Record Drawings	0
e. Transportation	5,000
f. Rep & Dist of Plans & Specs	0
g. Misc. Reproduction	1,000
h. TDLR	1,215
i.	
j.	
TOTAL	**7,215**

7. OWNER DIRECT EXPENSES

a. IT/Computers	0
b. IT infrastructure Reconfiguration	20,000
c. Phones	0
d. AMH	0
e. Safe	0
f. Card Readers	0
g. Site Construction Testing	0
h. Project Contin-5%	9,454
I. Projector-Video Tech	0
j. Building Security	0
k. Building Security Subscription	0
TOTAL	**29,454**

9. SUMMARY

	Dollars	Sq. Ft.
a. LAND	0.00	0.00
b. CONSTRUCTION COSTS (SITE & BLDG)	207,983	90.43
c. Alternate Bids	36,800	16.00
d. FURNISHINGS & SIGNAGE	24,000	10.43
e. A/E FEE & EXPENSES	45,613	19.83
f. OWNER DIRECT COSTS	29,454	12.81
TOTAL PROJECT COSTS	**343,849**	149.50

Agenda Item No. A)

PRESENTER:
Caitlin Krobot - City Secretary

SUBJECT:
Discussion and or possible action to approve the minutes of the general city council meeting August 9, 2021, the special budget workshop August 9, 2021, the special budget workshop August 10, 2021, the special budget workshop August 12, 2021, and the special budget workshop August 16, 2021.

DEPARTMENT: City Secretary

City of New Braunfels, Texas

550 LANDA STREET

Minutes

Monday, August 9, 2021

6:00 PM

City Council

Rusty Brockman, Mayor - present
Shane Hines, Councilmember (District 1) -present
Justin Meadows, Mayor Pro Tem (District 2) - present
Harry Bowers, Councilmember (District 3) – present
Lawrence Spradley, Councilmember (District 4) – present
Jason Hurta, Councilmember (District 5) – present
James Blakey, Councilmember (District 6) – present

The meeting was called to order by Mayor Brockman at 6:05 p.m. Mayor ProTem Meadows gave the invocation and Mayor Brockman led the Pledge of Allegiance and Salute to the Texas Flag.

PROCLAMATIONS:

A) 2021 Childhood Cancer Awareness month

Mayor Brockman asked if anyone was present representing the aforementioned proclamation. No one was present to accept the proclamation. The proclamation was not read.

B) S'mores Day

Mayor Brockman asked if anyone was present representing the aforementioned proclamation. No one was present to accept the proclamation. The proclamation was not read.

C) Cat Osterman

Mayor Brockman read the aforementioned proclamation and presented the proclamation to Cat Osterman. Mayor Brockman expressed the city's pride in Cat Osterman calling her a hometown hero, a Texas hero, and an American hero.

CITIZENS' COMMUNICATIONS

This time is for citizens to address the City Council on issues and items of concerns not on this agenda. There will be no City Council action at this time.

There were no individuals who spoke at this time.

PRESENTATIONS:

A) Presentation regarding the New Braunfels Public Library's inaugural Community Read

Mayor Brockman read the aforementioned caption.

Gretchen Pruett presented this item.

1. MINUTES

A) Discussion and or action to approve the minutes from the Executive Session July 26, 2021and the General City Council meeting 07-26-2021.

Mayor Brockman read the aforementioned caption.

Councilmember Hurta moved to approve this item. Councilmember Blakey seconded the motion which passed unanimously via roll call vote.

2. CONSENT AGENDA

All items listed below are considered to be routine and non-controversial by the City Council and will be approved by one motion. There will be no separate discussion of these items unless a Councilmember or citizen so requests, in which case the item will be removed from the consent agenda and considered as part of the normal order of business. Citizens must be present to pull an item.

Resolutions & Action Items

A) Confirm the appointment of Paul Ericksen to the Civil Service Commission for a term ending August 10, 2024.

B) Approval of a contract with Data Projections, Inc for audio-visual design, consulting, equipment and installation services, and authorize the City Manager to execute any

change orders up to the contingency amount to support new buildings being constructed as a part of the 2019 bond program.

C) Approval of annual routine recurring expenditures for FY 2021 in accordance with City Charter Section 9.17.

D) Approval of a contract with Avfuel Corporation to provide aviation fuel to the New Braunfels Regional Airport.

E) Approval of a contract with All City Management Services, Inc. for school Crossing Guard services.

F) Approval of a contract with Westnet, Inc. for the purchase of First-In Alerting Automated Voice Dispatch Systems for Fire Station 2, Fire Station 3, and Police Headquarters.

G) Approval of the appointment of Tommy Carden and Jonathan Packer to the Workforce Housing Advisory Committee for unexpired terms ending November 11, 2022.

Ordinances

(In accordance with Section 3.10 of the City Charter, a descriptive caption of each ordinance shall be read on two separate days.)

H) First reading of an ordinance amending Section 2-130 of the City of New Braunfels Code of Ordinances to align the city manager's expenditure authority with the City Charter, as amended in the May, 2021 election.

I) First reading of an ordinance amending Section 2-56 of the City of New Braunfels Code of Ordinances to align all terms for city board and commissions to begin December 1 or June 1.

J) Approval of the second and final reading of an ordinance regarding a proposed rezoning of approximately 2.0 acres out of the Orilla Russell Survey No. 2, A-485 addressed at 696Orion Drive, from "APD AH" Agricultural/Pre-Development, Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home, Airport Hazard Overlay District.

K) Approval of the second and final reading of an ordinance regarding the proposed rezoning of approximately 105 acres out of the A. M. Esnaurizar A-20 Survey, addressed at 1621 FM 758, from "APD AH" Agricultural/Pre-Development, Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line, Airport Hazard Overlay District.

Councilmember Bowers asked to have consent item E pulled for individual consideration.

Mayor Brockman read consent items A-D and F-K into record.

Councilmember Hines moved to approve consent items A-D and F-K. Councilmember Bowers seconded the motion which passed unanimously via roll call vote.

3. INDIVIDUAL ITEMS FOR CONSIDERATION

E) Approval of a contract with All City Management Services, Inc. for school Crossing

Guard services.

Mayor Brockman read the aforementioned consent item 2- E.

Councilmember Bowers moved to approve this item. Councilmember Blakey seconded the motion which passed unanimously via roll call vote.

A) Discuss and consider approval of a resolution authorizing the City's intervention through the Alliance of Centerpoint Municipalities in proceedings at the Railroad Commission of Texas related to the implementation of House Bill 1520.

Mayor Brockman read the aforementioned caption.

Valeria Acevedo presented this item.

Councilmember Hines moved to approve this item. Councilmember Bowers seconded the motion which passed unanimously via roll call vote.

B) Discussion and approval of a resolution stating that the City elects to participate in property tax abatement pursuant to Chapter 312 of the Texas Tax Code and establish the City of New Braunfels' Tax Abatement Policy including guidelines and criteria relating to the abatement of taxes granted by the City.

Mayor Brockman read the aforementioned caption.

Councilmember Hurta moved to approve this item. Councilmember Spradley seconded the motion which passed unanimously via roll call vote.

4. EXECUTIVE SESSIONS

In accordance with Texas Government Code, Subchapter D, the City Council may convene in a closed session to discuss any of the following items; any final action or vote taken will be in public.

A) Deliberate pending/contemplated litigation, settlement offer(s), and matters concerning privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with Section 551.071, of the Texas Government Code, specifically:
- State Comptroller's rule amending the Texas Administrative Code, Section 3.334, relating to Local Sales and Use Taxes;
- Rafael Marfil, et al. v. City of New Braunfels.

B) Deliberate the purchase, exchange, lease or value of real estate in accordance with Section 551.072 of the Texas Government Code; and, Deliberate pending/contemplated litigation, settlement offers, and matters related to privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with

Section 551.071 of the Texas Government Code, specifically

- ROW Encroachment and Billboards

Mayor Brockman read Executive Session B. into record and recessed back into executive session at 6:42 p.m. continuing the unfinished executive session that proceeded the general city council meeting.

NOTE: The City Council reserves the right to retire into executive session concerning any of the items listed on this Agenda whenever it is considered necessary and legally justified under the Open Meetings Act (Chapter 551 of the Texas Government Code).

5. RECONVENE INTO OPEN SESSION AND TAKE ANY NECESSARY ACTION RELATING TO THE EXECUTIVE SESSION AS DESCRIBED ABOVE.

Mayor Brockman reconvened back into open session at 6:56 p.m.

No action was taken at this time.

ADJOURNMENT

Mayor Brockman adjourned at 6:56 p.m.

City of New Braunfels, Texas

550 Landa St.

Minutes

Monday, August 9, 2021

4:30 PM

Special City Council

Rusty Brockman, Mayor - present
Shane Hines, Councilmember (District 1) -present
Justin Meadows, Mayor Pro Tem (District 2) - present
Harry Bowers, Councilmember (District 3) – arrived at 6:15 p.m.
Lawrence Spradley, Councilmember (District 4) – present
Jason Hurta, Councilmember (District 5) – present
James Blakey, Councilmember (District 6) – present

The meeting was called to order by Mayor Brockman at 4:34 p.m.

1. WORKSHOP

A) Presentation and discussion regarding the Fiscal Year 2022 Proposed Budget and Plan of Municipal Services and the 2021 No New Revenue and Voter Approval tax rates.

Mayor Brockman read the aforementioned caption.

Robert Camareno presented this item providing a PowerPoint presentation and addressed questions from council.

B) Discuss and consider approval of the Proposed 2021 Tax Rate.

Mayor Brockman read the aforementioned caption.

Jared Werner presented this item providing a PowerPoint presentation and addressed questions from council.

Councilmember Hurta stated, "I move that the proposed tax rate be set at .475376 per $100 of valuation, which is effectively a 5.6% percent increase in the tax rate." Councilmember Spradley seconded the motion which passed unanimously via roll call vote.

C) Discuss and consider scheduling the public hearings on the 2021 tax rate and the FY 2022 Proposed Budget and Plan of Municipal Services.

Mayor Brockman read the aforementioned caption.

Jared Werner presented this item.

Councilmember Hines stated, "I make a motion to set the public hearing for the tax rate and Proposed Budget to be held at a meeting beginning at 6:00 p.m. Thursday, September 9, 2021 at 550 Landa Street, in the City Council Chambers or via Zoom at https://us02web.zoom.us/j/88043154501 or via telephone at 833-926-2300 Webinar ID 880 4315." Councilmember Bowers seconded the motion which passed unanimously via roll call vote.

2. EXECUTIVE SESSION

In accordance with Texas Government Code, Subchapter D, the City Council may convene in a closed session to discuss any of the following items; any final action or vote taken will be in public.

A) Deliberate pending/contemplated litigation, settlement offer(s), and matters concerning privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with Section 551.071, of the Texas Government Code, specifically:

- State Comptroller's rule amending the Texas Administrative Code, Section 3.334, relating to Local Sales and Use Taxes;
- Rafael Marfil, et al. v. City of New Braunfels.

B) Deliberate the purchase, exchange, lease or value of real estate in accordance with Section 551.072 of the Texas Government Code; and, Deliberate pending/contemplated litigation, settlement offers, and matters related to privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with Section 551.071 of the Texas Government Code, specifically

- ROW Encroachment and Billboards

Mayor Brockman read the aforementioned into record.

Mayor Brockman recessed into executive session at 5:41 p.m.

NOTE: The City Council reserves the right to retire into executive session concerning any of the items listed on this Agenda whenever it is considered necessary and legally justified under the Open Meetings Act (Chapter 551 of the Texas Government Code).

3. RECONVENE INTO OPEN SESSION AND TAKE ANY NECESSARY ACTION RELATING TO THE EXECUTIVE SESSION AS DESCRIBED ABOVE.

Mayor Brockman reconvened into open session at 6:05 p.m. with executive session to be continued under the general city council meeting.

No Action taken.

City of New Braunfels, Texas

550 Landa St.

Minutes

Tuesday, August 10, 2021

4:30 PM

Special City Council

Rusty Brockman, Mayor - present
Shane Hines, Councilmember (District 1) -present
Justin Meadows, Mayor Pro Tem (District 2) - present
Harry Bowers, Councilmember (District 3) – present
Lawrence Spradley, Councilmember (District 4) – present
Jason Hurta, Councilmember (District 5) – present
James Blakey, Councilmember (District 6) – arrived at 4:34 p.m.

The meeting was called to order by Mayor Brockman at 4:30 p.m.. Mayor Brockman led the Pledge of Allegiance and Salute to the Texas Flag.

1. WORKSHOP

A) Discuss and consider possible action regarding the Fiscal Year 2022 Proposed Budget and Plan of Municipal Services and the proposed 2021 tax rate and announce public hearings.

Mayor Brockman read the aforementioned caption.

Jared Werner and Robert Camareno presented this item providing a PowerPoint and addressed questions from Council.

No action was taken.

Mayor Brockman adjourned the meeting at 6:01 p.m.

City of New Braunfels, Texas

550 Landa St.

Minutes

Thursday, August 12, 2021

4:30 PM

Special City Council

Rusty Brockman, Mayor - present
Shane Hines, Councilmember (District 1) -present
Justin Meadows, Mayor ProTem (District 2) - present
Harry Bowers, Councilmember (District 3) – present
Lawrence Spradley, Councilmember (District 4) – present
Jason Hurta, Councilmember (District 5) – present
James Blakey, Councilmember (District 6) – arrived at 4:42 p.m.

The meeting was called to order by Mayor Brockman at 4:34 p.m. Councilmember Spradley gave the invocation and Mayor Brockman led the Pledge of Allegiance and Salute to the Texas Flag.

1. WORKSHOP

A) Discuss and consider possible action regarding the Fiscal Year 2022 Proposed Budget and Plan of Municipal Services and the proposed 2021 tax rate and announce public hearings.

Mayor Brockman read the aforementioned caption.

Jared Werner presented this item providing a PowerPoint and addressed questions from Council.

No action was taken.

Mayor Brockman adjourned the meeting at 5:11 p.m.

City of New Braunfels, Texas

550 Landa St.

Minutes

Monday, August 16, 2021

4:30 PM

Special City Council

Rusty Brockman, Mayor - present
Shane Hines, Councilmember (District 1) -present
Justin Meadows, Mayor ProTem (District 2) - present
Harry Bowers, Councilmember (District 3) – present
Lawrence Spradley, Councilmember (District 4) – present
Jason Hurta, Councilmember (District 5) – present via Zoom
James Blakey, Councilmember (District 6) – arrived via Zoom at 4:42 p.m.

The meeting was called to order by Mayor Brockman at 4:30 p.m. Councilmember Bowers gave the invocation and Mayor Brockman led the Pledge of Allegiance and Salute to the Texas Flag.

1. WORKSHOP

A) Discuss and consider possible action regarding the Fiscal Year 2022 Proposed Budget and Plan of Municipal Services and the proposed 2021 tax rate and announce public hearings.

Mayor Brockman read the aforementioned caption.

Robert Camareno and Jared Werner presented this item and introduced Jonathan Packer, the president and CEO of the New Braunfels Chamber of Commerce who spoke on this item.

No action was taken at this time.

B) Discuss and consider approval of an Ordinance Authorizing the Issuance of City of New Braunfels, Texas General Obligation Bonds, Series 2021; Authorizing the Levy of An Ad Valorem Tax In Support of The Bonds; Approving An Official Statement, A Bond Purchase Agreement, A Paying Agent/Registrar Agreement, And Other Matters Relating to the Issuance Of The Bonds.

Mayor Brockman read the aforementioned caption.

Jared Werner presented this item and introduced Mark McLiney, a financial advisor with Samco Captial Markets, who gave a presentation and addressed questions from Council.

Councilmember Hines moved to approve this item. Mayor ProTem Meadows seconded the motion which passed unanimously via roll call vote.

C) Discuss and Consider Approval of an Ordinance Authorizing the Issuance of City of New Braunfels, Texas Tax Notes, Series 2021; Approval of An Official Statement and A Paying Agent/Registrar Agreement; Prescribing the Form of the Note; Levying An Ad Valorem Tax to Pay the Note; Awarding the Sale Thereof; and Enacting Other Provisions Relating to the Issuance of the Notes

Mayor Brockman read the aforementioned caption.

Jared Werner presented this item and turned the presentation over to Mark McLiney, a financial advisor with Samco Captial Markets, who gave a presentation and addressed questions from Council.

Councilmember Spradley moved to approve this item. Councilmember Hines seconded the motion which passed unanimously via roll call vote.

Adjournment

Mayor Brockman adjourned the meeting at 5:24 p.m.

PRESENTER:
Christopher J. Looney, AICP, Planning and Development Services Director
SUBJECT:
Approval of a resolution regarding a request from the Heritage Society of New Braunfels to waive the application fee for a rezoning to apply a Special Use Permit to allow short term rental of a single-family residence in the C-1 Local Business District at 1370 Church Hill Drive.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: 5

BACKGROUND INFORMATION:
Applicant/
Owner: Heritage Society of New Braunfels
Justin Ball, Executive Director
1370 Church Hill Drive
New Braunfels, TX 78130
(210) 246-2006 director@nbheritagesociety.org

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

The Heritage Society of New Braunfels, a 501(c)3 corporation, is requesting a waiver of fees associated with the proposed rezoning application to allow short term rental of a residence on the museum property commonly known as the Heritage Village.

ISSUE:
The Heritage Society of New Braunfels has operated the Heritage Village and the Museum of Texas Handmade Furniture on Church Hill Drive since 1985 with the mission to preserve the history of New Braunfels. This request for fee waivers would apply to all application related fees for the short term rental of a single apartment unit located at 1370 Church Hill Drive.

The proposed fee waiver is consistent with the following action from Envision New Braunfels

- *Action 3.35:* Support local non-profits whose mission includes Comprehensive Plan goals.
- *Action 8.3:* Foster opportunities for collaboration with local non-profits.

FISCAL IMPACT:
Application fees offset the costs associated with the City's examination of plans and processing of development applications, thereby reducing the impact to the taxpayer. If approved, the waiver would result in a reduction of application revenue to the Development Services Fund.

- Special Use Permit base application fee: approximately $2,513 - the applicant is intending to pay all additional fees associated with the application/use (newspaper notice, signs, mailings and inspection fees)

RECOMMENDATION:
Approval. Staff supports application fee relief or discounts for not-for-profit organizations. The City Council has provided reduced fees or discounts for such organizations for a variety of development-related fees such as street banners, special event permits, building permits, platting fees and health permits. The Heritage Society of New Braunfels is a not-for-profit entity that provides services to the community and relies on local contributions and assistance for support.

Attachments:
1. Applicant's Request

2. Location Map

3. Ordinance

HERITAGE SOCIETY OF NEW BRAUNFELS

1370 CHURCH HILL DR NEW BRAUNFELS, TX 78130
WWW.TEXASHANDMADEFURNITURE.ORG

MUSEUM · OF · TEXAS HANDMADE · FURNITURE

KINDERMASKEN PARADE & BALL

FOLK FEST

July 15, 2021

Chris Looney, Planning and Zoning
Mayor Rusty Brockman
City Council Members
City of New Braunfels
550 Landa Street
New Braunfels, Tx 78130

Mr. Mayor and City Council Members,

The Heritage Society of New Braunfels inc. (a 501(c)3 Non profit) has operated Heritage Village and the Museum of Texas Handmade Furniture located at 1370 Church Hill Dr since 1985 with the mission to preserve and protect the History and Heritage of New Braunfels and Comal County through our museum and community outreach programs. As the unprecedented growth that our city has experienced in the past few years continues, it is important for us to find new and innovative ways to make our organization financially sustainable so that we can continue bringing the people of New Braunfels the high quality, family friendly, educational programming that they have come to expect.

To that end, the Heritage Society is seeking to make use of the single unit, 450 square foot apartment located in an outbuilding located on our historic campus that recently underwent renovations as a short-term rental. After reviewing the requirements to obtain licensure through the city planner's office, it was discovered that the fees for the license for this project would cost us in excess of $4000.00. Our board of Directors feels that this amount is excessive and would put undue stress on our budget without a variance from the city. It is with this in mind that we humbly ask City Council to consider waiving the fees associated with the permitting of the museum's single unit to let out as a short-term rental.

Thank you for your time and consideration regarding this matter,

Justin Ball
Executive Director
Heritage Society of New Braunfels inc
Director@nbheritagesociety.org
830-629-6504

City of New Braunfels

PLAT21-WVR21-260

Heritage Society - Fee Waiver

0 110 220 Feet

N

DISCLAIMER: This map and information contained in it were developed exclus
for use by the City of New Braunfels. Any use or reliance on this map by an
else is at that party's risk and without liability to the City of New Braunfels,
officials or employees for any discrepancies, errors, or variances which may exist.

Path:
Y:\Tools\Tools\PLN_NotificationTool\NotificationTool.aprx

Source: City of New Braunfels Planning
Date: 8/5/2021

RESOLUTION NO. 2021R-

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, WAIVING FEES ASSOCIATED WITH THE ZONING AND INITIAL SHORT TERM RENTAL PERMIT FOR A PROPOSED SHORT TERM RENTAL TO BE LOCATED AT 1370 CHURCH HILL DRIVE TO BE OPERATED BY HERITAGE SOCIETY OF NEW BRAUNFELS.

WHEREAS, the adopted Envision New Braunfels Comprehensive Plan recommends the City foster opportunities for collaboration with local nonprofits, and that the City maintain its friendly business and resident regulatory climate; and

WHEREAS, the Envision New Braunfels Comprehensive Plan also sets a goal to increase and improve the understanding, appreciation, and learning of historic and cultural assets; and

WHEREAS, the Heritage Society of New Braunfels is a not-for-profit corporation with a mission to serve the community by preserving the history and heritage of New Braunfels through the Heritage Village and the Museum of Texas Handmade Furniture ("Museum"); and

WHEREAS, the City Council of the City of New Braunfels wishes to provide support to Heritage Society of New Braunfels because of their ongoing efforts to make New Braunfels a better place to live by preserving its rich history; now, therefore;

BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

THAT, we hereby waive all fees associated with the zoning and initial short term rental permit for a proposed short term rental to be located at 1370 Church Hill Drive, and the City Manager is hereby directed to implement this waiver of fees immediately.

PASSED, ADOPTED AND APPROVED this the 23rd day of August, 2021.

CITY OF NEW BRAUNFELS, TEXAS

Rusty Brockman, Mayor

ATTEST:

Caitlin Krobot, City Secretary

PRESENTER:
Christopher J. Looney, AICP, Planning & Development Services Director

SUBJECT:
Approval of amendments to the agreement between the City of New Braunfels, Texas and the Humane Society of the New Braunfels Area, Inc.

DEPARTMENT: Planning & Development Services

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
In 2012, the City of New Braunfels entered into an agreement with the Humane Society of the New Braunfels Area, Inc. (HSNBA), a local not-for-profit, to share administration and operation of various animal-related services for the community. This included shared use of the animal shelter for impoundments, details on quarantine services, and parameters for the welfare of animals in shelter care. The agreement was updated by City Council in 2015, and again in 2018. Agreements between the two entities include fees for animal intake, administrative costs, and facility use which includes mortgage contribution. HSNBA has similar agreements with Comal County and the City of Marion, minus administrative and facility use fees.

ISSUE:
Like all not-for-profits, HSNBA relies on charitable donations and volunteers to accomplish their mission. HSNBA continues to experience increased costs associated with vaccinations, population increases, personnel retention and recruitment, and general inflation. Additionally, the City's agreed-to monthly contribution to the building's mortgage will expire in 2022. HSNBA and the City collaborated on this proposed update to address these issues and better align recurring income and expenditures.

Following is a summary of the proposed edits:

- Updating the term of the agreement
- Alphabetizing definitions of terms
- Restructuring the animal intake fee methodology from per animal, to a rolling 3-year average to better predict revenue/cost for service/budget on both sides
- Streamlining of fees for quarantine services
- Clarification of terminology to know what the fees are intended to cover

- Streamlining and adding clarifying detail to the reporting and financial document sections
- Various grammar corrections
- Terminology, position/title, legal, and division name updates throughout

Updating this agreement as proposed is supported by Envision New Braunfels as follows:

- Action 3.35: Support local non-profits whose missions support the Comprehensive Plan goals
- Action 8.3: Foster opportunities for collaboration with local non-profits

FISCAL IMPACT:
The fiscal impact associated with the proposed edits will be approximately $50,000 additional dollars towards the contract in FY 2022, a result of the increased and streamlined animal intake fee referenced above. These additional funds have been incorporated into the FY 2022 Proposed Budget. However, in FY 2023 and beyond, the total cost associated with the contract will actually revert back to current levels, due entirely to the intended sunset of the facilities use fee payment that will expire at the end of FY 2022.

RECOMMENDATION:
Approval

THE STATE OF TEXAS §

§ KNOW ALL MEN BY THESE PRESENTS

COUNTY OF COMAL §

SECOND

AMENDMENT TO

AGREEMENT

This Agreement, by and between the City of New Braunfels, a Home Rule Municipal Corporation located in Comal and Guadalupe Counties, Texas, hereinafter referred to as the "City," and the Humane Society of the New Braunfels Area, Inc., a Texas Non-Profit Corporation located in New Braunfels, Comal County, Texas, hereinafter referred to as the "Humane Society," shall upon approval and execution by the parties described herein, automatically terminate all other previous contractual agreements between the City and the Humane Society.

WITNESSETH

WHEREAS, the City and the Humane Society entered into an Agreement for the management to operate and maintain animal control services and well as operating and maintaining an animal care facility for the purpose of sheltering lost or abandoned animals until humanely disposed of in accordance with its principles and all applicable state and local rules and regulations; and

WHEREAS, the City agrees with the Humane Society, and local veterinary medical providers that providing preventive vaccination services to animals at intake improves the health and welfare of animals in shelter care, and

WHEREAS, the City has a continuing need for animal impoundment facilities to house, board and keep animals collected by City Animal Control Officers, City appointed agents(s), and/or residents of the City of New Braunfels; and

WHEREAS, the City Council of the City of New Braunfels authorizes the City Manager to amend the previous Animal Control Services Contract with the Humane Society of the New Braunfels Area, Inc.

NOW THEREFORE, it is hereby agreed that all animals collected by the aforementioned parties shall be impounded for the time prescribed by the City's animal control ordinances and the policies adopted by the Humane Society at the Humane Society's shelter in accordance with the terms, conditions and agreements as follows:

1. Definitions: For the purposes of this Agreement the following terms are defined as follows:

A. "City" means and refers to the City of New Braunfels, in Comal and Guadalupe Counties, Texas.

B. "Humane Society" means and refers to the Humane Society of the New Braunfels Area, Inc. "Shelter"

C. "Animal Control Ordinances" means and refers to City of New Braunfels Code of Ordinances. Chapter 6 – Animals, and all amendments thereto.

D. "Shelter" and "Premises" are used interchangeably and both refer to and mean the Humane Society's animal shelter, currently located at 3353 Morningside Drive, New Braunfels, Texas, and any subsequent location.

E. "Animal" or "animal" means every nonhuman species of animal, both domestic and wild.

F. "Animal Fees" means the total revenue collected by the City over a twelve (12) month period, defined herein, for dog and cat licensing fees, impoundment fees, commercial animal establishment fees and fines and fees collected through the New Braunfels' Municipal Court, excluding court costs, for violations of the City's Animal Control Ordinance.

G. "Major holidays" means and refers only to those holidays observed by the Humane Society limited to fourteen (14) per year.

H "Quarantine" or "Quarantine Services" means and refers to the strict confinement, for the purpose of preventing the spread of disease, under restraint by closed cage, isolation, kennel, rabies chamber, paddock, or any other manner approved by the local health authority on the premises of the Humane Society.

I. "Quarantine Period" means that portion of the observation period during which an animal is physically confined for observation as provided for under section 6-109 of the City's Code of Ordinances as amended.

J.

2. Term: This Agreement shall begin on January 1, 2019, the effective date, and shall continue for a period of three (3) years, unless sooner terminated by either party by giving written notice of its desire to terminate this Agreement ninety (90) days prior to the desired effective termination date. Option to Extend; this contract may be extended provided all terms and conditions, except for the contract period being extended or any price redetermination as authorized elsewhere in this contract, remain unchanged and in full force effect. Option to Extend, if exercised is to be executed in the form of a Modification/Supplemental Agreement, to be issued not sooner than ninety (90) days prior to expiration of this contract, not later than the final day of the contract period. This Option to Extend requires the mutual agreement of both parties. Refusal by either party to exercise

this Option to Extend shall require this contract to expire on the original or mutually agreed date. The normal extension period shall be in one (1) year increments.

3. Animal Control Responsibilities: The Humane Society's responsibility for a seized animal shall not begin until the animal has been placed in the custody of the Shelter. The City agrees that all animals apprehended within the confines of the City by Animal Control Officers or the City's duly appointed agents shall be delivered either to the Humane Society Animal Shelter or the animal's owner. Once impounded, animals shall remain under the control and custody of the Humane Society for such period of time as required under state law and the City's Animal Control Ordinances except as hereinafter stipulated.

4. Quarantine Services: The Humane Society agrees to provide Quarantine Services to the City, in accordance with State and local laws, for animals placed into quarantine with the Shelter by City personnel or its authorized agents, in return for the agreement to reimburse the Humane Society for quarantine expenses not recovered from the owner of the quarantined animal (limited to $450.00 maximum per year), specifically: (1) holding fees at $18.00 per day, maximum of 3 days per animal; (2) rabies vaccinations at $10.00 per vaccination; and (3) veterinary certifications at $35.00 per certification. The Humane Society acknowledges and agrees that it shall use its best efforts to obtain payment from the owner of the animal first and seek reimbursement from the City only after its attempts at collection of the expenses have failed. The City acknowledges that the Shelter may be required to raise quarantine service fees in response to market events, however, the City's potential total reimbursement responsibility shall be limited to a maximum of $450.00 per year.

5. Payments:

A. Impound Fees - Beginning October 1, 2018, the City shall pay to the Humane Society an impoundment fee of Eighty Five Dollars ($85.00) for each animal delivered to the Shelter by the City's Animal Control Officers, appointed agents or residents of the city. The impoundment fee includes the costs of impoundment and vaccination of the animals. The City and the Humane Society will annually negotiate, in good faith, revisions to the impoundment fee. In order to calculate the amount owed by the City, the Humane Society agrees to provide the City a monthly statement, signed by the Humane Society's designated official, listing all animals delivered to the Shelter during the previous month. The City agrees to tender payment to the Humane Society within 30 days of receipt of the Humane Society's signed, detailed statement.

B. Disposal Fees - The Humane Society agrees to turnover to the City on a monthly basis, all animal disposal fees and costs collected by the Shelter. The City agrees to pay the disposal costs for animal remains accumulated at the Shelter and to provide appropriate personnel when available, to assist Shelter personnel in the preparation and delivery of animal remains to a proper disposal site. The City agrees that should City personnel not be available on a timely basis to assist in the preparation and delivery of animal remains to the disposal site when requested by the Humane Society, then the Humane Society may utilize disposal fees and costs collected by the Shelter, to pay for preparation and transport of animal remains to a proper waste disposal site.

C. Monthly Payments - In addition to the impoundment fee stated above, the City shall pay the Humane Society on a monthly basis, on or before the (15th) of each month, an Administrative Fee of $4,000. Effective October 1 of each year, the City agrees to an annual increase in the monthly administrative fee amount paid the Society through October 1, 2022, in the amount of an additional one hundred Dollars ($100.00). After this period, the City will negotiate in good faith revisions to the monthly administrative fee with the Humane Society.

D. Facility Use Fee Payment - The City shall pay to the Humane Society on a monthly basis, on or before the (15th) of each month, a Facilities Use Fee in the amount of $4,167 in consideration for office space, utilities, facilities, and the enumerated operational services herein provided to the animal control services division. The total amount of the Facilities Use Fee paid shall not exceed $500,000; inclusive of the previous amounts paid under the terms of the original contract dated October 1, 2012. Once this total amount has been paid, the Facilities Use Fee shall terminate and the City shall have no further obligation to the Humane Society regarding this Facilities Use Fee.

E. Impoundment and License fee payments - The Humane Society shall pay to the City on a monthly basis, on or before the fifteenth (15th) day of each month, all impoundment and license fees collected or received by the Humane Society, including those license fees collected by authorized providers and turned over to the Humane Society.

F. Quarantine Fee Reimbursement - The City shall reimburse the Humane Society up to $450.00 per year, for quarantine expenses not collected from owners of animals quarantined at the Humane Society shelter. The Humane Society agrees to provide a detailed invoice and copies of documents indicating its collection efforts for each animal for which the Society seeks reimbursement.

6. Records and Reports:

A. The Humane Society shall be the central records depository for the City for records pertaining to the City's Animal Control Ordinances. The Humane Society shall maintain, at its expense, a computer system to facilitate said record keeping. Such records shall include those listed below.

B. The Humane Society shall provide the City a monthly report, in addition to the statement described in Section 5(A) above, that provides the following information on a per month basis for animals brought in by City Animal Control Officers, Appointed Agents or City residents:

1. The number of animals received sorted by:
   a. Animals delivered by the City's Animal Control Officers and Appointed Agents.
   b. Animals not delivered by the City's Animal Control Officers and Appointed Agents.
2. The number of animals euthanized.
3. The number of animals adopted.
4. The number of animals redeemed.
5. The number of animal control calls taken.
6. The total amount of impoundment fees collected.
7. The number of summons issued by the City's Animal Control Officers.
8. The number of City licenses issued, sorted by those issued by:
   a. The Humane Society.
   b. Local veterinarians, sorted by each veterinarian, if applicable.
9. The amount of City license fees collected, sorted by the amounts collected by the:
   a. Humane Society.
   b. Local veterinarians, sorted by each veterinarian, if applicable.

C. The Humane Society agrees to submit to the City prior to January 1st of each year, a copy of their projected and proposed fiscal budget for the upcoming fiscal period detailing funding, planned operations, and any capital investments on assets, liabilities and equities. The Humane Society further agrees to submit to the City prior to February 1st of each year a copy of its final operating budget for that year, which shall cover the time period of January 1st through December 31st. All

financial statements and reports shall be on forms approved by the City. In addition, the Humane Society agrees to allow the City to audit, at the City's expense, the Humane Society's books, financial and otherwise, maintained by the Humane Society, provided the City provides at least five (5) days written notice of its intent to perform an audit. The Humane Society agrees to provide the City and its auditors with complete access to all records necessary to perform said audit.

D. The Humane Society agrees to meet with the City quarterly to review financials and other above information in a mutual effort to ensure and maintain fiscal health for the benefit of the taxpayers.

7. Operation: The Humane Society agrees to operate and maintain the Shelter in a safe, humane and businesslike manner, in compliance with all State regulations and in a manner comparable with other animal shelters. Without limiting the foregoing, operation of the Shelter shall include the following:

A. Hours of operation – Animal Control officers shall have twenty-four (24) hour access to the Shelter for the delivery of animals. The Shelter's hours of operation shall be conspicuously posted at the Shelter and viewable by the public twenty-four (24) hours a day, seven days a week.

Excluding major holidays and two (2) days of required training, the Shelter will be open to the public each week a minimum of thirty-six (36) hours, as follows:

1. Monday through Friday- Thirty (30) hours minimum.

2. Saturday and Sunday- Six (6) hours minimum, with at least four (4) hours on Saturday.

B. Dispatch - The Humane Society shall provide dispatch service for Animal Control Officers during the thirty-six (36) hours of public operation outlined above. In addition, the Humane Society shall provide an additional twelve (12) hours of dispatch service whether or not the shelter is open to the public. The Shelter shall provide dispatch service at least six (6) days per week for a minimum of forty-eight (48) hours total dispatch service per week. The Shelter is not required to provide dispatch service when the Shelter is closed for major holidays.

C. Equipment - The City shall provide, install, maintain, and pay for the following equipment for use by the Shelter in providing dispatch services:

1. Telephone - A dedicated telephone and telephone line with a separate directory listing for Animal Control at the Shelter. The telephone shall be equipped with call forwarding or other such switching device as to allow the routing of calls

to the City's Police Dispatch when the Shelter is closed. The Humane Society agrees not to use the line for other Shelter business.

2. Radio – Radio dispatch equipment, including but not limited to the placement of a base radio and antenna at the Shelter.

D. Ownership of animals delivered to Shelter - The City agrees, to the extent permitted by law, that every dog, cat or other animal, licensed or unlicensed, not claimed or redeemed by the owner before the expiration of the dates specified in the City's Animal Control Ordinances, shall become the sole and exclusive property of the Humane Society, so that neither the City nor any agency of the City shall have any claim or right to said animals. Once an animal has become the property of the Humane Society, it may sell any animal, save and except for dogs and cats, according to the procedures outlined in the City's Animal Control Ordinances and all sale proceeds shall be the property of the Humane Society.

E. Disposal of animals - The City agrees that the Humane Society may, in accordance with its principles humanely dispose of every animal placed in its custody, in a manner consistent with the City's Animal Control Ordinances.

The Humane Society is authorized to euthanize any animal placed in its custody by the City or the City's agents, and not redeemed or adopted within the time periods outlined in the City's Animal Control Ordinance. An animal may be immediately euthanized if its owner cannot be readily determined or contacted and when in the opinion of the Animal Control Officer, the Shelter Director or their designees, and in consultation with a licensed veterinarian, it would be more humane to euthanize the sick or injured animal than to attempt to preserve its life for the designated impoundment/holding periods set forth in the Animal Control Ordinance.

F. Shelter Conditions - The Humane Society agrees to provide suitable, safe and sanitary kennels, cages and pens for the impoundment of all animals in its custody and shall be responsible for their safekeeping for the impoundment periods as set forth in the City's Animal Control Ordinance.

G. Liability - The Humane Society shall not be held liable to any person for the detention of any animal delivered to the Shelter by the City or its agent, provided the detention is in accordance with the City's Animal Control Ordinances.

H. Employment – Nothing in this Agreement shall be construed as altering the employment status of the City's Animal Control Officers. Animal Control Officers are City employees under the Animal Services division of the City. Disciplinary authority over Animal Control Officers shall be the exclusive domain of the City. The City is responsible for providing all vehicles equipment, salaries; dispatch forms,

records, office supplies and photocopy services to be utilized by the City's Animal Control Officers. All such equipment and supplies provided by the City shall remain the property of the City.

I. Additional Considerations - The Humane Society agrees to provide office space for City Animal Control Officers for the duration of the contract. The Humane Society agrees to provide all customary utility services for animal control operations. The Society agrees to provide the following animal control services, including but not limited to housing, intake functions, isolation and quarantine facilities, and targeted medical treatment. The Humane Society further agrees to the following:

1. The Society will strive to continue to reduce euthanasia, promote the humane treatment of animals, promote enhanced animal adoptions and fostering, advocate proactive Spay/Neuter initiatives, community education, and provide safe harbor for animals afflicted by neglect, abandonment and abuse, and in pursuit of such the Society agrees to maintain representation on the City's Animal Shelter Advisory Board as currently structured.
2. The Society agrees to develop, provide, and maintain a web based computer software program which shall be made available to the City Animal Control Division. The computer software program will allow animal control officers the capability to remotely access the information collected and documented by the Society, including but not limited to current animal intake information, impoundment status, calls for service demographical details, animal vaccination and licensing information and other similar particulars.
3. The Society agrees that the City shall have first right of refusal to purchase the property if the Humane Society decides to sell or vacate the premises. Additionally, the City shall be afforded the right to purchase the real and personal property at the fair market value determined by appraisal at the time of sale. The final purchase price amount shall be equal to the difference remaining, after the City deducts all accrued facilities use fee amounts paid to the Shelter, as described in Section (5) D, at the time of sale. If the City decides not to purchase the facilities, the Humane Society will reimburse to the City, from sale of proceeds, the total accrued facilities use fee payment amounts paid to the Society at that time.
4. The Society agrees to contact and notify the City within twenty-four (24) hours of any potential or actual material changes impacting the operation of the facility, changes which may include, but are not limited to the following reportable events: (1) Signs or symptoms of potential or actual zoonotic disease transmission or

similar communicable disease outbreak conditions;

(2) Adding to or reducing indoor or outdoor space(s);

(3) Reducing the number of currently existing quarantine units;

(4) Receiving notice of failure or substandard compliance with statutory minimum standards pursuant to applicable Texas Department of State Health Services inspection reviews;

(5) Changing the type of animals to be cared for;

(6) Changing the hours, days, or months of operation;

(7) Offering new services, which may fiscally affect contractual stipulations found in this contract; or

(8) Closing temporarily.

5. The Society agrees to provide a copy of the Texas Department of State Health Services facility inspection report to the City upon request.

6. The Society agrees to develop written daily operational policies and practices related to animal care and housing, zoonotic disease control, isolation and separation protocols, and cleaning & disinfection procedures, updating and introducing industry best management practices whenever possible. The Society agrees to provide copies of said documents to the City for review.

7. The Society agrees to allow City inspection officials access to enter the Shelter, in order to conduct periodic inspections of the premises to ensure compliance with the terms of this agreement.

8. License: The City's designee shall sell City dog and cat licenses to owners not purchasing said licenses from a veterinarian at the time of vaccination, and may also sell duplicate licenses to owners who have lost a license.

9. Training: Animal Control Officers shall participate in Animal Control Officer training classes as to be certified by the State of Texas and to hold certification in current status.

10. Commercial Animal Establishments: The City agrees to solicit input from the Humane Society on the development and adoption of rules and regulations regarding commercial animal establishments.

11 Conflicts: It is mutually agreed that in all cases of conflict between this Agreement, State law and the City's Animal Control Ordinances, State law and the City's Ordinances shall prevail.

12. Notice: The City agrees to provide the Humane Society notice of any proposed amendments to the City's Animal Control Ordinances at least two (2) weeks prior to the amendments first reading before the City Council, in order for the Humane Society to have an opportunity to review and comment on the proposed amendments. Notwithstanding the foregoing, failure to provide notice in accordance with this Agreement shall in no way affect the validity of any amendment to the City's Animal Control Ordinances. All notices required to be furnished in writing under the terms of this Agreement shall he furnished to the City at the following address:

City of New Braunfels, Texas
550 Landa Street
New Braunfels, TX 78130
Attention: City Manager

and shall be provided to the Humane Society at the following address:

Humane Society of the New Braunfels Area, Inc.
3353 Morningside Drive
New Braunfels, TX 78130
Attention: Director

Any notice sent to any other address shall be insufficient to comply with the provisions of this Agreement. Notices will be deemed furnished when deposited in the United States mail postage prepaid.

14. Amendments: This Agreement may be amended from time to time in writing, approved by both the City and the Humane Society.

15. Indemnification: The Humane Society shall indemnify and hold the City harmless from any liability from claims, demands and expenses, including attorney fees that may arise due to actions by the Humane Society in the performance of its duties pursuant to this Agreement. To the extent allowed by law, the City shall indemnify and hold the Humane Society harmless from any liability from claims, demands, and expenses, including attorney fees that may arise due to actions by the City in the performance of its functions pursuant to this Agreement. Nothing in this Agreement shall be construed as a waiver of the City's Governmental Immunity.

16. Miscellaneous: The City shall have no further responsibility to the Humane Society other than as set forth in this Agreement. The Humane Society shall not have any authority over

the City or its agents, except as set forth in this Agreement. The Humane Society shall not have any further responsibility to the City other than as set forth in this Agreement and the City shall not have any authority over Humane Society employees, or other individuals affiliated with the Humane Society, except as set forth in this Agreement. Venue for all disputes related to this Agreement shall lie in New Braunfels. Comal County, Texas.

IN WITNESS WHEREOF, the Humane Society by and through its President, and the City, acting through its City manager, duly authorized by the City Council of the City of New Braunfels, Texas, enters into this Agreement on this the 1st day of January, 2019.

+

THE HUMANE SOCIETY OF THE NEW BRAUNFELS AREA, INC., A TEXAS NON-PROFIT CORPORATION.

By:_____
John Velasquez , President

ATTEST:

Dr. James Rierson, Vice President

CITY OF NEW BRAUNFELS, TEXAS

By:_____
Robert Camareno, City Manager

ATTEST:

Patrick D. Aten, City Secretary

CITY OF NEW BRAUNFELS TEXAS

APPROVED AS TO FORM:

Valeria M. Acevedo

Valeria M. Acevedo, City Attorney

THE STATE OF TEXAS § **COUNTIES OF COMAL & GUADALUPE**

§

THIRD AMENDED

AGREEMENT

This Third AmendedAgreement, by and between the City of New Braunfels, a Home Rule Municipal Corporation located in Comal and Guadalupe Counties, Texas, hereinafter referred to as the "City", and the Humane Society of the New Braunfels Area, Inc., a Texas Non-Profit Corporation located in New Braunfels, Comal County, Texas, hereinafter referred to as the "Humane Society", shall upon approval and execution., .be the effective Agreement between these parties commencing October 1, 2021.

WITNESSETH

WHEREAS, the City and the Humane Society entered into an Agreement for the management to operate and maintain animal control, care and welfare services as well as to operate and maintain an animal care facility for the purpose of sheltering lost or abandoned animals until humanely disposed of in accordance with its principles and all applicable state and local rules and regulations; and

WHEREAS, the City agrees with the Humane Society, and local veterinary medical providers that providing preventive vaccination services to animals at intake improves the health and welfare of animals in shelter care, and

WHEREAS, the City has a continuing need for animal impoundment facilities to house, board and keep animals collected by City Animal Control Officers, City appointed agents, and/or residents of the City of New Braunfels; and

WHEREAS, the City Council of the City of New Braunfels authorizes the City Manager to amend the previous Agreement with the Humane Society.

NOW THEREFORE, it is hereby agreed that all animals collected by the aforementioned parties shall be impounded for the time prescribed by the City's animal control ordinances and the policies adopted by the Humane Society at the Humane Society's shelter in accordance with the terms, conditions and agreements as follows:

1. Definitions: For the purposes of this Agreement the following terms are defined as follows:
   A. "Animal" means every non-human species of animal, both domestic and wild.

B. "Animal Fees" refers to intake fees, disposal fees, and impoundment fees collected by the City or the Humane Society over a twelve (12) month period.

C. “Animal Ordinances” means and refers to City of New Braunfels Code of Ordinances, Chapter 6 – Animals, any related ordinances, and all amendments thereto.

D. “City” means and refers to the City of New Braunfels, in Comal and Guadalupe Counties, Texas.

E. “Humane Society” means and refers to the Humane Society of the New Braunfels Area, Inc.

F. "Major holidays” means and refers only to those holidays observed by the Humane Society limited to fourteen (14) per year.

G. "Quarantine" or "Quarantine Services" means and refers to the strict confinement, for the purpose of preventing the spread of disease, under restraint by closed cage, isolation, kennel, rabies chamber, paddock, or any other manner approved by the local health authority on the premises of the Humane Society. This also includes the daily rabies review of all city animals under quarantine at the Humane Society by Humane Society staff.

H. "Quarantine Period" means that portion of the observation period during which an animal is physically confined for observation as provided for under section 6-109 of the City's Code of Ordinances as amended.

I. “Shelter” and "Premises" are used interchangeably, and both refer to and mean the Humane Society's animal shelter, currently addressed at 3353 Morningside Drive, New Braunfels, Texas, and any subsequent location.

2. Term: This Agreement shall begin on October 1, 2021, the effective date, and shall continue for a period of three (3) years, with two 1-year options for renewal, unless sooner terminated by either party by giving written notice of its desire to terminate this Agreement ninety (90) days prior to the desired effective termination date. Option to Extend: this Agreement may be extended provided all terms and conditions, except for the Agreement period being extended or any price redetermination as authorized elsewhere in this Agreement, remain unchanged and in full force effect. Option to Extend, if exercised is to be executed in the form of a Modification/Supplemental Agreement, to be issued not sooner than ninety (90) days prior to expiration of this Agreement, not later than the final day of the Agreement period. This Option to Extend requires the mutual

agreement of both parties. Refusal by either party to exercise this Option to Extend shall require this Agreement to expire on the original or mutually agreed date. The normal extension period shall be in one (1) year increments.

3. Animal Control Responsibilities: The Humane Society's responsibility for a seized animal shall not begin until the animal has been placed in the custody of the Shelter. The City agrees that all animals apprehended within the city limits by Animal Control Officers or the City's duly appointed agents shall be delivered either to the Shelter or the animal's owner. Once impounded, animals shall remain under the control and custody of the Humane Society for such period of time as required under state law and the City's Animal Ordinances except as hereinafter stipulated.

4. Quarantine Services: The Humane Society agrees to provide Quarantine Services to the City for animals placed into quarantine with the Shelter by City personnel or its authorized agents in accordance with State statutes and local ordinances..

5. Payments:

A. Intake Fees - Beginning October 1, 2021, the City's fiscal year (FY) payment for intake services shall be based on a rolling three (3) calendar year (CY) average of the annual number of animals that were in-taken by the City's Animal Control Officers or apprehended within the New Braunfels city limits. For the term of this Agreement, the base rate for intake services is $110.00 per animal. By March 31st of every CY, city and Humane Society staff will verify the actual number of animals that received intake services so that the payment for the upcoming FY can be calculated. The amount will be paid in twelve (12) equal monthly payments.

Payment Methodology - $110 per Animal		
FY 2022 payment	**FY 2023 payment**	**FY 2024 payment**
Average Animal Intake – CY 2018, 2019 & 2020	Average Animal Intake – CY 2019, 2020 & 2021	Average Animal Intake – CY 2020, 2021 & 2022

B. Disposal Fees - The Humane Society agrees to turnover to the City on a monthly basis, all animal disposal fees and costs collected by the Shelter. The City agrees to pay the disposal costs for animal remains accumulated at the Shelter.

C. Dispatch Services - In addition to the intake fee stated above, the City shall pay the Humane Society on a monthly basis, on or before the 15th of each month, a fee of $4,500 to cover the cost of dispatch services.

D. Facilities Use Fee Payment - The City shall pay to the Humane Society on a monthly basis, on or before the (15th) of each month, a Facilities Use Fee Payment in the amount of $4,167 as an originally agreed-upon contribution to the facility mortgage in consideration for impoundment space and access herein provided to the City. The total amount of the Facilities Use Fee paid shall not exceed $500,000; inclusive of the previous amounts paid under the terms of the original contract dated October 1, 2012. As of the commencement date of this Agreement, October 1, 2021, the City has paid $450,036 in Facilities Use Fees. Once the total amount has been paid, the Facilities Use Fee shall terminate and the City shall have no further obligation to the Humane Society regarding this Facilities Use Fee, but shall still be granted the same impoundment space and access to facilities as provided in this Agreement.

E. Impoundment Fee Payments - The Humane Society shall pay to the City on a monthly basis, on or before the 15th day of each month, all impoundment fees collected or received by the Humane Society from animal owners.

F. License Registration – The Humane Society shall refer to the City any residents or providers who wish to pay their animal license registration fees. The Humane Society shall notify the Neighborhood Services Manager of any animals in-taken that are not licensed/registered.

6. Records and Reports:

A. The Humane Society shall be the central records depository for the City for records pertaining to the City's Animal Ordinances. The Humane Society shall maintain, at its expense, a computer system to facilitate said record keeping. Such records shall include those listed below.

B. The Humane Society shall provide the City's Neighborhood Services Manager a monthly report, in addition to the statement described in Section 5(A) above, that provides the following information on a per month basis for animals brought in by City Animal Control Officers, Appointed Agents or City residents:

(1) The number of animals received sorted by:a. Animals delivered by the City's Animal Control Officers and Appointed Agents

b. Animals not delivered by the City's Animal Control Officers and Appointed Agents

(2) The number of animals euthanized

(3) The number of animals adopted

(4) The number of animals reclaimed

(5) The total amount of impoundment fees collected

C. The Humane Society agrees to submit to the City's Chief Financial Officer prior to October 1st of each year, a copy of its projected and proposed fiscal budget for the upcoming fiscal period detailing funding, planned operations, and any capital investments on assets, liabilities and equities. The Humane Society further agrees to submit to the City prior to January 1st of each year a copy of its final operating budget for that year, which shall cover the time period of October 1st through September 30th. All financial statements and reports shall be on forms approved by the City. In addition, the Humane Society agrees to allow the City to audit, at the City's expense, the Humane Society's books, financial and otherwise, maintained by the Humane Society, provided the City provides at least five (5) days written notice of its intent to perform an audit. The Humane Society agrees to provide the City and its auditors with complete access to all records necessary to perform said audit.

D. On a quarterly basis, the Humane Society will provide the following financial documents to the City's Chief Financial Officer in a mutual effort to ensure and maintain fiscal health for the benefit of the taxpayers:

1. Bank reconciliations
2. Income statement
3. Balance sheet
4. IRS-990 Tax Form and supporting documentation (annual)

7. Operation: The Humane Society agrees to operate and maintain the Shelter in a safe, humane and business-like manner, in compliance with all State regulations, and in a manner comparable with other animal shelters. Without limiting the foregoing, operation of the Shelter shall include the following:

A. Hours of operation – Animal Control officers shall have twenty-four (24) hour access to the Shelter for the delivery of animals. The Shelter's hours of operation shall be conspicuously posted at the Shelter and viewable by the public twenty-four (24) hours a day, seven days a week.

Excluding major holidays and two (2) days of required training, the Shelter will be open to the public each week a minimum of thirty-six (36) hours, as follows:

(1) Monday through Friday- Thirty (30) hours minimum.

(2) Saturday and Sunday- Six (6) hours minimum, with at least four (4) hours on Saturday.

B. Dispatch - The Humane Society shall provide dispatch service for Animal Control Officers during the thirty-six (36) hours of public operation outlined above. In addition, the Humane Society shall provide an additional twelve (12) hours of dispatch service whether or not the shelter is open to the public. The Shelter shall provide dispatch service at least six (6) days per week for a minimum of forty-eight (48) hours total dispatch service per week. The Shelter is not required to provide dispatch service when the Shelter is closed for major holidays or for the aforementioned two training days. The Humane Society shall inform the City's Neighborhood Services Manager if the shelter will be closed for training so that the City can ensure alternative dispatch services no later than seven (7) days before the scheduled closure.

C. Equipment - The City shall provide, install, maintain and pay for the following equipment for use by the Shelter in providing dispatch services:

(1) Telephone - A dedicated telephone and telephone line with a separate directory listing for Animal Welfare and Rescue at the Shelter. The telephone shall be equipped with call forwarding or other such switching device as to allow the routing of calls to the City's Police Dispatch when the Shelter is closed. The Humane Society agrees not to use the line for other Shelter business.

(2) Radio – Radio dispatch equipment, including but not limited to the placement of a base radio and antenna at the Shelter.

D. Ownership of animals delivered to Shelter - The City agrees, to the extent permitted by law, that every dog, cat or other animal, licensed or unlicensed, not claimed or redeemed by the owner before the expiration of the dates specified in the City's Animal Ordinances, shall become the sole and exclusive property of the Humane Society, so that neither the City nor any agency of the City shall have any claim or right to said animals. Once an animal has become the property of the Humane Society, it may sell any animal, save and except for dogs and cats, according to the procedures outlined in the City's Animal Ordinances and all sale proceeds shall be the property of the Humane Society.

E. Disposal of animals - The City agrees that the Humane Society may, in accordance with its principles humanely dispose of every animal placed in its custody, in a manner

consistent with the City's Animal Ordinances. The Humane Society is authorized to euthanize any animal placed in its custody by the City or the City's agents, and not redeemed or adopted within the time periods outlined in the City's Animal Ordinances. An animal may be euthanized if its owner cannot be determined or contacted within a reasonable time and when in the opinion of the Animal Control Officer, the Shelter Director or their designees, and in consultation with a licensed veterinarian, it would be more humane to euthanize the sick or injured animal than to attempt to preserve its life for the designated impoundment/holding periods set forth in the Animal Ordinances.

F. Shelter Conditions - The Humane Society agrees to provide suitable, safe and sanitary kennels, cages and pens for the impoundment of all animals in its custody and shall be responsible for their safekeeping for the impoundment periods as set forth in the City's Animal Ordinances.

G. Liability - The Humane Society shall not be held liable to any person for the detention of any animal delivered to the Shelter by the City or its agent, provided the detention is in accordance with the City's Animal Ordinances.

H. Employment – Nothing in this Agreement shall be construed as altering the employment status of the City's Animal Control Officers. Animal Control Officers are City employees. Disciplinary authority over Animal Control Officers shall be the exclusive domain of the City. The City is responsible for providing all vehicles equipment, salaries, dispatch forms, records, office supplies and photocopy services to be utilized by the City's Animal Control Officers. All such equipment and supplies provided by the City shall remain the property of the City.

I. Additional Considerations - The Humane Society agrees to provide all customary utility services for animal control operations. The Humane Society agrees to provide the following animal control services, including but not limited to housing, intake functions, isolation and quarantine facilities, and targeted medical treatment. The Humane Society further agrees to the following:

(1) The Humane Society will strive to maintain "No Kill" status and continue to reduce euthanasia, promote the humane treatment of animals, promote enhanced animal adoptions and fostering, advocate proactive Spay/Neuter initiatives, community education, and provide safe harbor for animals afflicted by neglect, abandonment and abuse, and in pursuit of such the Humane Society agrees to maintain representation on the City's Animal Services Advisory Board as currently structured.

(2) The Humane Society agrees to develop, provide, and maintain a web-based

program which shall be made available to the City's Animal Welfare and Rescue Division. The web-based program will allow animal control officers the capability to remotely access the information collected and documented by the Humane Society, including but not limited to current animal intake information, impoundment status, calls for service, demographic details, animal vaccination and licensing information, and other similar particulars.

(3) The Humane Society agrees that the City shall have first right of refusal to purchase its real property addressed at 3353 Morningside Drive, New Braunfels, Texas if the Humane Society decides to sell. . The City has paid the Humane Society ten dollars ($10) and other valuable consideration for the first right of refusal, the sufficiency and receipt of such consideration is hereby acknowledged. Additionally, the City shall be afforded the right to purchase the personal property if the Humane Society decides to sell. An appraisal at the time of the sale shall determine the fair market value of the real and personal property.. The final purchase price amount for the City shall be equal to the difference remaining, after deduction of all accrued facilities use fee amounts paid to the Shelter, as described in Section 5.D,at the time of sale.

(4) The Humane Society agrees to contact and notify the City within twenty-four (24) hours of any potential or actual material changes impacting the operation of the facility, changes which may include, but are not limited to the following reportable events:

a. Signs or symptoms of potential or actual zoonotic disease transmission or similar communicable disease outbreak conditions;
b. Adding to or reducing indoor or outdoor space(s);
c. Reducing the number of currently existing quarantine units;
d. Receiving notice of failure or substandard compliance with statutory minimum standards pursuant to applicable Texas Department of State Health Services inspection reviews;
e. Changing the type of animals to be cared for;
f. Changing the hours, days, or months of operation;
g. Offering new services, which may fiscally affect contractual stipulations found in this Agreement;
h. Extended utility outages; or
i. Closing temporarily.

(5) The Humane Society agrees to provide a copy of the Texas Department of State Health Services facility inspection report to the City upon request.

(6) The Humane Society agrees to develop written daily operational policies and practices related to animal care and housing, zoonotic disease control, isolation and separation protocols, and cleaning and disinfection procedures, updating and introducing industry best management practices whenever possible. The Humane Society agrees to provide copies of said documents to the City for review.

(7) The Humane Society agrees to allow City inspection officials access to enter the Shelter, in order to conduct periodic inspections of the premises to ensure compliance with the terms of this agreement, city ordinances and/or building codes.

8. Commercial Animal Establishments: The City agrees to solicit input from the Humane Society on the development and adoption of rules and regulations regarding commercial animal establishments.

9. Conflicts: It is mutually agreed that in all cases of conflict between this Agreement, State law and the City's Animal Ordinances, State law and the City's Ordinances shall prevail.

10. Notice: The City agrees to provide the Humane Society notice of any proposed amendments to the City's Animal Ordinances at least two (2) weeks prior to the amendments' first reading before the City Council, in order for the Humane Society to have an opportunity to review and comment on the proposed amendments. Notwithstanding the foregoing, failure to provide notice in accordance with this Agreement shall in no way affect the validity of any amendment to the City's Animal Ordinances. All notices required to be furnished in writing under the terms of this Agreement shall be furnished to the City at the following address:

City of New Braunfels, Texas
550 Landa Street
New Braunfels, TX 78130
Attention: Neighborhood Services Manager

and shall be provided to the Humane Society at the following address:

Humane Society of the New Braunfels Area, Inc.
3353 Morningside Drive

New Braunfels, TX 78130
Attention: Director

Any notice sent to any other address shall be insufficient to comply with the provisions of this Agreement. Notices will be deemed furnished when deposited in the United States mail postage prepaid.

11. Amendments: This Agreement may be amended from time to time in writing, approved by both the City and the Humane Society.

12. Indemnification: The Humane Society shall indemnify and hold the City harmless from any liability from claims, demands and expenses, including attorney fees that may arise due to actions by the Humane Society in the performance of its duties pursuant to this Agreement. To the extent allowed by Texas law, the City shall indemnify and hold the Humane Society harmless from any liability from claims, demands, and expenses, including attorney fees that may arise due to actions by the City in the performance of its functions pursuant to this Agreement. Nothing in this Agreement shall be construed as a waiver of the City's Governmental Immunity.

13. Miscellaneous: The City shall have no further responsibility to the Humane Society other than as set forth in this Agreement. The Humane Society shall not have any authority over the City or its agents, except as set forth in this Agreement. The Humane Society shall not have any further responsibility to the City other than as set forth in this Agreement and the City shall not have any authority over Humane Society employees, or other individuals affiliated with the Humane Society, except as set forth in this Agreement. Venue for all disputes related to this Agreement shall lie in New Braunfels. Comal County, Texas.

IN WITNESS WHEREOF, the Humane Society by and through its President, and the City, acting through its City Manager, duly authorized by the City Council of the City of New Braunfels, Texas, enters into this Agreement with an effective date of the 1st day of October, 2021.

THE HUMANE SOCIETY OF THE NEW BRAUNFELS AREA, INC., A TEXAS NON-PROFIT CORPORATION.

By:_____
_____ , President

ATTEST:

_____
_____, Vice President

CITY OF NEW BRAUNFELS, TEXAS

By:_____
Robert Camareno, City Manager

ATTEST:

_____
Caitlin Krobot, City Secretary

APPROVED AS TO FORM:

_____
Valeria M. Acevedo, City Attorney

THE STATE OF TEXAS	**§**	**COUNTIES OF COMAL**
	§	**AND GUADALUPE**

THIRD AMENDED AGREEMENT

This Third Amended Agreement, by and between the City of New Braunfels, a Home Rule Municipal Corporation located in Comal and Guadalupe Counties, Texas, hereinafter referred to as the "City", and the Humane Society of the New Braunfels Area, Inc., a Texas Non-Profit Corporation located in New Braunfels, Comal County, Texas, hereinafter referred to as the "Humane Society", shall upon approval and execution be the effective Agreement between these parties commencing October 1, 2021.

WHEREAS, the City and the Humane Society entered into an Agreement for the management to operate and maintain animal control, care and welfare services as well as to operate and maintain an animal care facility for the purpose of sheltering lost or abandoned animals until humanely disposed of in accordance with its principles and all applicable state and local rules and regulations; and

WHEREAS, the City agrees with the Humane Society, and local veterinary medical providers that providing preventive vaccination services to animals at intake improves the health and welfare of animals in shelter care; and

WHEREAS, the City has a continuing need for animal impoundment facilities to house, board and keep animals collected by City Animal Control Officers, City-appointed agents, and/or residents of the City of New Braunfels; and

WHEREAS, the City Council of the City of New Braunfels authorizes the City Manager to amend the previous Agreement with the Humane Society.

NOW THEREFORE, it is hereby agreed that all animals collected by the aforementioned parties shall be impounded for the time prescribed by the City's animal control ordinances and the policies adopted by the Humane Society at the Humane Society's shelter in accordance with the terms, conditions and agreements as follows:

1. Definitions: For the purposes of this Agreement the following terms are defined as follows:

   A. "Animal" means every non-human species of animal, both domestic and wild.

B. “Animal Fees” refers to intake fees, disposal fees, and impoundment fees collected by the City or the Humane Society over a twelve (12) month period.

C. “Animal Ordinances” means and refers to City of New Braunfels Code of Ordinances, Chapter 6 - Animals, any related ordinances, and all amendments thereto.

D. “City” means and refers to the City of New Braunfels, in Comal and Guadalupe Counties, Texas.

E. “Humane Society” means and refers to the Humane Society of the New Braunfels Area, Inc.

F. “Major Holidays” means and refers only to those holidays observed by the Humane Society limited to fourteen (14) per year.

G. “Quarantine” or “Quarantine Services” means and refers to the strict confinement, for the purpose of preventing the spread of disease, under restraint by closed cage, isolation, kennel, rabies chamber, paddock, or any other manner approved by the local health authority on the premises of the Humane Society. This also includes the daily rabies review of all city animals under quarantine at the Humane Society by Humane Society staff.

H. “Quarantine Period” means that portion of the observation period during which an animal is physically confined for observation as provided for under section 6-109 of the City’s Code of Ordinances as amended.

I. “Shelter” and “Premises” are used interchangeably, and both refer to and mean the Humane Society’s animal shelter, currently addressed at 3353 Morningside Drive, New Braunfels, Texas, and any subsequent location.

2. Term: This Agreement shall begin on October 1, 2021, the effective date, and shall continue for a period of three (3) years, with two 1-year options for renewal, unless sooner terminated by either party by giving written notice of its desire to terminate this Agreement ninety (90) days prior to the desired effective termination date. Option to Extend: this Agreement may be extended provided all terms and conditions, except for the Agreement period being extended or any price redetermination as authorized elsewhere in this Agreement, remain unchanged and in full force effect. Option to Extend, if exercised is to be executed in the form of a Modification/Supplemental Agreement, to be issued not sooner than ninety (90) days prior to expiration of this

Agreement, not later than the final day of the Agreement period. This Option to Extend requires the mutual agreement of both parties. Refusal by either party to exercise this Option to Extend shall require this Agreement to expire on the original or mutually agreed date. The normal extension period shall be in one (1) year increments.

3. Animal Control Responsibilities: The Humane Society's responsibility for a seized animal shall not begin until the animal has been placed in the custody of the Shelter. The City agrees that all animals apprehended within the city limits by Animal Control Officers or the City's duly appointed agents shall be delivered either to the Shelter or the animal's owner. Once impounded, animals shall remain under the control and custody of the Humane Society for such period of time as required under state law and the City's Animal Ordinances except as hereinafter stipulated.
4. Quarantine Services: The Humane Society agrees to provide Quarantine Services to the City for animals placed into quarantine with the Shelter by City personnel or its authorized agents in accordance with state statutes and local ordinances.
5. Payments:
   A. Intake Fees – Beginning October 1, 2021, the City's fiscal year (FY) payment for intake services shall be based on a rolling three (3) calendar year (CY) average of the annual number of animals that were in-taken by the City's Animal Control Officers or apprehended within the New Braunfels city limits. For the term of this Agreement, the base rate for intake services is $110.00 per animal. By March 31st of every CY, city and Humane Society staff will verify the actual number of animals that received intake services so that the payment for the upcoming FY can be calculated. The amount will be paid in twelve (12) equal monthly payments.

Payment Methodology - $110 per Animal		
FY 2022 payment	**FY 2023 payment**	**FY 2024 payment**
Average Animal Intake – CY 2018, 2019 & 2020	Average Animal Intake – CY 2019, 2020 & 2021	Average Animal Intake – CY 2020, 2021 & 2022

   B. Disposal Fees – The Humane Society agrees to turnover to the City on a monthly basis, all animal disposal fees and costs collected by the Shelter. The City agrees to pay the disposal costs for animal remains accumulated at the Shelter.

C. Dispatch Services – In addition to the intake fee stated above, the City shall pay the Humane Society on a monthly basis, on or before the 15th of each month, a fee of $4,500 to cover the cost of dispatch services.

D. Facilities Use Fee Payment – The City shall pay to the Humane Society on a monthly basis, on or before the 15th of each month, a Facilities Use Fee Payment in the amount of $4,167 as an originally agreed-upon contribution to the facility mortgage in consideration for impoundment space and access herein provided to the City. The total amount of the Facilities Use Fee paid shall not exceed $500,000; inclusive of the previous amounts paid under the terms of the original contract dated October 1, 2012. As of the commencement date of this Agreement, October 1, 2021, the City has paid $450,036 in Facilities Use Fees. Once the total amount has been paid, the Facilities Use Fee shall terminate and the City shall have no further obligation to the Humane Society regarding this Facilities Use Fee, but shall still be granted the same impoundment space and access to facilities as provided in this Agreement.

E. Impoundment Fee Payments – The Humane Society shall pay to the City on a monthly basis, on or before the 15th day of each month, all impoundment fees collected or received by the Humane Society from animal owners.

F. License Registration – The Humane Society shall refer to the City any residents or providers who wish to pay their animal license registration fees. The Humane Society shall notify the Neighborhood Services Manager of any animals in-taken that are not licensed/registered.

6. Records and Reports:

A. The Humane Society shall be the central records depository for the City for records pertaining to the City's Animal Ordinances. The Humane Society shall maintain, at its expense, a computer system to facilitate said record keeping. Such records shall include those listed below.

B. The Humane Society shall provide the City's Neighborhood Services Manager a monthly report, in addition to the statement described in Section 5(A) above, that provides the following information on a per month basis for animals brought in by City Animal Control Officers, Appointed Agents or City residents:

(1) The number of animals received sorted by:

a. Animal delivered by the City's Animal Control Officers and Appointed Agents
b. Animals not delivered by the City's Animal Control Officers and Appointed Agents

(2) The number of animals euthanized
(3) The number of animals adopted
(4) The number of animals reclaimed
(5) The total amount of impoundment fees collected

C. The Humane Society agrees to submit to the City's Chief Financial Officer prior to October 1st of each year, a copy of its projected and proposed fiscal budget for the upcoming fiscal period detailing funding, planned operations, and any capital investments on assets, liabilities and equities. The Humane Society further agrees to submit to the City prior to January 1st of each year a copy of its final operating budget for that year, which shall cover the time period of October 1st through September 30th. All financial statements and reports shall be on forms approved by the City. In addition, the Humane Society agrees to allow the City to audit, at the City's expense, the Humane Society's books, financial and otherwise, maintained by the Humane Society, provided the City provides at least five (5) days written notice of its intent to perform an audit. The Humane Society agrees to provide the City and its auditors with complete access to all records necessary to perform said audit.

D. On a quarterly basis, the Humane Society will provide the following financial document to the City's Chief Financial Officer in a mutual effort to ensure and maintain fiscal health for the benefit of the taxpayers:

(1) Bank reconciliations
(2) Income statement
(3) Balance sheet
(4) IRS-990 Tax Form and supporting documentation (annual)

7. Operation: The Humane Society agrees to operate and maintain the Shelter in a safe, humane and business-like manner, in compliance with all State regulations, and in a manner comparable with other animal shelters. Without limiting the foregoing, operation of the Shelter shall include the following:

A. Hours of operation – Animal Control Officers shall have twenty-four (24) hour access to the Shelter for the delivery of animals. The Shelter's hours of operation shall be conspicuously posted at the Shelter and viewable by the public twenty-four (24) hours a day, seven days a week. Excluding Major Holidays and two (2) days of required training, the Shelter will be open to the public each week a minimum of thirty-six (36) hours, as follows:
   (1) Monday through Friday – Thirty (30) hours minimum
   (2) Saturday and Sunday – Six (6) hours minimum, with at least four (4) hours on Saturday

B. Dispatch – The Humane Society shall provide dispatch service for Animal Control Officers during the thirty-six (36) hours of public operation outlined above. In addition, the Humane Society shall provide an additional twelve (12) hours of dispatch service whether or not the shelter is open to the public. The Shelter shall provide dispatch service at least six (6) days per week for a minimum of forty-eight (48) hours total dispatch service per week. The Shelter is not required to provide dispatch service when the Shelter is closed for major holidays or for the aforementioned two training days. The Humane Society shall inform the City's Neighborhood Services Manager if the shelter will be closed for training so that the City can ensure alternative dispatch services no later than seven (7) days before the scheduled closure.

C. Equipment – The City shall provide, install, maintain and pay for the following equipment for use by the Shelter in providing dispatch services:
   (1) Telephone – A dedicated telephone and telephone line with a separate directory listing for Animal Welfare and Rescue at the Shelter. The telephone shall be equipped with call forwarding or other such switching device as to allow the routing of calls to the City's Police Dispatch when the Shelter is closed. The Humane Society agrees not to use the line for other Shelter business.
   (2) Radio – Radio dispatch equipment, including but not limited to the placement of a base radio and antenna at the Shelter.

D. Ownership of animals delivered to Shelter – The City agrees, to the extent permitted by law, that every dog, cat or other animal, licensed or unlicensed, not claimed or

redeemed by the owner before the expiration of the dates specified in the City's Animal Ordinances, shall become the sole and exclusive property of the Humane Society, so that neither the City nor any agency of the City shall have any claim or right to said animals. Once an animal has become the property of the Humane Society, it may sell any animal, save and except for dogs and cats, according to the procedures outlined in the City's Animal Ordinances and all sale proceeds shall be the property of the Humane Society.

E. Disposal of animals – The City agrees that the Humane Society may, in accordance with its principles humanely dispose of every animal placed in its custody, in a manner consistent with the City's Animal Ordinances. The Humane Society is authorized to euthanize any animal placed in its custody by the City or the City's agents, and not redeemed or adopted within the time periods outlined in the City's Animal Ordinances. An animal may be euthanized if its owner cannot be determined or contacted within a reasonable time and when in the opinion of the Animal Control Officer, the Shelter Director or their designees, and in consultation with a licensed veterinarian, it would be more humane to euthanize the sick or injured animal than to attempt to preserve its life for the designated impoundment/holding periods set forth in the Animal Ordinances.

F. Shelter Conditions – The Humane Society agrees to provide suitable, safe and sanitary kennels, cages and pens for the impoundment of all animals in its custody and shall be responsible for their safekeeping for the impoundment periods as set forth in the City's Animal Ordinances.

G. Liability – The Humane Society shall not be held liable to any person for the detention of any animal delivered to the Shelter by the City or its agent, provided the detention is in accordance with the City's Animal Ordinances.

H. Employment – Nothing in this Agreement shall be construed as altering the employment status of the City's Animal Control Officers. Animal Control Officers are City employees. Disciplinary authority over Animal Control Officers shall be the exclusive domain of the City. The City is responsible for providing all vehicles, equipment, salaries, dispatch forms, records, office supplies and photocopy services

to be utilized by the City's Animal Control Officers. All such equipment and supplies provided by the City shall remain the property of the City.

I. Additional Considerations – The Humane Society agrees to provide all customary utility services for animal control operations. The Humane Society agrees to provide the following animal control services, including but not limited to housing, intake functions, isolation and quarantine facilities, and targeted medical treatment. The Humane Society further agrees to the following:

(1) The Humane Society will strive to maintain "No Kill" status and continue to reduce euthanasia, promote the humane treatment of animals, promote enhanced animal adoptions and fostering, advocate proactive Spay/Neuter initiatives, community education, and provide safe harbor for animals afflicted by neglect, abandonment and abuse, and in pursuit of such the Humane Society agrees to maintain representation on the City's Animal Services Advisory Board as currently structured.

(2) The Humane Society agrees to develop, provide, and maintain a web-based program which shall be made available to the City's Animal Welfare and Rescue Division. The web-based program will allow animal control officers the capability to remotely access the information collected and documented by the Humane Society, including but not limited to current animal intake information, impoundment status, calls for service, demographic details, animal vaccination and licensing information, and other similar particulars.

(3) The Humane Society agrees that the City shall have first right of refusal to purchase its real property addressed at 3353 Morningside Drive, New Braunfels, Texas if the Humane Society decides to sell. The City has paid the Humane Society ten dollars ($10) and other valuable consideration for the first right of refusal, the sufficiency and receipt of such consideration is hereby acknowledged. Additionally, the City shall be afforded the right to purchase the personal property if the Humane Society decides to sell. An appraisal at the time of the sale shall determine the fair market value of the real and personal property. The final purchase price amount for the City shall be equal to the difference remaining after

deduction of all accrued facilities use fee amounts paid to the Shelter, as described in Section 5.D, at the time of sale.

(4) The Humane Society agrees to contact and notify the City within twenty-four (24) hours of any potential or actual material changes impacting the operation of the facility, changes which may include, but are not limited to the following reportable events:

a. Signs or symptoms of potential or actual zoonotic disease transmission or similar communicable disease outbreak conditions;
b. Adding to or reducing indoor or outdoor space(s);
c. Reducing the number of currently existing quarantine units;
d. Receiving notice of failure or substandard compliance with statutory minimum standards pursuant to applicable Texas Department of State Health Services inspection reviews;
e. Changing the type of animals to be cared for;
f. Changing the hours, days, or months of operation;
g. Offering new services, which may fiscally affect contractual stipulations found in this Agreement;
h. Extended utility outages; or
i. Closing temporarily.

(5) The Humane Society agrees to provide a copy of the Texas Department of State Health Services facility inspection report to the City upon request.

(6) The Humane Society agrees to develop written daily operational policies and practices related to animal care and housing, zoonotic disease control, isolation and separation protocols, and cleaning and disinfection procedures, updating and introducing industry best management practices whenever possible. The Humane Society agrees to provide copies of said documents to the City for review.

(7) The Humane Society agrees to allow City inspection officials access to enter the Shelter, in order to conduct periodic inspections of the premises to ensure compliance with the terms of this agreement, city ordinances and/or building codes.

8. Commercial Animal Establishments: The City agrees to solicit input from the Humane Society on the development and adoption of rules and regulations regarding commercial animal establishments.
9. Conflicts: It is mutually agreed that in all cases of conflict between this Agreement, State law and the City's Animal Ordinances, State law and the City's Ordinances shall prevail.
10. Notice: The City agrees to provide the Humane Society notice of any proposed amendments to the City's Animal Ordinances at least two (2) weeks prior to the amendments' first reading before the City Council, in order for the Humane Society to have an opportunity to review and comment on the proposed amendments. Notwithstanding the foregoing, failure to provide notice in accordance with this Agreement shall in no way affect the validity of any amendment to the City's Animal Ordinances. All notices required to be furnished in writing under the terms of this Agreement shall be furnished to the City at the following address:

    City of New Braunfels, Texas
    550 Landa Street
    New Braunfels, TX 78130
    Attention: Neighborhood Services Manager

    and shall be provided to the Humane Society at the following address:

    Humane Society of the New Braunfels Area, Inc.
    3353 Morningside Drive
    New Braunfels, TX 78130
    Attention: Director

    Any notice sent to any other address shall be insufficient to comply with the provisions of this Agreement. Notices will be deemed furnished when deposited in the United States mail postage prepaid.
11. Amendments: This Agreement may be amended from time to time in writing, approved by both the City and the Humane Society.
12. Indemnification: The Humane Society shall indemnify and hold the City harmless from any liability from claims, demands and expenses, including attorney fees that may arise due to actions by the Humane Society in the performance of its duties pursuant to this Agreement.
13. Miscellaneous: The City shall have no further responsibility to the Humane Society other than as set forth in this Agreement. The Humane Society shall not have any authority

over the City or its agents, except as set forth in this Agreement. The Humane Society shall not have any further responsibility to the City other than as set forth in this Agreement and the City shall not have any authority over the Humane Society employees, or other individuals affiliated with the Humane Society, except as set forth in this Agreement. Venue for all disputes related to this Agreement shall lie in New Braunfels, Comal County, Texas.

IN WITNESS WHEREOF, the Humane Society by and through its President, and the City, acting through its City Manager, duly authorized by the City Council of the City of New Braunfels, Texas, enters into this Agreement with an effective date of the 1st day of October, 2021.

THE HUMANE SOCIETY OF THE NEW BRAUNFELS AREA, INC., A TEXAS NON-PROFIT CORPORATION.

By:_____

_____, President

ATTEST:

_____

_____, Vice President

CITY OF NEW BRAUNFELS, TEXAS

By: _____

Robert Camareno, City Manager

ATTEST:

_____

Caitlin Krobot, City Secretary

APPROVED AS TO FORM:

_____

Valeria M. Acevedo, City Attorney

PRESENTER:
Mark Enders, Watershed Program Manager

SUBJECT:
Approval of and authorization for the City Manager to execute a contract with the Texas Commission on Environmental Quality to accept grant funding to continue implementation of the Dry Comal Creek and Comal River Watershed Protection Plan

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
The City and its project partners, with input from local stakeholders, have developed a Watershed Protection Plan (WPP) to address bacteria loading to the Dry Comal Creek and Comal River. The WPP has been formally accepted by the US Environmental Protection Agency and the Texas Commission on Environmental Quality (TCEQ).

The City has been taking the lead on the implementation of bacteria reduction measures outlined in the WPP which has been supported with previous grant funding from TCEQ.

The proposed contract with TCEQ is for a total of $1,377,295 of which the TCEQ reimbursable grant portion is $826,377 (60% of the total contract cost). The City is responsible for a 40% match or cost share in the amount of $550,918. The match portion will be provided largely by the cost of projects implemented as part of the Edwards Aquifer Habitat Conservation Plan (EAHCP) that are paid by the City and reimbursed by the Edwards Aquifer Authority (EAA). A portion of City staff salary and benefits will also be applied as match. It is not anticipated that any funding will be required from the City's General Fund for matching costs. The term of the grant contract is September 1, 2021 through February 28, 2026.

The work to be conducted as part of this grant contract will include but is not limited to: 1) design and construction of structural stormwater treatment infrastructure, 2) management of overabundant urban wildlife, 3) pet waste management, and 4) education & outreach. A portion of the grant funding will also be utilized for consultant support for the implementation of the contractual tasks and reporting.

ISSUE:
Both the Dry Comal Creek and the Comal River are listed on the Texas 303(d) list of impaired waterbodies. Both waterways are listed as impaired for bacteria (contact recreation) meaning that *E.coli* bacteria concentrations have exceeded the State's long-term water quality standard for bacteria.

FISCAL IMPACT:
Per the contract, all City expenditures up to the authorized reimbursement amount ($826,377) associated with the work listed in the contract will be reimbursed by TCEQ on a quarterly basis. An account has previously been established for tracking grant-funded expenditures and reimbursements.

RECOMMENDATION:
Staff recommends approval of a contract with the Texas Commission on Environmental Quality to accept grant funding to continue implementation of the Dry Comal Creek and Comal River Watershed Protection Plan.

Texas Commission on Environmental Quality (TCEQ)

CONTRACT SIGNATURE PAGE

Contract Name: Dry Comal Creek and Comal River Watershed Protection Plan Implementation: Wildlife, Pet, and Stormwater Management Measures and Outreach in New Braunfels

Contract Number: 582-22-30199

Performing Party: City of New Braunfels

Performing Party Identification Number: 17460017746

Maximum Authorized Reimbursement: $826,377.00

Effective Date: 9/1/2021

Expiration Date: 2/28/2026

☒ If checked, this Contract requires matching funds. Match Requirement: $550,918.00

☒ If checked, this Contract is funded with federal funds.

CFDA Number: 66.460
Federal Grant Number: C9-99614625

This Contract is entered under: ☐ Gov't Code ch. 771 (Interagency) ☒ Gov't Code ch. 791 (Interlocal)
☐ Water Code §5.229 (Intergovernmental) ☒ Water Code §5.124 (Grant)

TCEQ, an agency of the State of Texas, and the named Performing Party, a state agency or local government of the State of Texas, enter this agreement (Contract) to cooperatively conduct authorized governmental functions and activities under the laws of the State of Texas.

The Parties agree as follows: (a) to be effective, the Contract must be signed by an authorized official of the TCEQ and the Performing Party; (b) this Contract consists of all documents specified in the list of Contract Documents following this page; and (c) as authorized by TCEQ, Performing Party will conduct Contract Activities as part of its own authorized governmental functions and TCEQ will reimburse Allowable Costs subject to 2 Code of Federal Regulations (CFR) Part 200, to the Texas Uniform Grant Management Standards (UGMS) and this Contract.

TCEQ

Authorized Signature

L'Oreal W. Stepney, P.E.
Printed Name

Deputy Executive Director
Title

Date

Procurements & Contracts Representative

Christopher Redden, CTCM, CTCD
Printed Name

Date

City of New Braunfels

Authorized Signature

Robert Camareno
Printed Name

City Manager
Title

Date

CONTRACT DOCUMENTS LIST

This Contract between TCEQ and Performing Party consists of the Contract Documents listed on this page and marked by an "X." Documents on this list include all Amendments. In the event of a conflict of terms, the Contract Documents as amended control in the descending order of the list, subject to provisions in the Special Terms and Conditions, if any. All Contract provisions, however, are subject to control by the latest Amendment and most specific provision and by the applicable state and federal laws, rules and regulations.

- ☒ Contract Signature Page
- ☒ Contract Documents List (this page)
- ☒ Special Terms and Conditions
- ☒ Federal Conditions and Forms
- ☒ Scope of Work
- ☒ Insurance Section
- ☒ General Terms and Conditions
- ☒ Cost Budget
- ☒ Notices, Project Representatives and Records Locations
- ☒ Attachment A – Financial Status Report (FSR)
- ☒ Attachment B – Release of Claims
- ☒ Attachment C – Budget Revision Request (BRR)
- ☒ Attachment D – Personnel Eligibility List (PEL)
- ☒ Attachment E – Performance Evaluation Report
- ☒ Attachment F – Level-of-Effort Certification

SPECIAL TERMS AND CONDITIONS

1. **PERFORMING PARTY'S PERFORMANCE EVALUATION.** Performance evaluations are a part of the TCEQ review of the Performing Party and may be a factor in the selection of future Contracts. TCEQ may provide this information to state agencies and, upon request, to others. The Performing Party consents to the disclosure of any information or opinion contained in the evaluations (Attachment E).

2. Sections 2, 7, and 8 in the **Cost Budget** section of the Contract are modified as follows:

   2. **Matching Funds**. This Contract requires matching funds.

      a. The Performing Party agrees to share the costs of the activities described in this Contract. The Performing Party will pay 40% of all allowable costs incurred. TCEQ payments to Performing Party will not exceed 60% of all allowable costs incurred.

      b. The U.S. Government has provided funds which are included in this Contract. Therefore, additional requirements apply to this Contract that are contained in the Contract Document titled "Federal Conditions". The Performing Party must comply with all applicable Federal Conditions.

      c. Performing Party's cost share or matching contribution must not be paid from other Federal funds under another award, except where authorized by Federal statute or rule. Performing Party's cost share or matching contribution must not be included as a cost share or match for any other federally-assisted project or program.

      d. Invoice Submittal: Each request for reimbursement must demonstrate that the Performing Party is contributing 40% of the allowable costs for the period specified on the invoice. Requests for reimbursement showing a match of an amount other than 40% may be rejected by TCEQ.

   7. **Budget Control**, **Subsection b. Cumulative transfers greater than 10% of the Total Budget**:

      b. TCEQ must **preapprove in writing** all budget revisions that result in the cumulative transfer from direct cost budget categories of funds greater than 10% of the Total Budget during the Contract Period. The Performing Party must submit a BRR to address this change.

   8. **Invoice Submittal.** Invoices must be submitted to the individuals named in the Notices, Project Representatives and Records Location section of the Contract at quarterly intervals. The reporting periods will correspond to the State of Texas fiscal year (September-November, December-February, March-May, and June-August). Invoices must include Attachment A (FSR).

      a. Requests for reimbursement must be submitted within 30 days after the close of each quarter with the exception of the last fiscal quarter of the Contract, when invoices will be due on a monthly basis (see below for monthly invoicing terms).

      b. For the last fiscal quarter of the Contract, reimbursement requests are due on a monthly basis. The Performing Party will submit the monthly reimbursement request documents within 15 days after the close of each month with the exception of the final billing, which is due within 45 days after the close of the Contract.

3. **INDIRECT COST REIMBURSABLE RATE CHANGES**. Subsection d. is added to Section **6. Budget Control** of the Cost Budget section of the Contract as follows:

   b. **Indirect Cost Reimbursable Rate Changes**. If Performing Party's indirect cost reimbursable rate changes during the term of the Contract, Performing Party must submit appropriate documentation supporting the new indirect rate to TCEQ. The adequacy of the supporting documentation will be determined at TCEQ's sole discretion. TCEQ must **pre-approve in writing** all changes to Performing Party's indirect cost reimbursable rate. This may be documented through a BRR so long as the indirect rate change does not (1) cause an increase to the Total Budget amount or (2) require the transfer of more than $2,000 to or from the Indirect Costs budget category. All other changes must be documented through an amendment.

4. **CLEAN WATER ACT SECTION 319 NON-POINT SOURCE ASSISTANCE AGREEMENTS PUBLIC AWARENESS TERMS AND CONDITIONS**

   a. Outreach Signage Requirements

      The Performing Party agrees to provide signage that informs the public that the project is funded by EPA. The signage shall contain the EPA logo. The Performing Party will work with the TCEQ Project Manager and EPA to obtain the appropriate EPA logo or seal graphic file. The EPA Logo will be displayed meeting the following specifications: EPA Logo and Seal Specifications for Signage produced by EPA Assistance Agreement Recipients. If the physical design of the sign allows, it should also include the following text:

      "This project has been funded by the United States Environmental Protection Agency" or "This cooperative project has been funded in part by the United States Environmental Protection Agency"

      Exceptions to including the EPA logo may be made by the Regional 319 Coordinator on recommendation by TCEQ.

   b. Announcements

      The Performing Party agrees that announcements through the web or print materials for workshops, conferences, demonstration days or other events as part of a project funded by a 319-assistance agreement shall contain a statement that the materials or conference has been funded by the TCEQ through a grant from the EPA.

   c. Public or Media Events

      The Performing Party agrees to notify the TCEQ Project Manager of public or media events publicizing the accomplishment of significant events related to construction projects as a result of this agreement and provide the opportunity for attendance and participation by state or federal representatives with at least fifteen (15) working days' notice.

   d. Limited English Proficiency Communities

      To increase public awareness of projects serving communities where English is not the predominant language, the Performing Party is encouraged to include in their outreach strategies communication in non-English languages. Translation costs for this purpose are allowable, provided the costs are reasonable.

5. General Term and Condition **11.1 Insurance** is supplemented with the following:

   The foregoing insurance coverages required of Performing Party's contractors must also protect Performing Party and TCEQ from all claims and liability for injury to persons and for damage to property arising from Performing Party's conduct in connection with any Project Site Tours performed by Performing Party (see Task 3 in the Scope of Work).

6. **OPERATION AND MAINTENANCE.** The Performing Party must assure the continued proper operation and maintenance of all nonpoint source management practices that are successfully implemented under this Contract. The Performing Party must properly operate and maintain the nonpoint source management practices implemented for the expected lifespan of the specific practice in accordance with commonly accepted standards, or 10 years. If the Performing Party awards funds to any subgrantees to perform these projects, this provision must also be included in any related sub-agreement.

7. **CONSTRUCTION REQUIREMENTS.** In addition to the insurance and legal requirements found in the General Terms and Conditions, Performing Party will comply with all applicable state and federal laws and regulations regarding procurement and utilization of any engineering services or construction services for the purposes of this Contract. Performing Party is solely responsible for the means and methods of procuring and overseeing any engineering services and construction services. Performing Party or its subcontractors are also solely responsible for ensuring compliance with any applicable Davis-Bacon prevailing wage provisions, Worker's Compensation, permitting, or bonding requirements.

8. **EQUIPMENT.** Consistent with 2 Code of Federal Regulations (CFR) 200.313, title to equipment vests upon acquisition with the Performing Party, pursuant to the following conditions:

   a) The Performing Party may keep the equipment and continue to use it on the activities under this Contract, or, if no longer needed for this Contract, must use it on other federally-funded projects.

   b. Per 2 CFR 200.313(b), the Performing Party may manage and dispose of equipment acquired under this Contract in accordance with state laws and procedures.

Federal Conditions and Forms (GRANTS)

ARTICLE 1. FEDERAL REQUIREMENTS

This Agreement is funded in whole or in part with federal grant money. All applicable requirements of TCEQ's federal grants; EPA grant policies and guidance; 2 Code of Federal Regulations (CFR) Part 200, including procurement standards; and any additional federal funding conditions that arise during the Agreement period, are incorporated herein by reference. (TCEQ will provide copies of applicable federal grants or regulations upon request). TCEQ has separately provided the current and available pass-through information required under 2 CFR 200.331 to the Performing Party with this agreement. The term "Performing Party" as used in these *Federal Conditions* means either Performing Party, Grantee, or Contractor, as applicable.

ARTICLE 2. FEDERAL INTELLECTUAL PROPERTY REQUIREMENTS

In accordance with 2 CFR 200.315, EPA has the right to reproduce, publish, use and authorize others to reproduce, publish and use copyrighted works or other data developed under this agreement for Federal purposes. EPA may authorize another grantee to use copyrighted works or other data developed with EPA funds provided under this agreement to perform another grant when such use promotes efficient and effective use of Federal grant funds.

ARTICLE 3. ACKNOWLEDGMENT OF FINANCIAL SUPPORT

The Performing Party shall acknowledge the financial support of the TCEQ and the U.S. EPA whenever work funded, in whole or part, by this Agreement is publicized or reported in news media or publications. All reports and other documents completed as a part of this Agreement, other than documents prepared exclusively for internal use within the TCEQ, shall carry the following notation on the front cover or title page:

PREPARED IN COOPERATION WITH THE
TEXAS COMMISSIONON ENVIRONMENTAL QUALITY AND
U.S. ENVIRONMENTAL PROTECTION AGENCY

This project has been funded wholly or in part by the United States Environmental Protection Agency under assistance agreement (number) to Texas Commission on Environmental Quality. The contents of this document do not necessarily reflect the views and policies of the Environmental Protection Agency, nor does the EPA endorse trade names or recommend the use of commercial products mentioned in this document.

ARTICLE 4. RECYCLED MATERIALS

1. When Performing Party procures $10,000 or more of a designated item in a fiscal year for this Contract or did so in the preceding fiscal year, Performing Party will select the item containing the highest percentage of recycled materials practicable as required by 42 U.S.C. 6962 and 2 CFR 200.322. This requirement does not apply to incidental purchases that are not a direct result of this Contract. Designated items are listed by the EPA in the most recent Consolidated Recovered Materials Advisory Notice. If the item with the highest percentage of recycled materials does not meet performance standards or is not available in a reasonable time or at a reasonable price, or the purchase of the item would not allow a reasonable level of competition, Performing Party may select a different item. With its invoice, Performing Party will report any purchases to which this section applies to TCEQ and indicate the percentage of recycled

materials in the items purchased. If Performing Party does not select the item containing the highest percentage of recycled materials, it will also state the reason.

2. Paper for Reports to EPA. When directed to provide paper documents, the Performing Party agrees to use recycled paper and double-sided printing for all reports which are prepared as a part of this agreement and delivered to EPA. This requirement does not apply to reports prepared on forms supplied by EPA.

ARTICLE 5. ACCOUNTING SYSTEMS AND PROPERTY MANAGEMENT

1. Performing Party shall have an accounting system which accounts for costs in accordance with generally accepted accounting standards or principles and complies with 2 CFR § 200.49. This system shall provide for the identification, accumulation, and segregation of allowable and unallowable project costs among projects.
2. Performing Party shall comply with the property management requirements of 2 CFR §§ 200.310 through 200.316.

ARTICLE 6. RECORDS, ACCESS, AND AUDIT

1. The Federal Government and its agencies will have the same rights of access to records as are granted to, assigned to, or reserved by the TCEQ under this Agreement. The Performing Party shall maintain fiscal records and supporting documentation for all expenditures of funds pursuant to 2 CFR Part 200, Subparts D and F, as appropriate.
2. In accordance with 2 CFR 200.501(a), the Performing Party shall obtain a single audit if it expends $750,000 or more a year in federal awards.
3. Performing Party must immediately notify the TCEQ of any audit findings specifically related to this award and provide the TCEQ a copy of such findings within three (3) business days after issuance. By submitting an invoice, Financial Status Report, or other financial reporting documentation, Performing Party certifies that it did not receive any audit findings specifically related to this award during the invoicing/reporting period, except for such audit findings Performing Party already provided notice of in accordance with this Section.

ARTICLE 7. SUSPENSION AND DEBARMENT

Performing Party shall fully comply with Subpart C of 2 CFR Part 180, entitled "Responsibilities of Participants Regarding Transactions Doing Business With Other Persons," as implemented and supplemented by 2 CFR Part 1532. Performing Party is responsible for ensuring that any lower tier covered transaction, as described in Subpart B of 2 CFR Part 180, entitled "Covered Transactions," includes a term or condition requiring compliance with Subpart C. Performing Party is responsible for further requiring the inclusion of a similar term or condition in any subsequent lower tier covered transactions. Performing Party acknowledges that failing to disclose the information required under 2 CFR § 180.335 may result in the delay or negation of this agreement or pursuance of legal remedies. Performing Party may access the System for Award Management at: https://www.sam.gov/SAM/ or type “System for Award Management” in an internet. search.

ARTICLE 8. PROHIBITION ON USE OF FEDERAL FUNDS FOR LOBBYING AND LITIGATION

1. The Performing Party agrees to comply with Title 40 CFR Part 34, New Restrictions on Lobbying. The Performing Party agrees that none of the funds paid under this Contract will be used to engage in the lobbying of the Federal Government in connection with obtaining any federal contract, grant, or other award, or in litigation against the United States unless authorized under existing law.
2. The Performing Party shall submit to the TCEQ the EPA Certification Regarding Lobbying form and if applicable, the Disclosure of Lobbying Activities form. The Performing Party must file a disclosure form at the end of each calendar quarter in

which there occurs any event that requires disclosure or that materially affects the accuracy of the information contained in any disclosure form previously filed.

3. In accordance with the Byrd Anti-Lobbying Amendment, any recipient who makes a prohibited expenditure under Title 40 CFR Part 34 or fails to file the required certification or lobbying forms shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such expenditure.

ARTICLE 9. CIVIL RIGHTS OBLIGATIONS

1. In carrying out this agreement, the recipient must comply with:
   a. Title VI of the Civil Rights Act of 1964, which prohibits discrimination based on race, color, and national origin, including limited English proficiency (LEP), by entities receiving Federal financial assistance.
   b. Section 504 of the Rehabilitation Act of 1973, which prohibits discrimination against persons with disabilities by entities receiving Federal financial assistance; and
   c. The Age Discrimination Act of 1975, which prohibits age discrimination by entities receiving Federal financial assistance.
2. If the recipient is conducting an education program under this agreement, it must also comply with:
   a. Title IX of the Education Amendments of 1972, which prohibits discrimination on the basis of sex in education programs and activities operated by entities receiving Federal financial assistance.
3. If this agreement is funded with financial assistance under the Clean Water Act (CWA), the recipient must also comply with:
   a. Section 13 of the Federal Water Pollution Control Act Amendments of 1972, which prohibits discrimination on the basis of sex in CWA-funded programs or activities.
4. Regulatory Requirements
   a. The recipient agrees to comply with all applicable EPA civil rights regulations, including:
      i. For Title IX obligations, 40 CFR Part 5; and
      ii. For Title VI, Section 504, Age Discrimination Act, and Section 13 obligations, 40 CFR Part 7.
      iii. As noted on the EPA Form 4700-4 signed by the recipient's authorized representative, these regulations establish specific requirements including maintaining compliance information, establishing grievance procedures, designating a Civil Rights Coordinator and providing notices of non-discrimination.
5. TITLE VI – LEP, Public Participation and Affirmative Compliance Obligation
   a. As a recipient of EPA financial assistance, you are required by Title VI of the Civil Rights Act to provide meaningful access to LEP individuals. In implementing that requirement, the recipient agrees to use as a guide the Office of Civil Rights (OCR) document entitled "Guidance to Environmental Protection Agency Financial Assistance Recipients Regarding Title VI Prohibition Against National Origin Discrimination Affecting Limited English Proficient Persons." The guidance can be found at https://www.federalregister.gov/documents/2004/06/25/04-14464/guidance-to-environmental-protection-agency-financial-assistance-recipients-regarding-title-vi.

6. If the recipient is administering permitting programs under this agreement, the recipient agrees to use as a guide OCR's Title VI Public Involvement Guidance for EPA Assistance Recipients Administering Environmental Permitting Programs. The Guidance can be found at https://www.govinfo.gov/content/pkg/FR-2006-03-21/pdf/06-2691.pdf.
7. In accepting this assistance agreement, the recipient acknowledges it has an affirmative obligation to implement effective Title VI compliance programs and ensure that its actions do not involve discriminatory treatment and do not have discriminatory effects even when facially neutral. The recipient must be prepared to demonstrate to EPA that such compliance programs exist and are being implemented or to otherwise demonstrate how it is meeting its Title VI obligations.

ARTICLE 10. DISADVANTAGED BUSINESS ENTERPRISES (DBEs)

1. The Performing Party shall not discriminate on the basis of race, color, national origin or sex in the performance of this Contract. The Performing Party shall carry out applicable requirements of 40 CFR Part 33 in the award and administration of contracts awarded under EPA financial assistance agreements. Failure by the Performing Party to carry out these requirements is a material breach of this Contract which may result in the termination of this Contract or other legally available remedies.
2. Performing Party agrees that qualified DBEs and active Historically Underutilized Businesses (HUBs) shall have the maximum practicable opportunity to participate in the performance of the Work required under this Contract through possible subcontracts to carry out portions of the Work or any goods or services procured to directly support the Work.
3. The Performing Party is required to make a good faith effort to include HUBs or DBEs on any procurement for subcontractors or suppliers/vendors for Work under this Contract.
4. The Performing Party must submit *one* of the following forms with each invoice.
   a. TCEQ Disadvantaged Business Enterprise (DBE) Program MBE and WBE Expenditures Report (attached); or
   b. Texas Comptroller HUB Subcontracting Plan Progress Assessment Report (PAR) found at https://comptroller.texas.gov/purchasing/vendor/hub/forms.php.

      At minimum, this form shall include the name and identification number of the HUB or DBE and the amount paid to the HUB or DBE.
5. The Performing Party shall retain all records documenting compliance with good faith efforts when performing under the EPA DBE program.
6. Before terminating a DBE for convenience, the Performing Party must notify TCEQ in writing.
7. If a DBE subcontractor fails to complete work for any reason, and the Performing Party plans to procure a replacement subcontractor, the Performing Party must demonstrate the same good faith effort to procure the replacement subcontractor.
8. The Performing Party must pay its subcontractors for satisfactory performance no more than 10 days from the Performing Party's receipt of payment from TCEQ.
9. TCEQ's established fair share goals are as follows:

	MBE GOAL(%)	WBE GOAL (%)
Construction	7.34	10.60
Equipment	19.57	19.64
Services	12.98	23.70
Supplies	19.37	14.15

ARTICLE 11. DEMONSTRATION OF COMPETENCY

In accordance with EPA directive FEM 2012-02 Rev. 1, "Policy to Assure the Competency of Organizations Generating Environmental Measurement Data Under Agency-Funded Assistance Agreements," if the Work performed by the Performing Party or any of its subcontractors or subrecipients under this Contract includes generating or using environmental data through sample collection, field measurements and/or laboratory analysis, then it must document and maintain certification demonstrating the competency of individuals using or generating environmental data under this Contract. Certification may include training records, certificates, or educational credentials.

ARTICLE 12. TRAFFICKING IN PERSONS

1. Prohibition Statement – Performing Party may not engage in severe forms of trafficking in persons during the period of time that the award is in effect; procure a commercial sex act during the period of time of the award; or use forced labor in the performance of the award or subaward under the award.
    a. TCEQ may unilaterally terminate this award, without penalty, if a Performing Party that is a private entity: (1) is determined to have violated an applicable prohibition in the Prohibition Statement above; or (2) has an employee who is determined by the agency official authorized to terminate the award to have violated an applicable prohibition in the Prohibition Statement through conduct that is either (a) associated with performance under this award; or (b) imputed to the Performing Party using the standards and due process for imputing the conduct of an individual to an organization that are provided in 2 CFR Part 180, "OMB Guidelines to Agencies on Governmentwide Debarment and Suspension (Nonprocurement)", as implemented at 2 CFR Part 1532. The Performing Party must inform TCEQ immediately of any information you receive from any source alleging a violation of a prohibition in the Prohibition Statement above.
    b. TCEQ's right to terminate unilaterally: (1) implements section 106(g) of the Trafficking Victims Protection Act of 2000 (TVPA), as amended (22 U.S.C. 7104(g)), and (2) is in addition to all other remedies for noncompliance that are available to TCEQ under this award.

ARTICLE 13. MISCELLANEOUS PROVISIONS

1. Drug-Free Workplace. The Performing Party must make an ongoing, good faith effort to maintain a drug-free workplace pursuant to the specific requirements set forth in Title 2 CFR Part 1536. Additionally, in accordance with these regulations, the Performing Party must identify all known workplaces under its federal awards and keep this information on file during the performance of the award.
2. Hotel and Motel Fire Safety Act. Pursuant to 40 CFR 30.18, if applicable, and 15 U.S.C. 2225a, the Performing Party agrees to ensure that all space for conferences, meetings, conventions, or training seminars funded in whole or in part with federal funds complies with the protection and control guidelines of the Hotel and Motel Fire Safety Act (PL 101-391, as amended). Performing Party may search the Hotel-Motel National Master List at https://apps.usfa.fema.gov/hotel/ to see if a property is in compliance, or to find other information about the Act.
3. Clean Air Act and Federal Water Pollution Control Act. If the Agreement is in excess of $150,000, the Performing Party agrees to comply with all applicable standards, orders and regulations issued pursuant to the Clean Air Act (42 U.S.C. 7401 – 7671q) and the Federal Water Pollution Control Act as amended (33 U.S.C. 1251 – 1387).
4. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment. The Performing Party is prohibited from using grant funds to enter into contracts or subawards (or extend or renew contracts or subawards) with entities that

use or provide covered telecommunications equipment or services as described in 2 CFR § 200.216 and Public Law 115-232, Section 889. This prohibition includes in-kind contributions. This provision is subject to the exceptions provided in Public Law 115-232, Section 889.

5. Domestic Preferences for Procurements. In accordance with 2 CFR 200.322, and to the maximum extent practicable, appropriate, and consistent with applicable law, Performing Party will provide a preference for the purchase, acquisition, or use of goods, products, or materials produced in the United States (including but not limited to iron, aluminum, steel, cement, and other manufactured products). The requirements of this provision must be included in all subawards, contracts, and purchase orders for work or products funded by this award.
6. Religious Liberty. In accordance with 2 CFR § 200.300 and Executive Order 13798, ensure, for states and other public recipients, that subawards are not conditioned in a manner that would disadvantage applicants for subawards based on their religious character.

ARTICLE 14. FEDERAL FUNDING ACCOUNTABILITY AND TRANSPARENCY ACT (FFATA) REPORTING

1. In accordance with 2 CFR Part 25, entities that receive subawards from TCEQ that are funded wholly or partially with federal funds must (1) be registered in the Central Contractor Registration (CCR) prior to submitting an application or plan or entering into an agreement; (2) maintain an active CCR registration with current information at all times while the application or plan is under consideration by TCEQ or during the term of the agreement; and (3) provide its Data Universal Numbering System (DUNS) number in each application or plan it submits to TCEQ, unless an exemption applies.
2. No funds may be received or awarded until Performing Party has complied with these requirements and provided a valid DUNS number.
3. Additionally, in accordance with 2 CFR Part 170, if certain elements are met, Performing Party must report the total compensation for each of its five most highly compensated executives for the preceding completed fiscal year.
4. These elements are found on the TCEQ Federal Funding Accountability and Transparency Act Reporting Form, which must be completed and provided to TCEQ no later than the Performing Party's date of signature on this agreement.

ARTICLE 15. CONSULTANT SALARY CAP

1. The salary rate (excluding overhead) paid to individual consultants retained by the Performing Party is limited to the maximum daily rate for a Level IV of the Executive Schedule, available at: https://www.opm.gov/policy-data-oversight/pay-leave/salaries-wages/, and adjusted annually.
2. This limit applies to consultation services of designated individuals with specialized skills who are paid at a daily or hourly rate. This salary limit applies unless the consultant was selected through a procurement process that conforms to Subpart D of 2 CFR 200.
3. Under EPA's policy regarding payments to consultants under grants, consultants are typically individuals who are experts with excellent qualifications and are usually regarded as authorities or practitioners of unusual competence and skill by other individuals engaged in the same profession.

ARTICLE 16. MANAGEMENT FEES

Management fees or similar charges in excess of the direct costs and approved indirect rates are not allowable. The term "management fees or similar charges" refers to expenses added to the direct costs in order to accumulate and reserve funds for ongoing business expenses;

unforeseen liabilities; or for other similar costs which are not allowable under this assistance agreement. Management fees or similar charges may not be used to improve or expand the project funded under this agreement, except to the extent authorized as a direct cost of carrying out the scope of work.

ARTICLE 17. COST AND PRICE OF THIS AGREEMENT

The Performing Party must comply with 2 CFR §200.323. The Performing Party may request a form from TCEQ to use when performing a cost or price analysis.

ARTICLE 18. CYBERSECURITY

1. Any connection between the Grantee's network or information technology system and an EPA network or information technology system used to transfer data under this agreement must be secure. A connection is a dedicated persistent interface between the Grantee's network or information technology system and EPA's network or information technology system for the purpose of transferring information.
2. The Grantee will contact the EPA Project Officer (PO) and work with the designated Regional/Headquarters Information Security Officer to ensure that the connections meet EPA security requirements, including entering into Interconnection Service Agreements as appropriate. Contact the TCEQ Grant Manager for the EPA PO's contact information.
3. This condition does not apply to (1) transitory user-controlled connections, such as website browsing, (2) manual entry of data by the Grantee into systems operated and used by EPA's regulatory programs for the submission of reporting and/or compliance data, or (3) Grantee's connections that use the Environmental Information Exchange Network or EPA's Central Data Exchange.

Instructions on how to fill out the attached Federal Forms:

1. **Certification Regarding Lobbying (EPA Form 6600-06)** — Complete and return with signed Contract. Contains certifications about the use of Federal appropriated funds in connection with lobbying. If at any time during the course of the Contract you have any federal lobbying to report, you must provide a **Disclosure Regarding Lobbying Form (SF-LLL)** to the TCEQ Project Representative, with quarterly updates. Note, this form is not attached, but may be found online.

2. **TCEQ Disadvantaged Business Enterprise (DBE) Program MBE and WBE Expenditures Report** — submitted with each invoice.

3. **TCEQ Federal Funding Accountability and Transparency Act Reporting Form** — Completed upon or prior to Contract execution.

United States
ENVIRONMENTAL PROTECTION AGENCY
Washington, DC 20460

OMB Control No. 2030-0020
Approval expires 04/30/2021

_____
EPA Project Control Number

CERTIFICATION REGARDING LOBBYING

CERTIFICATION FOR CONTRACTS, GRANTS, **LOANS AND COOPERATIVE AGREEMENTS**

The undersigned certifies, to the best of his or her knowledge and belief, that:

(1) No Federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any Federal contract, the making of any Federal grant, the making of any Federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any Federal contract, grant, loan, or cooperative agreement.

(2) If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress in connection with this Federal contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, “Disclosure Form to Report Lobbying,” in accordance with its instructions.

(3) The undersigned shall require that the language of this certification be included in the award documents for all sub-awards at all tiers (including sub-contracts, sub-grants, and contracts under grants, loans, and cooperative agreements) and that all sub-recipients shall certify and disclose accordingly.

This certification is a material representation of fact upon which reliance was placed when this transaction was made or entered into. Submission of this certification is a prerequisite for making or entering into this transaction imposed by section 1352, title 31 U.S. Code. Any person who fails to file the required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each such failure.

_____
Typed Name & Title of Authorized Representative

_____
Signature and Date of Authorized Representative

EPA Form 6600-06 (Rev. 06/2014) Previous editions are obsolete.

TCEQ - DISADVANTAGED BUSINESS ENTERPRISE (DBE) PROGRAM - MINORITY BUSINESS ENTERPRISE (MBE) AND WOMAN OWNED BUSINESS ENTERPRISE (WBE) EXPENDITURES REPORT

Federally Funded Grants

Grantee Name:				
Grantee ID #:				
Grantee Point of Contact (POC) Name:				
POC Phone Number:		POC Email:		
TCEQ Contract #:		Invoice #:		
Invoice Reporting Period Date:			Invoice Amount:	

MBE/WBE Subcontractor Expenditures for this Reporting Period

MBE/WBE Subcontractor	Vendor ID:	Was this payment for Services, Equipment or Supplies?	Indicate MBE or WBE	Amt. Paid
A DBE is a Disadvantaged, Minority, or Woman Business Enterprise that has been certified by an entity from which EPA accepts certifications as described in 40 CFR 33.204-33.205 or certifies by EPA. Subcontractor is defined as a company, firm, joint venture, or individual who provides goods or services pursuant to an EPA award of financial assistance. This does not include a grantee's subrecipients.		Total MBE/WBE Pmts. for this Reporting Period:		

AFFIRMATION. The information provided on this form is accurate and complete.

Signature: Date:

Federal Funding Accountability and Transparency Act

This form is required to be completed by the subrecipient for contracts funded wholly or partially with federal funds by TCEQ. In accordance with 2 Code of Federal Regulation (CFR) Part 170 the Federal Funding Accountability and Transparency Act, TCEQ must collect subrecipient information for transactions $25,000 or greater.

Information completed by TCEQ Program Area:

TCEQ Contract No./PCR	

Information completed by Subrecipient:

Legal Name of Entity			
DUNS Number + 4			
Location of Entity			
	(address)	(city, state)	(zip + 4)

Exemption from reporting compensation information
* ☐ Please check box for exemption from reporting if in the preceding fiscal year ANY of the following applied:
• Recipient received less than 80% of its annual gross revenues in Federal awards (federal contracts (and subcontracts), loans, grants (and subgrants) and cooperative agreements); or • the recipient received less than $25,000,000 in annual gross revenues from Federal awards; or • the public has access to information about compensation of the senior executives through periodic reports filed under section 13(a) or 15(d) of the Securities Exchange Act of 1934 (15 U.S.C. 78m(a), 78o(d)) or section 6104 of the Internal Revenue Code of 1986.

Total Compensation and Names of Top Five Executives (if applicable)	
Name	**Compensation Amount**

Subrecipient Responsible Party		
Title	Print Name	Signature/Date

Federal Funding Accountability and Transparency Act

This form is required to be completed by the subrecipient for contracts funded wholly or partially with Federal funds by TCEQ. In accordance with 2 CFR 170 the Federal Funding Accountability and Transparency Act (FFATA), TCEQ must collect subrecipient information for transactions $25,000 or greater.

FFATA Form Instructions

Information completed by TCEQ Program Area:
This field should be completed by TCEQ program area.

- **TCEQ Contract No./PCR** – Enter the Contract Number and Purchase Contract Request (PCR) generated by BAMS when the original contract is first established. The PCR number does not need to be provided if it is the same as the last five digits of the Contract number.

Information completed by Subrecipient:
Each field requires a response by the subrecipient. If data is not available, the subrecipient should enter an asterisk (*) in the field and provide an explanation.

- **Legal Name of Entity** – Enter name of the subrecipient organization that corresponds with subrecipient's Data Universal Numbering System (DUNS) as it appears in the System for Award Management (SAM) profile, www.sam.gov.
- **DUNS Number + 4** – Enter subrecipient's organization's 9-digit DUNS number as it appears in its SAM Profile and the +4 extension to the DUNS number. The +4 extension is created by registrants in SAM when there is a need for more than one bank/Electronic Funds Transfer (EFT) account for a location.
- **Location of Entity** – Provide address where subrecipient's organization is located as it appears in subrecipient's SAM profile.
- **Total Compensation and Names of Top Five Executives (if applicable)** – As defined in 2 CFR 170.110, you must report Executive Compensation from your preceding fiscal year unless any of the exemption criteria apply.
- **Subrecipient Responsible Party** – The person completing the form should provide title, print name, signature, and date the form was signed.

Return completed and signed form to TCEQ Contract Manager.

SCOPE OF WORK

The Performing Party will implement targeted Best Management Practices (BMPs) and a proactive outreach and education program to reduce *Escherichia coli* (*E. coli*) pollution from sources identified in the Dry Comal Creek and Comal River Watershed Protection Plan (WPP). The BMPs implemented by this project will focus on areas that contribute the most bacterial loading, have the greatest potential to improve water quality, and have strong community support. The Performing Party will also collect and review water quality data in the watershed to assess water quality progress and changes over time.

Task 1: Project Administration

Objective: To effectively administer, coordinate, and monitor all work performed under this project including technical and financial supervision and preparation of status reports.

Subtask 1.1: Project Oversight — The Performing Party will provide technical and fiscal oversight of the staff and/or subgrantee(s)/subcontractor(s) to ensure Tasks and Deliverables are acceptable and completed as scheduled and within budget. With the TCEQ Project Manager's authorization, the Performing Party may secure the services of subgrantees(s)/subcontractors(s). Project oversight status will be provided to the TCEQ Project Manager with the quarterly Progress Reports.

Subtask 1.2: Progress Reports (PRs) — The Performing Party will submit PRs to the TCEQ Project Manager by the 15th of the month following each state fiscal quarter (Sept – Nov, Dec – Feb, March – May, June – August). PRs will include reporting on the status of Deliverables and proposed revisions to due dates, narrative description of progress by Task, and status of nonconformances/corrective actions. The TCEQ Project Manager will provide a template for the PR to the Performing Party.

Subtask 1.3: Reimbursement Forms — The Performing Party will submit Reimbursement Forms in accordance with the Special Terms and Conditions.

Subtask 1.4: Contract Communication — The Performing Party will participate in a call/meeting with TCEQ to discuss project scope and contract requirements within 30 days of Contract execution. The Performing Party will maintain regular telephone and/or e-mail communication with the TCEQ Project Manager regarding the status and progress of the project and any matters that require attention between PRs. Communications will include a quarterly conference call to discuss items such as project Tasks, financial status, Quality Assurance Project Plans (QAPPs), corrective actions, and any other matters that require attention. The TCEQ Project Manager may request additional information from the Performing Party prior to the call or meeting. The Performing Party will provide meeting notes and identifying action items for the telephone calls within five days of the call.

The first conference call held each fiscal year of the project will cover, as applicable, any staff changes, the previous year's performance, budget estimates, invoicing issues, quality assurance issues, and overall project progress.

Matters that will be communicated to the TCEQ Project Manager include, but are not limited to:

- Notification a minimum of 14 days before the Performing Party has scheduled public meetings or events, initiation of construction, or other major Task activities.
- Notification within 48 hours following events or circumstances that may require changes to the Budget, Scope of Work, or Schedule of Deliverables.
- Requests for prior approval of activities or expenditures for which the Contract requires advance approval or that are not specifically included in the Scope of Work

Subtask 1.5: Contractor Evaluation — The Performing Party will participate in an annual Contractor Evaluation at the end of each state fiscal year.

Subtask 1.6: Coordination Call with Environmental Protection Agency (EPA) — Upon request by TCEQ and EPA, the Performing Party will participate in a conference call with EPA to share progress on goals, measures of success, challenges, and draft documents.

Subtask 1.7: Project Article — The Performing Party, upon request by TCEQ, will provide a project article. The article will state the project's purpose, describe the activities of the past fiscal year, and include photographs of the project. The Performing Party will address TCEQ comments on the article and provide a final article.

Subtask 1.8: Contract Budget Updates — The Performing Party will discuss annual fiscal year budgets with the TCEQ Project Manager on a quarterly basis at a minimum. Starting in the second year of the project, the Performing Party will provide an Annual Budget Update that details state fiscal year spending projections associated with planned project activities. These updates will be revised when fiscal year spending projections change by 10% or more, or upon request by the TCEQ Project Manager. The update in the final year of the project will include a budget for all remaining project activities. The TCEQ Project Manager will provide a template for the Annual Budget Update.

Deliverables:

1.2 PRs (by the 15th of the month following each state fiscal quarter)

1.3 Reimbursement forms (See Special Terms and Conditions)

1.4 Conference calls with meeting notes and action items (quarterly, notes within five days of meeting)

1.5 Contractor Evaluation (annually, upon request by TCEQ)

1.6 EPA coordination call (upon request by TCEQ)

1.7 Project article and photographs (upon request by TCEQ)

1.8 Contract Budget updates *(*by the 15th of the month following the end of each state fiscal quarter, in PRs*)*

1.8 Annual Budget updates (within 2 weeks following TCEQ request)

Task 2: Quality Assurance

Objective: To refine, document, and implement data quality objectives (DQOs) and quality assurance/quality control (QA/QC) activities that ensure data of known and acceptable quality are generated by this project.

Subtask 2.1: QAPP Planning Meetings — The Performing Party will schedule a QAPP planning meeting with the TCEQ Project Manager, QA staff, technical staff, and contractors within 30 days of Contract execution. The purpose of this meeting is to implement a systematic planning process based on the elements in the applicable QAPP Shell. A QAPP shell/examples may be provided by the TCEQ Project Manager. The information developed during this meeting will be incorporated into a QAPP by the Performing Party. The Performing Party may conduct additional meetings to determine whether changes to an existing QAPP are needed.

Subtask 2.2: Monitoring QAPP — The Performing Party will develop and submit to TCEQ a QAPP with project-specific DQOs and other components consistent with the following documents:

TCEQ NPS QAPP Shell(s)
EPA Requirements for QAPPs (QA/R5)
EPA Guidance for Geospatial Data QAPPs (QA/G-5G)

TCEQ Surface Water Quality Monitoring (SWQM) Procedures

The Performing Party will develop the QAPP in consultation with the TCEQ Project Manager, QA staff, and contractors. The Performing Party will address comments and submit a final QAPP for review. The QAPP must be signed/fully approved by TCEQ before any environmental data operations begin.

Subtask 2.3: QAPP Annual Reviews, Revisions, and Updates — The Performing Party will submit documentation certifying its annual review of the QAPP no less than 90 days prior to the QAPP anniversary date. Amendments approved since the initial QAPP approval or a subsequent certified annual review (if applicable) must be submitted along with the certification. If extensive changes to a QAPP are necessary, a full revision is required. Once TCEQ certifies the annual review or approves the full revision, the QAPP effective period is extended an additional year. No work described in a QAPP will be conducted outside the effective period of the QAPP.

Subtask 2.4: QAPP Amendments — The Performing Party will submit Draft QAPP Amendments for TCEQ review when changes to QAPPs are necessary. Draft QAPP Amendments should be submitted no less than 90 days prior to the scheduled initiation of changes and must be accompanied by a justification, summary of changes, and detail of changes. The Performing Party will submit Final QAPP Amendments within 30 days of receipt of any comments provided by TCEQ. Final QAPP Amendments will be submitted to TCEQ with the Performing Party's signatures and responses to comments and circulated for appropriate TCEQ signatures. The QAPP Amendments must be signed/fully approved by TCEQ before any changes conveyed within Amendments are implemented.

Subtask 2.5: Corrective Action Reports — The Performing Party will provide corrective action reports (CARs), as needed, to document deviations from sampling method requirements or sample design, failures associated with chain-of-custody procedures or in field and laboratory measurement systems. The Performing Party will submit CARs with PRs until the issue is resolved.

Deliverables:

2.1 QAPP Planning Meeting notes (within 30 days of Contract execution)

2.2 Draft QAPP (120 days prior to the scheduled initiation of environmental data operations)

2.2 Final QAPP (30 days prior to the scheduled initiation of environmental data operations)

2.3 QAPP Annual Reviews and Revisions (at least 90 days prior to the QAPP approval anniversary)

2.4 Draft QAPP Amendments (at least 90 days prior to the scheduled initiation of changes or additions to activities listed in the current QAPP)

2.4 Final QAPP Amendments (within 30 days of receipt of TCEQ comments)

2.5 CARs (as needed, submitted with PRs)

Task 3: BMPs Addressing Overabundant Urban and Non-Native Wildlife

Objective: To reduce *E. coli* loading from overabundant urban deer and non-native avian populations by reducing the population of non-native waterfowl in Landa Park (e.g., by oil coating non-native waterfowl eggs) and by removing waste from the park.

Subtask 3.1: Oil Coat Non-Native Waterfowl Eggs — The Performing Party will hire an Environmental Consultant to perform at least nine egg oil coating events in Landa Park to reduce the non-native duck population. Site visits are strategically scheduled during nesting season. The Performing Party will record the number and location of eggs oiled per event.

Subtask 3.2: Reduce Wildlife Waste in Landa Park — The City will contract with a professional cleanup service to pick up animal waste in Landa Park in order to reduce the *E. coli* concentration in Landa Lake. At least twelve clean-up events will be held.

Subtask 3.3: BMPs Addressing Overabundant Urban and Non-Native Wildlife Task Report — The Performing Party will provide a report summarizing activities completed under this Task.

Deliverables:

3.1 Documentation of subcontract with an Environmental Consultant for egg oil-coating services (quarter 8)

3.1 Documentation of egg oiling events, including number and location of eggs oiled per event (by the end of quarters 9, 13, and 17)

3.2 Documentation of subcontract with a waste clean-up service (quarter 8)

3.2 Documentation of waste clean-up events and quantity of waste removed (by the end of quarters 9, 13, and 17)

3.3 Draft BMPs Addressing Overabundant Urban and Non-Native Wildlife Task Report (final quarter, month 1)

3.3 Final BMPs Addressing Overabundant Urban and Non-Native Wildlife Task Report (at least two weeks prior to end of contract)

Task 4: BMPs Addressing Pet Waste

Objective: To reduce *E. coli* loading from pet waste by reducing the amount of pet waste not picked-up by pet owners.

Subtask 4.1: Pet Waste Stations and Bags — The Performing Party will replace or install at least 10 pet waste stations in public areas, apartment complexes, rural neighborhoods, short-term rentals, and other areas with a high density of pet walkers. The Performing Party will also maintain the pet waste stations by continuing to restock the pet waste stations with pet waste bags and/or provide bag holders to the community at local events.

Subtask 4.2: BMPs Addressing Pet Waste Task Report — The Performing Party will provide a report summarizing activities completed under this task.

Deliverables:

4.1 Documentation of pet waste station installations/replacements, including a map of installation sites, minimum of 10 (quarter 18)

4.1 Documentation of replacement bags and/or bag holders purchased and distributed (quarter 18)

4.2 Draft BMPs Addressing Pet Waste Task Report (final quarter, month 1 with Task 9)

4.2 Final BMPs Addressing Pet Waste Task Report (at least two weeks prior to end of contract)

Task 5: BMP Design and Construction

Objective: To design and oversee construction of two structural stormwater BMPs, one in-pipe *E. coli* filter and one natural treatment facility, such as a retention pond. The identified BMPs will function as a pilot program allowing evaluation of the effectiveness of each BMP type for *E. coli* reduction in the Dry Comal Creek and Comal River Watershed; the outcomes will inform future efforts. The Performing Party will obtain the services of a subcontractor (i.e., Stormwater Consultant and Contractor) to design and construct the identified BMPs.

Subtask 5.1: BMP Selection — The Performing Party will select two BMPs out of the *Analysis of E. coli Structural Stormwater BMPs Beyond the City's MS4 Report (completed under TCEQ Contract No. 582-19-90207)* to be designed and constructed. The report will also include justification for why the two BMPs were selected to be implemented.

Subtask 5.2: BMP Design Contract — The Performing Party will execute a subcontract for the professional design of an in-pipe *E. coli* filter and a natural treatment facility (total of two BMPs).

Subtask 5.3: BMP Design — The Performing Party will submit to TCEQ for review and approval, a proposed BMP design, a final design, and an as-built design for each of the two BMPs. Preliminary design criteria will be outlined in the *Analysis of E. coli Structural Stormwater BMPs Beyond the City's MS4 Report* which was completed under a separate contract.

Subtask 5.4: BMP Construction Contract — The Performing Party will execute a subcontract providing for construction of final design BMPs.

Subtask 5.5: BMP Construction Supervision — The Performing Party will provide supervision of the subcontractor during all construction activities until construction completion.

Subtask 5.6: Establishment of Operation and Maintenance Procedures for BMPs — The Performing Party will develop and implement a guide for BMP inspection, operation, and maintenance (O&M) for each of the sites to assure effective performance over the life of the installations. These procedures will be used by operations staff to appropriately operate and maintain the BMPs. The Performing Party will procure materials and supplies needed to perform maintenance.

Subtask 5.7: BMP Design and Construction Task Report — The Performing Party will provide a report summarizing activities completed under this Task.

Deliverables:

5.1 BMP Selection Report (by the end of quarter 4)
5.2 Documentation of executed design subcontract for BMP 1 (quarter 8)
5.2 Documentation of executed design subcontract for BMP 2 (quarter 8)
5.3 Proposed design plans for BMP 1 (quarter 10)
5.3 Proposed design plans for BMP 2 (quarter 10)
5.3 Final design plans for BMP 1 (quarter 12)
5.3 Final design plans for BMP 2 (quarter 12)
5.3 As-built design plans for BMPs 1 and 2 (quarter 16)
5.4 Documentation of executed construction subcontract for BMP 1 (quarter 12)
5.4 Documentation of executed construction subcontract for BMP 2 (quarter 12)
5.5 Progress reports on construction supervision activities, with photo-documentation of the construction progress (quarterly during construction duration, by end of quarter 14)
5.5 Photo documentation of completed BMPs (quarter 16)
5.6 Operation and Maintenance Manual for BMP 1 (quarter 12)
5.6 Operation and Maintenance Manual for BMP 2 (quarter 12)
5.6 Documentation of maintenance material procurement (quarter 18)
5.6 Documentation of inspection and maintenance events (quarter 18)
5.7 Draft BMP Design and Construction Task Report (final quarter, month 1, with Task 9)
5.7 Final BMP Design and Construction Task Report (at least two weeks prior to end of contract)

Task 6: BMP Effectiveness Monitoring

Objective: To conduct effectiveness monitoring for installed structural stormwater BMPs (as identified in Task 5) by collecting samples and analyzing for *E. coli*. All monitoring and analytical activities will be conducted in accordance with the QAPP(s) for this project. No monitoring structures or equipment will be installed; grab samples will be collected for analysis.

Subtask 6.1: Water Quality Monitoring Readiness Assessment — The Performing Party will satisfy the following water quality monitoring assessment requirements described in their monitoring QAPP:

- Perform a desk readiness review with field staff of field sampling procedures and requirements as outlined in the QAPP and the TCEQ SWQM Procedures Manual. The Performing Party will submit a brief report documenting topics discussed and attendance at this review.
- Submit field notes and instrument calibration sheets from first sampling event within 30 days of first event.

Subtask 6.2: Storm Event Monitoring — The Performing Party will monitor *E. coli* concentrations during a minimum of 16 total storm events at the BMP sites as described in the executed QAPP and Task 5. Rainfall data and flow measurements will be collected with each storm event to calculate *E. coli* loadings. Qualifying storm events will be defined in the QAPP. All analyses will be conducted in the Performing Party's National Environmental Laboratory Accreditation Program (NELAP) accredited lab, per the approved QAPP.

Subtask 6.3: Data Submittals — The Performing Party will submit all water quality data into the Surface Water Quality Monitoring Information System (SWQMIS) Test Environment and submit successful data sets and SWQMIS Data Loading Validator Reports to the TCEQ Project Manager. Water quality data will be submitted electronically to the TCEQ Project Manager in the Event/result file format described in the most current version of the TCEQ Data Management Reference Guide. A completed Data Review Checklist and Data Summary will be submitted with each data submittal.

Subtask 6.4: BMP Evaluation Report — The Performing Party will use data collected to write a report that evaluates the effectiveness of each type of BMP selected for the project area in terms of pollutant load reductions, including annualized load reduction estimates based on average annual rainfall data. The report should:

- Assess individual BMPs and overall project site efficiency in the reduction of *E. coli*.
- Compare effluent *E. coli* concentrations and loads from the BMP drainage area(s), including runoff bypassing the BMP(s) with those of one or more equivalent sites (similar size, topography, land use, and impervious cover) without BMPs.
- Express BMP performance results in percentage and in effluent load multiplying the reduction in event mean *E. coli* concentration for both BMPs by site runoff volume.

Deliverables:

6.1 Documentation of water quality monitoring readiness review (before first sampling event)

6.1 All field notes and instrument calibration sheets from first sampling event (within 30 days of event)

6.2 Documentation of Stormwater Data collection events (following QAPP approval, in PRs)

6.3 Data Submission after successful upload into the SWQMIS test environment including date review checklist, data summary, event and results files, and validator report (quarterly following QAPP approval, as new data are available)

6.4 Draft BMP Evaluation Report (final quarter, month 1 with Task 9)

6.4 Final BMP Evaluation Report (at least two weeks prior to the end of the contract)

Task 7: Outreach and Education

Objective: To provide information to the community on the current sources of *E. coli* in the watershed and strategies for reducing *E. coli* pollution. Education programs will encourage the community to change behaviors where necessary (e.g., not feeding urban wildlife).

Subtask 7.1: News Campaign — The Performing Party will develop and publish at least six paper and/or online advertisements in local newspapers. The Performing Party will submit advertisements for review by the TCEQ Project Manager at least two weeks in advance of distribution.

Subtask 7.2: Movie Theater and Radio Campaign — The Performing Party will produce a short radio advertisement. The Performing Party will contract with local movie theatres to run the previously developed watershed video prior to movies for at least 10 weeks. The Performing Party will contract with a local radio station to run the radio advertisement for at least 50 weeks. The Performing Party will submit the video and radio ad for review by the TCEQ Project Manager at least two weeks in advance of distribution.

Subtask 7.3: Hands-On Learning Module — The Performing Party will distribute hands-on learning modules, including a presentation, workbook and laboratory component, that illustrates bacteria growth and describes how bacteria are transported within the watershed. Students and educators will be able to work through the module at home by joining a virtual workshop or with small groups in a classroom. Modules will be distributed to at least 400 students. The Performing Party will submit the educational materials, developed previously, to the TCEQ Project Manager at least two weeks before use in an education setting.

Subtask 7.4: Watershed Education Personnel — The Performing Party will hire a part-time watershed educator. The educator will be employed for approximately 1000 hours to provide nonpoint source pollution and urban wildlife management education programs to residents, community groups and students.

Subtask 7.5: WPP Implementation Infographic — The Performing Party will produce and distribute an infographic that summarizes the WPP implementation progress. At least three infographics will be produced and distributed to stakeholders and via the WPP website. The Performing Party will submit the infographic to the TCEQ Project Manager at least two weeks prior to distribution.

Subtask 7.6: Watershed Visualization Tool — The Performing Party will expand upon and update the virtual interactive educational resource accessed through the WPP website that illustrates the watershed, waterflow, sampling results, stormwater outfalls and BMPs implemented. The Performing Party will submit the updated tool to the TCEQ Project Manager at least two weeks prior to publication.

Subtask 7.7: Education and Outreach Task Report — The Performing Party will provide a report summarizing activities completed under this Task.

Deliverables:

7.1 Documentation of advertisements in local news sources, minimum of six (quarter 18)

7.1 News advertisements, minimum of six (prior to each advertisement, by quarters 10, 14, and 18, at least two weeks prior to publication)

7.2 Radio ad (quarter 12)

7.2 Subcontracts with movie theaters to advertise video, minimum of 10 weeks (quarter 14)

7.2 Subcontracts with a radio station to advertise, minimum of 60 weeks (quarter 14)
7.3 Documentation of the distribution of hands-on learning modules, minimum of 400 students (quarter 18)
7.3 Hands-on learning module presentation and workbook (quarter 12)
7.4 Documentation of subcontract to hire a part-time watershed educator (quarter 14)
7.5 WPP implementation infographic, minimum of 3 updates (quarters 10, 14, and 18)
7.6 Watershed visualization tool update (quarter 14)
7.7 Draft Education and Outreach Task Report (final quarter, month 1 with Task 9)
7.7 Final Education and Outreach Task Report (at least two weeks prior to end of contract)

Task 8: Data Acquisition and Analysis

Objective: To acquire, compile, and evaluate *E. coli* data collected by project partners. The Performing Party will evaluate the data to track progress towards goals identified in the Dry Comal Creek and Comal River WPP

Subtask 8.1: Acquire and Evaluate *E. Coli* Data — The Performing Party will acquire monthly *E. coli* concentrations collected by project partners at the three Clean Rivers Program (CRP) routine monitoring sites. Project partners, as directed by the Performing Party, will collect *E. coli* samples at additional sites in the watershed. These sites will be monitored under the approved CRP QAPP. The data collected by these project partners will be compiled by the Performing Party's WPP Consultant for use by the project partners and stakeholders. All data collected by project partners will be covered by QAPPs sponsored by those agencies. Funding requested as part of this Task only supports the Performing Party's WPP Consultant time for analyzing data and will not be used to fund collection or analysis of water samples.

Subtask 8.2: Acquired Data Analysis Report — The Performing Party will develop an Acquired Data Analysis Report. The Performing Party will develop the report detailing results, observations, and a discussion of data acquired during the implementation period. Data analysis may include, but is not limited to, graphs of the data, trends, averages, means, minimums, maximums, number and percent of standards or screening criteria exceedances, and correlations.

Deliverables:
8.1 Graphs and tables of updated data (final quarter, month 1)
8.2 Draft Acquired Data Analysis Report (final quarter, month 1 with Task 9)
8.2 Final Acquired Data Analysis Report (at least two weeks prior to end of contract)

Task 9: Final Report

Objective: To produce a Final Report that summarizes all activities completed and conclusions reached during the project. The Final Report will discuss the extent to which project goals and purposes have been achieved and state the amount of funds spent on the project. The Final Report should emphasize successes, failures, lessons learned, and should include analyses estimating the project's water quality improvements and/or load reductions, if applicable. The Final Report will summarize all the Task Reports either in the text or as appendices.

Subtask 9.1: Load Reduction Estimate Methodology — The Performing Party will submit their load reduction estimate methodology and input sources to the TCEQ Project Manager. If possible, load reduction estimates will be calculated for nitrogen, phosphorus, sediment, and *E. coli* for BMPs implemented through this project. The TCEQ Project Manager must approve the methodology used to estimate load reductions.

Subtask 9.2: Draft Final Report — At least 30 days prior to submitting the Final Report, the Performing Party will provide a Draft Final Report. The comprehensive report should document all Deliverables under this Scope of Work. The Draft Final Report should be structured per the following outline:

- Title and Contract Number;
- Table of Contents;
- Project Significance and Background;
- Study Area (maps);
- Summary of all Task Reports and final approved PR;
- Amount of project funding and amount spent;
- Discussion: include deliverables not completed, lessons learned, recommendations for future work;
- Water quality results achieved and estimated load reductions; and
- Appendices (if needed).

Subtask 9.3: Final Report — The Performing Party will revise the Draft Final Report to address comments provided by the TCEQ Project Manager. At least two weeks before the expiration of the Contract, the Performing Party will submit the Final Report to the TCEQ Project Manager.

Deliverables:

9.1 Load reduction estimate methodology and inputs *(*quarter 16)

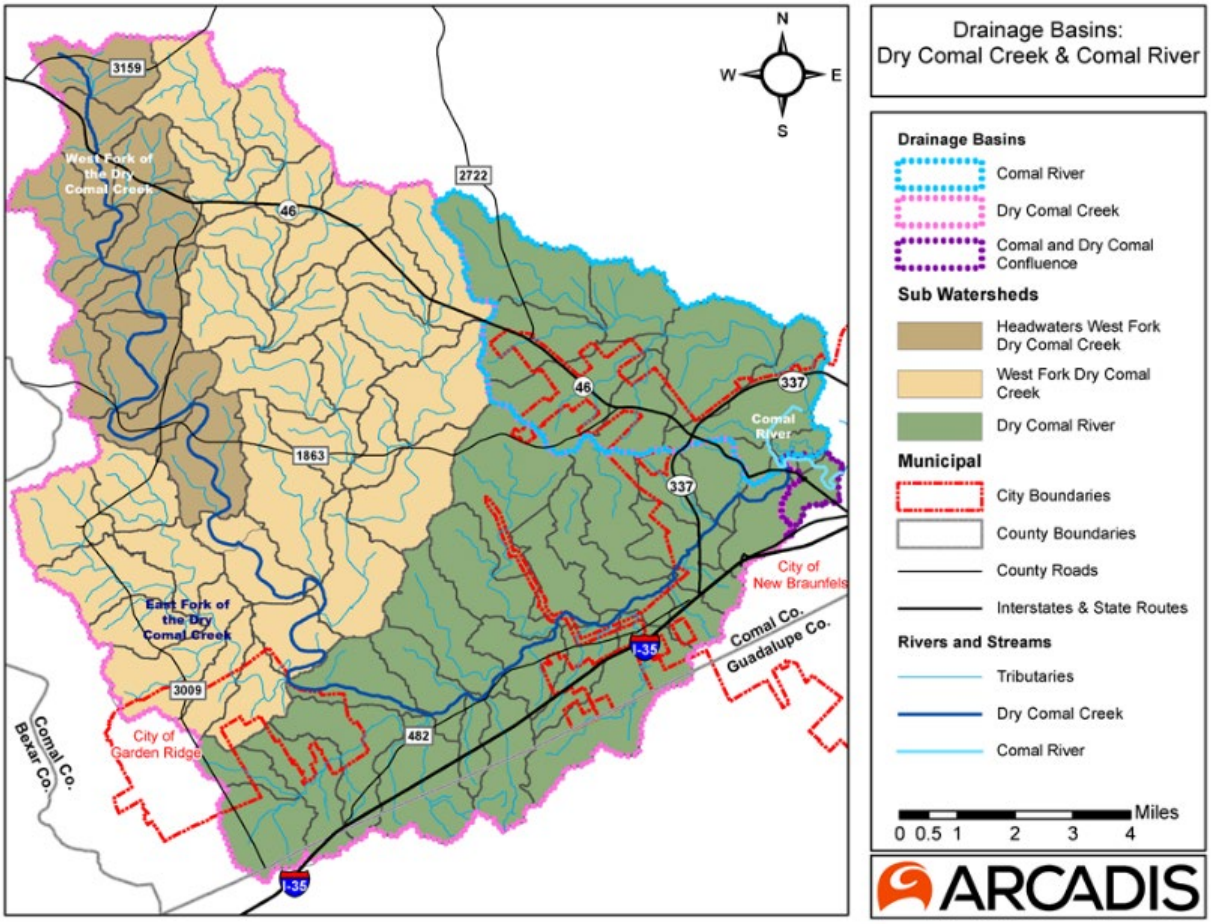
9.1 Load reduction estimates and calculations (in Final Task Report, quarter 18)

9.2 Draft Final Report (final quarter, month 1)

9.2 Address TCEQ comments (within 10 days of receipt of comments)

9.3 Final Report (at least two weeks prior to end of contract)

Project Map:


Drainage Basins:
Dry Comal Creek & Comal River
Drainage Basins
Comal River
Dry Comal Creek
Comal and Dry Comal Confluence
Sub Watersheds
Headwaters West Fork Dry Comal Creek
West Fork Dry Comal Creek
Dry Comal River
Municipal
City Boundaries
County Boundaries
County Roads
Interstates & State Routes
Rivers and Streams
Tributaries
Dry Comal Creek
Comal River
Miles
0 0.5 1 2 3 4
ARCADIS
N
W
E
S
3159
West Fork of the Dry Comal Creek
2722
46
337
Comal River
1863
City of New Braunfels
East Fork of the Dry Comal Creek
Comal Co.
Guadalupe Co.
I-35
3009
482
City of Garden Ridge
Comal Co.
Bexar Co.

INSURANCE SECTION

1. **COVERAGES REQUIRED.** Contractor shall obtain and maintain throughout the Contract term the insurance coverages listed below:

   1.1 *Worker's Compensation Insurance*: Coverage to secure the payment of compensation to injured employees as defined in the Texas Worker's Compensation Act.

   1.2 *Employer's Liability Insurance*: Coverage in the following minimum amounts:
   - Bodily Injury, $500,000 per accident;
   - Disease, $500,000 per employee;
   - Aggregate policy limit of $1,000,000.

   1.3 *Commercial Automobile Liability Insurance*: Coverage in the following minimum amounts for owned, hired, and non-owned vehicles for claims of automobile bodily injury and property damage which may arise in the performance of the Contract:

   - $500,000 per person;
   - $500,000 per occurrence for bodily injury; and
   - $1,000,000 per occurrence for property damage; or
   - $1,000,000 per occurrence if the policy is issued for bodily injury and property damage combined.

   1.4 *Commercial General Liability Insurance*: Coverage for claims of personal injury and bodily injury, including accidental death, and property damage which may arise from the performance of the contract. The types of coverage required are: Blanket, Broad Form Property Damage, Premises and Operations Hazards, Products and Completed Operations Hazards, Independent Contractor's, and Contractual Liability in the minimum amounts of:

   - $1,000,000 per occurrence for bodily injury; and
   - $1,000,000 per occurrence for property damage; or
   - $2,000,000 per occurrence if the policy is issued for bodily injury and property damage combined.

   1.5 *Excess Liability Insurance (Umbrella)*: Additional coverage for all liability policies required for this Contract (excluding Worker's Compensation and Employer's Liability Insurance, which are not liability insurance) in an amount not less than $1,000,000 in the aggregate.

   1.6 *Professional Liability Insurance:* Coverage for financial loss resulting from errors, omissions and failure to properly coordinate the plans and specifications of the Work or Contract documents in an amount not less than $1,000,000 plus deductible exclusion.

   1.7 *Requirements for Subcontractors:* The same requirements apply to all subcontractors.

2. **MINIMUM INSURER RATING**. The Contractor will obtain all required policies from insurers licensed, eligible or registered under Texas law with a rating of A- or better in a financial size category of IV or higher according to A.M. Best Company.

3. **NOTICES OF CHANGE**. The Contractor's insurance policies must require the insurer or the insurer's authorized agent to notify TCEQ of any cancellation, or material change, other than for non-payment, at least 30 days in advance. The Contractor's insurance policy must require the insurer or the insurer's authorized agent to notify TCEQ of any cancellation or material change due to non-payment at least 10 days in advance. These notices of changes must reference the TCEQ contract number and be made in writing by certified mail to the TCEQ Contract Manager at the address shown in the Contract.

4. **INSURANCE CERTIFICATE.** Contractor shall provide TCEQ with evidence of the insurance coverage required under this Contract. The evidence of the coverage shall be a certificate of insurance on a form approved by the Texas Department of Insurance. Contractor will submit the certificate to the TCEQ Contract Manager no later than ten days after award of the Contract, or as directed by the Special Terms and Conditions. Prior to the expiration of any insurance coverages during the term of the Contract, Contractor will submit a certificate evidencing renewed or new insurance policies. Certificates must bear the contract number of this Contract. If Contractor changes insurers, Contractor shall give TCEQ a new certificate of insurance within ten days. The certificate of insurance shall set out any deductible or self-insured retention amounts for each coverage required.

5. **REQUIRED ADDITIONAL PROVISIONS.** All policies of insurance shall include the following provisions:

    5.1 TCEQ and its officers and employees are named additional insureds to the *Commercial General Liability Insurance*, *Excess Liability Insurance (Umbrella)*, and Excess Liability Insurance (Other than Umbrella);

    5.2 Waiver of subrogation in favor of TCEQ, its officers and employees for bodily injury (including death), property damage or any other loss arising from this Contract, except for the Professional Liability Insurance; and

    5.3 The Contractor's insurance is primary insurance with respect to the TCEQ and its officers and employees.

6. **SELF-INSURANCE.** Contractor must disclose on its insurance certificate if any of the coverage required under the contract is being satisfied with a Self-Insured Retention (SIR) and list the amount of the SIR.

GENERAL TERMS AND CONDITIONS

1. CONTRACT PERIOD

1.1. **Contract Period.** The Contract begins on the Effective Date and ends on the Expiration Date as provided on the Contract Signature Page. If no Effective Date is provided, the Effective Date of the Contract is the date of last signature. If no Expiration Date is provided, the Expiration Date is August 31 of the same Fiscal Year in which the Contract is signed.

1.2. **Amendments.** This Contract is not subject to competitive selection requirements and may be amended by mutual agreement. Except as specifically allowed by the Contract, all changes to the Contract require a written amendment that is signed by both parties.

1.2.1. Material Changes. Material changes to the contract require a written amendment signed by both parties. These Amendments take effect when signed by the Contractor and TCEQ, unless otherwise designated in the Amendment. Material changes include the following:

1.2.1.1. Changes in the total amount of funds in the Budget or the Contract;

1.2.1.2. Changes to the Contract's Expiration Date;

1.2.1.3. Changes to the Scope of Work that affect TCEQ's obligations to the entity providing funding, such as the United States Environmental Protection Agency (EPA), another state or federal agency, or the Texas Legislature; and

1.2.1.4. Changes that affect the material obligations of the Performing Party in this Contract.

1.2.2. Unilateral Amendments. As specifically allowed by the Contract, TCEQ may issue unilateral amendments. Unilateral amendments take effect when issued by TCEQ.

1.2.3. Minor Changes. The TCEQ Contract Manager and/or the TCEQ Project Manager has the authority, without a formal Amendment, to correct typographical errors; make written Contract interpretations; and make minor, non-material changes to the requirements in the Scope of Work, the Procedures for Work Orders, or the Work Orders (Work Orders include Proposals for Grant Activities); or as agreed to elsewhere in the Contract. Contractor must provide TCEQ with a written objection to any Notice of Interpretation no later than five (5) business days from the effective date of the Notice. A copy of the agreed change must be retained in the appropriate file by both the Performing Party and TCEQ.

1.2.3.1. Minor, non-material changes include:

1.2.3.1.1. Changes to the schedule in the Scope of Work including an extension of a deliverable due date, not to exceed the expiration date of the Contract;

1.2.3.1.2. Changes to the schedule in the Work Order including an extension of a deliverable due date, not to exceed the expiration date of the Work Order;

1.2.3.1.3. Changes to the individual tasks/activities in the Scope of Work or Work Order, if applicable, that do not substantially change the obligations of the Parties relative to those tasks/activities;

1.2.4. It is the Performing Party's responsibility to request extensions to the deliverable schedule and other changes that are within the authority of TCEQ.

1.3. **Extensions.** TCEQ may by unilateral written amendment extend the Expiration Date for a period of up to 90 days. Unless otherwise indicated in the applicable contract amendment, an extension does not extend any other deadlines or due dates other than the expiration of the Contract Period.

2. FUNDS

2.1 **Availability of Funds.** This Contract and all claims, suits or obligations arising under or related to this Contract are subject to the receipt and availability of funds appropriated by the Texas Legislature for the purposes of this Contract or the respective claim, suit or obligation, as applicable. Performing Party will ensure that this article is included in any subcontract it awards.

2.2 **Maximum Authorized Reimbursement.** The total amount of funds provided by TCEQ for the Contract will not exceed the amount of the Maximum Authorized Reimbursement as shown on the Contract Signature Page.

2.3 **Fiscal Year Restrictions.** In order to be reimbursed under this Contract, costs must be incurred during the Contract Period and within the time limits applicable to the funds from which the Contract is being paid. TCEQ is under no obligation to offer deadline extensions which extend to the maximum availability of the contract funding source.

2.4 **Grants.** If this Contract was entered under the TCEQ's authority to award grants, TCEQ is providing financial assistance to the recipient to undertake its own project.

2.5 **No Debt against the State.** This Contract is contingent on the continuing appropriation of funds. This Contract shall not be construed to create debt against the State of Texas.

2.6 **Abortion Funding Limitation.** Performing Party represents and warrants that payments made by TCEQ to Performing Party and Performing Party's receipt of appropriated funds under the Contract are not prohibited by Article IX, Section 6 of the General Appropriations Act, nor by Texas Government Code Chapter 2273 Prohibited Transactions.

2.7 **Excluded Parties.** Performing Party represents and warrants that it is not listed in the prohibited vendors lists authorized by Executive Order No. 13224, "Blocking Property and Prohibiting Transactions with Persons Who Commit, Threaten to Commit, or Support Terrorism," published by the United States Department of the Treasury, Office of Foreign Assets Control. Performing Party will notify TCEQ if it can no longer make this representation.

3. ALLOWABLE COSTS

3.1 **Conforming Activities.** TCEQ will reimburse the Performing Party for necessary and reasonable Allowable Costs that are incurred and paid by the Performing Party in performance of the Scope of Work as authorized by this Contract in the Cost Budget or Fixed Payment Amounts.

3.2 **UGMS.** Allowable Costs are restricted to costs that comply with the Texas Uniform Grant Management Standards (UGMS) and applicable state and federal rules and law. The parties agree that all the requirements of the UGMS apply to this Contract, including the criteria for Allowable Costs. UGMS is defined to

include its successor guidance, Texas Grant Management Standards, the terms of which shall control for purposes of this contract effective January 1, 2022. Additional federal requirements apply if this Contract is funded, in whole or in part, with federal funds.

4. REIMBURSEMENT

4.1. **Reimbursement Requests.** Performing Party shall invoice TCEQ to request reimbursement for its Allowable Costs for performing the Scope of Work. Performing Party's invoice shall conform to all reimbursement requirements specified by TCEQ.

4.2. **Personnel Eligibility List (PEL).** Performing Party must submit a completed Personnel Eligibility List (PEL) prior to starting activities under this Contract and an updated PEL with any invoice following changes to the information provided in the most recent PEL. If a Contract amendment is necessary due to changes reflected on the PEL, Performing Party must immediately submit an updated PEL with a request to amend the Contract.

4.3. **Level-of-Effort Certification (LEC).** Performing Party must complete the attached Level-of-Effort Certification (LEC) for salaried employees performing work under this Contract. LEC must be completed monthly and LEC(s) must be submitted with each invoice, except for nonexempt employees, for which the Performing Party must submit time sheets. Performing Party may develop and use its own LEC method, which must be reviewed and approved by TCEQ prior to implementation. The LEC method must meet the following requirements and all other federal and state requirements regarding documentation for personnel expenses:

a. Reflect an after-the-fact distribution of the actual activity of each employee;

b. Account for the total activity for which each employee is compensated, including activities not performed under this Contract;

c. Be prepared at least monthly and must coincide with one or more pay periods; and

d. Be signed, physically or electronically, by the employee and the supervisory official having first-hand knowledge of the work performed by the employee. The employee's signature is not required in the event the employee cannot be reached due to termination of employment, lack of forwarding address, death or other documented reason.

4.4. **Conditional Payments.** Reimbursements are conditioned on the Scope of Work being performed in compliance with the Contract. Performing Party shall return payment to TCEQ for either overpayment or activities undertaken that are not compliant with the Scope of Work. This does not limit or waive any other TCEQ remedy.

4.5. **No Interest for Delayed Payment**. Because the Performing Party is not a vendor of goods and services within the meaning of Texas Government Code Chapter 2251, no interest is applicable in the case of late payments.

4.6. **Release of Claims.** As a condition to final payment or settlement, or both, the Performing Party shall execute and deliver to the TCEQ a release of all claims against the TCEQ for payment under this Contract.

4.7. **State Agencies/Institutions of Higher Education.** If the Contractor is a State agency or institution of higher education payments must be made via interagency transaction voucher (ITV), please provide a Recurring Transaction

Index (RTI) number on the face of the invoice OR if payments are to be deposited into a local bank account, the following statement must be placed on the face of the invoice: "Funds to be deposited into local bank account." For additional information, please refer to the Texas Comptroller's Accounting Policy Statement (APS) 014.

5. FINANCIAL RECORDS, ACCESS AND AUDITS

5.1 **Audit of Funds.** The Performing Party understands that acceptance of funds under this Contract acts as acceptance of the authority of the State Auditor's Office, or any successor agency, to conduct an audit or investigation in connection with those funds. Performing Party further agrees to fully cooperate with the State Auditor's Office or its successor in the conduct of the audit or investigation, including providing all records requested. Performing Party shall ensure that this clause concerning the audit of funds accepted under this Contract is included in any subcontract it awards.

5.2 **Financial Records.** Performing Party shall establish and maintain financial records including records of costs of the Scope of Work in accordance with generally accepted accounting practices. Upon request Performing Party shall submit records in support of reimbursement requests. Performing Party shall allow access during business hours to its financial records by TCEQ and other state agencies for the purpose of inspection and audit. Financial records regarding this contract shall be retained for a period of three (3) years after date of submission of the final reimbursement request.

6. PERFORMING PARTY'S RESPONSIBILITIES

6.1 **Performing Party's Responsibility for the Scope of Work.** Performing Party undertakes performance of the Scope of Work as its own project and does not act in any capacity on behalf of the TCEQ nor as a TCEQ agent or employee. Performing Party agrees that the Scope of Work is furnished and performed at Performing Party's sole risk as to the means, methods, design, processes, procedures and performance.

6.2 **Standard Assurances**. Performing Party assures compliance with the provisions found in UGMS III Subpart B, _.14 State assurances, that are applicable to this Contract.

6.3 **Independent Contractor.** The parties agree that the Performing Party is an independent contractor. Nothing in this Contract shall create an employee-employer relationship between Performing Party and TCEQ. Nothing in this Contract shall create a joint venture between TCEQ and the Performing Party.

6.4 **Performing Party's Responsibilities for Subcontractors.** All acts and omissions of subcontractors, suppliers and other persons and organizations performing or furnishing any of the Scope of Work under a direct or indirect contract with Performing Party shall be considered to be the acts and omissions of Performing Party.

6.5 **No Third Party Beneficiary.** TCEQ does not assume any duty to exercise any of its rights and powers under the Contract for the benefit of third parties. Nothing in this Contract shall create a contractual relationship between TCEQ and any of the Performing Party's subcontractors, suppliers or other persons or organizations with a contractual relationship with the Performing Party.

6.6 **Cybersecurity Training.** Performing Party shall ensure that any Performing Party representative (employee, officer, or subcontractor personnel) who has Access to a TCEQ Computer System or Database completes a cybersecurity

training program certified by the Texas Department of Information Resources (DIR) under § 2054.519 of the Texas Government Code, during the term of the Contract and each renewal.

6.6.1. "Access to TCEQ Computer System or Database" means having a TCEQ network user account or the authorization to maintain, modify, or allow access control to any TCEQ web page, TCEQ computer system or TCEQ database.

6.6.2. Within seven (7) days after the execution of the Contract and any renewals, Performing Party shall provide a list of persons requiring training to the TCEQ Contract Manager, and thereafter provide an updated list by the first workday of any additional person who becomes subject to the training requirements. For applicable umbrella contracts, Contractor shall provide a list of any persons requiring training within seven (7) days of issuance of Notice to Proceed/Commence for any Work Order/Proposal for Grant Activities that requires Access to a TCEQ Computer System or Database.

6.6.3. If a Performing Party representative has previously completed a DIR-certified cybersecurity training during the term of the Contract or renewal, Contractor shall provide evidence that the Performing Party representative completed the required training to the TCEQ Contract Manager within seven (7) days after the execution of the Contract or as applicable, the issuance of Notice to Proceed/Commence for any Work Order/Proposal for Grant Activities that requires Access to a TCEQ Computer System or Database.

6.6.4. For the term of the Contract and each renewal, all Performing Party representatives subject to the training requirement must complete DIR-certified training within seven (7) calendar days after TCEQ provides access to the training, unless the Performing Party provides evidence to TCEQ that the Performing Party representative previously completed the required training. Performing Party shall retain in their records, and upon request, provide the TCEQ Contract Manager evidence that the training was successfully completed.

6.6.5. Performing Party shall notify the TCEQ Contract Manager within two (2) business days when a person with Access to a TCEQ Computer System or Database no longer needs Access to such Computer System or Database.

6.6.6. TCEQ may terminate the Contract for Cause if Performing Party fails to adhere to any of the above terms, including completing the required certified cybersecurity training or notifying the TCEQ Contract Manager when access is no longer needed.

6.6.7. TCEQ may terminate the Contract for Cause if a Performing Party's representative misuses a TCEQ Computer System or Database, including allowing multiple individuals to utilize a single individual's TCEQ network user account.

7. TIME AND FORCE MAJEURE

7.1 **Time is of the Essence.** Performing Party's timely performance is a material term of this Contract.

7.2 **Delays.** Where Performing Party's performance is delayed, except by Force Majeure or act of the TCEQ, TCEQ may withhold or suspend reimbursement, terminate the Contract for cause, or enforce any of its other rights (termination for convenience may be effected even in case of Force Majeure or act of TCEQ).

7.3 **Force Majeure.** Force majeure is defined as acts of God, war, fires, explosions, hurricanes, floods, or other causes that are beyond the reasonable control of either party, could not reasonably be foreseen, and by the exercise of all reasonable due diligence, is unable to be overcome by either party. Neither party shall be liable to the other for any failure or delay of performance of any requirement included in the contract caused by force majeure. Upon timely notice by the non-performing party, the time for performance shall be extended for a reasonable period after the causes of delay or failure have been removed provided the non-performing party exercises all reasonable due diligence to perform. The non-performing party must provide evidence of any failure resulting in impossibility to perform.

8. CONFLICT OF INTEREST

Performing Party shall have a policy governing disclosure of actual and potential conflicts of interests. Specifically, for work performed under this Contract by Performing Party or any related entity or individual, Performing Party shall promptly disclose in writing to TCEQ any actual, apparent, or potential conflicts of interest, including but not limited to disclosure of:

i. Any consulting fees or other compensation paid to employees, officers, agents of Performing Party, or members of their immediate families, or paid by subcontractor or subrecipients; or

ii. Any organizational conflicts of interest between Performing Party and its subcontractors or subrecipients under a subaward.

No entity or individual with any actual, apparent, or potential conflict of interest will take part in the performance of any portion of the Scope of Work, nor have access to information regarding any portion of the Scope of Work, without TCEQ's written consent in the form of a unilateral amendment. Performing Party agrees that TCEQ has sole discretion to determine whether a conflict exists, and that a conflict of interest is grounds for termination of this Contract.

9. DATA AND QUALITY

9.1 **Quality and Acceptance.** All work performed under this Contract must be complete and satisfactory in the reasonable judgment of the TCEQ. All materials and equipment shall be handled in accordance with instructions of the applicable supplier, except as otherwise provided in the Contract.

9.2 **Quality Assurance.** All work performed under this Contract that involves the acquisition of environmental data will be performed in accordance with a TCEQ-approved Quality Assurance Project Plan (QAPP) meeting all applicable TCEQ and EPA requirements. Environmental data includes any measurements or information that describe environmental processes, location, conditions, ecological or health effects and consequences. Environmental data includes information collected directly from measurements, produced from models, and compiled from other sources such as databases or literature. No data collection or other work covered by this requirement will be implemented prior to Performing Party's receipt of the QAPP signed by TCEQ and, if necessary, the EPA. Without prejudice to any other remedies available to TCEQ, TCEQ may refuse reimbursement for any environmental data acquisition performed prior to approval of a QAPP by TCEQ and, if necessary, the EPA. Also, without prejudice to any other remedies available to TCEQ, Performing Party's failure to meet the terms of the QAPP may result in TCEQ's suspension of associated activities and non-reimbursement of expenses related to the associated activities.

9.3 **Laboratory Accreditation.** Any laboratory data or analyses provided under this Contract must be prepared by a laboratory that is accredited by TCEQ according to 30 Texas Administrative Code Chapter 25, subchapters A and B, unless TCEQ agrees in writing to allow one of the regulatory exceptions specified in 30 Texas Administrative Code Section 25.6.

10. INTELLECTUAL PROPERTY

10.1. **Third Party Intellectual Property.** Unless specifically modified in an amendment or waived in a unilateral amendment, Performing Party must obtain all intellectual property licenses expressly required in the Scope of Work, or incident to the use or possession of any deliverable under the Contract. Performing Party shall obtain and furnish to TCEQ: documentation on the use of such intellectual property, and a perpetual, irrevocable, enterprise-wide license to reproduce, publish, otherwise use, or modify such intellectual property and associated user documentation, and to authorize others to reproduce, publish, otherwise use, or modify such intellectual property for TCEQ non-commercial purposes, and other purposes of the State of Texas.

10.2. **Grant of License.** Performing Party grants to TCEQ a nonexclusive, perpetual, irrevocable, enterprise-wide license to reproduce, publish, modify or otherwise use for any non-commercial TCEQ purpose any preexisting intellectual property belonging to the Performing Party that is incorporated into any new works created as part of the Scope of Work, intellectual property created under this Contract, and associated user documentation.

11. INSURANCE AND INDEMNIFICATION

11.1 **Insurance.** Unless prohibited by law, the Performing Party shall require its contractors to obtain and maintain during the Contract Period adequate insurance coverage sufficient to protect the Performing Party and the TCEQ from all claims and liability for injury to persons and for damage to property arising from the Contract. Unless specifically waived by the TCEQ, sufficient coverage shall include Workers Compensation and Employer's Liability Insurance, Commercial Automobile Liability Insurance, and Commercial General Liability Insurance.

11.2 **Indemnification.** TO THE EXTENT AUTHORIZED BY LAW, THE PERFORMING PARTY SHALL REQUIRE ALL CONTRACTORS PERFORMING CONTRACT ACTIVITIES ON BEHALF OF PERFORMING PARTY TO INDEMNIFY, DEFEND, AND HOLD HARMLESS THE TCEQ AND PERFORMING PARTY AND THEIR OFFICERS, AND EMPLOYEES, FROM AND AGAINST ALL LOSSES, LIABILITIES, DAMAGES, AND OTHER CLAIMS OF ANY TYPE ARISING FROM THE PERFORMANCE OF CONTRACT ACTIVITIES BY THE CONTRACTOR OR ITS SUBCONTRACTORS, SUPPLIERS AND AGENTS, INCLUDING THOSE ARISING FROM DEFECT IN DESIGN, WORKMANSHIP, MATERIALS, OR FROM INFRINGEMENT OF ANY PATENT, TRADEMARK OR COPYRIGHT; OR FROM A BREACH OF APPLICABLE LAWS, REGULATIONS, SAFETY STANDARDS OR DIRECTIVES. THE DEFENSE OF TCEQ SHALL BE SUBJECT TO THE AUTHORITY OF THE OFFICE OF THE ATTORNEY GENERAL OF TEXAS TO REPRESENT TCEQ. THIS CONVENANT SURVIVES THE TERMINATION OF THE CONTRACT.

12. TERMINATION

12.1 **Termination for Cause.** TCEQ may, upon providing 10 days' written notice and the opportunity to cure to the Performing Party, terminate this Contract for cause if Performing Party materially fails to comply with the Contract including any one or more of the following acts or omissions: nonconforming work, or

existence of a conflict of interest. Termination for cause does not prejudice TCEQ's other remedies authorized by this Contract or by law.

12.2 **Termination for Convenience.** TCEQ may, upon providing 10 days' written notice to the Performing Party, terminate this Contract for convenience. Termination shall not prejudice any other right or remedy of TCEQ or the Performing Party. Performing Party may request reimbursement for: conforming work and timely, reasonable costs directly attributable to termination. Performing Party shall not be paid for: work not performed, loss of anticipated profits or revenue, consequential damages or other economic loss arising out of or resulting from the termination.

12.3 If, after termination for cause by TCEQ, it is determined that the Performing Party had not materially failed to comply with the Contract, the termination shall be deemed to have been for the convenience of TCEQ.

13. DISPUTES, CLAIMS AND REMEDIES

13.1 **Payment as a Release.** Neither payment by TCEQ nor any other act or omission other than an explicit written release, in the form of a unilateral amendment, constitutes a release of Performing Party from liability under this Contract.

13.2 **Schedule of Remedies available to the TCEQ.** In accordance with Texas Government Code Chapter 2261 the following Schedule of Remedies applies to this Contract. In the event of Performing Party's nonconformance, TCEQ may do one or more of the following:

13.2.1. Issue notice of nonconforming performance;

13.2.2. Reject nonconforming performance and request corrections without charge to the TCEQ;

13.2.3. Reject a reimbursement request or suspend further payments, or both, pending accepted revision of the nonconformity;

13.2.4. Suspend all or part of the Contract Activities or payments, or both, pending accepted revision of the nonconformity;

13.2.5. Demand restitution and recover previous payments where performance is subsequently determined nonconforming;

13.2.6. Terminate the contract without further obligation for pending or further payment by the TCEQ and receive restitution of previous payments.

13.3 Opportunity to Cure. The Performing Party will have a reasonable opportunity to cure its nonconforming performance, if possible under the circumstances.

13.4 Cumulative Remedies. Remedies are cumulative; the exercise of any remedy under this Contract or applicable law does not preclude or limit the exercise of any other remedy available under this Contract or applicable law.

14. SOVEREIGN IMMUNITY

The parties agree that this Contract does not waive any sovereign immunity to which either party is entitled by law.

15. SURVIVAL OF OBLIGATIONS.

Except where a different period is specified in this Contract or applicable law, all representations, indemnifications, and warranties made in, required by or given in accordance with the Contract, as well as all continuing obligations indicated in the Contract, survive for four (4) years beyond the termination or completion of the Contract, or until four (4) years after the end of a related proceeding. A related proceeding includes any litigation, legal proceeding,

permit application, or State Office of Administrative Hearings proceeding, which is brought in relation to the Contract or which in TCEQ's opinion is related to the subject matter of the Contract. Either party shall notify the other of any related proceeding if notice of the proceeding has not been provided directly to that other party.

16. CONTRACT INTERPRETATION

16.1 **Definitions.** The word "include" and all forms such as "including" mean "including but not limited to" in the Contract and in documents issued in accordance with the Contract, such as Work Orders or Proposals for Grant Activities (PGAs).

16.2 **Headings.** The headings of the sections contained in this Contract are for convenience only and do not control or affect the meaning or construction of any provision of this Contract.

16.3 **Delivery of Notice.** Notices are deemed to be delivered three (3) working days after postmarked if sent by U.S. Postal Service certified or registered mail, return receipt requested. Notices delivered by other means are deemed delivered upon receipt by the addressee. Routine communications may be made by first class mail, facsimile transmission, email, or other commercially accepted means.

16.4 **Interpretation of Time.** All days are calendar days unless stated otherwise. Days are counted to exclude the first and include the last day of a period. If the last day of the period is a Saturday or Sunday or a state or federal holiday, it is omitted from the computation.

16.5 **State, Federal Law.** This Contract is governed by, and interpreted under the laws of the State of Texas, as well as applicable federal law.

16.6 **Severability.** If any provision of this Contract is found by any court, tribunal or administrative body of competent jurisdiction to be wholly or partly illegal, invalid, void or unenforceable, it shall be deemed severable (to the extent of such illegality, invalidity or unenforceability) and the remaining part of the provision and the rest of the provisions of this Contract shall continue in full force and effect. If possible, the severed provision shall be deemed to have been replaced by a valid provision having as near an effect to that intended by the severed provision as will be legal and enforceable.

16.7 **Assignment.** No delegation of the obligations, rights, or interests in the Contract, and no assignment of payments by Performing Party will be binding on TCEQ without its written consent, except as restricted by law. No assignment will release or discharge the Performing Party from any duty or responsibility under the Contract.

16.8 **Venue.** Performing Party agrees that the Contract is being performed in Travis County, Texas, because this Contract has been performed or administered, or both, in Travis County, Texas. The Performing Party agrees that any cause of action involving this Contract arises solely in Travis County, Texas.

16.9 **Publication.** Performing Party agrees to notify TCEQ five (5) days prior to the publication or advertisement of information related to this Contract. Performing Party agrees not to use the TCEQ logo or the TCEQ graphic as an advertisement or endorsement without written permission signed by the appropriate TCEQ authority.

16.10 **Waiver.** With the exception of an express, written waiver in the form of a unilateral amendment signed by TCEQ, no act or omission will constitute a waiver or release of Performing Party's obligation to perform conforming

Contract Activities. No waiver on one occasion, whether expressed or implied, shall be construed as a waiver on any other occasion.

16.11 **Compliance with Laws.** TCEQ relies on Performing Party to perform all Contract Activities in conformity with all applicable laws, regulations, and rules and obtain all necessary permits and licenses.

16.12 **Counterparts.** This Contract may be signed in any number of copies. Each copy when signed is deemed an original and each copy constitutes one and the same Contract.

16.13 **Accessibility.** All electronic content and documents created as deliverables under this Contract must meet the accessibility standards prescribed in 1 Texas Administrative Code sections 206.50 and 213 for state agency web pages, web content, software, and hardware, unless TCEQ agrees that exceptions or exemptions apply.

COST BUDGET – MATCHING FUNDS

1. **Budget**. Authorized budgeted expenditures for work performed are as follows:

Budget Category	**Total Project Costs**
Salary / Wages	$53,217.00
Fringe Benefits	$22,165.00
Travel	$0.00
Supplies	$30,000.00
Equipment	$0.00
Contractual	$944,791.00
Construction	$280,000.00
Other	$41,800.00
Total Direct Cost	$1,371,973.00
Indirect Costs (10% as match)	$5,322.00
Other In-kind Contributions	$0.00
Total Contract Cost	**$1,377,295.00**
Cost Share (40%)	**$550,918.00**
TCEQ Reimbursement Amount (60%)	**$826,377.00**

2. **Matching Funds.** This Contract requires matching funds.

Performing Party must match TCEQ expenditures by contributing 40% of the total project costs as shown above. Each invoice must demonstrate that the Performing Party is contributing the required match for the period specified on the invoice.

3. **Indirect Cost Reimbursable Rate**. The reimbursable rate for this Contract is 10% of (check one):

☐ salary and fringe benefits

☐ modified total direct costs

☒ other direct costs base

If other direct cost base, identify: salary/wages

This rate is less than or equal to (check one):

☐ Predetermined Rate—an audited rate that is not subject to adjustment.

☐ Negotiated Predetermined Rate—an experienced-based predetermined rate agreed to by Performing Party and TCEQ. This rate is not subject to adjustment.

☒ Default rate—a standard rate of ten percent of salary/wages may be used in lieu of determining the actual indirect costs of the service.

4. **Other**. If Budget Category "Other" is greater than $25,000 or more than 10% of budget total, identify the main constituents: Performing Party's match consisting of project monitoring activities not being reimbursed.
5. **Travel**. In order to be reimbursable, travel costs must be specifically authorized in advance of the travel. Travel costs will be reimbursed only in the amount of actual costs, up to the maximum allowed by law for employees of the State of Texas at the time the cost is incurred.
6. **Budget Categories**. The Budget Categories above have the definitions, requirements and limitations stated in UGMS. Construction costs are not reimbursable without prior, specific written authorization from TCEQ.
7. **Budget Control**.
    a. **Cumulative transfers equal to or less than 10% of the Total Budget.** Performing Party may transfer amounts between the approved direct cost budget categories so long as cumulative transfers from direct cost budget categories during the Contract Period do not exceed ten percent (10%) of the Total Budget amount. Performing Party must timely submit a Budget Revision Request (BRR) Form reflecting the revised budget. Upon approval by TCEQ, the BRR will be incorporated into this Contract as though it is a document revised under General Term and Condition Section 1.2. The 10% limit does not reset with the approval of each BRR. It resets when an amendment is signed by the parties reflecting changes to the budget.
    b. **Cumulative transfers greater than 10% of the Total Budget.** TCEQ must **pre-approve in writing** all budget revisions that result in the cumulative transfer from direct cost budget categories of funds greater than 10% of the Total Budget during the Contract Period. The Performing Party must request to amend the Contract. A contract amendment is required **before** Performing Party incurs these costs.
    c. Performing Party may not transfer amounts to budget categories containing zero dollars without TCEQ pre-approval in writing.
8. **Invoice Submittal**. Unless otherwise stipulated in the Contract, invoices must be submitted to the individual named in TCEQ Project Representatives and Records Location at monthly intervals. Final invoices shall be submitted within two (2) calendar months after completing the Scope of Work activities. TCEQ may unilaterally extend this deadline by e-mail.
    a. All invoices must be submitted in a format that clearly shows how the budget control requirement is being met.
9. **Supporting Records**. Performing Party shall submit records and documentation to TCEQ as appropriate for the review and approval of reimbursing costs. TCEQ may reject invoices without appropriate supporting documentation. TCEQ has the right to request additional documentation such as expenses for the invoice period, year-to-date expenses, projected totals for the year (or applicable contract period), percent of budget spent to date, and percentage of budget projected to be spent. Performing Party shall maintain records subject to the terms of this Contract.
10. **Indirect Costs**. Performing Party's indirect costs will be reimbursed at the reimbursable rate entered above. If no reimbursable rate is shown above, indirect costs are not reimbursable under this Contract. The reimbursable rate must be less than or equal to the rate authorized under UGMS. To the extent that the reimbursable rate is lower than Performing Party's actual indirect costs, Performing Party is contributing its unreimbursed indirect costs to the successful performance of this Contract, and waives any right it may have to reimbursement of those costs (if this Contract requires matching funds, Performing Party may claim its unreimbursed indirect costs as part or all of its match). Performing Party must fund all unreimbursed indirect costs from other funds. It is the Performing

Party's responsibility to ensure that unreimbursed indirect costs are not charged to other projects which do not benefit from them, and that it uses funding sources that may be properly used to fund its unreimbursed costs.

NOTICES, PROJECT REPRESENTATIVES AND RECORDS LOCATION

1. **Representatives.** The individual(s) named below are the representatives of TCEQ and the Performing Party. They are authorized to give and receive communications and directions on behalf of TCEQ and the Performing Party as indicated below. All communications including official Contract notices must be addressed to the appropriate representative or his or her designee.

2. **Changes in Representatives.** Either party may change its information in this Notices, Project Representatives and Records Location document by providing notice to the other party's representative for contractual matters.

3. **TCEQ Representatives**

TCEQ Contract Manager
(for Contractual Matters)

Samuel Davis III, CTCM
P.O. Box 13087, MC-141
Austin, Texas 78711-3087
Phone: (512) 239-2412
Email: samuel.davis@tceq.texas.gov

TCEQ Project Manager
(for Technical Matters)

Samantha Litchke
P.O. Box 13087, MC-203
Austin, Texas 78711-3087
Phone: (512) 239-5635
Email: samantha.litchke@tceq.texas.gov

4. **Performing Party Representatives**
(for Contractual Matters)

Mark Enders
City of New Braunfels
550 Landa Street
New Braunfels, Texas 78130
Phone: (830) 221-4369
Email: menders@nbtexas.org

5. **Invoice Submittal.** Invoices may be submitted electronically to the TCEQ Contract Manager and TCEQ Project Manager at WQPDInv@tceq.texas.gov. Invoices submitted by mail must be addressed to the TCEQ Contract Manager.

6. **Designated Location for Records Access and Review**. The Performing Party designates the physical location indicated below for record access and review pursuant to any applicable provision of this Contract:

City of New Braunfels
550 Landa Street
New Braunfels, Texas 78130

Attachment A:
Financial Status Report

Texas Commission on Environmental Quality
FINANCIAL STATUS REPORT

1.	STATE AGENCY TO WHICH REPORT IS SUBMITTED:	**Texas Commission on Environmental Quality**		
2.	GRANT/AGREEMENT TITLE:			
3.	PAYEE IDENTIFICATION NUMBER:		4.	RECIPIENT ORGANIZATION (NAME AND COMPLETE ADDRESS, INCLUDING ZIP CODE):
5.	TCEQ AGREEMENT NUMBER:			
6.	FINAL REPORT: YES NO			
7.	ACCOUNTING BASIS: CASH ACCRUAL			
8.	TOTAL PROJECT/GRANT PERIOD: FROM TO		9.	PERIOD COVERED BY THIS REPORT: FROM TO

10. BUDGET CATEGORIES:	Approved Budget	Project Cost This Report	Cumulative Project Cost	Balance **
a. Salary/Wages				
b. Fringe Benefits (%)				
c. Travel				
d. Supplies				
e. Equipment				
f. Contractual				
g. Construction				
h. Other				
i. Total Direct Costs (Sum a – h)				
j. Indirect Costs (___% x $_____ Base)				
k. TCEQ Reimbursement Amount				

* List (Itemize) on the appropriate supplemental form all component expenses comprising the total for each of these categories. Please attach receipts, as required,

** Negative balances in any of the budget categories should be explained in a brief accompanying narrative.

11. CERTIFICATION I certify to the best of my knowledge and belief that this report is correct and complete and that all outlays and unliquidated obligations are for the purposes set forth in the award document.

Signature of Authorized Certifying Official: _____

Typed or Printed Name and Title: _____

Telephone (Area code, number and ext.): _____ Date Submitted: _____

TCEQ Form 20248

PERSONNEL/SALARY EXPENDITURES (during this report period)			
EMPLOYEE NAME	TITLE/POSITION	SALARY (THIS PERIOD)	TASKS
A. **PERSONNEL/SALARY** All Employees listed on current PEL? ___Yes ___No B. **FRINGE** Rate = _____% Total for the reporting period = $_____ (Do not include fringe in total at right)			
TOTAL PERSONNEL/SALARY EXPENDITURES (must agree with line 10a on Form 20248)			

On this Supplemental Form, list employee's name, title/position, salary for the period, and Task number(s) worked. An updated PEL is required when employment status changes occur.

TRAVEL EXPENDITURES (during this report period)						
EMPLOYEE(S)	DATE(S) OF TRAVEL	DESTINATION & PURPOSE OF TRAVEL	MEALS	LODGING	TRANSPORTATION (Miles X Rate)	TASKS
TOTAL TRAVEL EXPENDITURES (must agree with line 10c on Form 20248)						$

On this Supplemental Form, itemize each traveler's costs to show name of traveler, date(s) of travel, destination and purpose, mode of transportation, costs for meals, lodging, transportation, and Tasks for which the cost applies (itemization may be attached).

SUPPLIES PURCHASED (during this report period)				
NUMBER PURCHASED	ITEM DESCRIPTION (Should match description provided for approval)	UNIT COST	TOTAL COST	TASKS
TOTAL SUPPLIES PURCHASED (must agree with line 10h on Form 20248)				

On this Supplemental form, list materials and supplies purchased for the Contract, cost, and Task to which each supply item applies. Provide enough information in the description to enable the TCEQ to determine the allowability of cost.

EQUIPMENT PURCHASES (during this report period)				
NUMBER PURCHASED	ITEM DESCRIPTION (Should match description provided for approval)	UNIT COST	TOTAL COST	TASKS
TOTAL EQUIPMENT EXPENDITURES (must agree with line 10e on Form 20248)				

List the description of equipment, serial No., cost and Task to which each equipment item applies. Note: TCEQ may disallow the cost of equipment purchased without prior approval.

CONTRACTUAL EXPENDITURES (during this report period)			
SUBCONTRACTOR (NAME)	FOR	COST (THIS PERIOD)	TASKS
TOTAL CONTRACTUAL EXPENDITURES (must agree with line 10f on Form 20248)			

List all subcontractor costs either incurred or paid during the period, including subcontractor name, description of activities performed, date(s) performed, costs, and related Tasks.

CONSTRUCTION COSTS (during this report period)			
DESCRIPTION	PURPOSE	COST (THIS PERIOD)	TASKS
TOTAL CONSTRUCTION EXPENDITURES (must agree with line 10g on Form 20248)		$	

* LEGIBLE RECEIPTS MUST BE ATTACHED TO THIS FORM FOR EACH LISTED ITEM OR EXPENDITURE.

OTHER EXPENDITURES (during this report period)				
NUMBER PURCHASED	DESCRIPTION	UNIT COST	TOTAL COST	TASKS
TOTAL Other EXPENDITURES (must agree with line 10g on Form 20248)			$	

On this Supplemental form, list the description of the item or cost, cost, and Task to which each item or cost applies. Provide enough information in the description to enable the TCEQ to determine the allowability of cost.

Attachment B:
Release of Claims

(Must be returned with last invoice per General Terms and Conditions Section 4.6)

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Conditional Final Waiver and Release of Claims

Upon receipt and clearance of payment from the Texas Commission on Environmental Quality (TCEQ) in the sum of $_____, which constitutes final payment to [*Performing Party's Name*](hereinafter referred to as "Performing Party"), Performing Party and its successors and assigns, release, discharge and relinquish the TCEQ, its officers, agents, and employees from all claims, known or unknown, arising out of or relating to TCEQ Contract Number _____ (Contract).

It is expressly agreed and understood that this conditional FINAL waiver and release of all claims is effective, without any further action of any party, only upon clearance of final payment to Performing Party in the above-mentioned amount. Performing Party warrants that it has completed all activities described in the Contract.

Executed on this _____ day of _____, 20____.

By:_____

(signature)

_____

(name)

_____

(title)

Attachment C:
Budget Revision Request

BUDGET REVISION # _____ REQUEST FORM

Purpose: To document recipient organization's proposed budget changes to ensure project deliverables are met and fiscal accountability. Prior TCEQ review and approval is required before incurring specific costs resulting in cumulative transfers of more than 10% of the total budget.

Instructions: Complete 1. - 8. Total the amounts.

1. Recipient Organization (Name & Complete Address Including Zip Code):

2. Grant/ Contract Title:		3. Payee Identification No.:	
4. TCEQ Contract No.:		5. Total Project/ Grant Period:	
6. Budget Categories:	7. Approved Budget	8. Change Requested (+ or -)	9. New or Revised Budget
a. Personnel/Salaries			
b. Fringe Benefits			
c. Travel			
d. Supplies			
e. Equipment			
f. Contractual			
g. Construction			
h. Other			
i. Total Direct Costs (sum a - h)			
j. Indirect Costs (___% x $_____ [Base: (Insert Base)])			
k. Total (sum i & j)			

Justification (Attach additional sheets, if necessary):

*** Budget Revision Request must contain all signatures to be approved/valid ***

Signature of Recipient's Representative	Date	Type or Printed Name and Title	
Signature of TCEQ Project Manager	Date	Type or Printed Name and Title	
Signature of TCEQ Contract Manager	Date	Type or Printed Name and Title	

Attachment D:
Personnel Eligibility List

(Must be returned per General Terms and Conditions Section 4.2)

Personnel Eligibility List (PEL)

Performing Party:

Date:

Staff Name or "Vacant"	Position or Title	Date Added to PEL	Date Removed from PEL	Initial Estimated Time to Contract (% or hours)*

*Only provided for estimation purposes and may be different from actual hours worked.

Attachment E:
Performing Party's Performance Evaluation Report

PERFORMING PARTY'S PERFORMANCE EVALUATION REPORT

☐ Final Report *(Check only if the Agreement has ended and this is the last Performance Report)* Today's Date:_____

Report No.: _____ of _____ Evaluation Period: From:_____ To:_____

Grantee: _____ Contract/Purchase Order No.:_____

Project Name (*if applicable*): _____ Phase *(if applicable)*:_____

Date of Last Report: _____ Date of Program's Last Site Visit (*if applicable)*:_____

Brief Description of Work/Services (*optional*):_____

Performance Category	**Ratings**				**Comments**
	Exceeds Expectations Score=3	**Satisfactory Performance** Score=2	**Marginal Performance** Score=1	**Unsatisfactory Performance** Score=0	Please provide a narrative description for ratings of one or below (*attachments are acceptable.*)
Quality & Accuracy					
Timeliness					
Reports					
HUB (for Quarterly Reporting, complete this portion only and return)					
Communication					
Cost Control					
Technology					
Other (describe) ***XXX***					

Evaluator's Name: _____ Signature:_____
(Printed or Typed)

Division: _____ Section:_____

XXX Requires an attachment describing category and rating description which corresponds.
Note: Please see reverse side for specific definitions for each performance category and an explanation for each score.

PERFORMING PARTY's PERFORMANCE EVALUATION REPORT - Category Descriptions

PERFORMANCE CATEGORY	EXCEEDS EXPECTATIONS (Score = 3)	SATISFACTORY PERFORMANCE (Score = 2)	MARGINAL PERFORMANCE (Score = 1)	UNSATISFACTORY PERFORMANCE (Score = 0)
1. Quality and Accuracy Quality, sufficiency, and accuracy of contract-required work, including work or Tasks performed by subcontractors	Work product always, with rare exceptions, of excellent quality. Revisions rarely or never required.	Work product of satisfactory quality with only typical errors and omissions, which were corrected upon request.	Work product is acceptable, although many errors and/or omissions had to be corrected prior to product being acceptable.	Work product not acceptable or of very low quality, with many errors and omissions noted. Not all errors and omissions corrected.
2. Timeliness Timeliness with respect to completing Contract-required work and/or work-related Tasks, including work performed by subcontractors	All Tasks and Contract deliverables on time or ahead of schedule. Quality of work did not suffer as a result of the time line.	Some intermediate Task delays, not expected to cause major deadlines to be missed or to require Contract extension. Prior approval granted for any other delays.	Some major work performance delays caused (or expected to cause) delivery schedules to be missed.	Required work product not completed on time, due to factors that should have been under Performing Party's control.
3. Reports Accuracy, adequacy, and timeliness of Contract-required activity/progress reports, notifications, financial reports, invoices, pay requests and other required documents, excluding HUB reports	All reports accurate and complete, as well as on time. No rewrites or additional information required.	Reports satisfactory with respect to both quality and timeliness. Performing Party responded quickly and appropriately to questions or comments raised.	Numerous errors and/or omissions corrected prior to reports being acceptable (or reminders of reports due were required to be sent). Reports not later than 5 working days.	Reports consistently of poor quality and/or late. Contents inadequate to permit interpretation or analysis. Reports more than 5 working days late.
FOR HUB PROGRAM USE ONLY: **4. HUB and/or DBE/ MBE/ WBE*** Performing Party's achievement of (or continued responsiveness toward) Contract-contained HUB Subcontracting Plan (HSP) and/or Good Faith Effort (GFE) requirements, including timely and accurate submittal of Contract-required HUB related reports. *When the term HUB is used, include evaluation of Performing Party's performance of DBE/MBE/WBE requirements.	Performing Party consistently meets or exceeds the HSP and/or GFE requirements. All reports accurate and complete, as well as on time. No rewrites or additional information required.	Performing Party satisfactorily meets the HSP and/or GFE requirements. Reports satisfactory with respect to both quality and timeliness. Performing Party responded quickly and appropriately to questions or comments raised.	Performing Party marginally meets the HSP and/or GFE requirements. Numerous errors and/or omissions corrected prior to reports being acceptable (or reminders of reports due were required to be sent). Reports frequently late.	Performing Party did not adequately meet the HSP and/or GFE requirements. Reports consistently of poor quality and/or late. Contents inadequate to permit interpretation or analysis. Reports habitually late.

5. Communication Performing Party's accessibility, responsiveness, and cooperativeness with respect to any Contract-related concerns communicated by the Contract Manager; plus Performing Party's demonstrated relationship with subcontractors	Performing Party consistently maintains excellent standing with subcontractors, including timely payments. Works as a team member and is flexible and responsive to changes in circumstances or scope of work.	Performing Party is usually flexible and responsive to changes in circumstances or scope of work. Generally maintains good standing with subs, and ensures that they are paid promptly.	Performing Party is only intermittently responsive to changes in Contract scope or other circumstances. Marginal team player. Failed to make timely payments to subs on one or two occasions.	Not flexible to changes in scope or other circumstances. Not cooperative or accessible. Failed to maintain good standing with subs and failed to make payments on more than two occasions.
6. Cost Control* Performing Party's ability to observe current cost levels; compare them with Contract or Work Order budget, as applicable; and institute corrective action to keep cost within budget. *Do not include consideration of Contract or Work Order budget amount changes requested or caused by TCEQ.	Performing Party took strong initiative to observe current cost levels; compare them with Contract or Work Order budget, as applicable; and institute corrective action to keep cost within budget.	Performing Party observed current cost levels; compared them with Contract or Work Order budget, as applicable; and instituted corrective action to keep cost within budget.	Performing Party sometimes failed to observe current cost levels; compare them with Contract or Work Order budget, as applicable; and institute corrective action to keep cost within budget.	Performing Party failed to observe current cost levels; compare them with Contract or Work Order budget, as applicable; and institute corrective action to keep cost within budget.
7. Technology Performing Party's demonstrated technical competence and/or expertise (including competence and expertise of subcontractors); plus Performing Party's innovativeness and willingness to apply, within the limitations of the Contract, new techniques or technologies	Performing Party is comfortable with and applies current proven technology. But is familiar with, and willing to use, latest techniques and solutions where such are appropriate.	Performing Party is capable of applying current proven technology. Is aware of, but not experienced in the use of latest techniques and solutions.	Performing Party usually uses more basic technology to solve Contract problems. Is aware of, but has little or no experience in the use of more current proven techniques and solutions.	Performing Party can only apply basic technology to Tasks. Requires direction concerning appropriate technology and solutions.
8. Other DESCRIBE	DESCRIBE	DESCRIBE	DESCRIBE	DESCRIBE

Attachment F:
Level-of-Effort Certification

(Certification(s) must be returned with each invoice per General Terms and Conditions Section 4.3)

Level-of-Effort Certification
[Month] 20[XX]
Employee Name: [Name]

Project	Actual Activities Performed	Activity for Which Employee was Compensated (% of Total Hours Worked)
TCEQ Contract Nos.		
582-XX-XXXXX	•	X %
582-XX-XXXXX	•	X %
582-XX-XXXXX	•	X %
582-XX-XXXXX	•	X %
582-XX-XXXXX	•	X %
582-XX-XXXXX	•	X %
Other Projects (Not Related to TCEQ Contracts/Grants)		X %

The information listed above is true and correct. TCEQ may request additional information.

_____	_____
Employee Name	Supervisor Name
_____	_____
Employee Signature	Supervisor Signature
_____	_____
Date	Date

PRESENTER:
Mike Mundell, Solid Waste Manager
SUBJECT:
Approval of a purchase from Chastang Autocar, Chastang Ford, and Rush Truck Centers of Texas, LP for heavy equipment collection vehicles and service vehicles for the Solid Waste Division and to declare the replaced vehicles as surplus.
DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: Continue an ongoing program of infrastructure and maintenance.

BACKGROUND INFORMATION:
The Solid Waste heavy equipment was added to the City's vehicle replacement program fund in FY 2009-10 and since that time Solid Waste has made annual contributions for the replacement of garbage collection vehicles as well as Fleet Services vehicles. The addition of the equipment to the program has allowed Solid Waste to improve the quality and predictability of the trash and recycling collection service.

Due to continued rapid growth in the community the purchase of three new automated side load collection vehicles has been recommended. The addition of these vehicles will allow the residential and recycling lines of business to better align the workload for these divisions with industry standards by adding two additional routes to each.

There are also several vehicles scheduled for replacement which is based on the vehicles age and condition. The replacements include: one front load collection vehicle and one roll-off in the Commercial Collection Division, three automated side load collection vehicles, and one grapple truck in the Residential Collection Division, two rear load collection vehicles in the Recycling Division, one stake bed delivery truck in the Container Maintenance Division, one service truck, and one parts truck in the Fleet Services Division. The funding for these vehicles will come from the Enterprise Maintenance and Equipment Replacement Fund. The replaced vehicles will be declared surplus and sold at auction.

Pricing was requested from Chastang Autocar, Chastang Ford, and Rush Truck Center utilizing a cooperative contract through Buyboard which has been competitively vetted. The total cost for the vehicles is $3,351,114.

Equipment Type	Vendor	Cost	Qty.	Total Cost
Automated Side Load Trucks	Chastang Autocar	$318,761	6	$1,912,966
Front Load Truck	Chastang Autocar	$334,429	1	$334,429
Roll-off Truck	Chastang Autocar	$252,775	1	$252,775
Grapple Truck	Chastang Autocar	$171,200	1	$171,200

Fleet Service Truck	Chastang Ford	$151,978	1	$151,978
Delivery Truck	Chastang Ford	$57,533	1	$57,533
Parts Truck	Chastang Ford	$33,423	1	$33,423
Rear Load Truck	Rush Truck Center	$218,405	2	$436,810
Total			14	$3,351,114

ISSUE:
There is a need for addition and replacement of Solid Waste equipment to support and maintain growing services. Staff is attempting to expedite the order give that vehicle purchases are anticipated to be impacted significantly by supply chain issues in FY 2022.

FISCAL IMPACT:
The addition of the equipment referenced above for $3,351,114 will be funded from the Enterprise Maintenance and Equipment Replacement Fund and Solid Waste Fund (FY 2022) therefore sufficient funds are available.

RECOMMENDATION:
Staff recommends approval of a purchase from Chastang Enterprises-Houston, LLC and Rush Truck Centers of Texas, LP for heavy equipment collection vehicles and service vehicles for the Solid Waste Division and to declare the replacement vehicles surplus.

PRESENTER:
Barbara Coleman, Purchasing Manager

SUBJECT:
Approval of annual routine recurring expenditures for FY 2021 in accordance with City Charter Section 9.17.

DEPARTMENT: Finance

COUNCIL DISTRICTS IMPACTED: Maintain fiscal stability of City operations

BACKGROUND INFORMATION:
Per section 9.17 of the City Charter, City Council approval is required for annual purchases that exceed $50,000. There are various routine expenditures that occur every year and staff recommend that these expenditures be approved all at once, to more efficiently manage staff resources as well as ensure compliance with the charter. This will eliminate the need for these expenditure requests to be brought to City Council individually throughout the year.

This action will allow purchases to be made as needed throughout the year. As indicated below, the purchases are competitively vetted by cooperative agreements, quote or justified as a single source. Funding has been allocated for all of the expenditures detailed below.

As additional vendors that are anticipated to exceed the $50,000 threshold are identified, they would still be brought for City Council at that time. Moreover, any purchases that warrant individual consideration and approval will be brought to City Council in that manner.

The following purchases and estimated annual expenditures are recommended for City Council consideration:

Vendor Source	Service	Contract Value
Heil of Texas	Mechanical services and parts for fleet vehicles (trash collection bodies). Requesting increase of annual spend from $60,000 to $150,000 - Funding is incorporated into the Solid Waste Fund.	$150,000

Master Plan	Consulting Services for Development Review Assistance for Planning Department. Requesting increase of annual spend from $100,000 to 130,000. -Funding is incorporated into the Development Services Fund.	$140,000

ISSUE:
Requesting additional annual spend to support departmental needs.

FISCAL IMPACT:
Funding for all initiatives and expenditures above were incorporated into the appropriate FY 2021 departmental budgets. However, the amounts above are estimates; actual costs are dependent upon needs. If the actual costs above exceed what was allocated in the budget for those services, departments are required to make that difference up elsewhere within their operating budget.

RECOMMENDATION:
Staff recommends approval of annual recurring expenditures for FY 2021 in accordance with City Charter section 9.17

PRESENTER:
Christopher J. Looney, AICP, Planning and Development Services Director

SUBJECT:
Approval of a Professional Services Agreement with Clarion Associates LLC to create a Unified Development Code for the City of New Braunfels.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
On March 25, 2021, Request for Qualifications (RFQ) 21-011was released for the purpose of seeking proposals from qualified consultant teams interesting in assisting the community in drafting and preparing a functional, practical, reasonable and responsible Unified Development Code (UDC). The project will include overhauling and consolidating the existing development-related ordinances into a single, easy-to-use document housed in a single chapter of the New Braunfels Code of Ordinances.

The primary objective of the UDC is to be one of the city's tools used to implement Envision New Braunfels, the community's comprehensive plan, which won the American Planning Association (APA) state chapter award for best Comprehensive Plan in 2018. The plan focuses on how to accommodate and manage the tremendous growth the region is experiencing, while maintaining New Braunfels' exceptional quality of life sustained through its history, cultural identity, environment, geography, architecture, and natural resources.

On April 29, 2021, the City received eight responses to our RFQ. Our City staff evaluated the responses received based on our identified criteria requirements, completeness and clarity of proposal, understanding of the community and State, experience, knowledge and reputation of proposer, past performance on similar projects, and planned approach and timeline. Additionally, City staff interviewed our top three (3) scored proposers. Based on their evaluation and interview presentations, Clarion Associates LLC was selected as the top scored proposer for this vital project. Clarion presented to the City their developed and finalized scope of work, agreed upon by the City, for a fee of $393,460, which includes contingencies for additional meetings or resources if needed. It is anticipated that this project will take 18 to 21 months to complete.

ISSUE:
The current development-related ordinances, including but not limited to the Zoning Ordinance (Chapter 144), Subdivision Platting Ordinance (Chapter 118), Sign Ordinance (Chapter 106), and Historic Preservation Ordinance (Chapter 66), were written at different times in New Braunfels' history. The standards, criteria, and limited development alternatives create barriers to implementation of Envision New Braunfels, as well as other adopted City plans and policies. Additionally, the ordinances' locations in different chapters in the Code of Ordinances result in time-consuming cross-referencing, missed requirements and development delays.

While Envision New Braunfels included a robust public engagement program that resulted in guidance for goals to achieve with the UDC, this project will include additional extensive public outreach to ensure as much

input can be gathered as possible. The consultant will collaborate with staff to develop an innovative stakeholder engagement methodology that will create opportunities for broad, diverse, community-wide input. The effort will include the creation of a Citizens Advisory Committee, and other technical committees made up of interested community members to help prepare the various land development ordinance updates.

The project will be divided into Tasks beginning with initial project meetings with staff, boards, commissions, and City Council, followed by development of the full Public Participation Plan. The next Task will involve stakeholder interviews to assess the status and effectiveness of the currently adopted codes in meeting the goals established by City Council and Envision New Braunfels. Drafting that occurs in the next Task will be divided into four modules (zoning, platting, admin/procedures, and historic preservation/ signs), utilizing community engagement throughout. Following public review/edits and testing of the drafts, the final Task includes the adoption process.

Adopting a new set of land development ordinances as a UDC meets 32 specific goals and strategies in Envision New Braunfels. The Comprehensive Plan very specifically calls for its creation to encourage great urban design for existing and future centers through modern, flexible and innovative development standards, alternatives and regulatory incentives.

FISCAL IMPACT:
Funding for this expenditure described above has been incorporated into the FY 2022 Development Services Fund budget. Therefore, sufficient funds are available.

RECOMMENDATION:
Staff recommends approval of a Professional Services Agreement with Clarion Associates LLC to assist in creating a Unified Development Code for the City of New Braunfels. Following engagement with Clarion Associates, staff will bring forward to City Council a recommended Citizens Advisory Committee make-up for consideration.

City of New Braunfels, Texas
Creation of a Unified Development Code
Request for Proposals

Introduction

Overview
The City of New Braunfels is seeking proposals from qualified consultant teams interested in assisting the community in drafting and preparing a functional, practical, reasonable, and responsible Unified Development Code (UDC). The project will include overhauling and consolidating the existing development-related ordinances into a single, easy-to-use document housed in a single chapter of the New Braunfels Code of Ordinances.

The primary objective of the UDC is to be one of the city's tools used to implement Envision New Braunfels, the community's comprehensive plan, which won the American Planning Association (APA) state chapter award for best Comprehensive Plan in 2018. The plan focuses on how to accommodate and manage the tremendous growth the region is experiencing, while maintaining New Braunfels' exceptional quality of life sustained through its history, cultural identity, environment, geography, architecture, and natural resources.

The current development-related ordinances, including but not limited to the Zoning Ordinance (Chapter 144), Subdivision Platting Ordinance (Chapter 118), Sign Ordinance (Chapter 106), and Historic Preservation Ordinance (Chapter 66), were written at a different time in New Braunfels' history. The suburban-style standards, subjective criteria, and lack of modern innovative development alternatives create barriers to implementation of Envision New Braunfels, as well as other adopted City plans and policies. Additionally, the ordinances' locations in different chapters in the Code of Ordinances create confusion: multiple cross-referencing can lead to missed requirements and, in turn, costly development delays.

The selected consultant team must have demonstrated experience in:
1. Drafting contemporary development codes/ordinances to implement a comprehensive plan;
2. Producing engaging descriptive design illustrations, maps and graphics to supplement and clarify written requirements or concepts;
3. Ensuring constitutionality of standards, processes and exactions;
4. Employing rough proportionality analyses, and applying Texas' vested rights statute;
5. Removing barriers to innovative development patterns, sprawl retrofits, workforce housing, and flexibility to allow for innovation, creativity, and placemaking;
6. Creating development and zoning incentives to achieve excellent urban design, great streets, enhanced mobility and a community's desired urban form;
7. Preparing guidelines as incentives for low impact development (LID), tree preservation and related environmental objectives identified in a community's comprehensive plan;
8. Writing innovative zoning tools for comprehensive plan implementation that appropriately address both the private and public realm;
9. Consolidating and streamlining inefficient and redundant processes;
10. Collaborating with broad groups of stakeholders to achieve desired outcomes; and
11. Working as an extension of city staff in engaging the public and workgroups to build consensus and understanding around innovative concepts for the built-environment.

Community Background

The seat of Comal County, New Braunfels is strategically situated between the Nation's seventh largest city, San Antonio, to the south, and the Texas Capital, Austin, to the north, with easy access to each along Interstate Highway 35. Interstate Highway 10, less than ten miles to the south, provides access to Houston, three hours to the east.

Consistently ranked by the U.S. Census Bureau in the top 10 fastest growing cities in the Nation, New Braunfels has a 2020 estimated population of over 90,000 within a metropolitan statistical area (MSA) of approximately 2.3 million inhabitants. Founded in 1845, New Braunfels has a rich history and retains its cultural heritage which influences its architecture, community activities, branding, pride of citizenship, and way of life.

The environmentally sensitive Balcones Escarpment on the west side of the city gives rise to the Texas Hill Country. The base of the escarpment includes numerous natural springs coming forth from karst in the limestone of the Edwards Aquifer, the region's main fresh water source. These springs form the headwaters of the Comal River. The pristine Comal River winds its way through town to its confluence with the Guadalupe River. The Guadalupe River, with headwaters in the western Hill Country, feeds Canyon Lake north of New Braunfels, then flows southeast, across the Blackland Prairie, filling several hydroelectric and recreational reservoirs downstream. Both watercourses provide much of the source for outdoor recreation that draws millions of visitors from across the Country to the area every year.

Situated approximately equidistant between Austin and San Antonio, New Braunfels has ready access to numerous state-supported and private universities in the region and boasts a solid transportation infrastructure network including a successful regional airport. All of the above, coupled with the region's changing demographics, contribute to continued vibrant business and corporate location and expansion in a variety of fields and sectors.

Comprehensive Plan

The innovative public engagement methods used to gather extensive community input were the hallmarks of Envision New Braunfels and contributed to its selection as the best Texas comprehensive plan in 2018. A truly community-driven plan, Envision New Braunfels encourages partnerships with private business, school districts, not-for-profits, service organizations, the medical industry, etc. to achieve full implementation.

Envision New Braunfels specifically calls for adopting a UDC that encourages great urban design for existing and future centers. Some of the 287 strategies and actions directly addressing the UDC include, but are not limited to:

Strategy 1 – Support Vibrant Centers

- Action 1.6: Incentivize infill development and redevelopment to take advantage of existing infrastructure.
- Action 1.11: Update policies and codes to achieve development patterns that implement the goals of Envision New Braunfels.
- Action 1.14: Ensure regulations do not unintentionally inhibit the provision of a variety of flexible and innovative lodging options and attractions.

Strategy 2 – Activate Neighborhoods

- Action 2.1: Sustain community livability for all ages and economic backgrounds.
- Action 2.5: Encourage diversification of commercial activity Downtown to build on and sustain existing historic resources and maximize structure utilization for economic expansion.
- Action 2.8: Establish or expand architectural standards for quality of design across the city.

- Action 2.33: Encourage vertical growth and development of key areas to take advantage of infrastructure capacity, maintain the core, and to discourage sprawl.
- Aging in Place special action: Ensure that community land-use planning improves older-adult mobility through zoning enhancements that support the logical location of older-adult housing and services near transportation and mobility infrastructure.

Strategy 3 – Balance Jobs and Housing Choice

- Action 3.6: Pro-actively provide a regulatory environment that remains business and resident friendly.
- Action 3.10: Change zoning/land use and platting rules, and create tax and permit fee incentives in underutilized neighborhoods, nodes, and corridors to encourage redevelopment.
- Action 3.13: Cultivate an environment where a healthy mix of different housing products at a range of sizes, affordability, densities, amenities and price points can be provided across the community as well as within individual developments.
- Action 3.16: Review and revise regulations that inadvertently inhibit creative housing options or workforce housing alternatives.
- Action 3.23: Revise local ordinances so that they do not inadvertently inhibit development of venues in close proximity to neighborhoods and schools.

Strategy 4 – Innovate in Parks and Public Spaces

- Action 4.1: Ensure parks and green spaces are within a one-mile walk or bicycle ride for every household in New Braunfels.

Strategy 5 – Bolster Resilient Infrastructure

- Action 5.2: Discourage development in Edwards Aquifer Recharge and contributing zones, stream zones, or other ecologically constrained areas. Where development in these areas must occur, require that it be environmentally sound using tools such as but not limited to low impact development (LID).
- Action 5.3: Amend codes to include incentives for developers to use LID tools such as permeable materials, rainwater harvesting, bio-swales, etc. Phase-in some as requirements over time.
- Action 5.13: Continuously seek new innovations in drainage, streets, engineering practices, etc. to achieve the state of the art; require or incentivize practices for the development community.
- Action 5.15: Ensure that developers adequately address drainage in their projects and developments.
- Action 5.16: Update City of New Braunfels ordinances to reflect the “Drainage and Erosion Control Design Manual” principles.
- Action 5.17: Review and update Tree and Landscape ordinances to ensure New Braunfels remains a green city and expands its tree canopy.
- Action 5.27: Enhance city codes to encourage solar energy usage/generation.

Strategy 6 – Coordinate Community Investments

- Action 6.2: Protect the airport from incompatible land use encroachment.

Strategy 7 – Connect All

- Action 7.4: Strengthen sidewalk requirements in the City’s codes.
- Action 7.6: Design neighborhoods and subdivision development codes with schools and school access in mind.
- Action 7.7: Ensure that local development codes which require sidewalks, trails, lanes or paths include healthy living, safety, and vehicular congestion relief as an intent.
- Action 7.9: Enact/enforce maximum block size limitations.
- Action 7.10: Require more street connectivity/adopt connectivity ratios.
- Action 7.11: Allow for smaller/narrower streets and lot size variety within individual subdivisions.
- Action 7.19: Improve connectivity for all modes of transportation including bicycles.

- Action 7.39: Add handicapped parking requirements to the New Braunfels parking ordinances.
- Action 7.50: Ensure the thoroughfare plan includes and ordinances require adequate dedication and reservation of right-of-way for future roadways.

Strategy 8 – Cultivate Local and Regional Partnerships

- Action 8.8: Collaborate with property owners to preserve historic structures.

Future Land Use Map

Envision New Braunfels includes an innovative future land use map that focuses on Sub Areas, Corridors, and Existing and Future Centers of activity and vitality. The existing zoning districts were written to accommodate outdated models of more prescriptive land use categories. The new UDC will need to embrace the new model with appropriate standards to achieve mixed-use, neighborhood compatibility, multi-modal connectivity, and use transitions.

Related Plans and Studies

The City and its area partner agencies and organizations have adopted various plans, reports, studies, GIS information and maps that further guide and shape the built environment. The selected consultant is expected to become familiar with these documents for UDC integration and policy implementation. These include, but are not limited to:

- South Castell Avenue Visioning Plan
- Workforce Housing Study
- Economic Development Strategic Plan
- Parks and Recreation Master Plan
- Downtown Implementation Plan
- Castell Avenue Study (2021)
- San Antonio Street Neighborhood Study (2021)
- River Mill Neighborhood Plan (underway)
- Regional Transportation Plan
- Hike and Bike Trail Master Plan
- River Properties Master Plan
- Drainage and Erosion Control Design Manual
- Veramendi Development and Design Control Document

Ordinances: https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances

The current Zoning Ordinance is an amalgamation of various different updates over the decades. Originally drafted in the 1960s as an update to one from the 1940s, it includes pyramidal zoning districts and suburban style development standards. This is surprising considering the community prides itself on not being a suburb of San Antonio. An update in 1987 added new districts that maintained a mostly pyramidal nature and did not integrate concepts beyond the suburban character. A number of collective edits were made in 2006 as an initial response to rapid growth that began that decade. Piecemeal amendments have made incremental improvements since.

The Subdivision Platting Ordinance was adopted in the 1990s and has remained largely in its current form since, save for the state-mandated edits in HB 3167 in 2019. Like the Zoning Ordinance, the Subdivision Platting Ordinance includes rules that favor typical suburban style layouts and designs, impact redevelopment costs and timelines, and limit creativity without complex process reviews or waivers. A few recent incremental amendments have added some strategic flexible improvements, however these improvements have not gone far enough to implement patterns desired by the community as reflected in Envision New Braunfels.

The Sign Ordinance was adopted in 2006. State law changes and court decisions have rendered parts of it unenforceable. Attempts by staff to make strategic edits to codify these issues have proven difficult due to the impact one seemingly minor change has on associated connecting or related standards. A complete rewrite has been frequently requested by the local sign industry.

The Historic Preservation Ordinance was written in the 1990s. The City has several historic districts, and relatively frequent property owner requests for historic landmark designation; however, the districts do not have design standards. Additionally, the ordinance includes complicated and onerous timing and procedural steps for demolition requests of structures that are not designated but may be eligible for consideration. Furthermore, while individual landmark designation carries the typical tax relief incentive, there are few incentives to the creation of broader historic districts.

Some of the specific issues with the current standards include, but are not limited to:

- Unnecessary overly regulatory language and messaging.
- Excessive subjectivity for decision making that should be replaced with objective criteria.
- Outdated standards that do not align with the Comprehensive Plan.
- Inconsistent format, structure, and numbering.
- Reliance on outdated pyramidal style zoning.
- Redundancy within individual ordinances and across multiple ordinances.
- Standards and regulations housed in the wrong ordinance.
- Lack of graphics, illustrations, sketches, and process flowcharts.
- Insufficient definitions, with regulatory language within the definitions.
- Minimal coordination between ordinances.
- Inadequate nonconforming use criteria and no amortization procedures.
- Outdated and ineffective parking standards.
- Block length requirements that are unclear and do not reflect desired development patterns.
- Lack of commentary on intent and connection to the comprehensive plan.
- Limited case management and board/commission procedures.
- Inadequate promotion of mixed use and neighborhood compatibility.
- Excessive specific delineation of uses (rather than use categories) which limits flexibility as uses change with the market.
- Lack of flexibility for creative subdivision design alternatives and variety, mixed use, and infill.
- Design requirements that unintentionally inhibit physical activity, ease of access to food, or protection of natural resources.
- Limited standards or incentives to achieve connectivity between neighborhoods, regardless of mode.
- Minimal landscaping buffers to provide better use intensity transitions.
- Inconsistency with court rulings, rendering some rules unenforceable or obsolete.
- Barriers to redevelopment, workforce housing and current market trends.
- Unintentional incentivizing of Special Use Permits (SUPs).

Recent and on-going incremental improvements, developed with thorough stakeholder input, likely need to only be briefly examined for general updates. These include, but are not limited to, ordinances on short-term rentals, truck stops, commercial vehicles in neighborhoods, overlays and special districts, downtown sidewalk permits, and edits to comply with HB 3167 and HB 2439. Critical improvements currently underway include recommendations from the Workforce Housing Advisory Committee on Missing Middle Housing concepts, minimum lot size adjustments, and accessory dwelling and live-work unit allowances.

Following are other ordinances or documents that, while related to development, will not be part of the scope of this project, aside from any necessary cross-referencing:

- Parkland Dedication and Development Ordinance
- Drainage and Erosion Control Design Manual
- I-Codes (Chapter 14)
- Environment (Chapter 50)
- Floods (Chapter 58)

An extraneous Chapter of the Code of Ordinances needs to be included and incorporated into the UDC: Chapter 98 "Planning", which includes an outline for establishment of the Planning Commission and Zoning Board of Adjustment.

Finally, the consultant team will examine ordinances in nearby cities, as well as comparable cities. Best practices and model ordinances that would achieve the goals of Envision New Braunfels should be considered.

Project Scope

The scope of services listed below is not intended to be a comprehensive list of what the consultant team will provide, but rather shall serve as a guide. It is expected that the selected consultant team's proposals will provide more specific recommendations for approaches, tasks, timelines, and deliverables based on their experience and expertise from past work on related projects. The consultant team is expected to bring creative and innovative ideas and procedures to the project, and work with City staff to customize the details, work plan and phase structure.

The UDC will be developed through a lens of equity and inclusion. Although not an exhaustive list, the following are to be examined for potential inclusion in the UDC:

- Placemaking
- Form-based zoning
- Walkable communities
- LID incentives
- Connectivity ratios
- Performance-based buffering of incompatible uses
- Incentives for housing type variety/diversity and missing-middle housing
- Allowances for lot shape and size variety
- Context sensitive standards to create a rich variety of building types and appropriately address the public and private realms
- Improved public health through the built environment
- Conservation subdivision alternatives
- Encouragements for housing types that support all ages in the community

Additionally, the South Castell Avenue Visioning Plan specifically calls for the creation of a Transit Oriented Development zoning district. The UDC will need to include the creation of a TOD to accomplish this goal.

Branding

The selected consultant will assist City staff with identifying a marketing brand and strategy for the project effort. Such branding could include a name and logo that complements the City's official logo in style and color, as well as the Envision New Braunfels logo. The marketing logo and branding will be the property of the City of New Braunfels, and may be used on all related documents, correspondence, marketing materials, website, etc.

Code Diagnostic and Analysis

The selected consultant team will perform a diagnostic analysis of the current zoning, subdivision platting, sign, and historic preservation ordinances. This diagnostic will identify conflicts with federal

regulations, state statutes, case law, other city ordinances, the Comprehensive Plan, the Future Land Use map, and other plans and studies. The diagnostic analysis will itemize known issues with the current ordinances, including information from staff regarding application and utilization. A Technical Staff Committee should be assembled to assist with this diagnostic, sharing issues and experiences. Stakeholder interviews will also prove helpful in assessing issues experienced by the development and building community, as well as neighborhood residents.

The selected consultant team is expected to demonstrate clear understanding of necessary actions to achieve the vision established in adopted plans. They shall take note, through general community and neighborhood evaluation, and review of the existing plans and policies, of unique neighborhood and geographic features, associated cultures, architecture, and form of development.

The consultant team should develop a menu of options and approaches to address issues identified in the diagnostic. To arrive at their conclusions, the consultant team may test implementation through scenarios and modeling. Approaches for how to address the potential creation of legal nonconforming uses upon adoption, will need to be provided. The consultant team shall articulate implications of the different options and recommend implementation strategies for discussion.

Community Outreach and Participation

As demonstrated with Envision New Braunfels, a robust public engagement program results in a superior product. The residents of New Braunfels take pride in the community and are passionate about maintaining and continuously improving quality of life. Substantial base vision data already exists in the various adopted long-range plans. However, considering the thousands of new residents who have moved to the city since adoption of the Comprehensive Plan, the UDC development process should include public input. Therefore, the consultant is expected to possess expertise in a variety of innovative public engagement approaches and techniques to encourage participation.

The consultant team, with input from the City, will develop a stakeholder engagement methodology that will ensure opportunities for broad, diverse, community-wide input. It should include an appropriate mix of effective tools and techniques such as public workshops, virtual town halls, open houses, charrettes, visual preference surveys, interactive webpage, social media conversations, community events, festival booths, department and city newsletter articles, press releases, etc. The consultant shall take special care to ensure the thoughts and ideas of disadvantaged and vulnerable groups are collected. The final document will integrate and reflect the overall community's values and guiding principles identified through the public outreach effort, as well as what has already been captured from the community in the Comprehensive Plan and other adopted plans.

Once the project is underway, a Citizens Advisory Committee, likely made up of members of the Planning Commission, Zoning Board of Adjustment, and Historic Landmark Commission, will provide project guidance. Four Task Groups may also be formed to provide expert input on each topical area (Zoning, Platting, Signs, Historic Preservation). These task groups should be composed of community members who have working knowledge of, or direct interest in the topics, but should be diverse in representation, industry, and points of view. Charette methods or workshops may be used for Task Groups to cooperatively develop draft standards. However, the consultant team should recommend approaches to the above to ensure successful outcomes. The Technical Staff Committee will also prove beneficial throughout the process to provide feedback, input, and insight.

The selected consultant team should expect to hold or attend meetings and workshops with City Council, Planning Commission, Zoning Board of Adjustment, Historic Landmark Commission, the development community, advisory committee, task groups, key stakeholders, and the general public. In

all engagement settings, the consultant team will act as expert facilitator in the formulation of standards that are acceptable to both residents and the development/business community by providing neutral opinions, creative alternatives, and potential resolutions.

The selected consultant team will prepare data, graphics, tables, charts, PowerPoints, maps, and all other materials necessary to facilitate all public engagement activities and meetings. Any GIS-oriented web applications to assist with public outreach will be developed by the consultant using the ArcGIS Online platform provided by ESRI.

UDC Drafting and Development

The selected consultant team will document, compile and analyze all data, public input, and committee guidance. This information will influence and drive document development and finalization of standards into a UDC draft that clearly reflects the Comprehensive Plan's expectations. The consultant team shall ensure compliance with all applicable Texas state statutes, federal laws, and Supreme Court decisions. The team will additionally provide guidance regarding any zoning map changes which result from converting to the UDC.

Overall, the UDC should:

- Be "user-friendly", i.e. easy to read, understand, and interpret for citizens, staff, developers, and elected and appointed officials.
- Be web-ready and searchable with hyperlinks to references and guiding plans and policies.
- Include process mapping flowcharts.
- Intuitively integrate all aspects of development requirements and operational processes.
- Be easily administered, with objective criteria for staff, saving subjective decision making for boards/commissions/council.
- Include objective administrative approval processes for minor adjustments and applications.
- Be heavily illustrated, with considerable, digitally compatible maps and graphics depicting requirements and concepts.
- Streamline processes.
- Remove barriers and add flexibility to allow for creative development, redevelopment, and preservation alternatives.
- Include regulatory incentives to encourage or catalyze quality redevelopment.
- Recognize the land use-transportation-public realm relationship within a framework of context sensitivity.
- Establish standards that result in quality development, street design, and a sense of place.
- Facilitate the creation of gateways and corridor reinvestment solutions.
- Encourage housing variety, enhance quality and equity, and address the "missing middle".
- Accommodate multi-modal transportation and complete streets to support mobility for all ages and physical needs.
- Maximize the use of all state-authorized subdivision and historic preservation tools.

Communications with Client

The consultant team shall provide, at a minimum:

- Twice-monthly phone calls/virtual meetings with the staff project manager,
- Twice-monthly email updates on the project progress/status,
- Pre- and post- committee meeting/public outreach communication/take-aways,
- Free flow of information, and
- Resolution of any questions or issues that arise.

Document component drafts and accompanying illustrations will be prepared for review by City staff and the Citizens Advisory Committee. After providing sufficient time for detailed review of drafts, the consultant will follow-up with final versions in response to comments, feedback, corrections, etc.

Adoption Process and Deliverables
The consultant team is expected to carry the UDC from inception through document adoption. The adoption process will include review and recommendation by boards and commissions, and potential joint workshops with boards, commissions and City Council, before final consideration by City Council. The consultant team's responsibility to present at the meetings with these boards/commissions will vary subject to strategy, although attendance at all at a minimum is required.

The consultant team will provide twenty (20) hard copies of the draft UDC ahead of the Planning Commission recommendation and City Council final consideration. The consultant team shall also track recommended modifications by all boards/commissions in a table or the best tool recommended by the team. These recommended modifications will be considered by City Council alongside the staff/consultant-recommended final draft.

The consultant will provide ten (10) bound hard copies of the final, adopted UDC, as well as the full document in web-ready electronic format acceptable to the City. Project files and GIS data used to produce all final maps will be provided as ESRI project files, geodatabases, and layer files containing the symbology and labeling properties that are compatible with the City's systems in place at time of adoption.

The City currently publishes its Code of Ordinances with the Municipal Code Corporation (Municode) and, therefore, relies on the Internet version as its official set of rules and standards; the final adopted version must be in a format compatible with and acceptable to Municode publishing standards. The consultant team's assistance in packaging the final document for submission to Municode for publication will be needed.

The final documents and all accompanying illustrations, images, maps, charts, tables, flowcharts, etc. shall be the property of the City of New Braunfels. Upon completion of the contract, maintenance of the UDC website and other online tools will be relinquished to the City of New Braunfels.

Timeline
The consultant shall prepare a timeline for individual phase or component completion and development. It is anticipated the overall project may take approximately 18 to 21 months. However, it is recognized that developing a UDC can ignite specific topic issues, therefore the City is flexible if such issues arise. The selected consultant is expected to have expertise in resolving such unforeseen issues related to land use, technical requirements, or development standards.

Response to the RFP
The following items are required in each proposal.

1. Cover Letter
   A cover letter with company name, address, phone number, email address, webpage, project contact, and principal signature is required. The letter should express the reasoning for your interest in the project and certify the firms/team has sufficient resources in personnel, equipment, brain power, and time to commit to this project.

2. Consultant Profile
   Provide at least the following information about any firm participating on the consultant team:
   - Firm name, business address, telephone number, and email address
   - Year established (including former firm names and year established if applicable)
   - Project Manager's name, mailing address, email address, telephone number, and resume
   - Office locations

3. Project Team
   Provide at least the following information about the personnel that will be assigned to this project:
   - Resumes, areas of competence or specialties, position in the firm, and include them on a team/project organizational chart
   - Describe the responsibilities of each team member, and include a brief statement from each expressing their interest in this project and why

4. Relevant Experience
   Please share information related to at least four similar projects the consultant directly worked on and successfully completed that will illustrate your ability to perform services required for this project. Be specific as to how the projects relate to this one, with a goal of demonstrating how well the consultant understands this project and the New Braunfels community. For each project, please provide at least the following information:
   - Project name and location.
   - General scope of services provided, and contract cost.
   - Information regarding the results of the services. Include any special circumstances or special conditions encountered.
   - Name of consultant team member(s) associated with the project.
   - Date of contract award and date of completion, including any milestones.
   - Links to final adopted projects.

5. Work Plan
   Describe the team's proposed work plan regarding approach to accomplishing the scope, including detailed specific tasks and responsible parties. Include your detailed approach to innovative public outreach and committee organization. Provide a written narrative detailing your general understanding of the City and project. Include a descriptive list of deliverables at each task step, and methodology for benchmarking performance.

6. Project Schedule
   Submit a schedule and timeline illustrating phasing, key task target dates, milestones, estimated task durations, anticipated time individual team members will spend on the project components, and requirements for completing the entire scope of work.

7. Quality Control
   Describe how the consultant will handle quality control to monitor and resolve issues, and check and cross-reference documents.

Feel free to include additional information that the firm considers to be pertinent to this project, but which is not included in the scope of services of this RFP.

Evaluation Criteria
The City will evaluate the submitted proposals based on, but not limited to, the following criteria, awarding up to the identified points in each category.

Completeness and Clarity. The consultant's ability to prepare a complete and clear submission is indicative of their abilities to do the same with the UDC. **10 points**

Understanding of the Community and State. New Braunfels is a unique community and only a consultant who understands what makes the community special, and what is required to ensure that uniqueness is maintained, will be successful. Additionally, how well the consultant understands Texas' property rights focus and corresponding statutes that impact municipal land use and platting authority will be evaluated. **10 points**

Experience, Knowledge, and Reputation. Consultants who have a breadth of experience in successful code writing, either as a whole or through their individual team members, is important to New Braunfels' project. The consultant's planning, engineering, legal, etc. credentials and references will illustrate the caliber of their assembled team. **20 points**

Past Performance on Similar Projects. Demonstration of the consultant's specific abilities to:

1. perform work as requested,
2. successfully shepherd similar projects through a development and adoption process,
3. adapt to changing circumstances,
4. respond to challenges, and
5. introduce creative solutions and public engagement methods

is vital to understanding a team's readiness for New Braunfels' UDC. **30 points**

Planned Approach and Timeline. The consultant team is required to provide a thoughtful and creative approach to accomplish this UDC project within the time expectations of the City. Emphasis will be placed on the team's approach to resolving competing interests, implementing the Comprehensive Plan, identifying process improvements, introducing innovative concepts, developing creative ideas to retrofit a suburban model, and addressing the needs of the community's most vulnerable. **30 points**

Total: 100 points

A committee of City staff and stakeholders will review each proposal against these criteria. The City may award a contract based on the original submissions with or without further presentation. The City may choose to request additional information as deemed necessary to assist in the determination of contract award. A short list of responders who have the highest score may be selected to be interviewed and provide an oral presentation to the same or alternate committee. The outcome of the process will constitute a recommendation to City Council.

The City is under no obligation to award a contract for these services based on the received proposals. If the City determines, in its soled discretion, that none of the proposals submitted are responsive or responsible, the City reserves the right, even after the interviews, to reject all proposals for any and all services covered in this RFP and restart the procurement process.

PRESENTER:
Debbie Kimball, Contract Administrator, Finance Department

SUBJECT:
Approval to renew the following annual contracts, as allowed for by their contract language: Purchase of Vehicles, Pavement Marking Services, Auditing Services, EMS Medical Supplies, 3rd Party Assistance with Permit Application Review, 3rd Party Building Permit Application Plan Reviews, 3rd Party Engineering Development Permit Reviews and Administrative Support for Community Development Block Grants.
DEPARTMENT: Finance
COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
On November 14, 2016, the City Council provided consent for a quarterly review and approval of renewals for various annual contracts that occur throughout the course of a fiscal year which are routine in nature and in accordance with the terms and conditions of the associated awarded contracts (which were originally approved by City Council). Quarterly approvals manage staff resources more efficiently as well as ensure compliance with the contracts' terms and conditions. Contract renewals that have any requested modifications, such as a significant increase or decrease in services or costs, will continue to be presented to City Council for individual consideration as needed.

The City Council has previously reviewed and approved the following annual contracts for various goods and services utilized for City operations; the contracts described below require Council authorization for contract renewal. All goods and services have been competitively vetted, and contracts have subsequently been executed on various dates in previous years. All awarded contractors have provided satisfactory performance during the term of their associated contract.

Renewal of Annual Contract for Purchase of Vehicles
City Department: Finance
Awarded Contractor: Kahlig Enterprises d/b/a Bluebonnet Motors, Inc.
Modified Contract Expiration Date: August 31, 2022
Approximate Annual Cost of Services During Renewal Period: Purchases occur based on a replacement schedule or in conjunction with new positions; therefore, the cost is incorporated into the appropriate replacement fund and/or departmental capital budget.

Renewal of Annual Contract for Pavement Marking Services
City Department: Public Works
Awarded Contractors: Flasher Equipment and Roadway Striping Inc.
Modified Contract Expiration Date: August 31, 2022
Approximate Annual Cost of Services During Renewal Period: Approximately $50,000, factors based on needs may affect the total cost, but subsequent cost to the City is itemized in contract language.

Renewal of Annual Contract for Auditing Services (independent auditing services for the performance of the City's annual financial audit)
City Department: Finance
Awarded Contractor: Belt Harris Pechacek, LLLP
Modified Contract Expiration Date: September 30, 2022
Approximate Annual Cost of Services During Renewal Period: $66,567, factors such as additional audit requests may affect the total cost, but subsequent cost to the City is itemized in contract language.

Renewal of Annual Contract for EMS Medical Supplies
City Department: Fire
Awarded Contractor: Bound Tree Medical LLC
Modified Contract Expiration Date: September 30, 2022
Annual Cost of Services During Renewal Period: $240,000

Renewal of Annual Contract for 3rd Party Assistance with Permit Application Review
City Department: Planning and Development
Awarded Contractors: Sunland Group Inc., Masterplan, K Friese & Associates,
Modified Contract Expiration Date: September 30, 2022
Approximate Annual Cost of Services During Renewal Period: Sunland Group, Inc. $161,000; Masterplan $140,000 and K Friese & Associates $100,000

Renewal of Annual Contract for 3rd Party Building Permit Application Plan Reviews
City Department: Planning and Development
Awarded Contractors: Bureau Veritas, Safebuilt Texas and Sunland Group, Inc.
Modified Contract Expiration Date: September 30, 2022
Approximate Annual Cost of Services During Renewal Period: Approximately $130,000 each

Renewal of Annual Contract for 3rd Party Engineering Development Permit Reviews
City Department: Public Works/Engineering
Awarded Contractor: K Friese & Associates
Modified Contract Expiration Date: September 30, 2022
Approximate Annual Cost of Services During Renewal Period: Not to Exceed $200,000

Renewal of Annual Contract for Administrative Support for Community Development Block Grants
City Department: Finance
Awarded Contractor: Paula Harper, d/b/a Community Solutions TX
Modified Contract Expiration Date: September 30, 2022
Approximate Annual Cost of Services During Renewal Period: $67,200

ISSUE:
Strategic Priorities: Maintain fiscal stability of City operations

FISCAL IMPACT:
Funding for all expenditures and contracts described above have been incorporated into the appropriate FY departmental budgets. Therefore, sufficient funds are available.

RECOMMENDATION:
Staff recommends approval to renew the following annual contracts, as allowed for by their contract language: Purchase of Vehicles, Pavement Marking Services, Auditing Services, EMS Medical Supplies, 3rd Party

Assistance with Permit Application Review, 3rd Party Building Permit Application Plan Reviews, 3rd Party Engineering Development Permit Reviews and Administrative Support for Community Development Block Grants.

PRESENTER:
Stacey Dicke, Director of Parks and Recreations Department
SUBJECT:
Approval of continuation of golf concessionaire services with River Hofbrau through a new lease agreement for the Landa Park Golf Course.
DEPARTMENT: Parks and Recreation
COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
The Golf Concessionaire Services provide for food and beverages served at Landa Park Golf Course. The City engaged in a contract with River Hofbrau on September 12, 2016 and it expires on August 31, 2021, with no available renewal options. The services being provided by River Hofbrau have been satisfactory and successful since 2016. Due to the complexity of this service, the City is requesting approval to continue the food and beverage service with River Hofbrau through a lease agreement. The lease will begin on September 1, 2021 for five (5) years, with annual options to renew the contract.

This lease is a revenue generating agreement. Revenue will be based on 8% of actual gross sales, or $32,000 whichever is greater, payable to the City each month over the five (5) year lease.

ISSUE:
Strategic Priorities: Maintain fiscal stability of City operations

FISCAL IMPACT:
This is a revenue generating agreement. Revenue will be based on 8% of actual gross sales, or $32,000 whichever is greater, payable monthly. Therefore, there is no direct fiscal impact associated with the agreement described above.
RECOMMENDATION:
Staff recommends approval of continuation of golf concessionaire services with River Hofbrau through a new lease agreement for the Landa Park Golf Course.

PRESENTER:
Tony Gonzalez, Director of Information Technology

SUBJECT:
Approval of a purchase increase with GTS Technology Solutions, Inc. for additional networking equipment at Fire Station #2, Fire Station #3 and Police Station, and a 5% owners' contingency with permission for the City Manager to execute change orders up to the contingency amount.

DEPARTMENT: Fire and Police

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
On June 14, 2021, City Council approved the purchase of networking equipment for the new bond projects at the Fire Stations #2 and #3 and the Police Station through GTS Technology Solutions, Inc. at a cost of $283,046. Additional reviews, discussions and consultation with various partners identified additional networking equipment is needed. The additional equipment for all locations will be $15,776. The total equipment costs with GTS Technology Solutions, Inc. will be $298,822.

Staff is also requesting a 5% contingency in the amount of $14,941 for unforeseen changes.

The requested increase is $30,717 for a total not to exceed amount of $313,763.

ISSUE:
The new buildings approved as a part of the 2019 Bond Program will need new networking equipment in order to make them fully functional.

FISCAL IMPACT:
The total requested purchase increase is $30,717. The total acquisition for the above referenced networking equipment will be $313,763. Funding for these costs have been incorporated into the project budgets within the 2019 Bond Program. Therefore, sufficient funds are available to approve the purchase as described above.

RECOMMENDATION:
Staff recommends approval of this increase.

Quote

Quote #:	**QT0072282**
Date:	7/30/2021
Delivery Date:	
Expire Date:	8/13/2021
Customer ID:	TXNEWB13003
Sales Contact:	Peggy Moses

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

QUOTE FOR:	SHIP TO:
City of New Braunfels	City of New Braunfels

CUSTOMER P.O. NO.	TERMS	SALES REP
POLICE STATION	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	210-AFTB: Dell Networking S3148, L3, 48x 1GbE, 2xCombo, 2x 10GbE SFP+ fixed ports, Stacking, IO to PSU airflow, 1x AC PSU	DIR-TSO-3763-R	1.00	EACH	$4,782.55	$4,782.55
	NOTE: QTY 1 EACH, UNLESS NOTED OTHERWISE: Dell Networking S3148, L3, 48x 1GbE, 2xCombo, 2x 10GbE SFP+ fixed ports, Stacking, IO to PSU airflow, 1x AC PSU Power Supply, 200w, S3124/S3148, with V-Lock, adds redundancy to non-POE S3100 series switches Dell Networking S3100 Series User Guide Dell Hardware Limited Warranty 1 Year Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only on Your Network Switch Mission Critical Package: 4-Hour 7X24 On-Site Service with Emergency Dispatch, 5 Year ProSupport: 7x24 HW / SW Tech Support and Assistance, 5 Year Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355 On-Site Installation Declined Dell Networking, Jumper Cord, 250V, 12A, 2 Meters, C13/C14, US - QTY 2					
2	210-ASPX: Powerswitch N2248PX-ON, 48x1/ 2.5G, PoE 30W/60W, 4x25G, 2x40G Stacking, 1xAC PSU, IO/PS airflow, OS6	DIR-TSO-3763-R	26.00	EACH	$5,352.13	$139,155.38
	NOTE: QTY 26 EACH, UNLESS NOTED OTHERWISE: Powerswitch N2248PX-ON, 48x1/2.5G, PoE 30W/60W, 4x25G, 2x40G Stacking, 1xAC PSU, IO/PS airflow, OS6 MPS-1S Shelf for one PSU, Extends PoE Budget for N2224PX, N2248PX, N3224PX, N3248P, N3248PXE Dell Hardware Limited Warranty 1 Year Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only on Your Network Switch ProSupport Mission Critical 7x24 HW-SW Technical Support, 5 Years ProSupport Mission Critical 4-Hour 7x24 On-Site Service with Emergency Dispatch, 5 Years Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355 INSTALL DECLINED - Switch deployment performed by Customer or 3rd party Power Supply, 1600W AC, Hot Swap, N2248PX, N3224PX, N3248PXE, MPS-1S Shelf, MPS-3S Shelf Dell Networking, Jumper Cord, 250V, 12A, 2 Meters, C13/C14, US - QTY 52 Dell EMC Networking N2200-ON Series Americas User Guide					
3	210-AXLU: Cables & Optics Virtual Base	DIR-TSO-3763-R	1.00	EACH	$11,398.12	$11,398.12
	NOTE: Dell Networking, Transceiver, SFP+, 10GbE, SR, 850nm Wavelength, 300m Reach - QTY 52					

Continued...

GTS TECHNOLOGY SOLUTIONS

Quote

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote #: QT0072282
Date: 6/23/2021
Delivery Date:
Expire Date: 7/23/2021
Customer ID: TXNEWB13003
Sales Contact: Peggy Moses

QUOTE FOR:	SHIP TO:
City of New Braunfels	City of New Braunfels

CUSTOMER P.O. NO.	TERMS	SALES REP
POLICE STATION	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
	Dell Networking, Cable, QSFP+ to QSFP+, 40GbE Passive Copper Direct Attach Cable, 0.5 m - QTY 21 Dell Networking, Cable, QSFP+ to QSFP+, 40GbE Passive Copper Direct Attach Cable, 2 Meter - QTY 5 Dell Networking Cable, 100GbE QSFP28 to QSFP28, Passive Copper Direct Attach Cable, 0.5 Meter - QTY 6					
4	210-APEX: Dell EMC S5248F-ON Switch, 48x25GbE SFP28, 4x100GbE QSFP28, 2x100GbE QSFP-DD, IO to PSU, 2xPSU, OS10 NOTE: QTY 4 EACH: Dell EMC S5248F-ON Switch, 48x25GbE SFP28, 4x100GbE QSFP28, 2x100GbE QSFP-DD, IO to PSU, 2xPSU, OS10 VLT Tech Sheet Document Dell EMC S52XX-ON Series User Guide OS10 Enterprise, S5248F-ON Dell Hardware Limited Warranty 1 Year Mission Critical Package: 4-Hour 7x24 On-Site Service with Emergency Dispatch, 1 Year Mission Critical Package: 4-Hour 7x24 On-Site Service with Emergency Dispatch, Extended to 4 Years ProSupport Mission Critical:7x24 HW/SW Technical Support and Assistance, 5 Years Dell Limited Hardware Warranty Extended Year(s) Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355 Info 3rd Party Software Warranty provided by Vendor On-Site Installation Declined Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13 Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13	DIR-TSO-3763-R	4.00	EACH	$12,100.56	$48,402.24
5	Q9H63A: ARUBA AP-515 US UNIFIED AP	DIR-TSO-4160	38.00	EACH	$713.00	$27,094.00
6	Q9G69A: AP-MNT-MP10-B AP MOUNT BRKT 10PK B	DIR-TSO-4160	3.00	EACH	$127.10	$381.30
7	R3J16A: AP-MNT-B AP MOUNT BRKT INDIVIDUAL B	DIR-TSO-4160	3.00	EACH	$18.60	$55.80
8	R3J19A: AP-MNT-E AP mount bracket individual E: wall-box	DIR-TSO-4160	5.00	EACH	$24.80	$124.00
9	JX967A: ARUBA AP-365 US OUTDR AP	DIR-TSO-4160	3.00	EACH	$843.20	$2,529.60
10	JW053A: ARUBA AP-270-MNT-V2 270 SERIES MOUNT KIT	DIR-TSO-4160	3.00	EACH	$83.70	$251.10
11	JW546AAE: ARUBA AIRWAVE 1 DEV LIC E-LTU	DIR-TSO-4160	41.00	EACH	$46.50	$1,906.50

Continued...

GTS TECHNOLOGY SOLUTIONS

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote

Quote #:	**QT0072282**
Date:	6/23/2021
Delivery Date:	
Expire Date:	7/23/2021
Customer ID:	TXNEWB13003
Sales Contact:	Peggy Moses

QUOTE FOR:	SHIP TO:
City of New Braunfels	City of New Braunfels

CUSTOMER P.O. NO.	TERMS	SALES REP
POLICE STATION	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
12	H2YW0E: CAREPACK ARUBA 5Y FC AIRWAVE 1 DEV E-LTU	DIR-TSO-4160	41.00	EACH	$43.35	$1,777.35
13	AB697650: CS-City of New Braunfels-SONIC WALL NSA 4650 APPL PERP	DIR-TSO-3763-R	1.00	EACH	$5,166.48	$5,166.48
14	AB697652: CS-City of New Braunfels-ADVAN CED GATEWAY SECURITY SUITELICS FOR NSA 4650 5YR	DIR-TSO-3763-R	1.00	EACH	$14,322.16	$14,322.16
15	AB697651: CS-City of New Braunfels-NSA 4 650 FIREWALL APPL PERP HIGH AV AILABILITY UNIT	DIR-TSO-3763-R	1.00	EACH	$3,615.34	$3,615.34

Total Weight (EACH):	0	**Sales Total:**	$260,961.92
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$260,961.92

These prices do NOT include taxes, insurance, shipping, delivery, setup fees, or any cables or cabling services or material unless specifically listed above. All prices are subject to change without notice. Supply subject to availability.

GTS TECHNOLOGY SOLUTIONS

Quote

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote #:	**QT0072281**
Date:	7/30/2021
Delivery Date:	
Expire Date:	8/13/2021
Customer ID:	TXNEWB13003
Sales Contact:	Peggy Moses

QUOTE FOR:	SHIP TO:
City of New Braunfels	City of New Braunfels

CUSTOMER P.O. NO.	TERMS	SALES REP
FIRE STATION 3	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	210-AXLU: Cables & Optics Virtual Base	DIR-TSO-3763-R	1.00	EACH	$1,418.30	$1,418.30
	NOTE: QTY 1 EACH, UNLESS NOTED OTHERWISE: Dell Networking, Transceiver, SFP+, 10GbE, LR, 1310nm Wavelength, 10km Reach- QTY 4 Dell Networking, Cable, SFP+ to SFP+, 10GbE, Copper Twinax Direct Attach Cable, 0.5 Meter					
2	210-ASPR: N3248P-ON, 48x1G, 4x10G SFP+, 2x100G QSFP28, PoE 30W, 1xAC PSU, IO/PS, OS6	DIR-TSO-3763-R	2.00	EACH	$3,554.27	$7,108.54
	NOTE: QTY 2 EACH, UNLESS NOTED OTHERWISE: N3248P-ON, 48x1G, 4x10G SFP+, 2x100G QSFP28, PoE 30W, 1xAC PSU, IO/PS, OS6 MPS-1S Shelf for one PSU, Extends PoE Budget for N2224PX, N2248PX, N3224PX, N3248P, N3248PXE ReadyRails, Full set, 2x outer and 2x inner rail, 2 or 4 post racks, for select Dell Networking 1U Dell EMC N3200 User guide Dell Hardware Limited Warranty 1 Year Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only on Your Network Switch ProSupport Mission Critical 7x24 HW-SW Techincal Support, 5 Years ProSupport Mission Critical 4-Hour 7x24 On-Site Service with Emergency Dispatch, 5 Years Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355 INSTALL DECLINED - Switch deployment performed by Customer or 3rd party Power Supply, 1050W AC, Hot Swap, for N2224PX, N3224P, N3248P, MPS-1S Shelf, MPS-3S Shelf Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13 - QTY 4					
3	Q9H63A: ARUBA AP-515 US UNIFIED AP	DIR-TSO-4160	9.00	EACH	$713.00	$6,417.00
4	Q9G69A: AP-MNT-MP10-B AP MOUNT BRKT 10PK B	DIR-TSO-4160	1.00	EACH	$127.10	$127.10
5	JX967A: ARUBA AP-365 US OUTDR AP	DIR-TSO-4160	3.00	EACH	$843.20	$2,529.60
6	JW053A: ARUBA AP-270-MNT-V2 270 SERIES MOUNT KIT	DIR-TSO-4160	3.00	EACH	$83.70	$251.10
7	JW546AAE: ARUBA AIRWAVE 1 DEV LIC E-LTU	DIR-TSO-4160	12.00	EACH	$46.50	$558.00
8	H2YW0E: CAREPACK ARUBA 5Y FC AIRWAVE 1 DEV E-LTU	DIR-TSO-4160	12.00	EACH	$43.35	$520.20

Total Weight (EACH):	0	**Sales Total:**	$18,929.84
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$18,929.84

These prices do NOT include taxes, insurance, shipping, delivery, setup fees, or any cables or cabling services or material unless specifically listed above. All prices are subject to change without notice. Supply subject to availability.

GTS TECHNOLOGY SOLUTIONS

Quote

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote #:	**QT0072280**
Date:	7/30/2021
Delivery Date:	
Expire Date:	8/13/2021
Customer ID:	TXNEWB13003
Sales Contact:	Peggy Moses

QUOTE FOR:	SHIP TO:
City of New Braunfels	City of New Braunfels

CUSTOMER P.O. NO.	TERMS	SALES REP
FIRE STATION 2	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	210-AXLU: Cables & Optics Virtual Base	DIR-TSO-3763-R	1.00	EACH	$1,418.30	$1,418.30
	NOTE: QTY 1 EACH, UNLESS NOTED OTHERWISE: Dell Networking, Transceiver, SFP+, 10GbE, LR, 1310nm Wavelength, 10km Reach- QTY 4 Dell Networking, Cable, SFP+ to SFP+, 10GbE, Copper Twinax Direct Attach Cable, 0.5 Meter					
2	210-ASPR: N3248P-ON, 48x1G, 4x10G SFP+, 2x100G QSFP28, PoE 30W, 1xAC PSU, IO/PS, OS6	DIR-TSO-3763-R	2.00	EACH	$3,554.27	$7,108.54
	NOTE: QTY 2 EACH, UNLESS NOTED OTHERWISE: N3248P-ON, 48x1G, 4x10G SFP+, 2x100G QSFP28, PoE 30W, 1xAC PSU, IO/PS, OS6 MPS-1S Shelf for one PSU, Extends PoE Budget for N2224PX, N2248PX, N3224PX, N3248P, N3248PXE ReadyRails, Full set, 2x outer and 2x inner rail, 2 or 4 post racks, for select Dell Networking 1U Dell EMC N3200 User guide Dell Hardware Limited Warranty 1 Year Lifetime Limited Hardware Warranty with Basic Hardware Service Next Business Day Parts Only on Your Network Switch ProSupport Mission Critical 7x24 HW-SW Techincal Support, 5 Years ProSupport Mission Critical 4-Hour 7x24 On-Site Service with Emergency Dispatch, 5 Years Thank you choosing Dell ProSupport. For tech support, visit //www.dell.com/support or call 1-800- 945-3355 INSTALL DECLINED - Switch deployment performed by Customer or 3rd party Power Supply, 1050W AC, Hot Swap, for N2224PX, N3224P, N3248P, MPS-1S Shelf, MPS-3S Shelf Power Cord, 125V, 15A, 10 Feet, NEMA 5-15/C13 - QTY 4					
3	Q9H63A: ARUBA AP-515 US UNIFIED AP	DIR-TSO-4160	9.00	EACH	$713.00	$6,417.00
4	Q9G69A: AP-MNT-MP10-B AP MOUNT BRKT 10PK B	DIR-TSO-4160	1.00	EACH	$127.10	$127.10
5	JX967A: ARUBA AP-365 US OUTDR AP	DIR-TSO-4160	3.00	EACH	$843.20	$2,529.60
6	JW053A: ARUBA AP-270-MNT-V2 270 SERIES MOUNT KIT	DIR-TSO-4160	3.00	EACH	$83.70	$251.10
7	JW546AAE: ARUBA AIRWAVE 1 DEV LIC E-LTU	DIR-TSO-4160	12.00	EACH	$46.50	$558.00
8	H2YW0E: CAREPACK ARUBA 5Y FC AIRWAVE 1 DEV E-LTU	DIR-TSO-4160	12.00	EACH	$43.35	$520.20

Total Weight (EACH):	0	**Sales Total:**	$18,929.84
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$18,929.84

These prices do NOT include taxes, insurance, shipping, delivery, setup fees, or any cables or cabling services or material unless specifically listed above. All prices are subject to change without notice. Supply subject to availability.

PRESENTER:
Patrick O'Connell, Fire Chief

SUBJECT:
Approval of a purchase with Chastang Ford for three Fire Department vehicles to support operations and emergency services.

DEPARTMENT: Fire

COUNCIL DISTRICTS IMPACTED: [Enter Text Here]

BACKGROUND INFORMATION:
Staff is requesting the purchase of three vehicles for the Fire Department - Two replacements and one addition to the fleet. The additional vehicle will be dedicated to the Support Services division within Fire for the continued readiness of the EMS Officer. There two scheduled for replacement are based on the current vehicles age and condition. Staff is recommending the 2021 F150 First Responder Truck (for all three vehicles) with a cost of $39,587 each from Chastang Ford.

The City will be utilizing Chastang Ford through a BuyBoard cooperative contract which has been competitively vetted. The total cost is $119,161 which includes an order fee of $400 to Buyboard. The replacement vehicles will be declared surplus and sold accordingly.

ISSUE:
Chastang Ford has a reserve order in with Ford which provides a limited supply and orders are being filled as they are received. The estimated delivery date for these vehicles is October 2021. The City would like to utilize this opportunity to shorten the delivery time and allow for quicker staff availability. The 2022 models can be ordered beginning September 15, 2021 with an estimated 10-month delivery.

FISCAL IMPACT:
Funding has been incorporated into the FY 2022 Vehicle Replacement Fund and the Fire Department Budget to support the cost of these vehicles; therefore, sufficient funds are available.

RECOMMENDATION:
Staff recommends approval of a purchase with Chastang Ford for three Fire Department vehicles to support operations and emergency services.

PRESENTER:
Garry Ford, Jr., Assistant Public Works Director/City Engineer

SUBJECT:
Approval of the first reading of an ordinance amending Section 126-136 of the City of New Braunfels Code of Ordinances to extend the existing school zone on Avery Parkway.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: 2

BACKGROUND INFORMATION:
Engineering staff received a request to investigate Avery Parkway during school peak hours to add yellow center line pavement markings, crosswalks, and all-way stop control at the intersections with Conner Drive and Avery Ranch Drive. This request is related to speeding concerns and pedestrian safety. Avery Parkway is a two-lane residential collector with a sidewalk on the north side of the street between Whispering Way and Avery Ranch Drive, and access to State Highway 46. Avery Ranch Drive is a minor collector with sidewalks and on the 2012 Regional Transportation Plan. Conner Drive is a two-lane local street with sidewalks. Avery Ranch Drive and Conner Drive are both currently stop controlled at their intersections with Avery Parkway. The speed limit on all streets is 30 mph.

Clear Spring Elementary School is located on Avery Parkway within the Avery Park subdivision. There is an existing school zone with static school zone signs on Avery Parkway at the intersection with Wood Drake to approximately 500 feet north of Conner Drive.

Traffic speed and volume data were collected on Thursday, October 29, 2020 for Avery Parkway near Avery Ranch Drive, outside of the currently posted school zone. The average daily traffic (ADT) on Avery Parkway was 1,899 vehicles per day (vpd) and the 85th percentile speed was 34 mph.

Crash data for 2018 through May 2021 was found through TxDOT's Crash Records Information System database. There were five (5) reported crashes on Avery Parkway between Whispering Way and Cypress Mill during this time. Two (2) crashes occurred in the daytime on weekdays. None of the five crashes appear to be speed related.

A site investigation was completed in September 2020 to evaluate vehicle and pedestrian traffic during morning and afternoon school peak times on Avery Parkway between Whispering Way and Avery Ranch Drive. School peak times are approximately 7 am to 7:30 am and 3 pm to 3:30 pm. The pavement width of Avery Parkway is approximately 30 feet.

The Clear Spring Elementary School pedestrian route is on the sidewalk on the north side of Avery Parkway. A

marked crosswalk with a police crossing guard during both morning and afternoon school peak times is present at Dorman Drive. The intersection of Avery Parkway and Dorman Drive is also controlled by an all-way stop. All children are gathered and escorted by teachers at afternoon release in a single-file line to this crosswalk location before crossing the street all together in one group. During this time, all vehicles are stopped at the intersection by the police officer for approximately 5-10 minutes before resuming normal operation. Several children walk and bike to school in the mornings, however pedestrian activity is much heavier in the afternoons leaving school - some getting picked up along Avery Parkway to skip the parent vehicle pick-up line, and some walking and biking home. The pedestrian route includes crossing Conner Drive and Avery Ranch Dr which currently do not have a marked crosswalks.

ISSUE:
Parents parallel park on Avery Parkway opposite the school, causing other vehicles to pass into the middle of Avery Parkway. Adequate sight distance is available for the street; however, vehicle maneuvers in the street may be an issue for oncoming traffic. Yellow center line pavement markings were requested on Avery Parkway to address this issue. Further evaluation is required to determine if parking restrictions are required in addition to the proposed centerline markings.

Pedestrians cross Avery Parkway on foot and bicycles to get to the sidewalk on the north side of Avery Parkway on their route to school, and the opposite path in the afternoons on their way home from school. The crossing locations at Conner Rd and Avery Ranch Dr are currently not marked and the Avery Ranch Dr crossing is outside of the existing posted school zone. The requested all-way stops were evaluated at Conner Rd and Avery Ranch Dr and not recommended at this time; however, marked crosswalks and associated signing are recommended. Additionally, the school zone is recommended to be extended to cover the crossing and proposed crosswalk at Avery Ranch Dr.

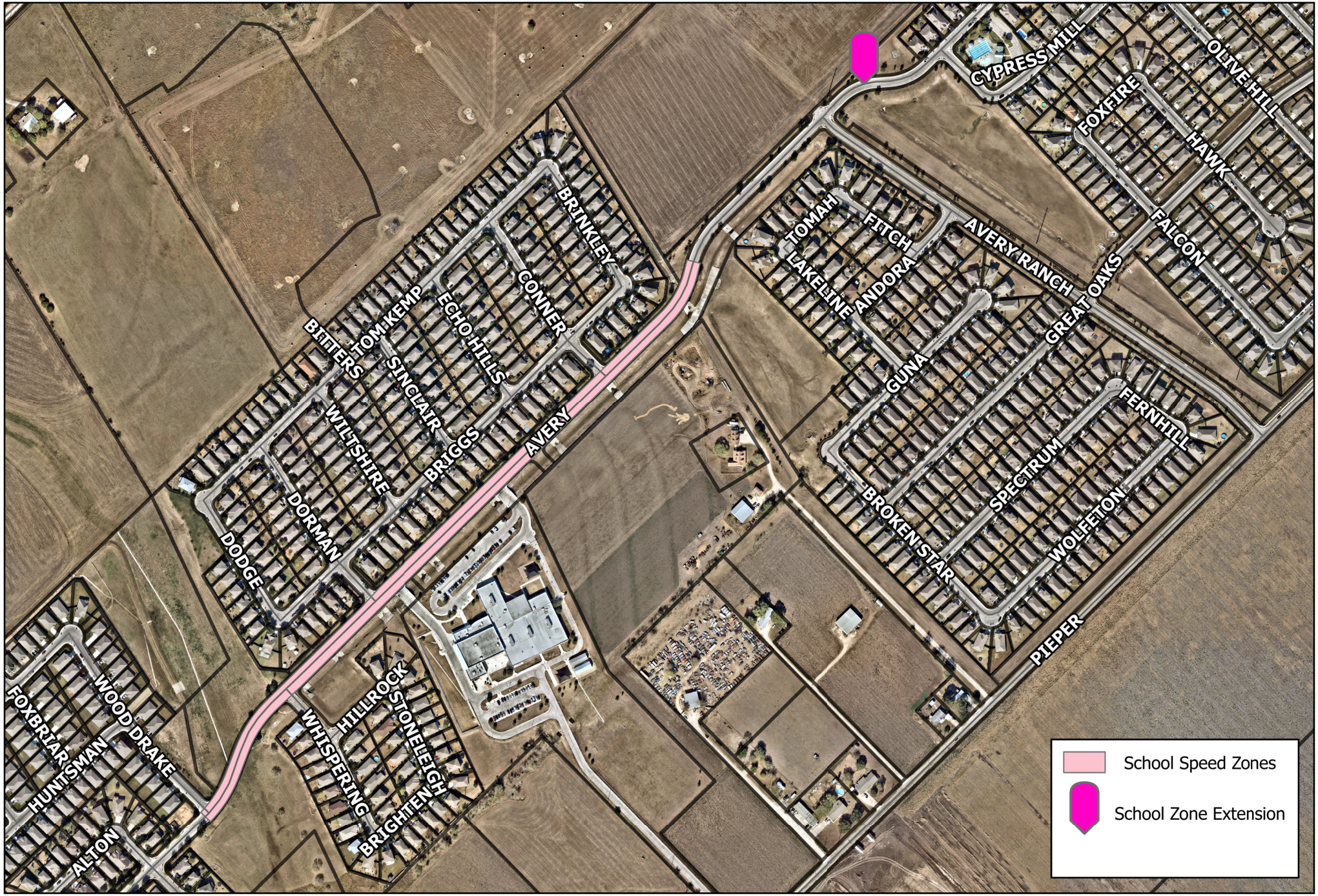
FISCAL IMPACT:
Sufficient funding is available in the FY 2021 approved streets and drainage budget for the installation of crosswalk markings on Avery Parkway at Avery Ranch Drive and on Conner Drive at Avery Parkway.

Total cost for pavement markings will be approximately $2,000. The cost for signs will be approximately $150 each.

RECOMMENDATION:

Transportation and Traffic Advisory Board
Transportation and Traffic Advisory Board unanimously recommended approval at their July 8, 2021 meeting.

Staff
Staff recommends an extension of the existing school zone on Avery Parkway on the northeast side to 200 feet northeast of Avery Ranch Drive with no changes to time frames; installation of crosswalk markings on Avery Parkway at the intersection with Avery Ranch Drive; and installation of crosswalk markings on Conner Drive at the intersection with Avery Parkway.



City of New Braunfels

School Zone on Avery Parkway

0 225 450 Feet

1:5,500

192

D t Path:
\\... sers$\Public Works\jperry\Documents\GIS Basemap\Basemap.aprx

Source: City of New Braunfels GIS
Date: 6/17/2021


Avery Park Ped Route
Police crossing guard

Traffic Study Summary

Date:	June 17, 2021
Prepared By:	Jessica Perry, E.I.T., Graduate Engineer
Request:	All-way stops at Avery Parkway and Avery Ranch Drive and at Avery Parkway and Conner Drive; crosswalks on Conner Drive at Avery Parkway and on Avery Parkway at Avery Ranch Drive; and yellow center line pavement markings on Avery Parkway
Recommendation:	Extension of the existing school zone on Avery Parkway; installation of a crosswalk on Avery Parkway at Avery Ranch Drive; and installation of a crosswalk on Conner Drive at Avery Parkway

Background

Engineering staff received a request to investigate Avery Parkway during school peak hours to consider adding yellow center line pavement markings, crosswalks, and all-way stop control at the intersections with Conner Drive and Avery Ranch Drive. Avery Parkway is a two-lane roadway classified as a local street and is the major street at these intersections at this time. Avery Ranch Drive is classified on the 2012 Regional Transportation Plan as a minor collector and is proposed to continue northwest outside of the Avery Ranch subdivision with development. Avery Ranch Drive and Conner Drive are both currently stop controlled at their intersections with Avery Parkway. Conner Drive is a two-lane local street. The speed limit on all streets is 30 mph.

Clear Spring Elementary School is located on Avery Parkway within the Avery Ranch subdivision. There is an existing school zone with static school zone signs on Avery Parkway at the intersection with Wood Drake to approximately 500 feet north of Conner Drive.

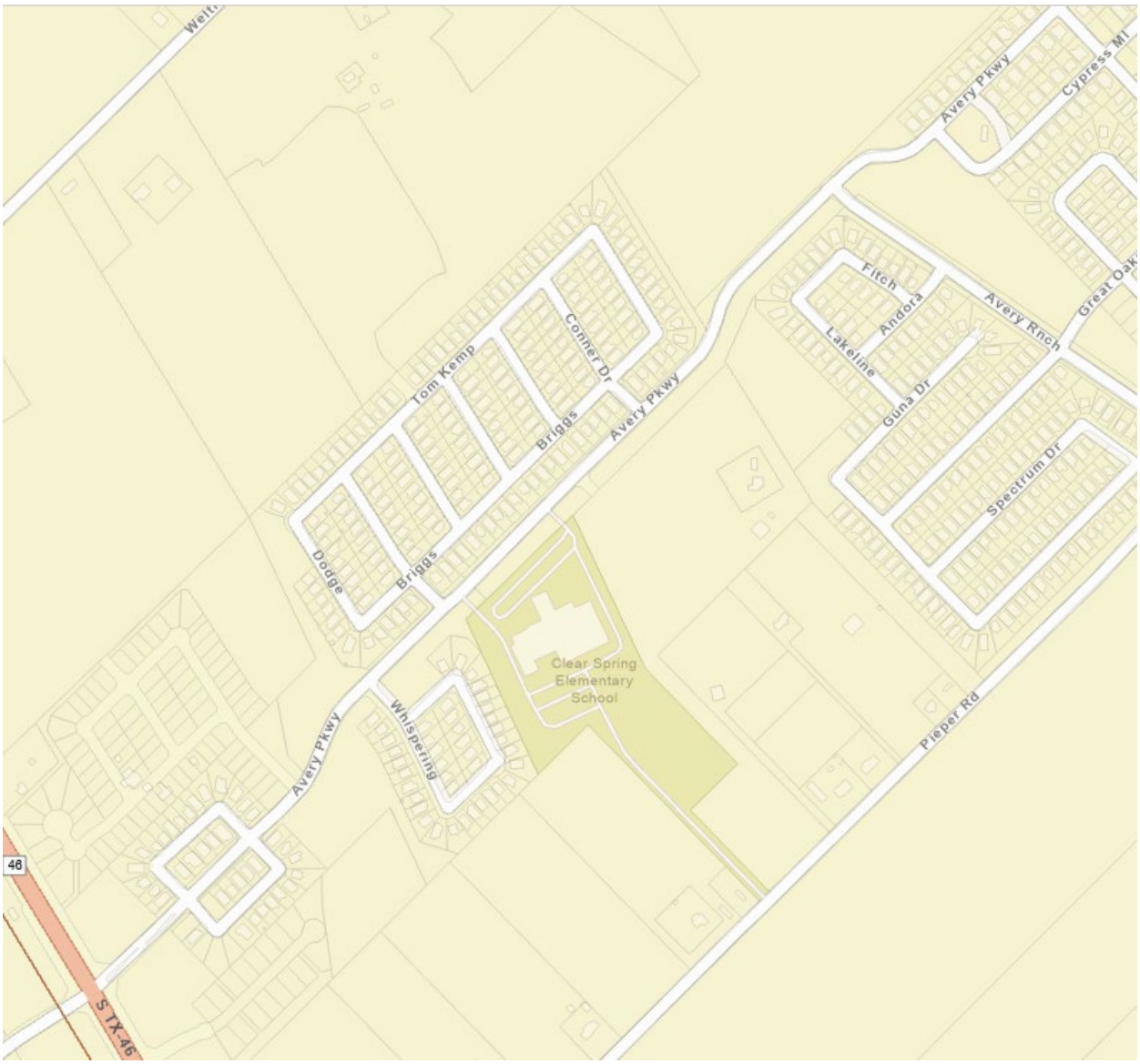


Figure 1. Avery Parkway from SH 46 to Cypress Mill

Guidance

Section 2B.04 of the *Texas Manual on Uniform Traffic Control Devices* (TMUTCD) provides support and guidance for right-of-way at intersections. The following TMUTCD guidance was considered for the all-way stop control requests,

> *Once the decision has been made to control an intersection, the decision regarding the appropriate roadway to control should be based on engineering judgment. In most cases, the roadway carrying the lowest volume of traffic should be controlled.*

Based on the existing traffic control and local street network, TMUTCD guidance from Section 2B.07 was used for engineering judgement. The attached multi-way stop evaluation details the specific criteria evaluated.

Sections 3B.01 and 3B.02 of the TMUTCD provide support and guidance for the application of yellow center line and no-passing zone pavement markings and warrants, respectively. The following TMUTCD guidance was considered for the yellow center line pavement marking request,

> *Center line markings should be placed on paved urban arterials and collectors that have a traveled way of 20 feet or more in width and an ADT of 4,000 vehicles per day or greater….Center line markings should also be placed on other traveled ways where an engineering study indicates such a need.*
>
> *On two-way, two- or three-lane roadways where center line markings are installed, no-passing zones shall be established at vertical and horizontal curves and other locations where an engineering study indicates that passing must be prohibited because of inadequate sight distances or other special conditions.*

Section 3B.18 of the TMUTCD provides guidance for the installation of crosswalks,

> *An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.*

Section 7C.02 of the TMUTCD provides support and guidance for the establishment of crosswalk markings at intersections to mark designated pedestrian routes to schools.

> *Crosswalks should be marked at all intersections on established routes to a school where there is substantial conflict between motorists, bicyclists, and student movements; where students are encouraged to cross between intersections; where students would not otherwise recognize the proper place to cross; or where motorists or bicyclists might not expect students to cross.*
>
> *Crosswalk lines should not be used indiscriminately. An engineering study considering the factors described in Section 3B.18 should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a STOP or YIELD sign.*

Crash History

Traffic crash data for 2018 through May 2021 was found through TxDOT's Crash Records Information System. There were five (5) reported crashes on Avery Parkway between Whispering Way and Cypress Mill during this time. Two (2) crashes occurred in the daytime on weekdays. One crash was due to assault between the driver and passenger, causing them to crash into a light pole; the other involved a

6-year-old running into a car with his bike. The remaining three (3) of the five were at night. Two involved impaired judgement due to drugs or alcohol; the third involved an unlicensed, teen driver with diverted attention who ran into a fence. None of the five crashes seem to be speed related.

Data Collection

Traffic speed and volume data were collected on Thursday, October 29, 2020 for Avery Parkway at Avery Ranch Drive. The average daily traffic (ADT) on Avery Parkway was 1,899 vehicles per day (vpd) and the 85th percentile speed was 34 mph. The ADT on Avery Ranch Drive near the intersection with Avery Parkway was 672 vpd.

Site Investigation

A site investigation was completed in September 2020 to evaluate vehicle and pedestrian traffic during morning and afternoon school peak times on Avery Parkway between Whispering Way and Avery Ranch Drive(see Figure 1). School peak times are approximately 7 am to 7:30 am, and 3 pm to 3:30 pm. Pavement width of Avery Parkway is approximately 30 feet.

Parents parallel park southwest-bound on Avery Parkway opposite the school, causing other vehicles to go into the middle of Avery Parkway in order to go around them (see Figure 2 below). However, Avery Parkway does not have vertical or horizontal curves in front of the school, so these vehicles do have adequate sight distance for these maneuvers.

Figure 2. Parallel-parked parent during PM pick-up

There is a horizontal curve on Avery Parkway northeast of Avery Ranch Drive as seen in Figure 3 below. The south side of Avery Parkway west of the intersection with Avery Ranch Drive does not have a sidewalk. Children cross Avery Parkway on foot and bicycles to get to the sidewalk on the north side of Avery Parkway on their route to school, and the opposite path in the afternoons on their way home

from school. The crossing location is currently not marked and outside of the existing posted school zone.

Figure 3. Avery Parkway looking northeast at Avery Ranch Drive

Conner Drive is approximately 150 feet northeast of the northernmost school driveway. A sidewalk exists spanning the entire length of the north side of Avery Parkway, however the sidewalk on the south side of the street ends at the northernmost school driveway (Figures 2 and 4). Little to no traffic was observed turning onto or out of Conner Drive at Avery Parkway during both the morning and afternoon school peak times. This intersection is stop controlled on Conner Drive, and vehicles do not appear to have a problem approaching the intersection slowly or stopping at the stop sign. Based on the observations conducted, children do not have any issues crossing Conner Drive without a marked crosswalk.

Figure 4. Avery Parkway at Conner Drive

Figure 5. Conner Drive at Avery Parkway Looking Northeast

A marked crosswalk with police crossing guard during both morning and afternoon school peak times is present across Avery Parkway at Dorman Drive (Figure 6). The intersection of Avery Parkway and Dorman Drive is controlled by an all-way stop. All children are gathered and escorted by teachers at afternoon release in a single-file line to this crosswalk location before crossing the street all together in one group. During this time, all vehicles are stopped at the intersection by the police officer for approximately 5-10 minutes before resuming normal operation. In the mornings just as well as afternoons, children all appear to use only the existing crosswalk at Dorman Drive in order to cross Avery Parkway to get to the school.

Figure 6. Marked Crosswalks at Avery Parkway and Dorman Drive

The northeastern corner of Dorman Drive at Avery Parkway also serves as a bus stop for another school, likely middle school. Children can be seen in Figure 7 waiting near the stop sign at this corner for morning bus pick-up. Avery Parkway carries majority of the pedestrian traffic, but Briggs Drive – parallel to and north of Avery Parkway – serves some pedestrian traffic too. Several children walk and bike to school in the mornings, however pedestrian activity is much heavier in the afternoons leaving school – some getting picked up along Avery Parkway to skip the parent vehicle pick-up line, and some walking and biking home.

Figure 7. Children waiting for the bus at Avery Parkway and Dorman Drive

During the morning peak time, parents enter and exit the school parking lot for drop-off using the northeastern driveway while the buses use the southwestern driveway. In the afternoons, the driveway functions switch, where the parents use the southwestern driveway and the buses use only the northeastern driveway. The parent line is long as is usual and can be expected at an elementary school, but traffic does appear to function smoothly. Figure 8 shows the parent drop off line during the morning peak time.

Figure 8. Two-lane utilization at northeast school driveway during morning drop-off

Recommendations

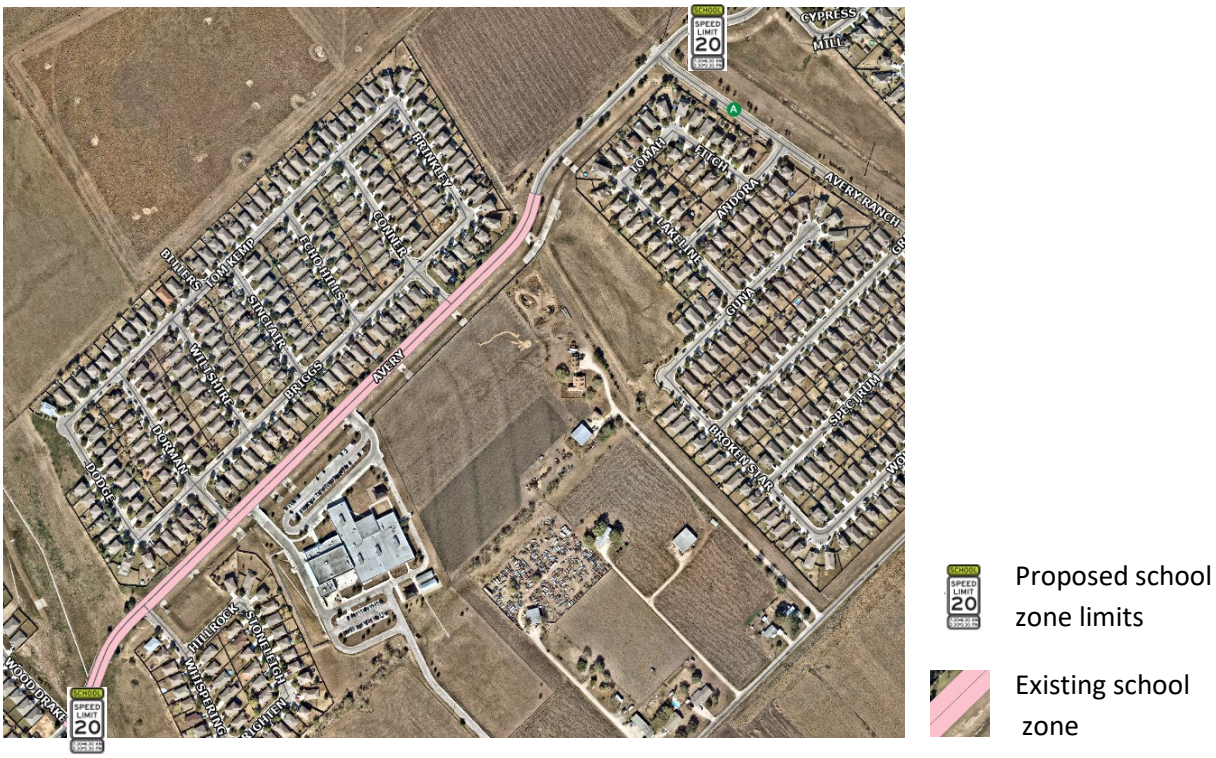
Avery Parkway was evaluated for yellow center line pavement markings following the guidance in the TMUTCD and does not currently meet any warrants based on ADT or sight distance issues. However, vehicle maneuvers in the street may be an issue for oncoming traffic. Further evaluation is required to determine if parking restrictions are required in addition to the proposed centerline markings.

The intersection of Avery Parkway and Avery Ranch Drive was evaluated for an all-way stop following the guidance in the TMUTCD. It does not currently meet any of the warrants for an all-way stop (see multi-way stop evaluation attached).

Data was not collected for the intersection of Avery Parkway and Conner Drive for the requested all-way stop. Staff did not conduct a full all-way stop warrant analysis because of the large difference in traffic

volumes between the two roadways. None of the other non-volume all-way stop warrants from the TMUTCD were met and an all-way stop is not recommended for this intersection at this time. A crosswalk will be installed on Conner Drive at Avery Parkway because it is a part of the school route.

Based on the site investigation and engineering judgement, it is recommended that the existing school zone on Avery Parkway be extended on the northeast side to 200 feet northeast of Avery Ranch Drive with no changes to time frames. Also, crosswalk markings are recommended at this time on Conner Drive at the intersection with Avery Parkway, and on Avery Parkway at Avery Ranch Drive with a School Crossing Assembly with downward-pointing arrow (S1-1; SW16-7P) at both approaches of the crosswalk on Avery Parkway.



Proposed school zone limits

Existing school zone

Figure 8. Recommended school zone extension on Avery Parkway

Attachments

Multi-way Stop Application Evaluation – Avery Parkway and Avery Ranch Drive

Sec. 126-136. - Speed zones—Twenty miles per hour on school days—Thirty miles per hour at other times.

(a) No person shall drive any vehicle on the following streets within the areas designated in this subsection during the posted hours or when the school zone flashing lights are operating from 7:00 a.m. to 5:00 p.m. on each scheduled school day during every authorized school term, in excess of 20 miles per hour; and 30 miles per hour at every other time:

Avery Parkway between 570 feet south of Whispering Way and ~~535~~ 200 feet north of ~~Conner Drive~~Avery Ranch Drive;

ORDINANCE NO. 2021-____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, AMENDING SECTION 126-136 (a) OF THE CITY OF NEW BRAUNFELS CODE OF ORDINANCES TO EXTEND A SCHOOL SPEED ZONE ON AVERY PARKWAY.

WHEREAS, after engineering and field investigation, the City Engineer has recommended that traffic control signs be installed on certain streets, avenues, thoroughfares and boulevards within the corporate limits of the City of New Braunfels in order to protect the health, safety and welfare of the citizens.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

I.

THAT the City of New Braunfels Code of Ordinances Section 126-136 (a) is hereby amended as follows:

(a) No person shall drive any vehicle on the following streets within the areas designated in this subsection during the posted hours or when the school zone flashing lights are operating from 7:00 a.m. to 5:00 p.m. on each scheduled school day during every authorized school term, in excess of 20 miles per hour; and 30 miles per hour at every other time:

Avery Parkway between 570 feet south of Whispering Way and 200 feet north of Avery Ranch Drive.

II.

THAT the Public Works Department is directed to obtain and install the traffic control signs in the locations as set forth in this ordinance, and is directed to maintain the signs in a manner that provides for the health, welfare and safety of the citizens of New Braunfels.

III.

THAT all provisions hereof are hereby declared to be severable and if any provisions hereof is declared to be invalid or unconstitutional, such shall not invalidate or affect the remaining provisions hereof which will be and remain in full force and effect.

IV.

This Ordinance shall become adopted and effective upon its second reading, signature required by City Charter, and filing with the City Secretary's Office. This Ordinance must also be published in a newspaper of general circulation at least one time within ten (10) days after its final passage, as required by the City Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this the _____ day of _____, 2021.

PASSED AND APPROVED: Second reading this the _____ day of _____, 2021.

CITY OF NEW BRAUNFELS, TEXAS

_____
RUSTY BROCKMAN, MAYOR

ATTEST:

_____
CAITLIN KROBOT, CITY SECRETARY

APPROVED AS TO FORM:

_____
VALERIA M. ACEVEDO, CITY ATTORNEY

PRESENTER:
Jared Werner, Chief Financial Officer

SUBJECT:
Approval of the second and final reading of an ordinance amending Section 2-130 of the City of New Braunfels Code of Ordinances to align with the City Charter.

DEPARTMENT: Finance Department

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
First reading was presented on August 9, 2021 and unanimously approved the first reading of this ordinance.

On May 1, 2021 the voters of the City of New Braunfels voted to approve Changes to the City Charter Chapter 9. The City Council certified the changes on June 14, 2021. Proposition H amended Section 9.17 of the City Charter to increase the City Manager's authority from $25,000 to $50,000 and to allow automatic adjustments to this amount if state law is amended in the future.

ISSUE:
The Code of Ordinances, 2-130 - City Manager-Execution of contracts and deeds, does not align to the amended Chapter 9.17 provision. The following changes are proposed to align to the newly adopted Charter changes.

Sec. 2-130. City manager-Execution of contracts and deeds.

The city manager is hereby authorized to execute the following documents on behalf of the city pursuant to the following conditions:

(1) All contracts for expenditures in an amount not exceeding ~~$25,000.00~~ $50,000.00, or as that amount is hereafter amended by state law, provided that the expenditure is budgeted;

(2) All contracts for expenditures in excess of ~~$25,000.00~~ $50,000.00, or as that amount is hereafter amended by state law, when said expenditures have been approved by the city council;

(3) Deeds and closing documents conveying real property owned by the city when the sale of the property has been approved by the city council;

FISCAL IMPACT:
There is no fiscal impact to this request.

RECOMMENDATION:
Staff recommends approval of an ordinance amending Section 2-130 of the City of New Braunfels Code of Ordinances to align with the City Charter.

ORDINANCE NO. 2021-

AN ORDINANCE AMENDING CHAPTER 2, ADMINISTRATION, ARTICLE I, CITY OF NEW BRAUNFELS, TEXAS CODE OF ORDINANCES BY AMENDING 2-130, TO REFLECT THE CHARTER AMENDMENT PROPOSITION H THAT INCREASED THE CITY MANAGER'S AUTHORITY FOR COMPETITIVE BIDDING AND PURCHASING FOR BUDGETED ITEMS FROM $25,000 UP TO $50,000; PROVIDING FOR SEVERABILITY AND AN EFFECTIVE DATE.

WHEREAS, the City Charter was amended by the majority vote in a special election held on May 2021; and

WHEREAS, Proposition H, which was passed by the voters, amended Section 9.17 of the City Charter to increase the City Manager's authority from $25,000 to $50,000, and to allow automatic adjustments to this amount if state law is amended in the future; and

WHEREAS, the Code of Ordinances is being amended to reflect the amended Charter provision so that it is congruous.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, THAT:

SECTION 1. Findings.

The findings and recitations set out in the preamble to this Ordinance are found to be true and correct and they are hereby adopted by the City Council and made a part hereof for all purposes.

SECTION 2: That the code of Ordinances be amended as indicate below with the use of strikeout font for deletions and underlined font for new language:

Sec. 2-130. City manager—Execution of contracts and deeds.

The city manager is hereby authorized to execute the following documents on behalf of the city pursuant to the following conditions:

(1) All contracts for expenditures in an amount not exceeding ~~$25,000.00~~ $50,000.00, or as that amount is hereafter amended by state law, provided that the expenditure is budgeted;

(2) All contracts for expenditures in excess of ~~$25,000.00~~ $50,000.00, or as that amount is hereafter amended by state law, when said expenditures have been approved by the city council;

(3) Deeds and closing documents conveying real property owned by the city when the sale of the property has been approved by the city council;

(4) Deeds and closing documents for the purchase of real property by the city when the purchase of the property has been approved by the city council; and

(5) The granting or abandonment of utility easements across city-owned real property provided that the granting or abandonment of the easement shall not unreasonably restrict the use of the property by the city and provided further that the execution of the document does not involve the payment of monetary consideration by the city.

SECTION 3: **Savings Clause.**
All ordinances or parts of ordinances, in conflict herewith are to the extent of such conflict hereby repealed. The balance of such ordinance is hereby saved from repeal.

SECTION 4: **Severability.**
If any section, subsection, sentence, clause or phrase of this ordinance is for any reason held to be unconstitutional or illegal, such decision shall not affect the validity of the remaining sections of this ordinance. The City Council hereby declares that it would have passed this ordinance, and each section, subsection, clause, or phrase thereof, irrespective of the fact that any one or more sections, subsections, sentences, clauses or phrases be declared void.

SECTION 5: **Effective Date.**
This Ordinance shall become adopted and effective upon its second reading, signature required by City Charter, and filing by the City Secretary.

PASSED AND APPROVED: First reading this ___ day of _____, 2021.

PASSED AND APPROVED: Second reading this ____ day of_____, 2021.

CITY OF NEW BRAUNFELS, TEXAS

_____
RUSTY BROCKMAN, Mayor

ATTEST:

_____
Caitlin Krobot, City Secretary

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Approval of the second and final reading of an ordinance amending Section 2-56 of the City of New Braunfels Code of Ordinances to align all terms for city board and commissions to begin December 1 or June 1.

DEPARTMENT: City Secretary's Office

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
The City of New Braunfels currently has 31 boards and commissions. Each board and commission have term dates, term lengths, and requirements for eligibility unique to the creating ordinance, state law or by-laws of the body. Currently, the City Secretary's Office brings board and commission appointments to City Council every month of the year but June and July.

In March of 2021, the City Secretary's Office began working on several improvements to the boards and commissions with three goals:

1. Implementation of board and commission management software
2. Application redesign
3. Term alignments

The City Secretary's Office launched Onboard in late March 2021 along with the redesigned application accomplishing the first two goals. The alignment of terms to a twice year process is the final step in the revamp of the City's boards and commissions.

The alignment of terms will allow city staff to work collaboratively to develop a more robust advertisement campaign that will better communicate information to the community regarding opportunities to serve on a board or commission. Additionally, the term alignment will streamline internal administrative processes.

ISSUE:
The proposed ordinance aligns all terms for city board and commission appointments to begin December 1 or June 1 with appointments to fill vacancies with unexpired terms to be made at any time. The City Secretary's Office will determine which boards and commissions will have terms that begin December 1 or June 1 considering current terms expirations and the number of boards and commissions. At this time, it is proposed

as follows:

Terms to Begin June 1
Airport Advisory Board
Arts Commission
Central Texas Technology Center Advisory Board
Downtown Board*
Ethics Commission*
Heritage Commission
Historic Landmark Commission
Planning Commission*
TIRZ
Traffic and Transportation Advisory Board*
Watershed Advisory Committee
Zoning Board of Adjustments*

Terms to Begin December 1
Animal Services Advisory Board
Building Standards Commission
Cemetery Committee*
Civil Service Commission
Library Board
NBEDC
NBU
Parks and Recreation Board
Partnership Committee
Workforce Housing Advisory Committee
Community Development Advisory Committee
Landa Park Golf Course Advisory Board
River Advisory Committee

The * symbol denotes boards and commissions that have existing terms that align with the proposed ordinance.

FISCAL IMPACT:
No fiscal impact.

RECOMMENDATION:
Staff recommends approval.

ORDINANCE NO. 2021-

AN ORDINANCE AMENDING THE CITY OF NEW BRAUNFELS CODE OF ORDINANCES, CHAPTER 2, ARTICLE 3 – BOARDS, COMMISSIONS, AND COMMITTEES, SPECIFICALLY SECTION 2-56 - APPOINTMENTS, TO ALIGN ALL TERMS FOR CITY BOARD AND COMMISSIONS TO BEGIN DECEMBER 1 OR JUNE 1.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

SECTION 1

THAT section 2-56 of the City of New Braunfels City Code pertaining to boards, commissions and committees are hereby amended as follows with new language indicated by underlined font:

Sec. 2-56. - Appointments and removal of members.

(a.) Appointments – As determined by the City Secretary's Office, appointments to all city boards, commissions and committees shall be in November of each year with terms to commence December 1, or May with terms to commence June 1 with appointments to fill vacancies with unexpired terms to be made at any time.

(b.) Removal of members - All appointments to city boards, commissions, and advisory groups, whether or not created by the City Charter, ordinance or resolution, and whether or not created for a specific term, shall be at the will of the city council. All members of such boards, commissions and advisory groups shall be considered to be serving at the will of the city council and may be removed at any time for any of the following reasons:

(1) Absence by an appointee from three consecutive board meetings;
(2) Conviction of a crime (excluding traffic offenses);
(3) Conduct of an appointee unbecoming a city board member; or
(4) Failure of an appointee to pay city property taxes when due.

Such removal procedure, as outlined in this section, shall be applicable only to those city boards, commissions and advisory groups that have no removal procedure outlined in the provisions pertaining to that particular board, commission or advisory group.

SECTION 2

THAT all ordinances, or parts thereof, that are in conflict or inconsistent with any provision of this Ordinance are hereby repealed to the extent of such conflict only, with the balance of such ordinances being saved from repeal. The provisions of this ordinance shall be and remain controlling as to the matters regulated herein.

SECTION 3

THAT if any provisions of this ordinance shall be held void or unconstitutional, it is hereby provided that all other parts of the same which are not held void or unconstitutional shall remain in

full force and effect.

SECTION 4

THIS ordinance will take effect upon the second and final reading in accordance with the provisions of the Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this 9th day of August 2021.

PASSED AND APPROVED: Second reading this XX day of August, 2021.

CITY OF NEW BRAUNFELS

_____

RUSTY BROCKMAN, Mayor

ATTEST:

_____

CAITLIN KROBOT, City Secretary

APPROVED AS TO FORM:

_____

VALERIA M. ACEVEDO, City Attorney

PRESENTER:
Jeff Jewell, Director of Economic and Community Development

SUBJECT:
Discuss and consider a resolution consenting to the issuance of unlimited tax bonds by Comal County Water Improvement District No. 1A, a water improvement district located within the Extraterritorial Jurisdiction of the City.

DEPARTMENT: Economic and Community Development

COUNCIL DISTRICTS IMPACTED: N/A

BACKGROUND INFORMATION:
The District is a part of an approximate 2,462 acre master planned community commonly known as Veramendi. The Development Agreement ("the Agreement") between the City of New Braunfels and Word-Borchers Ranch Joint Venture ("Veramendi") authorizes up to $620 million in debt for eligible, designated purposes. In 2020, the WID issued $3.15 million in unlimited tax bonds to provide reimbursements to the developer for eligible costs associated with the project. The bonds were paid for by tax revenues secured by approximately $25.16 million in taxable assessed valuation within the boundaries of the WID. These were the preliminarily assessed valuations as of January 1, 2020.

As of February 28, 2021, the District consisted of 262 completed homes (150 occupied and 112 unoccupied homes under contract to a homebuyer), 51 homes under construction or in a builder's name of which 51 are under contract to a homebuyer, and 198 vacant developed lots available for home construction. According to the Developer and Builders, homes within the District range in sales price from approximately $265,000 to over $450,000. In addition, utility construction is underway for an additional 61 single-family residential lots on approximately 30 acres, trunk utilities have been constructed for approximately 95 acres of commercial tracts, a church has been constructed on approximately 12 acres and Veramendi Elementary School has been constructed by the New Braunfels Independent School District on approximately 16 acres within the District.

On April 26, 2021, the City Council approved the Comal County Water Improvement District's No 1A ("WID") issuance of tax bonds in the amount of $2,590,000 for reimbursable expenses on the project. The estimated bond amount was based upon preliminary values approximately $57,450,000. Since the appraisal district delivered certified values in the amount of $88,189,684, the WID is wishing to increase its issuance of bonds from $2,590,000 to $6,000,000.

Section 8 of the Agreement outlines the requirements for the District (and subdistricts) and indebtedness, as well as the obligations of the District to the City. The District has underwritten the bonds at an estimated interest rate of 3.75%. Since the 90-day window as required by the Agreement has elapsed, the WID is making

a new presentation and requesting City Council's consideration of a new resolution authorizing the increased bond issuance.

ISSUE:
This resolution would approve the next issuance of bonds in the amount of $6,000,000 for reimbursable expenses on the project.

FISCAL IMPACT:
Since the bonds are secured solely by property taxes paid by owners within the District, there is no fiscal impact to the City of New Braunfels.

RECOMMENDATION:
Staff recommends approval of the resolution.

RESOLUTION NO. _____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS GIVING CONSENT TO THE ISSUANCE OF UNLIMITED TAX BONDS BY COMAL COUNTY WATER IMPROVEMENT DISTRICT NO. 1A, A WATER IMPROVEMENT DISTRICT LOCATED WITHIN THE EXTRATERRITORIAL JURISDICTION OF THE CITY.

WHEREAS, the City of New Braunfels, Texas (the "City") is a Texas municipal corporation as defined by the Texas Local Government Code; and

WHEREAS, Comal Water Improvement District No. 1A (the "District") is a water district operating pursuant to Chapters 49 and 51 of the Texas Water Code, and is located within the extraterritorial jurisdiction of the City; and

WHEREAS, the District desires to proceed with the issuance of $6,000,000 Comal Water Improvement District No. 1A Unlimited Tax Bonds, Series 2021 (the "Bonds"); and

WHEREAS, the District desires that the City give its written consent to the issuance of the Bonds, pursuant to Section 8.2 of that certain Development Agreement, dated February 25, 2013, by and between the City and Word-Borchers Ranch Joint Venture, a Texas general partnership; and

NOW, THEREFORE, BE IT RESOLVED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

SECTION 1. That the findings contained in the preamble of this Resolution are determined to be true and correct and are hereby adopted as part of this Resolution.

SECTION 2. That the City Council of the City hereby specifically gives its written consent to the issuance of the Bonds.

PASSED AND APPROVED by the City Council of the City of New Braunfels, Texas on this _____ day of _____, 2021.

Rusty Brockman, Mayor
City of New Braunfels, Texas

ATTEST:

Caitlin Krobot, City Secretary
City of New Braunfels, Texas

COMAL COUNTY
WATER IMPROVEMENT DISTRICT NO. 1A

$6,000,000

Unlimited Tax Bonds, Series 2021

MASTERSON ADVISORS LLC

THE BONDS

- $6,000,000 Principal Amount (see 10% discussion)
- Sale of the Bonds is subject to approval of the Texas Commission on Environmental Quality (the "TCEQ)
- Maturity Schedule: September 1, 2023 through 2047
- Callable September 1, 2027
- Expected Sale Date: Fall 2021
- Security: Unlimited Tax Bonds
- Rating: None at this time
- Type of Sale: Competitive

FEASIBILITY OF THE BONDS

- 2021 Certified Value: $88,189,684. Estimate of Value as of August 15, 2021 has been requested.
- Bond size is based upon a 10% debt ratio as required by the TCEQ. The current outstanding debt of Comal 1A is $3,080,000, leaving $5,735,000 of debt issuance under the TCEQ 10% rule.
- The requested estimate of value must show at least $90,800,000 of value to support the proposed $6,000,000 bond issue, otherwise it will be adjusted downward according to that estimate in order to not exceed a 10% debt ratio.
- 2021 Total Tax Rate is $0.794 ($0.45 Debt + $0.344 M&O). No change to the 2020 total rate.
- Average Annual Debt Service of $514,569 (2022-2047).
- No increase in taxable value is required for feasibility although significant growth is occurring.

PRESENTER:
Melissa Reynolds, First Assistant City Engineer

SUBJECT:
Discuss and consider approval of proposed amendments to the City of New Braunfels Drainage and Erosion Control Manual.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
City staff is proposing amendments to the Drainage and Erosion Control Design Manual and the Code of Ordinances, Chapter 58 - Floods. The proposed amendments are based on recommendations from the Drainage Area Master Plan (DAMP) development and the Community Rating System (CRS) Improvement Report. These items were previously presented in fall of 2020 and have been posted on the Engineering webpage for comment since late 2020. Staff has received minor comments and questions primarily regarding one element, to which more detail is presented below.

The DAMP, initiated in 2019, is currently finalizing Phase 1 which includes updates to regulations to align with State standards. These updates are important for Phase 2 - remapping of floodplains based on new hydrology. Phase 1 also provided recommendations for improvements to the floodplain ordinance to improve CRS rating enhancements. This DAMP is intended to function as a comprehensive and holistic watershed program that is sustainable.

The CRS is the National Flood Insurance Program's (NFIP) voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. The CRS Improvement Report was intended to investigate the City's potential to achieve improved CRS rating, creating better benefits for residents.

Drainage and Erosion Control Design Manual
The following amendments are proposed to the Drainage and Erosion Control Design Manual:

Chapter 2 - Drainage Policy and Criteria are proposed and include a new section, Floodplain Development Requirements. This section will include floodplain development requirements, establishing floodplain regulation to the 1% annual chance ultimate development (AC UD) flood, establishing requirements for compensatory excavation in the floodplain to offset lost floodplain volume in the 1% AC UD.

Chapter 3 - Design Rainfall was revised ahead of the full policy changes and updates the City's Design Rainfall

to align with the new NOAA Atlas 14, Volume 11 Texas. Note that this change went into effect January 2021 and is simply included to illustrate the holistic changes.

Chapter 4 - Determination of Design Discharge are proposed in order to update references to design rainfall criteria. Additionally, proposed changes include adding mitigation for the 50-year design storm to the already required 2, 10, 25, and 100-year storms.

Chapter 7 - Storm Drain Systems include updates proposed to incorporate changes based on stakeholder input clarifying hydraulic grade line (HGL) criteria and cover over pipe requirements.

Chapter 10 - Detention and Retention Facilities include updates for clarification for maximum water depths and incorporating the 50-year storm frequency to the design criteria for mitigation ponds.

Other updates include updates to Appendixes for Definitions of Terms, incorporating new terminology and removing the Stream Bank Erosion Hazard Setback Exhibit.

Review Process
This item was initially presented to the Watershed Advisory Committee, Planning Commission, and City Council for information and feedback in fall of 2020. The changes have been posted online for stakeholder and public input since December 2020. Engineering hosted 2 virtual stakeholder presentations on April 1, 2021 along with an engineering workshop on April 8, 2021.

Based on feedback from the Planning Commission, Watershed Advisory Committee, and stakeholders, along with staff research, Engineering has adjusted the recommended changes to remove the previously presented "Stream Buffers" from this update. Staff recognized additional effort is needed and this will follow in a later update after appropriate supporting information is developed. In addition, the proposal to require floodplains be platted as drainage easements has also been removed.

The feedback received at the virtual meetings and proposed text was discussed at a follow-up meeting for the Watershed Advisory Committee on April 22, 2021. The Committee recommended approval of the update. All feedback received was presented to the Planning Commission on May 4, 2021 for discussion and action was taken the following meeting on June 1, 2021 receiving approval with recommendation to not require the floodplain to be platted as a drainage easement, which has been incorporated in this recommendation.

ISSUE:
Envision New Braunfels (2018):
ACTION 4.28 [PROGRAM] Acquire and set aside as much land as possible along the Comal and Guadalupe Rivers and their tributaries within the floodplain for greenspace and/or additional river access.
ACTION 5.2 [POLICY] Discourage development in Edwards Aquifer Recharge and contributing zones, stream zones, flood-prone areas, steep slopes, or other ecologically constrained areas. Where development in these areas must occur, require that it be environmentally sound using tools such as but not limited to low impact development (LID).
ACTION 5.6 [POLICY] Implement measures to achieve and maintain a high National Flood Insurance Program CRS rating to ensure the safety of all residents and to reduce property owner flood insurance rates.
ACTION 5.15 [POLICY] Ensure that developers adequately address drainage in their projects and

developments.

Municipal Separate Storm Sewer System (MS4) Stormwater Management Program: Minimum Control Measure 4: Post-Construction stormwater management in new development and re-development. Encouraging low impact development designs and establishing riparian zones and vegetative areas.

Stormwater Management Strategy Report (2013):
Open Space Conservation - Set aside lands and preserve open space that have high infiltration rates which would contribute to reduced peak flow levels and increased infiltration.
Floodway Hazard Mitigation - to Further limit or restrict new construction in the 100-year floodplain and floodway beyond existing ordinance.
Stream Bank Setback - Establish setbacks from streams for new development.

FISCAL IMPACT:
N/A

RECOMMENDATION:
Staff recommends approval of this proposed update to the Drainage and Erosion Control Design Manual. Staff proposes these updates to go into effect on October 1, 2021. The new criteria will not be required for projects with approved master plans and/or final plats prior to the effective date. After the effective dates, any projects that were designed using the previous criteria will require an exception issued by the City Engineer (per Section 143-2(c)) prior to permit approval. If an approved master plan requires a major revision as specified in Section 118-22(h), the development shall comply with the most current DCM criteria including water quality requirements.

Section 118-17 specifies that the City Engineer may amend the standards for the design and construction of streets, curbs and drainage facilities, upon the recommendation of the Planning Commission to City Council, and such amendment shall be filed with the City Secretary at least ten days before it becomes effective.

City of New Braunfels
Drainage and Erosion Control Design Manual

2016

Manual Updates:

2017-1, 2018-1, 2021-1

Notice of Manual Updates 2017-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: August 28, 2017

Effective Date: September 1, 2017

Purpose: To provide clarification and implement best practices.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.1.4 – Specify requirements for Preliminary Drainage Report.
- Section 2.1.5 – Specify requirements for Master Drainage Plan Report.
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 10 inches above finished grade of the surrounding ground (in previous DCM).
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 12 inches above adjacent stormwater conveyance structures (clarification).
- Section 2.5 – Require and specify grading plan required at plat and building permit.
- Section 2.5 – Specify that residential lots shall be graded to avoid water flowing over curb and driveway, and out of right-of-way.
- Section 2.7 – Specify that if development activity changes runoff characteristics that creates point discharge or any increase in discharge rates or velocities, the flow shall outfall into right-of-way or drainage easement that has capacity and an impact analysis is required to verify capacity and no adverse impact.
- Section 2.7 – Specify engineered retaining walls greater than three feet shall be designed to prevent freefall of stormwater.
- Section 2.11 – Specify pumped drainage facilities design, maintenance and operations requirements.
- Section 2.11 – Require feasibility analysis of pumped detention prior to permit application.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2018-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: January 22, 2018

Effective Date: February 5, 2018

Purpose: To provide amend and clarify channel and maintenance access requirements.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.3 – Clarify and revise channel definition, design frequency and freeboard.
- Section 2.10.2 – Clarify easement and maintenance access criteria.

Chapter 8 – Open Channels

- Section 8.1 – Clarify easement and maintenance access criteria and specify pilot channel and channel fencing requirements.

Appendix B – Definition of Terms

- Redefine channel and define ditch and swale.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2021-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: August 23, 2021

Effective Date: October 1, 2021

Purpose: To provide hydrology updates aligning with new statewide NOAA Atlas 14 adoption. To implement floodplain criteria improvements providing better designs in flood prone areas allowing for higher standards of protection for the citizens of New Braunfels.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.3 – Specify Floodplain Development Requirements.
- Section 2.3.1 – Establish floodplain regulation to the 1% annual chance ultimate development flood
- Section 2.3.2 – Establish requirements for compensatory excavation in the floodplain.

Chapter 3 – Design Rainfall

- Section 3.1 – Update hydrology data to align with NOAA Atlas 14 point precipitation frequencies.

Chapter 4 – Determination of Design Discharge

- Section 4.1 – Update various references for NOAA Atlas 14 point precipitation frequencies.
- Section 4.3 – Update various references for NOAA Atlas 14 point precipitation frequencies.

Chapter 7 – Storm Drain Systems

- Section 7.1 – Updated hydraulic grade line (HGL) criteria and pipe cover requirements

Chapter 10 – Detention and Retention Facilities

- Section 10.1 – Clarification to the maximum water depths criteria.
- Section 10.2 – Update design mitigation to include the 2, 10, 25, 50, and 100-year
- Section 10.3 – Update the outlet structure design requirements to reference 2, 10, 25, 50, and 100-year

Appendix B – Definition of Terms

- Add new definitions

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Table of Contents

List of Figures

List of Tables

List of Appendices

1 Introduction

1.1 Purpose and Scope

The purpose of the Drainage and Erosion Control Design Manual is to establish standard principles and practices for the design and construction of storm drainage, flood protection, erosion control, and water quality facilities within the City of New Braunfels, Texas and its extraterritorial jurisdiction (ETJ).

The design factors, formulas, graphs, and procedures described in this manual are intended to serve as guidelines for the design of drainage improvements and projects involving the volume, rate of flow, method of collection, storage, conveyance, treatment, and disposal of stormwater and erosion protection from stormwater flows. Responsibility for actual design remains with the design engineer. Any variations from the methodology or requirements in this manual must have expressed written approval of the City Engineer and Engineering Division, as permitted by Ordinance.

This manual and the City of New Braunfels Code of Ordinances contain requirements for the design of storm drainage, flood protection, water quality, and erosion control facilities. Where there is any conflict between this manual and the current code, the code shall take precedence. The design engineer is responsible for complying with the latest version of this manual and code adopted by the City.

Should conflicts occur between policy and criteria in this manual versus other regulatory authorities with jurisdiction in the same area, such as Texas Commission on Environmental Quality (TCEQ) or Texas Department of Transportation (TxDOT), then the more stringent requirement will apply and the designer will need to show how both requirements have been met.

1.2 Applicability

Criteria in this manual shall apply to all drainage improvements and projects that may have an impact on drainage, both publicly and privately funded, within the City of New Braunfels, Texas and within its ETJ. Criteria in this manual shall apply to any capital improvement or development project, plat, master plan, or building permit except as otherwise noted in the manual.

1.3 Computer Programs

The use of computer programs for calculating and modeling storm data and drainage facilities is accepted as standard practice. There are a variety of computer programs available and the design engineer maintains responsibility of selecting the appropriate approach and/or computer program unless otherwise specified in this manual. Computer programs are not a replacement for sound engineering judgment and the user must understand how the program performs the calculations and what assumptions are made.

1.4 References and Definition of Terms

At certain points in the text, the reader will encounter numbers enclosed in brackets, for example [1]. These numbers correspond to the references listed in **Appendix A**. Figures and tables reproduced from

other sources have the source listed beneath each figure or table. Common terms used in this manual are provided in **Appendix B**.

1.5 Acknowledgements

This manual is the result of the dedication and energy of the Drainage Advisory Committee members for the 2000 edition. For the 2015 update, acknowledgements go to City staff, Watershed Advisory Committee, Design Workshop, Lockwood Andrews & Newnam, Inc., and input from a wide variety of stakeholders.

Updates incorporated in 2021, acknowledgements go to City Staff, Pape Dawson Engineers, and the Watershed Advisory Committee.

2 Drainage Policy and Criteria

2.1 Drainage and Water Quality Design Requirements

All drainage improvements and projects shall be designed and constructed in accordance with the current regulations, standards and specifications adopted by the City of New Braunfels. Any capital improvement or development project within the City of New Braunfels jurisdiction is required to comply with the requirements outlined in this manual. When necessary, properly sized easements shall be granted across all contiguous property owned by the property owner.

A drainage report is required to be submitted by the property owner or its agent according to the requirements of this manual. The Engineering Division prior to issuance of a permit must approve the report. The type of development and report shall be based on the location and additional impervious cover of the development as shown in Table 2-1.

Table 2-1: Development Categories

Category	Criteria
Type 1 Development	Less than one acre of land; and < 1,000 SF additional impervious cover
Type 2 Development	Less than one acre of land; and 1,000 – 4,999 SF additional impervious cover; or Agricultural development (not including feedlots)
Type 3 Development	≥ 5,000 SF additional impervious cover; or Development within FEMA designated Special Flood Hazard Area

If any onsite and offsite stormwater structure related to the development is known to be at or above design capacity, the development will be considered a Type 3 Development.

Drainage report requirements are outlined below. An electronic media copy of the report is required in addition to a paper copy at time of city acceptance of infrastructure improvements.

2.1.1 Type 1 Drainage Report

A Type 1 Development is any development or redevelopment that disturbs less than one acre of land and creates less than 1,000 square foot of additional impervious cover. The Type 1 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch showing any existing features or infrastructure and proposed disturbance
D. Temporary erosion control plan

2.1.2 Type 2 Drainage Report

A Type 2 Development is any development or redevelopment that disturbs less than one acre of land, and creates more than 1,000 but less than 5,000 square foot of additional impervious cover. Type 2 Developments also include any agricultural development not including feedlots. The Type 2 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch of the affected area scaled to 1" = 50' (or less) on minimum 11" x 17" paper showing the following:
    1. Existing drainage ways and easements
    2. Runoff flow directions
    3. Floodplain boundaries
    4. Proposed grading and development
    5. Proposed drainage and erosion control facilities
    6. A copy of the survey plat showing the lot layout, streets, and utility and drainage easements
D. Temporary erosion control plan
E. If any on-site and off-site stormwater structure related to this development is known to be at or above design capacity, the development will be considered a Type 3 Development

2.1.3 Type 3 Drainage and Water Quality Report

A Type 3 Development is any development or redevelopment greater than or equal to 5,000 square feet of additional impervious cover, not Type 1 or Type 2, or any development within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area. A Type 3 Drainage and Water Quality Report shall be prepared by a professional engineer licensed in the State of Texas, experienced in civil engineering, and having a thorough knowledge of the hydraulic analysis and design. The report shall be signed and sealed, per Texas Board of Professional Engineers, by the person responsible for the report. The Type 3 Drainage and Water Quality Report shall consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. A copy of the final plat showing the lot layout, streets, and utility and drainage easements
D. Construction drawings adhering to all applicable codes and regulations including details and specifications
E. Drainage and Water Quality Report as outlined in **Section 2.2** – Type 3 Drainage and Water Quality Report Criteria
F. Temporary and permanent erosion control plan as outlined in **Section 12** – Site Erosion Control
G. Approval letters from other agencies with jurisdiction or permit requirements for the site location

2.1.4 Preliminary Drainage Report

A Preliminary Drainage Report of the storm drainage system is required with a preliminary plat. The report shall include the following:

A. Preliminary Drainage Site Plan including: plat boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the plat; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Conformance with the Master Drainage Plan Report (if applicable) specified in **Section 2.1.5**. The report may require updating for development plat submittals and changes in the drainage design.

2.1.5 Master Drainage Plan Report

A Master Drainage Plan Report shall be provided with a subdivision master plan and planned development. The report shall include the following:

A. Existing Drainage Site Plan including: development boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; and floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Existing Watershed Map including: development boundary; existing drainage area and all sub areas; 2-foot contours; and existing runoff flow directions.
C. Preliminary Drainage Site Plan including: development boundary; proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries.
D. Master Drainage Plan Summary including how drainage and water quality resulting from the proposed development will be managed and how proposed drainage infrastructure will impact adjacent property owners.

2.2 Type 3 Drainage and Water Quality Report Criteria

The planning and design of drainage systems should ensure that problems are not transferred from one location to another. Grading and other construction activities may not change the terrain in such a way to cause damage to public or private property from drainage or flood problems, increased runoff, or increased erosion or sediment movement.

Existing drainage between developed lots will remain the responsibility of the affected property owners. Commercial developments are required to drain surface runoff from an individual lot to a public right-of-way or to a drainage system contained in an easement. Residential lot-to-lot drainage of sheet flows should be avoided, and residential developments are encouraged to direct surface runoff to a public right-of-way or to a drainage system contained in an easement.

The Engineering Division shall not approve any drainage report pertaining to proposed construction, platting or other development where the proposed activity or change in the land would result in post-development discharge from the site exceeding discharge under pre-developed conditions (for new development) or existing conditions (for re-development). Downstream capacity shall not be exceeded as a result of development. Exemptions from this provision are as follows:

A. Additional drainage improvements are not required if drainage improvements have been provided for the fully developed condition, which includes the proposed development.
B. Prior written approval of a Stormwater Connection Fee from the City Engineer.

No proposed development shall be constructed which impedes or constricts runoff from an upstream watershed based on fully developed conditions. Therefore, drainage computations shall be provided to verify no adverse impact upstream or downstream.

2.3 Floodplain Development Requirements

The purpose of floodplain management is to focus on safety of the citizens, minimize flood loses, avoid flooding of buildings, preserve floodplain areas and ultimately improve quality of life for the residents of City of New Braunfels. With this being the primary focus, the City has adopted higher standards than currently illustrated in FEMA's general guidance (FEMA Policy Standards for Flood Risk Analysis and Mapping).

1% Annual Chance (AC) floodplain, also known as the 100-year floodplain is the area subject to 1% or greater chance of flooding in any given year, as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2% AC storm or 1% AC storm based on Ultimate Development (UD) Conditions, also known as Future Conditions (FC). The City permits floodplain reclamation if supported by a signed and sealed study which demonstrates no adverse impacts to any property and demonstrates a no-rise in the 1% AC UD water surface elevation outside of the requestor's property limits.

2.3.1 Regulating to the 1% Annual Chance Ultimate Development Flood

The City of New Braunfels has adopted the 1% AC UD floodplain mapped using Atlas 14 rainfall data published in this document, as the regulatory floodplain. Such floodplain is delineated based on flows developed by assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to estimate fully developed conditions. The City requires all new and re-studied FEMA floodplains to delineate the 1% AC UD floodway to be depicted and platted or otherwise secured as a drainage easement.

Once the Flood Insurance Rate Maps (FIRM) for City of New Braunfels are updated with the revised rainfall data, the 1% AC UD floodplains will be designated as Shaded-X areas for all FEMA floodplain establishments or revisions. Until the FEMA FIRM are updated with the revised rainfall data, the City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions. The City requires demonstration of the elevation of fill placed in the 1% AC UD

floodplain for construction of habitable structures to be greater than the 1% AC UD water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities, etc.

The City requires all drainage easements and crossings in the floodplains to be based on the 1% AC UD conditions. For drainage areas greater than 150 acres, which propose or require grading adjacent to the stream, for unmapped streams and within the floodplain for mapped streams; the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the 1% AC flows.

The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to support their 1% AC UD flows and floodplain delineation.

The City allows floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no adverse impact to the 1% AC UD water surface elevation outside of the requestor's property limits.

For streams which have a drainage area greater than 150 acres and currently not-mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a 1% AC UD floodplain along, within or adjacent to the project site and plat the floodplain delineation as a drainage easement.

2.3.2 Compensatory – Excavation

The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate lost floodplain volume due to fill placed in the 1% Annual Chance (AC) Ultimate Development (UD) floodplain. The City permits excavation in the floodplain to mitigate the increases to 1% AC UD water surface elevations, in additional to excavation compensation along the same flooding source and must be within the general vicinity of the fill being placed. All submittals must include a signed drawing by a licensed Professional Engineer clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes, indicating total Cut volume higher than total Fill volume placed in the 1% AC UD floodplain established for the site.

If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require evidence of coordination and approval from the US Army Corps of Engineers.

2.4 Freeboard

Freeboard is the vertical distance between the design water surface and the elevation of the drainage facility, such as the top of channel or detention pond. Freeboard is intended to provide a factor of safety and prevent the fluctuation of the water surface from overflowing the drainage facility. Freeboard requirements are shown in Table 2-2. Freeboard is not required where parking areas are designed to serve as detention facilities; however, site design should consider safety and drainage overflow location.

Table 2-2: Freeboard Requirements

Drainage Facility	Design Frequency	Minimum Freeboard
Street right-of-way	100-year	None
Creek improvements	100-year	1.0 ft
Channels with drainage area > 128 acres	100-year	1.0 ft
Channels with drainage area ≤ 128 acres		
• 100-year design depth < 5 ft	100-year	25-year + 0.5 ft
• 100-year design depth 5-10 ft	100-year	25-year + 10% design depth
• 100-year design depth > 10 ft	100-year	25-year + 1.0 ft
Detention ponds and reservoirs	100-year	1.0 ft
Bridges and culverts	25-year	See note *2*
Floodways and floodplains	100-year	2.0 ft (See note *3*)

[1] Channels with drainage area ≤ 128 acres shall be designed to contain the 100-year storm event or 25-year storm event plus freeboard, whichever is greater.

[2] Bridges and culverts shall be designed to withstand the 100-year event, but the water level may reach roadway level at the 25-year design level if no public safety issues are involved.

[3] Floodways and floodplains shall have a minimum of 2-feet freeboard or the minimum freeboard established in the most recently adopted Floodplain Ordinance.

2.5 Drainage Easements and Rights-of-way

All private drainage and water quality facilities must have an associated drainage easement, restrictive covenant, or similar recorded instrument that clearly identifies ownership and the party responsible for maintenance. Drainage easements and rights-of-way shall be dedicated to the City as required in the Code of Ordinances.

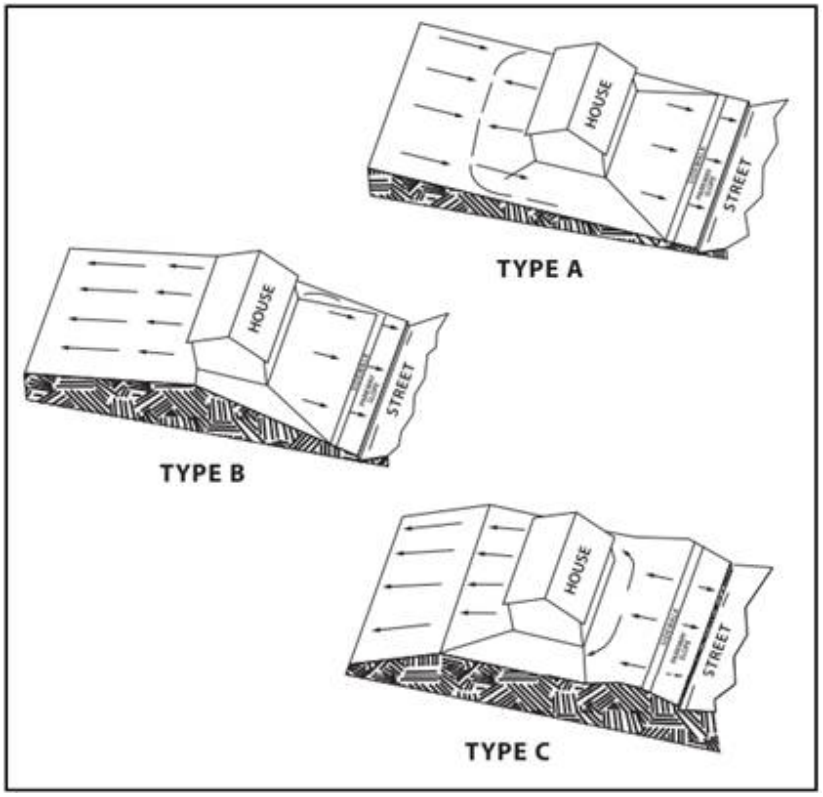
2.6 Finished Floor Elevations

The elevation of the lowest floor shall be elevated 10 inches above the finished grade of the surrounding ground as prescribed in the building regulations and Code of Ordinances. Finished grades shall be sloped to direct stormwater away from the structure. Developments adjacent to stormwater conveyance structures must be elevated 12 inches above the 100-year water flow elevation (in the conveyance structure) to the same elevation that a development adjacent to a 100-year floodplain would be required to meet. Driveways serving houses on the downhill side of the street shall have properly sized swales before entering the garage.

A grading plan shall be prepared and submitted to the City at final plat and building permit, which indicates typical lot grading for all lots in the subdivision using typical Federal Housing Administration

(FHA) lot grading types (A, B and C). See Figure 2-1. No more than two (2) residential lots may drain onto another lot unless a drainage easement is dedicated and free of obstructions to contain the runoff. An alternate grading plan may be submitted for large lot or commercial subdivisions.

Figure 2-1: Typical Federal Housing Administration Lot Grading



Where residential lots are located on the downhill side of a T-intersection, cul-de-sac, or elbow, the street intersection shall be graded so to avoid water flowing over the curb and driveway, and out of the right-of-way. Detailed calculations shall be required at permit to show that the discharges are contained within the right-of-way.

2.7 Stormwater Mitigation

It is the intent of this manual, in concert with applicable ordinances, to provide all development under its jurisdiction the option of providing mitigation or demonstrating that no mitigation is in the best interest of the watershed and paying a share of the cost to participate with a stormwater connection fee.

Mitigation through detention, retention, or some other technique must be designed, constructed, and maintained to reduce the post-development discharge rates to below that of pre-development/existing rates for the two (2), ten (10), twenty-five (25), fifty (50), and one-hundred (100) year design storms. Participation in neighborhood or regional mitigation is an acceptable option.

Demonstration that no mitigation is in the best interest of the watershed shall be accomplished by showing no adverse impact due to any increased runoff from the proposed development for the design

storms. Approval of a Stormwater Connection Fee is required in compliance with Chapter 143 of the Code of Ordinances. The property owner, or his/her designee, shall meet with the Engineering Division to discuss mitigation and/or Stormwater Connection Fee options prior to commencing the project.

For stormwater mitigation, the following two development conditions shall be analyzed with each adverse impact analysis:

A. Existing Conditions. This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site, or the watershed, to other properties or drainage systems.
B. Proposed Conditions. This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact to other properties or drainage systems.

2.8 Drainage Facility Design

Drainage design in the urban environment should also consider appearance as an integral part of the design and structures should generally blend with the natural surroundings as much as possible to maintain the aesthetics of the natural area.

The City requires preservation of the natural floodplains. The protection of existing trees and vegetation should be maximized during development of drainage plans. Whenever possible, the replacement of the trees destroyed by drainage and flood protection procedures is encouraged.

Computations to support all drainage designs shall be submitted to the Engineering Division for review in an easy to follow format. On-site pre-development stormwater runoff computations shall be based upon conditions representing the existing land conditions with respect to soil type, percentage cover, and cover type as indicated by current aerial imagery and supporting documentation. Design of structures shall use fully developed sub-basin conditions for the prescribed design storms based on the sub-basin zoning. If zoning does not exist, then the engineer shall assume the ultimate development based on the most recently adopted Future Land Use Plan.

If a development activity changes stormwater runoff characteristics in a manner that creates a point or points of concentrated flow, where previously there was sheet flow or lesser intensity flow pattern, or any increase in discharge rates or velocities for the 2, 10, 25 and 100-year frequency storms, the flow shall outfall into right-of-way or drainage easement that has the capacity for the discharge. An impact analysis is required to verify the capacity and/or required size of the downstream facility clearly demonstrating no adverse impact.

In development of engineered retaining walls greater than three feet, drainage facilities shall be designed in such a manner as to prevent the freefall of stormwater from natural drainage patterns and sheet flow conditions.

The design requirements and criteria are specified in following chapters. Modeling and calculations shall be included in drainage report submittals to ensure the specified criteria are met for all drainage

infrastructure improvements. Infrastructure that is within TxDOT right-of-way and requires dual permitting from both the City and TxDOT shall be designed in compliance with the more conservative requirements.

2.9 Stream Bank Erosion Hazard Setback

Erosion hazard setback zone determination is necessary for the banks of streams in which the natural channel is to be preserved. The purpose of the setbacks is to reduce the amount of structural damage and stream degradation caused by the erosion of the bank. With the application of stream bank erosion hazard setbacks, an easement is dedicated to the City such that no structure can be located, constructed, or maintained in the area encompassing the erosion hazard setback.

The City allows for stream bank stabilization as an alternative to dedicating the erosion hazard setback zone. Stream bank erosion hazard setbacks may extend beyond the limits of the regulatory floodplain and are shown in Table 2-3.

Table 2-3: Stream Bank Erosion Hazard Setbacks

Contributing Drainage Area (square miles)	Setback Distance from Stream Centerline (feet)
0-1	0
1-5	50
5 or more	100

A map delineating the contributing drainage area sizes along each stream in the City's jurisdiction is included for reference in **Appendix C**. For the purpose of this manual, any watercourse that was included in the rivers and stream data set published in the United States Geological Survey (USGS) National Hydrography Dataset (NHD) in 2013 was considered a stream.

2.10 Water Quality Controls

Temporary water quality best management practices (BMPs) shall be required when any disturbance could result in appreciable erosion that could result in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties during construction activities. Site erosion control requirements are provided in **Section 12**.

Development and redevelopment located over the Edwards Aquifer regulatory zones shall comply with the latest TCEQ published rules and technical design guidance for the Edwards Aquifer. Permanent water quality BMPs for development outside of the Edwards Aquifer regulated zones shall be designed to provide adequate treatment of the water quality volume in the City's jurisdiction as defined in **Section 13**.

2.11 Maintenance of Drainage Facilities

The property owner or designee will maintain the hydraulic integrity of drainage systems not dedicated to the City. The City will maintain the hydraulic integrity of drainage systems dedicated to and accepted

by the City. Maintenance of the floodplain, drainage easements, and water quality features shall be explicitly stated in a recorded instrument.

2.11.1 Maintenance Schedule

A maintenance schedule supported by engineering or scientific published documents shall be submitted to the Engineering Division prior to approval of construction plans for public and private facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage and water quality improvements to ensure that the maintenance schedule is being implemented.

2.11.2 Maintenance Access

Access shall be provided for all channels to allow equipment access for maintenance. Access shall have a width of at least 12 feet and a cross slope no greater than two percent. Maintenance ramps used for access shall have a vertical grade no steeper than 6:1. An unobstructed access easement connecting the channel drainage easement with a roadway parallel to or near the easement shall be provided at a minimum spacing of one access easement at a minimum of 1,000 feet intervals. Access shall be provided within dedicated right-of-way or within the drainage easement dedicated for the channel. The bottom of the channel cannot be considered as maintenance access.

2.12 Pumped Drainage Facilities

The City of New Braunfels discourages the use of Pumped Drainage Facilities. A Pumped Drainage Facility is defined as any drainage system not wholly utilizing gravity outflow. Facility designs considered under this section's guidelines must first demonstrate that a gravity system is not feasible from both an engineering and economic standpoint. A feasibility analysis is required to be submitted prior to permit application. The applicant must have expressed written approval from the City Engineer and Engineering Division with permit application.

Pumped Drainage Facilities will only be acceptable in commercial applications and must meet all other drainage requirements outlined in this manual. All approved Pumped Drainage Facilities must be privately owned and maintained. The owner assumes responsibility for any damage to property as a result of a system's normal operation or failure.

2.12.1 Design Requirements

If approved by the Engineering Division, Pumped Drainage Facilities design submittals should include the following items:

A. Pump discharge shall be used for a maximum of 50% of the total required basin capacity, not including freeboard. The remaining volume must discharge by gravity.
B. A minimum of two (2) pumps will be provided, each of which is sized to pump the designed flow rate.
C. Provide an emergency power source for the drainage facility pumps.
D. Design should include but not be limited to controls, pumps, cycling and anti-vandalism measures.
E. Facility discharge must be into an existing right-of-way or drainage easement that has the capacity for the increase discharge.

F. Provide an armored gravity emergency outflow structure designed to allow the outflow of the 100-year design storm, assuming the pond is full and the discharge is 100% clogged. At minimum, the emergency overflow shall engage when ponding exceeds the 100-year water surface elevation plus freeboard.

2.12.2 Maintenance and Operations

A maintenance and operations plan shall be submitted to the Engineering Division prior to approval of construction plans for all facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage improvements to ensure that the maintenance schedule is being implemented.

This page intentionally left blank.

3 Design Rainfall

3.1 Rainfall Intensity Duration Frequency

The City evaluated precipitation based on NOAA Atlas 14, Volume 11 Texas statewide precipitation study. This study updated precipitation frequency estimates for Texas and replaces previous precipitation estimate studies. The revised rainfall data will be the standard for Design for the City of New Braunfels.

Runoff shall be calculated in accordance with Section 4 using the updated precipitation values as shown in Tables 3-1 and 3-2. The 100-year (1% AC) 24-hour rainfall depth for City of New Braunfels is 13.1 inches. The data published by NOAA Atlas 14 varies linearly across the City. The values shown below are taken from the highest rainfall data within the City limits.

Table 3-1: New Braunfels Atlas 14 Area Depth-Duration Value

Year	Depth-Duration-Frequency (inches)									
	5-Min	15-Min	1-Hr	2-Hr	3-Hr	6-Hr	12-Hr	24-Hr	2-day	3-day
2	0.528	1.06	1.96	2.4	2.67	3.13	3.59	4.08	4.66	5.05
5	0.664	1.33	2.45	3.08	3.47	4.14	4.79	5.48	6.27	6.78
10	0.781	1.66	2.88	3.71	4.23	5.13	5.97	6.86	7.82	8.43
25	0.946	1.88	3.5	4.63	5.39	6.66	7.82	8.99	10.2	10.9
50	1.08	2.14	3.97	5.4	6.39	8.03	9.46	10.9	12.3	13.1
100	1.22	2.41	4.49	6.26	7.54	9.62	11.4	13.1	14.7	15.6
500	1.57	3.09	5.95	8.74	10.8	14.2	17.1	19.8	22	23.1

Table 3-2 shows rainfall intensities by storm event. The intensities were calculated based off the depth duration table for each frequency storm. Durations range from 5 minutes up to 1 day for recurrence intervals from the 2-year to 500-year storm events, which will be the standard design for New Braunfels.

The City requires all flood study submittals to be performed using rainfall data presented in the document. If a FEMA submittal is required for the purpose of a map revision or amendment such as a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) or a Letter of Map Amendment (LOMA), FEMA will require the hydrologic and hydraulic models to be updated based on the information used for the Current Effective Flood Insurance Study (FIS). In which case, the City requires two separate submittals. One, which uses FEMA data and will be submitted for FEMA map revisions and incorporation upon City Floodplain Administrator's (FPA) approval; another which uses the guidelines published in this manual and will be submitted for review and approval by the City Engineer or his/her designee.

Regardless of a FEMA submittal, the City will require a signed and sealed memo or report, summarizing the hydrologic and hydraulic analysis as illustrated in this manual, for all improvements adjacent to a mapped or un-mapped stream with a contributing drainage area greater than 200 acres.

Table 3-2: New Braunfels Rainfall Intensities by Storm Event

Rainfall Intensity (inches/hour) by Storm Frequency							
Time (minutes)	**2**	**5**	**10**	**25**	**50**	**100**	**500**
5	6.34	7.97	9.37	11.35	12.96	14.64	18.84
6	5.98	7.53	8.88	10.78	12.29	13.88	17.72
7	5.70	7.18	8.47	10.30	11.73	13.24	16.83
8	5.45	6.88	8.11	9.87	11.24	12.68	16.08
9	5.24	6.61	7.79	9.48	10.79	12.17	15.42
10	5.05	6.36	7.50	9.12	10.38	11.70	14.82
11	4.87	6.13	7.23	8.78	9.99	11.26	14.27
12	4.70	5.92	6.97	8.45	9.61	10.83	13.76
13	4.54	5.71	6.72	8.13	9.25	10.42	13.27
14	4.39	5.51	6.47	7.82	8.90	10.03	12.81
15	4.24	5.32	6.24	7.52	8.56	9.64	12.36
16	4.10	5.14	6.03	7.26	8.25	9.29	11.93
17	3.97	4.98	5.83	7.02	7.98	8.98	11.54
18	3.86	4.83	5.66	6.81	7.74	8.71	11.19
19	3.75	4.69	5.50	6.62	7.51	8.46	10.88
20	3.65	4.57	5.36	6.45	7.31	8.23	10.59
21	3.57	4.46	5.23	6.29	7.12	8.01	10.33
22	3.48	4.35	5.10	6.14	6.95	7.82	10.09
23	3.41	4.26	4.99	6.00	6.79	7.64	9.86
24	3.34	4.17	4.88	5.87	6.64	7.47	9.65
25	3.27	4.08	4.78	5.75	6.50	7.32	9.46
26	3.20	4.00	4.69	5.64	6.37	7.17	9.27
27	3.14	3.93	4.60	5.53	6.25	7.03	9.10
28	3.09	3.85	4.52	5.43	6.13	6.90	8.94
29	3.03	3.79	4.44	5.33	6.02	6.78	8.79
30	2.98	3.72	4.36	5.24	5.92	6.66	8.64
31	2.93	3.66	4.29	5.15	5.82	6.55	8.50
32	2.88	3.60	4.22	5.07	5.73	6.44	8.37
33	2.84	3.54	4.15	4.99	5.63	6.34	8.24
34	2.79	3.49	4.09	4.91	5.55	6.24	8.12
35	2.75	3.43	4.02	4.84	5.46	6.15	8.00
36	2.71	3.38	3.96	4.77	5.38	6.06	7.89
37	2.67	3.33	3.90	4.70	5.30	5.97	7.78
38	2.63	3.28	3.85	4.63	5.23	5.89	7.68
39	2.59	3.24	3.79	4.57	5.16	5.80	7.58
40	2.55	3.19	3.74	4.50	5.09	5.73	7.48
41	2.52	3.14	3.69	4.44	5.02	5.65	7.38
42	2.48	3.10	3.64	4.38	4.95	5.58	7.29
43	2.45	3.06	3.59	4.32	4.88	5.50	7.20
44	2.42	3.02	3.54	4.27	4.82	5.43	7.12
45	2.38	2.98	3.49	4.21	4.76	5.36	7.03
46	2.35	2.94	3.45	4.16	4.70	5.30	6.95
47	2.32	2.90	3.40	4.11	4.64	5.23	6.87
48	2.29	2.86	3.36	4.06	4.58	5.17	6.79
49	2.26	2.82	3.31	4.00	4.53	5.11	6.71
50	2.23	2.79	3.27	3.95	4.47	5.04	6.64
51	2.20	2.75	3.23	3.91	4.42	4.98	6.56
52	2.17	2.72	3.19	3.86	4.36	4.93	6.49
53	2.14	2.68	3.15	3.81	4.31	4.87	6.42
54	2.11	2.65	3.11	3.76	4.26	4.81	6.35
55	2.08	2.61	3.07	3.72	4.21	4.76	6.28
56	2.06	2.58	3.03	3.67	4.16	4.70	6.21
57	2.03	2.55	2.99	3.63	4.11	4.65	6.14
58	2.00	2.51	2.95	3.59	4.06	4.59	6.08
59	1.98	2.48	2.92	3.54	4.02	4.54	6.01
60	1.95	2.45	2.88	3.50	3.97	4.49	5.95
120	1.20	1.54	1.86	2.32	2.70	3.13	4.37
180	0.89	1.16	1.41	1.80	2.13	2.51	3.60
240	0.71	0.93	1.14	1.47	1.75	2.08	3.02
360	0.52	0.69	0.85	1.11	1.34	1.60	2.37
720	0.30	0.40	0.50	0.65	0.79	0.95	1.43
1440	0.17	0.23	0.29	0.37	0.45	0.55	0.83

4 Determination of Design Discharge

4.1 General Requirements

The selection of the appropriate method for calculating runoff depends upon the size of the drainage area, time of concentration, and detention mitigation. Flows are to be analyzed for both existing, proposed, and ultimate development conditions at all locations where runoff leaves a proposed project for the 2, 10, 25, 50, and 100- year frequencies. Design discharges are to be calculated by either Rational Method or Unit Hydrograph using Atlas 14 rainfall from Section 3.

4.2 The Rational Method

Rational Method equation is based on the following assumptions:

- Rainfall intensity is constant over the time it takes to drain the watershed (time of concentration)
- The runoff coefficient remains constant during the time of concentration
- The watershed area does not change
- The minimum time of concentration is not less than 10 minutes and does not exceed 3-hours

The Rational Method may be used to generate peak flows for drainage basins less than 150 acres that do not require detention or timing considerations. For drainage areas in excess of 150 acres, reclaiming floodplains, creating lakes or building other types of drainage-related facilities on major drainage courses where the use of the Rational Method does not provide reliable results, a unit hydrograph method shall be used. The discharge computed by the Rational Method is the peak discharge for a given frequency on the watershed in question, and is given by the following relationship (Equation 4-2):

Equation 4-1

$$Q = CIA$$

Where:
Q = peak design for a given frequency on the watershed at the desired design point (cfs)
C = dimensionless weighted runoff coefficient, representing ground cover conditions and/or land use within the watershed area. (See Table 4-1)
I = average rainfall intensity in inches per hour at a rainfall duration equal to the time of concentration, associated with the desired design frequency. (See Table 3-2) (in/hr)
A = the drainage area in acres contributing runoff to the desired design point (acres).

4.2.1 Runoff Coefficient

Suggested coefficients with respect to specific surface types are given in Table 4-1. “C” values for developed conditions should be based on composite values. The Engineering Division must approve assumptions for fully developed conditions where maximum allowable impervious cover is not defined by city ordinance. The runoff coefficients include an antecedent precipitation factor to reflect the additional runoff that results from saturated ground conditions with less frequent recurrence intervals.

Table 4-1: Runoff Coefficients

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS Runoff Coefficient (C)							
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition**							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	0.42	0.44	0.48	0.51	0.54	0.61
Pasture/Range							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Forest/Woodlands							
Flat, 0-7%	0.22	0.25	0.28	0.31	0.35	0.39	0.48
Average, 2-7%	0.31	0.34	0.36	0.40	0.43	0.47	0.56
Steep, over 7%	0.35	0.39	0.41	0.45	0.48	0.52	0.58
Composite "C" value for developed conditions (C_{DEV}) is : $C_{DEV} = IC_1 + (1-I)C_2$							
Where: I = Impervious cover, percent C_1 = "C" value for impervious cover C_2 = "C" value for pervious area (grass, lawns, parks, etc.)							
* Grass cover less than 50 percent of the area. ** Grass cover on 50 to 75 percent of the area. *** Grass cover larger than 75 percent of the area.							
Source: *City of Austin Drainage Criteria Manual* [2]							

The drainage area under investigation may consist of several different drainage surfaces or zoning classifications. In such cases, an average coefficient weighted in accordance with the respective areas shall be used, as outlined in Equation 4-2.

Equation 4-2

$$C_w = \left(\frac{A_1C_1 + A_2C_2 + \cdots A_nC_n}{A_1 + A_2 + A_3 + \cdots A_n}\right)$$

4.2.2 Time of Concentration

The time of concentration (T_c) is the amount of time required for surface runoff to travel from the most hydraulically remote point within the drainage basin to the drainage point under consideration. The most hydraulically remote drainage point refers to the route requiring the longest drainage travel time and not necessarily the greatest linear distance. Furthermore, the most hydraulically remote point must be taken from a location that best represents the majority of the contributing area.

The Natural Resources Conservation Service (NRCS) method in *Technical Release 55: Urban Hydrology for Small Watersheds (TR-55)* [3] is the preferred method for estimating time of concentration, unless the design engineer can justify why an alternative method is more suitable for the watershed under analysis. Other methodologies can be used but must be approved by the Engineering Division.

The procedure for estimating time of concentration, as described in TR-55, is outlined below. The overall time of concentration is calculated as the sum of the sheet, shallow concentrated and channel flow travel times as shown in Equation 4-3. Note that there may be multiple shallow concentrated and channel segments depending on the nature of the flow path.

Equation 4-3

$$T_C = T_{t(sheet)} + T_{t(shallow\ concentration)} + T_{t(channel)}$$

Sheet Flow

Sheet flow is shallow flow over land surfaces, which usually occurs in the headwaters of streams. The engineer should realize that sheet flow occurs for only very short distances, especially in urbanized conditions. Sheet flow for both natural (undeveloped) and developed conditions should be limited to a maximum of 100 feet. Sheet flow for developed conditions should be based on the actual pavement or grass conditions for areas that are already developed and should be representative of the anticipated land use within the headwater area in the case of currently undeveloped areas. In a typical residential subdivision, sheet flow may be the distance from one end of the lot to the other or from the house to the edge of the lot. In some heavily urbanized drainage areas, sheet flow may not exist in the headwater area. The NRCS method employs Equation 4-4, which is a modified form kinematic wave equation, for the calculation of the sheet flow travel time.

Equation 4-4

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2^{0.5})(s^{0.4})} \times 60$$

Where:
T_t = Sheet flow travel time (min)
L = Length of the reach (ft)
n = Manning's n (see Table 4-2)
P_2 = 2-year, 24-hour rainfall (in) (see Table 3-1)
s = Slope of the ground (ft/ft).

Table 4-2: Manning's "n" for overland flow

Manning's "n"[1]	Surface Description
0.015	Concrete (rough or smoothed finish)
0.016	Asphalt
0.05	Fallow (no residue)
	Cultivated Soils:
0.06	Residue Cover ≤ 20%
0.17	Residue cover > 20%
	Grass:
0.15	Short-grass prairie
0.24	Dense grasses[2]
0.41	Bermuda Grass
0.13	Range (natural)
	Woods[3]:
0.04	Light underbrush
0.8	Dense underbrush
[1] The Manning's n values are a composite of information compiled by Engman (1986).	
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.	
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.	
Source: *City of Austin Drainage Criteria Manual* [2] and *TR-55* [3]	

Shallow Concentrated Flow

After a maximum of approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. The travel time for shallow concentrated flows can be computed by Equation 4-5 and Equation 4-6. These two equations are based on the solution of Manning's Equation with different assumptions for n (Manning's Roughness Coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

Equation 4-5 : Unpaved

$$T_t = \frac{L}{(60)(16.1345)(s^{0.5})}$$

Equation 4-6: Paved

$$T_t = \frac{L}{(60)(20.3282)(s^{0.5})}$$

Where:
T_t = Travel time for shallow concentrated flows (min)
L = Length of the reach (ft)
s = Slope of the ground (ft/ft).

4.2.3 Channel or Storm Drain Flow

The velocity in an open channel or a storm drain not flowing full can be determined by using Manning's Equation. Channel velocities can also be determined by using backwater profiles. For open channel flow, average flow velocity is usually determined by assuming a bank-full condition. Note that the channel flow component of the time of concentration may need to be divided into multiple segments in order to represent significant changes in channel characteristics. The details of using Manning's Equation and selecting Manning's "n" values for channels can be obtained from **Section 8**.

For the storm drain flow under pressure conditions (hydraulic grade line is higher than the lowest crown of a storm drain) the following equation should be applied:

Equation 4-7

$$V = \frac{Q}{A}$$

Where:
V = Average velocity (ft/s)
Q = Design discharge (cfs)
A = Cross-sectional area (ft^2).

Total travel time through a channel and/or storm drain can be calculated by Equation 4-8.

Equation 4-8

$$T_t = \sum \left(\frac{L_i}{60 V_i} \right)$$

Where:
L_i = The i-th channel segment length (ft)
V_i = The average flow velocity within the i-th channel segment (ft/s)
T_t = Total flow travel time through the channel (min).

4.3 SCS/NRCS Unit Hydrograph

The preferred unit hydrograph in general is the Soil Conservation Service (SCS)/Natural Resource Conservation Service (NRCS) Dimensionless Unit Hydrograph. The runoff curve number(s) used in calculating the pre-development/existing condition, the post-development condition, and the ultimate development condition shall be documented. Post-development conditions, condition of the given site and drainage area after the anticipated development has taken place, shall be based on the project. A fully developed watershed and the proposed project shall be assumed for the ultimate development condition based on future zoning projections. NRCS curve numbers are to be selected from Table 4-3. Curve numbers in Table 4-4 shall be used when performing an analysis of fully developed conditions. Average antecedent moisture conditions II (AMC II) shall be assumed.

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair Good	45 36 30	66 60 55	77 73 70	83 79 77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95
Source: *TR-55* [3]				

Curve numbers can be reduced by either using a climatic adjustment as described in the *Texas Department of Transportation (TxDOT) Hydraulic Design Manual (HDM)* [4] or calibrating to historical storms. If curve numbers are calibrated from historical storms, the Engineer must provide documented data for rainfall, stream flow data, or detention pond stage storage data used to determine the historical curve numbers.

Time of concentration shall be computed using the same techniques as for the Rational Method. The lag time, defined as the time between the center of mass of excess rainfall to the runoff peak, is typically used in the Hydrologic Modeling System (HEC-HMS) implementation of the SCS methodology. The lag time can be estimated with Equation 4-9.

Equation 4-9

$$T_{lag} = 0.6T_c$$

The SCS/NRCS Unit Hydrograph shall be analyzed using 24-hour rainfall depths provided in Table 3-2. The 24-hour rainfall depths are to be distributed temporally with the NRCS Type III rainfall distribution.

4.4 Hydrologic Computer Programs

The preferred hydrologic model for the City is HEC-HMS. The use of other computer modeling software is discussed in **Section 1.3**. When using any model, use the procedures outlined in the respective user's manual. Data generated with the model and the results of the program shall be summarized on the drainage plans.

5 Street Flow

5.1 General Requirements

A. All roadways and/or paved alleys must contain the 100-year flow within the right-of-way. Runoff shall not enter private property from a street except in recorded drainage easements or rights-of-way, or in historic watercourses where easements or rights-of-way have not yet been obtained.

B. 100-year design storm depth of water shall not exceed 10 inches at any point within the street right-of-way and the product of maximum depth (feet) times average cross-section velocity (feet per second) at any point shall not exceed 6.0.

C. Rundowns, roadway slope, shall be designed to convey and contain drainage carried by the roadway to ensure the 100-year event is contained within the right-of-way. If a storm drain system is present, rundowns shall be designed for the difference between the storm drain capacity and the 100-year runoff, with a 25-year minimum design assuming all of the flow bypasses the storm drain system.

D. Driveways should be constructed to allow the 25-year design storm runoff to pass under the driveway in a culvert (18 inches minimum or equivalent) or over the driveway on a concrete apron. Concrete aprons or box culverts are preferred in areas of heavy sediment transport.

E. The side slope of a ditch or swale on the side adjacent to City roads shall be no steeper than 4:1. Roadways under TxDOT jurisdiction shall be designed in accordance with TxDOT requirements (6:1).

F. Water Spread Limits for Roadways is as indicated in Table 5-1. No lowering of the standard height of street crown shall be allowed for the purposes of obtaining additional hydraulic capacity. Where additional hydraulic capacity is required, the proposed street gradient must be increased or curb inlets and storm sewers installed to remove a portion of the flow.

Table 5-1: Water Spread Limits for Roadways

Street Classification	10-Yr Permissible Water Spread
Arterial Streets and Parkways	One 11-foot traffic lane must remain open in each direction.
Collector Streets	Clear width of 11 feet must remain open.
< Collector Streets	Water flow must not exceed the top of either curb.

5.2 Positive Overflow

The approved drainage system shall provide for positive overflow at all low points. The term “positive overflow” means that, when the inlets do not function properly or when the design capacity of the conduit or roadway ditch is exceeded, the excess flow can be conveyed overland along an open course. Normally, this would mean along a street or alley, but it can be constructed on private property within the dedication of a drainage easement.

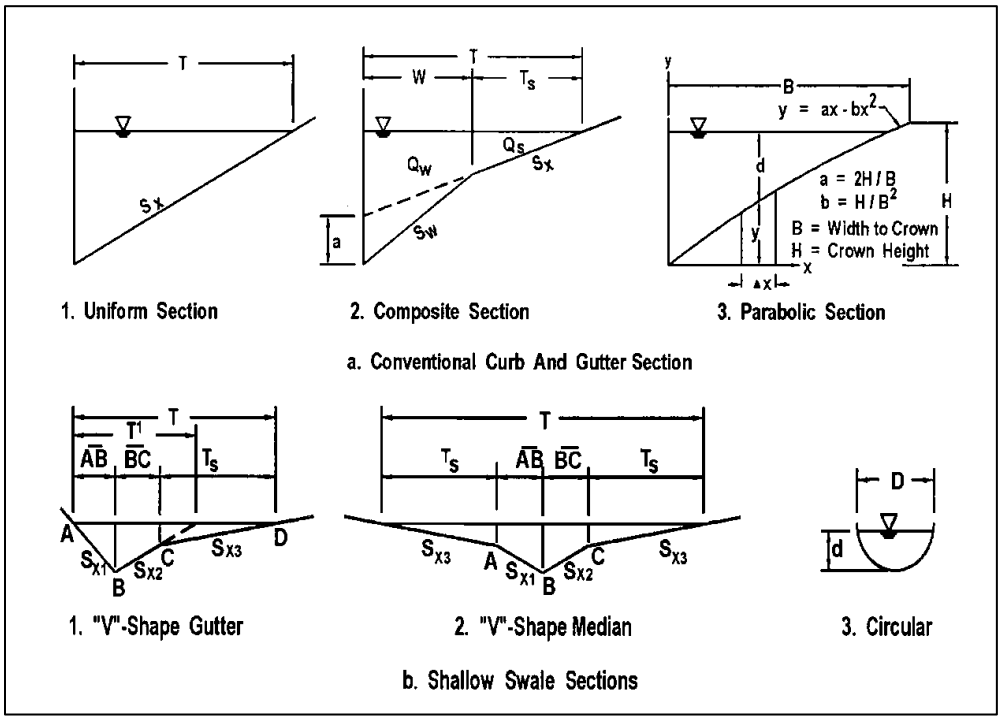
5.3 Street Flow Calculations

Evaluation of street flow is based upon open channel hydraulics theory, with the Manning’s Equation modified to allow direct solution, based on the street cross section. Refer to *Hydraulic Engineering*

Circular 22: Urban Drainage Design Manual (HEC 22) [5]. All proposed projects must meet the ponding criteria defined in this manual.

The following information was summarized from *HEC 22* for street flow calculations. The distance of the spread, T, is measured perpendicular to the curb face to the extent of the water on the roadway and is shown in Figure 5-1.

Figure 5-1: Typical Gutter Sections



Source: *HEC 22* [5]

Capacity Relationship

Gutter flow calculations are necessary to establish the spread of water on the shoulder, parking lane, or pavement section. A modification of the Manning's Equation can be used for computing flow in triangular channels. The modification is necessary because the hydraulic radius in the equation does not adequately describe the gutter cross section, particularly where the top width of the water surface may be more than 40 times the depth at the curb. To compute gutter flow, the Manning's Equation is integrated for an increment of width across the section [6]. The resulting equation is:

Equation 5-1

$$Q = \left(\frac{K_u}{n}\right) {S_x}^{1.67} {S_L}^{0.5} T^{2.67}$$

Or in terms of *T*:

Equation 5-2

$$T = \left[\frac{Qn}{K_u S_x^{1.67} S_L^{0.5}}\right] T^{0.375}$$

Where:

K_u = 0.56 in English units
n = Manning's coefficient (Table 5-2)
Q = Flow rate (cfs)
T = Width of flow (spread) (ft)
S_x = Cross slope (ft/ft)
S_L = Longitudinal slope (ft/ft).

Equation 5-1 neglects the resistance of the curb face since this resistance is negligible.

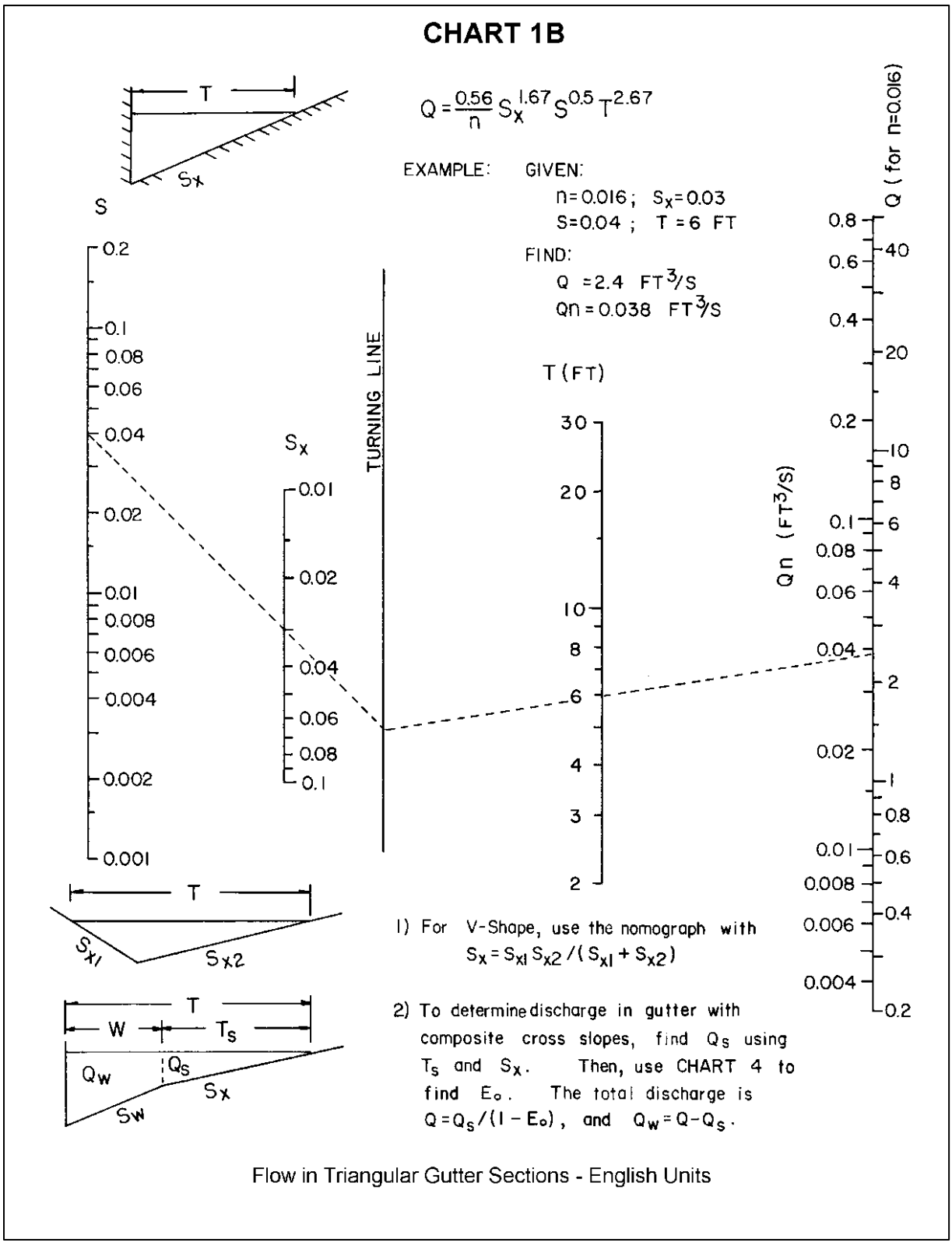
Spread on the pavement and flow depth at the curb are often used as criteria for spacing pavement drainage inlets. Figure 5-2 is a nomograph for solving Equation 5-1 and should be used as reference only, Figure 5-2 is not intended to replace equation 5-1. The chart can be used for either criterion with the relationship:

Equation 5-3

$$d = TS_x$$

Where:
d = Depth of flow (ft)
T = Width of flow (ft)
S_x = Cross slope (ft/ft).

Figure 5-2: Chart 1B – Flow in Triangular Gutter Sections



Source: *HEC 22* [5]

Table 5-2: Manning's n for Street and Pavement Gutters

Type of Gutter or Pavement	Manning's n
Concrete gutter, troweled finish	0.012
Asphalt Pavement: Smooth texture Rough texture	 0.013 0.016
Concrete gutter-asphalt pavement: Smooth Rough	 0.013 0.015
Concrete pavement: Float finish Broom finish	 0.014 0.016
For gutters with small slope, where sediment may accumulate, increase above values of "n" by…….	0.002
Source: *Design Charts for Open-Channel Flow (HDS 3)* [7]	

5.3.1 Shallow Swale Sections

Where curbs are not needed for traffic control, a small swale section of circular or V-shape may be used to convey runoff from the pavement. As an example, the control of pavement runoff on fills may be needed to protect the embankment from erosion. Small swale sections may have sufficient capacity to convey the flow to a location suitable for interception.

In lieu of using an irregular open channel cross-section to compute flow in small swale, Figure 5-2 can be used to compute the flow in a shallow V-shaped section. When using Chart 1B for V-shaped channels, the cross slope, S_x is determined by the following equation:

Equation 5-4

$$S_x = \frac{(S_{x1}S_{x2})}{(S_{x1} + S_{x2})}$$

5.4 Alley Flow Limitations

Alley capacities shall be checked at all alley turns and “T” intersections to determine if curbing is needed or grades should be flattened. Curbing shall be required for at least 10 feet on either side of an inlet in an alley and on the other side of the alley so that the top of the inlet is even with the high edge of the alley pavement. Alleys adjacent to drainage channel shall be required to have curbs for the full length of the channel.

5.5 Alley Flow Calculations

Flow in alleys is also based upon open channel hydraulic theory, with the Manning equation modified to allow direct solution, with regard to the alley cross section.

This page intentionally left blank.

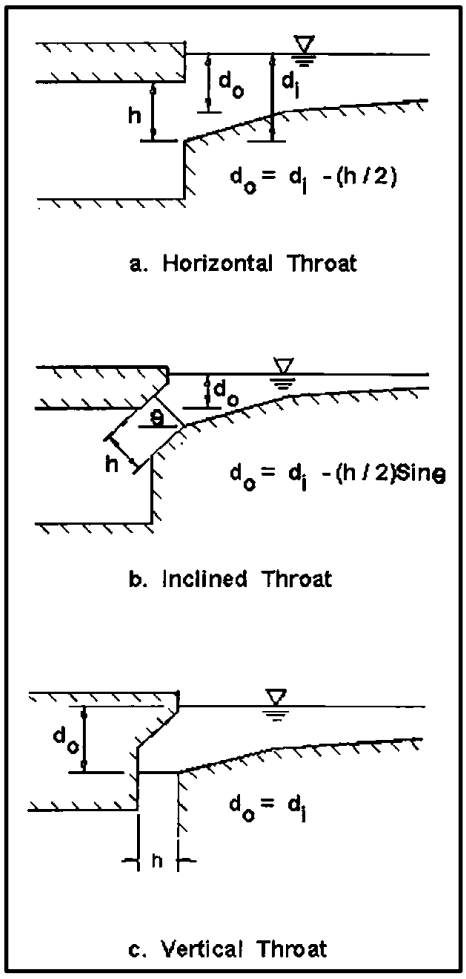
6 Inlet Design

6.1 General Requirements

Inlets shall be located as necessary to remove the flow based on the 25-year storm and accommodate ponding widths in streets as defined in Table 5-1. The hydraulic efficiency of storm drain inlets varies with the amount of gutter flow, street grade, street crown and the geometry of the inlet opening. The following are design considerations, which must be given attention during inlet design:

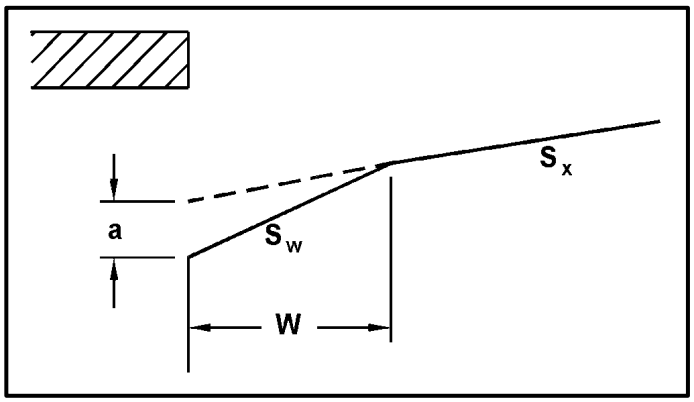
1. Inlets must be located where the allowable street flow capacities are exceeded, at low points (sumps or sags) and upstream of transition between normal and super-elevated street sections. Inlets should be located to intercept stormwater prior to traversing intersections.
2. In super-elevated sections of divided arterial streets, inlets placed against the center medians shall have no gutter depression. Interior gutter flow (flow along the median) shall be intercepted at the point of super-elevation transition, to prevent pavement cross flow.
3. At bridges with curbed approaches, gutter flow shall be intercepted prior to flowing onto the bridge, to prevent ice from developing during cold weather.
4. The maximum approved inlet throat opening is seven inches. Openings larger than seven inches require approval by the Engineering Division and, if approved, must contain a bar or other form of restraint. For curb opening inlets the throat opening is shown as “h” in Figure 6-1.
5. The design and location of all inlets must take into consideration pedestrian and bicycle traffic. Combination curb inlets (with opening in curb and grate opening in gutter) may be used only where space behind the curb prohibits the use of other inlet types.
6. Where recessed inlets are required, they shall not decrease the width of the sidewalk or interfere with utilities. Recessed inlets must also be depressed. The depression is measured from the theoretical gutter flow line, shown as “a” in Figure 6-2, and shall be one inch minimum.
7. Non-recessed, depressed inlets shall have a maximum allowable inlet depression of five inches.
8. The use of slotted drains is not allowed except in instances where there is no alternative, in which case approval must be obtained from the City Engineer. If slotted drains are used, the inlet capacity shall be the lesser of the calculated capacity from this manual or the manufacturer’s design guidelines and cleanouts shall be provided.

Figure 6-1: Curb Opening Inlet Examples



Source: *HEC 22* [5]

Figure 6-2: Depressed Curb Opening Inlet



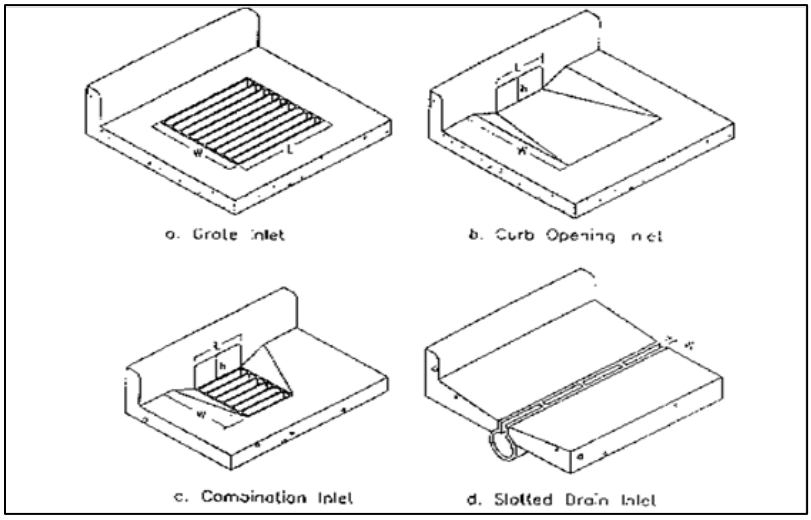
Source: *HEC 22* [5]

6.2 Inlet Types and Descriptions

Stormwater inlets are used to remove surface runoff and convey it to a storm drainage system. For the purposes of this manual, inlets are divided into four classes listed below and shown in Figure 6-3.

1. Grate Inlets
2. Curb Opening Inlets
3. Combination Inlet
4. Slotted Drain Inlets

Figure 6-3: Inlet Types



Source: *TxDOT HDM* [4]

6.2.1 Grate Inlets

Although grate inlets may be designed to operate satisfactorily in a range of conditions, they may become clogged by floating debris during storm events. In addition, they can produce a hazard to wheel chair and bicycle traffic and must be designed to be safe for both. For these reasons, they may be used only at locations where space restriction prohibit the use of other types of inlets and shall be designed to be twice as large as the theoretical required area to compensate for clogging.

6.2.2 Curb Opening Inlets

Curb opening inlets are the most effective type of inlet on slopes flatter than 3%, in sag locations, and with flows which typically carry large amounts of debris. Similar to grate inlets, curb opening inlets also tend to lose capacity as street grades increase, but to a lesser degree than grate inlets.

6.2.3 Combination Inlets

A combination inlet consists of both the grate inlet and the curb opening inlet. This configuration provides many of the advantages of both inlet types. The combination inlet also reduces the chance of clogging by debris with flow into the curb portion of the inlet. If a curb opening is extended on the upstream side of the combination inlet it will act as a “Sweeper”, and remove debris before it reaches the grate portion of the inlet.

6.2.4 Slotted Drain Inlets

Although slotted drain inlets can be used to intercept sheet flow, or flow in wide sections, they are not recommended for use in the City of New Braunfels since they are very susceptible to clogging from debris. Slot inlets may only be used with the permission of the City Engineer.

6.3 Inlet Capacity Calculations

The inlet capacity calculations provided below are summarized from *TxDOT HDM*. For additional information refer to the source document.

6.3.1 Combination Inlets

For a combination curb opening and grate inlet, assume that the capacity of the combination inlet comprises the sum of the capacity of the grate and the upstream curb opening length. Ignore the capacity of the curb opening that is combined with the grate opening. Refer to *HEC 22* for additional procedures and examples for computing the interception capacity of combination inlets.

6.3.2 Curb Opening Inlets On-Grade

The design of on-grade curb opening inlets involves determination of length required for total flow interception, subjective decision about actual length to be provided, and determination of any resulting carryover rate. For each on-grade inlet, determine early whether or not carryover is to be a valid design consideration. In some cases due to a logical location of the inlet, no carryover may be allowed. In other cases, while carryover is acceptable, there may not be a convenient location to accommodate the bypass flow. Use the following procedure to design curb inlets on-grade:

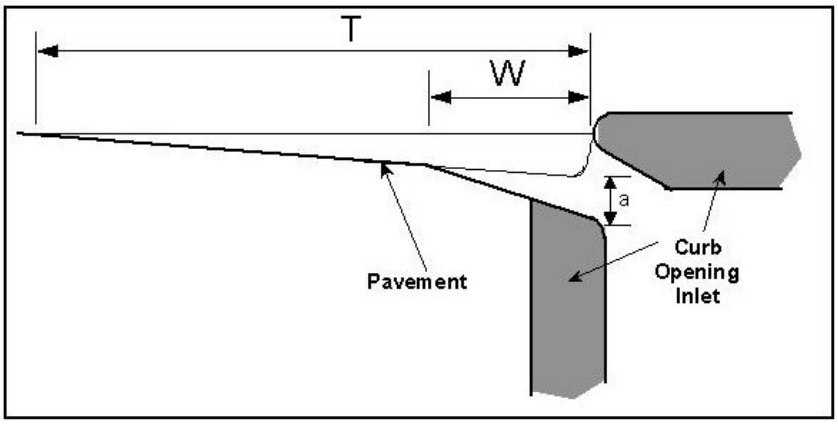
1. Compute depth of flow and ponded width (T) in the gutter section at the inlet.
2. Determine the ratio of the width of flow in the depressed section (W) to the width of total gutter flow (T) using Equation 6-1. Figure 6-4 shows the gutter cross section at an inlet.

Equation 6-1

$$E_0 = \frac{K_w}{K_w + K_0}$$

Where:
E_0 = ratio of depression flow to total flow
K_w = conveyance of the depressed gutter section (cfs)
K_0 = conveyance of the gutter section beyond the depression (cfs).

Figure 6-4: Gutter Cross-Section Diagram



Source: *TxDOT HDM* [4]

3. Use Equation 6-2 to calculate conveyance, K_w and K_0.

Equation 6-2

$$K = \frac{zA^{5/3}}{nP^{2/3}}$$

Where:
K = conveyance of cross section (cfs)
z = 1.486 for English measurements
A = area of cross section (ft^2)
n = Manning's roughness coefficient
P = wetted perimeter (ft).

4. Use Equation 6-3 to calculate the area of cross section in the depressed gutter section.

Equation 6-3

$$A_w = WS_x\left(T - \frac{W}{2}\right) + \frac{1}{2}aW$$

Where:
A_W = area of depressed gutter section (ft^2)
W = depression width for an on-grade curb inlet (ft)
S_X = cross slope (ft/ft)
T = calculated ponded width (ft)
a = curb opening depression depth (ft).

5. Use Equation 6-4 to calculate the wetted perimeter in the depressed gutter section.

Equation 6-4

$$P_W = \sqrt{[(WS_x + a)^2 + W^2]}$$

Where:
P_W = wetted perimeter of depressed gutter section (ft)
W = depression width for an on-grade curb inlet (ft)
S_X = cross slope (ft/ft)
a = curb opening depression depth (ft).

6. Use
7. Equation 6-5 to calculate the area of cross section of the gutter section beyond the depression.

Equation 6-5

$$A_0 = \frac{S_x}{2}(T - W)^2$$

Where:
A_0 = area of gutter/road section beyond the depression width (ft^2)
S_x = cross slope (ft/ft)
W = depression width for an on-grade curb inlet (ft)
T = calculated ponded width (ft).

8. Use Equation 6-6 to calculate the wetted perimeter of the gutter section beyond depression.

Equation 6-6

$$P_0 = T - W$$

Where:
P_0 =wetted perimeter of the depressed gutter section (ft)
T = calculated ponded width (ft)
W = depression width for an on-grade curb inlet (ft).

9. Use Equation 6-7 to determine the equivalent cross slope (S_e) for a depressed curb opening inlet.

Equation 6-7

$$S_e = S_x + \frac{a}{W} E_0$$

Where:
S_e = equivalent cross slope (ft/ft)
S_x = cross slope of the road (ft/ft)
a = gutter depression depth (ft)
W = gutter depression width (ft)
E_0 = ratio of depression flow to total flow.

10. Use Equation 6-8 to calculate the length of curb inlet required for total interception.

Equation 6-8

$$L_r = zQ^{0.42}S^{0.3}\left(\frac{1}{nS_e}\right)^{0.6}$$

Where:
L_r = length of curb inlet required (ft)
z = 0.6 for English measurement
Q = flow rate in gutter (cfs)
S = longitudinal slope (ft/ft)
n = Manning's roughness coefficient
S_e = equivalent cross slope (ft/ft).

If no carryover is allowed, the inlet length is assigned a nominal dimension of at least L_r. Use a nominal length available in standards for curb opening inlets. Do not use the exact value of L_r if doing so requires special details, special drawings and structural design, and costly and unfamiliar construction. If carryover is considered, round the curb opening inlet length down to the next available (nominal) standard curb opening length and compute the carryover flow.

6.3.2.1 Determine Carryover Flow

In carryover computations, efficiency of flow interception varies with the ratio of actual length of curb opening inlet supplied (L_a) to length L_r and with the depression to depth of flow ratio. Use Equation 6-9 for determining carryover flow.

Equation 6-9

$$Q_{co} = Q\left(1 - \frac{L_a}{L_r}\right)^{1.8}$$

Where:
Q_{co}= carryover discharge (cfs)
Q = total discharge (cfs)
La = design length of the curb opening inlet (ft)
L_r = length of curb opening inlet required to intercept the total flow (ft).

Carryover rates usually should not exceed about 0.5 cfs or about 30% of the original discharge. Greater rates can be troublesome and cause a significant departure from the principles of the Rational Method application. In all cases, you must accommodate any carryover rate at some other specified point in the storm drain system.

6.3.2.2 Calculate Intercepted Flow

Calculate the intercepted flow as the original discharge in the approach curb and gutter minus the amount of carryover flow.

6.3.3 Curb Inlets in Sag Configuration

The capacity of a curb inlet in a sag depends on the water depth at the curb opening and the height of the curb opening. The inlet operates as a weir to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage and the capacity should be based on the lesser of the computed weir and orifice capacity. Generally, this ratio should be less than 1.4 such that the inlet operates as a weir.

If the depth of flow in the gutter (d) is less than or equal to 1.4 times the inlet opening height (h), (d≤1.4H), determine the length of inlet required considering weir control. Otherwise, skip this step. Calculate the capacity of the inlet when operating under weir conditions with Equation 6-10.

Equation 6-10

$$L = \frac{Q}{C_w d^{1.5}} - 1.8W$$

Where:
Q = total flow reaching inlet (cfs)
C_w= weir coefficient ($ft^{\frac{0.5}{s}}$)

Suggested value = 2.3 $ft.^{\frac{0.5}{s}}$ for depressed inlets.

Suggested value = 3.0 $ft.^{\frac{0.5}{s}}$ without depression.

d = head at inlet opening (ft), computed with Equation 10-1.
L = length of curb inlet opening (ft)
W = gutter depression width (perpendicular to curb)

If L > 12 ft, then W = 0 and C_w = 3.0 $ft.^{\frac{0.5}{s}}$

If the depth of flow in the gutter is greater than the inlet opening height (d > h), determine the length of inlet required considering orifice control. The equation for interception capacity of a curb opening operating as an orifice follows:

Equation 6-11

$$Q = C_o h L \sqrt{2 g d_o}$$

Where:
Q = total flow reaching inlet (cfs)
*C*o = orifice coefficient = 0.67 *h* = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
d_o = effective head at the centroid of the orifice (ft).

For curb inlets with an inclined throat such as Type C inlet, the effective head, d_0, is at the centroid of the orifice.

This changes Equation 6-11 to:

Equation 6-12

$$Q = C_o h L \sqrt{2 g (y + a - \frac{h}{2} sin\theta)}$$

Where:
Q = total flow reaching inlet (cfs)
C_o = orifice coefficient = 0.67
h = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = Length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
y = depth of water in the curb and gutter cross section (ft)
a = gutter depression depth (ft).

Rearranging Equation 6-12 allows a direct solution for required length.

Equation 6-13

$$L = \frac{Q}{C_o h \sqrt{2 g (y + a - \frac{h}{2} \sin\theta)}}$$

If both steps 1 and 2 were performed (i.e., h < d < 1.4h), choose the larger of the two computed lengths as being the required length. Select a standard inlet length that is greater than the required length.

6.3.4 Slotted Drain Inlet Design

Use the following procedure for on-grade slotted drain inlets:

1. Determine the length of slotted drain inlet required for interception of all of the water in the curb and gutter calculated by Equation 6-14.

Equation 6-14

$$L_r = \frac{zQ_a^{0.442}S^E S_x^{-0.849}}{n^{0.384}}$$

Where:
*L*r = length of slotted drain inlet required for total interception of flow (ft)
z = 0.706 for English measurement
Q_a = total discharge (cfs)
S = gutter longitudinal slope (ft/ft)
E = function of S and S_X as determined by Equation
S_X = transverse slope (ft/ft)
n = Manning's roughness coefficient.

Equation 6-14 is limited to the following ranges of variables: total discharge ≤ 5.5 cfs longitudinal gutter slope ≤ 0.09 ft/ft roughness coefficient (n) in the curb and gutter: 0.011 ≤ n ≤ 0.017.

Equation 6-15

$$E = 0.207 - 19.084S^2 + 2.613S - 0.0001S_x^{-2} + 0.007S_x^{-1} - 0.049SS_x^{-1}$$

The longitudinal slope exponent (E) is determined with Equation 6-14: Because the equations are empirical, extrapolation is not recommended.

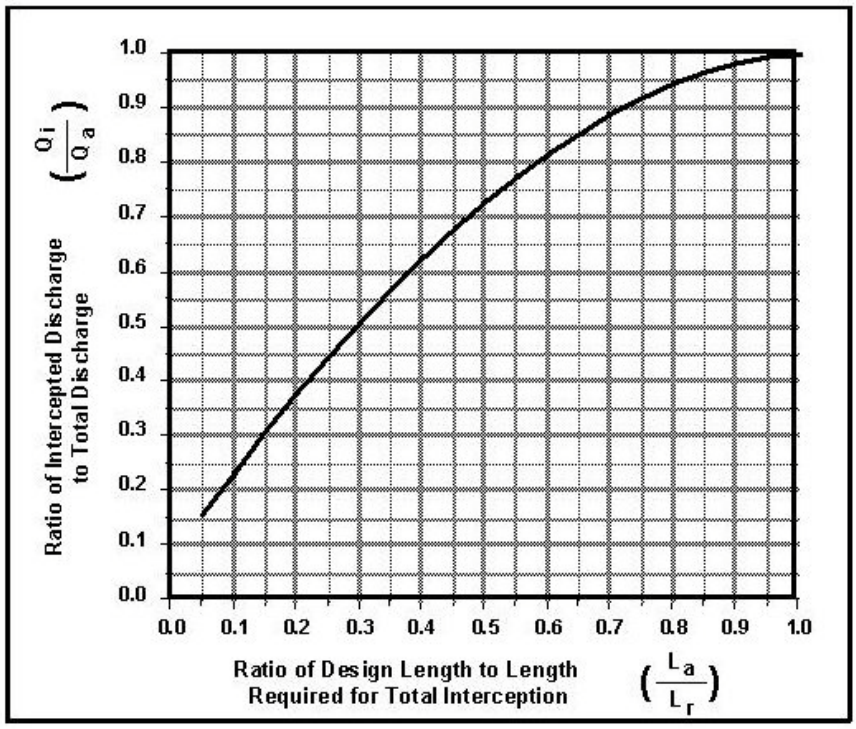
2. Select the desired design slotted drain length (L_a) based on standard inlet sizes. If $L_a < L_r$ the interception capacity may be estimated using Figure 6-5, multiplying the resulting discharge ratios by the total discharge. Alternatively, the carryover for a slotted drain inlet length may be directly computed using Equation 6-16.

Equation 6-16

$$Q_{co} = 0.918\,Q\left(1 - \frac{L_a}{L_r}\right)^{1.769}$$

Where:
Q_{co} = carryover discharge (cfs)
Q = total discharge (cfs)
L_a = design length of slotted drain inlet (ft)
L_r = length of slotted drain inlet required to intercept the total flow (ft).

Figure 6-5: Slotted Drain Inlet Interception Rate



Source: *TxDOT HDM* [4]

As a rule of thumb, you can optimize slotted drain inlets' economy by providing actual lengths (L_a) to required lengths (L_r) in an approximate ratio of about 0.65. This implies a usual design with carryover for on-grade slotted drain inlets.

6.3.5 Grate Inlets On-Grade

The capacity of a grate inlet on-grade depends on its geometry and cross slope, longitudinal slope, total gutter flow, depth of flow, and pavement roughness. The depth of water next to the curb is the major factor affecting the interception capacity of grate inlets. At low velocities, all of the water flowing in the section of gutter occupied by the grate, called frontal flow, is intercepted by grate inlets, and a small portion of the flow along the length of the grate, termed side flow, is intercepted. On steep slopes, only a portion of the frontal flow will be intercepted if the velocity is high or the grate is short and splash-over occurs. For grates less than 2 feet long, intercepted flow is small. Agencies and manufacturers of grates have investigated inlet interception capacity. For inlet efficiency data for various sizes and shapes of grates, refer to *Hydraulic Engineering Circular 12: Drainage of Highway Pavements (HEC 12)* [8].

Grate inlets shall be designed to be twice as large as the theoretical required area.

6.3.5.1 Bicycle Safety

A parallel bar grate is the most efficient type of gutter inlet; however, when crossbars are added for bicycle safety, the efficiency is reduced. Where bicycle traffic is a design consideration, the curved vane grate and the tilt bar grate are recommended for both their hydraulic capacity and bicycle safety

features. In certain locations where leaves may create constant maintenance problems, the parallel bar grate may be used more efficiently if bicycle traffic is prohibited.

6.3.5.2 Design Procedure

Use the following procedure for grate inlets on-grade:

1. Compute the ponded width of flow (T).
2. Choose a grate type and size.
3. Find the ratio of frontal flow to total gutter flow (E_o) for a straight cross-slope using Equation 6-1. No depression is applied to a grate on-grade inlet.
4. Find the ratio of frontal flow intercepted to total frontal flow, R_f, using Equation 6-17, Equation 6-18, and Equation 6-19.

Equation 6-17

$$R_f = 1 - 0.3(v - v_o) \ , if \ v > v_o$$

Equation 6-18

$$R_f = 1.0 \ , if \ v > v_o$$

Where:

R_f = ratio of frontal flow intercepted to total frontal
v = approach velocity of flow in gutter (ft/s)
v_o = minimum velocity that will cause splash over grate (ft/s).

For triangular sections, calculate the approach velocity of flow in gutter (v) using Equation 6-19.

Equation 6-19

$$v = \frac{2Q}{Ty} = \frac{2Q}{T^2 S_x}$$

Otherwise, compute the section area of flow (A) and calculate the velocity using Equation 6-20.

Equation 6-20

$$v = \frac{Q}{A}$$

Calculate the minimum velocity (v_o) that will cause splash over the grate using the appropriate equation in Table 6-1.

Where:
v_o = splash-over velocity (ft/s)
L = length of grate (ft).

Table 6-1: Splash-Over Velocity Calculation Equations

Grate Configuration	Typical Bar Spacing (in.)	Splash-over Velocity Equation
Parallel Bars	2	$v_o = 2.218 + 4.031L - 0.649L^2 + 0.056L^3$
Parallel Bars	1.2	$v_o = 1.762 + 3.117L - 0.451L^2 + 0.033L^3$
Transverse Curved Vane	4.5	$v_o = 1.381 + 2.78L - 0.300L^2 + 0.020L^3$
Transverse 45° Tilted Vane	4	$v_o = 0.988 + 2.625L - 0.359L^2 + 0.029L^3$
Parallel bars w/ transverse rods	2 parallel / 4 trans	$v_o = 0.735 + 2.437L - 0.265L^2 + 0.018L^3$
Transverse 30° Tilted Vane	4	$v_o = 0.505 + 2.344L - 0.200L^2 + 0.014L^3$
Reticuline	n/a	$v_o = 0.030 + 2.278L - 0.179L^2 + 0.010L^3$

Source: *TxDOT HDM* [4]

5. Find the ratio of side flow intercepted to total side flow, R_s.

Equation 6-21

$$R_s = \left[1 + \frac{zv^{1.8}}{S_x L^{2.3}}\right]^{-1}$$

Where:
R_S = ratio of side flow intercepted to total flow
z = 0.15 for English measurement
S_x = transverse slope
v = approach velocity of flow in gutter (ft/s)
L = length of grate (ft).

6. Determine the efficiency of grate, E_f. Use Equation 6-22.

Equation 6-22

$$E_f = \left[R_f E_o + R_s(1 - E_o)\right]$$

7. Calculate the interception capacity of the grate, Q_i. Use Equation 6-23. If the interception capacity is greater than the design discharge, skip step 8.

Equation 6-23

$$Q_i = E_f Q = Q[R_f E_o + R_s(1 - E_o)]$$

8. Determine the carryover, CO. Use Equation 6-24.

Equation 6-24

$$CO = Q - Q_i$$

9. Depending on the carryover, select a larger or smaller inlet as needed. If the carryover is excessive, select a larger configuration of inlet and return to step 3. If the interception capacity far exceeds the design discharge, consider using a smaller inlet and return to step 3.

6.3.6 Design Procedure for Grate Inlets in Sag Configurations

A grate inlet in sag configuration operates in weir flow at low ponding depths. A transition to orifice flow begins as the ponded depth increases. Use the following procedure for calculating the inlet capacity:

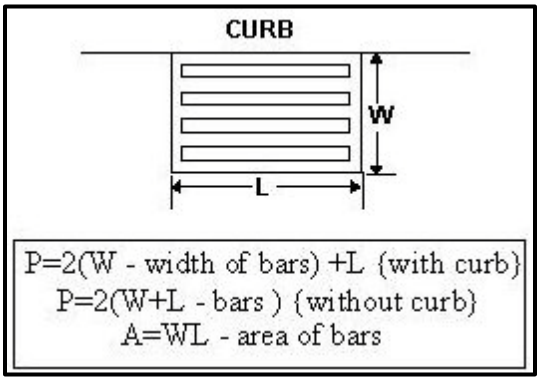
1. Choose a grate of standard dimensions to use as a basis for calculations.
2. Determine an allowable head (h) for the inlet location. This should be the lower of the curb height and the depth associated with the allowable ponded width. No gutter depression is applied at grate inlets.
3. Determine the capacity of a grate inlet operating as a weir. Under weir conditions, the grate perimeter controls the capacity. Figure 6-6 shows the perimeter length for a grate inlet located next to and away from a curb. The capacity of a grate inlet operating as a weir is determined using Equation 6-25.

Equation 6-25

$$Q_w = C_w P^{1.5}$$

Where:
Q_w = weir capacity of grate (cfs)
C_w = weir coefficient = 3 for English measurement
P = perimeter of the grate (ft) as shown in Figure 6-6: A multiplier of 0.5 is required to be applied to the measured perimeter as a safety factor.
h = allowable head on grate (ft).

Figure 6-6: Perimeter Length for Grate Inlet in Sag Configuration



Source: *TxDOT HDM* [4]

4. Determine the capacity of a grate inlet operating under orifice flow. Under orifice conditions, the grate area controls the capacity. The capacity of a grate inlet operating under orifice flow is computed with Equation 6-26.

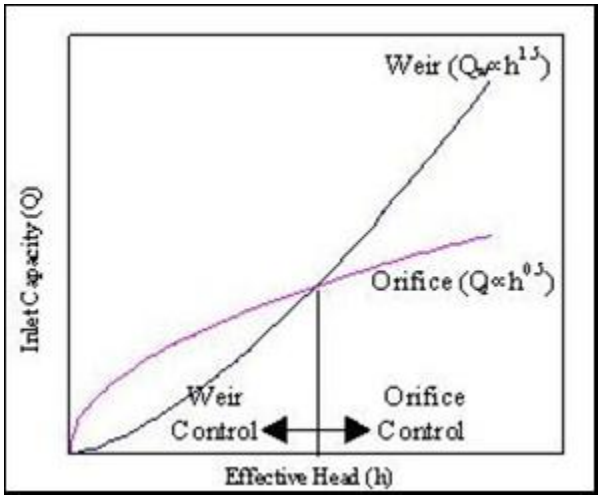
Equation 6-26

$$Q_o = C_o A \sqrt{2 g h}$$

Where:
Q_o = orifice capacity of grate (cfs)
C_o = orifice flow coefficient = 0.67
A = clear opening area (ft²) of the grate (the total area available for flow). A multiplier of 0.5 is required to be applied to the measured area as a safety factor
g = acceleration due to gravity = 32.2 ft/s²
h = allowable head on grate (ft).

5. Compare the calculated capacities from steps 3 and 4 and choose the lower value as the design capacity. The design capacity of a grated inlet in a sag is based on the minimum flow calculated from weir and orifice conditions. Figure 6-7 demonstrates the relationship between weir and orifice flow. If Q_o is greater than Q_w (to the left of the intersection in Figure 6-7), then the designer would use the capacity calculated with the weir equation. If, however, Q_o is less than Q_w (to the right of the intersection), then the capacity as determined with the orifice equation would be used.

Figure 6-7: Relationship between Head and Capacity for Weir and Orifice Flow



Source: *TxDOT HDM* [4]

This page intentionally left blank.

7 Storm Drain Systems

7.1 General Requirements

A. Storm drain systems shall be designed for the 25-year design storm with the design hydraulic grade line (HGL) of the system located, at minimum, below the gutter flow line and shall not cause surcharging. Storm drain energy grade lines (EGL) shall remain below top of curb elevation.

B. Storm drain pipe shall be reinforced concrete pipe (AASHTO M170 Class III). Corrugated metal pipe or plastic pipe shall not be permitted for storm drain systems in the public right-of-way.

C. Concrete pipe collars or manufactured transition pieces must be used at all pipe size changes on trunk lines. For all pipe junctions other than manholes and junction boxes, manufactured wye connections should be used, and the angle of intersection shall not be greater than 45 degrees. This includes discharges into box culverts and channels. Laterals shall be connected to trunk lines using manholes or manufactured wye connections. Inlet laterals will connect only one inlet to the trunk line. Vertical curves in the conduit will not be permitted, and horizontal curves must meet manufacturer's requirements for offsetting of the joints.

D. The maximum manhole and junction box spacing for storm drain systems are shown in Table 7-1. Manholes or junction boxes shall also be place at: pick up points having three or more laterals; trunk line size changes for pipes with diameter differences greater than 24 inches; vertical alignment changes; and, future collection points. The requirement for manholes may be waived if the pipe size allows direct access into the pipe by maintenance personnel and equipment.

E. The crown of circular pipe should be a minimum 6 inches below the design pavement section and should be based on the type of pipe used, the expected loads and the supporting strength of the pipe. Box sections should normally have a minimum of one foot of cover; however, box sections may be designed for direct traffic in special situations with approval.

F. Grates for drop inlets should be designed to facilitate removal for maintenance, but minimize vandalism. Design shall consider traffic loading, bicycle and pedestrian safety, and a means to secure grate.

G. The minimum lateral and trunk line pipe shall be 24 inches.

H. At no time shall bypass flow exceed the water spread limits for roadways as defined by Table 5-1. Inlets shall be located to prevent water convergence and/or excessive flows through intersections.

I. For arterial or collector streets with super-elevated sections, no more than 3 cubic feet per second of the 25-year flow will be allowed to cross flow from the higher elevation to the lower elevation.

J. All storm sewer conduits to be dedicated to the City of New Braunfels, and outside of the right-of-way, shall be located in drainage easements dedicated to the City of New Braunfels at the time of final platting of the property. Storm sewer easements shall be at least 15 feet wide. Wider easements may be required to accommodate larger storm drain systems.

Table 7-1: Maximum Spacing of Manholes and Junction Boxes

Pipe Diameter (in)	Max. Spacing (ft)
24	400
27-39	800
42-60	1,000
Larger than 60	1,200

7.2 Design Criteria

A. Storm drain systems shall be designed for the 25-year design storm and evaluated for the 100-year design storm. Systems shall be designed with Manning's Equation and step backwater methodology outlined in the *TxDOT HDM* and summarized in this section. The minimum coefficient of roughness for concrete storm drain pipe is 0.013.

B. The minimum velocity in a conduit shall be 2.5 feet per second for the 25-year design storm. This minimum velocity is required to minimize or prevent the accumulation of sediment in the system. Such sediment accumulation can severely reduce to ability of the system to convey the design flow.

C. Maximum velocities in conduits are important because of the possibility of excessive erosion of the storm drainpipe material. Table 7-2 lists the maximum velocities allowed. Maximum flow velocities at the downstream end of pipe systems shall be consistent with the maximum allowable velocities for the receiving channel (refer to **Section 8**). Erosion protection is required for outfalls into natural channels.

D. The maximum discharge velocities in the pipe shall not exceed the design velocity of the receiving channel or conduit at the outfall. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater.

E. When establishing the hydraulic gradient of a storm sewer, entrance and exit losses, expansion losses, manhole and bend losses, junction losses, and minor head losses at points of turbulence shall be calculated and included in the computation of the hydraulic gradient.

F. The flow lines of storm sewer conduits that discharge into open channels shall be higher than or equal to the flow line of the channel. Storm sewer outfall pipes shall not be at sump with the receiving channel.

G. Pipe diameters shall increase downstream. Pipe size and slope shall be designed so that the velocity of flow will increase progressively down the system or at least will not appreciably decrease at inlets, bends or other changes in geometry or configuration to prevent sedimentation.

H. At points of change in storm drain size, pipe crowns (soffits) shall be set at the same elevation.

Table 7-2: Maximum Velocity in Storm Drains

Storm Drain Type	Maximum Velocity
Inlet Laterals (shorter than 30 feet)	No Limit
Inlet Laterals (longer than 30 feet)	15 feet per second
Trunk Lines	15 feet per second

7.3 Calculation of the Hydraulic Grade Line

The 25-year and 100-year frequency hydraulic grade line (HGL) shall be computed and plotted for all storm drain systems. The 25-year frequency hydraulic grade line shall be calculated throughout the system and shall be at least two feet below the theoretical gutter line at the entrance to the inlet. The determination of friction losses and minor losses are required for these calculations.

7.3.1 Tailwater Conditions

A. The designer must determine the tailwater conditions at the downstream end of the proposed storm drain system when calculating the hydraulic performance of the system. When proposed storm drains are to discharge into existing watercourses, the tailwater elevation used in hydraulic calculations of the proposed storm drain system will be determined by the design engineer. The tailwater elevation shall be the greater of the water surface of the receiving stream and the minimum outlet water surface, y_m, both in feet above mean sea level (ft msl). The minimum water surface, y_m, is derived from the following equations:

Equation 7-1

$$y_{m=}\frac{(D_0+y_c)}{2}+FL$$

Where:
y_m = minimum water surface elevation of the pipe (ft msl)
D_0 = pipe outlet diameter (ft)
y_c = critical depth of the channel for a given flow and geometric conditions (ft)
FL = flow line of the pipe, lateral, trunk, or channel (ft msl).

The critical depth, y_c, is determined by the following equation for Froude Number, which is set equal to 1.0 and solved for depth:

Equation 7-2

$$1.0 = \frac{\left({}^{Q}/_{A}\right)}{(gD)^{0.5}}$$

Where:
Q = flow in the inlet pipe (cfs)
A = cross-sectional area of the flow (ft^2)
D = diameter of the inlet pipe (ft)
g = acceleration due to gravity = 32.2 ft/sec^2

B. Storm drain outfalls to a river or stream creates the need to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the elevation of the tailwater in the receiving stream. The relative independence of the discharge from the storm drainage system can be qualitatively evaluated by a comparison of the drainage area of the receiving stream to the area of the storm drainage system. For example, if the storm drainage system has a drainage area much smaller than that of the receiving stream, the peak discharge from the storm drainage system may be out of phase with the peak discharge from the receiving watershed. In this case, it would be necessary to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. The area ratio shown in Figure 7-3 is the ratio of the main stream (receiving area) to the tributary (storm system drainage area).
C. The designer must also perform a “Normal Depth” outfall analysis to determine the maximum outlet velocities of the facility. This analysis includes solving the downstream boundary condition using Manning’s Equation for Normal Depth.

Table 7-3: Frequencies for Coincidental Occurrences

Area Ratio	2-Year design		5-Year Design	
	Main Stream	Tributary	Main Stream	Tributary
10,000:1	1	2	1	5
	2	1	5	1
1,000:1	1	2	2	5
	2	1	5	2
100:1	2	2	2	5
	2	2	5	5
10:1	2	2	5	5
	2	2	5	5
1:1	2	2	5	5
	2	2	5	5
Area Ratio	**10-year design**		**25-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	1	10	2	25
	10	1	25	2
1,000:1	2	10	5	25
	10	2	25	5
100:1	5	10	10	25
	10	5	25	10
10:1	10	10	10	25
	10	10	25	10
1:1	10	10	25	25
	10	10	25	25
Area Ratio	**50-year design**		**100-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	2	50	2	100
	50	2	100	2
1,000:1	5	50	10	100
	50	5	100	10
100:1	10	50	25	100
	50	10	100	25
10:1	25	50	50	100
	50	25	100	50
1:1	50	50	100	100
	50	50	100	100
Source: *TxDOT HDM* [4]				

7.3.2 Friction Losses

Friction losses or major losses shall be computed using Manning's Equation. The friction loss (h_f) for a segment of conduit is defined by the product of the friction slope at full flow and the length of the conduit. Per the *TxDOT HDM*, the simplified form of the equation is shown in Equation 7-3.

Equation 7-3

$$h_f = \frac{Q^2 n^2}{z^2 A^2 R^{4/3}} L$$

Where:
Q = discharge (cfs)
n = Manning's roughness coefficient
z = 1.486 for use with English measurements only
A = cross-sectional area of flow (ft^2)
R = hydraulic radius (ft)
L = length of pipe (ft).

7.3.3 Minor Energy Losses

Minor energy losses in storm drains are attributed from junctions, bends, manholes or inlets, and expansions and contractions. Minor energy losses are required to be evaluated when designing a storm drain system. The following equations and methods shall be used when designing a storm drain system and are base on design information in the *TxDOT HDM*.

7.3.3.1 Junction Loss Equation

A pipe junction is the connection of a lateral pipe to a larger trunk pipe without the use of an access hole. The minor loss equation for a pipe junction is in the form of the momentum equation. In Equation 7-4, the subscripts "i", "o", and "1" indicate the inlet, outlet and lateral, respectively.

Equation 7-4

$$h_j = \frac{Q_o v_o - Q_i v_i - Q_1 v_1 cos\theta}{0.5 g (A_o + A_i)}$$

Where:

h_j = junction head loss (ft)
Q = flow (cfs)
v = velocity (fps)
A = cross-sectional area (ft^2)
θ = angle in degrees of lateral with respect to centerline of outlet pipe
g = gravitational acceleration = 32.2 ft/s^2.

The above equation applies only if $v_0 > v_i$ and assumes that $Q_o = Q_i + Q_1$.

7.3.3.2 Exit Loss Equation

The exit loss, h_0, is a function of the change in velocity at the outlet of the pipe as shown in Equation 7-5.

Equation 7-5

$$h_o = C_o \frac{v^2 - v_d^2}{2g}$$

Where:
h_o = exit loss (ft)
v = average outlet velocity (fps)
v_d = channel velocity downstream of the outlet (fps)
C_O = exit loss coefficient (0.5 typical).

The above assumes that the channel velocity is lower than the outlet velocity. Note that, for partial flow where the pipe outfalls into a channel with water moving in the same direction, the exit loss may be reduced to virtually zero.

7.3.3.3 Inlet and Access Hole Energy Loss Equations

HEC 22 presents the method to compute energy losses for inlets and access holes.

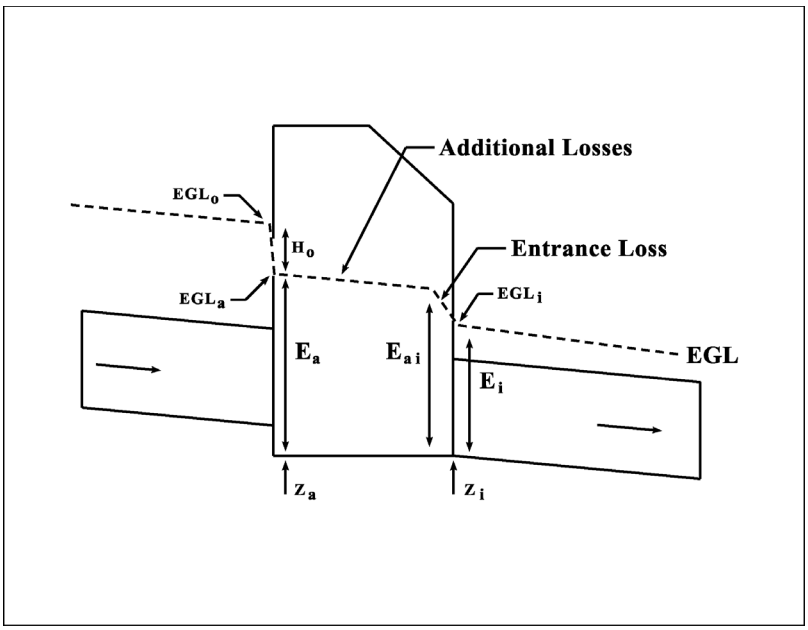
As a starting point, the outflow pipe energy head (E_i) is the difference between the energy gradeline in the outflow pipe (EGL_i) and the outflow pipe flowline (Z_i), as determined in Equation 7-6 and shown on Figure 7-1.

Equation 7-6

$$E_i = EGL_i - Z_i$$

Where:
E_i = Outflow pipe energy head (ft)
EGL_i = Outflow pipe energy gradeline (ft)
Z_i = Outflow pipe flowline elevation (ft).

Figure 7-1: Access Hole Energy Level Definitions



Source: *TxDOT HDM* [4]

Initial Access Hole Energy Level

The initial estimate of energy level (E_{ai}) is taken as the maximum of the three values, E_{aio}, E_{ais}, and E_{aiu}, as determined in Equation 7-7.

Equation 7-7

$$E_{ai} = max(E_{aio}, E_{ais,} E_{aiu})$$

Where:
E_{aio} = estimated access hole energy level for outlet control (full and partial flow)
E_{ais} = estimated access hole energy level for inlet control (submerged)
E_{aiu} = estimated access hole energy level for inlet control (unsubmerged).

E_{aio} – Estimated Energy Level for Outlet Control

In the outlet control condition, flow out of the access hole is limited by the downstream storm drain system. The outflow pipe would be in subcritical flow and could be either flowing full or partially full. Whether the outflow pipe is flowing full or partially full affects the value of E_{aio}. This can be determined by describing and rearranging the outflow pipe energy head E_i. E_i can be described as the sum of the potential head, pressure head, and velocity head, as shown in Equation 7-8.

Equation 7-8

$$E_i = y + \left({}^{P}/_{\gamma}\right) + \frac{V^2}{2g}$$

Where:
y = Outflow pipe depth (potential head) (ft)
(P/γ) = Outflow pipe pressure head (ft)
$V^2/2g$ = Outflow pipe velocity head (ft).

Rearranging Equation 7-8 to isolate the potential head and pressure head gives Equation 7-9.

Equation 7-9

$$y + \left({}^{P}/_{\gamma}\right) = E_i - \frac{V^2}{2g}$$

If $y + (P/\gamma)$ is less than the diameter of the outflow pipe, then the pipe is in partial flow and the estimated initial structure energy level (E_{aio}) is equal to zero ($E_{aio} = 0$).

If $y + (P/\gamma)$ is greater than the diameter of the outflow pipe, then the pipe is in full flow, and the estimated initial structure energy level (E_{aio}) is calculated using Equation 7-10:

Equation 7-10

$$E_{aio} = E_i + H_i$$

Where:
E_i = Outflow pipe energy head (ft)
H_i = entrance loss assuming outlet control, using Equation 7-11.

Equation 7-11

$$H_i = 0.2\frac{V^2}{2g}$$

Where:
$V^2/2g$ = Outflow pipe velocity head (ft).

E_{ais} – Estimated Energy Level for Inlet Control: Submerged

The submerged inlet control energy level (E_{ais}) checks the orifice condition and is estimated using Equation 7-12:

Equation 7-12

$$E_{ais} = D_o(DI)^2$$

Where:
D_o = Diameter of outflow pipe (ft)
DI = Discharge Intensity parameter, calculated by Equation 7-13:

Equation 7-13

$$DI = \frac{Q}{[A(gD_o)^{0.5}]}$$

Where:
DI = discharge Intensity parameter
Q = flow in outfall pipe (cfs)
A = area of outflow pipe (ft^2)
D_o = diameter of outflow pipe (ft).

E_{aiu} – Estimated Energy Level for Inlet Control: Unsubmerged

The unsubmerged inlet control energy level (E_{aiu}) checks the weir condition and is estimated using Equation 7-14:

Equation 7-14

$$E_{aiu} = 1.6D_o(DI)^{0.67}$$

Adjustments for Benching, Angled Flow, and Plunging Flow

The revised access hole energy level (E_a) is determined by adding three loss factors for: (1) benching configurations; (2) flows entering the structure at an angle; and (3) plunging flows. Flows entering a structure from an inlet can be treated as plunging flows and determined by Equation 7-15.

Equation 7-15

$$E_a = E_{ai} + H_a$$

Where:
E_a = the revised access hole energy level
E_{ai} = the initial estimate of access hole energy level, calculated using Equation 7-7
H_a = additional energy loss due to benching, angled inflow and plunging inflow, calculated using Equation 7-16.

If E_a is calculated to be less than the outflow pipe energy head (E_i), then E_a should be set equal to E_i.

Equation 7-16

$$H_a = \left(C_B + C_\theta + C_p\right)\left(E_{ai} - E_i\right)$$

Where:

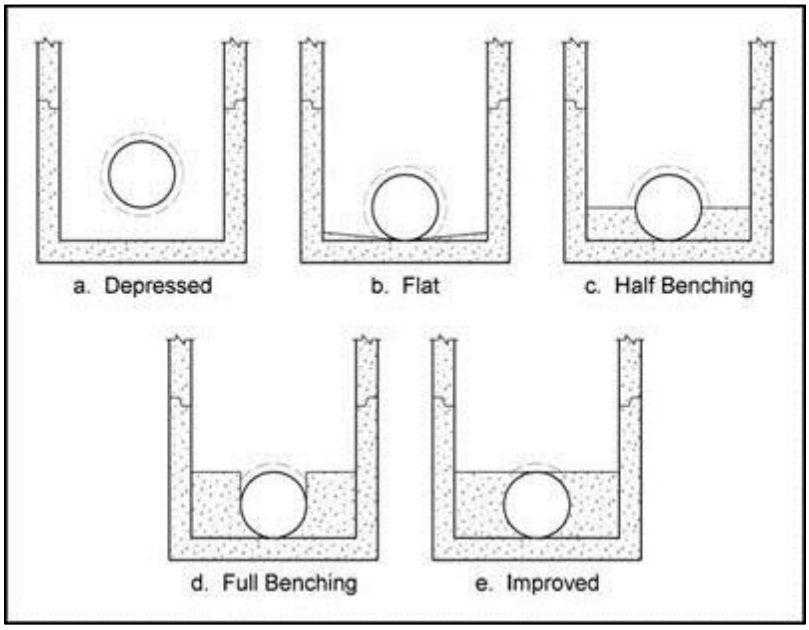
C_B = Coefficient for benching (floor configuration)
C_θ = Coefficient for angled flows
C_P = Coefficient for plunging flows.

Note that the value of H_a should always be positive. If not, H_a should be set to zero.

Additional Energy Loss: Benching

Benching serves to direct flow through the access hole, which reduces energy losses. Figure 7-2 illustrates some typical bench configurations.

Figure 7-2: Access hole benching methods



Source: *TxDOT HDM* [4]

The energy loss coefficient for benching, (C_B), is obtained from Table 7-4. A negative value indicates water depth will be decreased rather than increased.

Table 7-4: Values for the Coefficient, CB

Floor Configuration	C_B
Flat (level)	-0.05
Depressed	0.0
Unknown	-0.05

Source: *TxDOT HDM* [4]

Additional Energy Loss: Angled Inflow

The angles of all inflow pipes into the access hole are combined into a single weighted angle (θ_w) using Equation 7-17:

Equation 7-17

$$\theta_W = \Sigma\left(\left(Q_J\theta_J\right)\left(\Sigma Q_J\right)\right)$$

Where:
Q_J = Contributing flow from inflow pipe (cfs)
θ_J = Angle measured from the outlet pipe (degrees)(plunging flow is 180 degrees).

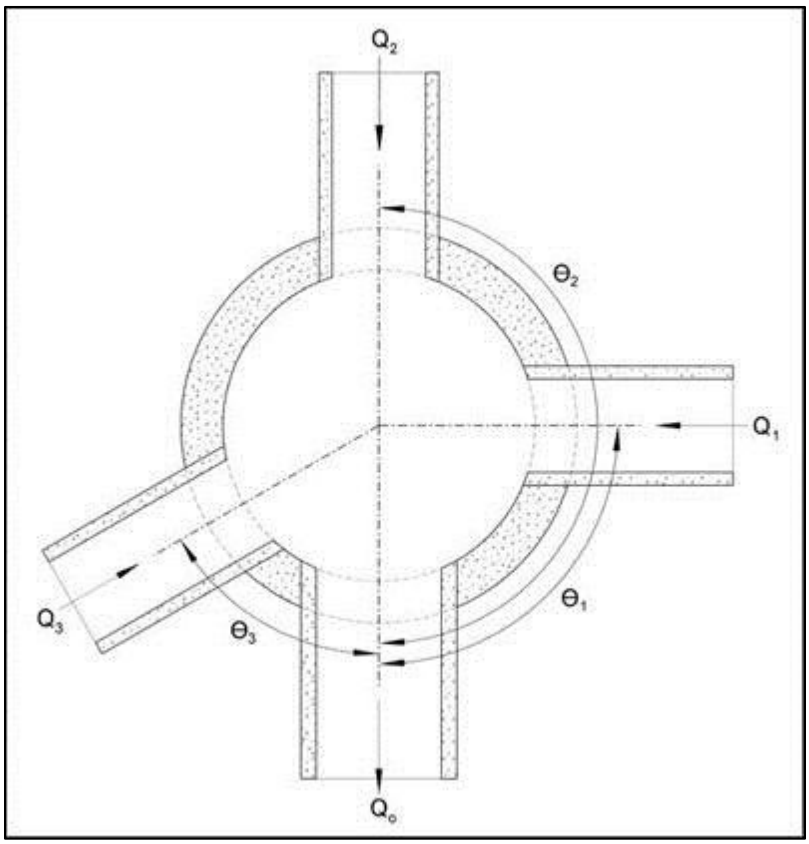
Figure 7-3 illustrates the orientation of the pipe inflow angle measurement. The angle for each inflow pipe is referenced to the outlet pipe, so that the angle is not greater than 180 degrees. A straight pipe angle is 180 degrees. If all flows are plunging, θ_w is set to 180 degrees; the angled inflow coefficient approaches zero as θ_w approaches 180 degrees and the relative inflow approaches zero. The angled inflow coefficient (C_θ) is calculated by Equation 7-18:

Equation 7-18

$$C_\theta = 4.5\frac{\left(\sum Q_J\right)}{Q_o}\cos\left(\frac{\theta_W}{2}\right)$$

Where:
Q_o = Flow in outflow pipe (cfs).

Figure 7-3: Access hole angled inflow definition



Source: *TxDOT HDM* [4]

Additional Energy Loss: Plunging Inflow

Plunging inflow is defined as inflow from an inlet or a pipe where the pipe flowline is above the estimated access hole water depth (approximated by E_{ai}).

The relative plunge height (h_k) for each inflow pipe is calculated using Equation 7-19

Equation 7-19

$$h_k = \frac{(Z_k - E_{ai})}{D_o}$$

Where:
Z_k = the difference between the inflow pipe flowline elevation and the access hole flowline elevation. If $Z_k > 10D_o$ it should be set to $10D_o$.

The relative plunge height for each inflow pipe is calculated separately and then combined into a single plunging flow coefficient (C_P):

Equation 7-20

$$C_p = \frac{\sum(Q_k H_k)}{Q_o}$$

As the proportion of plunging flows approaches zero, C_P also approaches zero.

Access Hole Energy Gradeline

Knowing the access hole energy level (E_a) and assuming that the access hole flowline (Z_a) is the same elevation as the outflow pipe flowline (Z_i) allows determination of the access hole energy gradeline (EGL_a):

Equation 7-21

$$EGL_a = E_a + Z_a$$

As described earlier, the potentially highly turbulent nature of flow within the access hole makes determination of water depth problematic. Research has shown that determining velocity head within the access hole is very difficult, even in controlled laboratory conditions. However, a reasonable assumption is to use the EGL_a as a comparison elevation to check for potential surcharging of the system.

Inflow Pipe Exit Losses

The final step is to calculate the energy gradeline into each inflow pipe, whether plunging or non-plunging.

Non-Plunging Inflow Pipe

Non-plunging inflow pipes are those pipes with a hydraulic connection to the water in the access hole. Inflow pipes operating under this condition are identified when the revised access hole energy gradeline (E_a) is greater than the inflow pipe flowline elevation (Z_o). In this case, the inflow pipe energy head (EGL_o) is equal to:

Equation 7-22

$$EGL_o = EGL_a + H_o$$

Where:
$H_o = 0.4(V^2/2g)$ = Inflow pipe exit loss.

Exit loss is calculated in the traditional manner using the inflow pipe velocity head since a condition of supercritical flow is not a concern on the inflow pipe.

Plunging Inflow Pipe

For plunging inflow pipes, the inflow pipe energy gradeline (EGL_o) is logically independent of access hole water depth and losses.

Continuing Computations Upstream

For either the nonplunging or plunging flows, the resulting energy gradeline is used to continue computations upstream to the next access hole. The procedure of estimating entrance losses, additional losses, and exit losses is repeated at each access hole.

7.3.4 Energy Gradeline Procedure

1. Determine the EGL_i and HGL_i downstream of the access hole. The EGL and HGL will most likely need to be followed all the way from the outfall. If the system is being connected to an existing storm drain, the EGL and HGL will be that of the existing storm drain.
2. Verify flow conditions at the outflow pipe.
    a. If HGL_i is greater or equal to the soffit of the outflow pipe, the pipe is in full flow.
    b. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth, the pipe is not in full flow but downstream conditions still control.
    c. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth and less than or equal to normal depth, the pipe is in subcritical partial flow. EGL_i becomes the flowline elevation plus normal depth plus the velocity head.
    d. If HGL_i is less than critical depth, the pipe is in super-critical partial flow conditions. Pipe losses in a supercritical pipe section are not carried upstream.
3. Estimate E_i (outflow pipe energy head) by subtracting Z_i (pipe flowline elevation) from the EGL_i using Equation 7-6. Calculate $y + P/\gamma$ using Equation 7-9. Compute DI using Equation 7-13.
4. Calculate E_{ai} as maximum of E_{aio}, E_{ais}, and E_{aiu} as below:
    a. If $(y + P/\gamma) > D$, then the pipe is in full flow and $E_{aio} = E_i + H_i$ (Equation 7-10). If $(y + P/\gamma) < D$, then the pipe is in partial flow and $E_{aio} = 0$.
    b. $E_{ais} = D_o(DI)^2$ (Equation 7-12)
    c. $E_{aiu} = 1.6\ D_o(DI)^{0.67}$ (Equation 7-14)

    If $E_{ai} < E_i$, the head loss through the access hole will be zero, and $E_{ai} = E_i$. Go to Step 10.

5. Determine the benching coefficient (C_B) using Table 7-4. The values are the same whether the bench is submerged or unsubmerged.
6. Determine the energy loss coefficient for angle flow (C_θ) by determining θ_W for every pipe into the access hole.
    a. Is $E_i <$ inflow pipe flowline? If so, then the flow is plunging and θ_W for that pipe is 180 degrees.
    b. If the pipe angle is straight, then θ_W for that pipe is 180 degrees.
    c. Otherwise, θ_W is the angle of the inflow pipe relevant to the outflow pipe. Maximum angle is 180 degrees (straight).

Use Equation 7-17 and Equation 7-18 to calculate θ_W and C_θ.

7. Determine the plunging flow coefficient (C_P) for every pipe into the access hole using Equation 7-20. The relative plunge height (h_k) is calculated using Equation 7-19. Z_k is the difference between the access hole flowline elevation and the inflow pipe flowline elevation. If $Z_k > 10D_o$, Z_k should be set to $10D_o$.
8. If the initial estimate of the access hole energy level is greater than the outflow pipe energy head ($E_{ai} > E_i$), then $E_a = E_i$. If $E_{ai} < E_i$, then $H_a = (E_{ai} - E_i)(C_B + C_\theta + C_P)$. If $H_a < 0$, set $H_a = 0$.
9. Calculate the revised access hole energy level (E_a) Equation 7-15. If $E_a < E_i$, set $E_a = E_i$.
10. Compute EGL_a by adding E_a to the outflow pipe flowline elevation. Assume HGL_a at the access hole structure is equal to EGL_a.
11. Compare EGL_a with the critical elevation (ground surface, top of grate, gutter elevation, or other limits). If EGL_a exceeds the critical elevation, modifications must be made to the design.

7.4 Hydraulic Grade Line Computation Sheet

The design engineer shall provide a HGL computation sheet that depicts all forms or energy loss for each junction and pipe connection and identifies the upstream and downstream HGL and EGL elevations. These computations shall be provided for the design storm and 100-year assessment.

8 Open Channels

8.1 General Requirements

The general classifications for open channels are: (1) Natural channels, which include all watercourses that have been carved by nature through erosion; and (2) Engineered channels, which are constructed or existing channels that have been significantly altered by human effort.

A. The City of New Braunfels encourages the preservation of natural channels and drainage patterns. Developed drainage flows must enter and depart from a developed area in the same manner and location as under pre-development conditions. Any concentration of previous over-land flow is required to leave the developed site into a receivable body such as a drainage easement or city right-of-way in a manner so as to not impact downstream properties and/or facilities.
B. Easements or drainage rights-of-way shall be provided for all open channels such that the 100-year runoff and maintenance access are contained within drainage easements and/or right-of-way. Drainage easements shall be designated on plats for recording. For properties with existing structural development on previously platted lots, additional drainage easements shall be dedicated by separate recorded instrument or an amended plat. Easements and FEMA floodways shall not be encroached upon with fill materials or structures, which would reduce the channel's ability to carry the 100-year flood.
    a. Easement width shall be at least the width of the water surface from the 100-year design storm runoff under post-development conditions plus maintenance access. Maintenance access shall extend 2 feet from one side of the channel and 12 feet on the other side of the channel. If a channel is located parallel and adjoining a roadway, maintenance access shall extend 2 feet from both sides of the channel.
    b. Additional easement width should be provided to allow for channel meandering near bends of channels
C. Engineered channels shall be designed to meet the applicable design, freeboard and easement requirements. Freeboard along the outside of channel bends shall include the increased water surface due to superelevation.
D. Fencing and/or warning signs should be required to prevent public access where flowing water would pose a safety hazard. Fencing shall be designed in such a way as to not pose a drainage obstruction.
E. Shear stress shall be computed for all open channels and adequate protection provided in accordance with *Hydraulic Engineering Circular 15: Design of Roadway Channels with Flexible Linings (HEC 15)* [9]. Channels shall be designed to be stable and to not create safety hazards. Side slopes of vegetative lined channels should be 3:1 or flatter (4:1 or flatter along roadways) in channels with depths greater than 2 feet. Recommended maximum water velocities for earthen channels are given in Table 8-1. Erosion control or energy dissipation devices should be used to control velocities such that channel degradation does not occur. Bank stabilization measures shall not reduce channel capacity and shall follow sound engineering practices

Table 8-1: Maximum Velocity in Open Channels

Channel Lining Material[1]	Channel Slope (%)	Maximum Velocity (fps)
Earthen Channels	0 – 5	6
	5 – 10	5
	> 10	4
Rock (native subgrades)		10
Gabion Lined		12
Reinforced concrete lining		20
Rock Riprap (placed rock)		12
Prefabricated lining products		Use 90% of manufacturer's recommended velocity limits

[1] *Uniform, in well-maintained condition.*

F. Should diversion of a natural drainage way be required, sufficient work shall be done upstream and/or downstream to provide all affected properties at least the same level of flood protection and erosion control that existed prior to the diversion. The time length of a diversion channel must be at least as long as the segment of natural channel being replaced so that velocity is not increased.

G. Fencing shall be required adjacent to the channel where channel vertical wall heights exceed 30 inches and where channel side slopes exceed 2:1 and the depth is greater than 30 inches. Fencing shall be a minimum of 42 inches high, provide for maintenance access and not hinder sight distance for traffic. Fence type and location shall be determined by the design engineer.

H. Concrete pilot channels shall be provided for channels with longitudinal slopes less than 0.5 percent or bottom widths greater than 30 feet. The minimum bottom width of the pilot channel shall be 4 feet and the minimum earthen slope draining toward the pilot channel shall be 1 percent.

8.2 Design Criteria

A. The depth and velocity of flow are necessary for the design and analysis of channel linings and structures. The depth and velocity at which a given discharge flows in a channel of known geometry, roughness, and slope can be determined through hydraulic analysis. The following two methods are commonly used in the hydraulic analysis of open channels:

1. Slope Conveyance Method
2. Standard Step Backwater Method

The Slope Conveyance and Standard Step Backwater Methods have been summarized from the *TxDOT HDM*.

B. Channels should have sufficient gradient, depending upon the type of soil or channel lining material, to provide velocities that will be self-cleaning (greater than 2 feet per second for the 2-year storm event) but not cause erosion due to excessive shear stress.

C. Appropriate energy dissipating structures may be used to control erosion due to high velocities at pipe system outfalls and steep grades and shall be designed in accordance with accepted design

practices such as outlined by the Soil Conservation Service, the Corps of Engineers, the Bureau of Land Reclamation, or TxDOT.

8.3 Channel Capacity

Per *HEC 22*, the most commonly used equation for solving steady, uniform flow problems is the Manning's Equation (Equation 8-1). The depth of flow in steady, uniform flow is called the normal depth.

Equation 8-1

$$v = \frac{z}{n} R^{2/3} S^{1/2}$$

Where:

v = velocity (cfs)
z = 1.486 for English measurement units
n = Manning's roughness coefficient (a coefficient for quantifying the roughness characteristics of the channel)
R = hydraulic radius (ft) = A/WP
WP = wetted perimeter of flow (the length of the channel boundary in direct contact with the water) (ft) and A = area of conveyance (ft^2)
S = slope of the energy gradeline (ft/ft) (For uniform, steady flow, S = channel slope, ft/ft).

Combine Manning's Equation with the continuity equation to determine the channel uniform flow capacity as shown in Equation 8-2.

Equation 8-2

$$Q = \frac{z}{n} A R^{2/3} S^{1/2}$$

Where:
Q = discharge (cfs)
z = 1.486 for English measurement units
A = cross-sectional area of flow (ft^2).

For convenience, Manning's Equation in this manual assumes the form of Equation 8-2. Since Manning's Equation does not allow a direct solution to water depth (given discharge, longitudinal slope, roughness characteristics, and channel dimensions), an indirect solution to channel flow is necessary.

8.4 Roughness Coefficients

All hydraulic conveyance formulas quantify roughness subjectively with a coefficient. In Manning's Equation, the roughness coefficients, or n-values, for Texas streams and channels range from 0.200 to 0.012; values outside of this range are probably not realistic. Determination of a proper n-value is the

most difficult and critical of the engineering judgments required when using the Manning’s Equation. The recommended Manning's roughness coefficients ("N" values) for use in open channel hydraulic calculations are listed in Table 8-2.

Table 8-2: Manning's Roughness Coefficients

Natural Channels	Min	Normal	Max
Minor Streams (top width at flood stage <30 meters)			
Streams on plain:			
♦ Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
♦ Same as above, but more stones and weeds	0.030	0.035	0.040
♦ Clean, winding, some pools and shoals	0.033	0.040	0.045
♦ Same as above, but some stones and weeds	0.035	0.045	0.050
♦ Same as above, but lower stages, more ineffective slopes and sections	0.040	0.048	0.055
♦ Clean, winding, some pools and shoals, some weeds and many stones	0.045	0.050	0.060
♦ Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
♦ Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages:			
♦ Bottom: gravel, cobbles, and few boulders	0.030	0.040	0.050
♦ Bottom: cobbles with large boulders	0.040	0.050	0.070
Flood Plains			
Pasture, no brush:			
♦ Short grass	0.025	0.030	0.035
♦ High grass	0.030	0.035	0.050
Cultivated areas:			
♦ No crop	0.020	0.030	0.040
♦ Mature row crops	0.025	0.035	0.045
♦ Mature field crops	0.030	0.040	0.050
Brush:			
♦ Scattered brush, heavy weeds	0.035	0.050	0.070
♦ Light brush and trees, in winter	0.035	0.050	0.060
♦ Light brush and trees, in summer	0.040	0.060	0.080
♦ Medium to dense brush, in winter	0.045	0.070	0.110
♦ Medium to dense brush, in summer	0.070	0.100	0.160
Trees:			
♦ Dense willows, summer, straight	0.110	0.150	0.200
♦ Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
♦ Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
♦ Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
♦ Same as above, but flood stage reaching branches	0.100	0.120	0.160
Major Streams (top width at flood stage >30 meters)			
♦ Regular section with no boulders or brush	0.025	--	0.060
♦ Irregular and rough section	0.035	--	0.100
Lined Channels			
♦ Concrete-lined	0.012	--	0.018
♦ Concrete rubble	0.017	--	0.030
Unlined Channels			
♦ Earth, straight and uniform	0.017	--	0.025
♦ Winding and sluggish	0.022	--	0.030
♦ Rocky beds, weeds on bank	0.025	--	0.040
♦ Earth bottom, rubble sides	0.028	--	0.035
♦ Rock cuts	0.025	--	0.045
Source: *TxDOT HDM* [4]			

In some instances, such as a trapezoidal section under a bridge, the n-value may vary drastically within a section, but the section should not be sub-divided. If the n-value varies as such, use a weighted n-value (n_w). This procedure is defined by Equation 8-3 as follows:

Equation 8-3

$$n_w = \frac{\sum(n\,WP)}{\sum WP}$$

Where:
WP = subsection wetted perimeter
n = subsection n-value.

8.5 Subdividing Cross-Sections

Because any estimating method involves the calculation of a series of hydraulic characteristics of the cross section, arbitrary water-surface elevations are applied to the cross section. The computation of flow or conveyance for each water-surface application requires a hydraulic radius. The hydraulic radius is intended as an average depth of a conveyance. A hydraulic radius and subsequent conveyance is calculated under each arbitrary water surface elevation. If there is significant irregularity in the depth across the section, the hydraulic radius may not accurately represent the flow conditions. Divide the cross section into sufficient subsections so that realistic hydraulic radii are derived.

Subdivide cross sections primarily at major breaks in geometry. Additionally, major changes in roughness may call for additional subdivisions. Subdivisions for major breaks in geometry or for major changes in roughness should maintain these approximate basic shapes so that the distribution of flow or conveyance is nearly uniform in a subsection.

Documentation must be submitted by the design engineer describing the methodology used to subdivide cross sections for review and approval by the City Engineer.

8.6 Slope Conveyance Method

The Slope Conveyance Method requires more judgment and assumptions than the Standard Step Method. In many situations, however, use of the Slope Conveyance Method is justified, as in the following conditions:

- Standard roadway ditches
- Culverts
- Storm drain outfalls

The procedure involves an iterative development of calculated discharges associated with assumed water surface elevations in a typical section. The series of assumed water surface elevations and associated discharges comprise the stage-discharge relationship. When stream gauge information exists, a measured relationship (usually termed a “rating curve”) may be available.

A channel cross section and associated roughness and slope data considered typical of the stream reach are required for this analysis. A typical section is one that represents the average characteristics of the stream near the point of interest. This cross section should be located downstream of and as close as reasonably possible to the proposed drainage facility discharge site. The closer to the proposed site a typical cross section is taken, the less error in the final water surface elevation

A typical cross section should be used for the analysis. If a cross section does not exist, then a "control" cross section (also downstream) should be used. The depth of flow in a control cross section is controlled by a constriction of the channel, a damming effect across the channel, or possibly an area with extreme roughness coefficients. The cross section should be normal to the direction of stream flow under flood conditions.

After identifying the cross section, apply Manning's roughness coefficients (n-values). Divide the cross section with vertical boundaries at significant changes in cross-section shape or at changes in vegetation cover and roughness components. Determine the average bed slope near the site.

8.6.1 Slope Conveyance Procedure

The calculation of the stage-discharge relationship should proceed as described in this section.

1. Select a trial starting depth and apply it to a plot of the cross section.
2. Compute the area and wetted perimeter weighted n-value for each submerged subsection.
3. Compute the subsection discharges with Manning's Equation. Use the subsection values for roughness, area, wetted perimeter, and slope. The sum of all of the incremental discharges represents the total discharge for each assumed water surface elevation. NOTE: Compute the average velocity for the section by substituting the total section area and total discharge into the continuity equation (Equation 8-4).
4. Tabulate or plot the water surface elevation and resulting discharge (stage versus discharge).
5. Repeat the above steps with a new channel depth, or add a depth increment to the trial depth. The choice of elevation increment is somewhat subjective. However, if the increments are less than about 0.25 feet, considerable calculation is required. On the other hand, if the increments are greater than 1.5 feet, the resulting stage-discharge relationship may not be detailed enough for use in design.
6. Determine the depth for a given discharge by interpolation of the stage versus discharge table or plot.

Equation 8-4

$$V = \frac{Q}{A}$$

8.7 Standard Step Backwater Method

Calculations of water surface profiles can be accomplished by using the Standard Step Method. Water surface profiles for the design frequency floods shall be computed for all channels and shown on all final drawings.

The Corps of Engineers HEC-RAS Water Surface Profile Programs may also be used to perform standard step backwater calculations, and if used, a summary table shall be submitted to the City. In addition, the design engineer shall provide documentation that justifies the flow regime (subcritical, supercritical, or mixed) used in the analysis. Losses due to changes in velocity, drops, bridge openings, and other obstructions shall be considered in the backwater computations, as described in the HEC-RAS User's Manuals.

Use the Standard Step Method for analysis in the following instances:

- Results from the Slope-Conveyance Method may not be accurate enough
- The drainage facility's level of importance deserves a more sophisticated channel analysis
- The channel is highly irregular with numerous or significant variations of geometry, roughness characteristics, or stream confluences
- A controlling structure affects backwater.

This procedure applies to most open channel flow, including streams having an irregular channel with the cross section consisting of a main channel and separate overbank areas with individual n-values. Use this method either for supercritical flow or for subcritical flow.

8.7.1 Standard Step Data Requirements

At least four cross sections are required to complete this procedure. The number and frequency of cross sections required is a direct function of the irregularity of the stream reach. The cross sections should represent the reach between them. A system of measurement or stationing between cross sections is also required. Evaluate roughness characteristics (n-values) and associated sub-section boundaries for all of the cross sections.

The selection of cross sections used in this method is critical. As the irregularities of a stream vary along a natural stream reach, accommodate the influence of the varying cross-sectional geometry. Incorporate transitional cross sections into the series of cross sections making up the stream reach.

8.7.2 Standard Step Procedure

The Standard Step Method uses the Energy Balance Equation, Equation 8-5, which allows the water surface elevation at the upstream section (noted as subscript 2) to be found from a known water surface elevation at the downstream section (noted as subscript 1). The following procedure assumes that cross sections, stationing, discharges, and n-values have already been established. Generally, for Texas, the assumption of subcritical flow will be appropriate to start the process. Subsequent calculations will check this assumption.

Equation 8-5

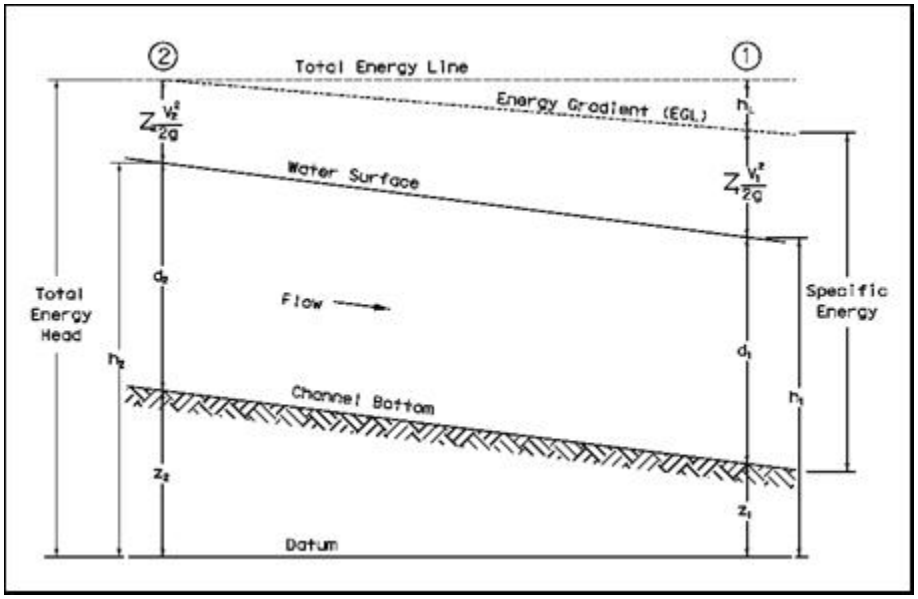
$$z_2 + d_2 + \alpha_2\left(\frac{v_2^2}{2g}\right) = z_1 + d_1 + \alpha_1\left(\frac{v_1^2}{2g}\right) + h_f + other\ losses$$

Where:
z = elevation of the streambed (ft)
d = depth of flow (ft)
α = kinetic energy coefficient
v = average velocity of flow (fps)
h_f = friction head loss from upstream to downstream (ft)
g = acceleration due to gravity = 32.2 ft/ s^2.

1. Select the discharge to be used. Determine a starting water surface elevation. For subcritical flow, begin at the most downstream cross section. Use one of the following methods to establish a starting water surface elevation for the selected discharge: a measured elevation, the Slope-Conveyance Method to determine the stage for an appropriate discharge, or an existing (verified) rating curve.
2. Referring to Figure 8-1 and Equation 8-5, consider the downstream water surface to be section 1 and calculate the following variables:

   z_1 = flowline elevation at section 1
   y_1 = tailwater minus flowline elevation
   α= kinetic energy coefficient (For simple cases or where conveyance does not vary significantly, it may be possible to ignore this coefficient).

Figure 8-1: EGL for Water Surface Profile



Source: *TxDOT HDM* [4]

3. From cross section 1, calculate the area, A_1. Then use Equation 8-6 to calculate the velocity, v_1, for the velocity head at A_1. The next station upstream is usually section 2. Assume a depth y_2 at section 2, and use y_2 to calculate z_2 and A_2. Calculate, also, the velocity head at A_2.

Equation 8-6

$$Q = A_1 v_1 = A_2 v_2$$

Q = discharge (cfs)
A = flow cross-sectional area (ft^2)
v = mean cross-sectional velocity (fps, perpendicular to the flow area).

The superscripts 1 and 2 refer to successive cross sections along the flow path.

4. Calculate the friction slope between the two sections using Equation 8-7and Equation 8-8:

Equation 8-7

$$s_f = \left(\frac{Q}{K_{ave}}\right)^2$$

Where:

$$K_{ave} = \frac{K_1 + K_2}{2} = 0.5\left(\frac{ZA_1R_1^{\frac{2}{3}}}{n_1} + \frac{ZA_2R_2^{\frac{2}{3}}}{n_2}\right)$$

5. Calculate the friction head losses (h_f) between the two sections using:

Equation 8-8

$$h_f = S_{ave}L$$

Where:

L = Distance between the two sections (ft).

6. Calculate the kinetic energy correction coefficients (α_1 and α_2) using Equation 8-9.

Equation 8-9

$$\alpha = \frac{\sum(Q_i v_i^2)}{Q v^2} = \frac{\sum[K_i(K_i/A_i)^2]}{K_t(K_t/A_t)^2}$$

Where:

v_i = average velocity in subsection (fps) (see Continuity Equation section)

Q_i = discharge in same subsection (cfs) (see Continuity Equation section)
Q = total discharge in channel (cfs)
v = average velocity in river at section or Q/A (ft/s)

K_i = conveyance in subsection (cfs) (see Conveyance section)

A_i = flow area of same subsection (ft^2)

K_t = total conveyance for cross-section (cfs)

A_t = total flow area of cross-section (ft^2).

7. Where appropriate, calculate expansion losses (h_e) using Equation 8-10 and contraction losses (h_c) using Equation 8-11 (Other losses, such as bend losses, are often disregarded as an unnecessary refinement.)

Equation 8-10

$$h_e = K_e \frac{\Delta V^2}{2g}$$

Where:
K_e = 0.1 for a gentle contraction
K_e = 0.5 for a sudden contraction

Equation 8-11

$$h_c = K_c \frac{\Delta V^2}{2g}$$

Where:

K_c = 0.1 for a gentle contraction

K_c = 0.5 for a sudden contraction

8. Check the energy equation for balance using Equation 8-12 and Equation 8-13.

Equation 8-12

$$L = z_2 + y_2 + \alpha_1 \frac{v_2^2}{2g}$$

Equation 8-13

$$R = z_1 + y_1 + \alpha_1 \frac{v_1^2}{2g} + h_f + h_e + h_c$$

The following considerations apply:

- if L=R within a reasonable tolerance, then the assumed depth at Section 1 is okay. This will be the calculated water surface depth at Section 1; proceed to step (9)
- if L≠R, go back to step (3) using a different assumed depth.

9. Determine the critical depth (d_c) at the cross section and find the uniform depth (d_u) by iteration. If, when running a supercritical profile, the results indicate that critical depth is greater than uniform depth, then it is possible the profile at that cross section is supercritical. For sub-critical flow, the process is similar but the calculations must begin at the upstream section and proceed downstream.
10. Assign the calculated depth from step (8) as the downstream elevation (Section 1) and the next section upstream as Section 2, and repeat steps (2) through (10).
11. Repeat these steps until all of the sections along the reach have been addressed.

8.8 Supercritical Flow

The Froude Number provides a relationship between flow velocity and the hydraulic depth of flow, and gravitational action, and shall be calculated for all channel improvements designs. Subcritical flow conditions occur when the Froude Number is less than 1.0 and supercritical flow conditions exist in lined channels when the Froude Number exceeds 1.0.

If a channel's normal depth is supercritical, its alternate depth is a deeper subcritical depth. Obstructions that may enter a stream during a storm event may cause supercritical flows to experience a hydraulic jump and become subcritical flows. When it is calculated that supercritical conditions could occur for the design storm, the depth of the channel must be at least the alternate depth plus the required freeboard. Adequate protection of the channel must be provided to protect against supercritical flow.

Subcritical flow conditions are recommended for all channel designs, as supercritical flow tends to have high velocities and high potential for channel erosion. Supercritical flow conditions will not be allowed in channels with a vegetative lining. Subcritical flow conditions may be achieved by using energy dissipators in areas where the existing topography will not allow subcritical flow conditions to occur

naturally. In all cases, the channel improvements shall be designed to avoid the unstable transitional flow conditions that occur when the Froude Number is between 0.9 and 1.1.

8.9 Flow in Bends

Adequate freeboard must be provided for a channel, ditch and swales as shown in Table 2-2. Flow around a bend in an open channel induces centrifugal forces because of the change in flow direction. This results in a superelevation of the water surface at the outside of bends and can cause the flow to splash over the side of the channel if adequate freeboard is not provided. This superelevation can be estimated by equation using Equation 8-14 from HEC-15.

Equation 8-14

$$\Delta H = \frac{V^2 T}{g R_c}$$

Where:

ΔH = Difference in water surface elevation between the inner and outer banks of the channel in the bend, (ft)
V = Average velocity (fps)
T = Surface width of the channel (ft)
Rc = Radius to the centerline of the channel (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Equation 8-14 is valid for subcritical flow conditions. The elevation of the water surface at the outer channel bank will be Δd/2 higher than the centerline water surface elevation (the average water surface elevation immediately before the bend) and the elevation of the water surface at the inner channel bank will be Δd/2 lower than the centerline water surface elevation.

Flow around a channel bend also imposes higher shear stress on the channel bottom and banks and may impact channel stability. Refer to *HEC 15* for further guidance if shear stress around a channel bend is anticipated to cause channel erosion.

8.10 Shear Stress

Shear stress shall be computed for all open channels and adequate protection shall be provided based on the tractive force method described in *HEC 15* and the permissible shear stresses reported in the *TxDOT HDM*.

A. The hydrodynamic force of water flowing in a channel is known as the tractive force. The basis for stable channel design with flexible lining materials is that flow-induced tractive force should not exceed the permissible or critical shear stress of the lining materials. In a uniform flow, the tractive force is equal to the effective component of the drag force acting on the body of water, parallel to the channel bottom [10]. The mean boundary shear stress applied to the wetted perimeter is computed with Equation 8-15.

Equation 8-15

$$\tau = \gamma RS$$

Where:
τ_o = mean boundary shear stress (lb/ft^2)
γ = unit weight of water (62.4 lb/ft^3)
R = hydraulic radius (ft)
S_o = average bottom slope (equal to energy slope for uniform flow) (ft/ft).

B. The maximum shear stress on a channel bottom, τ_d, and on the channel side, τ_s, in a straight channel depends on the channel shape. To simplify the design process, the maximum channel bottom shear stress is computed with Equation 8-16.

Equation 8-16

$$\tau = \gamma dS$$

Where:
τ_d = shear stress in channel at maximum depth (lb/ft^2)

d = maximum depth of flow in the channel for the design discharge (ft).

C. Determine channel lining or protection needed. Calculate uniform flow depth (y_m in ft or m) at design discharge using the Slope Conveyance Method. Compute maximum shear stress at normal depth using Equation 8-16. Select a lining and determine the permissible shear stress (in lbs/ft^2 or N/m^2) using Table 8-3 and Table 8-4. If $\tau_d < \tau_p$, then the lining is acceptable.

Table 8-3: Retardation Class for Lining Materials

Retardance Class	Cover	Condition
A	Weeping Lovegrass	Excellent stand, tall (average 30 in. or 760 mm)
	Yellow Bluestem Ischaemum	Excellent stand, tall (average 36 in. or 915 mm)
B	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (average 12 in. or 305 mm)
	Native grass mixture little bluestem, bluestem, blue gamma, other short and long stem medwest grasses	Good stand, unmowed
	Weeping Lovegrass	Good Stand, tall (average 24 in. or 610 mm)
	Lespedeza sericea	Good stand, not woody, tall (average 19 in. or 480 mm)
	Alfalfa	Good stand, uncut (average 11 in or 280 mm)
	Weeping lovegrass	Good stand, unmowed (average 13 in. or 330 mm)
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut (average 13 in. or 330 mm)
C	Crabgrass	Fair stand, uncut (10-to-48 in. or 55-to-1220 mm)
	Bermuda grass	Good stand, mowed (average 6 in. or 150 mm)
	Common lespedeza	Good stand, uncut (average 11 in. or 280 mm)
	Grass-legume mixture: summer (orchard grass redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (6-8 in. or 150-200 mm)
	Centipedegrass	Very dense cover (average 6 in. or 150 mm)
	Kentucky bluegrass	Good stand, headed (6-12 in. or 150-305 mm)
D	Bermuda grass	Good stand, cut to 2.5 in. or 65 mm
	Common lespedeza	Excellent stand, uncut (average 4.5 in. or 115 mm)
	Buffalo grass	Good stand, uncut (3-6 in. or 75-150 mm)
	Grass-legume mixture: fall, spring (orchard grass Italian ryegrass, and common lespedeza	Good Stand, uncut (4-5 in. or 100-125 mm)
	Lespedeza sericea	After cutting to 2 in. or 50 mm (very good before cutting)
E	Bermuda grass	Good stand, cut to 1.5 in. or 40 mm
	Bermuda grass	Burned stubble
Source: *TxDOT HDM* [4]		

Table 8-4: Permissible Shear Stresses for Various Linings

Protective Cover	(lb./sq.ft.)	tp (N/m2)
Retardance Class A Vegetation (See the "Retardation Class for Lining Materials" table above)	3.7	177
Retardance Class B Vegetation (See the "Retardation Class for Lining Materials" table above)	2.1	101
Retardance Class C Vegetation (See the "Retardation Class for Lining Materials" table above)	1	48
Retardance Class D Vegetation (See the "Retardation Class for Lining Materials" table above)	0.6	29
Retardance Class E Vegetation (See the "Retardation Class for Lining Materials" table above)	0.35	17
Woven Paper	0.15	7
Jute Net	0.45	22
Single Fiberglass	0.6	29
Double Fiberglass	0.85	41
Straw W/Net	1.45	69
Curled Wood Mat	1.55	74
Synthetic Mat	2	96
Gravel, D50 = 1 in. or 25 mm	0.4	19
Gravel, D50 = 2 in. or 50 mm	0.8	38
Rock, D50 = 6 in. or 150 mm	2.5	120
Rock, D50 = 12 in. or 300 mm 6-in. or 50-mm Gabions	5 35	239 1675
4-in. or 100-mm Geoweb	10	479
Soil Cement (8% cement)	>45	>2154
Dycel w/out Grass	>7	>335
Petraflex w/out Grass	>32	>1532
Armorflex w/out Grass	20-Dec	574-957
Erikamat w/3-in or 75-mm Asphalt	13-16	622-766
Erikamat w/1-in. or 25 mm Asphalt	<5	<239
Armorflex Class 30 with longitudinal and lateral cables, no grass	>34	>1628
Dycel 100, longitudinal cables, cells filled with mortar	<12	<574
Concrete construction blocks, granular filter underlayer	>20	>957
Wedge-shaped blocks with drainage slot	>25	>1197
Source: *TxDOT HDM* [4]		

8.11 Drop Structures

The function of a drop structure is to reduce flow velocities by dissipating some of the kinetic energy of the flow at the drop structure, and also providing flatter channel slopes upstream and downstream of the drop structure. Sloping channel drops and vertical channel drops are two commonly used drop structure types.

An apron shall be designed and constructed immediately upstream and downstream of a drop structure to protect against turbulence and prevent scour. Unless an alternative is approved by the City Engineer, the upstream apron shall extend at least ten feet upstream from the point where flow becomes supercritical, and the downstream apron shall be extended downstream from the anticipated location of

the hydraulic jump by the minimum distance listed in Table 8-5. Each end shall include a concrete toe that extends a minimum of twenty-four inches into the ground.

Table 8-5: Minimum Lengths of Downstream Aprons beyond Hydraulic Jumps

Discharge Rate per Unit Width of Apron (cfs/ft)	Minimum Distance to extend Downstream Apron beyond the Hydraulic Jump (ft)
0-14	10
15	15
20	20
25	23
30	25

All drop structures shall be constructed of reinforced concrete, and the bottom and walls (if any) shall have a minimum thickness of six inches. To facilitate maintenance, drop structures should be located near bridges or culverts if possible.

8.11.1 Vertical Drop Structures

The drop length and the hydraulic jump length of the drop structure should be calculated to determine the length of the downstream apron required to prevent erosion [8] [11]. In order to utilize a vertical drop structure vehicular access must be provided to both the upstream and downstream ends of the structures.

8.11.2 Sloping Drop Structures

The location of the hydraulic jump should be determined based on the upstream and downstream flow depths and channel slopes [8] [11]. When utilizing a sloping drop structure, a minimum slope of 6:1 shall be used to allow vehicular access from one end across the structure. If the slope of the drop structure is less than 6:1, vehicular access must be provided to both the upstream and downstream ends of the structures.

8.12 Energy Dissipators

Although hydraulic jumps can be used as energy dissipators, impact dissipators are recommended for their predictability, efficiency, and economy. The Baffled Apron is used to dissipate the energy in the flow at a drop. It requires no initial tailwater to be effective, although scour is reduced with tailwater. The chute of the Baffle Apron is constructed on a 2:1 or flatter slope extending below the channel bottom. Refer to *Hydraulic Engineering Circular 14: Energy Dissipators (HEC 14)* [12] for methods to design energy dissipators.

This page intentionally left blank.

9 Bridges and Culverts

9.1 General Requirements

A bridge is defined as a structure, including supports, erected over a depression or an obstruction (e.g., water, highway or railway) having a roadway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between faces of abutments, spring lines of arches, or extreme ends of openings for multiple box culverts. Culverts convey surface water through a roadway embankment or away from the roadway right-of-way or into a channel along the right-of-way.

A. Bridges and culverts shall be designed to withstand the 100-year design storm.
B. Bridges and culverts on arterial streets and parkways shall meet the following requirements:
    1. 50-year design storm runoff with headwater one foot below the top of the culvert structure.
    2. 100-year water surface shall not encroach through half of roadway lanes.
    3. Minimum culvert size of a 24-inch circular pipe or equivalent for alternate shapes.
C. Bridges and culverts on all other streets shall meet the following requirements:
    1. 25-year design storm runoff with headwater one foot below the top embankment.
    2. 25-year water surface shall leave at least one lane open.
    3. 50-year design storm runoff no more than 6 inches over top of roadway.
    4. Allowance shall be made for conveyance of the 100-year runoff across the road and into the downstream channel without damage to the road or adjacent property.
    5. Minimum culvert size of an 18-inch circular pipe or equivalent for alternate shapes.
D. Temporary crossings shall be designed to safely pass the 2-year design storm runoff.
E. The backwater created by a culvert or bridge during the 100-year design storm runoff shall not cause damage to public or private property.
F. Culvert outlets shall be designed to minimize damage caused by erosion.
G. Culverts and bridges shall be aligned with natural drainage ways in grade and direction whenever practical. Culverts shall have a minimum design storm velocity of 2.5 feet per second for the 2-year storm to reduce sediment accumulation.
H. Larger culvert sizes, bridges, box culverts, and/or smooth-walled pipes are recommended for crossings where heavy debris or sediment accumulations are anticipated. Trash racks may be required.
I. All headwalls shall be constructed of reinforced concrete.
J. Plastic pipe is prohibited for use as a culvert pipe material in the public right-of-way.
K. Corrugated metal pipe will not be allowed in the public right-of-way except beneath driveways.

9.2 Bridge Design Criteria

Design criteria for all bridges shall be on a case-by-case basis as determined by the City Engineer.

9.3 Culvert Design Criteria

A. Headwalls and necessary erosion protection shall be provided at all culverts and shall comply with TxDOT standard details. All culverts and bridges are to be analyzed at both the design flow and 100-year check flow.

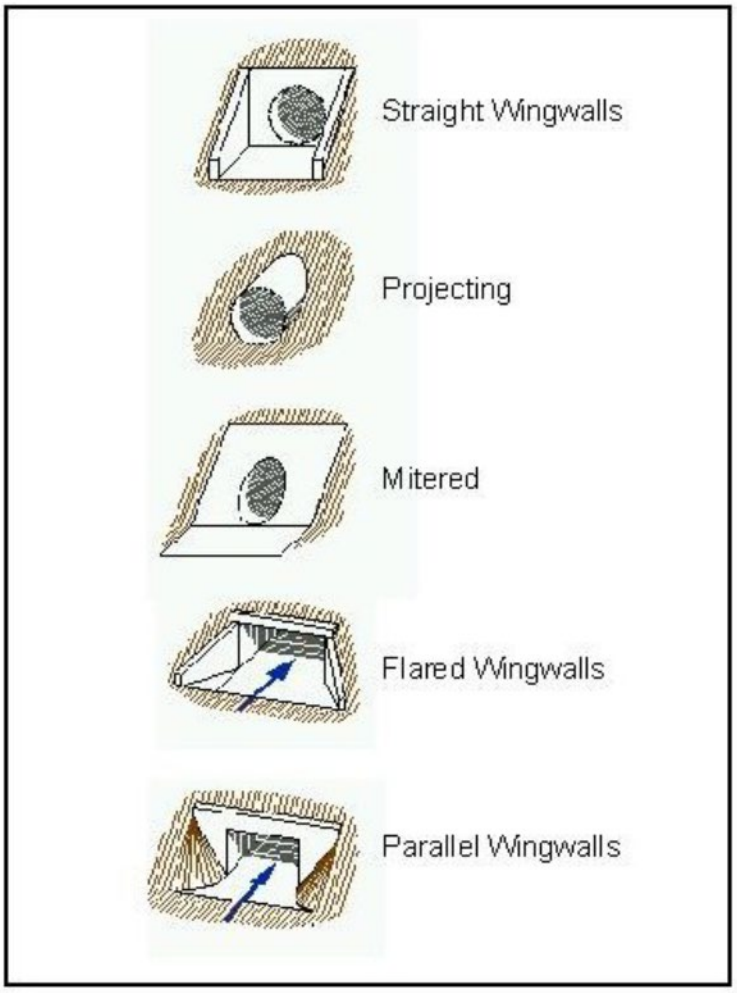
B. Alignment, location and grade of proposed culverts must be consistent with planned development of the drainage system for that watershed. In the event the particular watershed or waterway is not covered by a planned storm drainage system, the designer should proceed with the design from the nearest downstream control (i.e. bridge, culvert dam, etc.) and design the proposed drainage system improvements anticipating future system expansion due to fully developed watershed conditions.

C. Wingwalls, if used, may be either straight parallel, flared, or tapered. Approach and discharge aprons shall be provided for all culvert headwall designs. Precast headwalls and end walls may be used if all other criteria are satisfied.

9.4 Culvert End Treatments

Figure 9-1 shows sketches of various end treatment types. The TxDOT Bridge Division maintains standard details of culvert end treatments. Safety End Treatment (SET) of a culvert provides a method of mitigating a less safe condition with-out interfering with the hydraulic function of the culvert. SETs such as those used with driveway and other small diameter culverts may be more hydraulically efficient by providing both tapered wingwalls and a beveled edge instead of using a mitered section. SETs for larger culverts that are not protected by a railing or guard fence use pipe runners arranged either horizontally or vertically.

Figure 9-1: Typical Culvert End Treatments



Source: *TxDOT HDM* [4]

The pipes of pipe runner SETs have been proven to be within the tolerance of the entrance loss equations. Therefore, the entrance should be evaluated solely for its shape and the effect of the pipes should be ignored.

9.5 Culvert Hydraulics

The hydraulic design of culverts shall be based upon design guidelines set forth by TxDOT, the U.S. Department of Transportation, or other suitable material as approved by the City Engineer. Computer programs such as FHWA's "HY-8" may be used, provided that the design engineer provides output tables showing models results and input data.

Values of entrance loss coefficients (C_e) are shown in Table 9-1 based on culvert shape and entrance condition.

Table 9-1: Entrance Loss Coefficients

Concrete Pipe	Ce
Projecting from fill, socket end (groove end)	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls:	-
• Socket end of pipe (groove end)	0.2
• Square-edge	0.5
• Rounded (radius 1/12 D)	0.2
Mitered to conform to fill slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Corrugated Metal Pipe or Pipe Arch	-
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Reinforced Concrete Box	-
Headwall parallel to embankment (no wingwalls):	-
• Square-edged on 3 edges	0.5
• Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30º to 75º to barrel:	-
• Square-edged at crown	0.4
• Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10º to 25º to barrel: square-edged at crown	0.5
Wingwalls parallel (extension of sides): square-edged at crown	0.7
Side- or slope-tapered inlet	0.2
Source: *TxDOT HDM* [4]	

There are two categories of flow through culverts: inlet control and outlet control.

1. **Inlet Control.** The flow is controlled by the cross-sectional area of the culvert, inlet configuration, and headwater depth. Slope, roughness and length of culvert are of no importance. Nomographs are available for inlet control estimations as proved in Hydraulic Design of Highway Culverts [13].
2. **Outlet control.** The flow is controlled by the cross-section area of the culvert, inlet configuration, and headwater depth and, slope, roughness and length of culvert. Culverts will be outlet controlled if the culvert slope is relatively flat, the tailwater sufficiently deep or the culvert is quite long. It is also possible, where the water enters the culvert under inlet control, but the culvert slope or tailwater conditions cause a hydraulic jump near the outlet. This situation should be avoided because damage can occur to the culvert pipe. Unstable conditions are most likely when the culvert is placed at a near-critical slope.

The design engineer shall calculate both outlet and inlet control conditions and use the more conservative of the two as the design condition.

9.6 Debris Fins

For conditions where more than one box culvert is required, the upstream face of the structure may incorporate debris deflector fins to prevent debris buildup. For multiple-pipe, or single box in critical situations, installations of debris fins may be used but are not required unless the Engineering Division requires upon review of the design situation. The engineer of record should analyze the situation for the applicability of debris fins.

The debris fin is an extension of the interior walls of a multiple-box culvert. The wall thickness shall be designed to satisfy structural requirements and reduce impact and turbulence to the flow.

A debris fin is constructed to the height of the culvert with a fin length of one and one-half times the height of the box culvert. Since the debris fins are subject to the same erosive forces as bridge piers, care must be taken in the design of the footing. A reinforced toewall at the upstream end of the debris fin and the apron is required. The reinforced toewall shall include a toe that extends a minimum of twenty-four inches into the ground.

9.7 Culvert Outlet Protection

High discharge velocities from culverts can cause eddies or other turbulence which could damage unprotected downstream channel banks and roadway embankments. To prevent damage from scour and erosion in these conditions, culvert outlet protection is needed. The outlet protection should extend downstream to a point where non-erosive channel velocities or shear stress are established in accordance with **Section 8.10** of this manual. The outlet protection should be placed sufficiently high on the adjacent banks to extend 1’ above the design WSEL. All outlet protection shall be designed with an appropriate toe depth. All toes shall be no less than twenty-four inches.

9.8 Energy Dissipation

Design of riprap stone protection shall be done in accordance to *HEC 22*. Design of concrete baffles and stilling basins shall be done in accordance with *HEC 14*.

This page intentionally left blank.

10 Detention and Retention Facilities

10.1 General Requirements

Detention is the storage of runoff for a controlled release during or immediately following a design storm. Retention is an artificial pond with used for flood protection, water quality or aesthetic improvement.

A. The method(s) of retention or detention shall be appropriate to the type of development, topography, and amount of control needed. Examples of methods include, but are not limited to, the following:
   1. Basins or swales – single or multiple
   2. Check dams in gullies to slow runoff and trap sediment
   3. Leach fields, infiltration chambers, dry wells, rain barrels, French drains
   4. Granular fill under permeable paving blocks
   5. Contour terracing, improved vegetation cover
B. Parking areas may be used as detention facilities provided that maximum depths of ponding do not exceed eight inches, and ponding is in the areas most remotely situated from structures.
C. Stormwater infiltration systems are not permitted for mitigation in any development where there is a potential for pollutants to adversely affect ground water quality (e.g. Edwards Aquifer Recharge Zone).
D. No detention or retention basin shall retain standing water longer than 36 hours unless it is designed and constructed to be a permanent pond with appropriate health, safety and water quality measures. Permanent ponds must comply with all applicable water rights requirements for such a body of water.
E. Detention basins to be excavated shall provide positive drainage through the pond. A concrete pilot channel shall be provided to convey runoff from entry points of concentrated flow into the pond to the outlet structure of the pond during low flow conditions. The minimum longitudinal slope of the concrete pilot channel shall be 0.25% and the minimum slope to the pilot channel shall be 0.5%. Erosion protection must be provided adjacent to the pilot channel to prevent undermining of the pilot channel due to scour.
F. Facilities shall be located such that the edge of the 100-year water surface is at least 10 feet from the pavement edge of any public road. Finished floors of adjacent structures should be a minimum of 1 foot above the 100-year water surface in the facility. Facilities should preferably be located such that the invert of the outlet structure is above the 100-year flood level in the receiving body; but in all cases facilities shall be designed to function properly during conditions where the outlet is submerged by the tailwater of the receiving stream.
G. Drainage easements are required for retention/detention facilities. Easement boundaries shall contain the berms, inlet and outlet structures, access ramps, permanent erosion control facilities, the 100-year water surface and any additional area needed for access and maintenance.
H. Ponding below natural grade (depressed storage) is allowed.

I. Detention facilities shall be designed with one or more outlet structures to allow safe passage of the 100-year post-development design storm runoff. If an overflow weir is not incorporated into the design of the outlet structure, then an emergency overflow weir or spillway shall be provided with sufficient capacity to pass at least the 25-year design storm runoff, assuming the pond is full and the discharge pipe in the outfall structure is 100% clogged. At minimum, the emergency overflow weir should engage when ponding exceeds the 100-year water surface elevation.

J. Weirs, spillways and outlets shall be protected from erosion with riprap, grouted riprap, or other method of erosion control to adequately protect the structure and downstream channel. Outflows shall be conveyed within proposed property limits to an appropriate receiving drainage facility in a manner such that roadways, private property, buildings, etc. are not damaged.

K. Best management practices shall be used in the event a detention facility empties into another storage facility downstream. The timing of the hydrograph from the detention facility shall be checked against the timing of the receiving storage facility to prevent any increase in the flow rate from the downstream facility.

L. Side slopes of earthen embankments shall be designed for stability and safety, with the following minimum requirements for facilities with unrestricted access: side slopes of earthen banks shall be 3:1 or flatter; a benched configuration is required for facilities with ponding depths over 6 feet. Bench widths shall be at least 4 feet, spaced at least every 3 feet vertically. The above slope criteria may be waived if security barriers are provided. Barriers may consist of chain-link, masonry, wood, vegetation or other materials, but must not restrict the hydraulic capacity of drainage facilities. Minimum barrier height is 48". Vegetative barriers must be of a width equal to or greater than the greatest interior embankment height/depth, with density sufficient to restrict access. All constructed stormwater structures of earthen material shall be re-vegetated to mature growth.

M. Maximum water depths over 6 feet shall not be allowed. In cases where design limitations require excess depths, due hardship shall be presented for consideration to the Engineering Division, consideration for exception approval will require additional safety measures of the design. Additional safety measures can include but shall not be limited to:
    a. Fencing,
    b. Benching,
    c. And/or other forms of access restriction.

N. Any detention facility that is classified as a dam by the State of Texas shall conform to the more stringent of rules listed in this manual or the dam safety rules adopted by the State of Texas.

O. Earthen embankments of a height greater than 3 feet used to impound a required detention volume must have a minimum top-width of 4 feet, shall contain a non-permeable core, and shall be based on a geotechnical investigation for the site. Compaction of all earthen drainage structures shall be to 90% standard proctor.

P. A maintenance ramp shall be provided for vehicular access in detention basin design for periodic de-silting and debris removal. The slope of the ramp shall not exceed 6:1 and the minimum width shall be 12 feet.

Q. Basins with permanent storage must include dewatering facilities to provide for maintenance.

R. The design of detention facilities shall include provisions for collecting and removing sediment deposited after collecting and releasing stormwater.

S. Detention ponds and reservoirs shall provide at least 1-foot of freeboard for the 100-year storm event measured from top of berm to the 100-year water surface elevation of the pond.

10.2 Design Criteria

A. Stormwater detention basins are used to temporarily impound (detain) excess stormwater, thereby reducing peak discharge rates.
B. All detention ponds are to be designed to prevent an increase in flow to the existing 2, 10, 25, 50, and 100-year peak runoff leaving a proposed site.
C. Detention ponds will be sized using the NRCS synthetic hydrograph as outlined in **Section 4** of this manual.

10.3 Outlet Structure Design

A. Multi-level outlet structures may be necessary to reduce the 2, 10, 25, 50, and 100-year developed design storm runoff to pre-development levels. See publication *Stormwater Detention Outlet Control Structures* [14] for further outlet design and construction guidance not presented below.
B. Documentation on retention or detention structures should include design hydrographs, calculation of stage-storage-discharge tables, drawings of the basin, spillway, weir and outlet size and location, and erosion control measures.
C. Development of a composite stage-discharge curve requires consideration of the discharge rating relationships for each component of the outlet structure. The following sections are design relationships for typical outlet controls summarized from *HEC 22*.

10.3.1 Orifices

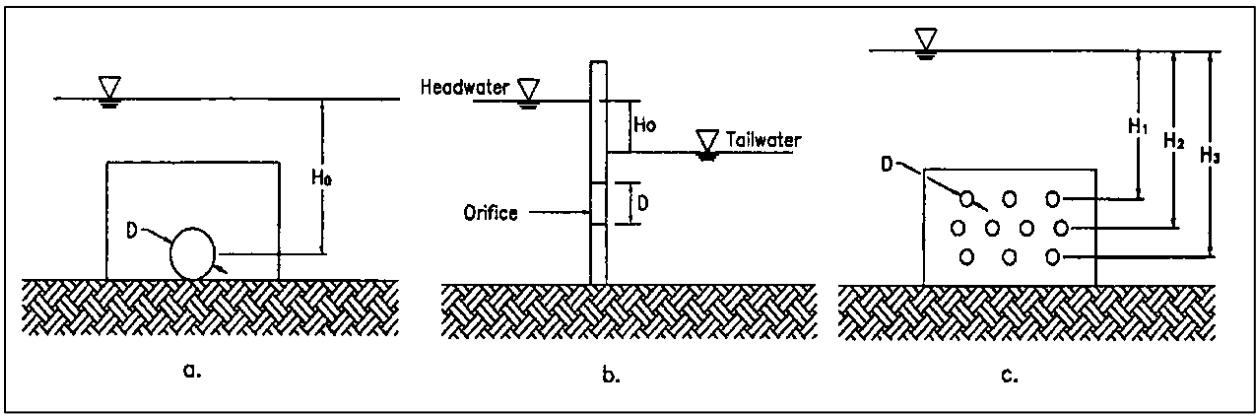
For a single orifice as illustrated in Figure 10-1 (a), orifice flow can be determined using Equation 10-1.

Equation 10-1

$$Q = C_o A_o (2gH_o)^{0.5}$$

Where:
Q = Orifice flow rate (cfs)
C_o = Discharge coefficient 0.40 – 0.60
A_o = Area of orifice (ft^2)
H_o = Effective head on the orifice measured from the centroid of the opening (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Figure 10-1: Definition Sketch for Orifice Flow



Source: *HEC 22* [5]

If the orifice discharges as a free outfall, then the effective head is measured from the centerline of the orifice to the upstream water surface elevation. If the orifice discharge is submerged, then the effective head is the difference in elevation of the upstream and downstream water surfaces. This latter condition of a submerged discharge is shown in Figure 10-1(b).

For square-edged, uniform orifice entrance conditions, a discharge coefficient of 0.6 should be used. For ragged edged orifices, such as those resulting from the use of an acetylene torch to cut orifice openings in corrugated pipe, a value of 0.4 should be used.

For circular orifices with C_o set equal to 0.6, the following equation results:

Equation 10-2

$$Q = K_{or} D^2 H_o^{0.50}$$

Where:

K_{or} = 3.78 (English units)
D = Orifice diameter (ft).

Pipes smaller than 1 foot in diameter may be analyzed as a submerged orifice as long as H_o/D is greater than 1.5. Pipes greater than 1 foot in diameter should be analyzed as a discharge pipe with headwater and tailwater effects taken into account, not just as an orifice.

Flow through multiple orifices (see Figure 10-1 (c)) can be computed by summing the flow through individual orifices. For multiple orifices of the same size and under the influence of the same effective head, the total flow can be determined by multiplying the discharge for a single orifice by the number of openings.

10.3.2 Weirs

Relationships for sharp-crested, broad-crested, V-notch, and proportional weirs are provided in the following sections.

10.3.2.1 Sharp Crested Weirs

Typical sharp crested weirs are illustrated in Figure 10-2. Equation 10-3 provides the discharge relationship for sharp crested weirs with no end contractions (illustrated in Figure 10-2 (a)).

Equation 10-3

$$Q = C_{scw} L H^{1.5}$$

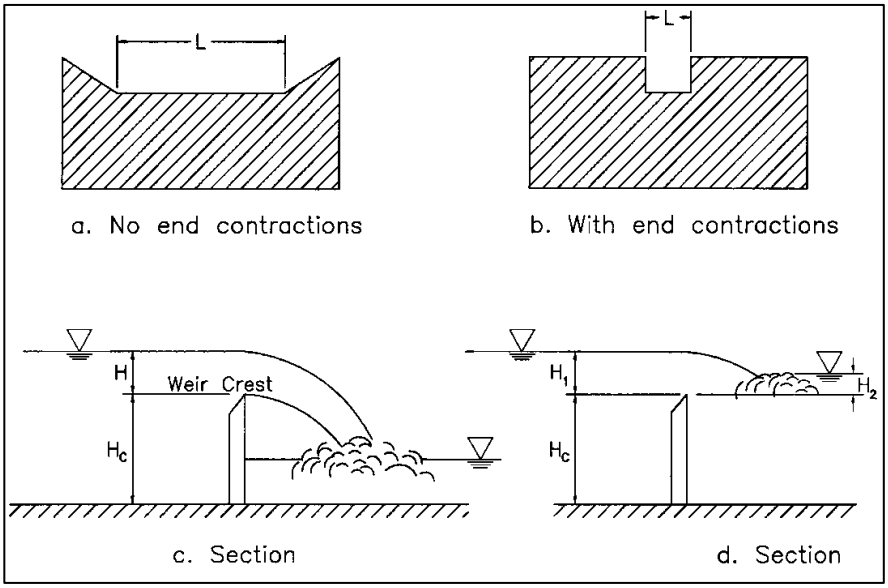
Where:
Q = Discharge (cfs)
L = Horizontal weir length (ft)
H = Head above weir crest excluding velocity head (ft)

$C_{SCW} = 3.27 + 0.4\ (H/H_C)$.

As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/H_c (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Equation 10-4 provides the discharge equation for sharp-crested weirs with end contractions (illustrated in Figure 10-2 (b)). As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/Hc (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Figure 10-2: Sharp Crested Weirs



Source: *HEC 22* [5]

Equation 10-4

$$Q = C_{scw}(L - 0.2H)H^{1.5}$$

Sharp crested weirs will be effected by submergence when the tailwater rises above the weir crest elevation, as shown in Figure 10-2 (d). The result will be that the discharge over the weir will be reduced. The discharge equation for a submerged sharp-crested weir is:

Equation 10-5

$$Q_s = Q_r\left(1 - \left({}^{H_2}/_{H_1}\right)^{1.5}\right)^{0.385}$$

Where:
Qs = Submerged flow (cfs)
Qr = Unsubmerged weir flow from Equation 10 3 or Equation 10 4 (cfs)
H1 = Upstream head above crest (ft)
H2 = Downstream head above crest (ft).

Flow over the top edge of a riser pipe is typically treated as flow over a sharp crested weir with no end constrictions. Equation 10-3 should be used for this case.

10.3.2.2 Broad-Crested Weir

The equation typically used for a broad-crested weir is:

Equation 10-6

$$Q = C_{BCW}LH^{1.5}$$

Where:

Q = Discharge, (ft^3/s)
C_{BCW} = Broad-crested weir coefficient, 2.34 to 3.32 (English units)
L = Broad-Crested weir length, (ft)
H = Head above weir crest (ft).

If the upstream edge of a broad-crested weir is so rounded as to prevent contraction and if the slope of the crest is as great as the loss of head due to friction, flow will pass through critical depth at the weir crest; this gives the maximum C value of 3.09 (in English units). For sharp corners on the broad crested weir, a minimum value of 2.62 (in English units) should be used. Additional information on C values as a function of weir crest breadth and head is given in Table 10-1.

Table 10-1: English Units-Broad-Crested Weir Coefficient C Values as a Function of Weir Crest

Broad-Crested Weir Coefficient C Values as a Function of Weir Crest Breadth and Head (coefficient has units of ft 0.5/sec)[1]											
Head[2](ft)	Breadth of Crest of Weir (ft)										
	0.5	0.75	1	1.5	2	2.5	3	4	5	10	15
0.2	2.8	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.8	2.72	2.64	2.61	2.6	2.58	2.54	2.5	2.56	2.7
0.6	3.08	2.89	2.75	2.64	2.61	2.6	2.68	2.69	2.7	2.7	2.7
0.8	3.3	3.04	2.85	2.68	2.6	2.6	2.67	2.68	2.68	2.69	2.64
1	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.2	3.08	2.86	2.7	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.2	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2	3.32	3.31	3.3	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3	3.32	3.32	3.32	3.32	3.2	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.7	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63
Source: Brater, E.F. and King, H.W., Handbook of Hydraulics, 6th ed., 1976 [15] Measured at least 2.5 Hc upstream of the weir											

10.3.2.3 V- Notch Weir

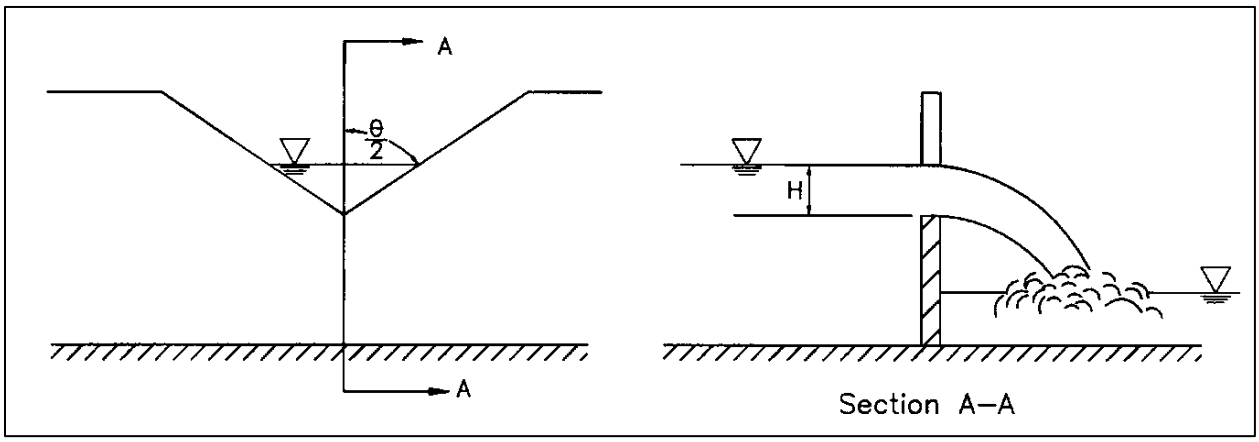
The discharge through a v-notch weir is shown in Figure 10-3 and can be calculated from the following equation:

Equation 10-7

$$Q = K_u[tan(\theta/2)]H^{2.5}$$

Where:
Q = Discharge (cfs)
θ = Angle of v-notch (degrees)
H = Head on apex of v-notch (ft)
Ku = 2.5 (English units).

Figure 10-3: V-Notch Weir



Source: *HEC 22* [5]

10.3.2.4 Proportional Weir

Although more complex to design and construct, a proportional weir may significantly reduce the required storage volume for a given site. The proportional weir is distinguished from other control devices by having a linear head-discharge relationship. This relationship is achieved by allowing the discharge area to vary nonlinearly with head. Design equations for proportional weirs are as follows: [16]

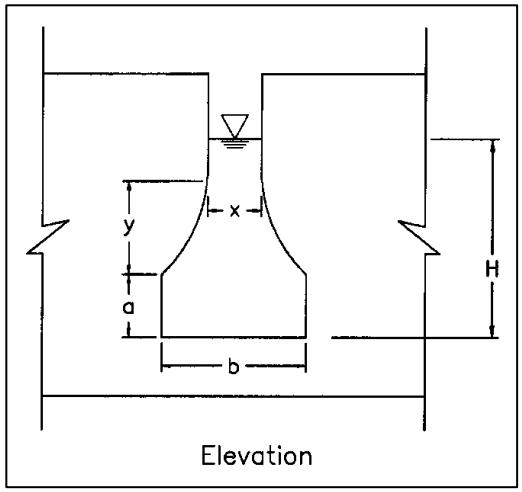
Equation 10-8

$$Q = K_u a^{0.5} b(H - a/3)$$

Where:
K_U = 4.96 (English units)
Q = Discharge (cfs)
H = Head above horizontal sill (ft).

Dimensions a, b, x, and y are shown in Figure 10-4.

Figure 10-4: Proportional Weir Dimensions



Source: *HEC 22* [5]

10.3.3 Discharge Pipes

Discharge pipes are often used as outlet structures for detention facilities. The design of these pipes can be for either single or multistage discharges. A single step discharge system would consist of a single culvert entrance system and would not be designed to carry emergency flows. A multistage inlet would involve the placement of a control structure at the inlet end of the pipe.

For single stage systems, the facility would be designed as if it were a simple culvert. Downstream boundary conditions are to be applied in the same manner as discussed in **Section 9** of this manual. A stage-discharge curve would be developed for the full range of flows that the structure would experience.

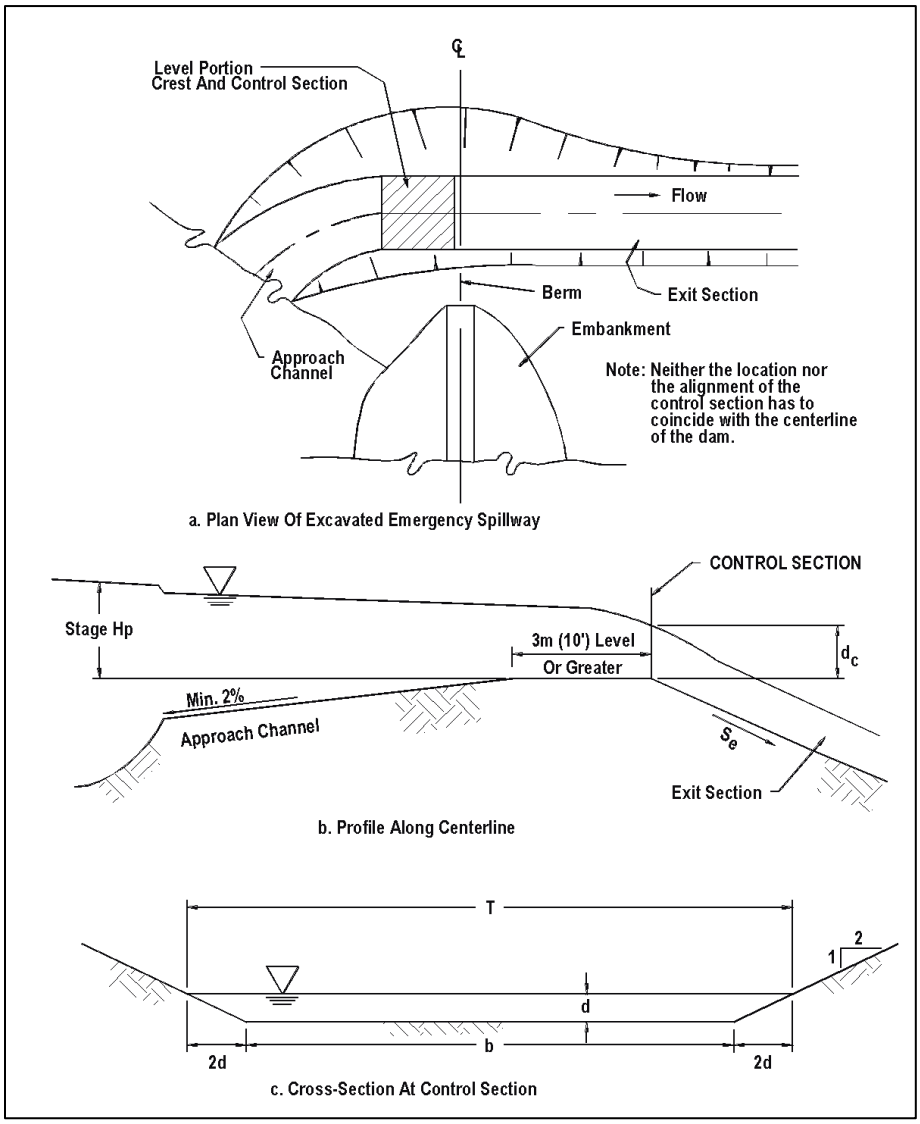
For multistage control structures, the inlet control structure would be designed considering the full range of flows. A stage-discharge curve would be developed for the full range of flows that the structure would experience. The design flows will typically be orifice flow through whatever shape the designer has chosen while the higher flows will typically be weir flow over the top of the control structure. Orifices can be designed using the equations in **Section 10.3.1** and weirs can be designed using the equations in **Section 10.3.2**. The pipe must be designed to carry all flows considered in the design of the control structure.

In designing a multistage structure, the designer would first develop peak discharges that must be passed through the facility. The second step would be to select a pipe that will pass the peak flow within the allowable headwater and develop a performance curve for the pipe. Thirdly, the designer would develop a stage-discharge curve for the inlet control structure, recognizing that the headwater for the discharge pipe will be the tailwater that needs to be considered in designing the inlet structure. Last, the designer would use the stage-discharge curve in the basin routing procedure.

10.3.4 Emergency Overflow Weirs

The purpose of an emergency overflow weir is to provide a controlled relief for storm flows in excess of the design discharge for the storage facility. An emergency overflow weir usually has a trapezoidal cross-section for ease of construction. Emergency overflow weirs that do not incorporate a spillway, comparable to the illustration in Figure 10-5, should be treated as a broad-crested weir. Spillway design should use the following equations.

Figure 10-5: Emergency Spillway Design Schematic



Source: *HEC 22* [5]

Equation 10-9 presents a relationship for computing the flow through a broad-crested emergency spillway. The dimensional terms in the equation are illustrated in Figure 10-5.

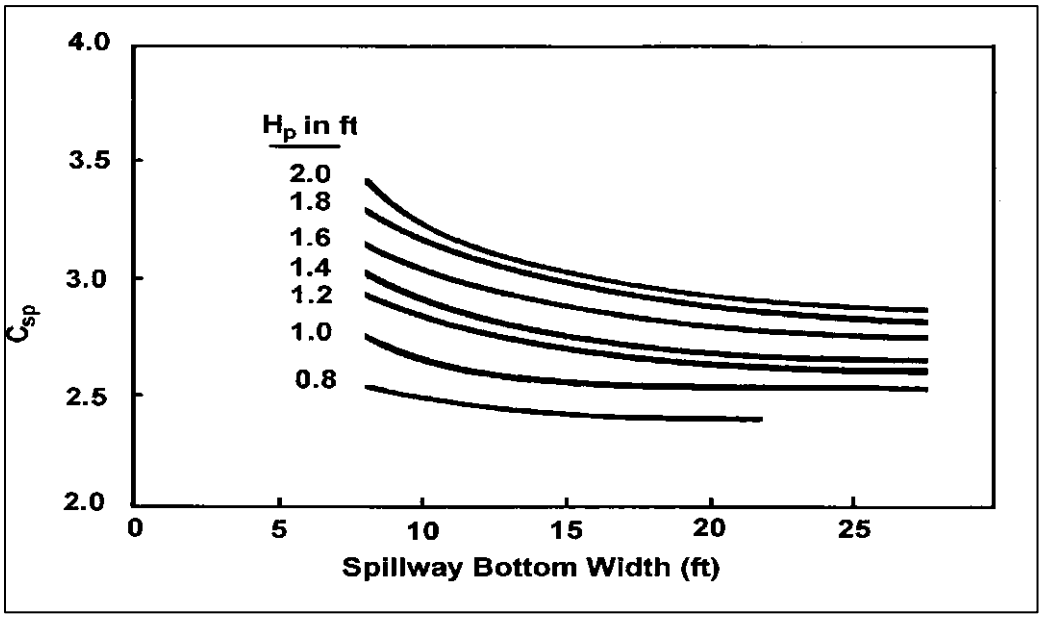
Equation 10-9

$$Q = C_{SP} b H_P{}^{1.5}$$

Where:
Q = Emergency spillway discharge (cfs)
C_{SP} = Discharge coefficient
b = Width of the emergency spillway (ft)
H_P = Effective head on the emergency spillway (ft).

The discharge coefficient, C_{SP}, in Equation 10-9 varies as a function of spillway bottom width and effective head. Figure 10-6 illustrates this relationship. Table 10-2 (modified from USDA, 1969) provides a tabulation of emergency spillway design parameters.

Figure 10-6: Discharge Coefficients for Emergency Spillways, English Units



Source: *HEC 22* [5]

The critical slopes of Table 10-2 are based upon an assumed n = 0.040 for turf cover of the spillway. For a paved spillway, the n should be assumed as 0.015. Equation 10-10 and Equation 10-11 can be used to compute the critical velocity and slope for spillway materials having other roughness values.

Equation 10-10

$$V_c = K_{SP}(Q/b)^{0.33}$$

Where:
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K_{SP} = 3.18 (English units).

Equation 10-11

$$S_c = K'_{SP} n^2 [(V_c b)/Q]^{0.33}$$

Where:
S_c = Critical slope (ft/ft)
n = Manning's coefficient
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K'_{SP} = 14.6 (English units).

Table 10-2: Emergency Spillway Design Parameters (English units)

H_p (ft)		Spillway Bottom Width, b, (ft)											
		8	10	12	14	16	18	20	22	24	26	28	30
0.8	Q	14	18	21	24	28	32	35	-	-	-	-	-
	V_c	3.6	3.6	3.6	3.7	3.7	3.7	3.7	-	-	-	-	-
	S_c	3.2	3.2	3.2	3.2	3.1	3.1	3.1	-	-	-	-	-
1	Q	22	26	31	36	41	46	51	56	61	66	70	75
	V_c	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2
	S_c	3	3	3	3	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
1.2	Q	31	37	44	50	56	63	70	76	82	88	95	101
	V_c	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.7	4.6	4.6	4.6	4.6
	S_c	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6
1.4	Q	40	48	56	65	73	81	90	98	105	113	122	131
	V_c	4.9	4.9	4.9	4.9	5	5	5	5	5	5	5	5
	S_c	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.6	Q	51	62	72	82	92	103	113	123	134	145	155	165
	V_c	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4
	S_c	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
1.8	Q	64	76	89	102	115	127	140	152	164	176	188	200
	V_c	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S_c	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
2	Q	78	91	106	122	137	152	167	181	196	211	225	240
	V_c	5.8	5.8	5.8	5.9	6	6	6	6	6	6	6	6
	S_c	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

NOTE:
1. For a given H_p, decreasing exit slope from S_c decreases spillway discharge, but increasing exit slope from S_c does not increase discharge.
2. If a slope S_e steeper than S_c is used, velocity V_e in the exit channel will increase according to the following relationship: $V_e = V_c(S_e/S_c)^{0.3}$
3. After Maryland SCS

Source: *HEC 22* [5]

This page intentionally left blank.

11 Lakes, Dams and Levees

11.1 Lakes and Dams

11.1.1 General Requirements

In the event that a property owner or developer desires to modify an existing pond or lake or desires to impound stormwater by filling or constructing an aboveground dam, thereby creating a lake, pond, lagoon or basin as part of the planned development of that property, the criteria listed below shall be met before city approval of the impoundment can be given. Ponds or lakes created by excavation of a channel area without erecting a dam above natural ground elevation or instream low water check dams are also subject to the criteria listed below, with the exception of spillway capacity requirements. The City Engineer has the final authority to determine the design criteria for a proposed dam, check dam or excavated lake. The dam safety requirements of the Texas Commission on Environmental Quality (TCEQ) and Federal Emergency Management Agency (FEMA) must also be met for the construction of dams, lakes, and other improvements.

11.1.2 Dam Design Criteria

A. The design criteria for a dam are dependent on the size and hazard classification of the dam. The size and hazard classification will be based on the recommended guidelines adopted by the TCEQ under Texas Water Code 12.052, which provides for the safe construction, maintenance, repair and removal of dams located in the State of Texas, and will be determined by the City Engineer based on information furnished by the owner. The following criteria will be used to classify a dam:
    1. Size. The classification for size is based on the height of the dam and storage capacity, whichever gives the larger size category. “Height” is defined as the distance between the top of the dam (minus the freeboard) and the existing streambed at the downstream toe. Storage is defined as the maximum water volume impounded at the top of the dam (minus the freeboard).
    2. Hazard potential. The hazard potential for a dam is based on the potential for loss of human life and property damage downstream from a dam in the event of failure. Hazard Potential Classifications are based on the potential for loss of life and for the extent of economic loss based on existing and potential development downstream of the dam.
    3. Spillway Design Flood. The classification of a dam based on the above criteria will be used to determine the Spillway Design Flood (SDF). The total capacity of a dam structure, including principal and emergency spillways, shall be adequate to pass the SDF without exceeding the top dam elevation. The SDF’s for various dam classifications are described by TCEQ Dam Safety Guidelines.
B. All design will be for the fully developed watershed contributing to the structure.
C. In all cases, the minimum principal spillway design capacity is a minimum of the 100-year design flood. In certain cases, a dam breach analysis may be required to determine the proper classification of the structure. For all structures requiring a spillway design flood equal to the Probable Maximum Flood (PMF), a dam breach analysis is required to determine the downstream consequences of a failure. All dams shall be constructed with a minimum freeboard of two feet

above SDF elevation and upstream development within the contour line determined by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.

D. Owners of significant and high hazard dams were required to submit an Emergency Action Plan in accordance with Title 30 Texas Administrative Code (TAC) Chapter 299, Dams and Reservoirs, §299.61(b).

11.1.3 Maintenance and Liability Criteria

The owner or developer shall retain their private ownership of the constructed lake, pond or lagoon or basin and shall assume full responsibility for the protection of the general public from any health or safety hazards related to the lake, pond or lagoon constructed. The owner or developer shall assume full responsibility for the maintenance of the lake, pond or lagoon or basin constructed. The owner or developer shall keep TCEQ advised of the currently responsible agent for this maintenance. All dams are required to be registered with TCEQ in accordance with the TCEQ Dam Safety Regulations.

11.1.4 Natural Resource Conservation Service Lakes

A. There are a number of NRCS (previously Soil Conservation Service) lakes within the City limits and extraterritorial jurisdiction of the City of New Braunfels. These lakes present complex issues of flood control, erosion control, maintenance, and floodplain management. These lakes were constructed to NRCS standards. The lakes are in private ownership, with maintenance provided by Comal County. Operation of the lakes is the responsibility of Comal County. The City of New Braunfels is responsible for floodplain management of those areas upstream, downstream and adjacent to the lakes. Operation and maintenance of the NRCS lakes shall remain the responsibility of others.

B. The City of New Braunfels shall control future development upstream, downstream and adjacent to all NRCS lakes. Planning for future development which impacts on, or is impacted by, NRCS lakes shall require that a detailed engineering study be performed to provide a technical basis for development and that the dam be upgraded as follows:

   1. Provide principal spillway capacity adequate to discharge the 100-year flood event based on fully developed watershed conditions.
   2. Provide total capacity of the dam structure, including principal and emergency spillways to accommodate the PMF.
   3. Manage existing flood storage capacity.
   4. Prohibit upstream development within the contour line determine by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.
   5. Restrict development and improvements within the floodplain established by a breach flow analysis from the dam to the downstream limits of the dam breach impact.

11.1.5 Additional Design Requirements

A. An engineering plan for such construction accomplished by complete drainage design information and sealed by a licensed professional engineer, shall be approved by the City of New Braunfels.

B. The spillway and any emergency overflow areas shall be located so that floodwaters will not inundate any permanent habitable structures.

C. The minimum SDF should be the 100-year, 24-hour storm regardless of critical inflow design storm peaks.
D. The design shall comply with all federal, state and county laws pertaining to the impoundment of surface water, including the design, construction, and safety of the impounding structure. Copies of any federal, state or county permits issued for proposed impoundments shall be submitted to the City Engineer.
E. Any existing NRCS structure or other dams which are included in the project drainage area shall comply with the applicable federal, state, county and city safety requirements for structures. Improvements may be required to upgrade the structure to the currently adopted guidelines. Before removing, enlarging or altering any existing lake, the applicant will furnish a study of the effects of the alteration upon flooding conditions both upstream and downstream. The study shall be prepared by a professional engineer and submitted to the City Engineer for approval prior to making the proposed alteration.
F. Any improvements to existing dams or lakes or construction of new impoundments shall be made at the expense of the developer, prior to completion of the adjacent street, utilities and drainage improvements, as provided for under the subdivision regulations.

11.2 Levees

In the event that developers or owners wish to build levees to protect an area from flooding, all applicable FEMA guidelines, State of Texas Dam Safety Guideline, and the following criteria apply:

A. Levees shall be designed to have freeboard requirements as specified by FEMA.
B. Levees shall be designed according to the Corps of Engineers' design criteria used for federally authorized levees, whether or not they are federally authorized.
C. Ring levees shall not be permitted.
D. If possible, provision shall be made to provide the permanent maintenance of levees either by a flood control district or similar governmental organization of by the existing property owner and all future owners, heirs or assigns, through the use of a maintenance agreement.
E. Levee systems shall be designed with interior drainage system to prevent flooding from local runoff contained within the system for the 100-year design flood.
F. Levee system shall have written operation procedures that address gate-closure conditions and an emergency warning plan. A copy of these procedures shall be furnished to the City Engineer.
G. Automated gate-closure systems shall have power from two independent sources and shall be capable of being operated manually.
H. All new levee systems shall have permanent positive closures to the required design elevation. Temporary closures involving sandbagging or other procedures requiring manual operations shall not be permitted.
I. Additional plan requirements including water surface profiles for the design flood and standard project flood; the top of the levee profile, definition of interior drainage facilities, including pump station and ponding areas; location of gravity outlets, gatewells and closure structures; and elevation-duration data on the receiving system.

This page intentionally left blank.

12 Site Erosion Control During Construction

12.1 Applicable Properties or Construction Sites

Private property owners, developers or builders shall be accountable for any erosion of their property or construction site which results in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties. Any accumulation or deposit of soil material beyond the limits of the property or in City streets, alleys or drainage facilities in an amount sufficient to constitute a threat to public safety and comfort as determined by the City Engineer shall constitute a violation. Sediment carried by stormwater runoff through these acres shall be prevented from entering storm drain systems and natural watercourses.

12.2 General Guidelines for Erosion Control Plan

A. Maximum use shall be made of vegetation to minimize soil loss. At a minimum, 70% established re-vegetation is required for residential subdivision developments that do not retain the natural vegetation. Vegetation measures should begin as soon as possible during construction in order to allow for establishment at construction termination.
B. Natural vegetation should be retained wherever possible.
C. Where inadequate natural vegetation exists or where it becomes necessary to remove existing natural vegetation, temporary controls should be installed promptly to minimize soil loss and ensure that erosion and sedimentation does not occur. The developer is responsible for maintenance of site erosion control devices until a sufficient vegetation cover has been provided or replaced as determined by the City Engineer. Periodic maintenance shall be performed by the developer to remove accumulated sediment that would otherwise inhibit the proper functioning of the erosion control devices. Storm Water Pollution Prevention Plans (SWPPP) are required to maintained on all permitted construction sites at all times.
D. During construction, erosion controls shall be used to slow drainage flow rate and prevent downstream sedimentation.
E. Erosion control elements should be implemented as soon as practical in the development process.
F. Waste or disposal areas and construction roads should be located and constructed in a manner that will minimize the amount of sediment entering streams.
G. Frequent fording of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of crossings of a stream are necessary.
H. When work areas or material sources are located in or adjacent to live streams, such areas shall be separated from the stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the sediment transport into a stream.
I. Should preventative measures fail to function effectively, the applicant shall act immediately to bring the erosion and/or siltation under control by whatever additional means are necessary.
J. Erosion control devices shall be placed to trap any losses from stockpiled topsoil. Some acceptable forms of site erosion control devices include, but are not limited to, silt fences, silt traps, geonetting and geotextiles. Hay bales are not permitted.

K. The selection and timing of the installation of erosion controls shall be based upon weather and seasonal conditions that could make certain controls not practicable.
L. Vegetation used for vegetative cover shall be suitable for local soil and weather conditions. Ground cover plants shall comply with listings from the Texas Agricultural Extension Service.
M. Runoff shall be diverted away from construction areas as much as possible.
N. Stripping of vegetation from project sites shall be phased so as to expose the minimum amount of area to soil erosion for the shortest possible period of time. Phasing shall also consider the varying requirements of an erosion control plan at different stages of construction and shall include the establishment of new vegetation or permanent erosion control measures.
O. Developers, builders, or owners of property shall install all utilities, including franchise utilities, before final acceptance of a subdivision, property and/or structure. Final acceptance will also be contingent upon having all necessary erosion control measures installed to minimize off-site sediment. At the discretion of the City Engineer; a site may be accepted without erosion control measures if perennial vegetative cover is actively growing.
P. SWPPP shall follow TCEQ rules.

12.3 Stream Bank Erosion

Erosion control will be provided along streams and drainage channels. Where bank stabilization or other erosion protection measures are required to protect streams and channels, the stream bank protection and erosion damage mitigation measures provided in this manual shall be utilized.

13 Water Quality Controls

13.1 Applicability

Permanent water quality controls for development located over Edwards Aquifer regulated zones shall comply with the latest Texas Commission on Environmental Quality (TCEQ) published rules and technical design guidance. Permanent water quality controls for new development outside of the Edwards Aquifer regulated zones shall meet the criteria in this manual if the following are met:

1. The development is located in the City's Jurisdiction; and,
2. The development is defined as Type 3; and,
3. The total impervious cover for the development will exceed 30% of the contiguous property as a result of the development.

13.2 Design Criteria

Permanent water quality best management practices (BMPs) shall be designed to provide adequate treatment of the water quality volume (WQV) in the City's Jurisdiction. The WQV is defined as the first one-half inch of runoff from all new impervious surfaces added to a site that does not replace existing impervious surfaces (Equation 13-1).

Equation 13-1

$$WQV\ (cubic\ feet) = \frac{0.5\ inches}{12\frac{inch}{foot}} \times (\ IC\ Area\ Post\ Construction - IC\ Area\ Pre\ Construction)(sq.ft.)$$

13.3 Treatment Methods

In order to provide adequate treatment, one of the following methods must be followed:

1. Detention Filtration: Detain the WQV in an earthen basin for at least 24 hours as described in this Section
2. Provide one or more BMPs that meet the requirements in TCEQ report publication RG-348 and/or subsequent addenda
3. Provide BMPs that are approved by the Engineering Division prior to submission of a development application.

The WQV may be reduced by applying for impervious cover credits and/or the use of Low Impact Development (LID) strategies. Impervious cover credits and LID strategies are defined in the City of New Braunfels LID Manual.

13.3.1 Detention Filtration

The following process determines detention filtration requirements:

1. Calculate the minimum extended detention volume using Equation 13-2. The water quality volume shall be increased by a safety factor of 20% to account for deposition of solids over time. A fixed vertical sediment depth marker shall be installed in the basin to indicate when sediment

accumulation meets or exceeds 20% of the water quality volume and sediment removal is required.

Equation 13-2

$$V = WQV * 1.2$$

2. The flow path from the inlet to the outlet of the extended detention basin should be twice as long as the width of the extended detention basin.
3. The 24-hour draw-down time should be achieved by installing the appropriate sized orifice on the outlet structure. No more than 50% of the extended detention volume shall drain from the facility within the first 12 hours. Outlet pipes shall be designed to prevent accumulated sediment from discharging from extended detention basin.
    a. If perforated pipe is used, then the size of the perforations should not be used for draw-down time design purposes, and a filter should be installed to prevent the perforations from clogging.
    b. If the discharge pipe extends through a concrete wall, then a sleeve is required in the wall, and a water proof sealant should be used to prevent leaks around the sleeve.
4. The extended detention basin may be installed offline from peak flow attenuating detention basins or incorporated into a detention basin

13.3.2 TCEQ Method

When a treatment method approved by TCEQ is utilized outside of the Edwards regulatory zones, the increase in TSS load resulting from all new impervious surfaces must be reduced by at least 70%. Calculation of the capture volume or minimum flow rate shall follow the method in the latest technical guidance on BMPs for the Edwards Aquifer Rules.

13.3.3 Alternative Methods

The Engineering Division prior to submitting a development application must approve all other methods. Alternative methods must show comparable treatment levels as the Detention Filtration or TCEQ Methods.

13.4 Maintenance

A maintenance schedule and plan for water quality controls shall be submitted to the Engineering Division prior to approval of construction plans. When included as part of a subdivided development, a maintenance bond shall be provided in accordance with Section 118-38 of the New Braunfels Code of Ordinances. Alternate methods may require additional monitoring and engineering studies to ensure compliance.

City of New Braunfels
Drainage and Erosion Control Design Manual

2016

Manual Updates:

2017-1, 2018-1, 2021-1

Notice of Manual Updates 2017-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: August 28, 2017

Effective Date: September 1, 2017

Purpose: To provide clarification and implement best practices.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.1.4 – Specify requirements for Preliminary Drainage Report.
- Section 2.1.5 – Specify requirements for Master Drainage Plan Report.
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 10 inches above finished grade of the surrounding ground (in previous DCM).
- Section 2.5 – Specify that the elevation of the lowest floor shall be elevated to 12 inches above adjacent stormwater conveyance structures (clarification).
- Section 2.5 – Require and specify grading plan required at plat and building permit.
- Section 2.5 – Specify that residential lots shall be graded to avoid water flowing over curb and driveway, and out of right-of-way.
- Section 2.7 – Specify that if development activity changes runoff characteristics that creates point discharge or any increase in discharge rates or velocities, the flow shall outfall into right-of-way or drainage easement that has capacity and an impact analysis is required to verify capacity and no adverse impact.
- Section 2.7 – Specify engineered retaining walls greater than three feet shall be designed to prevent freefall of stormwater.
- Section 2.11 – Specify pumped drainage facilities design, maintenance and operations requirements.
- Section 2.11 – Require feasibility analysis of pumped detention prior to permit application.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2018-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: January 22, 2018

Effective Date: February 5, 2018

Purpose: To provide amend and clarify channel and maintenance access requirements.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

Chapter 2 – Drainage Policy and Criteria

- Section 2.3 – Clarify and revise channel definition, design frequency and freeboard.
- Section 2.10.2 – Clarify easement and maintenance access criteria.

Chapter 8 – Open Channels

- Section 8.1 – Clarify easement and maintenance access criteria and specify pilot channel and channel fencing requirements.

Appendix B – Definition of Terms

- Redefine channel and define ditch and swale.

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Notice of Manual Updates 2021-1

Manual: City of New Braunfels Drainage and Erosion Control Design Manual (2016)

From: Engineering Division | Public Works Department

City Council Approval: August 23, 2021

Effective Date: October 1, 2021

Purpose: To provide hydrology updates aligning with new statewide NOAA Atlas 14 adoption. To implement floodplain criteria improvements providing better designs in flood prone areas allowing for higher standards of protection for the citizens of New Braunfels.

Content: The following updates were made to the City of New Braunfels Drainage and Erosion Control Design Manual (2016):

- **Chapter 2 – Drainage Policy and Criteria**
  - Section 2.3 – Specify Floodplain Development Requirements.
  - Section 2.3.1 – Establish floodplain regulation to the 1% annual chance ultimate development flood
  - Section 2.3.2 – Establish requirements for compensatory excavation in the floodplain.
  - ~~Section 2.9 – Update of stream bank erosion hazard setbacks to Stream Buffers with increased buffer requirements~~
- **Chapter 3 – Design Rainfall**
  - Section 3.1 – Update hydrology data to align with NOAA Atlas 14 point precipitation frequencies.
- **Chapter 4 – Determination of Design Discharge**
  - Section 4.1 – Update various references for NOAA Atlas 14 point precipitation frequencies.
  - Section 4.3 – Update various references for NOAA Atlas 14 point precipitation frequencies.
- **Chapter 7 – Storm Drain Systems**
  - Section 7.1 – Updated hydraulic grade line (HGL) criteria and pipe cover requirements
- **Chapter 10 – Detention and Retention Facilities**
  - Section 10.1 – Clarification to the maximum water depths criteria.
  - Section 10.2 – Update design mitigation to include the 2, 10, 25, 50, and 100-year
  - Section 10.3 – Update the outlet structure design requirements to reference 2, 10, 25, 50, and 100-year
- **Appendix B – Definition of Terms**
  - Add new definitions
- ~~**Appendix C – Stream Bank Erosion Hazard Setbacks Exhibit**~~
  - ~~Removed.~~

Supersedes: The revised manual supersedes prior versions of the City of New Braunfels Drainage and Erosion Control Design Manual (2016)

Commented [MR1]: Postponed

Table of Contents

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted ...

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Tab stops: Not at 0.46"

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Tab stops: Not at 0.46"

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Tab stops: Not at 0.46"

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Tab stops: Not at 0.46"

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

List of Figures

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

List of Tables

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

Formatted: Default Paragraph Font, Check spelling and grammar

List of Appendices

1 Introduction

1.1 Purpose and Scope

The purpose of the Drainage and Erosion Control Design Manual is to establish standard principles and practices for the design and construction of storm drainage, flood protection, erosion control, and water quality facilities within the City of New Braunfels, Texas and its extraterritorial jurisdiction (ETJ).

The design factors, formulas, graphs, and procedures described in this manual are intended to serve as guidelines for the design of drainage improvements and projects involving the volume, rate of flow, method of collection, storage, conveyance, treatment, and disposal of stormwater and erosion protection from stormwater flows. Responsibility for actual design remains with the design engineer. Any variations from the methodology or requirements in this manual must have expressed written approval of the City Engineer and Engineering Division, as permitted by Ordinance.

This manual and the City of New Braunfels Code of Ordinances contain requirements for the design of storm drainage, flood protection, water quality, and erosion control facilities. Where there is any conflict between this manual and the current code, the code shall take precedence. The design engineer is responsible for complying with the latest version of this manual and code adopted by the City.

Should conflicts occur between policy and criteria in this manual versus other regulatory authorities with jurisdiction in the same area, such as Texas Commission on Environmental Quality (TCEQ) or Texas Department of Transportation (TxDOT), then the more stringent requirement will apply and the designer will need to show how both requirements have been met.

1.2 Applicability

Criteria in this manual shall apply to all drainage improvements and projects that may have an impact on drainage, both publicly and privately funded, within the City of New Braunfels, Texas and within its ETJ. Criteria in this manual shall apply to any capital improvement or development project, plat, master plan, or building permit except as otherwise noted in the manual.

1.3 Computer Programs

The use of computer programs for calculating and modeling storm data and drainage facilities is accepted as standard practice. There are a variety of computer programs available and the design engineer maintains responsibility of selecting the appropriate approach and/or computer program unless otherwise specified in this manual. Computer programs are not a replacement for sound engineering judgment and the user must understand how the program performs the calculations and what assumptions are made.

1.4 References and Definition of Terms

At certain points in the text, the reader will encounter numbers enclosed in brackets, for example [1]. These numbers correspond to the references listed in **Appendix A**. Figures and tables reproduced from

other sources have the source listed beneath each figure or table. Common terms used in this manual are provided in **Appendix B**.

1.5 Acknowledgements

This manual is the result of the dedication and energy of the Drainage Advisory Committee members for the 2000 edition. For the 2015 update, acknowledgements go to City staff, Watershed Advisory Committee, Design Workshop, Lockwood Andrews & Newnam, Inc., and input from a wide variety of stakeholders.

Updates incorporated in 2021, acknowledgements go to City Staff, Pape Dawson Engineers, and the Watershed Advisory Committee.

2 Drainage Policy and Criteria

2.1 Drainage and Water Quality Design Requirements

All drainage improvements and projects shall be designed and constructed in accordance with the current regulations, standards and specifications adopted by the City of New Braunfels. Any capital improvement or development project within the City of New Braunfels jurisdiction is required to comply with the requirements outlined in this manual. When necessary, properly sized easements shall be granted across all contiguous property owned by the property owner.

A drainage report is required to be submitted by the property owner or its agent according to the requirements of this manual. The Engineering Division prior to issuance of a permit must approve the report. The type of development and report shall be based on the location and additional impervious cover of the development as shown in Table 2-1.

Table 2-1: Development Categories

Category	Criteria
Type 1 Development	Less than one acre of land; and < 1,000 SF additional impervious cover
Type 2 Development	Less than one acre of land; and 1,000 – 4,999 SF additional impervious cover; or Agricultural development (not including feedlots)
Type 3 Development	≥ 5,000 SF additional impervious cover; or Development within FEMA designated Special Flood Hazard Area

If any onsite and offsite stormwater structure related to the development is known to be at or above design capacity, the development will be considered a Type 3 Development.

Drainage report requirements are outlined below. An electronic media copy of the report is required in addition to a paper copy at time of city acceptance of infrastructure improvements.

2.1.1 Type 1 Drainage Report

A Type 1 Development is any development or redevelopment that disturbs less than one acre of land and creates less than 1,000 square foot of additional impervious cover. The Type 1 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch showing any existing features or infrastructure and proposed disturbance
D. Temporary erosion control plan

2.1.2 Type 2 Drainage Report

A Type 2 Development is any development or redevelopment that disturbs less than one acre of land, and creates more than 1,000 but less than 5,000 square foot of additional impervious cover. Type 2 Developments also include any agricultural development not including feedlots. The Type 2 Drainage Report shall be prepared by the property owner or its agent, and consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. Detailed site drawing or sketch of the affected area scaled to 1" = 50' (or less) on minimum 11" x 17" paper showing the following:
    1. Existing drainage ways and easements
    2. Runoff flow directions
    3. Floodplain boundaries
    4. Proposed grading and development
    5. Proposed drainage and erosion control facilities
    6. A copy of the survey plat showing the lot layout, streets, and utility and drainage easements
D. Temporary erosion control plan
E. If any on-site and off-site stormwater structure related to this development is known to be at or above design capacity, the development will be considered a Type 3 Development

2.1.3 Type 3 Drainage and Water Quality Report

A Type 3 Development is any development or redevelopment greater than or equal to 5,000 square feet of additional impervious cover, not Type 1 or Type 2, or any development within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area. A Type 3 Drainage and Water Quality Report shall be prepared by a professional engineer licensed in the State of Texas, experienced in civil engineering, and having a thorough knowledge of the hydraulic analysis and design. The report shall be signed and sealed, per Texas Board of Professional Engineers, by the person responsible for the report. The Type 3 Drainage and Water Quality Report shall consist of the following:

A. Applicant contact information (e.g. name, address, phone number, and email address)
B. Site location map
C. A copy of the final plat showing the lot layout, streets, and utility and drainage easements
D. Construction drawings adhering to all applicable codes and regulations including details and specifications
E. Drainage and Water Quality Report as outlined in **Section 2.2** – Type 3 Drainage and Water Quality Report Criteria
F. Temporary and permanent erosion control plan as outlined in **Section 12** – Site Erosion Control
G. Approval letters from other agencies with jurisdiction or permit requirements for the site location

2.1.4 Preliminary Drainage Report

A Preliminary Drainage Report of the storm drainage system is required with a preliminary plat. The report shall include the following:

A. Preliminary Drainage Site Plan including: plat boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the plat; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Conformance with the Master Drainage Plan Report (if applicable) specified in **Section 2.1.5**. The report may require updating for development plat submittals and changes in the drainage design.

2.1.5 Master Drainage Plan Report

A Master Drainage Plan Report shall be provided with a subdivision master plan and planned development. The report shall include the following:

A. Existing Drainage Site Plan including: development boundary; existing and proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; and floodplain and floodway boundaries. Drainage infrastructure includes inlets, channels, storm sewer, detention, retention and water quality facilities.
B. Existing Watershed Map including: development boundary; existing drainage area and all sub areas; 2-foot contours; and existing runoff flow directions.
C. Preliminary Drainage Site Plan including: development boundary; proposed drainage infrastructure, right-of-way and easements in and adjacent to the development; proposed stormwater connections and point(s) of development discharge; and proposed changes to floodplain and floodway boundaries.
D. Master Drainage Plan Summary including how drainage and water quality resulting from the proposed development will be managed and how proposed drainage infrastructure will impact adjacent property owners.

2.2 Type 3 Drainage and Water Quality Report Criteria

The planning and design of drainage systems should ensure that problems are not transferred from one location to another. Grading and other construction activities may not change the terrain in such a way to cause damage to public or private property from drainage or flood problems, increased runoff, or increased erosion or sediment movement.

Existing drainage between developed lots will remain the responsibility of the affected property owners. Commercial developments are required to drain surface runoff from an individual lot to a public right-of-way or to a drainage system contained in an easement. Residential lot-to-lot drainage of sheet flows should be avoided, and residential developments are encouraged to direct surface runoff to a public right-of-way or to a drainage system contained in an easement.

The Engineering Division shall not approve any drainage report pertaining to proposed construction, platting or other development where the proposed activity or change in the land would result in post-development discharge from the site exceeding discharge under pre-developed conditions (for new development) or existing conditions (for re-development). Downstream capacity shall not be exceeded as a result of development. Exemptions from this provision are as follows:

A. Additional drainage improvements are not required if drainage improvements have been provided for the fully developed condition, which includes the proposed development.
B. Prior written approval of a Stormwater Connection Fee from the City Engineer.

No proposed development shall be constructed which impedes or constricts runoff from an upstream watershed based on fully developed conditions. Therefore, drainage computations shall be provided to verify no adverse impact upstream or downstream.

2.3 Floodplain Development Requirements

The purpose of floodplain management is to focus on safety of the citizens, minimize flood loses, avoid flooding of buildings, preserve floodplain areas and ultimately improve quality of life for the residents of City of New Braunfels. With this being the primary focus, the City has adopted higher standards than currently illustrated in FEMA's general guidance (FEMA Policy Standards for Flood Risk Analysis and Mapping).

1% Annual Chance (AC) floodplain, also known as the 100-year floodplain is the area subject to 1% or greater chance of flooding in any given year, as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2% AC storm or 1% AC storm based on Ultimate Development (UD) Conditions, also known as Future Conditions (FC). The City permits floodplain reclamation if supported by a signed and sealed study which demonstrates no adverse impacts to any property and demonstrates a no-rise in the 1% AC UD water surface elevation outside of the requestor's property limits.

2.3.1 Regulating to the 1% Annual Chance Ultimate Development Flood

The City of New Braunfels has adopted the 1% AC UD floodplain mapped using Atlas 14 rainfall data published in this document, as the regulatory floodplain. Such floodplain is delineated based on flows developed by assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to estimate fully developed conditions. The City requires all new and re-studied FEMA floodplains to delineate the 1% AC UD flood~~plain~~way to be depicted and platted or otherwise secured as a drainage easement.

Once the Flood Insurance Rate Maps (FIRM) for City of New Braunfels are updated with the revised rainfall data, the 1% AC UD floodplains will be designated as Shaded-X areas for all FEMA floodplain establishments or revisions. Until the FEMA FIRM are updated with the revised rainfall data, the City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions. The City requires demonstration of the elevation of fill placed in the 1% AC UD

floodplain for construction of habitable structures to be greater than the 1% AC UD water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities, etc.

The City requires all drainage easements and crossings in the floodplains to be based on the 1% AC UD conditions. For drainage areas greater than 150 acres, which propose or require grading adjacent to the stream, for unmapped streams and within the floodplain for mapped streams; the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the 1% AC flows.

The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to support their 1% AC UD flows and floodplain delineation.

The City allows floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no adverse impact to the 1% AC UD water surface elevation outside of the requestor's property limits.

For streams which have a drainage area greater than 150 acres and currently not-mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a 1% AC UD floodplain along, within or adjacent to the project site and plat the floodplain delineation as a drainage easement.

2.3.2 Compensatory – Excavation

The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate lost floodplain volume due to fill placed in the 1% Annual Chance (AC) Ultimate Development (UD) floodplain. The City permits excavation in the floodplain to mitigate the increases to 1% AC UD water surface elevations, in additional to excavation compensation along the same flooding source and must be within the general vicinity of the fill being placed. All submittals must include a signed drawing by a licensed Professional Engineer clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes, indicating total Cut volume higher than total Fill volume placed in the 1% AC UD floodplain established for the site.

If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require evidence of coordination and approval from the US Army Corps of Engineers.

~~2.3~~2.4 Freeboard

Freeboard is the vertical distance between the design water surface and the elevation of the drainage facility, such as the top of channel or detention pond. Freeboard is intended to provide a factor of safety and prevent the fluctuation of the water surface from overflowing the drainage facility. Freeboard requirements are shown in Table 2-2. Freeboard is not required where parking areas are designed to serve as detention facilities; however, site design should consider safety and drainage overflow location.

Table 2-2: Freeboard Requirements

Drainage Facility	Design Frequency	Minimum Freeboard
Street right-of-way	100-year	None
Creek improvements	100-year	1.0 ft
Channels with drainage area > 128 acres	100-year	1.0 ft
Channels with drainage area ≤ 128 acres		
• 100-year design depth < 5 ft	100-year	25-year + 0.5 ft
• 100-year design depth 5-10 ft	100-year	25-year + 10% design depth
• 100-year design depth > 10 ft	100-year	25-year + 1.0 ft
Detention ponds and reservoirs	100-year	1.0 ft
Bridges and culverts	25-year	See note *2*
Floodways and floodplains	100-year	2.0 ft (See note *3*)

[1] Channels with drainage area ≤ 128 acres shall be designed to contain the 100-year storm event or 25-year storm event plus freeboard, whichever is greater.

[2] Bridges and culverts shall be designed to withstand the 100-year event, but the water level may reach roadway level at the 25-year design level if no public safety issues are involved.

[3] Floodways and floodplains shall have a minimum of 2-feet freeboard or the minimum freeboard established in the most recently adopted Floodplain Ordinance.

~~2.4~~2.5 Drainage Easements and Rights-of-way

All private drainage and water quality facilities must have an associated drainage easement, restrictive covenant, or similar recorded instrument that clearly identifies ownership and the party responsible for maintenance. Drainage easements and rights-of-way shall be dedicated to the City as required in the Code of Ordinances.

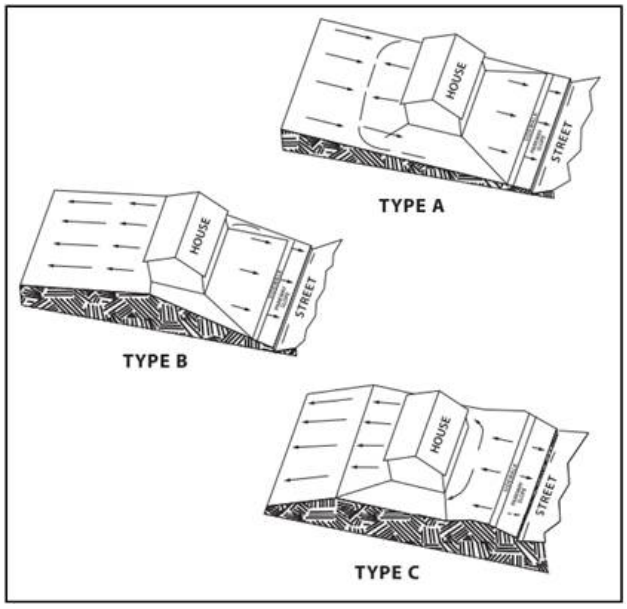
~~2.5~~2.6 Finished Floor Elevations

The elevation of the lowest floor shall be elevated 10 inches above the finished grade of the surrounding ground as prescribed in the building regulations and Code of Ordinances. Finished grades shall be sloped to direct stormwater away from the structure. Developments adjacent to stormwater conveyance structures must be elevated 12 inches above the 100-year water flow elevation (in the conveyance structure) to the same elevation that a development adjacent to a 100-year floodplain would be required to meet. Driveways serving houses on the downhill side of the street shall have properly sized swales before entering the garage.

A grading plan shall be prepared and submitted to the City at final plat and building permit, which indicates typical lot grading for all lots in the subdivision using typical Federal Housing Administration

(FHA) lot grading types (A, B and C). See Figure 2-1. No more than two (2) residential lots may drain onto another lot unless a drainage easement is dedicated and free of obstructions to contain the runoff. An alternate grading plan may be submitted for large lot or commercial subdivisions.

Figure 2-1: Typical Federal Housing Administration Lot Grading



Where residential lots are located on the downhill side of a T-intersection, cul-de-sac, or elbow, the street intersection shall be graded so to avoid water flowing over the curb and driveway, and out of the right-of-way. Detailed calculations shall be required at permit to show that the discharges are contained within the right-of-way.

~~2.6~~2.7 Stormwater Mitigation

It is the intent of this manual, in concert with applicable ordinances, to provide all development under its jurisdiction the option of providing mitigation or demonstrating that no mitigation is in the best interest of the watershed and paying a share of the cost to participate with a stormwater connection fee.

Mitigation through detention, retention, or some other technique must be designed, constructed, and maintained to reduce the post-development discharge rates to below that of pre-development/existing rates for the two (2), ten (10), twenty-five (25), fifty (50), and one-hundred (100) year design storms. Participation in neighborhood or regional mitigation is an acceptable option.

Demonstration that no mitigation is in the best interest of the watershed shall be accomplished by showing no adverse impact due to any increased runoff from the proposed development for the design

storms. Approval of a Stormwater Connection Fee is required in compliance with Chapter 143 of the Code of Ordinances. The property owner, or his/her designee, shall meet with the Engineering Division to discuss mitigation and/or Stormwater Connection Fee options prior to commencing the project.

For stormwater mitigation, the following two development conditions shall be analyzed with each adverse impact analysis:

A. Existing Conditions. This refers to current development conditions in the watershed and on site. This shall be used as the baseline for determining the impact of the development of the site, or the watershed, to other properties or drainage systems.
B. Proposed Conditions. This refers to existing conditions with the proposed development added. This shall be used to determine if the increased runoff from the proposed development results in an adverse impact to other properties or drainage systems.

~~2.7~~2.8 Drainage Facility Design

Drainage design in the urban environment should also consider appearance as an integral part of the design and structures should generally blend with the natural surroundings as much as possible to maintain the aesthetics of the natural area.

The City requires preservation of the natural floodplains. The protection of existing trees and vegetation should be maximized during development of drainage plans. Whenever possible, the replacement of the trees destroyed by drainage and flood protection procedures is encouraged.

Computations to support all drainage designs shall be submitted to the Engineering Division for review in an easy to follow format. On-site pre-development stormwater runoff computations shall be based upon conditions representing the existing land conditions with respect to soil type, percentage cover, and cover type as indicated by current aerial imagery and supporting documentation. Design of structures shall use fully developed sub-basin conditions for the prescribed design storms based on the sub-basin zoning. If zoning does not exist, then the engineer shall assume the ultimate development based on the most recently adopted Future Land Use Plan.

If a development activity changes stormwater runoff characteristics in a manner that creates a point or points of concentrated flow, where previously there was sheet flow or lesser intensity flow pattern, or any increase in discharge rates or velocities for the 2, 10, 25 and 100-year frequency storms, the flow shall outfall into right-of-way or drainage easement that has the capacity for the discharge. An impact analysis is required to verify the capacity and/or required size of the downstream facility clearly demonstrating no adverse impact.

In development of engineered retaining walls greater than three feet, drainage facilities shall be designed in such a manner as to prevent the freefall of stormwater from natural drainage patterns and sheet flow conditions.

The design requirements and criteria are specified in following chapters. Modeling and calculations shall be included in drainage report submittals to ensure the specified criteria are met for all drainage

infrastructure improvements. Infrastructure that is within TxDOT right-of-way and requires dual permitting from both the City and TxDOT shall be designed in compliance with the more conservative requirements.

~~2.8~~2.9 Stream Bank Erosion Hazard Setback

Erosion hazard setback zone determination is necessary for the banks of streams in which the natural channel is to be preserved. The purpose of the setbacks is to reduce the amount of structural damage and stream degradation caused by the erosion of the bank. With the application of stream bank erosion hazard setbacks, an easement is dedicated to the City such that no structure can be located, constructed, or maintained in the area encompassing the erosion hazard setback.

The City allows for stream bank stabilization as an alternative to dedicating the erosion hazard setback zone. Stream bank erosion hazard setbacks may extend beyond the limits of the regulatory floodplain and are shown in Table 2-3.

Table 2-3: Stream Bank Erosion Hazard Setbacks

Contributing Drainage Area (square miles)	Setback Distance from Stream Centerline (feet)
0-1	0
1-5	50
5 or more	100

A map delineating the contributing drainage area sizes along each stream in the City's jurisdiction is included for reference in **Appendix C**. For the purpose of this manual, any watercourse that was included in the rivers and stream data set published in the United States Geological Survey (USGS) National Hydrography Dataset (NHD) in 2013 was considered a stream.

~~2.9~~2.10 Water Quality Controls

Temporary water quality best management practices (BMPs) shall be required when any disturbance could result in appreciable erosion that could result in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties during construction activities. Site erosion control requirements are provided in **Section 12**.

Development and redevelopment located over the Edwards Aquifer regulatory zones shall comply with the latest TCEQ published rules and technical design guidance for the Edwards Aquifer. Permanent water quality BMPs for development outside of the Edwards Aquifer regulated zones shall be designed to provide adequate treatment of the water quality volume in the City's jurisdiction as defined in **Section 13**.

~~2.10~~2.11 Maintenance of Drainage Facilities

The property owner or designee will maintain the hydraulic integrity of drainage systems not dedicated to the City. The City will maintain the hydraulic integrity of drainage systems dedicated to and accepted

by the City. Maintenance of the floodplain, drainage easements, and water quality features shall be explicitly stated in a recorded instrument.

~~2.10.1~~2.11.1 Maintenance Schedule

A maintenance schedule supported by engineering or scientific published documents shall be submitted to the Engineering Division prior to approval of construction plans for public and private facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage and water quality improvements to ensure that the maintenance schedule is being implemented.

~~2.10.2~~2.11.2 Maintenance Access

Access shall be provided for all channels to allow equipment access for maintenance. Access shall have a width of at least 12 feet and a cross slope no greater than two percent. Maintenance ramps used for access shall have a vertical grade no steeper than 6:1. An unobstructed access easement connecting the channel drainage easement with a roadway parallel to or near the easement shall be provided at a minimum spacing of one access easement at a minimum of 1,000 feet intervals. Access shall be provided within dedicated right-of-way or within the drainage easement dedicated for the channel. The bottom of the channel cannot be considered as maintenance access.

~~2.11~~2.12 Pumped Drainage Facilities

The City of New Braunfels discourages the use of Pumped Drainage Facilities. A Pumped Drainage Facility is defined as any drainage system not wholly utilizing gravity outflow. Facility designs considered under this section's guidelines must first demonstrate that a gravity system is not feasible from both an engineering and economic standpoint. A feasibility analysis is required to be submitted prior to permit application. The applicant must have expressed written approval from the City Engineer and Engineering Division with permit application.

Pumped Drainage Facilities will only be acceptable in commercial applications and must meet all other drainage requirements outlined in this manual. All approved Pumped Drainage Facilities must be privately owned and maintained. The owner assumes responsibility for any damage to property as a result of a system's normal operation or failure.

~~2.11.1~~2.12.1 Design Requirements

If approved by the Engineering Division, Pumped Drainage Facilities design submittals should include the following items:

A. Pump discharge shall be used for a maximum of 50% of the total required basin capacity, not including freeboard. The remaining volume must discharge by gravity.
B. A minimum of two (2) pumps will be provided, each of which is sized to pump the designed flow rate.
C. Provide an emergency power source for the drainage facility pumps.
D. Design should include but not be limited to controls, pumps, cycling and anti-vandalism measures.
E. Facility discharge must be into an existing right-of-way or drainage easement that has the capacity for the increase discharge.

F. Provide an armored gravity emergency outflow structure designed to allow the outflow of the 100-year design storm, assuming the pond is full and the discharge is 100% clogged. At minimum, the emergency overflow shall engage when ponding exceeds the 100-year water surface elevation plus freeboard.

~~2.11.2~~2.12.2 Maintenance and Operations

A maintenance and operations plan shall be submitted to the Engineering Division prior to approval of construction plans for all facilities. The City has the right to conduct periodic inspections of privately owned and maintained drainage improvements to ensure that the maintenance schedule is being implemented.

This page intentionally left blank.

3 Design Rainfall

3.1 Rainfall Intensity Duration Frequency

The City evaluated precipitation based on NOAA Atlas 14, Volume 11 Texas statewide precipitation study. This study updated precipitation frequency estimates for Texas and replaces previous precipitation estimate studies. The revised rainfall data will be the standard for Design for the City of New Braunfels.

Runoff shall be calculated in accordance with Section 4 using the updated precipitation values as shown in Tables 3-1 and 3-2. The 100-year (1% AC) 24-hour rainfall depth for City of New Braunfels is 13.1 inches. The data published by NOAA Atlas 14 varies linearly across the City. The values shown below are taken from the highest rainfall data within the City limits.

~~The City evaluated area rainfall data in 2011 following the procedures outlined in United States Geological Survey (USGS) *Water Resources Investigation Report 98-4044* [1]. The data set used in 2011 included several significant rain events that occurred after the USGS analysis. The City determined that the following rainfall data was more appropriate for use in this area than the USGS analysis. Rainfall intensities will be computed using the Intensity Duration Frequency (IDF) equation (Equation 3-1) below and appropriate design frequency coefficients provided in Table 3-1. This equation is to be used only with time of concentrations between 10 minutes and 3 hours.~~

~~**Equation 3-1**~~

$$I = \frac{b}{(T_c + d)^e}$$

~~Where:~~
~~I = Rainfall intensity (in/hr)~~
~~T_c = Time of concentration (min)~~
~~b, d, e = Rainfall intensity constants.~~

Table 3-1: New Braunfels Atlas 14 Area Depth-Duration Value ~~Rainfall Intensity Constants~~

Year	Depth-Duration-Frequency (inches)									
	5-Min	15-Min	1-Hr	2-Hr	3-Hr	6-Hr	12-Hr	24-Hr	2-day	3-day
2	0.528	1.06	1.96	2.4	2.67	3.13	3.59	4.08	4.66	5.05
5	0.664	1.33	2.45	3.08	3.47	4.14	4.79	5.48	6.27	6.78
10	0.781	1.66	2.88	3.71	4.23	5.13	5.97	6.86	7.82	8.43
25	0.946	1.88	3.5	4.63	5.39	6.66	7.82	8.99	10.2	10.9
50	1.08	2.14	3.97	5.4	6.39	8.03	9.46	10.9	12.3	13.1
100	1.22	2.41	4.49	6.26	7.54	9.62	11.4	13.1	14.7	15.6
500	1.57	3.09	5.95	8.74	10.8	14.2	17.1	19.8	22	23.1

Table 3-2 shows rainfall intensities by storm event. The intensities were calculated based off the depth duration table for each frequency storm. Durations range from 5 minutes up to 1 day for recurrence intervals from the 2-year to 500-year storm events, which will be the standard design for New Braunfels.

The City requires all flood study submittals to be performed using rainfall data presented in the document. If a FEMA submittal is required for the purpose of a map revision or amendment such as a Conditional Letter of Map Revision (CLOMR) or Letter of Map Revision (LOMR) or a Letter of Map Amendment (LOMA), FEMA will require the hydrologic and hydraulic models to be updated based on the information used for the Current Effective Flood Insurance Study (FIS). In which case, the City requires two separate submittals. One, which uses FEMA data and will be submitted for FEMA map revisions and incorporation upon City Floodplain Administrator's (FPA) approval; another which uses the guidelines published in this manual and will be submitted for review and approval by the City Engineer or his/her designee.

Regardless of a FEMA submittal, the City will require a signed and sealed memo or report, summarizing the hydrologic and hydraulic analysis as illustrated in this manual, for all improvements adjacent to a mapped or un-mapped stream with a contributing drainage area greater than 200 acres.

~~3.2 Rainfall Depth Duration Frequency~~

~~The appropriate rainfall depths for calculations in the New Braunfels area are provided in Table 3-2.~~

Table 3-2: New Braunfels Rainfall Intensities by Storm Event~~Area Depth-Duration Value~~

Rainfall Intensity (inches/hour) by Storm Frequency							
Time (minutes)	2	5	10	25	50	100	500
5	6.34	7.97	9.37	11.35	12.96	14.64	18.84
6	5.98	7.53	8.88	10.78	12.29	13.88	17.72
7	5.70	7.18	8.47	10.30	11.73	13.24	16.83
8	5.45	6.88	8.11	9.87	11.24	12.68	16.08
9	5.24	6.61	7.79	9.48	10.79	12.17	15.42
10	5.05	6.36	7.50	9.12	10.38	11.70	14.82
11	4.87	6.13	7.23	8.78	9.99	11.26	14.27
12	4.70	5.92	6.97	8.45	9.61	10.83	13.76
13	4.54	5.71	6.72	8.13	9.25	10.42	13.27
14	4.39	5.51	6.47	7.82	8.90	10.03	12.81
15	4.24	5.32	6.24	7.52	8.56	9.64	12.36
16	4.10	5.14	6.03	7.26	8.25	9.29	11.93
17	3.97	4.98	5.83	7.02	7.98	8.98	11.54
18	3.86	4.83	5.66	6.81	7.74	8.71	11.19
19	3.75	4.69	5.50	6.62	7.51	8.46	10.88
20	3.65	4.57	5.36	6.45	7.31	8.23	10.59
21	3.57	4.46	5.23	6.29	7.12	8.01	10.33
22	3.48	4.35	5.10	6.14	6.95	7.82	10.09
23	3.41	4.26	4.99	6.00	6.79	7.64	9.86
24	3.34	4.17	4.88	5.87	6.64	7.47	9.65
25	3.27	4.08	4.78	5.75	6.50	7.32	9.46
26	3.20	4.00	4.69	5.64	6.37	7.17	9.27
27	3.14	3.93	4.60	5.53	6.25	7.03	9.10
28	3.09	3.85	4.52	5.43	6.13	6.90	8.94
29	3.03	3.79	4.44	5.33	6.02	6.78	8.79
30	2.98	3.72	4.36	5.24	5.92	6.66	8.64
31	2.93	3.66	4.29	5.15	5.82	6.55	8.50
32	2.88	3.60	4.22	5.07	5.73	6.44	8.37
33	2.84	3.54	4.15	4.99	5.63	6.34	8.24
34	2.79	3.49	4.09	4.91	5.55	6.24	8.12
35	2.75	3.43	4.02	4.84	5.46	6.15	8.00
36	2.71	3.38	3.96	4.77	5.38	6.06	7.89
37	2.67	3.33	3.90	4.70	5.30	5.97	7.78
38	2.63	3.28	3.85	4.63	5.23	5.89	7.68
39	2.59	3.24	3.79	4.57	5.16	5.80	7.58
40	2.55	3.19	3.74	4.50	5.09	5.73	7.48
41	2.52	3.14	3.69	4.44	5.02	5.65	7.38
42	2.48	3.10	3.64	4.38	4.95	5.58	7.29
43	2.45	3.06	3.59	4.32	4.88	5.50	7.20
44	2.42	3.02	3.54	4.27	4.82	5.43	7.12
45	2.38	2.98	3.49	4.21	4.76	5.36	7.03
46	2.35	2.94	3.45	4.16	4.70	5.30	6.95
47	2.32	2.90	3.40	4.11	4.64	5.23	6.87
48	2.29	2.86	3.36	4.06	4.58	5.17	6.79
49	2.26	2.82	3.31	4.00	4.53	5.11	6.71
50	2.23	2.79	3.27	3.95	4.47	5.04	6.64
51	2.20	2.75	3.23	3.91	4.42	4.98	6.56
52	2.17	2.72	3.19	3.86	4.36	4.93	6.49
53	2.14	2.68	3.15	3.81	4.31	4.87	6.42
54	2.11	2.65	3.11	3.76	4.26	4.81	6.35
55	2.08	2.61	3.07	3.72	4.21	4.76	6.28
56	2.06	2.58	3.03	3.67	4.16	4.70	6.21
57	2.03	2.55	2.99	3.63	4.11	4.65	6.14
58	2.00	2.51	2.95	3.59	4.06	4.59	6.08
59	1.98	2.48	2.92	3.54	4.02	4.54	6.01
60	1.95	2.45	2.88	3.50	3.97	4.49	5.95
120	1.20	1.54	1.86	2.32	2.70	3.13	4.37
180	0.89	1.16	1.41	1.80	2.13	2.51	3.60

240	0.71	0.93	1.14	1.47	1.75	2.08	3.02
360	0.52	0.69	0.85	1.11	1.34	1.60	2.37
720	0.30	0.40	0.50	0.65	0.79	0.95	1.43
1440	0.17	0.23	0.29	0.37	0.45	0.55	0.83

4 Determination of Design Discharge

4.1 General Requirements

The selection of the appropriate method for calculating runoff depends upon the size of the drainage area, time of concentration, and detention mitigation. Flows are to be analyzed for both existing, proposed, and ultimate development conditions at all locations where runoff leaves a proposed project for the 2, 10, 25, 50, and 100- year frequencies. Design discharges are to be calculated by either Rational Method or Unit Hydrograph using Atlas 14 rainfall from Section 3.~~existing and proposed conditions at all locations where runoff leaves a proposed project for the 2, 10, 25, and 100-year frequencies. Design discharges are to be calculated by either Rational Method or Unit Hydrograph.~~

4.2 The Rational Method

Rational Method equation is based on the following assumptions:

- Rainfall intensity is constant over the time it takes to drain the watershed (time of concentration)
- The runoff coefficient remains constant during the time of concentration
- The watershed area does not change
- The minimum time of concentration is not less than 10 minutes and does not exceed 3-hours

The Rational Method may be used to generate peak flows for drainage basins less than 150 acres that do not require detention or timing considerations. For drainage areas in excess of 150 acres, reclaiming floodplains, creating lakes or building other types of drainage-related facilities on major drainage courses where the use of the Rational Method does not provide reliable results, a unit hydrograph method shall be used. The discharge computed by the Rational Method is the peak discharge for a given frequency on the watershed in question, and is given by the following relationship (Equation 4-2):

Equation 4-1

$$Q = CIA$$

Where:
Q = peak design for a given frequency on the watershed at the desired design point (cfs)
C = dimensionless weighted runoff coefficient, representing ground cover conditions and/or land use within the watershed area. (See Table 4-1)
I = average rainfall intensity in inches per hour at a rainfall duration equal to the time of concentration, associated with the desired design frequency. (See Table 3-~~1~~2) (in/hr)
A = the drainage area in acres contributing runoff to the desired design point (acres).

4.2.1 Runoff Coefficient

Suggested coefficients with respect to specific surface types are given in Table 4-1. "C" values for developed conditions should be based on composite values. The Engineering Division must approve assumptions for fully developed conditions where maximum allowable impervious cover is not defined

by city ordinance. The runoff coefficients include an antecedent precipitation factor to reflect the additional runoff that results from saturated ground conditions with less frequent recurrence intervals.

Table 4-1: Runoff Coefficients

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS Runoff Coefficient (C)							
	Return Period						
Character of Surface	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition**							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	0.42	0.44	0.48	0.51	0.54	0.61
Pasture/Range							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Forest/Woodlands							
Flat, 0-7%	0.22	0.25	0.28	0.31	0.35	0.39	0.48
Average, 2-7%	0.31	0.34	0.36	0.40	0.43	0.47	0.56
Steep, over 7%	0.35	0.39	0.41	0.45	0.48	0.52	0.58
Composite "C" value for developed conditions (C_{DEV}) is : $C_{DEV} = IC_1 + (1-I)C_2$							
Where: I = Impervious cover, percent C_1 = "C" value for impervious cover C_2 = "C" value for pervious area (grass, lawns, parks, etc.)							

RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS Runoff Coefficient (C)							
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
* Grass cover less than 50 percent of the area. ** Grass cover on 50 to 75 percent of the area. *** Grass cover larger than 75 percent of the area.							
Source: *City of Austin Drainage Criteria Manual* [2]							

The drainage area under investigation may consist of several different drainage surfaces or zoning classifications. In such cases, an average coefficient weighted in accordance with the respective areas shall be used, as outlined in Equation 4-2.

Equation 4-2

$$C_w = \left(\frac{A_1C_1 + A_2C_2 + \cdots A_nC_n}{A_1 + A_2 + A_3 + \cdots A_n}\right)$$

4.2.2 Time of Concentration

The time of concentration (T_c) is the amount of time required for surface runoff to travel from the most hydraulically remote point within the drainage basin to the drainage point under consideration. The most hydraulically remote drainage point refers to the route requiring the longest drainage travel time and not necessarily the greatest linear distance. Furthermore, the most hydraulically remote point must be taken from a location that best represents the majority of the contributing area.

The Natural Resources Conservation Service (NRCS) method in *Technical Release 55: Urban Hydrology for Small Watersheds (TR-55)* [3] is the preferred method for estimating time of concentration, unless the design engineer can justify why an alternative method is more suitable for the watershed under analysis. Other methodologies can be used but must be approved by the Engineering Division.

The procedure for estimating time of concentration, as described in TR-55, is outlined below. The overall time of concentration is calculated as the sum of the sheet, shallow concentrated and channel flow travel times as shown in Equation 4-3. Note that there may be multiple shallow concentrated and channel segments depending on the nature of the flow path.

Equation 4-3

$$T_C = T_{t(sheet)} + T_{t(shallow\ concentration)} + T_{t(channel)}$$

Sheet Flow

Sheet flow is shallow flow over land surfaces, which usually occurs in the headwaters of streams. The engineer should realize that sheet flow occurs for only very short distances, especially in urbanized conditions. Sheet flow for both natural (undeveloped) and developed conditions should be limited to a

maximum of 100 feet. Sheet flow for developed conditions should be based on the actual pavement or grass conditions for areas that are already developed and should be representative of the anticipated land use within the headwater area in the case of currently undeveloped areas. In a typical residential subdivision, sheet flow may be the distance from one end of the lot to the other or from the house to the edge of the lot. In some heavily urbanized drainage areas, sheet flow may not exist in the headwater area. The NRCS method employs Equation 4-4, which is a modified form kinematic wave equation, for the calculation of the sheet flow travel time.

Equation 4-4

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2^{0.5})(s^{0.4})} \times 60$$

Where:
T_t = Sheet flow travel time (min)
L = Length of the reach (ft)
n = Manning's n (see Table 4-2)
P_2 = 2-year, 24-hour rainfall (in) (see Table 3-~~1~~2)
s = Slope of the ground (ft/ft).

Table 4-2: Manning's "n" for overland flow

Manning's "n"[1]	Surface Description
0.015	Concrete (rough or smoothed finish)
0.016	Asphalt
0.05	Fallow (no residue)
	Cultivated Soils:
0.06	Residue Cover ≤ 20%
0.17	Residue cover > 20%
	Grass:
0.15	Short-grass prairie
0.24	Dense grasses[2]
0.41	Bermuda Grass
0.13	Range (natural)
	Woods[3]:
0.04	Light underbrush
0.8	Dense underbrush

[1] The Manning's n values are a composite of information compiled by Engman (1986).
[2] Includes species such as weeping lovegrass, bluegrass, buffalo grass, blue grama grass, and native grass mixtures.
[3] When selecting n, consider cover to a height of about 0.1 ft. This is the only part of the plant cover that will obstruct sheet flow.
Source: *City of Austin Drainage Criteria Manual* [2] and *TR-55* [3]

Shallow Concentrated Flow

After a maximum of approximately 100 feet, sheet flow usually becomes shallow concentrated flow collecting in swales, small rills, and gullies. Shallow concentrated flow is assumed not to have a well-defined channel and has flow depths of 0.1 to 0.5 feet. The travel time for shallow concentrated flows can be computed by Equation 4-5 and Equation 4-6. These two equations are based on the solution of Manning's Equation with different assumptions for n (Manning's Roughness Coefficient) and r (hydraulic radius, ft). For unpaved areas, n is 0.05 and r is 0.4; for paved areas, n is 0.025 and r is 0.2.

Equation 4-5 : Unpaved

$$T_t = \frac{L}{(60)(16.1345)(s^{0.5})}$$

Equation 4-6: Paved

$$T_t = \frac{L}{(60)(20.3282)(s^{0.5})}$$

Where:
T_t = Travel time for shallow concentrated flows (min)
L = Length of the reach (ft)
s = Slope of the ground (ft/ft).

4.2.3 Channel or Storm Drain Flow

The velocity in an open channel or a storm drain not flowing full can be determined by using Manning's Equation. Channel velocities can also be determined by using backwater profiles. For open channel flow, average flow velocity is usually determined by assuming a bank-full condition. Note that the channel flow component of the time of concentration may need to be divided into multiple segments in order to represent significant changes in channel characteristics. The details of using Manning's Equation and selecting Manning's "n" values for channels can be obtained from **Section 8**.

For the storm drain flow under pressure conditions (hydraulic grade line is higher than the lowest crown of a storm drain) the following equation should be applied:

Equation 4-7

$$V = \frac{Q}{A}$$

Where:
V = Average velocity (ft/s)
Q = Design discharge (cfs)
A = Cross-sectional area (ft^2).

Total travel time through a channel and/or storm drain can be calculated by Equation 4-8.

Equation 4-8

$$T_t = \sum \left(\frac{L_i}{60 V_i} \right)$$

Where:
L_i = The i-th channel segment length (ft)
V_i = The average flow velocity within the i-th channel segment (ft/s)
T_t = Total flow travel time through the channel (min).

4.3 SCS/NRCS Unit Hydrograph

The preferred unit hydrograph in general is the Soil Conservation Service (SCS)/Natural Resource Conservation Service (NRCS) Dimensionless Unit Hydrograph. The runoff curve number(s) used in calculating the pre-development/existing condition, the post-development condition, and the ultimate development condition~~condition and the post-development condition~~ shall be documented. Post-development conditions, condition of the given site and drainage area after the anticipated development has taken place, shall be based on the project. A fully developed watershed and the proposed project shall be assumed for the ultimate development condition based on future zoning projections~~drainage area shall be assumed for the post-development condition~~. NRCS curve numbers are to be selected from Table 4-3. Curve numbers in Table 4-4 shall be used when performing an analysis of fully developed conditions. Average antecedent moisture conditions II (AMC II) shall be assumed.

Table 4-3: NRCS Runoff Curve Numbers for Urban Areas and Agricultural Lands

Cover Description	Average % Impervious Area[1]	Curve Numbers for Hydrologic Soil Group			
Cover Type and Hydrologic Condition		**A**	**B**	**C**	**D**
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.):					
Poor condition (grass cover 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right of way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm drains (excluding right of way)		98	98	98	98
Paved; open ditches (including right of way)		83	89	92	93
Gravel (including right of way)		76	85	89	91
Dirt (including right of way)		72	82	87	89
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)		77	86	91	94
Agricultural lands					
Grassland, or range-continuous forage for grazing[2]	Poor Fair Good	68 49 39	79 69 61	86 79 74	89 84 80
Meadow-continuous grass, protected from grazing and generally mowed for hay		30	58	71	78
Brush—brush-weed-grass mixture with brush the major element[3]	Poor Fair Good	48 35 30	67 56 48	77 70 65	83 77 73
Woods—grass combination (orchard or tree farm).[4]	Poor Fair Good	57 43 32	73 65 58	82 76 72	86 82 79
Woods[5]	Poor Fair Good	45 36 30	66 60 55	77 73 70	83 79 77
Farmsteads—buildings, lanes, driveways and surrounding lots		59	74	82	86

[1] Poor: less than 50 percent ground cover or heavily grazed with no mulch.
Fair: 50 to 75 percent ground cover and not heavily grazed.
Good: greater than 75 percent ground cover and lightly or only occasionally grazed.
[2] Poor: less than 50 percent ground cover.
Fair: 50 to 75 percent ground cover.
Good: greater than 75 percent ground cover.
[3] Curve numbers shown were computed for areas with 50 percent woods and 50 percent grass (pasture) cover. Other combinations of conditions may be computed from the curve numbers for woods and pasture.
[4] Poor: Forest litter, small trees and brush are destroyed by heavy grazing or regular burning.
Fair: Woods are grazed but not burned, and some forest litter covers the soil.
Good: Woods are protected from grazing, and litter and brush adequately cover the soil.

Source: *TR-55* [3]

Table 4-4: Curve Numbers for Fully Developed Conditions

Zone	Curve Numbers for Hydrologic Soil Group			
	A	B	C	D
R-1/R-1A Single family	61	75	83	87
R-2/R-2A Single and two family	77	85	90	92
R-3/R-3L Multi family high density	77	89	92	94
R-3/R-3H Multi family low density	77	85	90	92
B-1/B-1A Convent & mobile homes	61	75	83	87
TH/TH-A Townhouse	77	89	92	92
ZH/ZH-A Zero lot line homes	68	79	87	90
C-1/C1A Neighborhood business	83	89	92	93
C-2/C-1B General Business	77	86	93	94
C-3 Commercial	89	92	94	95
C-4/C-4A Resort Commercial/PUD (must use composite values)	-	-	-	-
M-1/M1A Light industry	68	79	87	90
M-2/M-2A Heavy industry	89	92	94	95
Source: *TR-55* [3]				

Curve numbers can be reduced by either using a climatic adjustment as described in the *Texas Department of Transportation (TxDOT) Hydraulic Design Manual (HDM)* [4] or calibrating to historical storms. If curve numbers are calibrated from historical storms, the Engineer must provide documented data for rainfall, stream flow data, or detention pond stage storage data used to determine the historical curve numbers.

Time of concentration shall be computed using the same techniques as for the Rational Method. The lag time, defined as the time between the center of mass of excess rainfall to the runoff peak, is typically used in the Hydrologic Modeling System (HEC-HMS) implementation of the SCS methodology. The lag time can be estimated with Equation 4-9.

Equation 4-9

$$T_{lag} = 0.6T_c$$

The SCS/NRCS Unit Hydrograph shall be analyzed using 24-hour rainfall depths provided in Table 3-2. The 24-hour rainfall depths are to be distributed temporally with the NRCS Type III rainfall distribution.

4.4 Hydrologic Computer Programs

The preferred hydrologic model for the City is HEC-HMS. The use of other computer modeling software is discussed in **Section 1.3**. When using any model, use the procedures outlined in the respective user's manual. Data generated with the model and the results of the program shall be summarized on the drainage plans.

5 Street Flow

5.1 General Requirements

A. All roadways and/or paved alleys must contain the 100-year flow within the right-of-way. Runoff shall not enter private property from a street except in recorded drainage easements or rights-of-way, or in historic watercourses where easements or rights-of-way have not yet been obtained.
B. 100-year design storm depth of water shall not exceed 10 inches at any point within the street right-of-way and the product of maximum depth (feet) times average cross-section velocity (feet per second) at any point shall not exceed 6.0.
C. Rundowns, roadway slope, shall be designed to convey and contain drainage carried by the roadway to ensure the 100-year event is contained within the right-of-way. If a storm drain system is present, rundowns shall be designed for the difference between the storm drain capacity and the 100-year runoff, with a 25-year minimum design assuming all of the flow bypasses the storm drain system.
D. Driveways should be constructed to allow the 25-year design storm runoff to pass under the driveway in a culvert (18 inches minimum or equivalent) or over the driveway on a concrete apron. Concrete aprons or box culverts are preferred in areas of heavy sediment transport.
E. The side slope of a ditch or swale on the side adjacent to City roads shall be no steeper than 4:1. Roadways under TxDOT jurisdiction shall be designed in accordance with TxDOT requirements (6:1).
F. Water Spread Limits for Roadways is as indicated in Table 5-1. No lowering of the standard height of street crown shall be allowed for the purposes of obtaining additional hydraulic capacity. Where additional hydraulic capacity is required, the proposed street gradient must be increased or curb inlets and storm sewers installed to remove a portion of the flow.

Table 5-1: Water Spread Limits for Roadways

Street Classification	10-Yr Permissible Water Spread
Arterial Streets and Parkways	One 11-foot traffic lane must remain open in each direction.
Collector Streets	Clear width of 11 feet must remain open.
< Collector Streets	Water flow must not exceed the top of either curb.

5.2 Positive Overflow

The approved drainage system shall provide for positive overflow at all low points. The term “positive overflow” means that, when the inlets do not function properly or when the design capacity of the conduit or roadway ditch is exceeded, the excess flow can be conveyed overland along an open course. Normally, this would mean along a street or alley, but it can be constructed on private property within the dedication of a drainage easement.

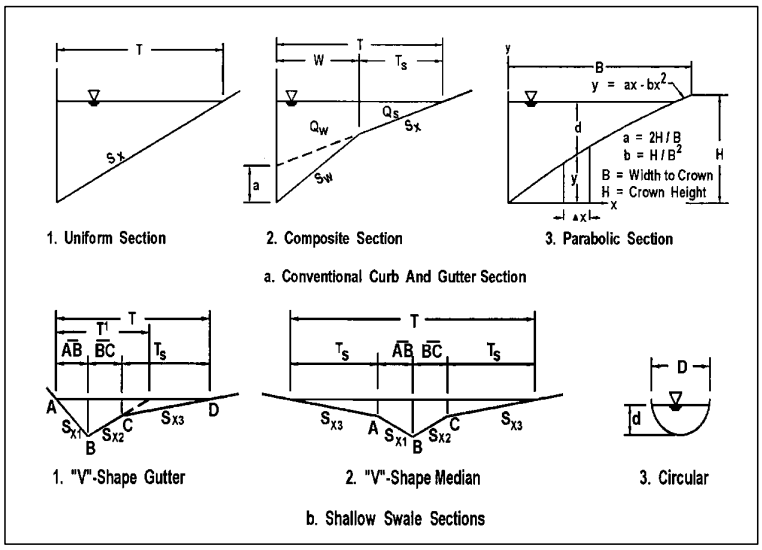
5.3 Street Flow Calculations

Evaluation of street flow is based upon open channel hydraulics theory, with the Manning’s Equation modified to allow direct solution, based on the street cross section. Refer to *Hydraulic Engineering*

Circular 22: Urban Drainage Design Manual (HEC 22) [5]. All proposed projects must meet the ponding criteria defined in this manual.

The following information was summarized from *HEC 22* for street flow calculations. The distance of the spread, T, is measured perpendicular to the curb face to the extent of the water on the roadway and is shown in Figure 5-1.

Figure 5-1: Typical Gutter Sections



Source: *HEC 22* [5]

Capacity Relationship

Gutter flow calculations are necessary to establish the spread of water on the shoulder, parking lane, or pavement section. A modification of the Manning's Equation can be used for computing flow in triangular channels. The modification is necessary because the hydraulic radius in the equation does not adequately describe the gutter cross section, particularly where the top width of the water surface may be more than 40 times the depth at the curb. To compute gutter flow, the Manning's Equation is integrated for an increment of width across the section [6]. The resulting equation is:

Equation 5-1

$$Q = \left(\frac{K_u}{n}\right) {S_x}^{1.67} {S_L}^{0.5} T^{2.67}$$

Or in terms of *T*:

Equation 5-2

$$T = \left[\frac{Qn}{K_u S_x^{1.67} S_L^{0.5}}\right] T^{0.375}$$

Where:

K_u = 0.56 in English units
n = Manning's coefficient (Table 5-2)
Q = Flow rate (cfs)
T = Width of flow (spread) (ft)
S_x = Cross slope (ft/ft)
S_L = Longitudinal slope (ft/ft).

Equation 5-1 neglects the resistance of the curb face since this resistance is negligible.

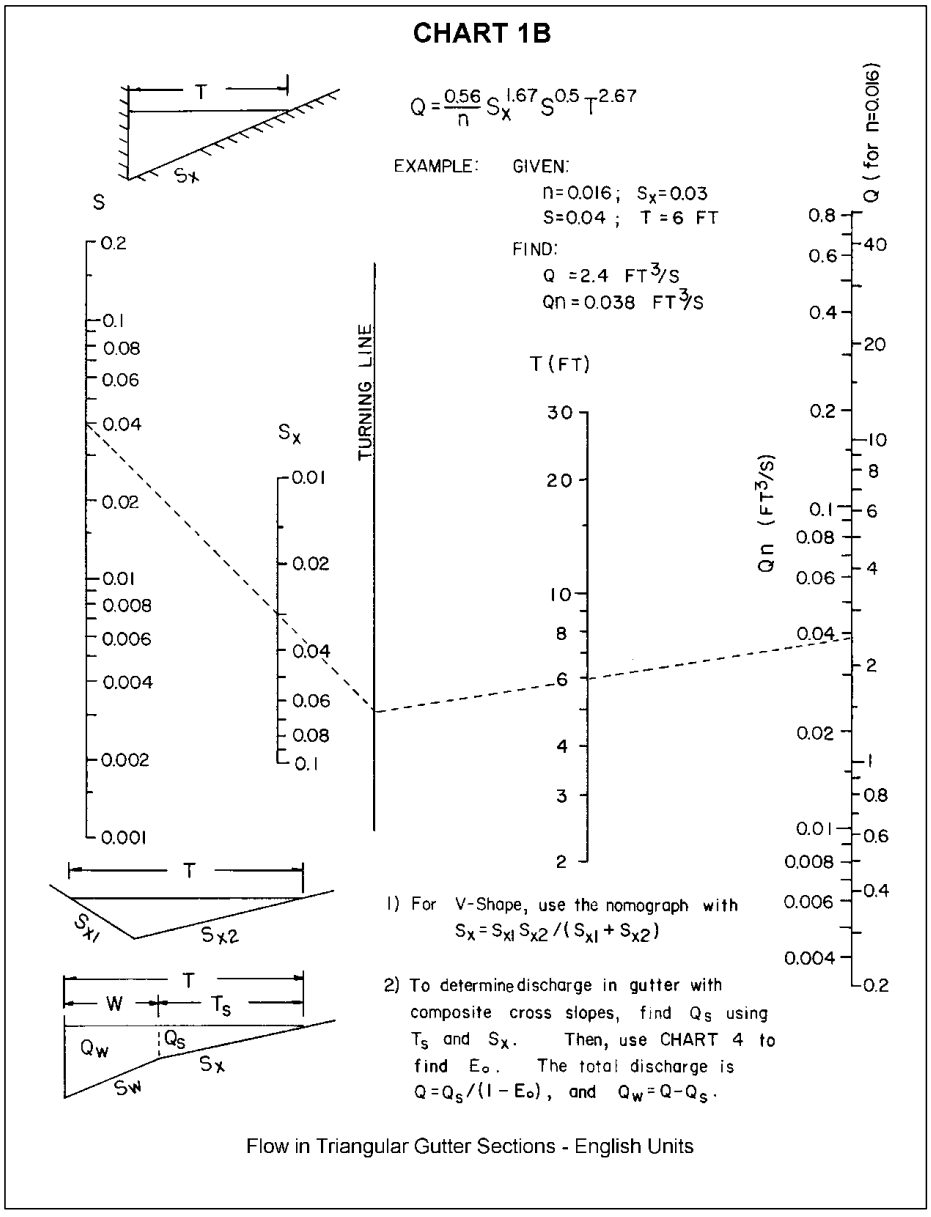
Spread on the pavement and flow depth at the curb are often used as criteria for spacing pavement drainage inlets. Figure 5-2 is a nomograph for solving Equation 5-1 and should be used as reference only, Figure 5-2 is not intended to replace equation 5-1. The chart can be used for either criterion with the relationship:

Equation 5-3

$$d = TS_x$$

Where:
d = Depth of flow (ft)
T = Width of flow (ft)
S_x = Cross slope (ft/ft).

Figure 5-2: Chart 1B – Flow in Triangular Gutter Sections



Flow in Triangular Gutter Sections - English Units

Source: *HEC 22* [5]

Table 5-2: Manning's n for Street and Pavement Gutters

Type of Gutter or Pavement	Manning's n
Concrete gutter, troweled finish	0.012
Asphalt Pavement: Smooth texture Rough texture	 0.013 0.016
Concrete gutter-asphalt pavement: Smooth Rough	 0.013 0.015
Concrete pavement: Float finish Broom finish	 0.014 0.016
For gutters with small slope, where sediment may accumulate, increase above values of "n" by…….	0.002
Source: *Design Charts for Open-Channel Flow (HDS 3)* [7]	

5.3.1 Shallow Swale Sections

Where curbs are not needed for traffic control, a small swale section of circular or V-shape may be used to convey runoff from the pavement. As an example, the control of pavement runoff on fills may be needed to protect the embankment from erosion. Small swale sections may have sufficient capacity to convey the flow to a location suitable for interception.

In lieu of using an irregular open channel cross-section to compute flow in small swale, Figure 5-2 can be used to compute the flow in a shallow V-shaped section. When using Chart 1B for V-shaped channels, the cross slope, S_x is determined by the following equation:

Equation 5-4

$$S_x = \frac{(S_{x1} S_{x2})}{(S_{x1} + S_{x2})}$$

5.4 Alley Flow Limitations

Alley capacities shall be checked at all alley turns and “T” intersections to determine if curbing is needed or grades should be flattened. Curbing shall be required for at least 10 feet on either side of an inlet in an alley and on the other side of the alley so that the top of the inlet is even with the high edge of the alley pavement. Alleys adjacent to drainage channel shall be required to have curbs for the full length of the channel.

5.5 Alley Flow Calculations

Flow in alleys is also based upon open channel hydraulic theory, with the Manning equation modified to allow direct solution, with regard to the alley cross section.

This page intentionally left blank.

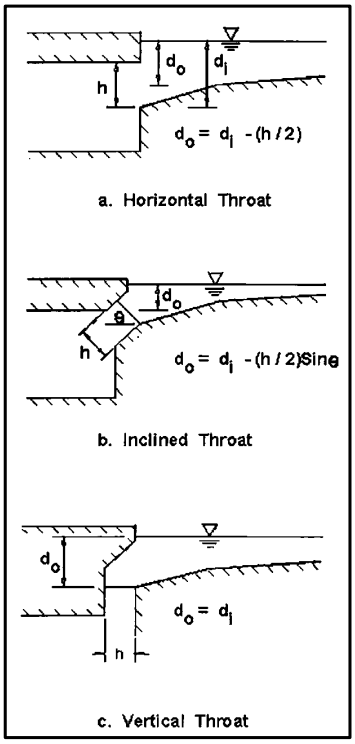
6 Inlet Design

6.1 General Requirements

Inlets shall be located as necessary to remove the flow based on the 25-year storm and accommodate ponding widths in streets as defined in Table 5-1. The hydraulic efficiency of storm drain inlets varies with the amount of gutter flow, street grade, street crown and the geometry of the inlet opening. The following are design considerations, which must be given attention during inlet design:

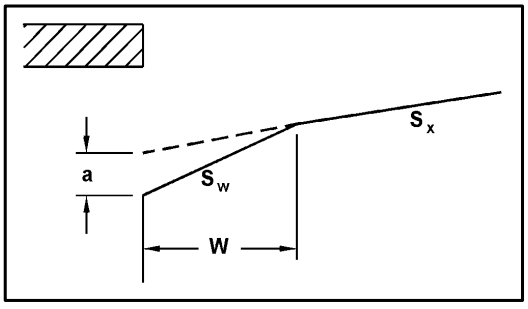
1. Inlets must be located where the allowable street flow capacities are exceeded, at low points (sumps or sags) and upstream of transition between normal and super-elevated street sections. Inlets should be located to intercept stormwater prior to traversing intersections.
2. In super-elevated sections of divided arterial streets, inlets placed against the center medians shall have no gutter depression. Interior gutter flow (flow along the median) shall be intercepted at the point of super-elevation transition, to prevent pavement cross flow.
3. At bridges with curbed approaches, gutter flow shall be intercepted prior to flowing onto the bridge, to prevent ice from developing during cold weather.
4. The maximum approved inlet throat opening is seven inches. Openings larger than seven inches require approval by the Engineering Division and, if approved, must contain a bar or other form of restraint. For curb opening inlets the throat opening is shown as “h” in Figure 6-1.
5. The design and location of all inlets must take into consideration pedestrian and bicycle traffic. Combination curb inlets (with opening in curb and grate opening in gutter) may be used only where space behind the curb prohibits the use of other inlet types.
6. Where recessed inlets are required, they shall not decrease the width of the sidewalk or interfere with utilities. Recessed inlets must also be depressed. The depression is measured from the theoretical gutter flow line, shown as “a” in Figure 6-2, and shall be one inch minimum.
7. Non-recessed, depressed inlets shall have a maximum allowable inlet depression of five inches.
8. The use of slotted drains is not allowed except in instances where there is no alternative, in which case approval must be obtained from the City Engineer. If slotted drains are used, the inlet capacity shall be the lesser of the calculated capacity from this manual or the manufacturer’s design guidelines and cleanouts shall be provided.

Figure 6-1: Curb Opening Inlet Examples



Source: *HEC 22* [5]

Figure 6-2: Depressed Curb Opening Inlet



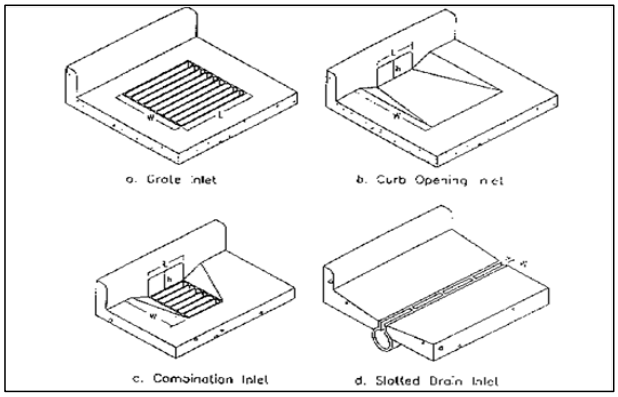
Source: *HEC 22* [5]

6.2 Inlet Types and Descriptions

Stormwater inlets are used to remove surface runoff and convey it to a storm drainage system. For the purposes of this manual, inlets are divided into four classes listed below and shown in Figure 6-3.

1. Grate Inlets
2. Curb Opening Inlets
3. Combination Inlet
4. Slotted Drain Inlets

Figure 6-3: Inlet Types



Source: *TxDOT HDM* [4]

6.2.1 Grate Inlets

Although grate inlets may be designed to operate satisfactorily in a range of conditions, they may become clogged by floating debris during storm events. In addition, they can produce a hazard to wheel chair and bicycle traffic and must be designed to be safe for both. For these reasons, they may be used only at locations where space restriction prohibit the use of other types of inlets and shall be designed to be twice as large as the theoretical required area to compensate for clogging.

6.2.2 Curb Opening Inlets

Curb opening inlets are the most effective type of inlet on slopes flatter than 3%, in sag locations, and with flows which typically carry large amounts of debris. Similar to grate inlets, curb opening inlets also tend to lose capacity as street grades increase, but to a lesser degree than grate inlets.

6.2.3 Combination Inlets

A combination inlet consists of both the grate inlet and the curb opening inlet. This configuration provides many of the advantages of both inlet types. The combination inlet also reduces the chance of clogging by debris with flow into the curb portion of the inlet. If a curb opening is extended on the upstream side of the combination inlet it will act as a “Sweeper”, and remove debris before it reaches the grate portion of the inlet.

6.2.4 Slotted Drain Inlets

Although slotted drain inlets can be used to intercept sheet flow, or flow in wide sections, they are not recommended for use in the City of New Braunfels since they are very susceptible to clogging from debris. Slot inlets may only be used with the permission of the City Engineer.

6.3 Inlet Capacity Calculations

The inlet capacity calculations provided below are summarized from *TxDOT HDM*. For additional information refer to the source document.

6.3.1 Combination Inlets

For a combination curb opening and grate inlet, assume that the capacity of the combination inlet comprises the sum of the capacity of the grate and the upstream curb opening length. Ignore the capacity of the curb opening that is combined with the grate opening. Refer to *HEC 22* for additional procedures and examples for computing the interception capacity of combination inlets.

6.3.2 Curb Opening Inlets On-Grade

The design of on-grade curb opening inlets involves determination of length required for total flow interception, subjective decision about actual length to be provided, and determination of any resulting carryover rate. For each on-grade inlet, determine early whether or not carryover is to be a valid design consideration. In some cases due to a logical location of the inlet, no carryover may be allowed. In other cases, while carryover is acceptable, there may not be a convenient location to accommodate the bypass flow. Use the following procedure to design curb inlets on-grade:

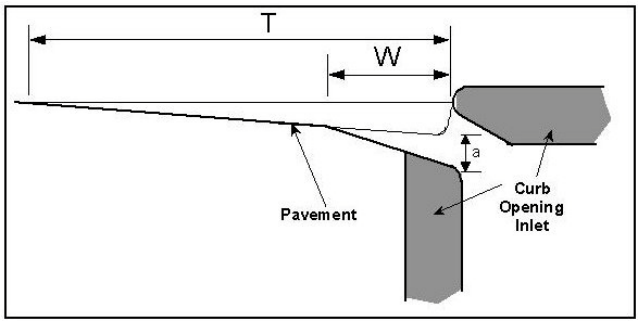
1. Compute depth of flow and ponded width (T) in the gutter section at the inlet.
2. Determine the ratio of the width of flow in the depressed section (W) to the width of total gutter flow (T) using Equation 6-1. Figure 6-4 shows the gutter cross section at an inlet.

Equation 6-1

$$E_0 = \frac{K_w}{K_w + K_0}$$

Where:
E_0 = ratio of depression flow to total flow
K_w = conveyance of the depressed gutter section (cfs)
K_0 = conveyance of the gutter section beyond the depression (cfs).

Figure 6-4: Gutter Cross-Section Diagram



Source: *TxDOT HDM* [4]

3. Use Equation 6-2 to calculate conveyance, K_w and K_0.

Equation 6-2

$$K = \frac{zA^{5/3}}{nP^{2/3}}$$

Where:
K = conveyance of cross section (cfs)
z = 1.486 for English measurements
A = area of cross section (ft^2)
n = Manning's roughness coefficient
P = wetted perimeter (ft).

4. Use Equation 6-3 to calculate the area of cross section in the depressed gutter section.

Equation 6-3

$$A_w = WS_x\left(T - \frac{W}{2}\right) + \frac{1}{2}aW$$

Where:
A_W = area of depressed gutter section (ft^2)
W = depression width for an on-grade curb inlet (ft)
S_x = cross slope (ft/ft)
T = calculated ponded width (ft)
a = curb opening depression depth (ft).

5. Use Equation 6-4 to calculate the wetted perimeter in the depressed gutter section.

Equation 6-4

$$P_W = \sqrt{[(WS_x + a)^2 + W^2]}$$

Where:
P_W = wetted perimeter of depressed gutter section (ft)
W = depression width for an on-grade curb inlet (ft)
S_x = cross slope (ft/ft)
a = curb opening depression depth (ft).

6. Use
7. Equation 6-5 to calculate the area of cross section of the gutter section beyond the depression.

Equation 6-5

$$A_0 = \frac{S_x}{2}(T - W)^2$$

Where:
A_0 = area of gutter/road section beyond the depression width (ft^2)
S_x = cross slope (ft/ft)
W = depression width for an on-grade curb inlet (ft)
T = calculated ponded width (ft).

8. Use Equation 6-6 to calculate the wetted perimeter of the gutter section beyond depression.

Equation 6-6

$$P_0 = T - W$$

Where:
P_0 =wetted perimeter of the depressed gutter section (ft)
T = calculated ponded width (ft)
W = depression width for an on-grade curb inlet (ft).

9. Use Equation 6-7 to determine the equivalent cross slope (S_e) for a depressed curb opening inlet.

Equation 6-7

$$S_e = S_x + \frac{a}{W} E_0$$

Where:
S_e = equivalent cross slope (ft/ft)
S_x = cross slope of the road (ft/ft)
a = gutter depression depth (ft)
W = gutter depression width (ft)
E_0 = ratio of depression flow to total flow.

10. Use Equation 6-8 to calculate the length of curb inlet required for total interception.

Equation 6-8

$$L_r = zQ^{0.42}S^{0.3}\left(\frac{1}{nS_e}\right)^{0.6}$$

Where:
L_r = length of curb inlet required (ft)
z = 0.6 for English measurement
Q = flow rate in gutter (cfs)
S = longitudinal slope (ft/ft)
n = Manning's roughness coefficient
S_e = equivalent cross slope (ft/ft).

If no carryover is allowed, the inlet length is assigned a nominal dimension of at least L_r. Use a nominal length available in standards for curb opening inlets. Do not use the exact value of L_r if doing so requires special details, special drawings and structural design, and costly and unfamiliar construction. If carryover is considered, round the curb opening inlet length down to the next available (nominal) standard curb opening length and compute the carryover flow.

6.3.2.1 Determine Carryover Flow

In carryover computations, efficiency of flow interception varies with the ratio of actual length of curb opening inlet supplied (L_a) to length L_r and with the depression to depth of flow ratio. Use Equation 6-9 for determining carryover flow.

Equation 6-9

$$Q_{co} = Q\left(1 - \frac{L_a}{L_r}\right)^{1.8}$$

Where:
Q_{co}= carryover discharge (cfs)
Q = total discharge (cfs)
La = design length of the curb opening inlet (ft)
L_r = length of curb opening inlet required to intercept the total flow (ft).

Carryover rates usually should not exceed about 0.5 cfs or about 30% of the original discharge. Greater rates can be troublesome and cause a significant departure from the principles of the Rational Method application. In all cases, you must accommodate any carryover rate at some other specified point in the storm drain system.

6.3.2.2 Calculate Intercepted Flow

Calculate the intercepted flow as the original discharge in the approach curb and gutter minus the amount of carryover flow.

6.3.3 Curb Inlets in Sag Configuration

The capacity of a curb inlet in a sag depends on the water depth at the curb opening and the height of the curb opening. The inlet operates as a weir to depths equal to the curb opening height and as an orifice at depths greater than 1.4 times the opening height. At depths between 1.0 and 1.4 times the opening height, flow is in a transition stage and the capacity should be based on the lesser of the computed weir and orifice capacity. Generally, this ratio should be less than 1.4 such that the inlet operates as a weir.

If the depth of flow in the gutter (d) is less than or equal to 1.4 times the inlet opening height (h), ($d \leq 1.4H$), determine the length of inlet required considering weir control. Otherwise, skip this step. Calculate the capacity of the inlet when operating under weir conditions with Equation 6-10.

Equation 6-10

$$L = \frac{Q}{C_w d^{1.5}} - 1.8W$$

Where:
Q = total flow reaching inlet (cfs)
C_w= weir coefficient ($ft\frac{0.5}{s}$)

Suggested value = 2.3 $ft.\frac{0.5}{s}$ for depressed inlets.

Suggested value = 3.0 $ft.\frac{0.5}{s}$ without depression.

d = head at inlet opening (ft), computed with Equation 10-1.
L = length of curb inlet opening (ft)
W = gutter depression width (perpendicular to curb)

If L > 12 ft, then W = 0 and C_w = 3.0 $ft.\frac{0.5}{s}$

If the depth of flow in the gutter is greater than the inlet opening height (d > h), determine the length of inlet required considering orifice control. The equation for interception capacity of a curb opening operating as an orifice follows:

Equation 6-11

$$Q = C_o h L \sqrt{2 g d_o}$$

Where:
Q = total flow reaching inlet (cfs)
Co = orifice coefficient = 0.67 *h* = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
d_o = effective head at the centroid of the orifice (ft).

For curb inlets with an inclined throat such as Type C inlet, the effective head, d_0, is at the centroid of the orifice.

This changes Equation 6-11 to:

Equation 6-12

$$Q = C_o h L \sqrt{2 g (y + a - \frac{h}{2} sin\theta)}$$

Where:
Q = total flow reaching inlet (cfs)
C_o = orifice coefficient = 0.67
h = depth of opening (ft) (this depth will vary slightly with the inlet detail used)
L = Length of curb opening inlet (ft)
g = acceleration due to gravity = 32.2 ft/s^2
y = depth of water in the curb and gutter cross section (ft)
a = gutter depression depth (ft).

Rearranging Equation 6-12 allows a direct solution for required length.

Equation 6-13

$$L = \frac{Q}{C_o h \sqrt{2 g (y + a - \frac{h}{2} \sin\theta)}}$$

If both steps 1 and 2 were performed (i.e., h < d < 1.4h), choose the larger of the two computed lengths as being the required length. Select a standard inlet length that is greater than the required length.

6.3.4 Slotted Drain Inlet Design

Use the following procedure for on-grade slotted drain inlets:

1. Determine the length of slotted drain inlet required for interception of all of the water in the curb and gutter calculated by Equation 6-14.

Equation 6-14

$$L_r = \frac{zQ_a^{0.442}S^E S_x^{-0.849}}{n^{0.384}}$$

Where:
Lr = length of slotted drain inlet required for total interception of flow (ft)
z = 0.706 for English measurement
Q_a = total discharge (cfs)
S = gutter longitudinal slope (ft/ft)
E = function of S and S_X as determined by Equation
S_X = transverse slope (ft/ft)
n = Manning's roughness coefficient.

Equation 6-14 is limited to the following ranges of variables: total discharge ≤ 5.5 cfs longitudinal gutter slope ≤ 0.09 ft/ft roughness coefficient (n) in the curb and gutter: 0.011 ≤ n ≤ 0.017.

Equation 6-15

$$E = 0.207 - 19.084S^2 + 2.613S - 0.0001S_x^{-2} + 0.007S_x^{-1} - 0.049SS_x^{-1}$$

The longitudinal slope exponent (E) is determined with Equation 6-14: Because the equations are empirical, extrapolation is not recommended.

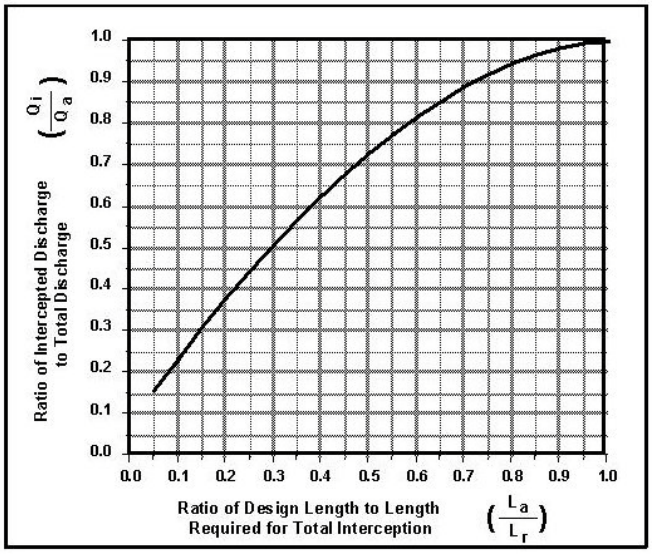
2. Select the desired design slotted drain length (L_a) based on standard inlet sizes. If $L_a < L_r$ the interception capacity may be estimated using Figure 6-5, multiplying the resulting discharge ratios by the total discharge. Alternatively, the carryover for a slotted drain inlet length may be directly computed using Equation 6-16.

Equation 6-16

$$Q_{co} = 0.918\,Q\left(1 - \frac{L_a}{L_r}\right)^{1.769}$$

Where:
Q_{co} = carryover discharge (cfs)
Q = total discharge (cfs)
L_a = design length of slotted drain inlet (ft)
L_r = length of slotted drain inlet required to intercept the total flow (ft).

Figure 6-5: Slotted Drain Inlet Interception Rate



Source: *TxDOT HDM* [4]

As a rule of thumb, you can optimize slotted drain inlets' economy by providing actual lengths (L_a) to required lengths (L_r) in an approximate ratio of about 0.65. This implies a usual design with carryover for on-grade slotted drain inlets.

6.3.5 Grate Inlets On-Grade

The capacity of a grate inlet on-grade depends on its geometry and cross slope, longitudinal slope, total gutter flow, depth of flow, and pavement roughness. The depth of water next to the curb is the major factor affecting the interception capacity of grate inlets. At low velocities, all of the water flowing in the section of gutter occupied by the grate, called frontal flow, is intercepted by grate inlets, and a small portion of the flow along the length of the grate, termed side flow, is intercepted. On steep slopes, only a portion of the frontal flow will be intercepted if the velocity is high or the grate is short and splash-over occurs. For grates less than 2 feet long, intercepted flow is small. Agencies and manufacturers of grates have investigated inlet interception capacity. For inlet efficiency data for various sizes and shapes of grates, refer to *Hydraulic Engineering Circular 12: Drainage of Highway Pavements (HEC 12)* [8].

Grate inlets shall be designed to be twice as large as the theoretical required area.

6.3.5.1 Bicycle Safety

A parallel bar grate is the most efficient type of gutter inlet; however, when crossbars are added for bicycle safety, the efficiency is reduced. Where bicycle traffic is a design consideration, the curved vane grate and the tilt bar grate are recommended for both their hydraulic capacity and bicycle safety

features. In certain locations where leaves may create constant maintenance problems, the parallel bar grate may be used more efficiently if bicycle traffic is prohibited.

6.3.5.2 Design Procedure

Use the following procedure for grate inlets on-grade:

1. Compute the ponded width of flow (T).
2. Choose a grate type and size.
3. Find the ratio of frontal flow to total gutter flow (E_o) for a straight cross-slope using Equation 6-1. No depression is applied to a grate on-grade inlet.
4. Find the ratio of frontal flow intercepted to total frontal flow, R_f, using Equation 6-17, Equation 6-18, and Equation 6-19.

Equation 6-17

$$R_f = 1 - 0.3(v - v_o) \ , if \ v > v_o$$

Equation 6-18

$$R_f = 1.0 \ , if \ v > v_o$$

Where:

R_f = ratio of frontal flow intercepted to total frontal
v = approach velocity of flow in gutter (ft/s)
v_o = minimum velocity that will cause splash over grate (ft/s).

For triangular sections, calculate the approach velocity of flow in gutter (v) using Equation 6-19.

Equation 6-19

$$v = \frac{2Q}{Ty} = \frac{2Q}{T^2 S_x}$$

Otherwise, compute the section area of flow (A) and calculate the velocity using Equation 6-20.

Equation 6-20

$$v = \frac{Q}{A}$$

Calculate the minimum velocity (v_o) that will cause splash over the grate using the appropriate equation in Table 6-1.

Where:
v_o = splash-over velocity (ft/s)
L = length of grate (ft).

Table 6-1: Splash-Over Velocity Calculation Equations

Grate Configuration	Typical Bar Spacing (in.)	Splash-over Velocity Equation
Parallel Bars	2	$v_o = 2.218 + 4.031L - 0.649L^2 + 0.056L^3$
Parallel Bars	1.2	$v_o = 1.762 + 3.117L - 0.451L^2 + 0.033L^3$
Transverse Curved Vane	4.5	$v_o = 1.381 + 2.78L - 0.300L^2 + 0.020L^3$
Transverse 45° Tilted Vane	4	$v_o = 0.988 + 2.625L - 0.359L^2 + 0.029L^3$
Parallel bars w/ transverse rods	2 parallel / 4 trans	$v_o = 0.735 + 2.437L - 0.265L^2 + 0.018L^3$
Transverse 30° Tilted Vane	4	$v_o = 0.505 + 2.344L - 0.200L^2 + 0.014L^3$
Reticuline	n/a	$v_o = 0.030 + 2.278L - 0.179L^2 + 0.010L^3$

Source: *TxDOT HDM* [4]

5. Find the ratio of side flow intercepted to total side flow, R_s.

Equation 6-21

$$R_s = \left[1 + \frac{zv^{1.8}}{S_x L^{2.3}}\right]^{-1}$$

Where:
R_S = ratio of side flow intercepted to total flow
z = 0.15 for English measurement
S_x = transverse slope
v = approach velocity of flow in gutter (ft/s)
L = length of grate (ft).

6. Determine the efficiency of grate, E_f. Use Equation 6-22.

Equation 6-22

$$E_f = \left[R_f E_o + R_s(1 - E_o)\right]$$

7. Calculate the interception capacity of the grate, Q_i. Use Equation 6-23. If the interception capacity is greater than the design discharge, skip step 8.

Equation 6-23

$$Q_i = E_f Q = Q[R_f E_o + R_s(1 - E_o)]$$

8. Determine the carryover, CO. Use Equation 6-24.

Equation 6-24

$$CO = Q - Q_i$$

9. Depending on the carryover, select a larger or smaller inlet as needed. If the carryover is excessive, select a larger configuration of inlet and return to step 3. If the interception capacity far exceeds the design discharge, consider using a smaller inlet and return to step 3.

6.3.6 Design Procedure for Grate Inlets in Sag Configurations

A grate inlet in sag configuration operates in weir flow at low ponding depths. A transition to orifice flow begins as the ponded depth increases. Use the following procedure for calculating the inlet capacity:

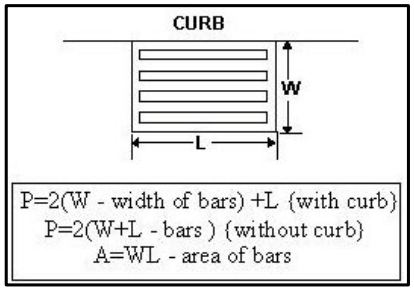
1. Choose a grate of standard dimensions to use as a basis for calculations.
2. Determine an allowable head (h) for the inlet location. This should be the lower of the curb height and the depth associated with the allowable ponded width. No gutter depression is applied at grate inlets.
3. Determine the capacity of a grate inlet operating as a weir. Under weir conditions, the grate perimeter controls the capacity. Figure 6-6 shows the perimeter length for a grate inlet located next to and away from a curb. The capacity of a grate inlet operating as a weir is determined using Equation 6-25.

Equation 6-25

$$Q_w = C_w P^{1.5}$$

Where:
Q_w = weir capacity of grate (cfs)
C_w = weir coefficient = 3 for English measurement
P = perimeter of the grate (ft) as shown in Figure 6-6: A multiplier of 0.5 is required to be applied to the measured perimeter as a safety factor.
h = allowable head on grate (ft).

Figure 6-6: Perimeter Length for Grate Inlet in Sag Configuration



Source: *TxDOT HDM* [4]

4. Determine the capacity of a grate inlet operating under orifice flow. Under orifice conditions, the grate area controls the capacity. The capacity of a grate inlet operating under orifice flow is computed with Equation 6-26.

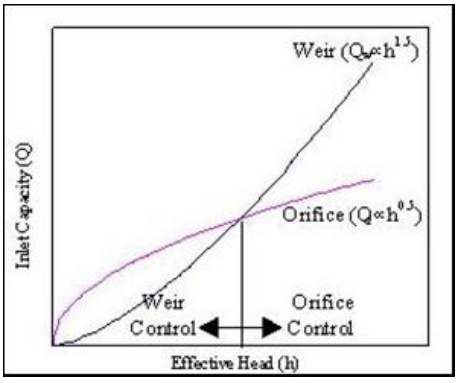
Equation 6-26

$$Q_o = C_o A \sqrt{2 g h}$$

Where:
Q_o = orifice capacity of grate (cfs)
C_o = orifice flow coefficient = 0.67
A = clear opening area (ft^2) of the grate (the total area available for flow). A multiplier of 0.5 is required to be applied to the measured area as a safety factor
g = acceleration due to gravity = 32.2 ft/s^2
h = allowable head on grate (ft).

5. Compare the calculated capacities from steps 3 and 4 and choose the lower value as the design capacity. The design capacity of a grated inlet in a sag is based on the minimum flow calculated from weir and orifice conditions. Figure 6-7 demonstrates the relationship between weir and orifice flow. If Q_O is greater than Q_w (to the left of the intersection in Figure 6-7), then the designer would use the capacity calculated with the weir equation. If, however, Q_o is less than Q_w (to the right of the intersection), then the capacity as determined with the orifice equation would be used.

Figure 6-7: Relationship between Head and Capacity for Weir and Orifice Flow



Source: *TxDOT HDM* [4]

This page intentionally left blank.

7 Storm Drain Systems

7.1 General Requirements

A. Storm drain systems shall be designed for the 25-year design storm with the design hydraulic grade line (HGL) of the system located, at minimum, ~~of 2 feet~~ below the ~~theoretical~~ gutter flow line ~~of inlets~~and shall not cause surcharging. Storm drain energy grade lines (EGL) shall remain below top of curb elevation.

B. Storm drain pipe shall be reinforced concrete pipe (AASHTO M170 Class III). Corrugated metal pipe or plastic pipe shall not be permitted for storm drain systems in the public right-of-way.

C. Concrete pipe collars or manufactured transition pieces must be used at all pipe size changes on trunk lines. For all pipe junctions other than manholes and junction boxes, manufactured wye connections should be used, and the angle of intersection shall not be greater than 45 degrees. This includes discharges into box culverts and channels. Laterals shall be connected to trunk lines using manholes or manufactured wye connections. Inlet laterals will connect only one inlet to the trunk line. Vertical curves in the conduit will not be permitted, and horizontal curves must meet manufacturer's requirements for offsetting of the joints.

D. The maximum manhole and junction box spacing for storm drain systems are shown in Table 7-1. Manholes or junction boxes shall also be place at: pick up points having three or more laterals; trunk line size changes for pipes with diameter differences greater than 24 inches; vertical alignment changes; and, future collection points. The requirement for manholes may be waived if the pipe size allows direct access into the pipe by maintenance personnel and equipment.

E. The ~~cover over the~~ crown of circular pipe should be ~~at least three feet~~ a minimum 6 inches below the design pavement section and should be based on the type of pipe used, the expected loads and the supporting strength of the pipe. Box sections should normally have a minimum of one foot of cover; however, box sections may be designed for direct traffic in special situations with approval.

F. Grates for drop inlets should be designed to facilitate removal for maintenance, but minimize vandalism. Design shall consider traffic loading, bicycle and pedestrian safety, and a means to secure grate.

G. The minimum lateral and trunk line pipe shall be 24 inches.

H. At no time shall bypass flow exceed the water spread limits for roadways as defined by Table 5-1. Inlets shall be located to prevent water convergence and/or excessive flows through intersections.

I. For arterial or collector streets with super-elevated sections, no more than 3 cubic feet per second of the 25-year flow will be allowed to cross flow from the higher elevation to the lower elevation.

J. All storm sewer conduits to be dedicated to the City of New Braunfels, and outside of the right-of-way, shall be located in drainage easements dedicated to the City of New Braunfels at the time of final platting of the property. Storm sewer easements shall be at least 15 feet wide. Wider easements may be required to accommodate larger storm drain systems.

Table 7-1: Maximum Spacing of Manholes and Junction Boxes

Pipe Diameter (in)	Max. Spacing (ft)
24	400
27-39	800
42-60	1,000
Larger than 60	1,200

7.2 Design Criteria

A. Storm drain systems shall be designed for the 25-year design storm and evaluated for the 100-year design storm. Systems shall be designed with Manning's Equation and step backwater methodology outlined in the *TxDOT HDM* and summarized in this section. The minimum coefficient of roughness for concrete storm drain pipe is 0.013.

B. The minimum velocity in a conduit shall be 2.5 feet per second for the 25-year design storm. This minimum velocity is required to minimize or prevent the accumulation of sediment in the system. Such sediment accumulation can severely reduce to ability of the system to convey the design flow.

C. Maximum velocities in conduits are important because of the possibility of excessive erosion of the storm drainpipe material. Table 7-2 lists the maximum velocities allowed. Maximum flow velocities at the downstream end of pipe systems shall be consistent with the maximum allowable velocities for the receiving channel (refer to **Section 8**). Erosion protection is required for outfalls into natural channels.

D. The maximum discharge velocities in the pipe shall not exceed the design velocity of the receiving channel or conduit at the outfall. The maximum outfall velocity of a conduit in partial flow shall be computed for partial depth and shall not exceed the maximum permissible velocity of the receiving channel unless controlled by an appropriate energy dissipater.

E. When establishing the hydraulic gradient of a storm sewer, entrance and exit losses, expansion losses, manhole and bend losses, junction losses, and minor head losses at points of turbulence shall be calculated and included in the computation of the hydraulic gradient.

F. The flow lines of storm sewer conduits that discharge into open channels shall be higher than or equal to the flow line of the channel. Storm sewer outfall pipes shall not be at sump with the receiving channel.

G. Pipe diameters shall increase downstream. Pipe size and slope shall be designed so that the velocity of flow will increase progressively down the system or at least will not appreciably decrease at inlets, bends or other changes in geometry or configuration to prevent sedimentation.

H. At points of change in storm drain size, pipe crowns (soffits) shall be set at the same elevation.

Table 7-2: Maximum Velocity in Storm Drains

Storm Drain Type	Maximum Velocity
Inlet Laterals (shorter than 30 feet)	No Limit
Inlet Laterals (longer than 30 feet)	15 feet per second
Trunk Lines	15 feet per second

7.3 Calculation of the Hydraulic Grade Line

The 25-year and 100-year frequency hydraulic grade line (HGL) shall be computed and plotted for all storm drain systems. The 25-year frequency hydraulic grade line shall be calculated throughout the system and shall be at least two feet below the theoretical gutter line at the entrance to the inlet. The determination of friction losses and minor losses are required for these calculations.

7.3.1 Tailwater Conditions

A. The designer must determine the tailwater conditions at the downstream end of the proposed storm drain system when calculating the hydraulic performance of the system. When proposed storm drains are to discharge into existing watercourses, the tailwater elevation used in hydraulic calculations of the proposed storm drain system will be determined by the design engineer. The tailwater elevation shall be the greater of the water surface of the receiving stream and the minimum outlet water surface, y_m, both in feet above mean sea level (ft msl). The minimum water surface, y_m, is derived from the following equations:

Equation 7-1

$$y_{m=\frac{(D_0+y_c)}{2}+FL}$$

Where:
y_m = minimum water surface elevation of the pipe (ft msl)
D_0 = pipe outlet diameter (ft)
y_c = critical depth of the channel for a given flow and geometric conditions (ft)
FL = flow line of the pipe, lateral, trunk, or channel (ft msl).

The critical depth, y_c, is determined by the following equation for Froude Number, which is set equal to 1.0 and solved for depth:

Equation 7-2

$$1.0 = \frac{\left({}^{Q}/_{A}\right)}{(gD)^{0.5}}$$

Where:
Q = flow in the inlet pipe (cfs)
A = cross-sectional area of the flow (ft^2)
D = diameter of the inlet pipe (ft)
g = acceleration due to gravity = 32.2 ft/sec^2

B. Storm drain outfalls to a river or stream creates the need to consider the joint or coincidental probability of two hydrologic events occurring at the same time to adequately determine the elevation of the tailwater in the receiving stream. The relative independence of the discharge from the storm drainage system can be qualitatively evaluated by a comparison of the drainage area of the receiving stream to the area of the storm drainage system. For example, if the storm drainage system has a drainage area much smaller than that of the receiving stream, the peak discharge from the storm drainage system may be out of phase with the peak discharge from the receiving watershed. In this case, it would be necessary to establish an appropriate design tailwater elevation for a storm drainage system based on the expected coincident storm frequency on the outfall channel. The area ratio shown in Figure 7-3 is the ratio of the main stream (receiving area) to the tributary (storm system drainage area).
C. The designer must also perform a "Normal Depth" outfall analysis to determine the maximum outlet velocities of the facility. This analysis includes solving the downstream boundary condition using Manning's Equation for Normal Depth.

Table 7-3: Frequencies for Coincidental Occurrences

Area Ratio	**2-Year design**		**5-Year Design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	1	2	1	5
	2	1	5	1
1,000:1	1	2	2	5
	2	1	5	2
100:1	2	2	2	5
	2	2	5	5
10:1	2	2	5	5
	2	2	5	5
1:1	2	2	5	5
	2	2	5	5
Area Ratio	**10-year design**		**25-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	1	10	2	25
	10	1	25	2
1,000:1	2	10	5	25
	10	2	25	5
100:1	5	10	10	25
	10	5	25	10
10:1	10	10	10	25
	10	10	25	10
1:1	10	10	25	25
	10	10	25	25
Area Ratio	**50-year design**		**100-year design**	
	Main Stream	**Tributary**	**Main Stream**	**Tributary**
10,000:1	2	50	2	100
	50	2	100	2
1,000:1	5	50	10	100
	50	5	100	10
100:1	10	50	25	100
	50	10	100	25
10:1	25	50	50	100
	50	25	100	50
1:1	50	50	100	100
	50	50	100	100
Source: *TxDOT HDM* [4]				

7.3.2 Friction Losses

Friction losses or major losses shall be computed using Manning's Equation. The friction loss (h_f) for a segment of conduit is defined by the product of the friction slope at full flow and the length of the conduit. Per the *TxDOT HDM*, the simplified form of the equation is shown in Equation 7-3.

Equation 7-3

$$h_f = \frac{Q^2 n^2}{z^2 A^2 R^{4/3}} L$$

Where:
Q = discharge (cfs)
n = Manning's roughness coefficient
z = 1.486 for use with English measurements only
A = cross-sectional area of flow (ft^2)
R = hydraulic radius (ft)
L = length of pipe (ft).

7.3.3 Minor Energy Losses

Minor energy losses in storm drains are attributed from junctions, bends, manholes or inlets, and expansions and contractions. Minor energy losses are required to be evaluated when designing a storm drain system. The following equations and methods shall be used when designing a storm drain system and are base on design information in the *TxDOT HDM*.

7.3.3.1 Junction Loss Equation

A pipe junction is the connection of a lateral pipe to a larger trunk pipe without the use of an access hole. The minor loss equation for a pipe junction is in the form of the momentum equation. In Equation 7-4, the subscripts "i", "o", and "1" indicate the inlet, outlet and lateral, respectively.

Equation 7-4

$$h_j = \frac{Q_o v_o - Q_i v_i - Q_1 v_1 cos\theta}{0.5 g (A_o + A_i)}$$

Where:

h_j = junction head loss (ft)
Q = flow (cfs)
v = velocity (fps)
A = cross-sectional area (ft^2)
θ = angle in degrees of lateral with respect to centerline of outlet pipe
g = gravitational acceleration = 32.2 ft/s^2.

The above equation applies only if $v_0 > v_i$ and assumes that $Q_o = Q_i + Q_1$.

7.3.3.2 Exit Loss Equation

The exit loss, h_0, is a function of the change in velocity at the outlet of the pipe as shown in Equation 7-5.

Equation 7-5

$$h_o = C_o \frac{v^2 - v_d^2}{2g}$$

Where:
h_o = exit loss (ft)
v = average outlet velocity (fps)
v_d = channel velocity downstream of the outlet (fps)
C_O = exit loss coefficient (0.5 typical).

The above assumes that the channel velocity is lower than the outlet velocity. Note that, for partial flow where the pipe outfalls into a channel with water moving in the same direction, the exit loss may be reduced to virtually zero.

7.3.3.3 Inlet and Access Hole Energy Loss Equations

HEC 22 presents the method to compute energy losses for inlets and access holes.

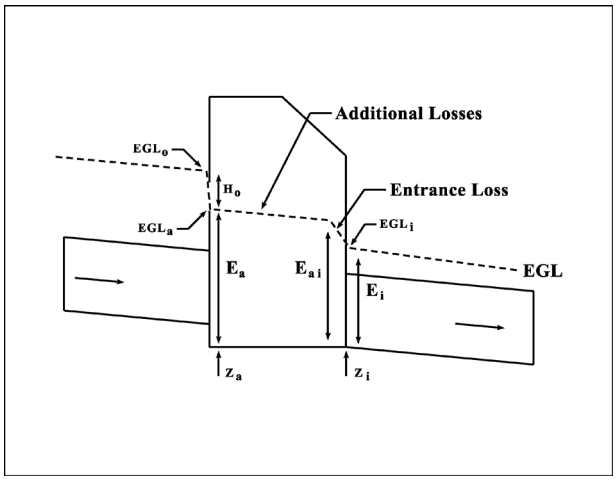
As a starting point, the outflow pipe energy head (E_i) is the difference between the energy gradeline in the outflow pipe (EGL_i) and the outflow pipe flowline (Z_i), as determined in Equation 7-6 and shown on Figure 7-1.

Equation 7-6

$$E_i = EGL_i - Z_i$$

Where:
E_i = Outflow pipe energy head (ft)
EGL_i = Outflow pipe energy gradeline (ft)
Z_i = Outflow pipe flowline elevation (ft).

Figure 7-1: Access Hole Energy Level Definitions



Source: *TxDOT HDM* [4]

Initial Access Hole Energy Level

The initial estimate of energy level (E_{ai}) is taken as the maximum of the three values, E_{aio}, E_{ais}, and E_{aiu}, as determined in Equation 7-7.

Equation 7-7

$$E_{ai} = max(E_{aio}, E_{ais,} E_{aiu})$$

Where:
E_{aio} = estimated access hole energy level for outlet control (full and partial flow)
E_{ais} = estimated access hole energy level for inlet control (submerged)
E_{aiu} = estimated access hole energy level for inlet control (unsubmerged).

E_{aio} – Estimated Energy Level for Outlet Control

In the outlet control condition, flow out of the access hole is limited by the downstream storm drain system. The outflow pipe would be in subcritical flow and could be either flowing full or partially full. Whether the outflow pipe is flowing full or partially full affects the value of E_{aio}. This can be determined by describing and rearranging the outflow pipe energy head E_i. E_i can be described as the sum of the potential head, pressure head, and velocity head, as shown in Equation 7-8.

Equation 7-8

$$E_i = y + \left({}^{P}/_{\gamma}\right) + \frac{V^2}{2g}$$

Where:
y = Outflow pipe depth (potential head) (ft)
(P/γ) = Outflow pipe pressure head (ft)
$V^2/2g$ = Outflow pipe velocity head (ft).

Rearranging Equation 7-8 to isolate the potential head and pressure head gives Equation 7-9.

Equation 7-9

$$y + \left({}^{P}/_{\gamma}\right) = E_i - \frac{V^2}{2g}$$

If $y + (P/\gamma)$ is less than the diameter of the outflow pipe, then the pipe is in partial flow and the estimated initial structure energy level (E_{aio}) is equal to zero ($E_{aio} = 0$).

If $y + (P/\gamma)$ is greater than the diameter of the outflow pipe, then the pipe is in full flow, and the estimated initial structure energy level (E_{aio}) is calculated using Equation 7-10:

Equation 7-10

$$E_{aio} = E_i + H_i$$

Where:
E_i = Outflow pipe energy head (ft)
H_i = entrance loss assuming outlet control, using Equation 7-11.

Equation 7-11

$$H_i = 0.2\frac{V^2}{2g}$$

Where:
$V^2/2g$ = Outflow pipe velocity head (ft).

E_{ais} – Estimated Energy Level for Inlet Control: Submerged

The submerged inlet control energy level (E_{ais}) checks the orifice condition and is estimated using Equation 7-12:

Equation 7-12

$$E_{ais} = D_o(DI)^2$$

Where:
D_o = Diameter of outflow pipe (ft)
DI = Discharge Intensity parameter, calculated by Equation 7-13:

Equation 7-13

$$DI = \frac{Q}{[A(gD_o)^{0.5}]}$$

Where:
DI = discharge Intensity parameter
Q = flow in outfall pipe (cfs)
A = area of outflow pipe (ft^2)
D_o = diameter of outflow pipe (ft).

E_{aiu} – Estimated Energy Level for Inlet Control: Unsubmerged

The unsubmerged inlet control energy level (E_{aiu}) checks the weir condition and is estimated using Equation 7-14:

Equation 7-14

$$E_{aiu} = 1.6D_o(DI)^{0.67}$$

Adjustments for Benching, Angled Flow, and Plunging Flow

The revised access hole energy level (E_a) is determined by adding three loss factors for: (1) benching configurations; (2) flows entering the structure at an angle; and (3) plunging flows. Flows entering a structure from an inlet can be treated as plunging flows and determined by Equation 7-15.

Equation 7-15

$$E_a = E_{ai} + H_a$$

Where:
E_a = the revised access hole energy level
E_{ai} = the initial estimate of access hole energy level, calculated using Equation 7-7
H_a = additional energy loss due to benching, angled inflow and plunging inflow, calculated using Equation 7-16.

If E_a is calculated to be less than the outflow pipe energy head (E_i), then E_a should be set equal to E_i.

Equation 7-16

$$H_a = \left(C_B + C_\theta + C_p\right)\left(E_{ai} - E_i\right)$$

Where:

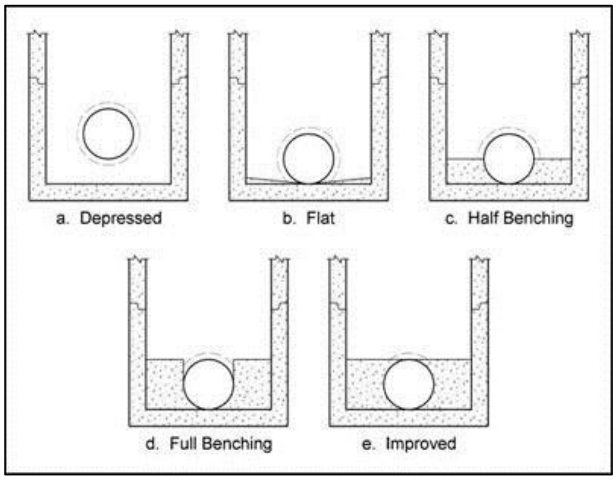
C_B = Coefficient for benching (floor configuration)
C_θ = Coefficient for angled flows
C_P = Coefficient for plunging flows.

Note that the value of H_a should always be positive. If not, H_a should be set to zero.

Additional Energy Loss: Benching

Benching serves to direct flow through the access hole, which reduces energy losses. Figure 7-2 illustrates some typical bench configurations.

Figure 7-2: Access hole benching methods



Source: *TxDOT HDM* [4]

The energy loss coefficient for benching, (C_B), is obtained from Table 7-4. A negative value indicates water depth will be decreased rather than increased.

Table 7-4: Values for the Coefficient, CB

Floor Configuration	C_B
Flat (level)	-0.05
Depressed	0.0
Unknown	-0.05

Source: *TxDOT HDM* [4]

Additional Energy Loss: Angled Inflow

The angles of all inflow pipes into the access hole are combined into a single weighted angle (θ_w) using Equation 7-17:

Equation 7-17

$$\theta_W = \Sigma\left(\left(Q_J\theta_J\right)\left(\Sigma Q_J\right)\right)$$

Where:
Q_J = Contributing flow from inflow pipe (cfs)
θ_J = Angle measured from the outlet pipe (degrees)(plunging flow is 180 degrees).

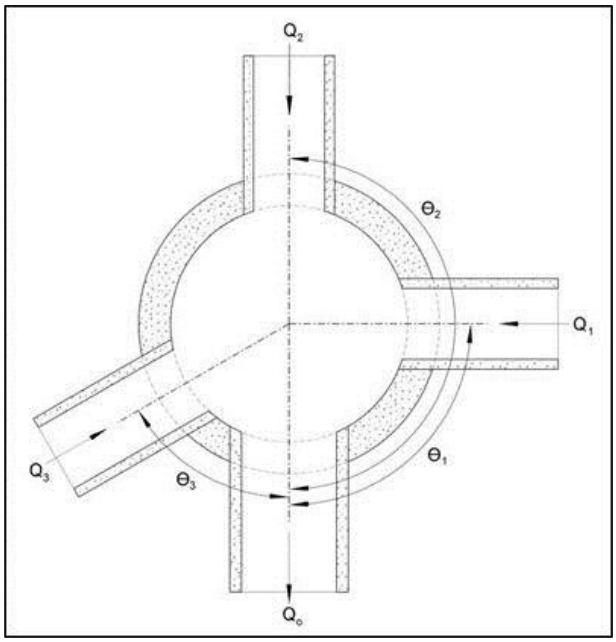
Figure 7-3 illustrates the orientation of the pipe inflow angle measurement. The angle for each inflow pipe is referenced to the outlet pipe, so that the angle is not greater than 180 degrees. A straight pipe angle is 180 degrees. If all flows are plunging, θ_w is set to 180 degrees; the angled inflow coefficient approaches zero as θ_w approaches 180 degrees and the relative inflow approaches zero. The angled inflow coefficient (C_θ) is calculated by Equation 7-18:

Equation 7-18

$$C_\theta = 4.5\frac{\left(\sum Q_J\right)}{Q_o}\cos\left(\frac{\theta_W}{2}\right)$$

Where:
Q_o = Flow in outflow pipe (cfs).

Figure 7-3: Access hole angled inflow definition



Source: *TxDOT HDM* [4]

Additional Energy Loss: Plunging Inflow

Plunging inflow is defined as inflow from an inlet or a pipe where the pipe flowline is above the estimated access hole water depth (approximated by E_{ai}).

The relative plunge height (h_k) for each inflow pipe is calculated using Equation 7-19

Equation 7-19

$$h_k = \frac{(Z_k - E_{ai})}{D_o}$$

Where:
Z_k = the difference between the inflow pipe flowline elevation and the access hole flowline elevation. If $Z_k > 10D_o$ it should be set to $10D_o$.

The relative plunge height for each inflow pipe is calculated separately and then combined into a single plunging flow coefficient (C_P):

Equation 7-20

$$C_p = \frac{\sum(Q_k H_k)}{Q_o}$$

As the proportion of plunging flows approaches zero, C_P also approaches zero.

Access Hole Energy Gradeline

Knowing the access hole energy level (E_a) and assuming that the access hole flowline (Z_a) is the same elevation as the outflow pipe flowline (Z_i) allows determination of the access hole energy gradeline (EGL_a):

Equation 7-21

$$EGL_a = E_a + Z_a$$

As described earlier, the potentially highly turbulent nature of flow within the access hole makes determination of water depth problematic. Research has shown that determining velocity head within the access hole is very difficult, even in controlled laboratory conditions. However, a reasonable assumption is to use the EGL_a as a comparison elevation to check for potential surcharging of the system.

Inflow Pipe Exit Losses

The final step is to calculate the energy gradeline into each inflow pipe, whether plunging or non-plunging.

Non-Plunging Inflow Pipe

Non-plunging inflow pipes are those pipes with a hydraulic connection to the water in the access hole. Inflow pipes operating under this condition are identified when the revised access hole energy gradeline (E_a) is greater than the inflow pipe flowline elevation (Z_o). In this case, the inflow pipe energy head (EGL_o) is equal to:

Equation 7-22

$$EGL_o = EGL_a + H_o$$

Where:
$H_o = 0.4(V^2/2g)$ = Inflow pipe exit loss.

Exit loss is calculated in the traditional manner using the inflow pipe velocity head since a condition of supercritical flow is not a concern on the inflow pipe.

Plunging Inflow Pipe

For plunging inflow pipes, the inflow pipe energy gradeline (EGL_o) is logically independent of access hole water depth and losses.

Continuing Computations Upstream

For either the nonplunging or plunging flows, the resulting energy gradeline is used to continue computations upstream to the next access hole. The procedure of estimating entrance losses, additional losses, and exit losses is repeated at each access hole.

7.3.4 Energy Gradeline Procedure

1. Determine the EGL_i and HGL_i downstream of the access hole. The EGL and HGL will most likely need to be followed all the way from the outfall. If the system is being connected to an existing storm drain, the EGL and HGL will be that of the existing storm drain.
2. Verify flow conditions at the outflow pipe.
    a. If HGL_i is greater or equal to the soffit of the outflow pipe, the pipe is in full flow.
    b. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth, the pipe is not in full flow but downstream conditions still control.
    c. If HGL_i is less than the soffit of the outflow pipe but greater than critical depth and less than or equal to normal depth, the pipe is in subcritical partial flow. EGL_i becomes the flowline elevation plus normal depth plus the velocity head.
    d. If HGL_i is less than critical depth, the pipe is in super-critical partial flow conditions. Pipe losses in a supercritical pipe section are not carried upstream.
3. Estimate E_i (outflow pipe energy head) by subtracting Z_i (pipe flowline elevation) from the EGL_i using Equation 7-6. Calculate $y + P/\gamma$ using Equation 7-9. Compute DI using Equation 7-13.
4. Calculate E_{ai} as maximum of E_{aio}, E_{ais}, and E_{aiu} as below:
    a. If $(y + P/\gamma) > D$, then the pipe is in full flow and $E_{aio} = E_i + H_i$ (Equation 7-10). If $(y + P/\gamma) < D$, then the pipe is in partial flow and $E_{aio} = 0$.
    b. $E_{ais} = D_o(DI)^2$ (Equation 7-12)
    c. $E_{aiu} = 1.6\ D_o(DI)^{0.67}$ (Equation 7-14)

    If $E_{ai} < E_i$, the head loss through the access hole will be zero, and $E_{ai} = E_i$. Go to Step 10.

5. Determine the benching coefficient (C_B) using Table 7-4. The values are the same whether the bench is submerged or unsubmerged.
6. Determine the energy loss coefficient for angle flow (C_θ) by determining θ_W for every pipe into the access hole.
    a. Is $E_i <$ inflow pipe flowline? If so, then the flow is plunging and θ_W for that pipe is 180 degrees.
    b. If the pipe angle is straight, then θ_W for that pipe is 180 degrees.
    c. Otherwise, θ_W is the angle of the inflow pipe relevant to the outflow pipe. Maximum angle is 180 degrees (straight).

Use Equation 7-17 and Equation 7-18 to calculate θ_W and C_θ.

7. Determine the plunging flow coefficient (C_P) for every pipe into the access hole using Equation 7-20. The relative plunge height (h_k) is calculated using Equation 7-19. Z_k is the difference between the access hole flowline elevation and the inflow pipe flowline elevation. If $Z_k > 10D_o$, Z_k should be set to $10D_o$.
8. If the initial estimate of the access hole energy level is greater than the outflow pipe energy head ($E_{ai} > E_i$), then $E_a = E_i$. If $E_{ai} < E_i$, then $H_a = (E_{ai} - E_i)(C_B + C_\theta + C_P)$. If $H_a < 0$, set $H_a = 0$.
9. Calculate the revised access hole energy level (E_a) Equation 7-15. If $E_a < E_i$, set $E_a = E_i$.
10. Compute EGL_a by adding E_a to the outflow pipe flowline elevation. Assume HGL_a at the access hole structure is equal to EGL_a.
11. Compare EGL_a with the critical elevation (ground surface, top of grate, gutter elevation, or other limits). If EGL_a exceeds the critical elevation, modifications must be made to the design.

7.4 Hydraulic Grade Line Computation Sheet

The design engineer shall provide a HGL computation sheet that depicts all forms or energy loss for each junction and pipe connection and identifies the upstream and downstream HGL and EGL elevations. These computations shall be provided for the design storm and 100-year assessment.

8 Open Channels

8.1 General Requirements

The general classifications for open channels are: (1) Natural channels, which include all watercourses that have been carved by nature through erosion; and (2) Engineered channels, which are constructed or existing channels that have been significantly altered by human effort.

A. The City of New Braunfels encourages the preservation of natural channels and drainage patterns. Developed drainage flows must enter and depart from a developed area in the same manner and location as under pre-development conditions. Any concentration of previous over-land flow is required to leave the developed site into a receivable body such as a drainage easement or city right-of-way in a manner so as to not impact downstream properties and/or facilities.
B. Easements or drainage rights-of-way shall be provided for all open channels such that the 100-year runoff and maintenance access are contained within drainage easements and/or right-of-way. Drainage easements shall be designated on plats for recording. For properties with existing structural development on previously platted lots, additional drainage easements shall be dedicated by separate recorded instrument or an amended plat. Easements and FEMA floodways shall not be encroached upon with fill materials or structures, which would reduce the channel's ability to carry the 100-year flood.
    a. Easement width shall be at least the width of the water surface from the 100-year design storm runoff under post-development conditions plus maintenance access. Maintenance access shall extend 2 feet from one side of the channel and 12 feet on the other side of the channel. If a channel is located parallel and adjoining a roadway, maintenance access shall extend 2 feet from both sides of the channel.
    b. Additional easement width should be provided to allow for channel meandering near bends of channels
C. Engineered channels shall be designed to meet the applicable design, freeboard and easement requirements. Freeboard along the outside of channel bends shall include the increased water surface due to superelevation.
D. Fencing and/or warning signs should be required to prevent public access where flowing water would pose a safety hazard. Fencing shall be designed in such a way as to not pose a drainage obstruction.
E. Shear stress shall be computed for all open channels and adequate protection provided in accordance with *Hydraulic Engineering Circular 15: Design of Roadway Channels with Flexible Linings (HEC 15)* [9]. Channels shall be designed to be stable and to not create safety hazards. Side slopes of vegetative lined channels should be 3:1 or flatter (4:1 or flatter along roadways) in channels with depths greater than 2 feet. Recommended maximum water velocities for earthen channels are given in Table 8-1. Erosion control or energy dissipation devices should be used to control velocities such that channel degradation does not occur. Bank stabilization measures shall not reduce channel capacity and shall follow sound engineering practices

Table 8-1: Maximum Velocity in Open Channels

Channel Lining Material[1]	Channel Slope (%)	Maximum Velocity (fps)
Earthen Channels	0 – 5	6
	5 – 10	5
	> 10	4
Rock (native subgrades)		10
Gabion Lined		12
Reinforced concrete lining		20
Rock Riprap (placed rock)		12
Prefabricated lining products		Use 90% of manufacturer's recommended velocity limits

[1] *Uniform, in well-maintained condition.*

F. Should diversion of a natural drainage way be required, sufficient work shall be done upstream and/or downstream to provide all affected properties at least the same level of flood protection and erosion control that existed prior to the diversion. The time length of a diversion channel must be at least as long as the segment of natural channel being replaced so that velocity is not increased.

G. Fencing shall be required adjacent to the channel where channel vertical wall heights exceed 30 inches and where channel side slopes exceed 2:1 and the depth is greater than 30 inches. Fencing shall be a minimum of 42 inches high, provide for maintenance access and not hinder sight distance for traffic. Fence type and location shall be determined by the design engineer.

H. Concrete pilot channels shall be provided for channels with longitudinal slopes less than 0.5 percent or bottom widths greater than 30 feet. The minimum bottom width of the pilot channel shall be 4 feet and the minimum earthen slope draining toward the pilot channel shall be 1 percent.

8.2 Design Criteria

A. The depth and velocity of flow are necessary for the design and analysis of channel linings and structures. The depth and velocity at which a given discharge flows in a channel of known geometry, roughness, and slope can be determined through hydraulic analysis. The following two methods are commonly used in the hydraulic analysis of open channels:

1. Slope Conveyance Method
2. Standard Step Backwater Method

The Slope Conveyance and Standard Step Backwater Methods have been summarized from the *TxDOT HDM*.

B. Channels should have sufficient gradient, depending upon the type of soil or channel lining material, to provide velocities that will be self-cleaning (greater than 2 feet per second for the 2-year storm event) but not cause erosion due to excessive shear stress.

C. Appropriate energy dissipating structures may be used to control erosion due to high velocities at pipe system outfalls and steep grades and shall be designed in accordance with accepted design

practices such as outlined by the Soil Conservation Service, the Corps of Engineers, the Bureau of Land Reclamation, or TxDOT.

8.3 Channel Capacity

Per *HEC 22*, the most commonly used equation for solving steady, uniform flow problems is the Manning's Equation (Equation 8-1). The depth of flow in steady, uniform flow is called the normal depth.

Equation 8-1

$$v = \frac{z}{n} R^{2/3} S^{1/2}$$

Where:

v = velocity (cfs)
z = 1.486 for English measurement units
n = Manning's roughness coefficient (a coefficient for quantifying the roughness characteristics of the channel)
R = hydraulic radius (ft) = A/WP
WP = wetted perimeter of flow (the length of the channel boundary in direct contact with the water) (ft) and A = area of conveyance (ft^2)
S = slope of the energy gradeline (ft/ft) (For uniform, steady flow, S = channel slope, ft/ft).

Combine Manning's Equation with the continuity equation to determine the channel uniform flow capacity as shown in Equation 8-2.

Equation 8-2

$$Q = \frac{z}{n} A R^{2/3} S^{1/2}$$

Where:
Q = discharge (cfs)
z = 1.486 for English measurement units
A = cross-sectional area of flow (ft^2).

For convenience, Manning's Equation in this manual assumes the form of Equation 8-2. Since Manning's Equation does not allow a direct solution to water depth (given discharge, longitudinal slope, roughness characteristics, and channel dimensions), an indirect solution to channel flow is necessary.

8.4 Roughness Coefficients

All hydraulic conveyance formulas quantify roughness subjectively with a coefficient. In Manning's Equation, the roughness coefficients, or n-values, for Texas streams and channels range from 0.200 to 0.012; values outside of this range are probably not realistic. Determination of a proper n-value is the

most difficult and critical of the engineering judgments required when using the Manning’s Equation. The recommended Manning's roughness coefficients ("N" values) for use in open channel hydraulic calculations are listed in Table 8-2.

Table 8-2: Manning's Roughness Coefficients

Natural Channels	Min	Normal	Max
Minor Streams (top width at flood stage <30 meters)			
Streams on plain:			
♦ Clean, straight, full stage, no rifts or deep pools	0.025	0.030	0.033
♦ Same as above, but more stones and weeds	0.030	0.035	0.040
♦ Clean, winding, some pools and shoals	0.033	0.040	0.045
♦ Same as above, but some stones and weeds	0.035	0.045	0.050
♦ Same as above, but lower stages, more ineffective slopes and sections	0.040	0.048	0.055
♦ Clean, winding, some pools and shoals, some weeds and many stones	0.045	0.050	0.060
♦ Sluggish reaches, weedy, deep pools	0.050	0.070	0.080
♦ Very weedy reaches, deep pools, or floodways with heavy stand of timber and underbrush	0.075	0.100	0.150
Mountain streams, no vegetation in channel, banks usually steep, trees and brush along banks submerged at high stages:			
♦ Bottom: gravel, cobbles, and few boulders	0.030	0.040	0.050
♦ Bottom: cobbles with large boulders	0.040	0.050	0.070
Flood Plains			
Pasture, no brush:			
♦ Short grass	0.025	0.030	0.035
♦ High grass	0.030	0.035	0.050
Cultivated areas:			
♦ No crop	0.020	0.030	0.040
♦ Mature row crops	0.025	0.035	0.045
♦ Mature field crops	0.030	0.040	0.050
Brush:			
♦ Scattered brush, heavy weeds	0.035	0.050	0.070
♦ Light brush and trees, in winter	0.035	0.050	0.060
♦ Light brush and trees, in summer	0.040	0.060	0.080
♦ Medium to dense brush, in winter	0.045	0.070	0.110
♦ Medium to dense brush, in summer	0.070	0.100	0.160
Trees:			
♦ Dense willows, summer, straight	0.110	0.150	0.200
♦ Cleared land with tree stumps, no sprouts	0.030	0.040	0.050
♦ Same as above, but with heavy growth of sprouts	0.050	0.060	0.080
♦ Heavy stand of timber, a few down trees, little undergrowth, flood stage below branches	0.080	0.100	0.120
♦ Same as above, but flood stage reaching branches	0.100	0.120	0.160
Major Streams (top width at flood stage >30 meters)			
♦ Regular section with no boulders or brush	0.025	--	0.060
♦ Irregular and rough section	0.035	--	0.100
Lined Channels			
♦ Concrete-lined	0.012	--	0.018
♦ Concrete rubble	0.017	--	0.030
Unlined Channels			
♦ Earth, straight and uniform	0.017	--	0.025
♦ Winding and sluggish	0.022	--	0.030
♦ Rocky beds, weeds on bank	0.025	--	0.040
♦ Earth bottom, rubble sides	0.028	--	0.035
♦ Rock cuts	0.025	--	0.045
Source: *TxDOT HDM* [4]			

In some instances, such as a trapezoidal section under a bridge, the n-value may vary drastically within a section, but the section should not be sub-divided. If the n-value varies as such, use a weighted n-value (n_w). This procedure is defined by Equation 8-3 as follows:

Equation 8-3

$$n_w = \frac{\sum(n\,WP)}{\sum WP}$$

Where:
WP = subsection wetted perimeter
n = subsection n-value.

8.5 Subdividing Cross-Sections

Because any estimating method involves the calculation of a series of hydraulic characteristics of the cross section, arbitrary water-surface elevations are applied to the cross section. The computation of flow or conveyance for each water-surface application requires a hydraulic radius. The hydraulic radius is intended as an average depth of a conveyance. A hydraulic radius and subsequent conveyance is calculated under each arbitrary water surface elevation. If there is significant irregularity in the depth across the section, the hydraulic radius may not accurately represent the flow conditions. Divide the cross section into sufficient subsections so that realistic hydraulic radii are derived.

Subdivide cross sections primarily at major breaks in geometry. Additionally, major changes in roughness may call for additional subdivisions. Subdivisions for major breaks in geometry or for major changes in roughness should maintain these approximate basic shapes so that the distribution of flow or conveyance is nearly uniform in a subsection.

Documentation must be submitted by the design engineer describing the methodology used to subdivide cross sections for review and approval by the City Engineer.

8.6 Slope Conveyance Method

The Slope Conveyance Method requires more judgment and assumptions than the Standard Step Method. In many situations, however, use of the Slope Conveyance Method is justified, as in the following conditions:

- Standard roadway ditches
- Culverts
- Storm drain outfalls

The procedure involves an iterative development of calculated discharges associated with assumed water surface elevations in a typical section. The series of assumed water surface elevations and associated discharges comprise the stage-discharge relationship. When stream gauge information exists, a measured relationship (usually termed a “rating curve”) may be available.

A channel cross section and associated roughness and slope data considered typical of the stream reach are required for this analysis. A typical section is one that represents the average characteristics of the stream near the point of interest. This cross section should be located downstream of and as close as reasonably possible to the proposed drainage facility discharge site. The closer to the proposed site a typical cross section is taken, the less error in the final water surface elevation

A typical cross section should be used for the analysis. If a cross section does not exist, then a "control" cross section (also downstream) should be used. The depth of flow in a control cross section is controlled by a constriction of the channel, a damming effect across the channel, or possibly an area with extreme roughness coefficients. The cross section should be normal to the direction of stream flow under flood conditions.

After identifying the cross section, apply Manning's roughness coefficients (n-values). Divide the cross section with vertical boundaries at significant changes in cross-section shape or at changes in vegetation cover and roughness components. Determine the average bed slope near the site.

8.6.1 Slope Conveyance Procedure

The calculation of the stage-discharge relationship should proceed as described in this section.

1. Select a trial starting depth and apply it to a plot of the cross section.
2. Compute the area and wetted perimeter weighted n-value for each submerged subsection.
3. Compute the subsection discharges with Manning's Equation. Use the subsection values for roughness, area, wetted perimeter, and slope. The sum of all of the incremental discharges represents the total discharge for each assumed water surface elevation. NOTE: Compute the average velocity for the section by substituting the total section area and total discharge into the continuity equation (Equation 8-4).
4. Tabulate or plot the water surface elevation and resulting discharge (stage versus discharge).
5. Repeat the above steps with a new channel depth, or add a depth increment to the trial depth. The choice of elevation increment is somewhat subjective. However, if the increments are less than about 0.25 feet, considerable calculation is required. On the other hand, if the increments are greater than 1.5 feet, the resulting stage-discharge relationship may not be detailed enough for use in design.
6. Determine the depth for a given discharge by interpolation of the stage versus discharge table or plot.

Equation 8-4

$$V = \frac{Q}{A}$$

8.7 Standard Step Backwater Method

Calculations of water surface profiles can be accomplished by using the Standard Step Method. Water surface profiles for the design frequency floods shall be computed for all channels and shown on all final drawings.

The Corps of Engineers HEC-RAS Water Surface Profile Programs may also be used to perform standard step backwater calculations, and if used, a summary table shall be submitted to the City. In addition, the design engineer shall provide documentation that justifies the flow regime (subcritical, supercritical, or mixed) used in the analysis. Losses due to changes in velocity, drops, bridge openings, and other obstructions shall be considered in the backwater computations, as described in the HEC-RAS User's Manuals.

Use the Standard Step Method for analysis in the following instances:

- Results from the Slope-Conveyance Method may not be accurate enough
- The drainage facility's level of importance deserves a more sophisticated channel analysis
- The channel is highly irregular with numerous or significant variations of geometry, roughness characteristics, or stream confluences
- A controlling structure affects backwater.

This procedure applies to most open channel flow, including streams having an irregular channel with the cross section consisting of a main channel and separate overbank areas with individual n-values. Use this method either for supercritical flow or for subcritical flow.

8.7.1 Standard Step Data Requirements

At least four cross sections are required to complete this procedure. The number and frequency of cross sections required is a direct function of the irregularity of the stream reach. The cross sections should represent the reach between them. A system of measurement or stationing between cross sections is also required. Evaluate roughness characteristics (n-values) and associated sub-section boundaries for all of the cross sections.

The selection of cross sections used in this method is critical. As the irregularities of a stream vary along a natural stream reach, accommodate the influence of the varying cross-sectional geometry. Incorporate transitional cross sections into the series of cross sections making up the stream reach.

8.7.2 Standard Step Procedure

The Standard Step Method uses the Energy Balance Equation, Equation 8-5, which allows the water surface elevation at the upstream section (noted as subscript 2) to be found from a known water surface elevation at the downstream section (noted as subscript 1). The following procedure assumes that cross sections, stationing, discharges, and n-values have already been established. Generally, for Texas, the assumption of subcritical flow will be appropriate to start the process. Subsequent calculations will check this assumption.

Equation 8-5

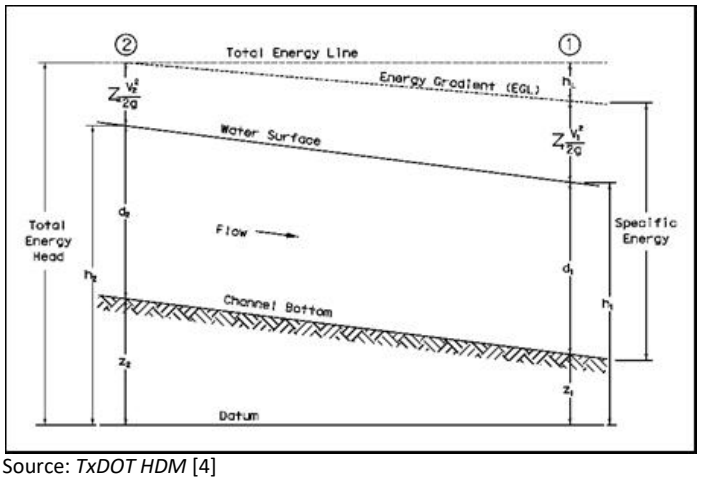
$$z_2 + d_2 + \alpha_2\left(\frac{v_2^2}{2g}\right) = z_1 + d_1 + \alpha_1\left(\frac{v_1^2}{2g}\right) + h_f + other\ losses$$

Where:
z = elevation of the streambed (ft)
d = depth of flow (ft)
α = kinetic energy coefficient
v = average velocity of flow (fps)
h_f = friction head loss from upstream to downstream (ft)
g = acceleration due to gravity = 32.2 ft/ s^2.

1. Select the discharge to be used. Determine a starting water surface elevation. For subcritical flow, begin at the most downstream cross section. Use one of the following methods to establish a starting water surface elevation for the selected discharge: a measured elevation, the Slope-Conveyance Method to determine the stage for an appropriate discharge, or an existing (verified) rating curve.
2. Referring to Figure 8-1 and Equation 8-5, consider the downstream water surface to be section 1 and calculate the following variables:

   z_1 = flowline elevation at section 1
   y_1 = tailwater minus flowline elevation
   α= kinetic energy coefficient (For simple cases or where conveyance does not vary significantly, it may be possible to ignore this coefficient).

Figure 8-1: EGL for Water Surface Profile



Source: *TxDOT HDM* [4]

3. From cross section 1, calculate the area, A_1. Then use Equation 8-6 to calculate the velocity, v_1, for the velocity head at A_1. The next station upstream is usually section 2. Assume a depth y_2 at section 2, and use y_2 to calculate z_2 and A_2. Calculate, also, the velocity head at A_2.

Equation 8-6

$$Q = A_1 v_1 = A_2 v_2$$

Q = discharge (cfs)
A = flow cross-sectional area (ft^2)
v = mean cross-sectional velocity (fps, perpendicular to the flow area).

The superscripts 1 and 2 refer to successive cross sections along the flow path.

4. Calculate the friction slope between the two sections using Equation 8-7and Equation 8-8:

Equation 8-7

$$s_f = \left(\frac{Q}{K_{ave}}\right)^2$$

Where:

$$K_{ave} = \frac{K_1 + K_2}{2} = 0.5\left(\frac{ZA_1R_1^{\frac{2}{3}}}{n_1} + \frac{ZA_2R_2^{\frac{2}{3}}}{n_2}\right)$$

5. Calculate the friction head losses (h_f) between the two sections using:

Equation 8-8

$$h_f = S_{ave}L$$

Where:

L = Distance between the two sections (ft).

6. Calculate the kinetic energy correction coefficients (α_1 and α_2) using Equation 8-9.

Equation 8-9

$$\alpha = \frac{\sum(Q_i v_i^2)}{Q v^2} = \frac{\sum[K_i(K_i/A_i)^2]}{K_t(K_t/A_t)^2}$$

Where:

v_i = average velocity in subsection (fps) (see Continuity Equation section)

Q_i = discharge in same subsection (cfs) (see Continuity Equation section)
Q = total discharge in channel (cfs)
v = average velocity in river at section or Q/A (ft/s)

K_i = conveyance in subsection (cfs) (see Conveyance section)

A_i = flow area of same subsection (ft^2)

K_t = total conveyance for cross-section (cfs)

A_t = total flow area of cross-section (ft^2).

7. Where appropriate, calculate expansion losses (h_e) using Equation 8-10 and contraction losses (h_c) using Equation 8-11 (Other losses, such as bend losses, are often disregarded as an unnecessary refinement.)

Equation 8-10

$$h_e = K_e \frac{\Delta V^2}{2g}$$

Where:
K_e = 0.1 for a gentle contraction
K_e = 0.5 for a sudden contraction

Equation 8-11

$$h_c = K_c \frac{\Delta V^2}{2g}$$

Where:

K_c = 0.1 for a gentle contraction

K_c = 0.5 for a sudden contraction

8. Check the energy equation for balance using Equation 8-12 and Equation 8-13.

Equation 8-12

$$L = z_2 + y_2 + \alpha_1 \frac{v_2^2}{2g}$$

Equation 8-13

$$R = z_1 + y_1 + \alpha_1 \frac{v_1^2}{2g} + h_f + h_e + h_c$$

The following considerations apply:

- if L=R within a reasonable tolerance, then the assumed depth at Section 1 is okay. This will be the calculated water surface depth at Section 1; proceed to step (9)
- if L≠R, go back to step (3) using a different assumed depth.

9. Determine the critical depth (d_c) at the cross section and find the uniform depth (d_u) by iteration. If, when running a supercritical profile, the results indicate that critical depth is greater than uniform depth, then it is possible the profile at that cross section is supercritical. For sub-critical flow, the process is similar but the calculations must begin at the upstream section and proceed downstream.
10. Assign the calculated depth from step (8) as the downstream elevation (Section 1) and the next section upstream as Section 2, and repeat steps (2) through (10).
11. Repeat these steps until all of the sections along the reach have been addressed.

8.8 Supercritical Flow

The Froude Number provides a relationship between flow velocity and the hydraulic depth of flow, and gravitational action, and shall be calculated for all channel improvements designs. Subcritical flow conditions occur when the Froude Number is less than 1.0 and supercritical flow conditions exist in lined channels when the Froude Number exceeds 1.0.

If a channel's normal depth is supercritical, its alternate depth is a deeper subcritical depth. Obstructions that may enter a stream during a storm event may cause supercritical flows to experience a hydraulic jump and become subcritical flows. When it is calculated that supercritical conditions could occur for the design storm, the depth of the channel must be at least the alternate depth plus the required freeboard. Adequate protection of the channel must be provided to protect against supercritical flow.

Subcritical flow conditions are recommended for all channel designs, as supercritical flow tends to have high velocities and high potential for channel erosion. Supercritical flow conditions will not be allowed in channels with a vegetative lining. Subcritical flow conditions may be achieved by using energy dissipators in areas where the existing topography will not allow subcritical flow conditions to occur

naturally. In all cases, the channel improvements shall be designed to avoid the unstable transitional flow conditions that occur when the Froude Number is between 0.9 and 1.1.

8.9 Flow in Bends

Adequate freeboard must be provided for a channel, ditch and swales as shown in Table 2-2. Flow around a bend in an open channel induces centrifugal forces because of the change in flow direction. This results in a superelevation of the water surface at the outside of bends and can cause the flow to splash over the side of the channel if adequate freeboard is not provided. This superelevation can be estimated by equation using Equation 8-14 from HEC-15.

Equation 8-14

$$\Delta H = \frac{V^2 T}{g R_c}$$

Where:

ΔH = Difference in water surface elevation between the inner and outer banks of the channel in the bend, (ft)
V = Average velocity (fps)
T = Surface width of the channel (ft)
Rc = Radius to the centerline of the channel (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Equation 8-14 is valid for subcritical flow conditions. The elevation of the water surface at the outer channel bank will be Δd/2 higher than the centerline water surface elevation (the average water surface elevation immediately before the bend) and the elevation of the water surface at the inner channel bank will be Δd/2 lower than the centerline water surface elevation.

Flow around a channel bend also imposes higher shear stress on the channel bottom and banks and may impact channel stability. Refer to *HEC 15* for further guidance if shear stress around a channel bend is anticipated to cause channel erosion.

8.10 Shear Stress

Shear stress shall be computed for all open channels and adequate protection shall be provided based on the tractive force method described in *HEC 15* and the permissible shear stresses reported in the *TxDOT HDM*.

A. The hydrodynamic force of water flowing in a channel is known as the tractive force. The basis for stable channel design with flexible lining materials is that flow-induced tractive force should not exceed the permissible or critical shear stress of the lining materials. In a uniform flow, the tractive force is equal to the effective component of the drag force acting on the body of water, parallel to the channel bottom [10]. The mean boundary shear stress applied to the wetted perimeter is computed with Equation 8-15.

Equation 8-15

$$\tau = \gamma RS$$

Where:
τ_o = mean boundary shear stress (lb/ft^2)
γ = unit weight of water (62.4 lb/ft^3)
R = hydraulic radius (ft)
S_o = average bottom slope (equal to energy slope for uniform flow) (ft/ft).

B. The maximum shear stress on a channel bottom, τ_d, and on the channel side, τ_s, in a straight channel depends on the channel shape. To simplify the design process, the maximum channel bottom shear stress is computed with Equation 8-16.

Equation 8-16

$$\tau = \gamma dS$$

Where:
τ_d = shear stress in channel at maximum depth (lb/ft^2)

d = maximum depth of flow in the channel for the design discharge (ft).

C. Determine channel lining or protection needed. Calculate uniform flow depth (y_m in ft or m) at design discharge using the Slope Conveyance Method. Compute maximum shear stress at normal depth using Equation 8-16. Select a lining and determine the permissible shear stress (in lbs/ft^2 or N/m^2) using Table 8-3 and Table 8-4. If $\tau_d < \tau_p$, then the lining is acceptable.

Table 8-3: Retardation Class for Lining Materials

Retardance Class	Cover	Condition
A	Weeping Lovegrass	Excellent stand, tall (average 30 in. or 760 mm)
	Yellow Bluestem Ischaemum	Excellent stand, tall (average 36 in. or 915 mm)
B	Kudzu	Very dense growth, uncut
	Bermuda grass	Good stand, tall (average 12 in. or 305 mm)
	Native grass mixture little bluestem, bluestem, blue gamma, other short and long stem medwest grasses	Good stand, unmowed
	Weeping Lovegrass	Good Stand, tall (average 24 in. or 610 mm)
	Lespedeza sericea	Good stand, not woody, tall (average 19 in. or 480 mm)
	Alfalfa	Good stand, uncut (average 11 in or 280 mm)
	Weeping lovegrass	Good stand, unmowed (average 13 in. or 330 mm)
	Kudzu	Dense growth, uncut
	Blue gamma	Good stand, uncut (average 13 in. or 330 mm)
C	Crabgrass	Fair stand, uncut (10-to-48 in. or 55-to-1220 mm)
	Bermuda grass	Good stand, mowed (average 6 in. or 150 mm)
	Common lespedeza	Good stand, uncut (average 11 in. or 280 mm)
	Grass-legume mixture: summer (orchard grass redtop, Italian ryegrass, and common lespedeza)	Good stand, uncut (6-8 in. or 150-200 mm)
	Centipedegrass	Very dense cover (average 6 in. or 150 mm)
	Kentucky bluegrass	Good stand, headed (6-12 in. or 150-305 mm)
D	Bermuda grass	Good stand, cut to 2.5 in. or 65 mm
	Common lespedeza	Excellent stand, uncut (average 4.5 in. or 115 mm)
	Buffalo grass	Good stand, uncut (3-6 in. or 75-150 mm)
	Grass-legume mixture: fall, spring (orchard grass Italian ryegrass, and common lespedeza	Good Stand, uncut (4-5 in. or 100-125 mm)
	Lespedeza sericea	After cutting to 2 in. or 50 mm (very good before cutting)
E	Bermuda grass	Good stand, cut to 1.5 in. or 40 mm
	Bermuda grass	Burned stubble
Source: *TxDOT HDM* [4]		

Table 8-4: Permissible Shear Stresses for Various Linings

Protective Cover	(lb./sq.ft.)	tp (N/m2)
Retardance Class A Vegetation (See the "Retardation Class for Lining Materials" table above)	3.7	177
Retardance Class B Vegetation (See the "Retardation Class for Lining Materials" table above)	2.1	101
Retardance Class C Vegetation (See the "Retardation Class for Lining Materials" table above)	1	48
Retardance Class D Vegetation (See the "Retardation Class for Lining Materials" table above)	0.6	29
Retardance Class E Vegetation (See the "Retardation Class for Lining Materials" table above)	0.35	17
Woven Paper	0.15	7
Jute Net	0.45	22
Single Fiberglass	0.6	29
Double Fiberglass	0.85	41
Straw W/Net	1.45	69
Curled Wood Mat	1.55	74
Synthetic Mat	2	96
Gravel, D50 = 1 in. or 25 mm	0.4	19
Gravel, D50 = 2 in. or 50 mm	0.8	38
Rock, D50 = 6 in. or 150 mm	2.5	120
Rock, D50 = 12 in. or 300 mm 6-in. or 50-mm Gabions	5 35	239 1675
4-in. or 100-mm Geoweb	10	479
Soil Cement (8% cement)	>45	>2154
Dycel w/out Grass	>7	>335
Petraflex w/out Grass	>32	>1532
Armorflex w/out Grass	20-Dec	574-957
Erikamat w/3-in or 75-mm Asphalt	13-16	622-766
Erikamat w/1-in. or 25 mm Asphalt	<5	<239
Armorflex Class 30 with longitudinal and lateral cables, no grass	>34	>1628
Dycel 100, longitudinal cables, cells filled with mortar	<12	<574
Concrete construction blocks, granular filter underlayer	>20	>957
Wedge-shaped blocks with drainage slot	>25	>1197
Source: *TxDOT HDM* [4]		

8.11 Drop Structures

The function of a drop structure is to reduce flow velocities by dissipating some of the kinetic energy of the flow at the drop structure, and also providing flatter channel slopes upstream and downstream of the drop structure. Sloping channel drops and vertical channel drops are two commonly used drop structure types.

An apron shall be designed and constructed immediately upstream and downstream of a drop structure to protect against turbulence and prevent scour. Unless an alternative is approved by the City Engineer, the upstream apron shall extend at least ten feet upstream from the point where flow becomes supercritical, and the downstream apron shall be extended downstream from the anticipated location of

the hydraulic jump by the minimum distance listed in Table 8-5. Each end shall include a concrete toe that extends a minimum of twenty-four inches into the ground.

Table 8-5: Minimum Lengths of Downstream Aprons beyond Hydraulic Jumps

Discharge Rate per Unit Width of Apron (cfs/ft)	Minimum Distance to extend Downstream Apron beyond the Hydraulic Jump (ft)
0-14	10
15	15
20	20
25	23
30	25

All drop structures shall be constructed of reinforced concrete, and the bottom and walls (if any) shall have a minimum thickness of six inches. To facilitate maintenance, drop structures should be located near bridges or culverts if possible.

8.11.1 Vertical Drop Structures

The drop length and the hydraulic jump length of the drop structure should be calculated to determine the length of the downstream apron required to prevent erosion [8] [11]. In order to utilize a vertical drop structure vehicular access must be provided to both the upstream and downstream ends of the structures.

8.11.2 Sloping Drop Structures

The location of the hydraulic jump should be determined based on the upstream and downstream flow depths and channel slopes [8] [11]. When utilizing a sloping drop structure, a minimum slope of 6:1 shall be used to allow vehicular access from one end across the structure. If the slope of the drop structure is less than 6:1, vehicular access must be provided to both the upstream and downstream ends of the structures.

8.12 Energy Dissipators

Although hydraulic jumps can be used as energy dissipators, impact dissipators are recommended for their predictability, efficiency, and economy. The Baffled Apron is used to dissipate the energy in the flow at a drop. It requires no initial tailwater to be effective, although scour is reduced with tailwater. The chute of the Baffle Apron is constructed on a 2:1 or flatter slope extending below the channel bottom. Refer to *Hydraulic Engineering Circular 14: Energy Dissipators (HEC 14)* [12] for methods to design energy dissipators.

This page intentionally left blank.

9 Bridges and Culverts

9.1 General Requirements

A bridge is defined as a structure, including supports, erected over a depression or an obstruction (e.g., water, highway or railway) having a roadway for carrying traffic or other moving loads, and having an opening measured along the center of the roadway of more than 20 feet between faces of abutments, spring lines of arches, or extreme ends of openings for multiple box culverts. Culverts convey surface water through a roadway embankment or away from the roadway right-of-way or into a channel along the right-of-way.

A. Bridges and culverts shall be designed to withstand the 100-year design storm.
B. Bridges and culverts on arterial streets and parkways shall meet the following requirements:
    1. 50-year design storm runoff with headwater one foot below the top of the culvert structure.
    2. 100-year water surface shall not encroach through half of roadway lanes.
    3. Minimum culvert size of a 24-inch circular pipe or equivalent for alternate shapes.
C. Bridges and culverts on all other streets shall meet the following requirements:
    1. 25-year design storm runoff with headwater one foot below the top embankment.
    2. 25-year water surface shall leave at least one lane open.
    3. 50-year design storm runoff no more than 6 inches over top of roadway.
    4. Allowance shall be made for conveyance of the 100-year runoff across the road and into the downstream channel without damage to the road or adjacent property.
    5. Minimum culvert size of an 18-inch circular pipe or equivalent for alternate shapes.
D. Temporary crossings shall be designed to safely pass the 2-year design storm runoff.
E. The backwater created by a culvert or bridge during the 100-year design storm runoff shall not cause damage to public or private property.
F. Culvert outlets shall be designed to minimize damage caused by erosion.
G. Culverts and bridges shall be aligned with natural drainage ways in grade and direction whenever practical. Culverts shall have a minimum design storm velocity of 2.5 feet per second for the 2-year storm to reduce sediment accumulation.
H. Larger culvert sizes, bridges, box culverts, and/or smooth-walled pipes are recommended for crossings where heavy debris or sediment accumulations are anticipated. Trash racks may be required.
I. All headwalls shall be constructed of reinforced concrete.
J. Plastic pipe is prohibited for use as a culvert pipe material in the public right-of-way.
K. Corrugated metal pipe will not be allowed in the public right-of-way except beneath driveways.

9.2 Bridge Design Criteria

Design criteria for all bridges shall be on a case-by-case basis as determined by the City Engineer.

9.3 Culvert Design Criteria

A. Headwalls and necessary erosion protection shall be provided at all culverts and shall comply with TxDOT standard details. All culverts and bridges are to be analyzed at both the design flow and 100-year check flow.

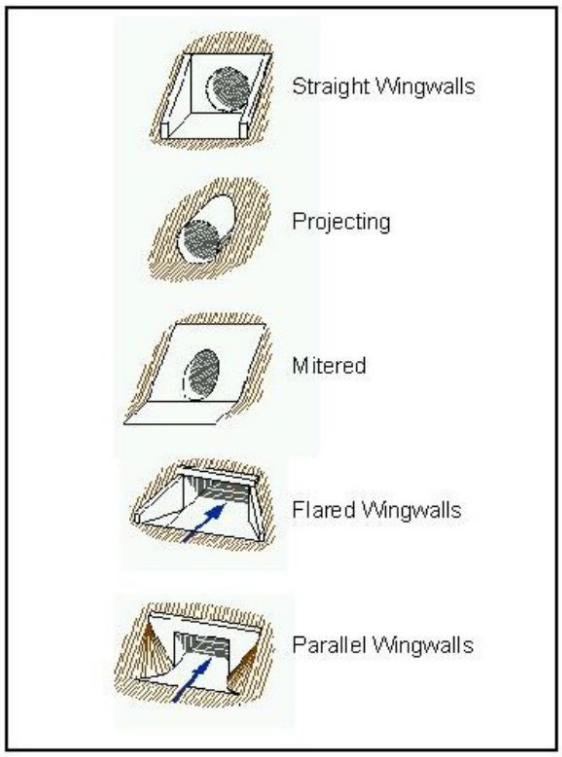
B. Alignment, location and grade of proposed culverts must be consistent with planned development of the drainage system for that watershed. In the event the particular watershed or waterway is not covered by a planned storm drainage system, the designer should proceed with the design from the nearest downstream control (i.e. bridge, culvert dam, etc.) and design the proposed drainage system improvements anticipating future system expansion due to fully developed watershed conditions.

C. Wingwalls, if used, may be either straight parallel, flared, or tapered. Approach and discharge aprons shall be provided for all culvert headwall designs. Precast headwalls and end walls may be used if all other criteria are satisfied.

9.4 Culvert End Treatments

Figure 9-1 shows sketches of various end treatment types. The TxDOT Bridge Division maintains standard details of culvert end treatments. Safety End Treatment (SET) of a culvert provides a method of mitigating a less safe condition with-out interfering with the hydraulic function of the culvert. SETs such as those used with driveway and other small diameter culverts may be more hydraulically efficient by providing both tapered wingwalls and a beveled edge instead of using a mitered section. SETs for larger culverts that are not protected by a railing or guard fence use pipe runners arranged either horizontally or vertically.

Figure 9-1: Typical Culvert End Treatments



Source: *TxDOT HDM* [4]

The pipes of pipe runner SETs have been proven to be within the tolerance of the entrance loss equations. Therefore, the entrance should be evaluated solely for its shape and the effect of the pipes should be ignored.

9.5 Culvert Hydraulics

The hydraulic design of culverts shall be based upon design guidelines set forth by TxDOT, the U.S. Department of Transportation, or other suitable material as approved by the City Engineer. Computer programs such as FHWA's "HY-8" may be used, provided that the design engineer provides output tables showing models results and input data.

Values of entrance loss coefficients (C_e) are shown in Table 9-1 based on culvert shape and entrance condition.

Table 9-1: Entrance Loss Coefficients

Concrete Pipe	Ce
Projecting from fill, socket end (groove end)	0.2
Projecting from fill, square cut end	0.5
Headwall or headwall and wingwalls:	-
• Socket end of pipe (groove end)	0.2
• Square-edge	0.5
• Rounded (radius 1/12 D)	0.2
Mitered to conform to fill slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Corrugated Metal Pipe or Pipe Arch	-
Projecting from fill (no headwall)	0.9
Headwall or headwall and wingwalls square-edge	0.5
Mitered to conform to fill slope, paved or unpaved slope	0.7
End section conforming to fill slope	0.5
Beveled edges, 33.7º or 45º bevels	0.2
Side- or slope-tapered inlet	0.2
Reinforced Concrete Box	-
Headwall parallel to embankment (no wingwalls):	-
• Square-edged on 3 edges	0.5
• Rounded on 3 edges to radius of 1/12 barrel dimension, or beveled edges on 3 sides	0.2
Wingwalls at 30º to 75º to barrel:	-
• Square-edged at crown	0.4
• Crown edge rounded to radius of 1/12 barrel dimension, or beveled top edge	0.2
Wingwall at 10º to 25º to barrel: square-edged at crown	0.5
Wingwalls parallel (extension of sides): square-edged at crown	0.7
Side- or slope-tapered inlet	0.2
Source: *TxDOT HDM* [4]	

There are two categories of flow through culverts: inlet control and outlet control.

1. **Inlet Control.** The flow is controlled by the cross-sectional area of the culvert, inlet configuration, and headwater depth. Slope, roughness and length of culvert are of no importance. Nomographs are available for inlet control estimations as proved in Hydraulic Design of Highway Culverts [13].
2. **Outlet control.** The flow is controlled by the cross-section area of the culvert, inlet configuration, and headwater depth and, slope, roughness and length of culvert. Culverts will be outlet controlled if the culvert slope is relatively flat, the tailwater sufficiently deep or the culvert is quite long. It is also possible, where the water enters the culvert under inlet control, but the culvert slope or tailwater conditions cause a hydraulic jump near the outlet. This situation should be avoided because damage can occur to the culvert pipe. Unstable conditions are most likely when the culvert is placed at a near-critical slope.

The design engineer shall calculate both outlet and inlet control conditions and use the more conservative of the two as the design condition.

9.6 Debris Fins

For conditions where more than one box culvert is required, the upstream face of the structure may incorporate debris deflector fins to prevent debris buildup. For multiple-pipe, or single box in critical situations, installations of debris fins may be used but are not required unless the Engineering Division requires upon review of the design situation. The engineer of record should analyze the situation for the applicability of debris fins.

The debris fin is an extension of the interior walls of a multiple-box culvert. The wall thickness shall be designed to satisfy structural requirements and reduce impact and turbulence to the flow.

A debris fin is constructed to the height of the culvert with a fin length of one and one-half times the height of the box culvert. Since the debris fins are subject to the same erosive forces as bridge piers, care must be taken in the design of the footing. A reinforced toewall at the upstream end of the debris fin and the apron is required. The reinforced toewall shall include a toe that extends a minimum of twenty-four inches into the ground.

9.7 Culvert Outlet Protection

High discharge velocities from culverts can cause eddies or other turbulence which could damage unprotected downstream channel banks and roadway embankments. To prevent damage from scour and erosion in these conditions, culvert outlet protection is needed. The outlet protection should extend downstream to a point where non-erosive channel velocities or shear stress are established in accordance with **Section 8.10** of this manual. The outlet protection should be placed sufficiently high on the adjacent banks to extend 1' above the design WSEL. All outlet protection shall be designed with an appropriate toe depth. All toes shall be no less than twenty-four inches.

9.8 Energy Dissipation

Design of riprap stone protection shall be done in accordance to *HEC 22*. Design of concrete baffles and stilling basins shall be done in accordance with *HEC 14*.

This page intentionally left blank.

10 Detention and Retention Facilities

10.1 General Requirements

Detention is the storage of runoff for a controlled release during or immediately following a design storm. Retention is an artificial pond with used for flood protection, water quality or aesthetic improvement.

A. The method(s) of retention or detention shall be appropriate to the type of development, topography, and amount of control needed. Examples of methods include, but are not limited to, the following:
   1. Basins or swales – single or multiple
   2. Check dams in gullies to slow runoff and trap sediment
   3. Leach fields, infiltration chambers, dry wells, rain barrels, French drains
   4. Granular fill under permeable paving blocks
   5. Contour terracing, improved vegetation cover

B. Parking areas may be used as detention facilities provided that maximum depths of ponding do not exceed eight inches, and ponding is in the areas most remotely situated from structures.

C. Stormwater infiltration systems are not permitted for mitigation in any development where there is a potential for pollutants to adversely affect ground water quality (e.g. Edwards Aquifer Recharge Zone).

D. No detention or retention basin shall retain standing water longer than 36 hours unless it is designed and constructed to be a permanent pond with appropriate health, safety and water quality measures. Permanent ponds must comply with all applicable water rights requirements for such a body of water.

E. Detention basins to be excavated shall provide positive drainage through the pond. A concrete pilot channel shall be provided to convey runoff from entry points of concentrated flow into the pond to the outlet structure of the pond during low flow conditions. The minimum longitudinal slope of the concrete pilot channel shall be 0.25% and the minimum slope to the pilot channel shall be 0.5%. Erosion protection must be provided adjacent to the pilot channel to prevent undermining of the pilot channel due to scour.

F. Facilities shall be located such that the edge of the 100-year water surface is at least 10 feet from the pavement edge of any public road. Finished floors of adjacent structures should be a minimum of 1 foot above the 100-year water surface in the facility. Facilities should preferably be located such that the invert of the outlet structure is above the 100-year flood level in the receiving body; but in all cases facilities shall be designed to function properly during conditions where the outlet is submerged by the tailwater of the receiving stream.

G. Drainage easements are required for retention/detention facilities. Easement boundaries shall contain the berms, inlet and outlet structures, access ramps, permanent erosion control facilities, the 100-year water surface and any additional area needed for access and maintenance.

H. Ponding below natural grade (depressed storage) is allowed.

I. Detention facilities shall be designed with one or more outlet structures to allow safe passage of the 100-year post-development design storm runoff. If an overflow weir is not incorporated into the design of the outlet structure, then an emergency overflow weir or spillway shall be provided with sufficient capacity to pass at least the 25-year design storm runoff, assuming the pond is full and the discharge pipe in the outfall structure is 100% clogged. At minimum, the emergency overflow weir should engage when ponding exceeds the 100-year water surface elevation.

J. Weirs, spillways and outlets shall be protected from erosion with riprap, grouted riprap, or other method of erosion control to adequately protect the structure and downstream channel. Outflows shall be conveyed within proposed property limits to an appropriate receiving drainage facility in a manner such that roadways, private property, buildings, etc. are not damaged.

K. Best management practices shall be used in the event a detention facility empties into another storage facility downstream. The timing of the hydrograph from the detention facility shall be checked against the timing of the receiving storage facility to prevent any increase in the flow rate from the downstream facility.

L. Side slopes of earthen embankments shall be designed for stability and safety, with the following minimum requirements for facilities with unrestricted access: side slopes of earthen banks shall be 3:1 or flatter; a benched configuration is required for facilities with ponding depths over 6 feet. Bench widths shall be at least 4 feet, spaced at least every 3 feet vertically. The above slope criteria may be waived if security barriers are provided. Barriers may consist of chain-link, masonry, wood, vegetation or other materials, but must not restrict the hydraulic capacity of drainage facilities. Minimum barrier height is 48". Vegetative barriers must be of a width equal to or greater than the greatest interior embankment height/depth, with density sufficient to restrict access. All constructed stormwater structures of earthen material shall be re-vegetated to mature growth.

M. Maximum water depths over 6 feet shall not be allowed. In cases where design limitations require excess depths, due hardship shall be presented for consideration to the Engineering Division, consideration for exception approval will require additional safety measures of the design. Additional safety measures can include but shall not be limited to:

   a. Fencing,
   b. Benching,
   c. And/or other forms of access restriction.

~~M.~~N. ~~without prior approval from the City Engineer.~~ Any detention facility that is classified as a dam by the State of Texas shall conform to the more stringent of rules listed in this manual or the dam safety rules adopted by the State of Texas.

~~N.~~O. Earthen embankments of a height greater than 3 feet used to impound a required detention volume must have a minimum top-width of 4 feet, shall contain a non-permeable core, and shall be based on a geotechnical investigation for the site. Compaction of all earthen drainage structures shall be to 90% standard proctor.

~~O.~~P. A maintenance ramp shall be provided for vehicular access in detention basin design for periodic de-silting and debris removal. The slope of the ramp shall not exceed 6:1 and the minimum width shall be 12 feet.

~~P.~~Q. Basins with permanent storage must include dewatering facilities to provide for maintenance.

~~Q.~~R. The design of detention facilities shall include provisions for collecting and removing sediment deposited after collecting and releasing stormwater.

~~R.~~S. Detention ponds and reservoirs shall provide at least 1-foot of freeboard for the 100-year storm event measured from top of berm to the 100-year water surface elevation of the pond.

10.2 Design Criteria

A. Stormwater detention basins are used to temporarily impound (detain) excess stormwater, thereby reducing peak discharge rates.

B. All detention ponds are to be designed to prevent an increase in flow to the existing 2, 10, 25, 50, and 100-year peak runoff leaving a proposed site.

C. Detention ponds will be sized using the NRCS synthetic hydrograph as outlined in **Section 4** of this manual.

10.3 Outlet Structure Design

A. Multi-level outlet structures may be necessary to reduce the 2, 10, 25, 50, and 100-year developed design storm runoff to pre-development levels. See publication *Stormwater Detention Outlet Control Structures* [14] for further outlet design and construction guidance not presented below.

B. Documentation on retention or detention structures should include design hydrographs, calculation of stage-storage-discharge tables, drawings of the basin, spillway, weir and outlet size and location, and erosion control measures.

C. Development of a composite stage-discharge curve requires consideration of the discharge rating relationships for each component of the outlet structure. The following sections are design relationships for typical outlet controls summarized from *HEC 22*.

10.3.1 Orifices

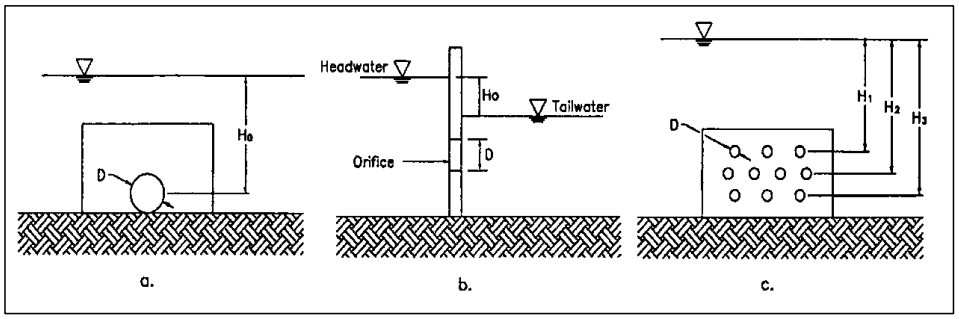
For a single orifice as illustrated in Figure 10-1 (a), orifice flow can be determined using Equation 10-1.

Equation 10-1

$$Q = C_o A_o (2gH_o)^{0.5}$$

Where:
Q = Orifice flow rate (cfs)
C_o = Discharge coefficient 0.40 – 0.60
A_o = Area of orifice (ft^2)
H_o = Effective head on the orifice measured from the centroid of the opening (ft)
g = Gravitational acceleration = 32.2 ft/s^2.

Figure 10-1: Definition Sketch for Orifice Flow



Source: *HEC 22* [5]

If the orifice discharges as a free outfall, then the effective head is measured from the centerline of the orifice to the upstream water surface elevation. If the orifice discharge is submerged, then the effective head is the difference in elevation of the upstream and downstream water surfaces. This latter condition of a submerged discharge is shown in Figure 10-1(b).

For square-edged, uniform orifice entrance conditions, a discharge coefficient of 0.6 should be used. For ragged edged orifices, such as those resulting from the use of an acetylene torch to cut orifice openings in corrugated pipe, a value of 0.4 should be used.

For circular orifices with C_o set equal to 0.6, the following equation results:

Equation 10-2

$$Q = K_{or} D^2 {H_o}^{0.50}$$

Where:

K_{or} = 3.78 (English units)
D = Orifice diameter (ft).

Pipes smaller than 1 foot in diameter may be analyzed as a submerged orifice as long as H_o/D is greater than 1.5. Pipes greater than 1 foot in diameter should be analyzed as a discharge pipe with headwater and tailwater effects taken into account, not just as an orifice.

Flow through multiple orifices (see Figure 10-1 (c)) can be computed by summing the flow through individual orifices. For multiple orifices of the same size and under the influence of the same effective head, the total flow can be determined by multiplying the discharge for a single orifice by the number of openings.

10.3.2 Weirs

Relationships for sharp-crested, broad-crested, V-notch, and proportional weirs are provided in the following sections.

10.3.2.1 Sharp Crested Weirs

Typical sharp crested weirs are illustrated in Figure 10-2. Equation 10-3 provides the discharge relationship for sharp crested weirs with no end contractions (illustrated in Figure 10-2 (a)).

Equation 10-3

$$Q = C_{scw} L H^{1.5}$$

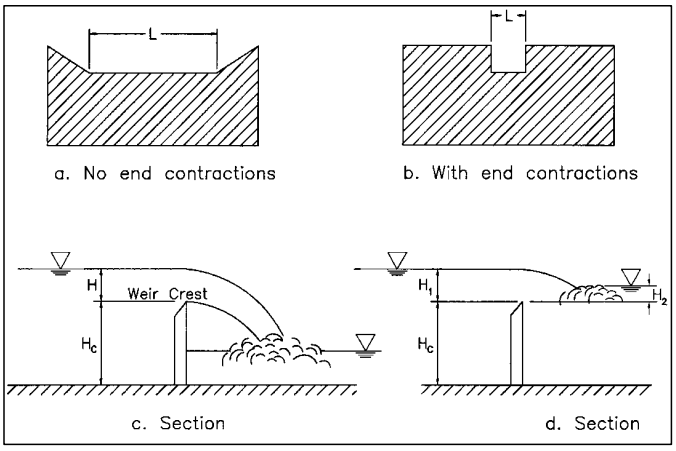
Where:
Q = Discharge (cfs)
L = Horizontal weir length (ft)
H = Head above weir crest excluding velocity head (ft)

$C_{SCW} = 3.27 + 0.4\ (H/H_C)$.

As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/H_c (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Equation 10-4 provides the discharge equation for sharp-crested weirs with end contractions (illustrated in Figure 10-2 (b)). As indicated above, the value of the coefficient C_{SCW} is known to vary with the ratio H/Hc (see Figure 10-2 (c) for definition of terms). For values of the ratio H/H_c less than 0.3, a constant C_{SCW} of 3.33 (in English units) is often used.

Figure 10-2: Sharp Crested Weirs



Source: *HEC 22* [5]

Equation 10-4

$$Q = C_{scw}(L - 0.2H)H^{1.5}$$

Sharp crested weirs will be effected by submergence when the tailwater rises above the weir crest elevation, as shown in Figure 10-2 (d). The result will be that the discharge over the weir will be reduced. The discharge equation for a submerged sharp-crested weir is:

Equation 10-5

$$Q_s = Q_r\left(1 - \left({}^{H_2}/_{H_1}\right)^{1.5}\right)^{0.385}$$

Where:
Qs = Submerged flow (cfs)
Qr = Unsubmerged weir flow from Equation 10 3 or Equation 10 4 (cfs)
H1 = Upstream head above crest (ft)
H2 = Downstream head above crest (ft).

Flow over the top edge of a riser pipe is typically treated as flow over a sharp crested weir with no end constrictions. Equation 10-3 should be used for this case.

10.3.2.2 Broad-Crested Weir

The equation typically used for a broad-crested weir is:

Equation 10-6

$$Q = C_{BCW}LH^{1.5}$$

Where:

Q = Discharge, (ft^3/s)
C_{BCW} = Broad-crested weir coefficient, 2.34 to 3.32 (English units)
L = Broad-Crested weir length, (ft)
H = Head above weir crest (ft).

If the upstream edge of a broad-crested weir is so rounded as to prevent contraction and if the slope of the crest is as great as the loss of head due to friction, flow will pass through critical depth at the weir crest; this gives the maximum C value of 3.09 (in English units). For sharp corners on the broad crested weir, a minimum value of 2.62 (in English units) should be used. Additional information on C values as a function of weir crest breadth and head is given in Table 10-1.

Table 10-1: English Units-Broad-Crested Weir Coefficient C Values as a Function of Weir Crest

Broad-Crested Weir Coefficient C Values as a Function of Weir Crest Breadth and Head (coefficient has units of ft 0.5/sec)[1]											
Head[2](ft)	Breadth of Crest of Weir (ft)										
	0.5	0.75	1	1.5	2	2.5	3	4	5	10	15
0.2	2.8	2.75	2.69	2.62	2.54	2.48	2.44	2.38	2.34	2.49	2.68
0.4	2.92	2.8	2.72	2.64	2.61	2.6	2.58	2.54	2.5	2.56	2.7
0.6	3.08	2.89	2.75	2.64	2.61	2.6	2.68	2.69	2.7	2.7	2.7
0.8	3.3	3.04	2.85	2.68	2.6	2.6	2.67	2.68	2.68	2.69	2.64
1	3.32	3.14	2.98	2.75	2.66	2.64	2.65	2.67	2.68	2.68	2.63
1.2	3.32	3.2	3.08	2.86	2.7	2.65	2.64	2.67	2.66	2.69	2.64
1.4	3.32	3.26	3.2	2.92	2.77	2.68	2.64	2.65	2.65	2.67	2.64
1.6	3.32	3.29	3.28	3.07	2.89	2.75	2.68	2.66	2.65	2.64	2.63
1.8	3.32	3.32	3.31	3.07	2.88	2.74	2.68	2.66	2.65	2.64	2.63
2	3.32	3.31	3.3	3.03	2.85	2.76	2.72	2.68	2.65	2.64	2.63
2.5	3.32	3.32	3.31	3.28	3.07	2.89	2.81	2.72	2.67	2.64	2.63
3	3.32	3.32	3.32	3.32	3.2	3.05	2.92	2.73	2.66	2.64	2.63
3.5	3.32	3.32	3.32	3.32	3.32	3.19	2.97	2.76	2.68	2.64	2.63
4	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.7	2.64	2.63
4.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.74	2.64	2.63
5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.07	2.79	2.64	2.63
5.5	3.32	3.32	3.32	3.32	3.32	3.32	3.32	3.32	2.88	2.64	2.63
Source: Brater, E.F. and King, H.W., Handbook of Hydraulics, 6th ed., 1976 [15] Measured at least 2.5 Hc upstream of the weir											

10.3.2.3 V- Notch Weir

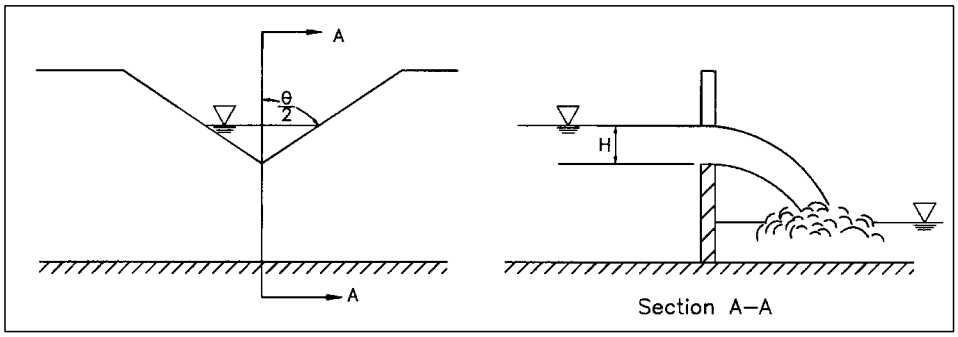
The discharge through a v-notch weir is shown in Figure 10-3 and can be calculated from the following equation:

Equation 10-7

$$Q = K_u[tan(\theta/2)]H^{2.5}$$

Where:
Q = Discharge (cfs)
θ = Angle of v-notch (degrees)
H = Head on apex of v-notch (ft)
Ku = 2.5 (English units).

Figure 10-3: V-Notch Weir



Source: *HEC 22* [5]

10.3.2.4 Proportional Weir

Although more complex to design and construct, a proportional weir may significantly reduce the required storage volume for a given site. The proportional weir is distinguished from other control devices by having a linear head-discharge relationship. This relationship is achieved by allowing the discharge area to vary nonlinearly with head. Design equations for proportional weirs are as follows: [16]

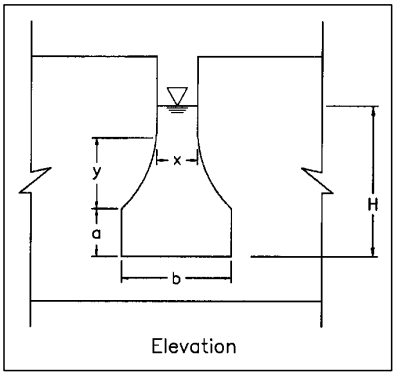
Equation 10-8

$$Q = K_u a^{0.5} b(H - a/3)$$

Where:
K_U = 4.96 (English units)
Q = Discharge (cfs)
H = Head above horizontal sill (ft).

Dimensions a, b, x, and y are shown in Figure 10-4.

Figure 10-4: Proportional Weir Dimensions



Source: *HEC 22* [5]

10.3.3 Discharge Pipes

Discharge pipes are often used as outlet structures for detention facilities. The design of these pipes can be for either single or multistage discharges. A single step discharge system would consist of a single culvert entrance system and would not be designed to carry emergency flows. A multistage inlet would involve the placement of a control structure at the inlet end of the pipe.

For single stage systems, the facility would be designed as if it were a simple culvert. Downstream boundary conditions are to be applied in the same manner as discussed in **Section 9** of this manual. A stage-discharge curve would be developed for the full range of flows that the structure would experience.

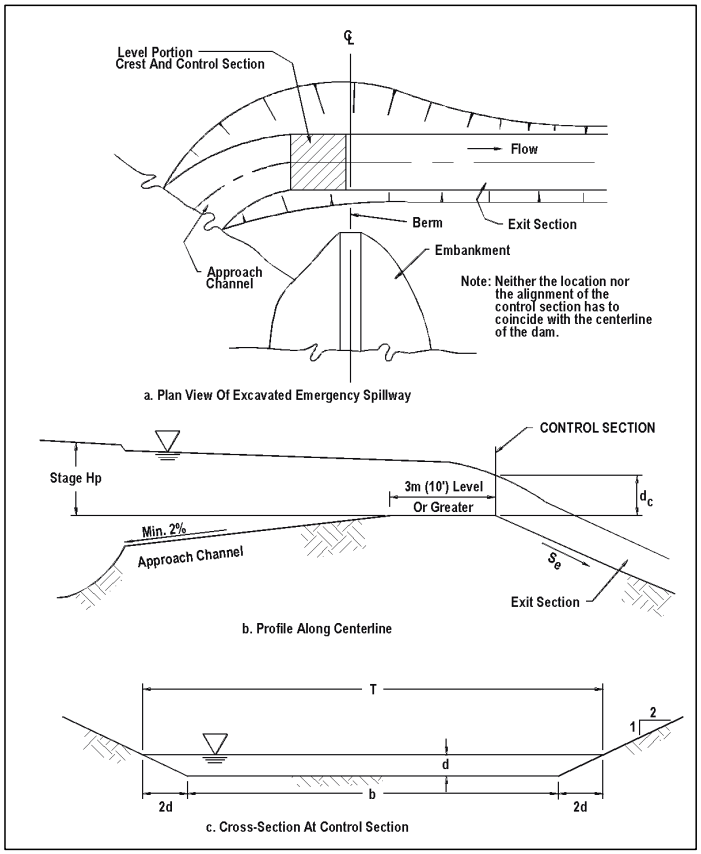
For multistage control structures, the inlet control structure would be designed considering the full range of flows. A stage-discharge curve would be developed for the full range of flows that the structure would experience. The design flows will typically be orifice flow through whatever shape the designer has chosen while the higher flows will typically be weir flow over the top of the control structure. Orifices can be designed using the equations in **Section 10.3.1** and weirs can be designed using the equations in **Section 10.3.2**. The pipe must be designed to carry all flows considered in the design of the control structure.

In designing a multistage structure, the designer would first develop peak discharges that must be passed through the facility. The second step would be to select a pipe that will pass the peak flow within the allowable headwater and develop a performance curve for the pipe. Thirdly, the designer would develop a stage-discharge curve for the inlet control structure, recognizing that the headwater for the discharge pipe will be the tailwater that needs to be considered in designing the inlet structure. Last, the designer would use the stage-discharge curve in the basin routing procedure.

10.3.4 Emergency Overflow Weirs

The purpose of an emergency overflow weir is to provide a controlled relief for storm flows in excess of the design discharge for the storage facility. An emergency overflow weir usually has a trapezoidal cross-section for ease of construction. Emergency overflow weirs that do not incorporate a spillway, comparable to the illustration in Figure 10-5, should be treated as a broad-crested weir. Spillway design should use the following equations.

Figure 10-5: Emergency Spillway Design Schematic



Source: *HEC 22* [5]

Equation 10-9 presents a relationship for computing the flow through a broad-crested emergency spillway. The dimensional terms in the equation are illustrated in Figure 10-5.

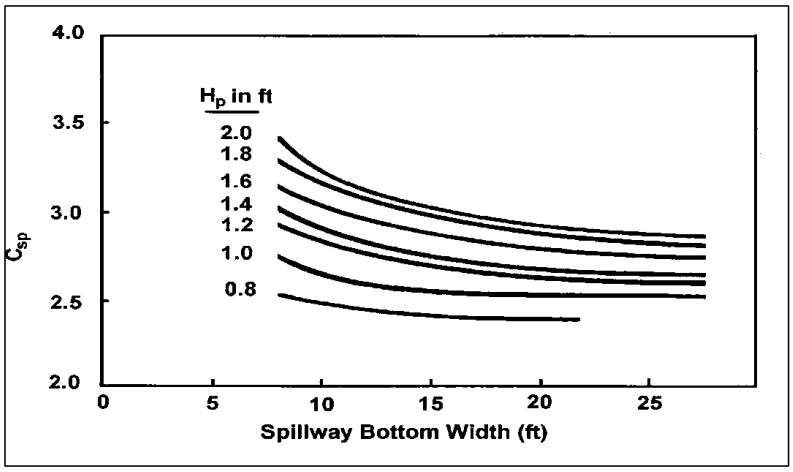
Equation 10-9

$$Q = C_{SP} b H_P{}^{1.5}$$

Where:
Q = Emergency spillway discharge (cfs)
C_{SP} = Discharge coefficient
b = Width of the emergency spillway (ft)
H_P = Effective head on the emergency spillway (ft).

The discharge coefficient, C_{SP}, in Equation 10-9 varies as a function of spillway bottom width and effective head. Figure 10-6 illustrates this relationship. Table 10-2 (modified from USDA, 1969) provides a tabulation of emergency spillway design parameters.

Figure 10-6: Discharge Coefficients for Emergency Spillways, English Units



Source: *HEC 22* [5]

The critical slopes of Table 10-2 are based upon an assumed n = 0.040 for turf cover of the spillway. For a paved spillway, the n should be assumed as 0.015. Equation 10-10 and Equation 10-11 can be used to compute the critical velocity and slope for spillway materials having other roughness values.

Equation 10-10

$$V_c = K_{SP}(Q/b)^{0.33}$$

Where:
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K_{SP} = 3.18 (English units).

Equation 10-11

$$S_c = K'_{SP} n^2 [(V_c b)/Q]^{0.33}$$

Where:
S_c = Critical slope (ft/ft)
n = Manning's coefficient
V_c = Critical velocity at emergency spillway control section (ft/s)
Q = Emergency spillway discharge (cfs)
b = Width of the emergency spillway (ft)
K'_{SP} = 14.6 (English units).

Table 10-2: Emergency Spillway Design Parameters (English units)

H_p (ft)		Spillway Bottom Width, b, (ft)											
		8	10	12	14	16	18	20	22	24	26	28	30
0.8	Q	14	18	21	24	28	32	35	-	-	-	-	-
	V_c	3.6	3.6	3.6	3.7	3.7	3.7	3.7	-	-	-	-	-
	S_c	3.2	3.2	3.2	3.2	3.1	3.1	3.1	-	-	-	-	-
1	Q	22	26	31	36	41	46	51	56	61	66	70	75
	V_c	4.1	4.1	4.1	4.1	4.1	4.1	4.2	4.2	4.2	4.2	4.2	4.2
	S_c	3	3	3	3	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
1.2	Q	31	37	44	50	56	63	70	76	82	88	95	101
	V_c	4.5	4.5	4.5	4.6	4.6	4.6	4.6	4.7	4.6	4.6	4.6	4.6
	S_c	2.8	2.8	2.8	2.8	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.6
1.4	Q	40	48	56	65	73	81	90	98	105	113	122	131
	V_c	4.9	4.9	4.9	4.9	5	5	5	5	5	5	5	5
	S_c	2.7	2.7	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.6
1.6	Q	51	62	72	82	92	103	113	123	134	145	155	165
	V_c	5.2	5.2	5.3	5.3	5.3	5.3	5.3	5.4	5.4	5.4	5.4	5.4
	S_c	2.6	2.6	2.6	2.6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.4
1.8	Q	64	76	89	102	115	127	140	152	164	176	188	200
	V_c	5.5	5.5	5.6	5.6	5.6	5.7	5.7	5.7	5.7	5.7	5.7	5.7
	S_c	2.5	2.5	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.3	2.3	2.3
2	Q	78	91	106	122	137	152	167	181	196	211	225	240
	V_c	5.8	5.8	5.8	5.9	6	6	6	6	6	6	6	6
	S_c	2.5	2.4	2.4	2.4	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3

NOTE:
1. For a given H_p, decreasing exit slope from S_c decreases spillway discharge, but increasing exit slope from S_c does not increase discharge.
2. If a slope S_e steeper than S_c is used, velocity V_e in the exit channel will increase according to the following relationship: $V_e = V_c(S_e/S_c)^{0.3}$
3. After Maryland SCS

Source: *HEC 22* [5]

This page intentionally left blank.

11 Lakes, Dams and Levees

11.1 Lakes and Dams

11.1.1 General Requirements

In the event that a property owner or developer desires to modify an existing pond or lake or desires to impound stormwater by filling or constructing an aboveground dam, thereby creating a lake, pond, lagoon or basin as part of the planned development of that property, the criteria listed below shall be met before city approval of the impoundment can be given. Ponds or lakes created by excavation of a channel area without erecting a dam above natural ground elevation or instream low water check dams are also subject to the criteria listed below, with the exception of spillway capacity requirements. The City Engineer has the final authority to determine the design criteria for a proposed dam, check dam or excavated lake. The dam safety requirements of the Texas Commission on Environmental Quality (TCEQ) and Federal Emergency Management Agency (FEMA) must also be met for the construction of dams, lakes, and other improvements.

11.1.2 Dam Design Criteria

A. The design criteria for a dam are dependent on the size and hazard classification of the dam. The size and hazard classification will be based on the recommended guidelines adopted by the TCEQ under Texas Water Code 12.052, which provides for the safe construction, maintenance, repair and removal of dams located in the State of Texas, and will be determined by the City Engineer based on information furnished by the owner. The following criteria will be used to classify a dam:
   1. Size. The classification for size is based on the height of the dam and storage capacity, whichever gives the larger size category. "Height" is defined as the distance between the top of the dam (minus the freeboard) and the existing streambed at the downstream toe. Storage is defined as the maximum water volume impounded at the top of the dam (minus the freeboard).
   2. Hazard potential. The hazard potential for a dam is based on the potential for loss of human life and property damage downstream from a dam in the event of failure. Hazard Potential Classifications are based on the potential for loss of life and for the extent of economic loss based on existing and potential development downstream of the dam.
   3. Spillway Design Flood. The classification of a dam based on the above criteria will be used to determine the Spillway Design Flood (SDF). The total capacity of a dam structure, including principal and emergency spillways, shall be adequate to pass the SDF without exceeding the top dam elevation. The SDF's for various dam classifications are described by TCEQ Dam Safety Guidelines.

B. All design will be for the fully developed watershed contributing to the structure.

C. In all cases, the minimum principal spillway design capacity is a minimum of the 100-year design flood. In certain cases, a dam breach analysis may be required to determine the proper classification of the structure. For all structures requiring a spillway design flood equal to the Probable Maximum Flood (PMF), a dam breach analysis is required to determine the downstream consequences of a failure. All dams shall be constructed with a minimum freeboard of two feet

above SDF elevation and upstream development within the contour line determined by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.

D. Owners of significant and high hazard dams were required to submit an Emergency Action Plan in accordance with Title 30 Texas Administrative Code (TAC) Chapter 299, Dams and Reservoirs, §299.61(b).

11.1.3 Maintenance and Liability Criteria

The owner or developer shall retain their private ownership of the constructed lake, pond or lagoon or basin and shall assume full responsibility for the protection of the general public from any health or safety hazards related to the lake, pond or lagoon constructed. The owner or developer shall assume full responsibility for the maintenance of the lake, pond or lagoon or basin constructed. The owner or developer shall keep TCEQ advised of the currently responsible agent for this maintenance. All dams are required to be registered with TCEQ in accordance with the TCEQ Dam Safety Regulations.

11.1.4 Natural Resource Conservation Service Lakes

A. There are a number of NRCS (previously Soil Conservation Service) lakes within the City limits and extraterritorial jurisdiction of the City of New Braunfels. These lakes present complex issues of flood control, erosion control, maintenance, and floodplain management. These lakes were constructed to NRCS standards. The lakes are in private ownership, with maintenance provided by Comal County. Operation of the lakes is the responsibility of Comal County. The City of New Braunfels is responsible for floodplain management of those areas upstream, downstream and adjacent to the lakes. Operation and maintenance of the NRCS lakes shall remain the responsibility of others.

B. The City of New Braunfels shall control future development upstream, downstream and adjacent to all NRCS lakes. Planning for future development which impacts on, or is impacted by, NRCS lakes shall require that a detailed engineering study be performed to provide a technical basis for development and that the dam be upgraded as follows:

   1. Provide principal spillway capacity adequate to discharge the 100-year flood event based on fully developed watershed conditions.
   2. Provide total capacity of the dam structure, including principal and emergency spillways to accommodate the PMF.
   3. Manage existing flood storage capacity.
   4. Prohibit upstream development within the contour line determine by the emergency spillway crest elevation plus 2-feet, or the 100-year flood elevation (based on fully developed watershed conditions) plus 2-feet, whichever is greater.
   5. Restrict development and improvements within the floodplain established by a breach flow analysis from the dam to the downstream limits of the dam breach impact.

11.1.5 Additional Design Requirements

A. An engineering plan for such construction accomplished by complete drainage design information and sealed by a licensed professional engineer, shall be approved by the City of New Braunfels.

B. The spillway and any emergency overflow areas shall be located so that floodwaters will not inundate any permanent habitable structures.

C. The minimum SDF should be the 100-year, 24-hour storm regardless of critical inflow design storm peaks.
D. The design shall comply with all federal, state and county laws pertaining to the impoundment of surface water, including the design, construction, and safety of the impounding structure. Copies of any federal, state or county permits issued for proposed impoundments shall be submitted to the City Engineer.
E. Any existing NRCS structure or other dams which are included in the project drainage area shall comply with the applicable federal, state, county and city safety requirements for structures. Improvements may be required to upgrade the structure to the currently adopted guidelines. Before removing, enlarging or altering any existing lake, the applicant will furnish a study of the effects of the alteration upon flooding conditions both upstream and downstream. The study shall be prepared by a professional engineer and submitted to the City Engineer for approval prior to making the proposed alteration.
F. Any improvements to existing dams or lakes or construction of new impoundments shall be made at the expense of the developer, prior to completion of the adjacent street, utilities and drainage improvements, as provided for under the subdivision regulations.

11.2 Levees

In the event that developers or owners wish to build levees to protect an area from flooding, all applicable FEMA guidelines, State of Texas Dam Safety Guideline, and the following criteria apply:

A. Levees shall be designed to have freeboard requirements as specified by FEMA.
B. Levees shall be designed according to the Corps of Engineers' design criteria used for federally authorized levees, whether or not they are federally authorized.
C. Ring levees shall not be permitted.
D. If possible, provision shall be made to provide the permanent maintenance of levees either by a flood control district or similar governmental organization of by the existing property owner and all future owners, heirs or assigns, through the use of a maintenance agreement.
E. Levee systems shall be designed with interior drainage system to prevent flooding from local runoff contained within the system for the 100-year design flood.
F. Levee system shall have written operation procedures that address gate-closure conditions and an emergency warning plan. A copy of these procedures shall be furnished to the City Engineer.
G. Automated gate-closure systems shall have power from two independent sources and shall be capable of being operated manually.
H. All new levee systems shall have permanent positive closures to the required design elevation. Temporary closures involving sandbagging or other procedures requiring manual operations shall not be permitted.
I. Additional plan requirements including water surface profiles for the design flood and standard project flood; the top of the levee profile, definition of interior drainage facilities, including pump station and ponding areas; location of gravity outlets, gatewells and closure structures; and elevation-duration data on the receiving system.

This page intentionally left blank.

12 Site Erosion Control During Construction

12.1 Applicable Properties or Construction Sites

Private property owners, developers or builders shall be accountable for any erosion of their property or construction site which results in measurable accumulation of sedimentation in dedicated streets, alleys, any waterway or other private properties. Any accumulation or deposit of soil material beyond the limits of the property or in City streets, alleys or drainage facilities in an amount sufficient to constitute a threat to public safety and comfort as determined by the City Engineer shall constitute a violation. Sediment carried by stormwater runoff through these acres shall be prevented from entering storm drain systems and natural watercourses.

12.2 General Guidelines for Erosion Control Plan

A. Maximum use shall be made of vegetation to minimize soil loss. At a minimum, 70% established re-vegetation is required for residential subdivision developments that do not retain the natural vegetation. Vegetation measures should begin as soon as possible during construction in order to allow for establishment at construction termination.
B. Natural vegetation should be retained wherever possible.
C. Where inadequate natural vegetation exists or where it becomes necessary to remove existing natural vegetation, temporary controls should be installed promptly to minimize soil loss and ensure that erosion and sedimentation does not occur. The developer is responsible for maintenance of site erosion control devices until a sufficient vegetation cover has been provided or replaced as determined by the City Engineer. Periodic maintenance shall be performed by the developer to remove accumulated sediment that would otherwise inhibit the proper functioning of the erosion control devices. Storm Water Pollution Prevention Plans (SWPPP) are required to maintained on all permitted construction sites at all times.
D. During construction, erosion controls shall be used to slow drainage flow rate and prevent downstream sedimentation.
E. Erosion control elements should be implemented as soon as practical in the development process.
F. Waste or disposal areas and construction roads should be located and constructed in a manner that will minimize the amount of sediment entering streams.
G. Frequent fording of live streams will not be permitted; therefore, temporary bridges or other structures shall be used wherever an appreciable number of crossings of a stream are necessary.
H. When work areas or material sources are located in or adjacent to live streams, such areas shall be separated from the stream by a dike or other barrier to keep sediment from entering a flowing stream. Care shall be taken during the construction and removal of such barriers to minimize the sediment transport into a stream.
I. Should preventative measures fail to function effectively, the applicant shall act immediately to bring the erosion and/or siltation under control by whatever additional means are necessary.
J. Erosion control devices shall be placed to trap any losses from stockpiled topsoil. Some acceptable forms of site erosion control devices include, but are not limited to, silt fences, silt traps, geonetting and geotextiles. Hay bales are not permitted.

K. The selection and timing of the installation of erosion controls shall be based upon weather and seasonal conditions that could make certain controls not practicable.
L. Vegetation used for vegetative cover shall be suitable for local soil and weather conditions. Ground cover plants shall comply with listings from the Texas Agricultural Extension Service.
M. Runoff shall be diverted away from construction areas as much as possible.
N. Stripping of vegetation from project sites shall be phased so as to expose the minimum amount of area to soil erosion for the shortest possible period of time. Phasing shall also consider the varying requirements of an erosion control plan at different stages of construction and shall include the establishment of new vegetation or permanent erosion control measures.
O. Developers, builders, or owners of property shall install all utilities, including franchise utilities, before final acceptance of a subdivision, property and/or structure. Final acceptance will also be contingent upon having all necessary erosion control measures installed to minimize off-site sediment. At the discretion of the City Engineer; a site may be accepted without erosion control measures if perennial vegetative cover is actively growing.
P. SWPPP shall follow TCEQ rules.

12.3 Stream Bank Erosion

Erosion control will be provided along streams and drainage channels. Where bank stabilization or other erosion protection measures are required to protect streams and channels, the stream bank protection and erosion damage mitigation measures provided in this manual shall be utilized.

13 Water Quality Controls

13.1 Applicability

Permanent water quality controls for development located over Edwards Aquifer regulated zones shall comply with the latest Texas Commission on Environmental Quality (TCEQ) published rules and technical design guidance. Permanent water quality controls for new development outside of the Edwards Aquifer regulated zones shall meet the criteria in this manual if the following are met:

1. The development is located in the City's Jurisdiction; and,
2. The development is defined as Type 3; and,
3. The total impervious cover for the development will exceed 30% of the contiguous property as a result of the development.

13.2 Design Criteria

Permanent water quality best management practices (BMPs) shall be designed to provide adequate treatment of the water quality volume (WQV) in the City's Jurisdiction. The WQV is defined as the first one-half inch of runoff from all new impervious surfaces added to a site that does not replace existing impervious surfaces (Equation 13-1).

Equation 13-1

$$WQV\ (cubic\ feet) = \frac{0.5\ inches}{12\frac{inch}{foot}} \times (\ IC\ Area\ Post\ Construction - IC\ Area\ Pre\ Construction)(sq.ft.)$$

13.3 Treatment Methods

In order to provide adequate treatment, one of the following methods must be followed:

1. Detention Filtration: Detain the WQV in an earthen basin for at least 24 hours as described in this Section
2. Provide one or more BMPs that meet the requirements in TCEQ report publication RG-348 and/or subsequent addenda
3. Provide BMPs that are approved by the Engineering Division prior to submission of a development application.

The WQV may be reduced by applying for impervious cover credits and/or the use of Low Impact Development (LID) strategies. Impervious cover credits and LID strategies are defined in the City of New Braunfels LID Manual.

13.3.1 Detention Filtration

The following process determines detention filtration requirements:

1. Calculate the minimum extended detention volume using Equation 13-2. The water quality volume shall be increased by a safety factor of 20% to account for deposition of solids over time. A fixed vertical sediment depth marker shall be installed in the basin to indicate when sediment

accumulation meets or exceeds 20% of the water quality volume and sediment removal is required.

Equation 13-2

$$V = WQV * 1.2$$

2. The flow path from the inlet to the outlet of the extended detention basin should be twice as long as the width of the extended detention basin.
3. The 24-hour draw-down time should be achieved by installing the appropriate sized orifice on the outlet structure. No more than 50% of the extended detention volume shall drain from the facility within the first 12 hours. Outlet pipes shall be designed to prevent accumulated sediment from discharging from extended detention basin.
    a. If perforated pipe is used, then the size of the perforations should not be used for draw-down time design purposes, and a filter should be installed to prevent the perforations from clogging.
    b. If the discharge pipe extends through a concrete wall, then a sleeve is required in the wall, and a water proof sealant should be used to prevent leaks around the sleeve.
4. The extended detention basin may be installed offline from peak flow attenuating detention basins or incorporated into a detention basin

13.3.2 TCEQ Method

When a treatment method approved by TCEQ is utilized outside of the Edwards regulatory zones, the increase in TSS load resulting from all new impervious surfaces must be reduced by at least 70%. Calculation of the capture volume or minimum flow rate shall follow the method in the latest technical guidance on BMPs for the Edwards Aquifer Rules.

13.3.3 Alternative Methods

The Engineering Division prior to submitting a development application must approve all other methods. Alternative methods must show comparable treatment levels as the Detention Filtration or TCEQ Methods.

13.4 Maintenance

A maintenance schedule and plan for water quality controls shall be submitted to the Engineering Division prior to approval of construction plans. When included as part of a subdivided development, a maintenance bond shall be provided in accordance with Section 118-38 of the New Braunfels Code of Ordinances. Alternate methods may require additional monitoring and engineering studies to ensure compliance.

PRESENTER:
Melissa Reynolds, First Assistant City Engineer
SUBJECT:
Public hearing and first reading of an ordinance amending Chapter 58, Floods, Article II. - Flood Damage Prevention.
DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
City staff is proposing amendments to the Drainage and Erosion Control Design Manual and the Code of Ordinances, Chapter 58 - Floods. The proposed amendments are based on recommendations from the Drainage Area Master Plan (DAMP) development and the Community Rating System (CRS) Improvement Report. These items were previously presented in fall of 2020 and have been posted on the Engineering webpage for comment since late 2020. Staff has received minor comments and questions primarily regarding one element, to which more detail is presented below.

The DAMP, initiated in 2019, is currently finalizing Phase 1 which includes updates to regulations to align with State standards. These updates are important for Phase 2 - remapping of floodplains based on new hydrology. Phase 1 also provided recommendations for improvements to the floodplain ordinance to improve CRS rating enhancements. This DAMP is intended to function as a comprehensive and holistic watershed program that is sustainable.

The CRS is the National Flood Insurance Program's (NFIP) voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements. The CRS Improvement Report was intended to investigate the City's potential to achieve improved CRS rating, creating better benefits for residents.

Code of Ordinances, Chapter 58 - Floods
The following amendments are proposed to the City of New Braunfels Code of Ordinances, Chapter 58, Floods:

Sec. 58-27 - *Definitions* is proposed to be revised to include new terms and clarification for existing terms.

Sec. 58-28.2 - *General Provisions* for establishment of the one percent annual chance ultimate development with Atlas 14 as the regulatory floodplain, which is critical to ensure accurate analysis prior to actual map revisions are adopted.

Sec. 58-29 - *Administration* include designating the floodplain administrator as the City Engineer, updates to

reference the current Fee Schedule, and updating the variance procedures to remove the Construction Board of Appeals and insert City Council.

Sec. 58-30 - *Provisions for flood hazard reduction* is proposed to be amended to include language not permitting recreational vehicles in the floodway. Further updates include a new section, *58-30.5 Floodplain* to include the detailed requirements for development in the floodplain and reference to new hydrology requirements. Additionally, clarifications and reference updates were provided for *Sec. 58-30.7 - "No-rise/no-impact certification"* in order to clarify the modelling needs for review analysis.

Review Process
This item was initially presented to the Watershed Advisory Committee, Planning Commission, and City Council for information and feedback in fall of 2020. The changes have been posted online for stakeholder and public input since December 2020. Engineering hosted 2 virtual stakeholder presentations on April 1, 2021 along with an engineering workshop on April 8, 2021.

Based on feedback from the Planning Commission, Watershed Advisory Committee, and stakeholders, along with staff research, Engineering has adjusted the recommended changes to remove the previously presented "Stream Buffers" from this update. Staff recognized additional effort is needed and this will follow in a later update after appropriate supporting information is developed. In addition, the proposal to require floodplains be platted as drainage easements has also been removed.

The feedback received at the virtual meetings and proposed text was discussed at a follow-up meeting for the Watershed Advisory Committee on April 22, 2021. The Committee recommended approval of the update. All feedback received was presented to the Planning Commission on May 4, 2021 for discussion and action was taken the following meeting on June 1, 2021 receiving approval with recommendation to not require the floodplain to be platted as a drainage easement, which has been incorporated in this recommendation.

ISSUE:
Envision New Braunfels (2018):
ACTION 4.28 [PROGRAM] Acquire and set aside as much land as possible along the Comal and Guadalupe Rivers and their tributaries within the floodplain for greenspace and/or additional river access.
ACTION 5.2 [POLICY] Discourage development in Edwards Aquifer Recharge and contributing zones, stream zones, flood-prone areas, steep slopes, or other ecologically constrained areas. Where development in these areas must occur, require that it be environmentally sound using tools such as but not limited to low impact development (LID).
ACTION 5.6 [POLICY] Implement measures to achieve and maintain a high National Flood Insurance Program CRS rating to ensure the safety of all residents and to reduce property owner flood insurance rates.
ACTION 5.15 [POLICY] Ensure that developers adequately address drainage in their projects and developments.

Municipal Separate Storm Sewer System (MS4) Stormwater Management Program: Minimum Control Measure 4: Post-Construction stormwater management in new development and re-development. Encouraging low impact development designs and establishing riparian zones and vegetative areas.

Stormwater Management Strategy Report (2013):
Open Space Conservation - Set aside lands and preserve open space that have high infiltration rates which would contribute to reduced peak flow levels and increased infiltration.

Floodway Hazard Mitigation - to Further limit or restrict new construction in the 100-year floodplain and floodway beyond existing ordinance.
Stream Bank Setback - Establish setbacks from streams for new development.

FISCAL IMPACT:
N/A

RECOMMENDATION:
Staff recommends approval of this ordinance amendment to Chapter 58, Article II - Flood Damage Prevention. This Ordinance shall become adopted and effective upon its second reading and filing with the City Secretary's Office.

ORDINANCE NO. 2021-____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, AMENDING CHAPTER 58 - FLOODS OF THE NEW BRAUNFELS CODE OF ORDINANCES TO UPDATE DRAINAGE POLICIES, REGULATORY CRITERIA, AND IMPROVE FLOODPLAIN PROTECTIONS.

WHEREAS, based on recommendations, City staff has recommended the proposed amendments in order to align with State rainfall data updates, to provide improvements to drainage policies and floodplain regulations, and to support the community goals of New Braunfels.

WHEREAS, the recommended amendments will support the provisions of Chapter 58 of the Code of Ordinances by minimizing future need for expenditure of public money for flood control projects, reducing the need for rescue and relief efforts, restricting uses that are dangerous to health, safety or property in times of flood, and controlling the alteration of natural floodplains, stream channels, and natural protective barriers.

WHEREAS, the City Council of the City of New Braunfels, Texas has the authority under its Home Rule Charter and under the laws of the State of Texas to adopt regulations aimed to protect the health, safety and general welfare of its citizens.

NOW, THEREFORE, BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

I.

THAT the City of New Braunfels Code of Ordinances Chapter 58 – FLOODS, Article II. – Flood Damage Prevention is hereby amended as follows:

Sec. 58-26. - Statutory authorization, findings of fact, purpose and methods.

58-26.1. *Statutory authorization.* The legislature of the state has in the Flood Control Insurance Act, V.T.C.A., Water Code§ 16.315, delegated the responsibility of local governmental

units to adopt regulations designed to minimize flood losses. Therefore, the city does ordain as follows.

58-26.2. *Findings of fact.*

(1) The flood hazard areas of the city are subject to periodic inundation, which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, all of which adversely affect the public health, safety and general welfare.

(2) These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, floodproofed or otherwise protected from flood damage.

58-26.3. *Statement of purpose.* It is the purpose of this article to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) Minimize prolonged business interruptions;

(5) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodplains;

(6) Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and

(7) Insure that potential buyers are notified that property is in a flood area.

58-26.4. *Methods of reducing flood losses.* In order to accomplish its purposes, this article uses the following methods:

(1) Restrict or prohibit uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities;

(2) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of flood waters;

(4) Control filling, grading, dredging and other development which may increase flood damage;

(5) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-27. - Definitions.

Unless specifically defined below, words or phrases used in this article shall be interpreted to give them the meaning they have in common usage and to give this article its most reasonable application.

Alluvial fan flooding means flooding occurring on the surface of an alluvial fan or similar landform which originates at the apex and is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flow paths.

Apex means a point on an alluvial fan or similar landform below which the flow path of the major stream that formed the fan becomes unpredictable and alluvial fan flooding can occur.

Appurtenant structure means a structure which is on the same parcel of property as the principal structure to be insured and the use of which is incidental to the use of the principal structure.

Area of future conditions flood hazard means the land area that would be inundated by the one-percent-annual chance (100-year) flood based on future conditions hydrology.

Area of shallow flooding means a designated AO, AH, AR/AO, AR/AH, or VO zone on a community's flood insurance rate map (FIRM) with a one percent or greater annual chance of flooding to an average depth of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of special flood hazard is the land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year. The area may be designated as Zone A on the flood hazard boundary map **(FHBM).** After detailed rate making has been completed in preparation for publication of the **FIRM,** Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE or V.

Atlas 14 refers to rainfall data obtained from NOAA Atlas 14, Volume 11 Precipitation Frequency Atlas of Current United States published September 27, 2018 for the State of Texas.

Base flood means the flood having a one percent chance of being equaled or exceeded in any given year.

Base flood elevation (BFE) means the elevation shown on the flood insurance rate map (FIRM) and found in the accompanying flood insurance study (FIS) for Zones A, AE, AH, A1-A30, AR, V1-V30, or VE that indicates the water surface elevation resulting from the flood that has a one percent chance of equaling or exceeding that level in any given year. Also called the "Base flood."

Basement means any area of the building having its floor subgrade (below ground level) on all sides.

Breakaway wall means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

Critical feature means an integral and readily identifiable part of a flood protection system, without which the flood protection provided by the entire system would be compromised.

Compensatory excavation means excavation to offset/mitigate lost floodplain volume due to fill placed in a special flood hazard area.

Development means any man-made change to improved and unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Elevated building means, for insurance purposes, a non-basement building, which has its lowest elevated floor, raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns.

Existing construction means for the purposes of determining rates, structures for which the "start of construction" commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. "Existing construction" may also be referred to as "existing structures."

Existing manufactured home park or subdivision means a manufactured home park or subdivision

for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by a community.

Expansion to an existing manufactured home park or subdivision means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Flood or *flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland or tidal waters.

(2) The unusual and rapid accumulation or runoff of surface waters from any source.

Flood elevation study means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards.

Flood insurance rate map (FIRM) means an official map of a community, on which the Federal Emergency Management Agency has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

Flood insurance study (FIS). See "Flood elevation study."

Floodplain or *flood-prone area* means any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by stormwater runoff. The extent of the floodplain shall be determined by the crest of a flood having a one percent chance of occurrence in one year. (see definition of "Flooding").

Floodplain fill means earthen fill placed in the special flood hazard area for development within the floodplain based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Floodplain management means the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain management regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as a floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

Floodplain reclamation means the area in the special flood hazard area that can be potentially used for fill placement and future development based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Flood protection system means those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to a "special flood hazard" and the extent of the depths of associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Flood proofing means any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Floodway. See "Regulatory floodway."

Functionally dependent use means a use, which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

Future condition means the condition of the watershed assumed to be fully built out based on zoning and/or future land use projections. See “Area of future conditions flood hazard.”

Highest adjacent grade means the highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

Historic structure means any structure that is:

(1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminary determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminary determined by the Secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(4) Individually listed on a local inventory or historic places in communities with historic preservation programs that have been certified either:

a. By an approved state program as determined by the Secretary of the Interior; or

b. Directly by the Secretary of the Interior in states without approved programs.

Levee means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

Levee system means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking or vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirement of Section 60.3 of the National Flood Insurance Program regulations.

Manufactured home means a structure transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

Manufactured home park or subdivision means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Mean sea *level* means, for purposes of the National Flood Insurance Program, the North American Vertical Datum (NAVO) of 1988 or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

New construction means, for the purpose of determining insurance rates, structures for which the

"start of construction" commenced on or after the effective date of an initial FIRM or after December 31, 1974, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, "new construction" means structures for which the "start of construction" commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

New manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of floodplain management regulations adopted by a community.

Pre-development conditions means the conditions of the site within the Special Flood Hazard Area before making any changes within the floodplain. Can also be referred to as Pre-Project Conditions

Post-development conditions means the conditions of the site either before or after construction is complete. Can also be referred to as Post-Project Conditions.

Recreational vehicle means a vehicle which is:

(1) Built on a single chassis;

(2) Four hundred square feet or less when measured at the largest horizontal projections;

(3) Designed to be self-propelled or permanently towable by a light duty truck; and

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Regulatory floodplain means the land within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Regulatory floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation.

Regulatory water surface elevation means the water surface elevation within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Riverine means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

Shaded-X means areas of moderate flood hazard from the principal source of flood in the area, determined to be within the limits of one percent and 0.2 percent annual chance floodplain. (Shaded Zone X is used on new and revised maps in place of Zone B).

Special flood hazard area. See "Area of special flood hazard."

Start of construction (for other than new construction or substantial improvements under the Coastal Barrier Resources Act [Pub. L. 97-348]), includes substantial improvement and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or fop tings, the installation of piles, the construction of columns, or any work beyond the stage of excavation, or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as

clearing, grading and filling; nor does it include the installation of streets and/or walk ways; nor does it include excavation for basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

Structure means, for floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before "start of construction" of the improvement. This term includes structures which have incurred "substantial damage", regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

(2) Any alteration of a "historic structure", provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Ultimate development means a hypothetical condition where it is assumed the entire watershed is fully developed. Ultimate development can also refer to an urban watershed which is already fully developed, in which case, the existing conditions represents Ultimate Development. Also, see “Future Conditions”

Variance means a grant of relief by a community from the terms of a floodplain management regulation. (For full requirements see Section 60.6 of the National Flood Insurance Program regulations.)

Violation means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in Section 60.3(b)(5), (c)(4), (c)(10), (d)(3), (e)(2), (e)(4), or (e)(5) is presumed to be in violation until such time as that documentation is provided.

Water surface elevation means the height, in relation to the North American Vertical Datum (NAVO) of 1988 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas. See “*Regulatory water surface elevation.”*

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-28. - General provisions.

58-28.1. *Lands to which this article applies.* The article shall apply to all areas of and adjacent to special flood hazard within the jurisdiction of the city.

58-28.2. *Basis for establishing the areas of special flood hazard.*

The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled "The Flood Insurance Study (FIS) for Comal County, Texas and Incorporated Areas," dated September 2, 2009, with accompanying flood

insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated September 2, 2009, and any revisions thereto are hereby adopted by reference and declared to be a part of this article; and

The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled, "The Flood Insurance Study (FIS) for Guadalupe County, Texas and Incorporated Areas," dated November 2, 2007, with accompanying flood insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated November 2, 2007, and any revisions thereto are hereby adopted by reference and declared to be part of this article.

The City requires the establishment of the one percent annual chance ultimate development conditions floodplain using Atlas 14 rainfall data as the regulatory floodplain. Until such time as such floodplain exists, it will be necessary for development to utilize the above information from Comal and Guadalupe County and their Incorporated Areas to develop and establish the regulatory floodplain.

58-28.3. – Establishment of development permit. A floodplain development permit shall be required to ensure conformance with the provisions of this article.

58-28.4. *Compliance.* No structure or land shall hereafter be located, altered, or have its use changed without full compliance with the terms of this article and other applicable regulations.

58-28.5. *Abrogation and greater restrictions.* This article is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this article and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

58-28.6. *Interpretation.* In the interpretation and application of this article, all provisions shall be:

(1) Considered as minimum requirements;

(2) Liberally construed in *favor* of the governing body; and

(3) Deemed neither to limit nor repeal any other powers granted under state statutes.

58-28.7. *Warning and disclaimer or liability.* The degree of flood protection required by this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. On occasions, greater floods can and will occur and flood heights may be increased by man-made or natural causes. This article does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This article shall not create liability on the part of the community or any official or employee thereof for any flood damages that result from reliance on this article or any administrative decision lawfully made hereunder.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-29. - Administration.

58-29.1. *Designation of the floodplain administrator.* The City Engineer or designee is hereby appointed the floodplain administrator to administer and implement the provisions of this article and other appropriate sections of 44 CFR (Emergency Management and Assistance - National Flood Insurance Program Regulations) pertaining to floodplain management.

58-29.2. *Duties and responsibilities of the floodplain administrator.* Duties and responsibilities of the floodplain administrator shall include, but not be limited to, the following:

(1) Maintain and hold open for public inspection all records pertaining to the provisions of this article.

(2) Collaborate with the Planning and Development Services Department on review of permit applications to determine whether to ensure that the proposed building

site project, including the placement of manufactured homes and recreation vehicles, will be reasonably safe from flooding.

(3) Collaborate with the Planning and Development Services Department to review, approve or deny all applications for development permits required by adoption of this article.

(4) Review permits for proposed development to assure that all necessary permits have been obtained from those federal, state or local governmental agencies (including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334) from which prior approval is required.

(5) Where interpretation is needed as to the exact location of the boundaries of the areas of special flood hazards (for example, where there appears to be a conflict between a mapped boundary and actual field conditions) the floodplain administrator shall make the necessary interpretation.

(6) Notify, in riverine situations, adjacent communities and the state coordinating agency which is the Texas Water Development Board (TWDB) and also the Texas Commission on Environmental Quality (TCEQ), prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Emergency Management Agency.

(7) Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained.

(8) When regulatory flood elevation data has not been provided in accordance with subsection 58-28.2, the floodplain administrator shall obtain, review and reasonably utilize any regulatory flood elevation data and floodway data available from a federal, state or other source, or request the engineer to develop such study in accordance to the guidelines specified by City of New Braunfels Drainage and Erosion Control Design manual (DCM), in order to administer the provisions of section 58-30.

(9) When a regulatory floodway has not been designated, the floodplain administrator must require that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated to the City that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

(10) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program regulations, in some cases, a community may approve certain development in Zones A1-30, AE, AH on the community's FIRM which increases the water surface elevation of the base flood by more than one foot, provided that the community first completes all of the provisions required by Section 65.12.

(11) Any requirements necessary for the strength, stability or proper operation of an existing or proposed building, structure, electrical, gas, mechanical or plumbing system, or for the public safety, health and general welfare, not specifically covered by this chapter or the other technical codes, shall be determined by the floodplain administrator or his/her designee. In addition, other requirements to implement, clarify or set procedures to accomplish the intent of this chapter may be set in writing by the floodplain administrator and may be posted electronically for public access.

58-29.3. *Permit procedures.*

(1) Application for a floodplain development permit shall be presented to the floodplain administrator on forms furnished by him/her and may include, but not be limited to, plans in duplicate drawn to scale showing the location, dimensions, and elevation of proposed landscape alterations, existing and proposed structures, including the placement of manufactured homes and recreational vehicles, and the location of the foregoing in relation to areas of special flood hazard. Additionally, the following information is required:

a. Elevation (in relation to mean sea level), of the lowest floor (including basement) of all new and substantially improved structures;

b. Elevation in relation to mean sea level to which any nonresidential structure shall be floodproofed;

c. A certificate from a registered professional engineer or architect that the nonresidential floodproofed structure shall meet the floodproofing criteria of subsection 58-30.2(2);

d. Description of the extent to which any watercourse or natural drainage will be altered or relocated as a result of proposed development;

e. Maintain a record of all such information in accordance with subsection 58-29.2(1);

f. Detailed drawings for the proposed development. Drawings must clearly indicate that all provisions of these regulations will be met. On developments other than residential accessory buildings less than 150 square feet or other insignificant developments (carports, well houses, gazebos, etc.) drawings must be sealed by a licensed professional engineer or registered architect certifying that all provisions of these regulations will be met if the development is completed in accordance with the sealed drawings.

g. A topographic survey of the property to be developed. This requirement may be waived for fences or other insignificant types of development.

h. In cases where a determination must be made as to whether the construction is substantial improvement, additional information may need to be submitted as outlined in these regulations.

i. The top of the slab of the lowest habitable floor must be elevated to two feet or more above the regulatory floodplain elevation.

j. A form board survey with elevations signed by a registered public land surveyor (R.P.L.S.) will be required before framing begins. Approval must be given by the floodplain administrator or his/her designee to begin framing if the survey meets all requirements.

k. A completed elevation certificate with the necessary regulatory floodplain elevations, hydrological and hydraulic data as needed must be submitted when the structure is completed (completed and ready for habitation for residential structures).

l. All structures will be constructed and anchored to prevent flotation, collapse or lateral movement of the structure resulting from the hydrodynamic and hydrostatic loads, including the effect of buoyancy.

m. Construction shall use methods that will minimize flood damage and construction materials and utility equipment that are resistant to flood damage. FEMA technical bulletins will serve as the guideline for this

requirement.

n. Unless dry-proofed, enclosed areas below the regulatory floodplain elevation must be equipped with flood openings or vents capable of equalizing water levels and hydrostatic loads. Covers for these openings must not interfere with the equalization of water levels in the event of a flood and should minimize potential blockage by debris. FEMA Bulletin 1 or subsequent revisions shall serve as the guideline for this requirement. A licensed architect or licensed professional engineer shall certify the flood openings. (This can only be done within the floodplain not the floodway.

o. Thermal insulation used below the regulatory floodplain elevation shall be of a type that does not absorb water.

p. Water heaters, furnaces, air conditioning systems, electrical distribution panels and any other mechanical or electrical equipment must be elevated at least two feet above the regulatory floodplain elevation. Separate electrical circuits shall serve any level below the regulatory floodplain elevation and shall be dropped from above.

q. All air ducts, loose pipes, propane tanks and storage tanks located at or below the regulatory floodplain level shall be firmly anchored to prevent floatation. Tanks and ducts shall be vented to at least two feet above the regulatory floodplain elevation.

(2) The floodplain development permit application may be filed with the application for building permit or separately prior to application for building permit. The floodplain development permit application shall include the following information:

a. Completed floodplain development permit application form.

b. Applicable permit fees:

1. One-and two-family dwelling floodplain permit + ($.05/sf for residential) …. $100.00

2. Other than one- and two-family dwelling floodplain permit + ($.10/sf for commercial) …. $250.00.

3. Any other applicable fees in accordance with the current Fee Schedule.

c. Plans, sealed by a Texas registered engineer, architect or land surveyor meeting (at minimum) requirements set forth in this chapter.

(3) Approval or denial of a floodplain development permit by the floodplain administrator shall be based on all of the provisions of this article and the following relevant factors:

a. The danger to life and property due to flooding or erosion damage;

b. The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

c. The danger that materials may be swept onto other lands to the injury of others;

d. The compatibility of the proposed use with existing and anticipated development;

e. The safety of access to the property in times of flood for ordinary and emergency vehicles;

f. The costs of providing governmental services during and after flood conditions including maintenance and repair of streets and bridges, and

public utilities and facilities such as sewer, gas, electrical and water systems;

g. The expected heights, velocity, duration, rate of rise and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site;

h. The necessity to the facility of a waterfront location, where applicable;

i. The availability of alternative locations, not subject to flooding or erosion damage, for the proposed use.

58-29.4. *Variance procedures*.

(1) The City Council shall hear and render judgment on requests for variances from the requirements of this article.

(2) The City Council shall hear and render judgment on an appeal only when it is alleged there is an error in any requirement, decision, or determination made by the floodplain administrator in the enforcement or administration of this article.

(3) Any person or persons aggrieved by the decision of the City Council may appeal such decision in the courts of competent jurisdiction.

(4) The floodplain administrator shall maintain a record of all actions involving an appeal and shall report variances to the Federal Emergency Management Agency upon request.

(5) Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this article.

(6) Variances may be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the regulatory floodplain level, providing the relevant factors in subsection 58-29.3(2) have been fully considered. As the lot size increases beyond the one-half acre, the technical justification required for issuing the variance increases.

(7) Upon consideration of the factors noted above and the intent of this article, the construction board of appeals may attach such conditions to the granting of variances as it deems necessary to further the purpose and objectives of this article (subsection 58-26.3).

(8) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

(9) Variances may be issued for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.

(10) Prerequisites for granting variances:

a. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

b. Variances shall only be issued upon:

1. Showing a good and sufficient cause;

2. A determination that failure to grant the variance would result in exceptional hardship to the applicant, and

3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

c. Any application to which a variance is granted shall be given written notice that the structure will be permitted to be built with the lowest floor elevation below the base flood elevation, and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation.

(11) Variances may be issued by a community for new construction and substantial improvements and for other development necessary for the conduct of a functionally dependent use provided that:

a. The criteria outlined in subsections 58-29.4(1)-(9) are met, and

b. The structure or other development is protected by methods that minimize flood damages during the regulatory flood event and create no additional threats to public safety.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-30. - Provisions for flood hazard reduction.

58-30.1. *General standards.* In all areas of special flood hazards the following provisions are required for all new construction and substantial improvements:

(1) All new construction or substantial improvements shall be designed (or modified) to be adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;

(2) All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage;

(3) All new construction or substantial improvements shall be constructed with materials resistant to flood damage;

(4) All new construction or substantial improvements shall be constructed two feet above the regulatory floodplain elevation with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

(5) The total value of improvements, repairs, modifications, and additions to existing buildings are counted cumulatively;

(6) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from the systems into flood waters; and,

(8) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

58-30.2. *Specific standards.* In all areas of special flood hazards where base flood elevation data has been provided as set forth in (i) subsection 58-28.2, (ii) subsection 58-29.2(8), or (iii) subsection 58- 30.3(3), the following provisions are required:

(1) *Residential construction.* New construction and substantial improvement of any

residential structure shall have the lowest floor (including basement), elevated to a minimum of two feet above the regulatory floodplain elevation together with attendant utility and sanitary facilities. A registered professional engineer, architect, or land surveyor shall submit a certification to the floodplain administrator that the standard of this subsection as proposed in subsection 58-29.3(1)a., is satisfied.

(2) *Nonresidential construction.* New construction and substantial improvements of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated to minimum of two feet or above the regulatory flood level or together with attendant utility and sanitary facilities, be designed so that below the regulatory flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice as outlined in this subsection. A record of such certification which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained by the floodplain administrator.

(3) *Enclosures.* New construction and substantial improvements, with fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:

a. A minimum of two openings on separate walls having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade.

c. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(4) *Manufactured homes.*

a. Require that all manufactured homes to be placed within Zone A on a community's FHBM or FIRM shall be installed using methods and practices which minimize flood damage. For the purposes of this requirement, manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

b. Require that manufactured homes that are placed or substantially improved within Zones A1-30, AH, and AE on the community's FIRM on sites (i) outside of a manufactured home park or subdivision, (ii) in a new manufactured home park or subdivision, (iii) in an expansion to an existing manufactured home park or subdivision, or (iv) in an existing manufactured home park or subdivision on which a manufactured home has incurred "substantial damage" as a result of a flood, be elevated on a permanent

foundation such that the lowest floor of the manufactured home is elevated to minimum of two feet or above the regulatory floodplain elevation and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

c. Require that manufactured homes be placed or substantially improved on sites in an existing manufactured home park or subdivision with Zones A1-30, AH, and AE on the community's FIRM that are not subject to the provisions of subsection (4) be elevated so that either:

1. The lowest floor of the manufactured home is at minimum of two feet or above the regulatory floodplain elevation, or

2. The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

(5) *Recreational vehicles.* Recreational vehicles are not permitted within the regulatory floodway. Require that recreational vehicles placed on sites within Zones A1-30, AH, and AE on the community's FIRM either (i) be on the site for fewer than 180 consecutive days, or (ii) be fully licensed and ready for highway use, or (iii) meet the permit requirements of subsection 58-29.3 (1), and the elevation and anchoring requirements for "manufactured homes" in subsection (4). A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions.

58-30.3. *Standards for subdivision proposals.*

(1) All subdivision proposals including the placement of manufactured home parks and subdivisions shall be consistent with subsections 58-26.2, 58-26.3 and 58-26.4.

(2) All proposals for the development of subdivisions including the placement of manufactured home parks and subdivisions shall meet floodplain development permit requirements of subsections 58-28.3, 58-29.3, and the provisions of section 58-30.

(3) Regulatory floodplain elevation data shall be generated for subdivision proposals and other proposed development including the placement of manufactured home parks and subdivisions which is greater than 50 lots or *five* acres, whichever is lesser, if not otherwise provided pursuant to subsection 58-28.2 or 58-29.2(8).

(4) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have adequate drainage provided to reduce exposure to flood hazards.

(5) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize or eliminate flood damage.

58-30.4. *Standards for areas of shallow flooding (AO/AH Zones).* Located within the areas of special flood hazard established in subsection 58-28.2, are areas designated as shallow flooding. These areas have special flood hazards associated with flood depths of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable, and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow; therefore, the following provisions apply:

(1) All new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated to or above the base flood elevation

or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified).

(2) All new construction and substantial improvements of non-residential structures:

a. Have the lowest floor (including basement) elevated to or above the base flood elevation or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or

b. Together with attendant utility and sanitary facilities be designed so that below the base specified flood depth in an AO Zone, or below the base flood elevation in an AH Zone, level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads of effects of buoyancy.

(3) A registered professional engineer or architect shall submit a certification to the floodplain administrator that the standards of this section, as proposed in subsection 58-29.3 are satisfied.

(4) Require within Zones AH or AO adequate drainage paths around structures on slopes, to guide flood waters around and away from proposed structures.

58-30.5. *Floodplains.* Any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by stormwater runoff. The extent of the floodplain shall be determined by the crest of a flood having a one percent chance of occurrence in one year. The following provisions shall apply:

(1) The City evaluated precipitation based on NOAA Atlas 14, Texas statewide precipitation study and updated the City's DCM with revised rainfall data. The one percent annual chance 24-hour rainfall depth for City is adopted to be 13.1 inches. Additional rainfall depth-duration-frequency values and intensity-duration-frequency values for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and 500-year storm frequencies are included in the Drainage and Erosion Control Design Manual. The City requires all flood study submittals to be performed using rainfall data published in the DCM. In case of mapped floodplains where FEMA submittals are needed, the study should use the rainfall data used in the current effective FEMA models, as required by FEMA for their submittals. In addition to this, the City requires a separate analysis using the rainfall data published in the Drainage and Erosion Control Design Manual, prepared for City's review and approval. Proposed conditions shall account for ultimate development of the watershed. All studies shall be in accordance with the Drainage and Erosion Control Design Manual.

(2) The one percent annual chance floodplain, also known as the 100-year floodplain is the area subject to one percent or greater chance of flooding in any given year, as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Most FEMA FIRMs also identify areas of Medium-Risk flood zones classified as Zone X, which are printed with a shade and hence are also known as Shaded-X. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2 percent annual chance storm or the one percent annual chance storm based on Ultimate Development Conditions, also known as Future Conditions. For all future studies, the City has adopted the one percent annual chance Ultimate Development floodplain mapped using rainfall data published in the Drainage and Erosion Control Design Manual, as the regulatory floodplain. Such floodplain is delineated based on flows developed by

assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to determine fully developed conditions.

a) The City requires all new and re-studied FEMA floodplains to delineate the Shaded-X areas based on the one percent annual chance Ultimate Development conditions. The City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions.

b) The City requires demonstration of the elevation of fill placed in the one percent annual chance Ultimate Development floodplain for construction of habitable structures to be greater than the one percent annual chance Ultimate Development water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities etc.

c) The City requires all future drainage easements and crossings in the floodplains to be based on the one percent annual chance Ultimate Development conditions.

d) For drainage areas greater than 150 acres, the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the one percent annual chance flows. The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to support their one percent annual chance Ultimate Development flows and floodplain delineation. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-impact to the one percent annual chance Ultimate Development water surface elevation outside of the requestor's property limits.

e) For streams which have a drainage area greater than 150 acres and currently not mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a one percent annual chance Ultimate Development floodplain along, within or adjacent to the project site.

(3) The stream setback limits, stream buffers, are different than the one percent annual chance floodplain. In some cases, the setback limits could be greater than the one percent annual chance Ultimate Development floodplain. Details for the City's requirements for setbacks/buffers are illustrated in the Drainage and Erosion Control Design Manual.

(4) The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate fill placed in the one percent annual chance Ultimate Development floodplain. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-rise in the one percent annual chance Ultimate

Development water surface elevation outside of the requestor's property limits. The City permits excavation in the floodplain to mitigate the increases to one percent annual chance Ultimate Development water surface elevations, in addition to excavation compensation along the same flooding source. All submittals will need a signed drawing by a licensed Professional Engineer (from the State of Texas) clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes. The City will require the plan to show cut volume be equal to or greater than the volume of fill. Additionally, the compensatory excavation is only allowable within the same flooding source or stream on which floodplain reclamation is being requested within the general vicinity of the fill.

f) If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require coordination and approval from the US Army Corps of Engineers.

(5) If subsection 58-30.5(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

(6) "No adverse impact" certification is required for all new construction in or adjacent to a stream designated with a regulatory floodplain.

58-30.6. *Floodways.* Located within areas of special flood hazard established in subsection 58-28.2, are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, the following provisions shall apply:

(1) Encroachments are prohibited, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the regulatory flood discharge a "no-rise/no- impact" certification.

(2) If subsection 58-30.6(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

(3) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program Regulation, a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided that the community first completes all of the provisions required by Section 65.12.

58-30.7. "No-rise/no-impact" certification. The engineering "no-rise/no-impact" certification and supporting technical data must stipulate no impact or no changes to 25-year water surface elevations, base flood elevations, regulatory floodway elevations, or regulatory floodway widths at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance, typically 1,000 feet, upstream and downstream of the development site or at the discretion of the floodplain administrator to insure proper "no-rise/no-impact" certifications.

"No adverse impact" certification. The engineering "no adverse impact" certification and supporting technical data must stipulate no adverse impacts to any habitable structures within the regulatory floodplain at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, at the floodplain administrator's discretion, the revised computer model should be sufficiently extended upstream and downstream of the development site such that the Engineer can insure proper "no adverse impact" certifications.

The "no-rise/no adverse impact" supporting data should include, but may not be limited to:

(1) Copy of the currently effective FIS hydraulic models (legible hard copy and a disc (if available).

(2) Duplicate effective FIS hydraulic models (hard copy and a disc).

(3) Existing conditions hydrology models developed using Atlas 14 analysis (hard copy and a disc).

(4) Proposed conditions hydrology models developed using Atlas 14 analysis (hard copy and a disc).

(5) Ultimate development conditions (or future conditions) hydrology model developed using Atlas 14 rainfall data for the one percent annual chance flood event and its supporting data (hard copy and a disc).

(6) Existing conditions hydraulic models (hard copy and a disc).

(7) Proposed conditions hydraulics models (hard copy and a disc).

(8) Ultimate development conditions hydraulics model (hard copy and a disc).

(9) Annotated effective FIRM or FBFM and topographic map, showing regulatory floodplain and floodway boundaries, the additional cross-sections, and the site location along with the proposed topographic modifications.

(10) Documentation clearly stating analysis procedures. All modifications made to the duplicate effective hydraulic models to correctly represent existing conditions, as well as those made to the existing conditions models to represent proposed conditions should be well documented and submitted with all supporting data.

(11) Floodway analysis using Method 1 or Method 4 encroachment methodology as described in FEMA Guidelines and Specifications for Hydrologic and Hydraulic modeling

(12) Annotated effective floodway data table (from the FIS report).

(13) Statement defining source of additional cross-sections, topographic data, and other supporting information.

(14) Cross-section plots of the additional cross sections for existing, proposed, and ultimate development conditions hydraulic models.

(15) Certified planimetric (boundary survey) information indicating the location of structures on the property.

(16) Hard copy of all output files.

(17) Clear explanation of how roughness parameters were obtained (if different from those used in the effective hydraulic models).

(18) Engineering certification.

(19) No wall enclosures over the allowed 120 square feet or breakaway walls within the floodway.

The "no rise or adverse impact" analysis along with supporting data and the original engineering certification must be reviewed by the floodplain administrator prior to issuing a development

permit. The original effective FIS model, the duplicate effective FIS model, the existing conditions model, and the proposed conditions model should be reviewed for any changes in the base and regulatory flood elevations, base and regulatory floodplain widths, regulatory floodway elevations and floodway widths.

58-30.8. *Severability.* If any section, clause, sentence, or phrase of this article is held to be invalid or unconstitutional by any court of competent jurisdiction, then said holding shall in no way affect the validity of the remaining portions of this article.

58-30.9. *Penalties for non-compliance.* No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this court order and other applicable regulations. Violation of the provisions of this court order by failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Each and every day or portion thereof during which any violation or failure to comply is committed or continued shall be deemed a separate offense subject to a fine of not more than $2,000.00 for each day. And each offense upon conviction in a court of competent jurisdiction, and in addition shall pay all costs and expenses involved in the case. Nothing herein contained shall prevent the city from taking such other lawful action as is necessary to prevent or remedy any violation.

(Ord. No. 2011-53, § 1, 6-27-11)

Secs. 58-31-58-55. - Reserved.

II.

THAT all provisions hereof are hereby declared to be severable and if any provisions hereof is declared to be invalid or unconstitutional, such shall not invalidate or affect the remaining provisions hereof which will be and remain in full force and effect.

III.

THAT it is hereby declared to be the intention of the City Council that the sections, paragraphs, sentences, clauses and phrases of this Ordinance are severable and, if any phrase, clause, sentence, paragraph or section of this Ordinance should be declared invalid by the final judgment or decree of any court of competent jurisdiction, such invalidity shall not affect any of the remaining phrases, clauses, sentences, paragraphs and sections of this Ordinance.

IV.

This Ordinance shall become adopted and effective upon its second reading, signature required by City Charter, and filing with the City Secretary's Office. This Ordinance must also be published in a newspaper of general circulation at least one time within ten (10) days after its final passage, as required by the City Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this the _____ day of _____, 2021.

PASSED AND APPROVED: Second reading this the _____ day of _____, 2021.

CITY OF NEW BRAUNFELS, TEXAS

_____
RUSTY BROCKMAN, MAYOR

ATTEST:

_____
CAITLIN KROBOT, CITY SECRETARY

APPROVED AS TO FORM:

_____
VALERIA M. ACEVEDO, CITY ATTORNEY

ARTICLE II. FLOOD DAMAGE PREVENTION[1]

Sec. 58-26. Statutory authorization, findings of fact, purpose and methods.

58-26.1. *Statutory authorization.* The legislature of the state has in the Flood Control Insurance Act, V.T.C.A., Water Code § 16.315, delegated the responsibility of local governmental units to adopt regulations designed to minimize flood losses. Therefore, the city does ordain as follows.

58-26.2. *Findings of fact.*

(1) The flood hazard areas of the city are subject to periodic inundation, which results in loss of life and property, health and safety hazards, disruption of commerce and governmental services, and extraordinary public expenditures for flood protection and relief, all of which adversely affect the public health, safety and general welfare.

(2) These flood losses are created by the cumulative effect of obstructions in floodplains which cause an increase in flood heights and velocities, and by the occupancy of flood hazard areas by uses vulnerable to floods and hazardous to other lands because they are inadequately elevated, floodproofed or otherwise protected from flood damage.

58-26.3. *Statement of purpose.* It is the purpose of this article to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas by provisions designed to:

(1) Protect human life and health;

(2) Minimize expenditure of public money for costly flood control projects;

(3) Minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) Minimize prolonged business interruptions;

(5) Minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodplains;

(6) Help maintain a stable tax base by providing for the sound use and development of flood-prone areas in such a manner as to minimize future flood blight areas; and

(7) Insure that potential buyers are notified that property is in a flood area.

58-26.4. *Methods of reducing flood losses.* In order to accomplish its purposes, this article uses the following methods:

(1) Restrict or prohibit uses that are dangerous to health, safety or property in times of flood, or cause excessive increases in flood heights or velocities;

[1]Editor's note(s)—Ord. No. 2011-53, § 1, adopted June 27, 2011, repealed and reenacted article II in its entirety to read as herein set out. Formerly, article II pertained to similar subject matter and derived from Ord. No. 2010-04, § 1, adopted January 11, 2010.

(2) Require that uses vulnerable to floods, including facilities which serve such uses, be protected against flood damage at the time of initial construction;

(3) Control the alteration of natural floodplains, stream channels, and natural protective barriers, which are involved in the accommodation of flood waters;

(4) Control filling, grading, dredging and other development which may increase flood damage;

(5) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-27. Definitions.

Unless specifically defined below, words or phrases used in this article shall be interpreted to give them the meaning they have in common usage and to give this article its most reasonable application.

Alluvial fan flooding means flooding occurring on the surface of an alluvial fan or similar landform which originates at the apex and is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flow paths.

Apex means a point on an alluvial fan or similar landform below which the flow path of the major stream that formed the fan becomes unpredictable and alluvial fan flooding can occur.

Appurtenant structure means a structure which is on the same parcel of property as the principal structure to be insured and the use of which is incidental to the use of the principal structure.

Area of future conditions flood hazard means the land area that would be inundated by the one-percent-annual chance (100-year) flood based on future conditions hydrology.

Area of shallow flooding means a designated AO, AH, AR/AO, AR/AH, or VO zone on a community's flood insurance rate map (FIRM) with a one percent or greater annual chance of flooding to an average depth of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

Area of special flood hazard is the land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year. The area may be designated as Zone A on the flood hazard boundary map (FHBM). After detailed rate making has been completed in preparation for publication of the FIRM, Zone A usually is refined into Zones A, AO, AH, A1-30, AE, A99, AR, AR/A1-30, AR/AE, AR/AO, AR/AH, AR/A, VO, V1-30, VE or V.

Atlas 14 refers to rainfall data obtained from NOAA Atlas 14, Volume 11 Precipitation Frequency Atlas of Current United States published September 27, 2018 for the State of Texas.

Base flood means the flood having a one percent chance of being equaled or exceeded in any given year.

Base flood elevation (BFE) means the elevation shown on the flood insurance rate map (FIRM) and found in the accompanying flood insurance study (FIS) for Zones A, AE, AH, A1-A30, AR, V1-V30, or VE that indicates the water surface elevation resulting from the flood that has a one percent chance of equaling or exceeding that level in any given year. Also called the "Base flood."

Basement means any area of the building having its floor subgrade (below ground level) on all sides.

Breakaway wall means a wall that is not part of the structural support of the building and is intended through its design and construction to collapse under specific lateral loading forces, without causing damage to the elevated portion of the building or supporting foundation system.

Critical feature means an integral and readily identifiable part of a flood protection system, without which the flood protection provided by the entire system would be compromised.

Development means any man-made change to improved and unimproved real estate, including but not limited to buildings or other structures, mining, dredging, filling, grading, paving, excavation or drilling operations or storage of equipment or materials.

Elevated building means, for insurance purposes, a non-basement building, which has its lowest elevated floor, raised above ground level by foundation walls, shear walls, posts, piers, pilings, or columns.

Existing construction means for the purposes of determining rates, structures for which the "start of construction" commenced before the effective date of the FIRM or before January 1, 1975, for FIRMs effective before that date. "Existing construction" may also be referred to as "existing structures."

Existing manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed before the effective date of the floodplain management regulations adopted by a community.

Expansion to an existing manufactured home park or subdivision means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

Flood or *flooding* means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(1) The overflow of inland or tidal waters.

(2) The unusual and rapid accumulation or runoff of surface waters from any source.

Flood elevation study means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) and/or flood-related erosion hazards.

Flood insurance rate map (FIRM) means an official map of a community, on which the Federal Emergency Management Agency has delineated both the special flood hazard areas and the risk premium zones applicable to the community.

Flood insurance study (FIS). See "Flood elevation study."

Floodplain or *flood-prone area* means any land area susceptible to being inundated by water from any source (see definition of "Flooding").

Floodplain fill means earthen fill placed in the special flood hazard area for development within the floodplain based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Floodplain management means the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

Floodplain management regulations means zoning ordinances, subdivision regulations, building codes, health regulations, special purpose ordinances (such as a floodplain ordinance, grading ordinance and erosion control ordinance) and other applications of police power. The term describes such state or local regulations, in any combination thereof, which provide standards for the purpose of flood damage prevention and reduction.

Floodplain reclamation means the area in the special flood hazard area that can be potentially used for fill placement and future development based on a permit under applicable Federal, state, and local laws, ordinances, and regulations.

Flood protection system means those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to a "special flood hazard" and the extent of the depths of associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

Flood proofing means any combination of structural and non-structural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities, structures and their contents.

Floodway. See "Regulatory floodway."

Functionally dependent use means a use, which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

Future condition means the condition of the watershed assumed to be fully built out based on zoning and/or future land use projections. See “Area of future conditions flood hazard.”

Highest adjacent grade means the highest natural elevation of the ground surface prior to construction next to the proposed walls of a structure.

Historic structure means any structure that is:

(1) Listed individually in the National Register of Historic Places (a listing maintained by the Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(2) Certified or preliminary determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminary determined by the Secretary to qualify as a registered historic district;

(3) Individually listed on a state inventory of historic places in states with historic preservation programs which have been approved by the Secretary of the Interior; or

(4) Individually listed on a local inventory or historic places in communities with historic preservation programs that have been certified either:

   a. By an approved state program as determined by the Secretary of the Interior; or

   b. Directly by the Secretary of the Interior in states without approved programs.

Levee means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control, or divert the flow of water so as to provide protection from temporary flooding.

Levee system means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

Lowest floor means the lowest floor of the lowest enclosed area (including basement). An unfinished or flood resistant enclosure, usable solely for parking or vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided that such enclosure is not built so as to render

the structure in violation of the applicable non-elevation design requirement of Section 60.3 of the National Flood Insurance Program regulations.

Manufactured home means a structure transportable in one or more sections, which is built on a permanent chassis and is designed for use with or without a permanent foundation when connected to the required utilities. The term "manufactured home" does not include a "recreational vehicle."

Manufactured home park or subdivision means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

Mean sea level means, for purposes of the National Flood Insurance Program, the North American Vertical Datum (NAVD) of 1988 or other datum, to which base flood elevations shown on a community's flood insurance rate map are referenced.

New construction means, for the purpose of determining insurance rates, structures for which the "start of construction" commenced on or after the effective date of an initial FIRM or after December 31, 1974, whichever is later, and includes any subsequent improvements to such structures. For floodplain management purposes, "new construction" means structures for which the "start of construction" commenced on or after the effective date of a floodplain management regulation adopted by a community and includes any subsequent improvements to such structures.

New manufactured home park or subdivision means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of floodplain management regulations adopted by a community.

Pre-development conditions means the conditions of the site within the Special Flood Hazard Area before making any changes within the floodplain. Can also be referred to as Pre-Project Conditions

Post-development conditions means the conditions of the site either before or after construction is complete. Can also be referred to as Post-Project Conditions.

Recreational vehicle means a vehicle which is:

(1) Built on a single chassis;

(2) Four hundred square feet or less when measured at the largest horizontal projections;

(3) Designed to be self-propelled or permanently towable by a light duty truck; and

(4) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

Regulatory floodplain Regulatory floodplain means the land within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Regulatory floodway means the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

Regulatory water surface elevation means the water surface elevation within the community subject to a one (1) percent or greater chance of flooding in any given year assuming Ultimate Development has occurred throughout the contributing watershed, which the city or community will use to future regulate design and construction within their municipality.

Riverine means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

Shaded-X means areas of moderate flood hazard from the principal source of flood in the area, determined to be within the limits of one percent and 0.2 percent annual chance floodplain. (Shaded Zone X is used on new and revised maps in place of Zone B).

Special flood hazard area. See "Area of special flood hazard."

Start of construction (for other than new construction or substantial improvements under the Coastal Barrier Resources Act [Pub. L. 97-348]), includes substantial improvement and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure on a site, such as the pouring of slab or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; or the placement of a manufactured home on a foundation. Permanent construction does not include land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for basement, footings, piers or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

Structure means, for floodplain management purposes, a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

Substantial damage means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed 50 percent of the market value of the structure before the damage occurred.

Substantial improvement means any reconstruction, rehabilitation, addition, or other improvement of a structure, the cost of which equals or exceeds 50 percent of the market value of the structure before "start of construction" of the improvement. This term includes structures which have incurred "substantial damage", regardless of the actual repair work performed. The term does not, however, include either:

(1) Any project for improvement of a structure to correct existing violations of state or local health, sanitary, or safety code specifications which have been identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions, or

(2) Any alteration of a "historic structure", provided that the alteration will not preclude the structure's continued designation as a "historic structure."

Ultimate development means a hypothetical condition where it is assumed the entire watershed is fully developed. Ultimate development can also refer to an urban watershed which is already fully developed, in which case, the existing conditions represents Ultimate Development. Also, see “Future Conditions”

Variance means a grant of relief by a community from the terms of a floodplain management regulation. (For full requirements see Section 60.6 of the National Flood Insurance Program regulations.)

Violation means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certifications, or other evidence of compliance required in Section 60.3(b)(5), (c)(4), (c)(10), (d)(3), (e)(2), (e)(4), or (e)(5) is presumed to be in violation until such time as that documentation is provided.

Water surface elevation means the height, in relation to the North American Vertical Datum (NAVD) of 1988 (or other datum, where specified), of floods of various magnitudes and frequencies in the floodplains of coastal or riverine areas.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-28. General provisions.

58-28.1. *Lands to which this article applies.* The article shall apply to all areas of and adjacent to special flood hazard within the jurisdiction of the city.

58-28.2. *Basis for establishing the areas of special flood hazard.* The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled "The Flood Insurance Study (FIS) for Comal County, Texas and Incorporated Areas," dated September 2, 2009, with accompanying flood insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated September 2, 2009, and any revisions thereto are hereby adopted by reference and declared to be a part of this article; and

The areas of special flood hazard identified by the Federal Emergency Management Agency in the current scientific and engineering report entitled, "The Flood Insurance Study (FIS) for Guadalupe County, Texas and Incorporated Areas," dated November 2, 2007, with accompanying flood insurance rate maps and/or flood boundary-floodway maps (FIRM and/or FBFM) dated November 2, 2007, and any revisions thereto are hereby adopted by reference and declared to be a part of this article.

The City requires the establishment of the one percent annual chance ultimate development conditions floodplain using Atlas 14 rainfall data as the regulatory floodplain. Until such time as such floodplain exists, it will be necessary for development to utilize the above information from Comal and Guadalupe County and their Incorporated Areas to develop and establish the regulatory floodplain.

58-28.3. *Establishment of development permit.* A floodplain development permit shall be required to ensure conformance with the provisions of this article.

58-28.4. *Compliance.* No structure or land shall hereafter be located, altered, or have its use changed without full compliance with the terms of this article and other applicable regulations.

58-28.5. *Abrogation and greater restrictions.* This article is not intended to repeal, abrogate, or impair any existing easements, covenants, or deed restrictions. However, where this article and another ordinance, easement, covenant, or deed restriction conflict or overlap, whichever imposes the more stringent restrictions shall prevail.

58-28.6. *Interpretation.* In the interpretation and application of this article, all provisions shall be:

(1) Considered as minimum requirements;

(2) Liberally construed in favor of the governing body; and

(3) Deemed neither to limit nor repeal any other powers granted under state statutes.

58-28.7. *Warning and disclaimer or liability.* The degree of flood protection required by this article is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. On ~~rare~~ occasions greater floods can and will occur and flood heights may be increased by man-made or natural causes. This article does not imply that land outside the areas of special flood hazards or uses permitted within such areas will be free from flooding or flood damages. This article shall not create liability on the part of the community or any official or employee thereof for any flood damages that result from reliance on this article or any administrative decision lawfully made hereunder.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-29. Administration.

58-29.1. *Designation of the floodplain administrator.* The ~~city's building official~~city engineer or designee is hereby appointed the floodplain administrator to administer and implement the provisions of this article and other

appropriate sections of 44 CFR (Emergency Management and Assistance - National Flood Insurance Program Regulations) pertaining to floodplain management.

58-29.2. *Duties and responsibilities of the floodplain administrator.* Duties and responsibilities of the floodplain administrator shall include, but not be limited to, the following:

(1) Maintain and hold open for public inspection all records pertaining to the provisions of this article.

(2) Collaborate with the Planning and Development Services Department on ~~R~~review of permit applications to determine whether to ensure that the proposed building site project, including the placement of manufactured homes and recreational vehicles, will be reasonably safe from flooding.

(3) Collaborate with the Planning and Development Services Department to ~~R~~review, approve or deny all applications for development permits required by adoption of this article.

(4) Review permits for proposed development to assure that all necessary permits have been obtained from those federal, state or local governmental agencies (including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334) from which prior approval is required.

(5) Where interpretation is needed as to the exact location of the boundaries of the areas of special flood hazards (for example, where there appears to be a conflict between a mapped boundary and actual field conditions) the floodplain administrator shall make the necessary interpretation.

(6) Notify, in riverine situations, adjacent communities and the state coordinating agency which is the Texas Water Development Board (TWDB) and also the Texas Commission on Environmental Quality (TCEQ), prior to any alteration or relocation of a watercourse, and submit evidence of such notification to the Federal Emergency Management Agency.

(7) Assure that the flood carrying capacity within the altered or relocated portion of any watercourse is maintained.

(8) When base flood elevation data has not been provided in accordance with subsection 58-28.2, the floodplain administrator shall obtain, review and reasonably utilize any base flood elevation data and floodway data available from a federal, state or other source, in order to administer the provisions of section 58-30.

(9) When a regulatory floodway has not been designated, the floodplain administrator must require that no new construction, substantial improvements, or other development (including fill) shall be permitted within Zones A1-30 and AE on the community's FIRM, unless it is demonstrated that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any point within the community.

(10) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program regulations, a community may approve certain development in Zones A1-30, AE, AH, on the community's FIRM which increases the water surface elevation of the base flood by more than one foot, provided that the community first completes all of the provisions required by Section 65.12.

(11) Any requirements necessary for the strength, stability or proper operation of an existing or proposed building, structure, electrical, gas, mechanical or plumbing system, or for the public safety, health and general welfare, not specifically covered by this chapter or the other technical codes, shall be determined by the floodplain administrator. In addition, other requirements to implement, clarify or set procedures to accomplish the intent of this chapter may be set in writing by the floodplain administrator ~~official~~ and may be posted electronically for public access.

58-29.3. *Permit procedures.*

(1) Application for a floodplain development permit shall be presented to the floodplain administrator on forms furnished by him/her and may include, but not be limited to, plans in duplicate drawn to scale showing the location, dimensions, and elevation of proposed landscape alterations, existing and proposed structures, including the placement of manufactured homes and recreational vehicles, and the location of the foregoing in relation to areas of special flood hazard. Additionally, the following information is required:

a. Elevation (in relation to mean sea level), of the lowest floor (including basement) of all new and substantially improved structures;

b. Elevation in relation to mean sea level to which any nonresidential structure shall be floodproofed;

c. A certificate from a registered professional engineer or architect that the nonresidential floodproofed structure shall meet the floodproofing criteria of subsection 58-30.2(2);

d. Description of the extent to which any watercourse or natural drainage will be altered or relocated as a result of proposed development;

e. Maintain a record of all such information in accordance with subsection 58-29.2(1);

f. Detailed drawings for the proposed development. Drawings must clearly indicate that all provisions of these regulations will be met. On developments other than residential accessory buildings less than 150 square feet or other insignificant developments (carports, well houses, gazebos, etc.) drawings must be sealed by a licensed professional engineer or registered architect certifying that all provisions of these regulations will be met if the development is completed in accordance with the sealed drawings.

g. A topographic survey of the property to be developed. This requirement may be waived for fences or other insignificant types of development.

h. In cases where a determination must be made as to whether the construction is substantial improvement, additional information may need to be submitted as outlined in these regulations.

i. The top of the slab of the lowest habitable floor must be elevated to two feet or more above the base flood elevation.

j. A form board survey with elevations signed by a registered public land surveyor (R.P.L.S.) will be required before framing begins. Approval must be given by the floodplain administrator or designee to begin framing if the survey meets all requirements.

k. A completed elevation certificate with the necessary base flood elevations, hydrological and hydraulic data as needed must be submitted when the structure is completed (completed and ready for habitation for residential structures).

l. All structures will be constructed and anchored to prevent flotation, collapse or lateral movement of the structure resulting from the hydrodynamic and hydrostatic loads, including the effect of buoyancy.

m. Construction shall use methods that will minimize flood damage and construction materials and utility equipment that are resistant to flood damage. FEMA technical bulletins will serve as the guideline for this requirement.

n. Unless dry-proofed, enclosed areas below the base flood elevation must be equipped with flood openings or vents capable of equalizing water levels and hydrostatic loads. Covers for these openings must not interfere with the equalization of water levels in the event of a flood and should minimize potential blockage by debris. FEMA Bulletin 1 or subsequent revisions shall serve

as the guideline for this requirement. A licensed architect or licensed professional engineer shall certify the flood openings. (This can only be done within the floodplain not the floodway.

o. Thermal insulation used below the base flood elevation shall be of a type that does not absorb water.

p. Water heaters, furnaces, air conditioning systems, electrical distribution panels and any other mechanical or electrical equipment must be elevated at least two feet above the base flood elevation. Separate electrical circuits shall serve any level below the base flood elevation and shall be dropped from above.

q. All air ducts, loose pipes, propane tanks and storage tanks located at or below the base flood level shall be firmly anchored to prevent floatation. Tanks and ducts shall be vented to at least two feet above the base flood elevation.

(2) The floodplain development permit application may be filed with the application for building permit or separately prior to application for building permit. The floodplain development permit application shall include the following information:

a. Completed floodplain development permit application form.

b. Applicable permit fees:

1. One- and two-family dwelling floodplain permit + ($.05/sf for residential)$100.00

2. Other than one- and two-family dwelling floodplain permit + ($.10/sf for commercial)250.00

3. Any other applicable fees in accordance with the current Fee Schedule.

c. Plans, sealed by a Texas registered engineer, architect or land surveyor meeting (at minimum) requirements set forth in this chapter.~~If filed separately prior to application for building permit. Three complete sets of plans, sealed by a Texas registered engineer, architect or land surveyor are needed~~.

(3) Approval or denial of a floodplain development permit by the floodplain administrator shall be based on all of the provisions of this article and the following relevant factors:

a. The danger to life and property due to flooding or erosion damage;

b. The susceptibility of the proposed facility and its contents to flood damage and the effect of such damage on the individual owner;

c. The danger that materials may be swept onto other lands to the injury of others;

d. The compatibility of the proposed use with existing and anticipated development;

e. The safety of access to the property in times of flood for ordinary and emergency vehicles;

f. The costs of providing governmental services during and after flood conditions including maintenance and repair of streets and bridges, and public utilities and facilities such as sewer, gas, electrical and water systems;

g. The expected heights, velocity, duration, rate of rise and sediment transport of the floodwaters and the effects of wave action, if applicable, expected at the site;

h. The necessity to the facility of a waterfront location, where applicable;

i. The availability of alternative locations, not subject to flooding or erosion damage, for the proposed use.

58-29.4. *Variance procedures.*

(1) The ~~construction board of appeals~~City Council, a~~s established by the community,~~ shall hear and render judgment on requests for variances from the requirements of this article.

(2) The ~~construction board of appeals~~City Council shall hear and render judgment on an appeal only when it is alleged there is an error in any requirement, decision, or determination made by the floodplain administrator in the enforcement or administration of this article.

(3) Any person or persons aggrieved by the decision of the ~~construction board of appeals~~City Council may appeal such decision in the courts of competent jurisdiction.

(4) The floodplain administrator shall maintain a record of all actions involving an appeal and shall report variances to the Federal Emergency Management Agency upon request.

(5) Variances may be issued for the reconstruction, rehabilitation or restoration of structures listed on the National Register of Historic Places or the State Inventory of Historic Places, without regard to the procedures set forth in the remainder of this article.

(6) Variances may be issued for new construction and substantial improvements to be erected on a lot of one-half acre or less in size contiguous to and surrounded by lots with existing structures constructed below the base flood level, providing the relevant factors in subsection 58-29.3(2) have been fully considered. As the lot size increases beyond the one-half acre, the technical justification required for issuing the variance increases.

(7) Upon consideration of the factors noted above and the intent of this article, the construction board of appeals may attach such conditions to the granting of variances as it deems necessary to further the purpose and objectives of this article (subsection 58-26.3).

(8) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

(9) Variances may be issued for the repair or rehabilitation of historic structures upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary to preserve the historic character and design of the structure.

(10) Prerequisites for granting variances:

a. Variances shall only be issued upon a determination that the variance is the minimum necessary, considering the flood hazard, to afford relief.

b. Variances shall only be issued upon:

1. Showing a good and sufficient cause;

2. A determination that failure to grant the variance would result in exceptional hardship to the applicant, and

3. A determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisances, cause fraud on or victimization of the public, or conflict with existing local laws or ordinances.

c. Any application to which a variance is granted shall be given written notice that the structure will be permitted to be built with the lowest floor elevation below the base flood elevation, and that the cost of flood insurance will be commensurate with the increased risk resulting from the reduced lowest floor elevation.

(11) Variances may be issued by a community for new construction and substantial improvements and for other development necessary for the conduct of a functionally dependent use provided that:

a. The criteria outlined in subsections 58-29.4(1)—(9) are met, and

b. The structure or other development is protected by methods that minimize flood damages during the base flood and create no additional threats to public safety.

(Ord. No. 2011-53, § 1, 6-27-11)

Sec. 58-30. Provisions for flood hazard reduction.

58-30.1. *General standards.* In all areas of special flood hazards the following provisions are required for all new construction and substantial improvements:

(1) All new construction or substantial improvements shall be designed (or modified) ~~and~~ to be adequately anchored to prevent flotation, collapse or lateral movement of the structure resulting from hydrodynamic and hydrostatic loads, including the effects of buoyancy;

(2) All new construction or substantial improvements shall be constructed by methods and practices that minimize flood damage;

(3) All new construction or substantial improvements shall be constructed with materials resistant to flood damage;

(4) All new construction or substantial improvements shall be constructed two feet above the base flood elevation with electrical, heating, ventilation, plumbing, and air conditioning equipment and other service facilities that are designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

(5) The total value of improvements, repairs, modifications, and additions to existing buildings are counted cumulatively;

(6) All new and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the system and discharge from the systems into flood waters; and,

(8) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

58-30.2. *Specific standards.* In all areas of special flood hazards where base flood elevation data has been provided as set forth in (i) subsection 58-28.2, (ii) subsection 58-29.2(8), or (iii) subsection 58-30.3(3), the following provisions are required:

(1) *Residential construction.* New construction and substantial improvement of any residential structure shall have the lowest floor (including basement), elevated to a minimum of two feet above the base flood elevation together with attendant utility and sanitary facilities. A registered professional engineer, architect, or land surveyor shall submit a certification to the floodplain administrator that the standard of this subsection as proposed in subsection 58-29.3(1)a., is satisfied.

(2) *Nonresidential construction.* New construction and substantial improvements of any commercial, industrial or other nonresidential structure shall either have the lowest floor (including basement) elevated to minimum of two feet or above the base flood level or together with attendant utility and sanitary facilities, be designed so that below the base flood level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the

capability of resisting hydrostatic and hydrodynamic loads and effects of buoyancy. A registered professional engineer or architect shall develop and/or review structural design, specifications, and plans for the construction, and shall certify that the design and methods of construction are in accordance with accepted standards of practice as outlined in this subsection. A record of such certification which includes the specific elevation (in relation to mean sea level) to which such structures are floodproofed shall be maintained by the floodplain administrator.

(3) *Enclosures.* New construction and substantial improvements, with fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding shall be designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters. Designs for meeting this requirement must either be certified by a registered professional engineer or architect or meet or exceed the following minimum criteria:

a. A minimum of two openings on separate walls having a total net area of not less than one square inch for every square foot of enclosed area subject to flooding shall be provided.

b. The bottom of all openings shall be no higher than one foot above grade.

c. Openings may be equipped with screens, louvers, valves, or other coverings or devices provided that they permit the automatic entry and exit of floodwaters.

(4) *Manufactured homes.*

a. Require that all manufactured homes to be placed within Zone A on a community's FHBM or FIRM shall be installed using methods and practices which minimize flood damage. For the purposes of this requirement, manufactured homes must be elevated and anchored to resist flotation, collapse, or lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable state and local anchoring requirements for resisting wind forces.

b. Require that manufactured homes that are placed or substantially improved within Zones A1-30, AH, and AE on the community's FIRM on sites (i) outside of a manufactured home park or subdivision, (ii) in a new manufactured home park or subdivision, (iii) in an expansion to an existing manufactured home park or subdivision, or (iv) in an existing manufactured home park or subdivision on which a manufactured home has incurred "substantial damage" as a result of a flood, be elevated on a permanent foundation such that the lowest floor of the manufactured home is elevated to minimum of two feet or above the base flood elevation and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

c. Require that manufactured homes be placed or substantially improved on sites in an existing manufactured home park or subdivision with Zones A1-30, AH and AE on the community's FIRM that are not subject to the provisions of subsection (4) be elevated so that either:

1. The lowest floor of the manufactured home is at minimum of two feet or above the base flood elevation, or

2. The manufactured home chassis is supported by reinforced piers or other foundation elements of at least equivalent strength that are no less than 36 inches in height above grade and be securely anchored to an adequately anchored foundation system to resist flotation, collapse, and lateral movement.

(5) *Recreational vehicles.* Recreational vehicles are not permitted within the regulatory floodway. Require that recreational vehicles placed on sites within Zones A1-30, AH, and AE on the community's FIRM either

(i) ___be on the site for fewer than 180 consecutive days, or

(ii) __be fully licensed and ready for highway use, or

(iii)__-meet the permit requirements of subsection 58-29.3 (1), and the elevation and anchoring requirements for "manufactured homes" in subsection (4).

A recreational vehicle is ready for highway use if it is on its wheels or jacking system, is attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached additions.

58-30.3. *Standards for subdivision proposals.*

(1) All subdivision proposals including the placement of manufactured home parks and subdivisions shall be consistent with subsections 58-26.2, 58-26.3 and 58-26.4.

(2) All proposals for the development of subdivisions including the placement of manufactured home parks and subdivisions shall meet floodplain development permit requirements of subsections 58-28.3, 58-29.3, and the provisions of section 58-30.

(3) Base flood elevation data shall be generated for subdivision proposals and other proposed development including the placement of manufactured home parks and subdivisions which is greater than 50 lots or five acres, whichever is lesser, if not otherwise provided pursuant to subsection 58-28.2 or 58-29.2(8).

(4) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have adequate drainage provided to reduce exposure to flood hazards.

(5) All subdivision proposals including the placement of manufactured home parks and subdivisions shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize or eliminate flood damage.

58-30.4. *Standards for areas of shallow flooding (AO/AH Zones).* Located within the areas of special flood hazard established in subsection 58-28.2, are areas designated as shallow flooding. These areas have special flood hazards associated with flood depths of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable, and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow; therefore, the following provisions apply:

(1) All new construction and substantial improvements of residential structures have the lowest floor (including basement) elevated to or above the base flood elevation or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified).

(2) All new construction and substantial improvements of non-residential structures:

a. Have the lowest floor (including basement) elevated to or above the base flood elevation or the highest adjacent grade at least as high as the depth number specified in feet on the community's FIRM (at least two feet if no depth number is specified), or

b. Together with attendant utility and sanitary facilities be designed so that below the base specified flood depth in an AO Zone, or below the base flood elevation in an AH Zone, level the structure is watertight with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads of effects of buoyancy.

(3) A registered professional engineer or architect shall submit a certification to the floodplain administrator that the standards of this section, as proposed in subsection 58-29.3 are satisfied.

(4) Require within Zones AH or AO adequate drainage paths around structures on slopes, to guide flood waters around and away from proposed structures.

58-30.5.- *Floodplains*. Any and all land area adjoining the channel of a river, stream, lake, watercourse, marshy area, or other drainage element, which has been or may be inundated by stormwater runoff. The extent of the floodplain shall be determined by the crest of a flood having a one percent chance of occurrence in one year. The following provisions shall apply:

(1) The City evaluated precipitation based on NOAA Atlas 14, Texas statewide precipitation study and updated the City's DCM with revised rainfall data. The one percent annual chance 24-hour rainfall depth for City is adopted to be 13.1 inches. Additional rainfall depth-duration-frequency values and intensity-duration-frequency values for the 2-year, 5-year, 10-year, 25-year, 50-year, 100-year and 500-year storm frequencies are included in the Drainage and Erosion Control Design Manual. The City requires all flood study submittals to be performed using rainfall data published in the DCM. In case of mapped floodplains where FEMA submittals are needed, the study should use the rainfall data used in the current effective FEMA models, as required by FEMA for their submittals. In addition to this, the City requires a separate analysis using the rainfall data published in the Drainage and Erosion Control Design Manual, prepared for City's review and approval. Proposed conditions shall account for ultimate development of the watershed. All studies shall be in accordance with the Drainage and Erosion Control Design Manual.

(2) The one percent annual chance floodplain, also known as the 100-year floodplain is the area subject to one percent or greater chance of flooding in any given year, as described in FEMA guidelines. These zones are typically represented as Zone A, AE, AH or AO on FEMA Flood Insurance Rate Maps (FIRM Panels) and are classified as High-Risk flood zones. Most FEMA FIRMs also identify areas of Medium-Risk flood zones classified as Zone X, which are printed with a shade and hence are also known as Shaded-X. Based on FEMA guidelines, the Shaded-X area can be delineated either using the 0.2 percent annual chance storm or the one percent annual chance storm based on Ultimate Development Conditions, also known as Future Conditions. For all future studies, the City has adopted the one percent annual chance Ultimate Development floodplain mapped using rainfall data published in the Drainage and Erosion Control Design Manual, as the regulatory floodplain. Such floodplain is delineated based on flows developed by assuming the entire watershed is fully developed. The City's GIS portal provides information regarding future zoning projections, which can be used to determine fully developed conditions.

a) The City requires all new and re-studied FEMA floodplains to delineate the Shaded-X areas based on the one percent annual chance Ultimate Development conditions. The City's regulatory criteria will require all storm water management facilities or a combination of facilities, stream crossings, new-development or re-development in the floodplain to be designed for Ultimate Development Conditions.

b) The City requires demonstration of the elevation of fill placed in the one percent annual chance Ultimate Development floodplain for construction of habitable structures to be greater than the one percent annual chance Ultimate Development water surface elevation. This includes but is not restricted to back of lot elevations, finished floor elevations, drainage facilities etc.

c) The City requires all future drainage easements and crossings in the floodplains to be based on the one percent annual chance Ultimate Development conditions.

d) For drainage areas greater than 150 acres, the City requires a rainfall-runoff model (such as HEC-HMS or similar) to support engineering calculations used to develop the one percent annual chance flows. The City will issue a floodplain development permit upon receiving and reviewing a signed report from an engineer, licensed to practice in the State of Texas. The report shall consist of all supporting information, data and calculations and may be accompanied with exhibits to

support their one percent annual chance Ultimate Development flows and floodplain delineation. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-impact to the one percent annual chance Ultimate Development water surface elevation outside of the requestor's property limits.

e) For streams which have a drainage area greater than 150 acres and currently not mapped by FEMA, the City requires the requestor to submit a flood study report which is signed and sealed by a Professional Engineer registered in the State of Texas, which establishes a one percent annual chance Ultimate Development floodplain along, within or adjacent to the project site.

(3) The stream setback limits, stream buffers, are different than the one percent annual chance floodplain. In some cases, the setback limits could be greater than the one percent annual chance Ultimate Development floodplain. Details for the City's requirements for setbacks/buffers are illustrated in the Drainage and Erosion Control Design Manual.

(4) The City's goal is conservation of floodplain areas, avoid potential impacts on structures adjacent to the currently mapped floodplains and ensure no net-loss of floodplain volume to preserve the area of conveyance. As such, the City will require Compensatory-Cut, also known as Compensatory-Excavation to offset/mitigate fill placed in the one percent annual chance Ultimate Development floodplain. The City permits floodplain reclamation if accompanied with a signed and sealed study which demonstrates no adverse impacts to any property outside of the requester and demonstrates a no-rise in the one percent annual chance Ultimate Development water surface elevation outside of the requestor's property limits. The City permits excavation in the floodplain to mitigate the increases to one percent annual chance Ultimate Development water surface elevations, in addition to excavation compensation along the same flooding source. All submittals will need a signed drawing by a licensed Professional Engineer (from the State of Texas) clearly marking the areas of Cut and Fill in the floodplain and should also include a table showing both volumes. The City will require the plan to show cut volume be equal to or greater than the volume of fill. Additionally, the compensatory excavation is only allowable within the same flooding source or stream on which floodplain reclamation is being requested within the general vicinity of the fill.

a) If excavation is performed in the floodplain, the City requires a signed and sealed report/memo from a Professional Engineer registered to practice in the State of Texas to demonstrate excavation is performed outside of the Waters of the United States (WOUS) also known as Jurisdictional Waters, including an exhibit clearly showing the Jurisdictional Delineation. If WOUS are impacted by the project, the City will require coordination and approval from the US Army Corps of Engineers.

(5) If subsection 58-30.5(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

(6) "No adverse impact" certification is required for all new construction in or adjacent to a stream designated with a regulatory floodplain.

58-30.6. *Floodways.* Located within areas of special flood hazard established in subsection 58-28.2, are areas designated as floodways. Since the floodway is an extremely hazardous area due to the velocity of flood waters which carry debris, potential projectiles and erosion potential, the following provisions shall apply:

(1) Encroachments are prohibited, including fill, new construction, substantial improvements and other development within the adopted regulatory floodway unless it has been demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practice that the proposed encroachment would not result in any increase in flood levels within the community during the occurrence of the 25-year and ~~base~~ regulatory flood discharge a "no-rise/no-impact" certification.

(2) If subsection 58-30.~~65~~(1) is satisfied, all new construction and substantial improvements shall comply with all applicable flood hazard reduction provisions of section 58-30.

(3) Under the provisions of 44 CFR Chapter 1, Section 65.12, of the National Flood Insurance Program Regulation, a community may permit encroachments within the adopted regulatory floodway that would result in an increase in base flood elevations, provided that the community first completes all of the provisions required by Section 65.12.

58-30.~~67~~. *"No-rise/no-impact" certification.* The engineering "no-rise/no-impact" certification and supporting technical data must stipulate no impact or no changes to the 25-year water surface elevations, ~~and~~ base flood elevations, regulatory floodway elevations, and/or regulatory floodway widths at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, the revised computer model should be run for a sufficient distance, typically 1,000 feet, upstream and downstream of the development site or at the discretion of the floodplain administrator to insure proper "no-rise/no-impact" certifications.

The engineering "no adverse impact" certification and supporting technical data must stipulate no adverse impacts to any habitable structures within the regulatory floodplain at the new cross-sections and at all existing cross-sections anywhere in the model. Therefore, at the floodplain administrator's discretion, the revised computer model should be sufficiently extended upstream and downstream of the development site such that the Engineer can insure proper "no adverse impact" certifications.

The "no-rise/no-impact" supporting data should include, but may not be limited to:

(1) Copy of the currently effective FIS hydraulic models (legible hard copy and ~~a disc~~ electronic (if available)).

(2) Duplicate effective FIS hydraulic models (hard copy and ~~a disc~~electronic).

(3) Existing conditions hydraulic models developed using Atlas 14 analysis (hard copy and ~~a disc~~electronic).

(4) Proposed conditions hydraulics models developed using Atlas 14 analysis (hard copy and ~~a disc~~ electronic).

~~(5)~~ Ultimate development conditions (or future conditions) hydrology model developed using Atlas 14 rainfall data for the one percent annual chance flood event and its supporting data (hard copy and electronic).

(6) Existing conditions hydraulic models (hard copy and electronic).

(7) Proposed conditions hydraulics models (hard copy and electronic).

(8) Ultimate development conditions hydraulics model (hard copy and electronic).

(9) Annotated effective FIRM or FBFM and topographic map, showing regulatory floodplain and floodway boundaries, the additional cross-sections, and the site location along with the proposed topographic modifications.

(~~6~~10) Documentation clearly stating analysis procedures. All modifications made to the duplicate effective hydraulic models to correctly represent existing conditions, as well as those made to the existing conditions models to represent proposed conditions should be well documented and submitted with all supporting data.

(11) Floodway analysis using Method 1 or Method 4 encroachment methodology as described in FEMA Guidelines and Specifications for Hydrologic and Hydraulic modeling.

(~~7~~12) Annotated effective floodway data table (from the FIS report).

(~~8~~13) Statement defining source of additional cross-sections, topographic data, and other supporting information.

(~~9~~14) Cross-section plots of the additional cross sections for existing, ~~and~~ proposed, and ultimate development conditions hydraulic models.

(15~~0~~) Certified planimetric (boundary survey) information indicating the location of structures on the property.

(16~~1~~) Hard copy of all output files.

(17~~2~~) Clear explanation of how roughness parameters were obtained (if different from those used in the effective hydraulic models).

(18~~3~~) Engineering certification.

(19~~4~~) No wall enclosures over the allowed 120 square feet or breakaway walls within the floodway.

The "no-impact" analysis along with supporting data and the original engineering certification must be reviewed by the floodplain administrator prior to issuing a development permit. The original effective FIS model, the duplicate effective FIS model, the existing conditions model, and the proposed conditions model should be reviewed for any changes in ~~a~~ the 25-year water surface elevations~~and~~, the base flood and regulatory elevations, regulatory floodway elevations, base and regulatory floodplain width, and regulatory floodway widths.

58-30.~~7~~8. *Severability.* If any section, clause, sentence, or phrase of this article is held to be invalid or unconstitutional by any court of competent jurisdiction, then said holding shall in no way affect the validity of the remaining portions of this article.

58-30.~~9~~8. *Penalties for non-compliance.* No structure or land shall hereafter be constructed, located, extended, converted, or altered without full compliance with the terms of this court order and other applicable regulations. Violation of the provisions of this court order by failure to comply with any of its requirements (including violations of conditions and safeguards established in connection with conditions) shall constitute a misdemeanor. Each and every day or portion thereof during which any violation or failure to comply is committed or continued shall be deemed a separate offense subject to a fine of not more than $2,000.00 for each day. And each offense upon conviction in a court of competent jurisdiction, and in addition shall pay all costs and expenses involved in the case. Nothing herein contained shall prevent the city from taking such other lawful action as is necessary to prevent or remedy any violation.

(Ord. No. 2011-53, § 1, 6-27-11)

Secs. 58-31—58-55. Reserved.

PRESENTER:
Jean Drew, AICP, CNU-A; Planning & Development Services Assistant Director
SUBJECT:
Public hearing and first reading of an ordinance regarding a proposed rezoning to apply a Special Use Permit to allow a duplex on a lot less than 8,000 square feet in area, in the R-2 Single and Two-family District addressed at 2662 Second Street.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 1

BACKGROUND INFORMATION:
Case No.: SUP21-234

Applicant: Chris Van Heerde
HMT Engineering & Surveying
290 S. Castell Avenue, Suite 100
New Braunfels, TX 78130
(830) 625-8555 chrisvh@hmtnb.com

Owner: Comal County Habitat for Humanity
Kristen Reynolds, Land Development Manager
1269 Industrial Drive
New Braunfels, TX 78130
kreynolds@comalhabitat.org

Staff Contact: Holly Mullins
(830) 221-4054 hmullins@nbtexas.org

The subject vacant property is a through-lot with frontage on both Katy and Second Streets. The Win-Con manufacturing facility is located across Katy Street. This area was platted as the Bergfeld Addition in 1927 with 50-foot wide residential lots, and consists primarily of single-family homes constructed in the 1930s and 40s. Current R-2 standards require a minimum lot width of 60 feet. Habitat for Humanity purchased this vacant lot in 2019.

Surrounding Zoning and Land Use:
North - Across Katy Street, M-1/ Light manufacturing, warehouse
South - Across Second Street, R-2/ Single-family residence
East - R-2/ Single-family residence
West - R-2/ Single-family residence

ISSUE:
Although a duplex in a variety of configurations (including two separate single-family dwelling units) is a permitted use in the R-2 district, current zoning ordinance standards require a minimum lot area of 8,000 square feet to allow a duplex. The subject property is 50 feet wide by 130 feet deep and 6,500 square feet in area. Because it was platted prior to 1967 when the lot area standards were adopted, the ordinance does allow construction of a new single-family home, but not a duplex.

The applicant is requesting this Special Use Permit (SUP) to allow construction of a duplex (two units) on the 6,500 square foot lot.

As part of the implementation of Envision New Braunfels (the Comprehensive Plan), staff is already analyzing minimum lot size requirements to determine whether code revisions to allow duplex development on smaller lots should be considered by City Council.

The request is consistent with the following actions from Envision New Braunfels:

- *Action 1.6:* Incentivize infill development and redevelopment to take advantage of existing infrastructure.
- *Action 1.11:* Update policies and codes to achieve development patterns that implement the goals of this plan.
- *Action 2.1:* Sustain community livability for all ages and economic backgrounds.
- *Action 3.13:* Cultivate an environment where a healthy mix of different housing products at a range of sizes, affordability, densities, amenities and price points can be provided across the community as well as within individual developments.
- *Action 3.16:* Review and revise regulations that inadvertently inhibit creative housing options or workforce housing alternatives.
- *Action 3.30:* Encourage and incentivize workforce/affordable housing to attract new workforce entrants and young families.
- *Action 3.31:* Adopt policies and ordinances supportive of workforce housing, creating opportunities that make investment in workforce housing more feasible for private and nonprofit developers.
- Future Land Use: The property is situated within the New Braunfels Sub-Area and in close proximity to an existing Civic Center.

FISCAL IMPACT:
N/A
RECOMMENDATION:
Committee Recommendation:
The Planning Commission held a public hearing on August 3, 2021 and recommended approval of the request (7-1-0 with Commissioner Tubb voting no and Commissioner Gibson absent).

Staff Recommendation:
Approval.

Mailed notification pursuant to state statute:
Public hearing notices were sent to 19 owners of property within 200 feet of the request. The City has received two responses in favor (4, 18) and two in opposition (2, 13). Opposition represents 7% of the notification area.

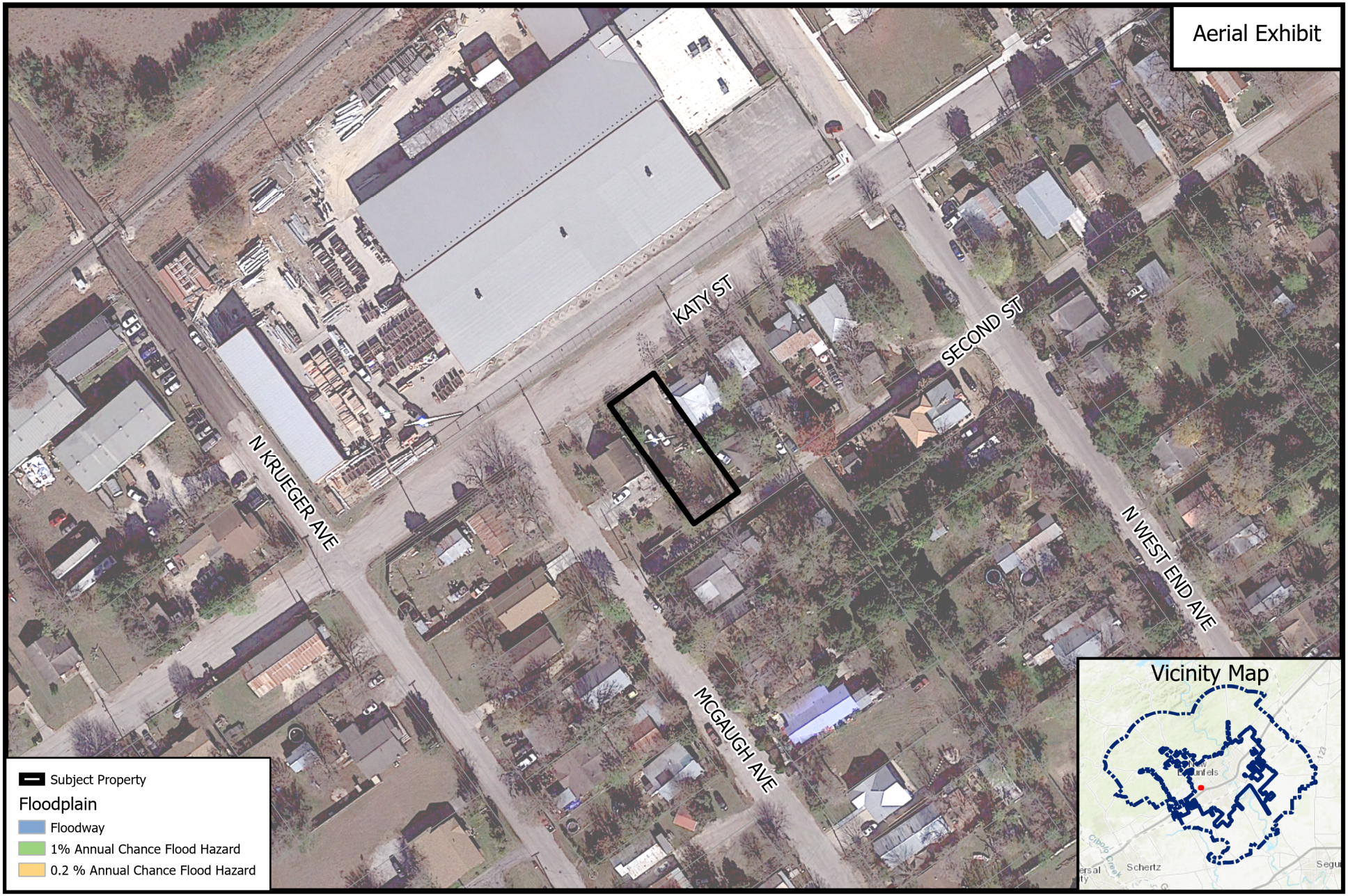
Resource Links:

• Chapter 144, Sec. 3.3-7 (R-2) of the City's Code of Ordinances:
https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.3ZODIREPRZOPRJU221987

• Chapter 144, Sec. 3.6 (SUP) of the City's Code of Ordinances:
https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.6SPUSPE

Attachments:

1. Aerial Map
2. Request Letter
3. Land Use Maps (Zoning, Existing, Future Land Use)
4. Notification Map
5. Photograph
6. Draft Planning Commission Minutes
7. Ordinance



City of New Braunfels

SUP21-234

SUP for duplex

0 70 140 Feet

N

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-234 - 2662 Second

Source: City of New Braunfels Planning
Date: 7/22/2021

HMT
ENGINEERING & SURVEYING
290 S. Castell Avenue, Ste 100
New Braunfels, TX 78130
TBPE-FIRM F-10961
TBPLS FIRM 10153600

July 1, 2021

Holly Mullins
City of New Braunfels
550 Landa St.
New Braunfels, TX 78130

RE: SUP Application for 2662 Second Street

We believe that this proposed duplex on 2662 Second Street is in harmony with both the neighborhood and the Envisions New Braunfels comprehensive plan.

This site is currently zoned as R-2 (two-family housing). The proposed duplex use matches that zoning and is compatible with the neighborhood. All adjacent uses are residential homes and the lot directly to the east of the subject tract contains two dwelling units similar to this proposal.

The proposed duplex use is compatible with the Envisions New Braunfels comprehensive plan as a substantial section of that plan contemplates the availably of workforce housing, including action item 3.31:

> "Adopt policies and ordinances supportive of workforce housing, creating opportunities that make investment in workforce housing more feasible for private and nonprofit developers."

This Type 1 SUP Application case is being brought by Habitat for Humanity a non-profit that is committed to has a mission of bringing "people together to build homes, communities and hope."

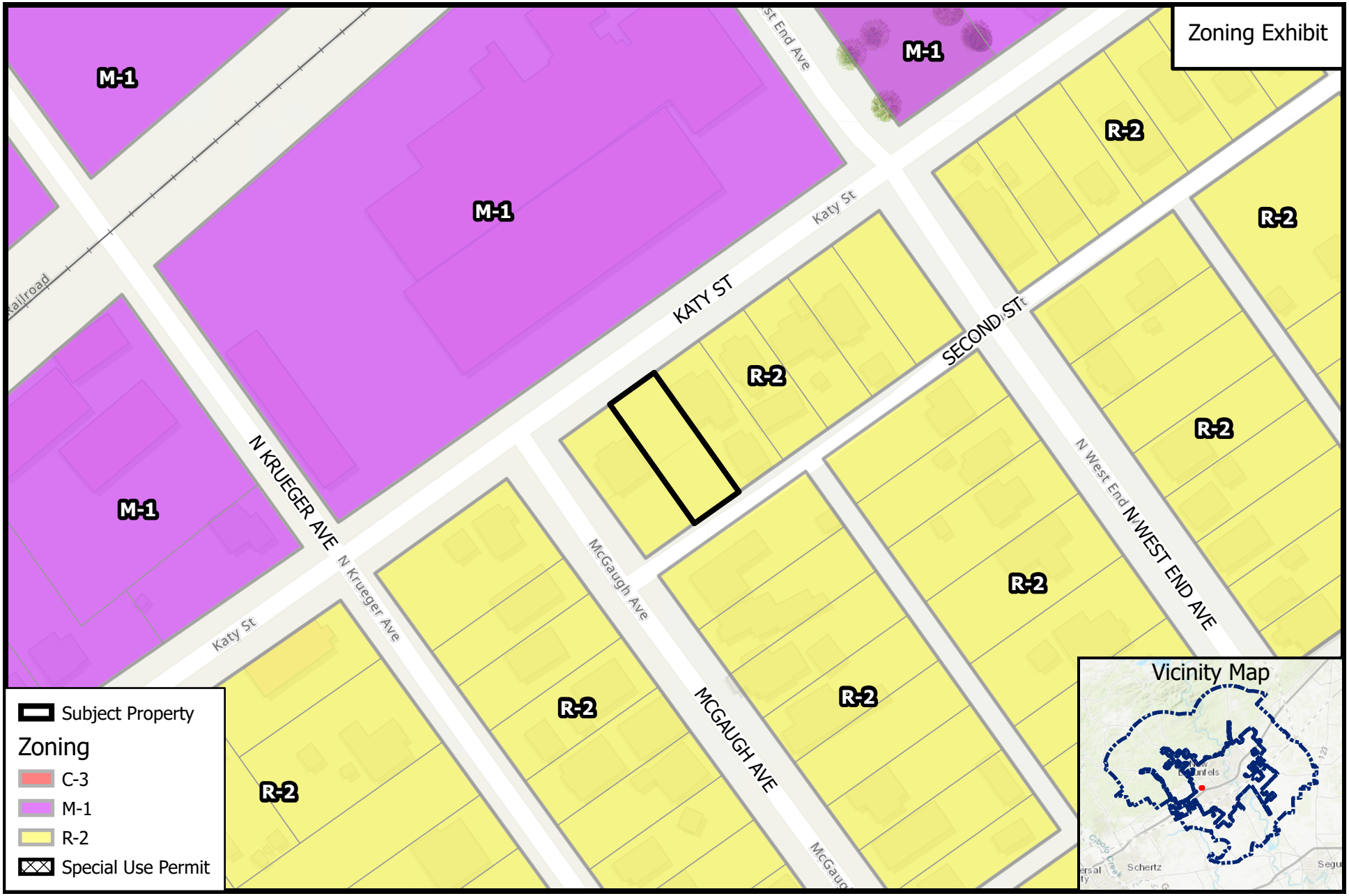
The reason for the submittal of this Type 1 SUP is due to the size of the existing lot. The current lot measures 50' wide by 130' deep with the area of the lot totaling 6,490 SF. The requirements from city code for a duplex lot are 60' width (Chapter 144, 3.3-2 (b)(2)(vi) and 8,000 SF area (Chapter 144, 3.3-2 (b)(2)(vii). We are therefore respectfully requesting this Type 1 SUP for relief from the above stated width and lot area requirements.

Please let us know if you have any questions or need any additional information.

Sincerely,

Chris Van Heerde, P.E.

Chris Van Heerde, P.E.
Managing Partner
HMT Engineering and Surveying



SUP21-234
SUP for duplex

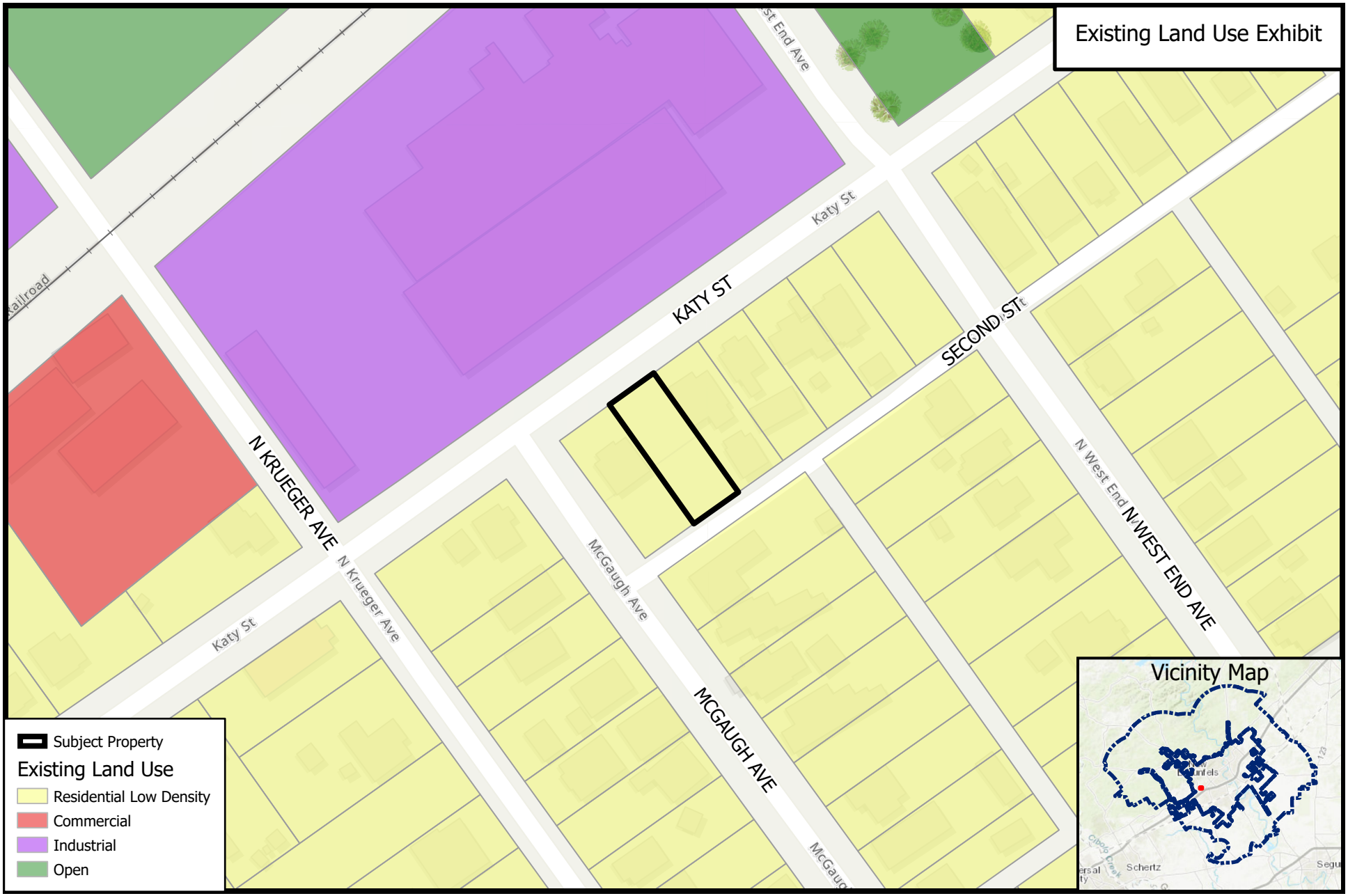
0 70 140 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-234 - 2662 Second

Source: City of New Braunfels Planning
Date: 7/23/2021

DISCLAIMER: This map and information contained in it were developed ex
for use by the City of New Braunfels. Any use or reliance on this map by
else is at that party's risk and without liability to the City of New Braun
officials or employees for any discrepancies, errors, or variances which may exist.



City of New Braunfels

SUP21-234
SUP for duplex

0 70 140 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-234 - 2662 Second

Source: City of New Braunfels Planning
Date: 7/23/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

EXISTING CENTERS

Centers are the middle, core or heart of an area. It is a point of activity and vitality. Centers come in many sizes and have different purposes or activities within. They may have endangered species habitat or aquifer recharge areas that require additional standards and consideration relating to future growth. It is envisioned that all centers be walkable, connected, and have a mix of uses. These centers must provide adequate infrastructure to support the commercial development present especially mobility and access for pedestrians, bicycles, vehicles and transit. Given the mixed-use nature of these centers, parking should be shared and not detract from the aesthetic of the area.

EMPLOYMENT CENTER

Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER

Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

MEDICAL CENTER

Medical Centers are mixed-use areas centered around a medical destination such as a hospital or clinic.

CIVIC CENTER

Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

OUTDOOR RECREATION CENTER

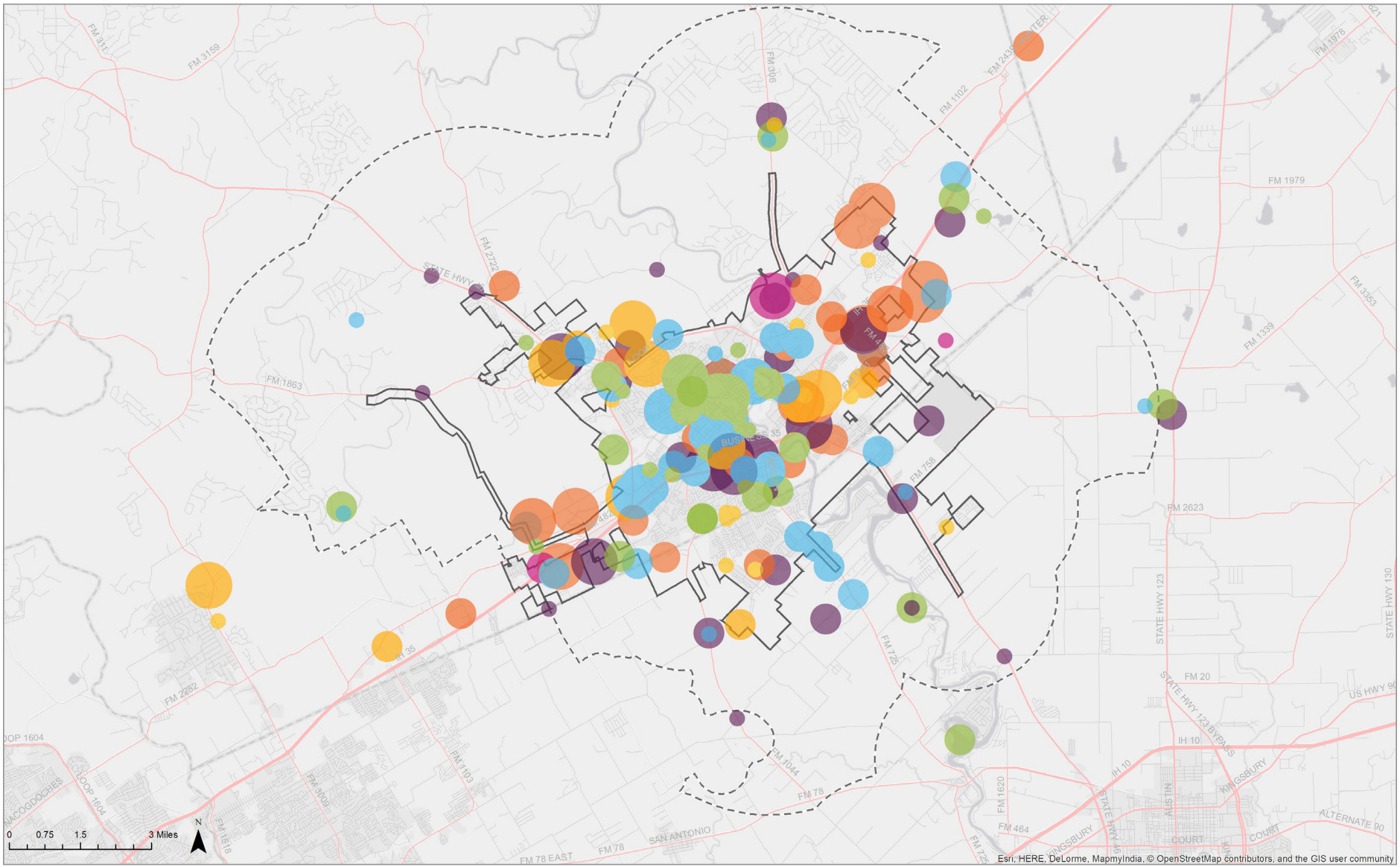
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

EDUCATION CENTER

Education Centers are mixed-use areas centered around an educational destination such as a K-12 school or university/college.

TOURIST/ENTERTAINMENT CENTER

Tourist/Entertainment Centers are mixed-use areas around an entertainment venue such as Gruene Hall or a tourist destination such as the Tube Chute.



The location of existing centers was determined through the analysis of previous studies and background documents, windshield surveys, and reviewed by City staff, Steering Committee members, and Plan Element Advisory Group members during a public workshop.

FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

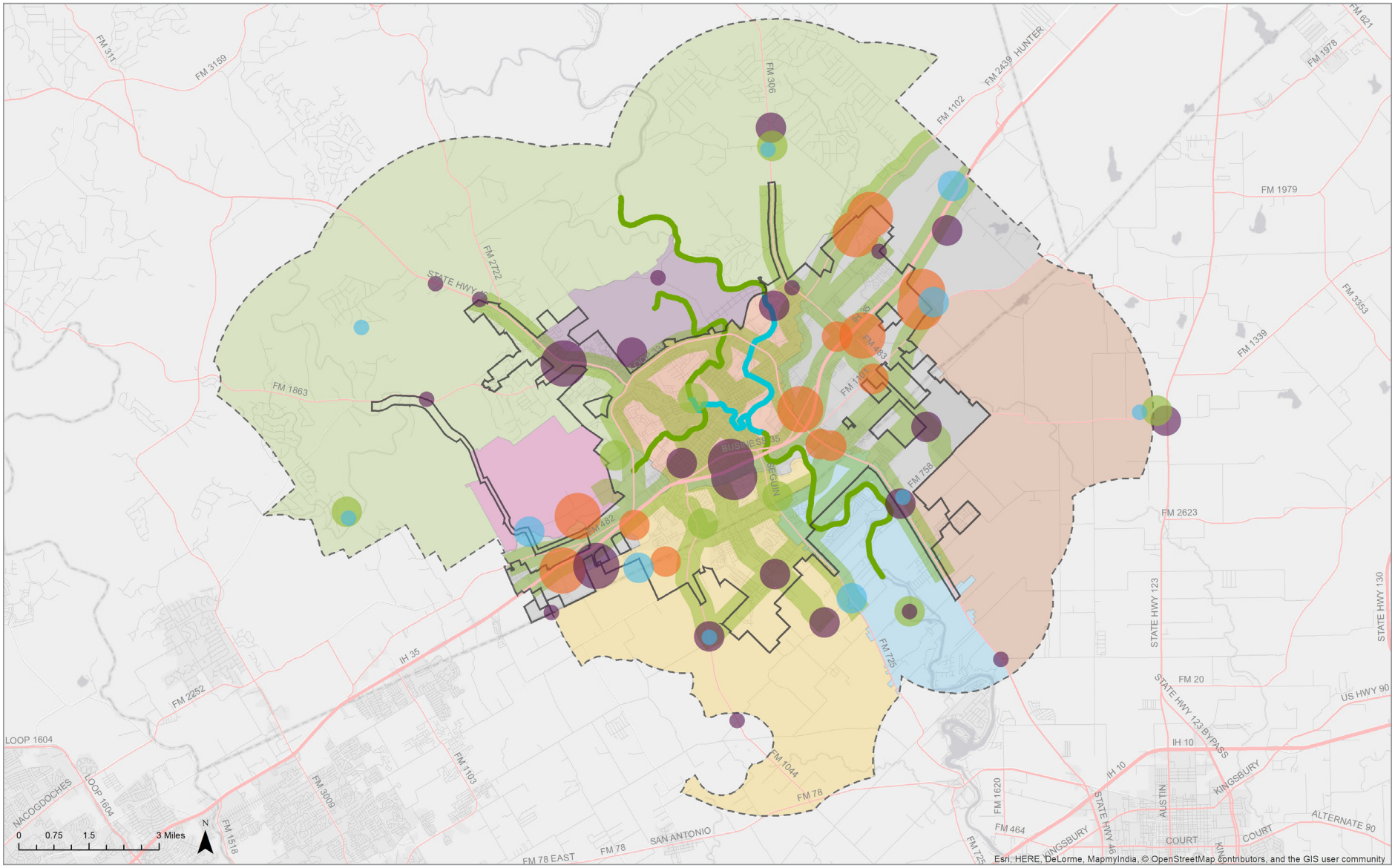
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

SUB AREA 6
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.

PLANNING COMMISSION – AUGUST 3, 2021 – 6:00PM

Zoom & City Hall Council Chambers

Applicant/Owner: HMT Engineering & Surveying on behalf of Comal County Habitat for Humanity

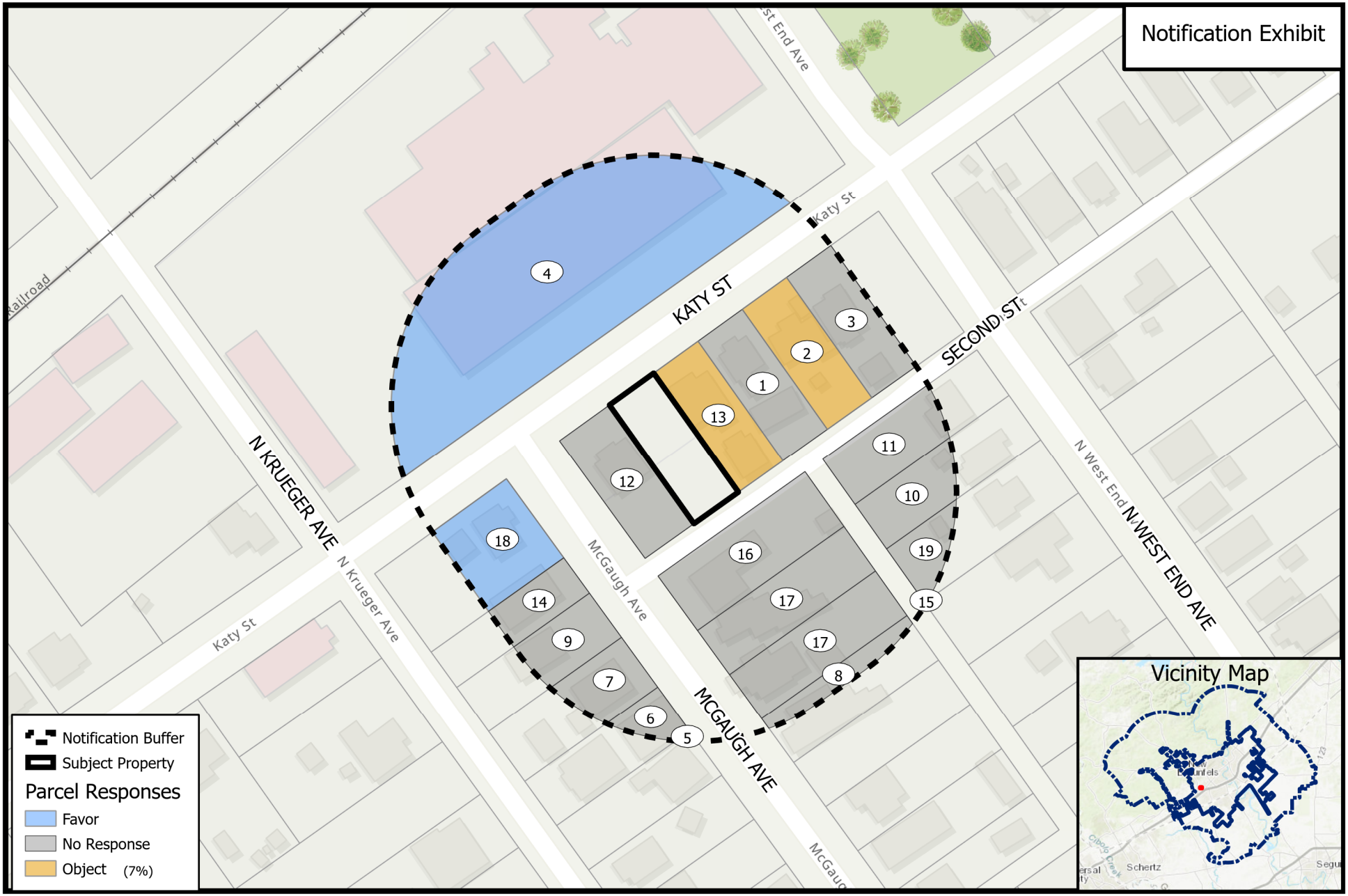
Address/Location: 2662 Second Street

PROPOSED ZONE CHANGE – CASE #SUP21-234

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. CASTILLO ISABEL
2. MONTANEZ ANTONIO & MARIA
3. HERNANDEZ CELVIN R
4. WIN CON ENTERPRISES INC
5. SALINAS MARIA
6. EURESTE MARIE G
7. HERRERA ALBERTO O & NORMA O
8. DIAZ CRISTINA M
9. PINA MANUEL
10. REYES IRENE
11. BALLESTEROS ANTONIO JR & MARIA
12. MANDUJANO ALBERTO & AURORA
13. ALEMAN LYDIA R
14. MANDUJANO ROSA
15. RIVERA ANASTACIO G & OFELIA PEREZ DE RIVERA
16. BAYONA FRANCISCO J & ALICIA
17. COMAL COUNTY HABITAT FOR HUMANITY
18. SCRJLP HOLDINGS LTD
19. CARREON ROBERTO & MARIA

SEE MAP



City of New Braunfels

SUP21-234

SUP for duplex

0 70 140 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-234 - 2662 Second

Source: City of New Braunfels Planning
Date: 8/2/2021

DISCLAIMER: This map and information contained in it were developed ex
for use by the City of New Braunfels. Any use or reliance on this map by
else is at that party's risk and without liability to the City of New Braun
officials or employees for any discrepancies, errors, or variances which may exist.

YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-234 hm

Name: Win-Con Enterprises, Inc.
Address: 483 N. West End, NB 78130
Property number on map: 4

I favor: ✓
I object: _____(State reason for objection)
Comments: (Use additional sheets if necessary)

Signature:

RECEIVED
JUL 26 2021
BY:

YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-234 hm

Name: SCRJLP Holdings. Ltd
Address: 383 McGzugh Ave, NB 78130
Property number on map: 18

I favor: ✓
I object: _____(State reason for objection)
Comments: (Use additional sheets if necessary)

Signature:

RECEIVED
JUL 26 2021
BY:

YOUR OPINION MATTERS - DETACH AND RETURN

Case: #SUP21-234 hm

Name: Antonio & Maria Martinez
Address: 2637 W. Katy St.
Property number on map: 3

I favor: _____
I object: ✓ (State reason for objection)
Comments: (Use additional sheets if necessary)

1. Katy St. is not a Street anymore, it's a Freeway.
2. This Alley is not same as 2nd Second Street. Never been maintained
3. Need Hwy Stop Stop sign at Katy & Western Street.

Signature: Antonio Martinez

RECEIVED
AUG 02 2021
BY:

Date: Wed, Jul 28, 2021

To the City Board Of New Braunfels:

I, Lydia Aleman, contest the rezoning of the lot next door to my residence located on 2665 Katy Street. The reason for the contestment is due to the fact that while I was owner of said lot, I was not able to build on the lot. The reason behind this is because The City of New Braunfels was admit that the lot in question was not big enough to build any kind of structure because of lack of square footage. After being told this I sold the lot to a Mr. Christino, who was also told the same information by The City of New Braunfels.

Habitat Of Humanity then hired a surveyor. When that survey was finished, the property line was drawn down the middle of my existing properties' driveway. This has been my driveway for over 44 years and was never part of the lot when sold in the past but was awarded to her. Although this lot has a lack of square footage, there are plans on building two residences. Now that a privacy fence has been put up, I have lost half of my driveway.

Despite the property lot next door remains 100 square feet short, Habitat of Humanity is being taken into consideration as a property to build on. I feel like my property, privacy, and rights as a long time property owner and New Braunfels local have been overlooked and disregarded.

I contest to the rezoning of the lot next door to my residence of 2665 Katy Street. Two residences should not be allowed to be built after two prior owners were told they couldn't and didn't build following the qualifications. Habitat of Humanity should not be the exception, and they too should abide to the rules and regulation set by The City of New Braunfels.

Thank You,

Lydia Aleman #13

2665 Katy St.

Subject Property – 2662 Second Street

C) SUP21-234 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow a duplex on a lot less than 8,000 square feet in area, in the R-2 Single and Two-Family District addressed at 2662 Second Street. *Applicant: HMT Engineering; Owner: Comal County Habitat for Humanity; Case Manager: Holly Mullins.*

Mrs. Mullins presented and recommended approval with conditions as stated in staff report.

Chair Edwards asked if there were questions for staff.

Discussion followed on nearby structures and surrounding properties.

Chair Edwards asked if the applicant would like to speak.

Crystal Moore elaborated on the request.

Discussion followed on the total number of floors, ownership structure, parking, price, Second St, and appearance of the project.

Chris Van Heerde provided further clarification.

Chair Edwards asked if anyone would like to speak.

Lydia Aleman, adjacent neighbor, spoke on Second St running behind the subject property, size of the lot, and survey.

Discussion followed on Second St. and access to the alleyway.

William Rodgers brought up a concern not posted on the agenda.

Chris Van Heerde addressed concerns over the driveway which was existing on the property.

Discussion followed on access to the property and the adjacent property.

Chair Edwards closed the public hearing.

Chair Edwards asked if there were further discussion or a motion.

Motion by Vice Chair Laskowski, seconded by Commissioner Mathis, to recommend approval to City Council of the proposed rezoning to apply a Special Use Permit to allow a duplex on a lot less than 8,000 square feet in area, in the R-2 Single and Two-Family District addressed at 2662 Second Street. Motion carried (7-1-0) with Commissioner Tubb in opposition.

ORDINANCE NO. 2021-

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS GRANTING A SPECIAL USE PERMIT TO ALLOW A DUPLEX ON A LOT LESS THAN 8,000 SQUARE FEET IN AREA IN THE R-2 SINGLE AND TWO-FAMILY DISTRICT, ON LOT 17 BLOCK 2, BERGFELD ADDITION, ADDRESSED AT 2662 SECOND STREET; REPEALING ALL ORDINANCES IN CONFLICT; CONTAINING A SAVINGS CLAUSE; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City Council of the City of New Braunfels has complied with all requirements of notice of public hearing as required by the Zoning Ordinance of the City of New Braunfels; and

WHEREAS, in keeping with the spirit and objectives of a Special Use Permit, the City Council has given due consideration to all components of said permit; and

WHEREAS, the City recognizes that granting such a permit is possible while promoting the health, safety, and general welfare of the public, by providing harmony between existing zoning districts and land uses; and

WHEREAS, it is the intent of the City to ensure for the health, safety and general welfare of the public by providing compatible and orderly development, which may be suitable only in certain locations in a zoning district through the implementation of a Special Use Permit meeting those requirements cited in Sections 3.6-2 and 3.6-3, Chapter 144 of the New Braunfels Code of Ordinances; and

WHEREAS, the property is located in an area suitable for a duplex; and

WHEREAS, the requested rezoning is in accordance with Envision New Braunfels, the City's Comprehensive Plan; and

WHEREAS, the City Council desires to grant a Special Use Permit on Lot 17 Block 2, Bergfeld Addition, addressed at 2662 Second Street, to allow a duplex on a lot less than 8,000 square feet in area in the R-2 Single and Two-family District; **now, therefore;**

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

SECTION 1

THAT pursuant to Section 1.2-3, Chapter 144 of the New Braunfels Code of Ordinances, the Zoning Map of the City of New Braunfels is revised by adding the following tract of land as a "Special Use Permit" for the uses and conditions herein described:

Being Lot 17 Block 2, Bergfeld Addition, addressed at 2662 Second Street, as

depicted in Exhibit “A” attached, to allow a duplex on a lot less than 8,000 square feet in area in the R-2 district.

SECTION 2

THAT all other ordinances, or parts of ordinances, in conflict herewith are hereby repealed to the extent that they are in conflict.

SECTION 3

THAT if any provisions of this ordinance shall be held void or unconstitutional, it is hereby provided that all other parts of the same which are not held void or unconstitutional shall remain in full force and effect.

SECTION 4

THIS ordinance will take effect upon the second and final reading in accordance with the provisions of the Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this 23rd day of August, 2021.

PASSED AND APPROVED: Second reading this 13th day of September, 2021.

CITY OF NEW BRAUNFELS

_____
RUSTY BROCKMAN, Mayor

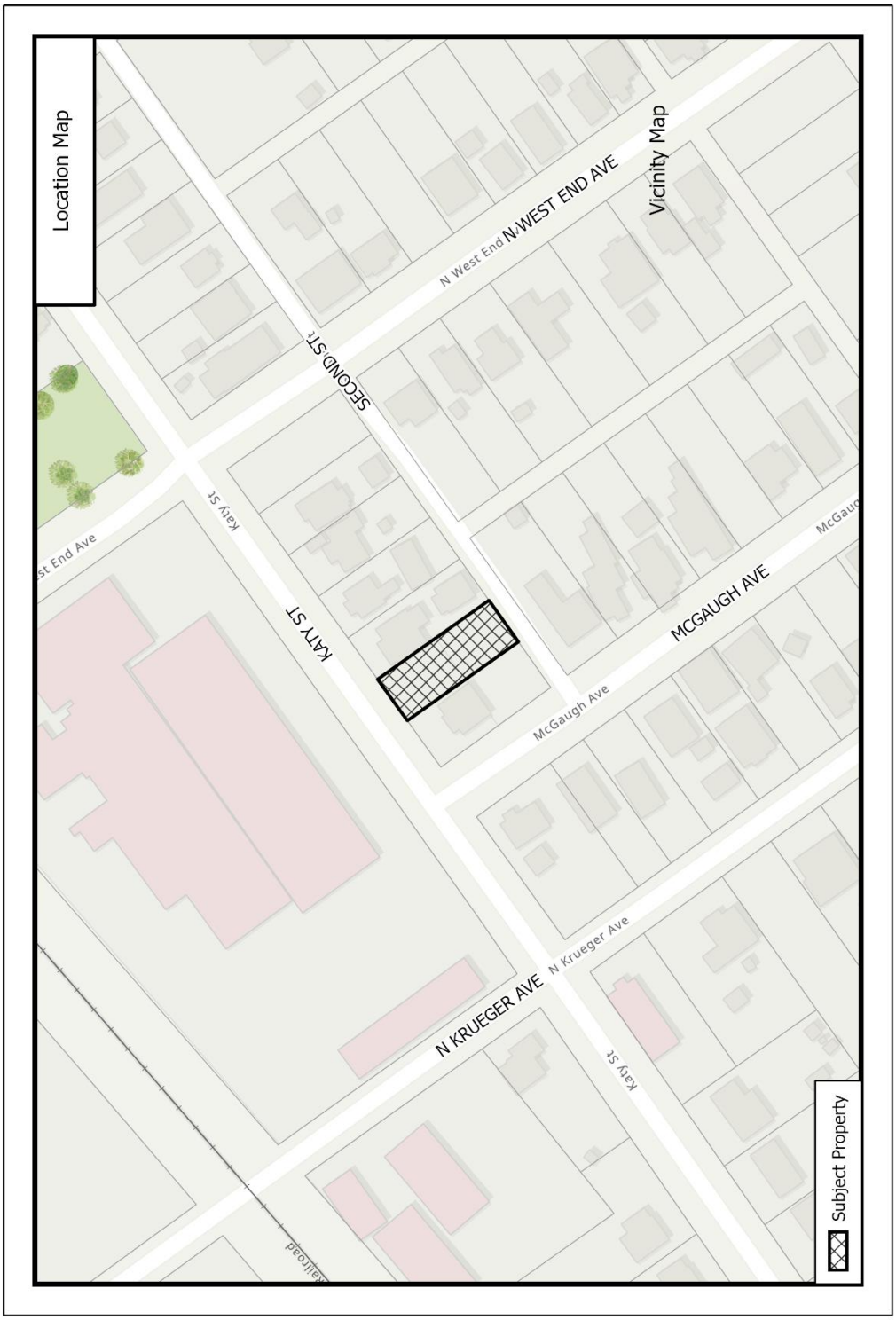
ATTEST:

_____
CAITLIN KROBOT, City Secretary

APPROVED AS TO FORM:

_____
VALERIA M. ACEVEDO, City Attorney

EXHIBIT "A"


Location Map
Vicinity Map
N West End Ave
N WEST END AVE
SECOND ST
KATY ST
Katy St
MCGAUGH AVE
McGaugh Ave
N KRUEGER AVE
N Krueger Ave
Subject Property
SUP21-234
SUP for duplex
Source: City of New Braunfels Planning
Date: 8/2/2021
0 70 140 Feet
N
DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.
City of New Braunfels
Path: \\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-234 - 2662 Second

Agenda Item No. E)

PRESENTER:
Jean Drew, AICP, CNU-A, Planning & Development Services Assistant Director

SUBJECT:
Public hearing and first reading of an ordinance regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family house and garage apartment in the C-1 Local Business District addressed at 556 N. Union Avenue.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 5

BACKGROUND INFORMATION:
Case No.: SUP21-230

Applicant/Owner: Cindy Espinosa
1101 Green Acres Drive
Wimberley, TX 78676
(713) 201-4155 cindy@esposervices.com

Staff Contact: Holly Mullins
(830) 221-4054 hmullins@nbtexas.org

The subject property is located on North Union Avenue, near Christus Santa Rosa Hospital, and is zoned "C-1" Local Business District. The property contains a two-bedroom residential structure originally built in the 1920s, plus a detached two-story garage with a one-bedroom apartment on the second floor.

The applicant is requesting this SUP to allow short term rental (STR) of both the house and garage apartment. With one bathroom in each dwelling, the maximum occupancy of the house will be 5 guests and the maximum occupancy of the apartment will be 4 guests (2 per bedroom plus 2 additional guests). At least three off-street parking spaces are required. The driveway is large enough to accommodate three or more vehicles; however, it is currently gravel with a concrete apron. The applicant is willing to pave the required parking spaces with concrete or asphalt prior to operating the short term rental.

Surrounding Zoning and Land Use:
North - C-1/ Commercial (medical professional building)
South - C-1/ Commercial
East - C-1, R-2/ Single-family residence
West - Across Union Avenue, C-1/ Single-family residence; professional office

ISSUE:
When the driveway is paved, the proposed SUP meets all Zoning Ordinance requirements for a short-term rental, and is consistent with the following actions from Envision New Braunfels:

- *Action 1.3:* Encourage balanced and fiscally responsible land use patterns.
- *Action 1.14:* Ensure regulations do not unintentionally inhibit the provisions of a variety of flexible and innovative lodging options and attractions.
- Future Land Use: The property is situated within the New Braunfels Sub-Area, in close proximity to Medical and Outdoor Recreation Centers.

The proposed STR is centrally located inside Loop 337, within walking distance to Christus Santa Rosa Hospital and Schlitterbahn, and a short drive to many visitor attractions. The neighborhood is a transitional area that contains a mix of residential and commercial uses. There are 11 approved short term rental SUPs within one-half mile of the subject property; 5 of those are currently active STRs (see attachment).

Short term rental standards in the Zoning Ordinance help to ensure proper measures are in place to protect public health, safety and neighboring properties. If the SUP is approved, the registration of the short-term rental and online payment of hotel occupancy taxes are required.

FISCAL IMPACT:
If approved, the property will be subject to local and state hotel occupancy tax (HOT).
RECOMMENDATION:
Committee Recommendation:
The Planning Commission held a public hearing on August 3, 2021 and recommended approval of the request with staff recommendations. (8-0-0 with Commission Gibson absent)

Staff Recommendation:
Staff recommends approval with the following conditions:

1. Paved off-street parking for at least three vehicles to be provided in accordance with City standards.
2. The residential character of the property must be maintained.
3. The property will remain in compliance with the approved site plan. Any significant changes to the site plan will require a revision to the SUP.
4. Occupancy is limited to a maximum of 5 guests in the main house and 4 guests in the garage apartment.
5. The applicant will register the short-term rental and create an account for online payment of hotel occupancy taxes.
6. All other standards of the Zoning Ordinance will also be met.

Mailed notification pursuant to state statute:
Public hearing notices were sent to 14 owners of property within 200 feet of the request. To date, the City has received no responses in favor and one in opposition (#7).

Resource Links:
• Chapter 144, Sec. 3.3-7 (C-1) of the City's Code of Ordinances:
https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.3ZODIREPRZOPRJU221987
• Chapter 144, Sec. 3.6 (SUP) of the City's Code of Ordinances:
https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.6SPUSPE
• Chapter 144, Sec. 5.17 (Short-term Rental) of the City's Code of Ordinances:

https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTVDEST_S144-5.17SHTEREOC

Attachments:

1. Aerial Map
2. Site Plan and Floor Plan
3. Land Use Maps (Zoning, Existing, Future Land Use)
4. Short Term Rental Vicinity Map
5. Notification Map
6. Photograph
7. Draft Minutes from Planning Commission
8. Ordinance

City of New Braunfels

SUP21-230

SUP for STR

0 75 150 Feet

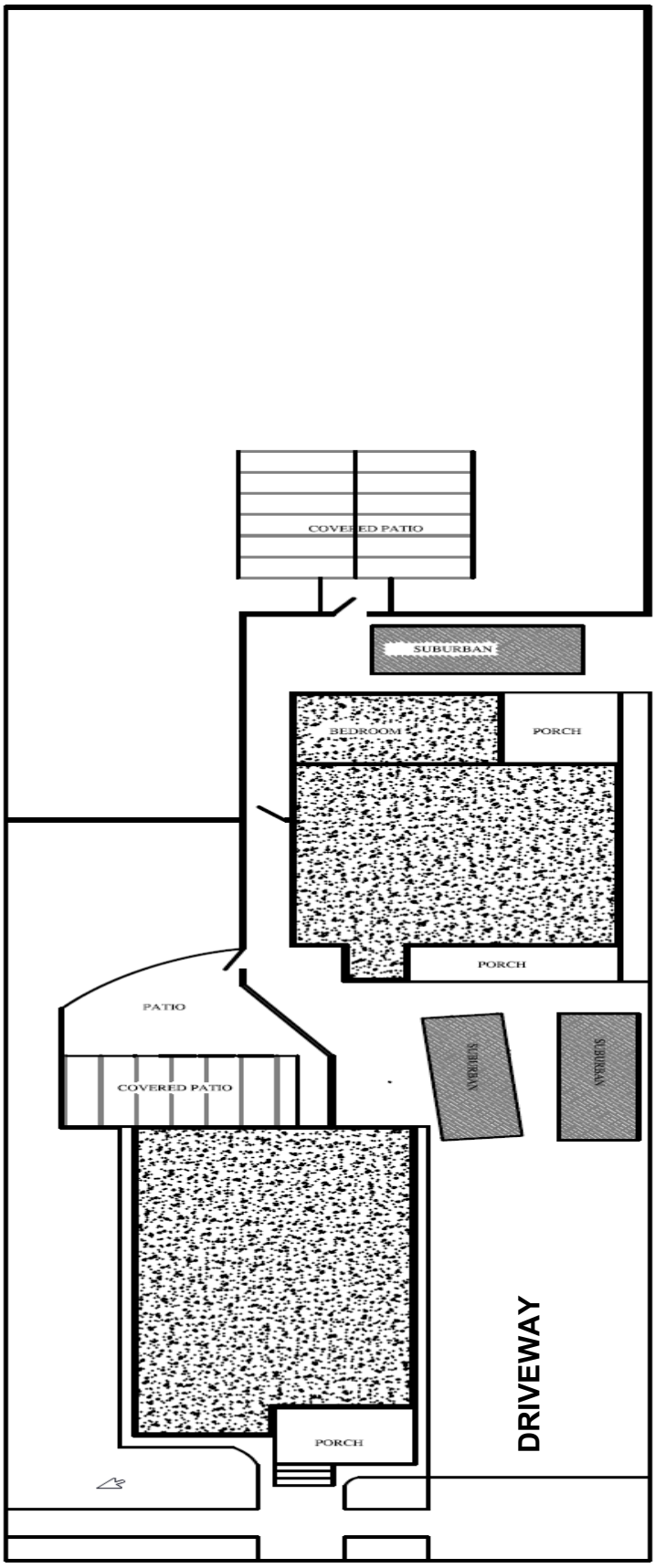
N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-230 - 556 N Union St

Source: City of New Braunfels Planning
Date: 7/16/2021

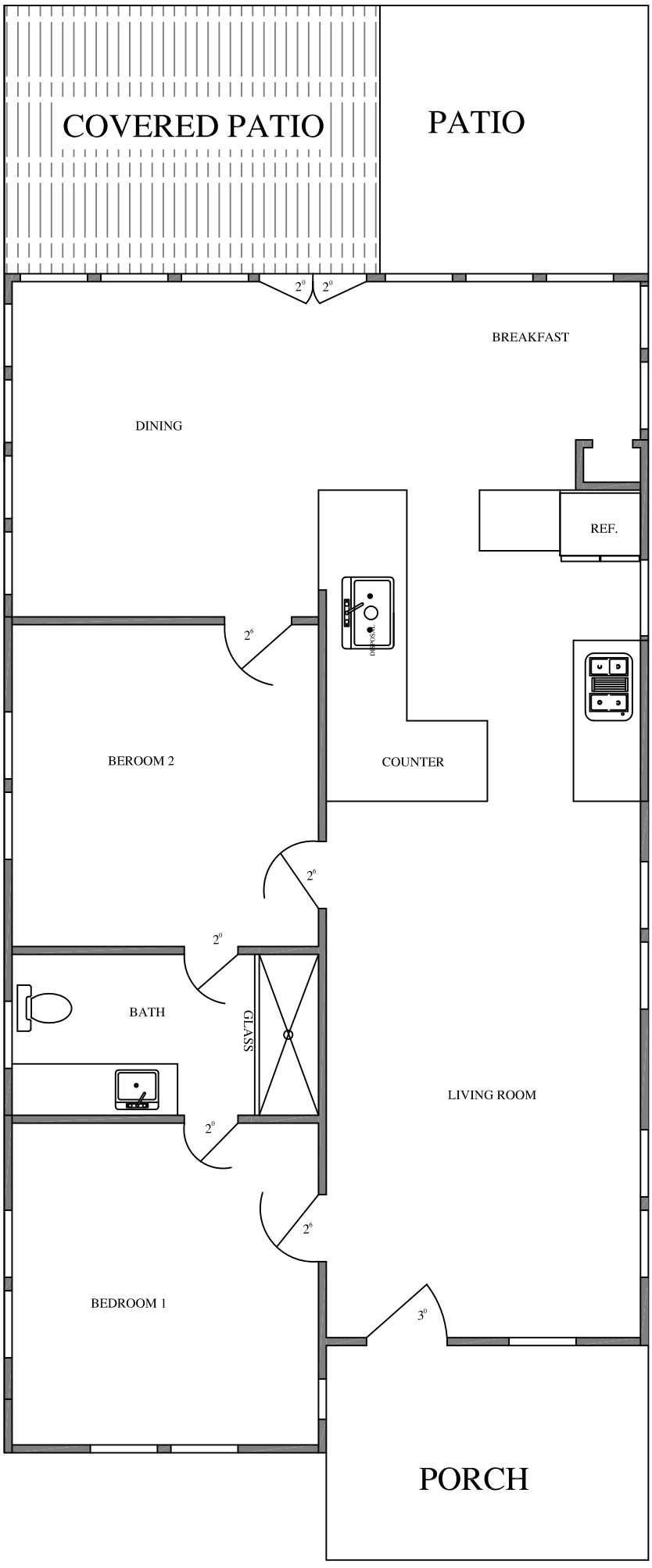
DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

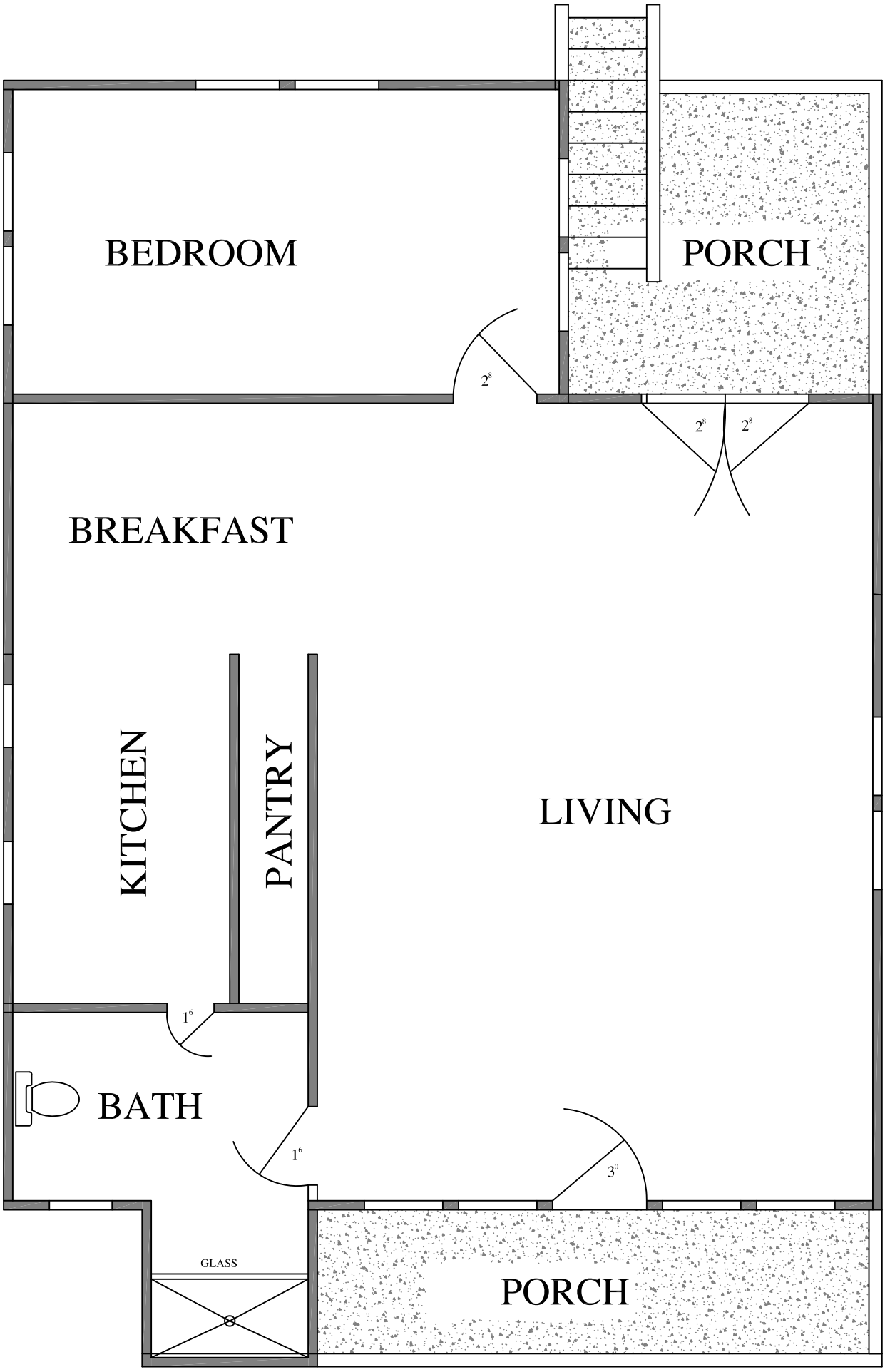
Site Plan



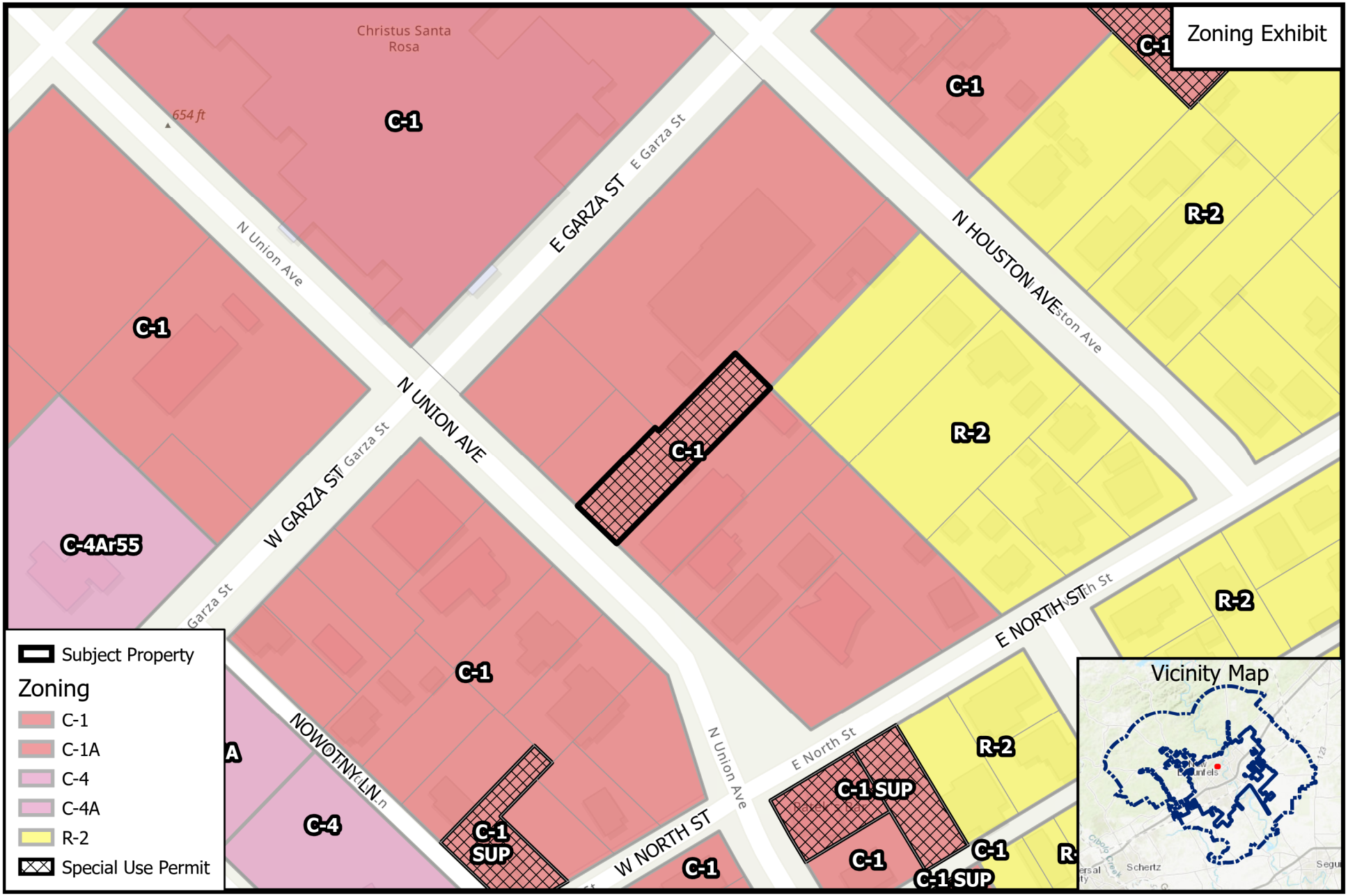
N. Union Avenue

House Floor Plan





Apartment Floor Plan



SUP21-230
SUP for STR

0 75 150 Feet

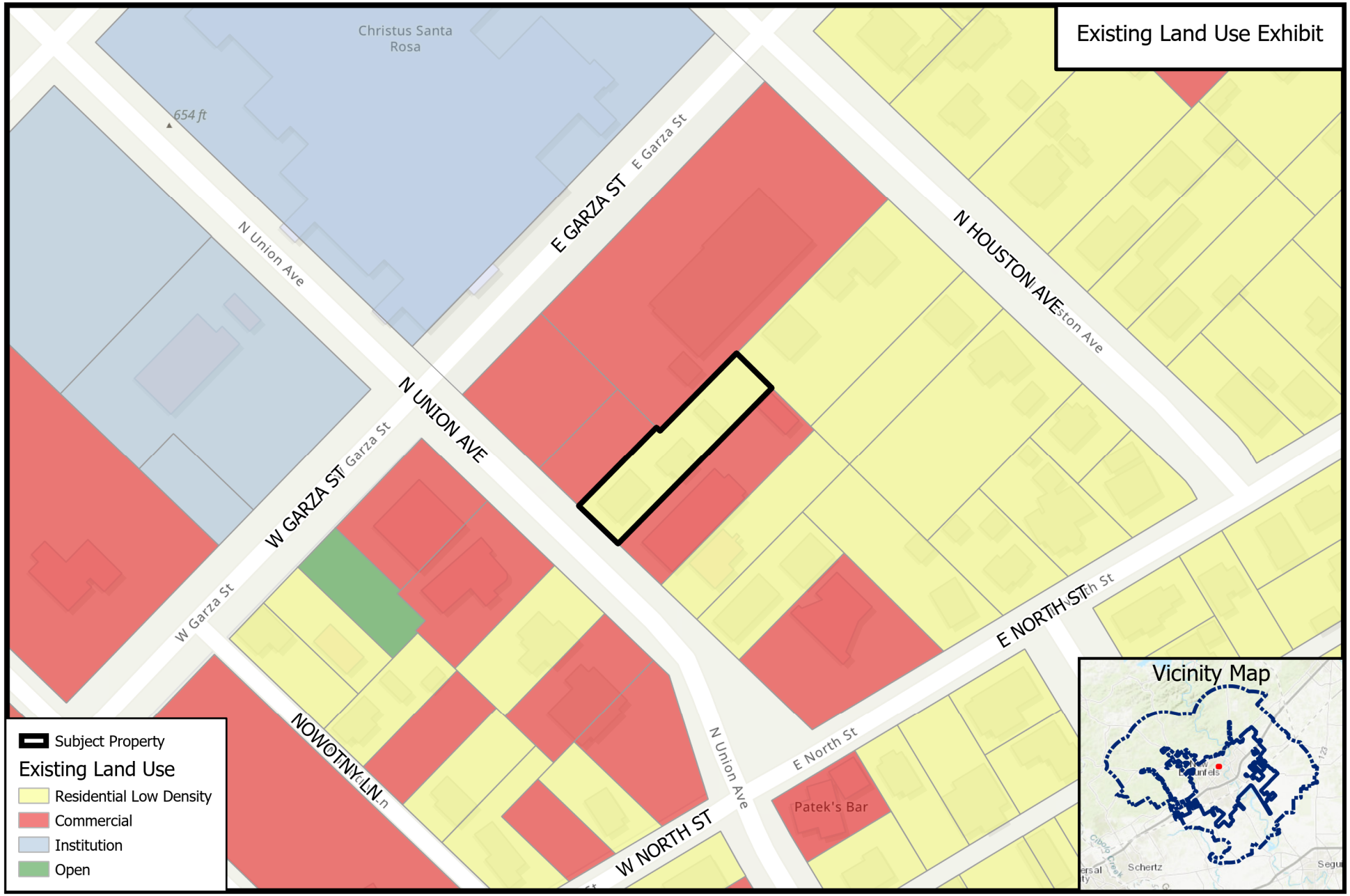
N

City of New Braunfels

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-230 - 556 N Union St

Source: City of New Braunfels Planning
Date: 7/16/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.



SUP21-230
SUP for STR

0 75 150 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-230 - 556 N Union St

Source: City of New Braunfels Planning
Date: 7/16/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

EXISTING CENTERS

Centers are the middle, core or heart of an area. It is a point of activity and vitality. Centers come in many sizes and have different purposes or activities within. They may have endangered species habitat or aquifer recharge areas that require additional standards and consideration relating to future growth. It is envisioned that all centers be walkable, connected, and have a mix of uses. These centers must provide adequate infrastructure to support the commercial development present especially mobility and access for pedestrians, bicycles, vehicles and transit. Given the mixed-use nature of these centers, parking should be shared and not detract from the aesthetic of the area.

EMPLOYMENT CENTER

Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER

Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

MEDICAL CENTER

Medical Centers are mixed-use areas centered around a medical destination such as a hospital or clinic.

CIVIC CENTER

Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

OUTDOOR RECREATION CENTER

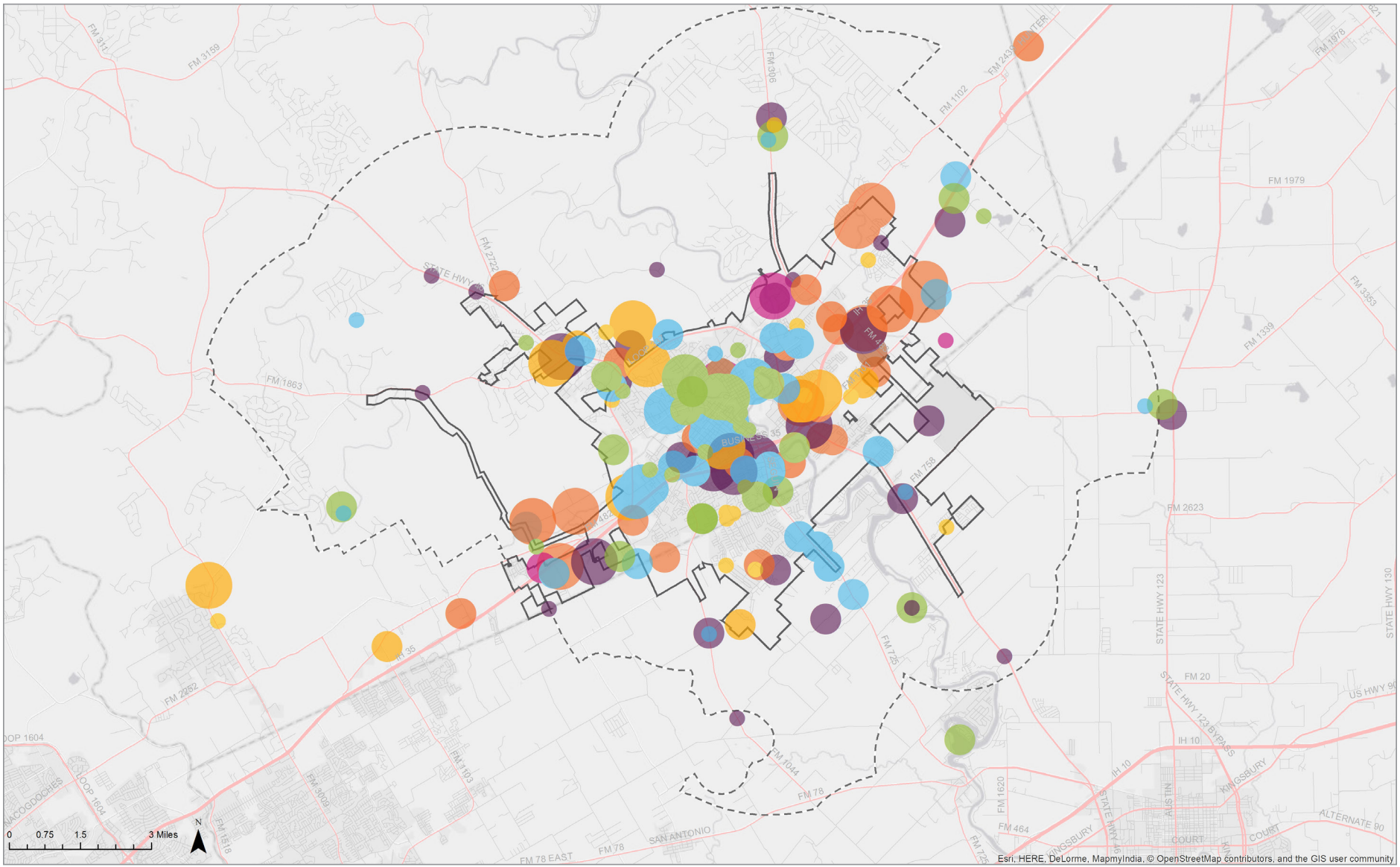
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

EDUCATION CENTER

Education Centers are mixed-use areas centered around an educational destination such as a K-12 school or university/college.

TOURIST/ENTERTAINMENT CENTER

Tourist/Entertainment Centers are mixed-use areas around an entertainment venue such as Gruene Hall or a tourist destination such as the Tube Chute.



The location of existing centers was determined through the analysis of previous studies and background documents, windshield surveys, and reviewed by City staff, Steering Committee members, and Plan Element Advisory Group members during a public workshop.

FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

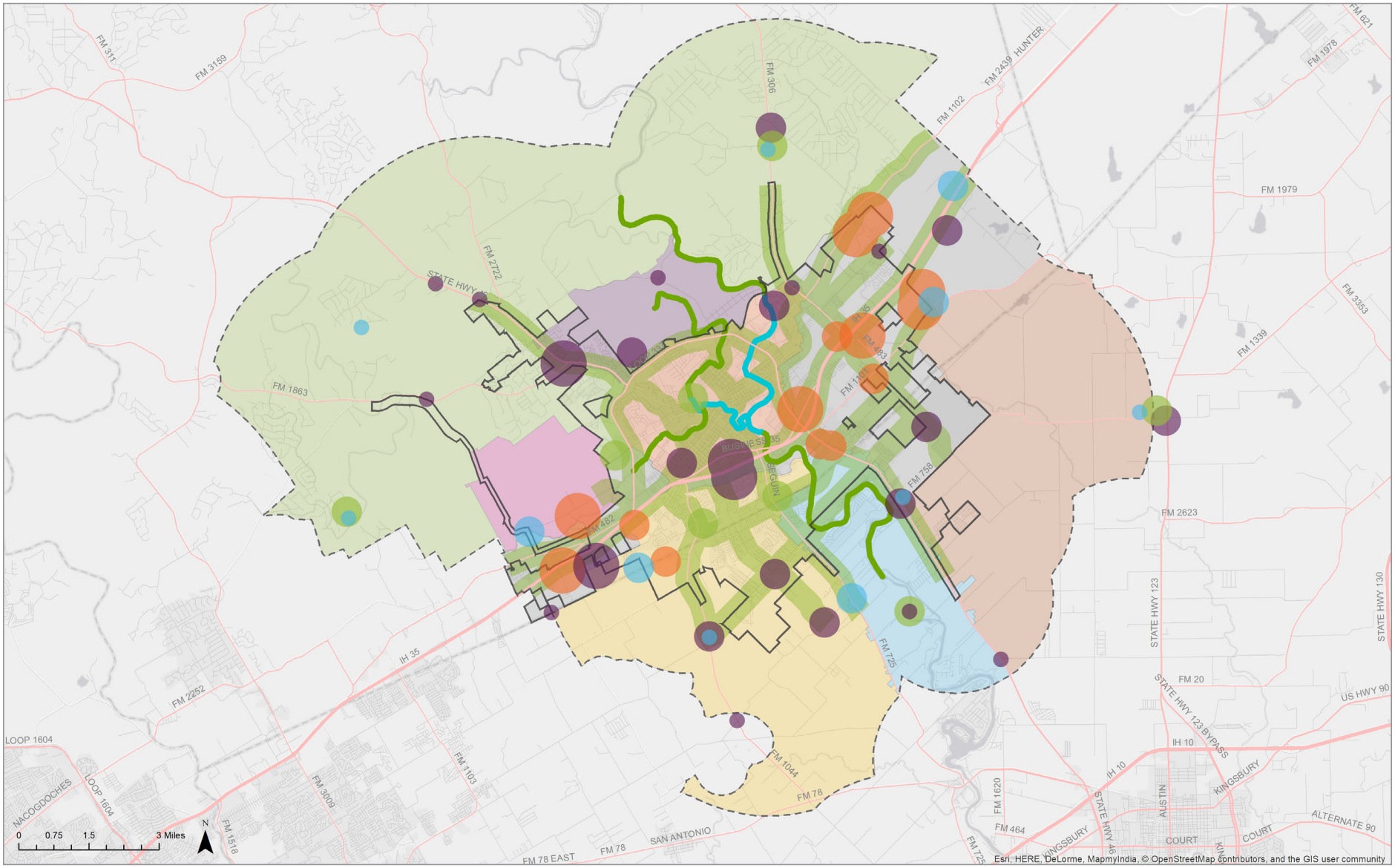
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

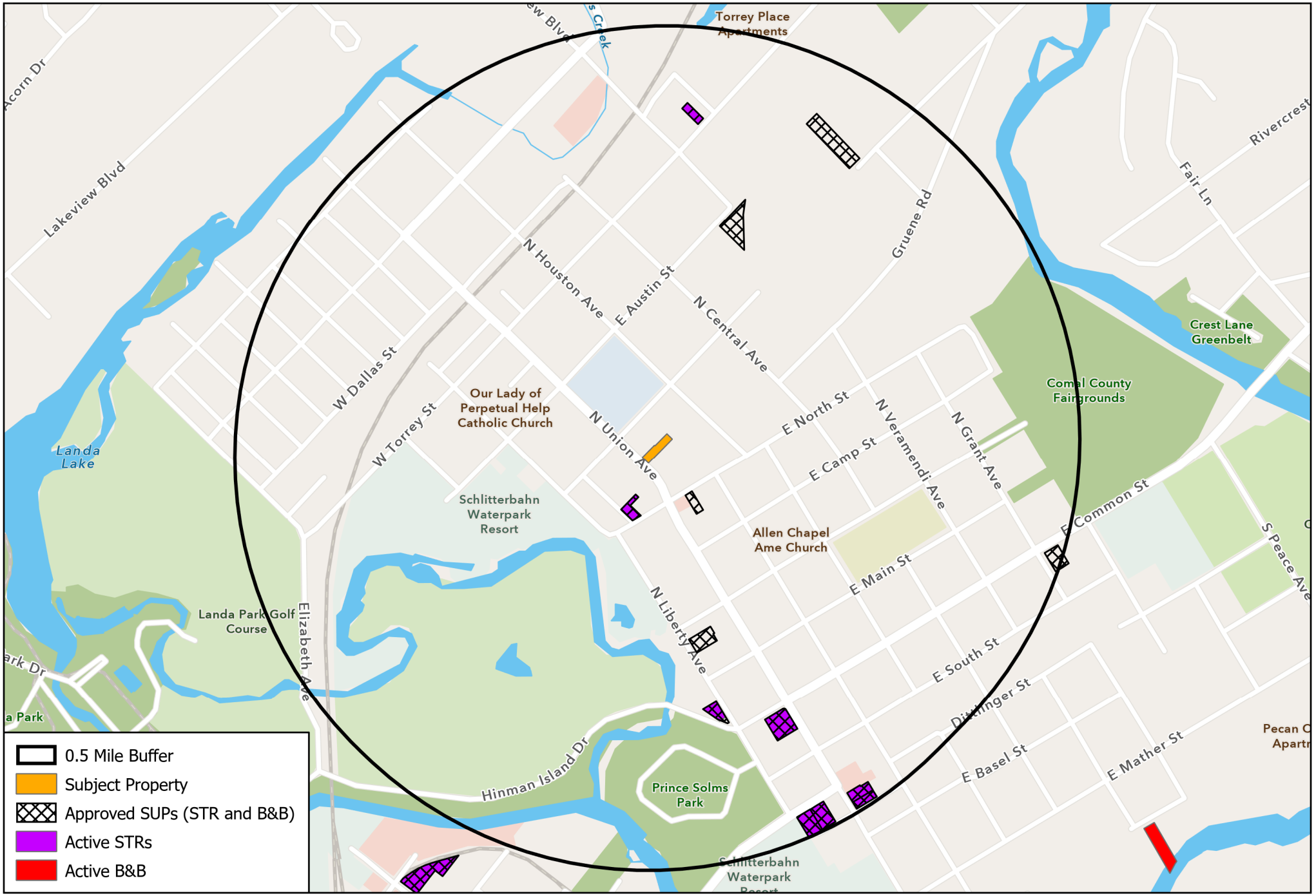
SUB AREA 6
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.



SUP21-230

SUP for STR

0 390 780 Feet

1:9,620

DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map b else is at that party's risk and without liability to the City of New Brau officials or employees for any discrepancies, errors, or variances which ma

Document Path:
Y:\Tools\Tools\PLN_STRBB\STR and BB Tool.aprx

Source: City of New Braunfels GIS
Date: 7/22/2021

PLANNING COMMISSION – AUGUST 3, 2021 – 6:00PM

Zoom & City Hall Council Chambers

Applicant/Owner: Cindy Espinosa

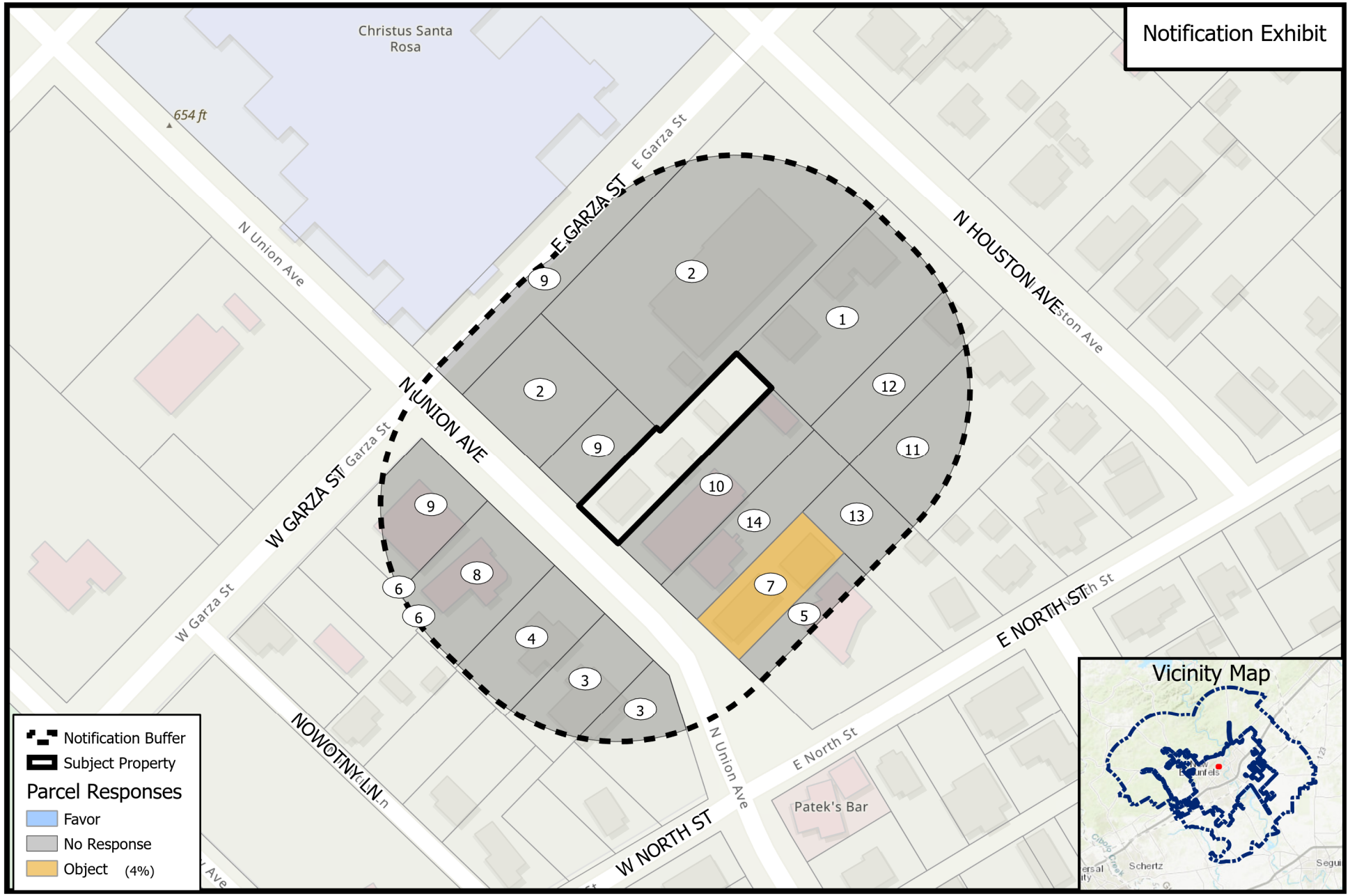
Address/Location: 556 N Union Ave

PROPOSED ZONE CHANGE – CASE #SUP21-230

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. WESCH DARRELL
2. PROPERTY OWNER
3. NOSUBI LTD
4. SUMALROT VERASAK
5. ALI NOORUDDIN Y & SANDRA M
6. FUNDIS CHARLENE E
7. CLITHEROE DEBORAH H
8. TEXCAL LAND CO
9. CHRISTUS SANTA ROSA HEALTH CARE CORP
10. NEW BRAUNFELS CITY PHARMACY INC
11. AGUIRRE JESUS
12. PEREZ RAMON G & SARAH
13. AMARO JOHN D
14. MENDEZ RAYMOND JR & YOLANDA

SEE MAP



SUP21-230
SUP for STR

0 75 150 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-230 - 556 N Union

Source: City of New Braunfels Planning
Date: 8/3/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

To: The New Braunfels Planning Commission

From: N. M. Haynes with Deborah Clitheroe, Owner #7

Re: Zoning Request for Short Term Rental of 556 N. Union Avenue

Case # sup21
For immediate consideration —

556 Union Avenue should not be zoned for short-term rental due to the current surge of Covid and the Delta Variance. As long as the pandemic flourishes world-wide we must protect hospitals and doctor's offices from the continuing spread. Both the Olympics and CruiseShips found Covid cases in spite of precautions!

For long term plans —
This area is a neighborhood. People work close at the hospital and other opportunities. They live close and know each other. I worked 15 years at the hospital (walking to work and back) and retired a few years ago. People walk and jog in the early morn or walk with their families and/or dogs in the evening. They pass my porch and wave.

It is not a worthy plan to admit those who will not give to our neighborhood and care about it.

Sincerely,

N. M. Haynes

#7

8-3-21

Subject Property – 556 N. Union Avenue

B) SUP21-230 Public hearing and recommendation to City Council regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a residential structure and garage apartment in the C-1 Local Business District addressed at 556 N Union Avenue. *Applicant/Owner: Cindy Espinosa; Case Manager: Holly Mullins.*

Mrs. Mullins presented and recommended approval with conditions as stated in staff report.

Chair Edwards asked if there were questions for staff.

Discussion followed on prior SUP requests on this property.

Cindy Espinosa, Owner, 1101 Green Acres clarified the paving of the driveway.

Discussion followed on the occupancy and the paving of the driveway.

Chair Edwards asked if anyone would like to speak.

William Rodgers, 16 La Mesa, spoke on the meeting posting.

Discussion followed.

Chair Edwards asked if there were further discussion or a motion.

Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to recommend approval to City Council of the proposed rezoning to apply a Special Use Permit to allow short term rental of a residential structure and garage apartment in the C-1 Local Business District addressed at 2262 Second Street with staff conditions. Motion carried (8-0-0).

ORDINANCE NO. 2021-

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS GRANTING A SPECIAL USE PERMIT TO ALLOW THE SHORT-TERM RENTAL OF A SINGLE_FAMILY HOUSE AND GARAGE APARTMENT IN THE "C-1" LOCAL BUSINESS DISTRICT, ON LOTS I AND P, CITY BLOCK 5086, ADDRESSED AT 556 N. UNION AVENUE; REPEALING ALL ORDINANCES IN CONFLICT; CONTAINING A SAVINGS CLAUSE; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City Council of the City of New Braunfels has complied with all requirements of notice of public hearing as required by the Zoning Ordinance of the City of New Braunfels; and

WHEREAS, in keeping with the spirit and objectives of a Special Use Permit, the City Council has given due consideration to all components of said permit; and

WHEREAS, the City recognizes that granting such a permit is possible while promoting the health, safety and general welfare of the public, by providing harmony between existing zoning districts and land uses; and

WHEREAS, it is the intent of the City to ensure for the health, safety and general welfare of the public by providing compatible and orderly development, which may be suitable only in certain locations in a zoning district through the implementation of a Special Use Permit meeting those requirements cited in Sections 3.6-2 and 3.6-3, Chapter 144 of the New Braunfels Code of Ordinances; and

WHEREAS, the property is located in an area suitable for short term rentals; and

WHEREAS, the requested rezoning is in accordance with Envision New Braunfels, the City's Comprehensive Plan; and

WHEREAS, the City Council desires to grant a Special Use Permit at 556 N. Union Avenue, to allow short term rental of a single-family house and garage apartment in the "C-1" Local Business District; **now, therefore;**

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

SECTION 1

THAT pursuant to Section 1.2-3, Chapter 144 of the New Braunfels Code of Ordinances, the Zoning Map of the City of New Braunfels is revised by adding the following tract of land as a "Special Use Permit" for the uses and conditions herein described:

> Being Lots I & P, City Block 2008, addressed at 556 N. Union Avenue, as depicted in Exhibit "A" attached, to allow a short-term rental of a single-family house and garage apartment in the "C-1" Local Business District.

SECTION 2

THAT the Special Use Permit be subject to the following conditions:

1. Paved off-street parking for at least three (3) vehicles must be provided in accordance with City standards.
2. The residential character of the property must be maintained.
3. The property will remain in compliance with the approved site plan illustrated in Exhibit "B". Any significant changes to the site plan will require a revision to the SUP.
4. Occupancy of the short-term rental is limited to five (5) guests in the main house and 4 guests in the garage apartment.
5. The applicant will register the short-term rental and create an account for online payment of hotel occupancy taxes.
6. All other standards of the Zoning Ordinance will also be met.

SECTION 3

THAT all other ordinances, or parts of ordinances, in conflict herewith are hereby repealed to the extent that they are in conflict.

SECTION 4

THAT if any provisions of this ordinance shall be held void or unconstitutional, it is hereby provided that all other parts of the same which are not held void or unconstitutional shall remain in full force and effect.

SECTION 5

THIS ordinance will take effect upon the second and final reading in accordance with the provisions of the Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this 23rd day of August, 2021.

PASSED AND APPROVED: Second reading this 13th day of September, 2021.

CITY OF NEW BRAUNFELS

_____

RUSTY BROCKMAN, Mayor

ATTEST:

_____

CAITLIN KROBOT, City Secretary

APPROVED AS TO FORM:

_____

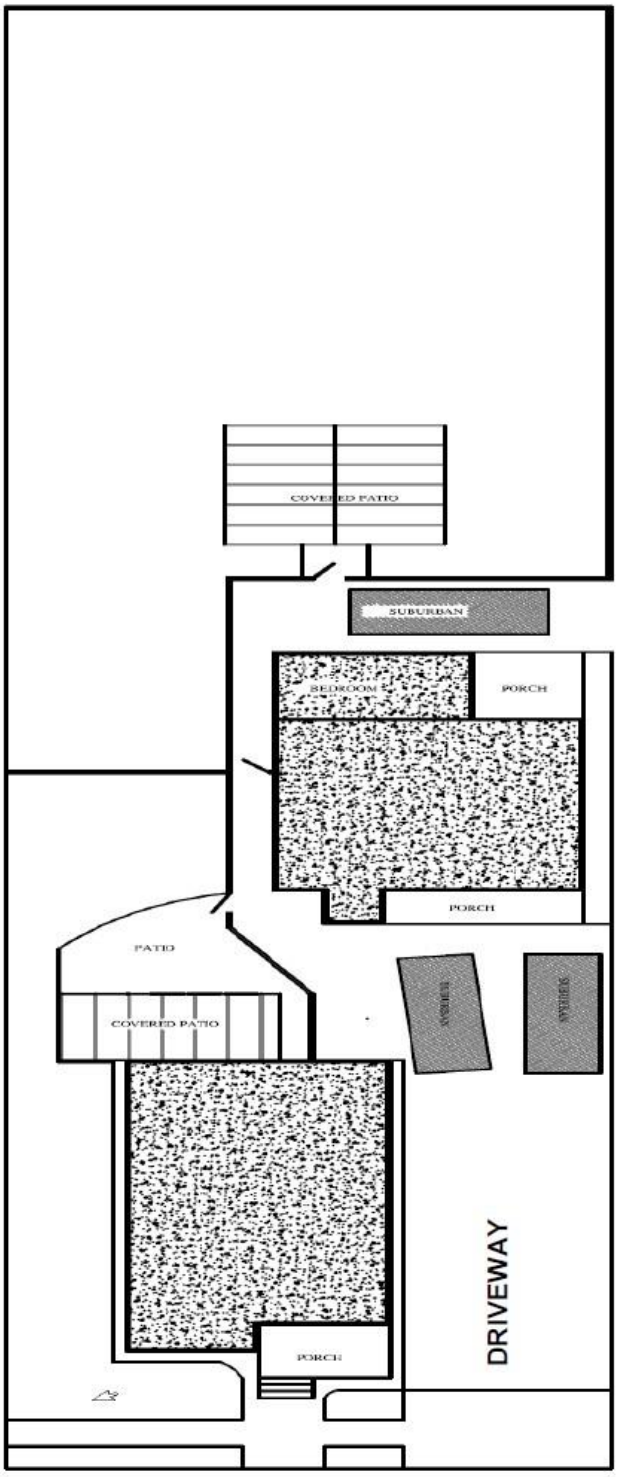
VALERIA M. ACEVEDO, City Attorney

EXHIBIT "A"

Location Map
Vicinity Map
N HOUSTON AVE
E NORTH ST
N WASHINGTON AVE
E North St
Patek's Bar
N Union Ave
W NORTH ST
F GARZA ST
E Garza St
N UNION AVE
W GARZA ST
Garza St
W Garza St
NOWOTNY LN
N LIBERTY AVE
Christus Santa Rosa
654 ft
Subject Property
SUP21-230
SUP for STR
Source: City of New Braunfels Planning
Date: 8/3/2021
0
75
150
Feet
N
DISCLAIMER: This map and information contained in it were developed exclusively for use by the City of New Braunfels. Any use or reliance on this map by anyone else is at that party's risk and without liability to the City of New Braunfels, its officials or employees for any discrepancies, errors, or variances which may exist.
City of New Braunfels
Path: \\CNFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\SUP21-230 - 556 N Union

EXHIBIT "B"

Site Plan



N. Union Avenue

PRESENTER:
Christopher J. Looney, AICP, Planning & Development Services Director
SUBJECT:
Public hearing and first reading of an ordinance regarding a proposed rezoning of approximately 7,406 square feet (0.17-acre) being parts of Lots 6 & 7, Block 46, New City Block 4002, Guenther Addition, addressed at 157 S. Guenther Ave., from "SND-1" Special Neighborhood District - 1 to "C-2A" Central Business District.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: 6

BACKGROUND INFORMATION:
Case #: PZ21-0233

Owner/
Applicant: Seals Family Properties, LLC
Kelly Garcia
392 W. Mill St.
New Braunfels, TX 78130
(210) 807-0288 kelly@furtherholdings.com

Staff Contact: Matthew Simmont
(830) 221-4058 msimmont@nbtexas.org

The 7,406 square foot (0.17-acre) tract is located approximately 250 feet southeast of the intersection of W. San Antonio Street and S. Guenther Ave. The subject property is developed with a single-family residence.

The applicant is requesting a change of the base zoning district from "SND-1" Special Neighborhood District to "C-2A" Central Business District. The applicant intends to combine the subject property with the 1.36-acre tract of land that surrounds it, currently zoned Central Business District (C-2), to facilitate its redevelopment. A district comparison chart (attached) shows the proposed zoning will allow for a variety of commercial and mixed-uses that are compatible with surrounding central business district uses, and consistent with zoning in this block and corridor.

Surrounding Zoning and Land Use:
North - C-2 / Antique Store and Warehouse
South - C-2 / Private driveway and single-family residences
East - C-2 / Antique Store and Warehouse
West - Across S. Guenther Ave., SND-1 / St. Paul Lutheran Church

ISSUE:
The current SND-1 zoning district is a Special Zoning District that was intended for development of detached single-family residences on minimum 6,600 square foot lots. It was created by the Sophienburg Hill

Neighborhood with development standards and allowed uses that were consistent with the historic layout and development of the neighborhood.

The proposed C-2A district is intended to be utilized within the downtown core and allows for commercial, residential and mixed-use development.

The proposed rezoning is consistent with the following actions from Envision New Braunfels and the Workforce Housing Study:

- *Action 1.3:* Encourage balanced and fiscally responsible land use patterns.
- *Action 2.33:* Encourage vertical growth and development of key areas to take advantage of infrastructure capacity, maintain the core, and to discourage sprawl.
- *Action 2.5:* Encourage diversification of commercial activity Downtown to build on and sustain existing historic resources and maximize structure utilization for economic expansion.
- *Action 3.13:* Cultivate an environment where a healthy mix of different housing products at a range of sizes, affordability, densities, amenities and price points can be provided across the community as well as within individual developments.
- *Action 3.4:* Revitalize the core of New Braunfels to ensure balanced development.
- *Workforce Housing Study Recommendation:* Ensure through city zoning and other required legal entitlements related to housing construction that new types of housing products (small lot, duplex, townhome, etc.) are allowed by regulations.

The property is situated in the New Braunfels Sub-Area, in close proximity to Employment, Market, Civic, Outdoor Recreation and Education Centers.

The permitted uses within the proposed zoning district create opportunities for encouraged commercial/mixed use development and vertical growth of the city core which is compatible with downtown uses along W. San Antonio Street.

The existing C-2 zoning surrounding the subject property and the proposed C-2A zoning of the subject property will both be required to comply with the residential setback standards of sections 3.3-8 and 3.4-14 of the Zoning Ordinance respectively, which require a setback of at least 20 feet plus one foot for each foot of building height over 20 feet, when adjacent to existing residential uses or residential zoning.

FISCAL IMPACT:

A preliminary fiscal impact analysis of the proposed overall development project indicates that the proposed 1.4 -acre project (of which the subject parcel is included within) would generate a net benefit to taxpayers in the amount $1,352,110 over 10 years. If all property in the proposed development remained in its current use and configuration, the estimated net benefit is $193,395 over 10 years.

RECOMMENDATION:

The Planning Commission held a public hearing on July 6, 2021 and recommended approval (8-0) with Commissioner Gibson absent.

Staff recommends approval. The applicants' proposal to rezone the subject property to be consistent with the zoning surrounding the subject property and provide the opportunity to create a mixed-use development in the urban core is consistent with ongoing development in the area and is supported by Envision New Braunfels and the Workforce Housing Study.

Mailed notification pursuant to state statute:

Public hearing notices were sent to owners of 12 properties within 200 feet of the request. No responses have been received at this time.

Resource Links:
Chapter 144, Section 3.4-1. (APD) of the City's Code of Ordinances:
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.4ZODIREPRZOSUJU221987>

- Chapter 144, Section 3.4-9. (ZH-A) of the City's Code of Ordinances:
<https://library.municode.com/tx/new_braunfels/codes/code_of_ordinances?nodeId=PTIICOOR_CH144ZO_ARTIIIZODI_S144-3.4ZODIREPRZOSUJU221987>

Attachments:
1. Aerial Map
2. Land Use Maps (Zoning, Existing Land Use, Future Land Use Plan)
3. District Comparison Chart
4. Traffic Impact Analysis (TIA) Worksheet
5. Notification List, Map and Responses
6. Draft Planning Commission Meeting Minutes
7. Ordinance

PZ21-0233
SND-1 to C-2A

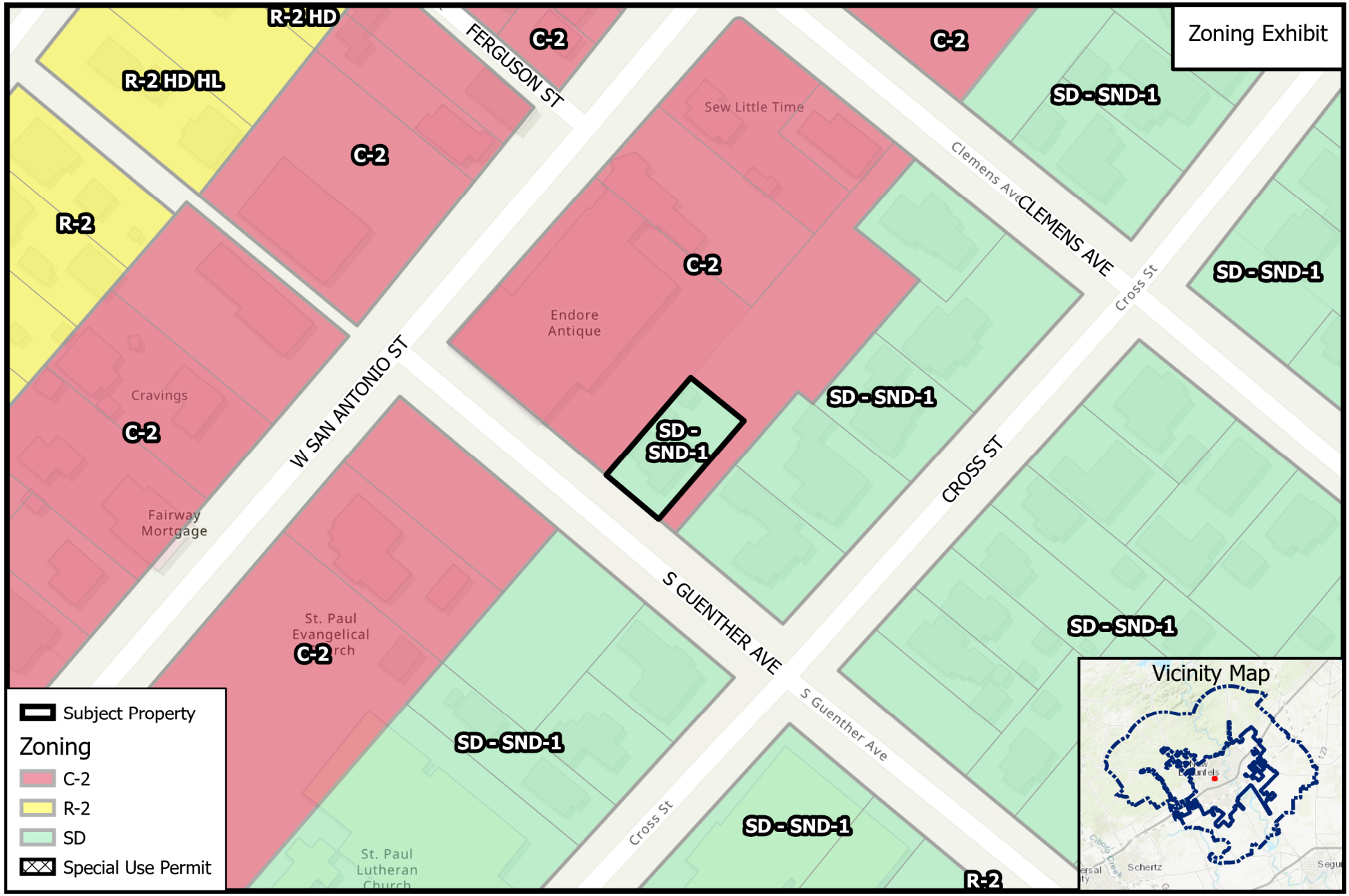
0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0233 - 157 S

Source: City of New Braunfels Planning
Date: 7/19/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.



PZ21-0233

SND-1 to C-2A

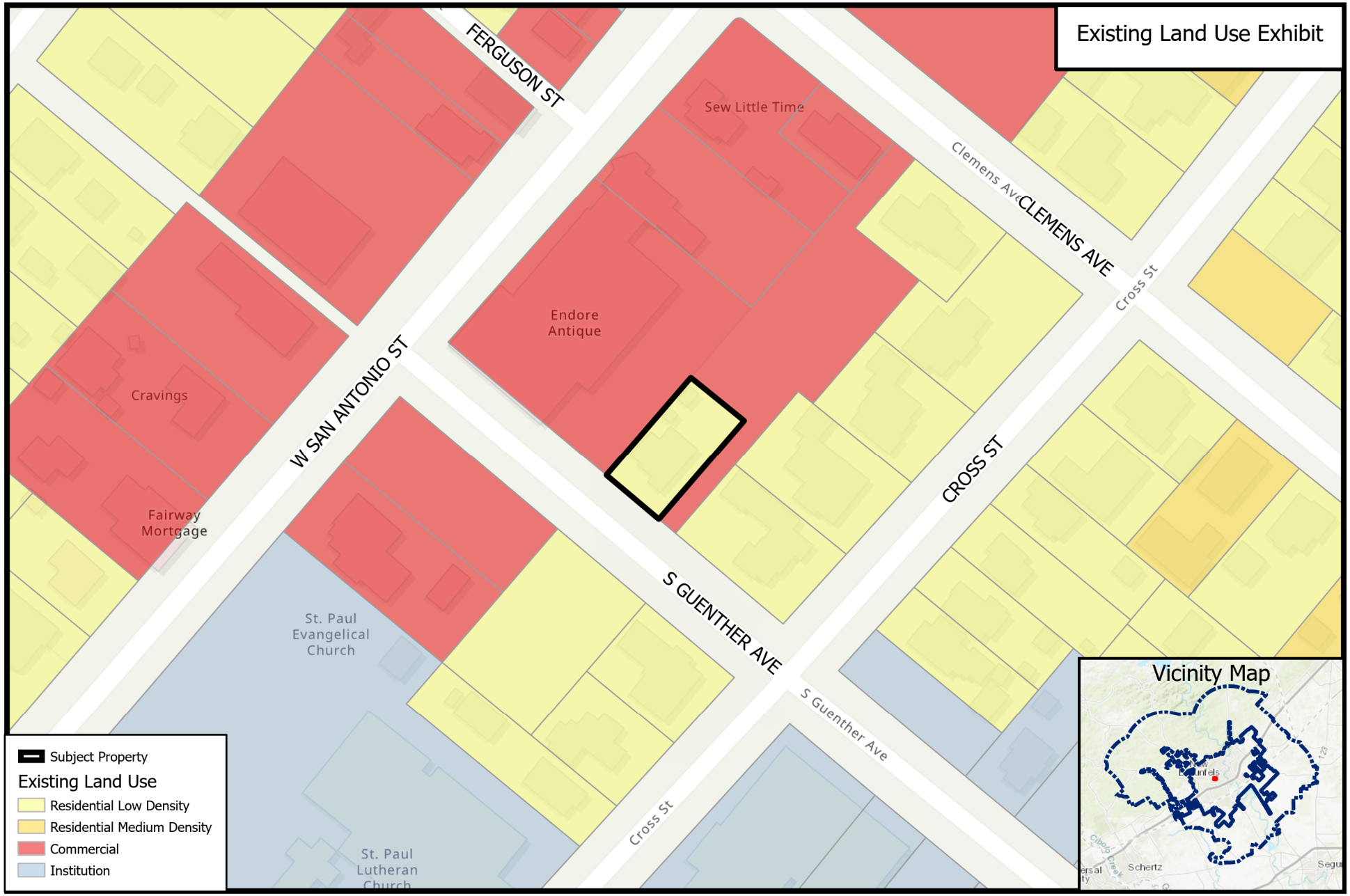
0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0233 - 157 S

Source: City of New Braunfels Planning
Date: 7/16/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.



PZ21-0233

SND-1 to C-2A

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0233 - 157 S

Source: City of New Braunfels Planning
Date: 7/16/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

EXISTING CENTERS

Centers are the middle, core or heart of an area. It is a point of activity and vitality. Centers come in many sizes and have different purposes or activities within. They may have endangered species habitat or aquifer recharge areas that require additional standards and consideration relating to future growth. It is envisioned that all centers be walkable, connected, and have a mix of uses. These centers must provide adequate infrastructure to support the commercial development present especially mobility and access for pedestrians, bicycles, vehicles and transit. Given the mixed-use nature of these centers, parking should be shared and not detract from the aesthetic of the area.

EMPLOYMENT CENTER

Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER

Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

MEDICAL CENTER

Medical Centers are mixed-use areas centered around a medical destination such as a hospital or clinic.

CIVIC CENTER

Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

OUTDOOR RECREATION CENTER

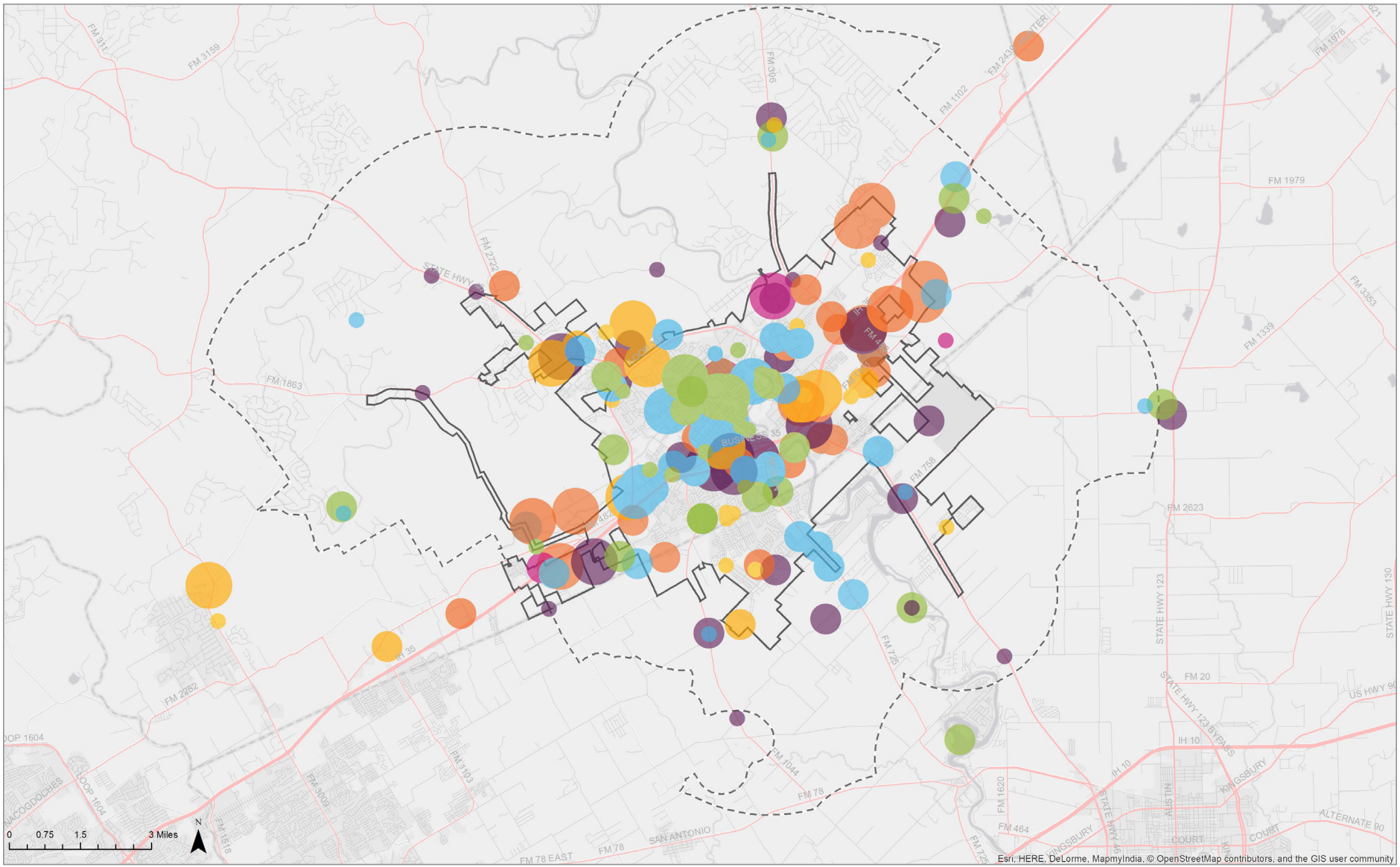
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

EDUCATION CENTER

Education Centers are mixed-use areas centered around an educational destination such as a K-12 school or university/college.

TOURIST/ENTERTAINMENT CENTER

Tourist/Entertainment Centers are mixed-use areas around an entertainment venue such as Gruene Hall or a tourist destination such as the Tube Chute.



The location of existing centers was determined through the analysis of previous studies and background documents, windshield surveys, and reviewed by City staff, Steering Committee members, and Plan Element Advisory Group members during a public workshop.

FUTURE LAND USE PLAN

A future land use plan is how land is envisioned to be. It establishes priorities for more detailed plans (sub area plans) and for detailed topical plans (such as parks and open spaces, trails and roads). It cannot be interpreted without the goals and actions of Envision New Braunfels.

TRANSITIONAL MIXED-USE CORRIDOR
Transitional Mixed-Use Corridors express an aspiration to retrofit existing auto-dominated retail corridors with a mix of uses and a variety of travel modes over time.

OUTDOOR RECREATION CENTER
Outdoor Recreation Centers are centered around a public or private outdoor destination like Fischer Park.

EMPLOYMENT CENTER
Employment Centers are mixed-use areas centered around office or industrial uses that can support significant employment.

MARKET CENTER
Market Centers are mixed-use areas anchored by a retail destination where surrounding residents go to get daily goods and services.

CIVIC CENTER
Civic Centers are mixed-use areas centered around a civic destination such as City Hall, a library or a recreation center.

SUB AREA 1
Sub Area 1 includes the Downtown, Gruene and the Mid-Century or older neighborhoods that surround them. It is home to the natural springs and headwaters of flowing rivers that have attracted New Braunfelsers to the town for centuries.

SUB AREA 2
Sub Area 2 refers to the neighborhoods and residential enclaves that have grown alongside the Hill Country landscape.

SUB AREA 3
Sub Area 3 includes a planned community offering a diversity of housing, distinct community centers and preserved Hill Country landscape features.

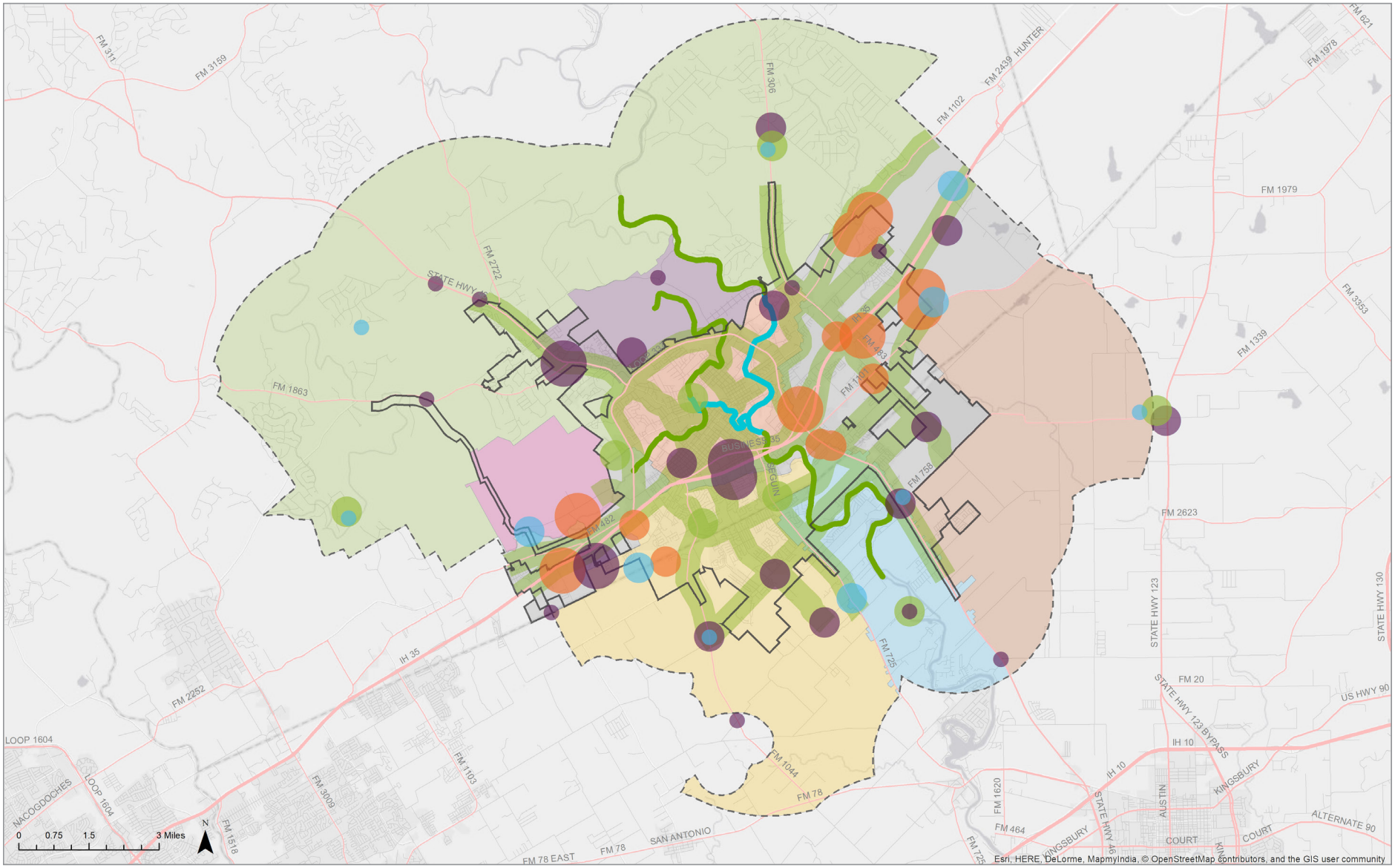
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

SUB AREA 5
Sub Area 5 bridges together many communities east of IH-35. It includes the scenic landscape along both banks of the Guadalupe River between Highway 46 and FM 725.

SUB AREA 6
Sub Area 6 expresses an aspiration for conservation communities focused around maintaining and enhancing ecological integrity while allowing some level of development to occur.

SUB AREA 7
Sub Area 7 includes parts of the city currently being mined for natural resources. These sites may become parks and open space, mixed-use communities or new commercial or entertainment areas in the future.

SUB AREA 8
This fast-growing Sub Area includes many neighborhoods offering affordable places for young families to live.



A Comprehensive Plan shall not constitute zoning regulations or establish zoning district boundaries. Preferred future growth scenario combines Scenarios A and C per recommendations of the Envision New Braunfels Steering Committee (February 2018). Exact boundaries of sub areas, centers, and corridors may be zoomed and viewed online.

	Existing Surround	Existing	Proposed
	C-2	SND-1	C-2A
Accessory building/structure (see section 144-5.4)	P	P	P
Accessory dwelling (one accessory dwelling per lot, no kitchen)	P	P	
Accounting, auditing, bookkeeping, and tax preparations	P		P
Adult day care (no overnight stay)	P		P
Adult day care (with overnight stay)	P		P
All-terrain vehicle (ATV) dealer/sales	P		P
Ambulance service (private)	P		P
Amphitheaters (outdoor live performances)	P		P
Amusement devices/arcade (four or more devices)	P		P
Amusement services or venues (indoors) (see section 144-5.13)	P		P
Animal grooming shop	P		P
Answering and message services	P		P
Antique shop	P		P
Appliance repair	P		P
Armed services recruiting center	P		P
Art dealer/gallery	P		P
Artist or artisans studio	P		P
Assembly/exhibition hall or areas	P		P
Auto body repair, garages (see section 144-5.11)	P		P
Auto leasing	P		P
Auto or trailer sales rooms or yards (see section 144-5.12)	P		P
Auto or truck sales rooms or yards—Primarily new (see section 144-5.12)	P		P
Auto repair as an accessory use to retail sales	P		P
Auto repair garage (general) (see section 144-5.11)	P		P
Auto supply store for new and factory rebuilt parts	P		P
Auto tire repair/sales (indoor)	P		P
Automobile driving school (including defensive driving)	P		P
Bakery (retail)	P		P
Bank, savings and loan, or credit union	P		P
Bar/tavern (no outdoor music)	P		P
Bar/tavern	P		P
Barber/beauty college (barber or cosmetology school or college)	P		P
Barber/beauty shop, haircutting (non-college)	P		P
Barns and farm equipment storage (related to agricultural uses)	P	P	P
Battery charging station	P		P
Bed and breakfast inn (see section 144-5.6)	P		P
Bicycle sales and/or repair	P		P
Billiard/pool facility	P		P
Bingo facility	P		P
Bio-medical facilities	P		P
Blacksmith or wagon shops			P
Boarding house/lodging house	P		P
Book binding	P		P
Book store	P		P

Bowling alley/center (see section 144-5.13)	P		P
Broadcast station (with tower) (see section 144-5.7)	P		P
Bus barns or lots			P
Bus passenger stations	P		P
Cabin or cottage (rental)			P
Cabin or cottage (rental for more than 30 days)			P
Cafeteria/cafe/delicatessen	P		P
Campers' supplies	P		P
Car wash (self-service; automated)	P		P
Car wash, full service (detail shop)	P		P
Carpenter, cabinet, or pattern shops			P
Caterer	P		P
Cemetery and/or mausoleum	P		P
Check cashing service	P		P
Child day care/children's nursery (business)	P		P
Church/place of religious assembly	P	P	P
Civic/conference center and facilities	P		P
Cleaning, pressing and dyeing (non-explosive fluids used)	P		P
Clinic (dental)	P		P
Clinic (emergency care)	P		P
Clinic (medical)	P		P
Club (private)	P		P
Coffee shop	P		P
Commercial amusement concessions and facilities	P		P
Communication equipment—Installation and/or repair	P		P
Community building (associated with residential uses)	P	P	
Community home (see definition)	P	P	P
Computer and electronic sales	P		P
Computer repair	P		P
Confectionery store (retail)	P		P
Consignment shop	P		P
Contractor's office/sales, with outside storage including vehicles			P
Contractor's temporary on-site construction office	P	P	P
Convenience store with gas sales	P		P
Convenience store without gas sales	P		P
Credit agency	P		P
Curio shops	P		P
Custom work shops	P		P
Dance hall/dancing facility (see section 144-5.13)	P		P
Day camp	P		P
Department store	P		P
Dormitory (in which individual rooms are for rental)			P
Drapery shop/blind shop	P		P
Drug store/pharmacy	P		P
Duplex/two-family/duplex condominiums	P		P
Electrical repair shop	P		P
Electrical substation	P		P

Exterminator service	P		P
Family home adult care	P	P	
Family home child care	P	P	
Farmers market (produce market—wholesale)	P		P
Farms, general (crops) (see chapter 6 and section 144-5.9)	P	P	P
Farms, general (livestock/ranch) (see chapter 6 and section 144-5.9)	P	P	P
Feed and grain store	P		P
Filling station (gasoline tanks must be below the ground)	P		P
Florist	P		P
Food or grocery store with gasoline sales	P		P
Food or grocery store without gasoline sales	P		P
Fraternal organization/civic club (private club)	P		P
Frozen food storage for individual or family use	P		P
Funeral home/mortuary	P		P
Furniture sales (indoor)	P		P
Garden shops and greenhouses	P		P
Golf course (public or private)	P	P	P
Golf course (miniature)	P		P
Government building or use with no outside storage (outside storage allowed in M-2 and M-2A)	P	P	P
Greenhouse (commercial)	P		P
Handicraft shop	P		P
Hardware store	P		P
Health club (physical fitness; indoors only)	P		P
Heating and air-conditioning sales/services	P		P
Heavy load (farm) vehicle sales/repair (see section 144-5.14)			P
Heliport			P
Home occupation (see section 144-5.5)	P	P	
Home repair and yard equipment retail and rental outlets			P
Hospice	P		P
Hospital, general (acute care/chronic care)	P		P
Hospital, rehabilitation	P		P
Hotel/motel	P		P
Hotels/motels—Extended stay (residence hotels)	P		P
Ice delivery stations (for storage and sale of ice at retail only)	P		P
Kiosk (providing a retail service)	P		P
Laundromat and laundry pickup stations	P		P
Laundry, commercial (without self-serve)	P		P
Laundry/dry cleaning (drop off/pick up)	P		P
Laundry/washateria (self-serve)	P		P
Lawnmower sales and/or repair	P		P
Limousine/taxi service	P		P
Locksmith	P		P
Maintenance/janitorial service			P
Major appliance sales (indoor)			P
Martial arts school	P		P
Medical supplies and equipment	P		P

Micro brewery (onsite mfg. and/or sales)	P		P
Mini-warehouse/self-storage units (no boat and RV storage permitted)	P		P
Motion picture studio, commercial film	P		P
Motion picture theater (indoors)	P		P
Motorcycle dealer (primarily new/repair)	P		P
Moving storage company			P
Multifamily (apartments/condominiums)	P		P
Museum	P	P	P
Needlework shop	P		P
Nursing/convalescent home/sanitarium	P		P
Offices, brokerage services	P		P
Offices, business or professional	P		P
Offices, computer programming and data processing	P		P
Offices, consulting	P		P
Offices, engineering, architecture, surveying or similar	P		P
Offices, health services	P		P
Offices, insurance agency	P		P
Offices, legal services, including court reporting	P		P
Offices, medical offices	P		P
Offices, real estate	P		P
Offices, security/commodity brokers, dealers, exchanges and financial services	P		P
One-family dwelling, detached	P	P	
Park and/or playground (private and public)	P	P	P
Parking lots (for passenger car only) (not as incidental to the main use)	P		P
Parking structure/public garage	P		P
Pawn shop	P		P
Pet shop/supplies (less than 10,000 sq. ft.)	P		P
Pet store (over 10,000 sq. ft.)			P
Photographic printing/duplicating/copy shop or printing shop	P		P
Photographic studio (no sale of cameras or supplies)	P		P
Photographic supply	P		P
Plant nursery (no retail sales on site)	P		P
Plant nursery (retail sales/outdoor storage)	P		P
Plumbing shop	P		P
Propane sales (retail)			P
Public recreation/services building for public park/playground areas	P	P	P
Publishing/printing company (e.g., newspaper)	P		P
Quick lube/oil change/minor inspection	P		P
Radio/television shop, electronics, computer repair	P		P
Recreation buildings (private)	P		P
Recreation buildings (public)	P	P	P
Refreshment/beverage stand	P		P
Rental or occupancy for less than one month (see section 144-5.17)	P		P
Research lab (non-hazardous)			P

Residential use in buildings with non-residential uses permitted in the district	P		P
Restaurant/prepared food sales	P		P
Restaurant with drive-through service	P		P
Retail store and shopping center without drive-through service (50,000 sq. ft. bldg. or less)	P		P
Retail store and shopping center with drive-through service (50,000 sq. ft. bldg. or less)	P		P
Retirement home/home for the aged	P		P
RV/travel trailer sales	P		P
School, K-12 public or private	P	P	P
School, vocational (business/commercial trade)	P		P
Security monitoring company (no outside storage or installation)	P		P
Security systems installation company	P		P
Shoe repair shops	P		P
Shopping center			P
Single-family industrialized home (see section 144-5.8)	P	P	
Specialty shops in support of project guests and tourists			P
Storage in bulk	P		P
Studio for radio or television, without tower (see zoning district for tower authorization)	P		P
Studios (art, dance, music, drama, reducing, photo, interior decorating, etc.)	P		P
Tailor shop (see home occupation)	P		P
Taxidermist			P
Telemarketing agency	P		P
Telephone exchange buildings (office only)	P		P
Tennis court (commercial)	P		P
Theater (non-motion picture; live drama)	P		P
Tire sales (outdoors)	P		P
Tool rental	P		P
Travel agency	P		P
Truck or transit terminal			P
University or college (public or private)	P		P
Upholstery shop (non-auto)	P		P
Used or second hand merchandise/furniture store	P		P
Vacuum cleaner sales and repair	P		P
Veterinary hospital (no outside animal runs or kennels)			P
Video rental/sales	P		P
Waterfront amusement facilities—Swimming/wading pools/bathhouses	P		P
Water storage (surface, underground or overhead), water wells and pumping stations that are part of a public or municipal system	P	P	P
Wholesale sales offices and sample rooms	P		P
Woodworking shop (ornamental)	P		P

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) DETERMINATION FORM

Complete this form to determine Traffic Impact Analysis requirements.
A site exhibit must be with this form to be considered a complete submittal.

Section 1: General Information

General Information			
Project Name: 157 S. Guenther			Date: 07/06/2021
Subdivision Plat Name: CB - Downtown		Project Address/Location: 157 S. Guenther Ave.	
Location? ☒ City of New Braunfels	☐ New Braunfels ETJ	☒ Comal County	☐ Guadalupe County
Owner Name: SEALS FAMILY PROPERTIES, LLC		Owner Email: kelly@furtherholdings.com	
Owner Address: 392 W. Mill St, New Braunfels, TX 78130		Owner Phone: (512) 712-8454	
Preparer Company: KFW Engineers & Surveying			
Preparer Name: Chris Orem		Preparer Email: corem@kfwengineers.com	
Preparer Address: 3421 Paesanos Parkway, San Antonio, Tx		Preparer Phone: (210) 979-8444	
Application Type or Reason for TIA Worksheet/Report			
☐ Master Plan	☐ Preliminary Plat	☐ Final Plat	☐ Commercial Permit ☒ Zoning
TIA Submittal Type (A TIA Worksheet is required with all zoning, plan and plat applications)			
☒ TIA Worksheet Only (100 peak hour trips or less)		☐ Level 1 TIA Report (101-500 peak hour trips)	
☐ Level 2 TIA Report (501-1,000 peak hour trips)		☐ Level 3 TIA Report (1,001 or more peak hour trips)	
TxDOT Access Approved?			
☐ Yes	☐ No	☒ Not Applicable	

Section 2: Proposed Land Use and Trip Information for Application

Land Use	ITE Code[1]	ITE Unit[2]	Est. Project Units	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips
Accessory Parking Lot				0	0	0	0	0	0
Total from additional tabulation sheet (if necessary):									
						Total:	0	0	0

[1] *Institute of Transportation Engineers (ITE) Trip Generation*, 10th Edition or most recent
[2] E.g., Dwelling Units, Acres, Employees, KSF, etc.

Internal Use Only	Reviewed by:		Date:
	□ TIA Worksheet only.	□ TIA Report required.	□ Additional information required to make a determination.

PLANNING COMMISSION – AUGUST 3, 2021 – 6:00PM

Zoom & City Hall Council Chambers

Applicant/Owner: Seals Family Properties LLC (Geoffrey Bley), owner

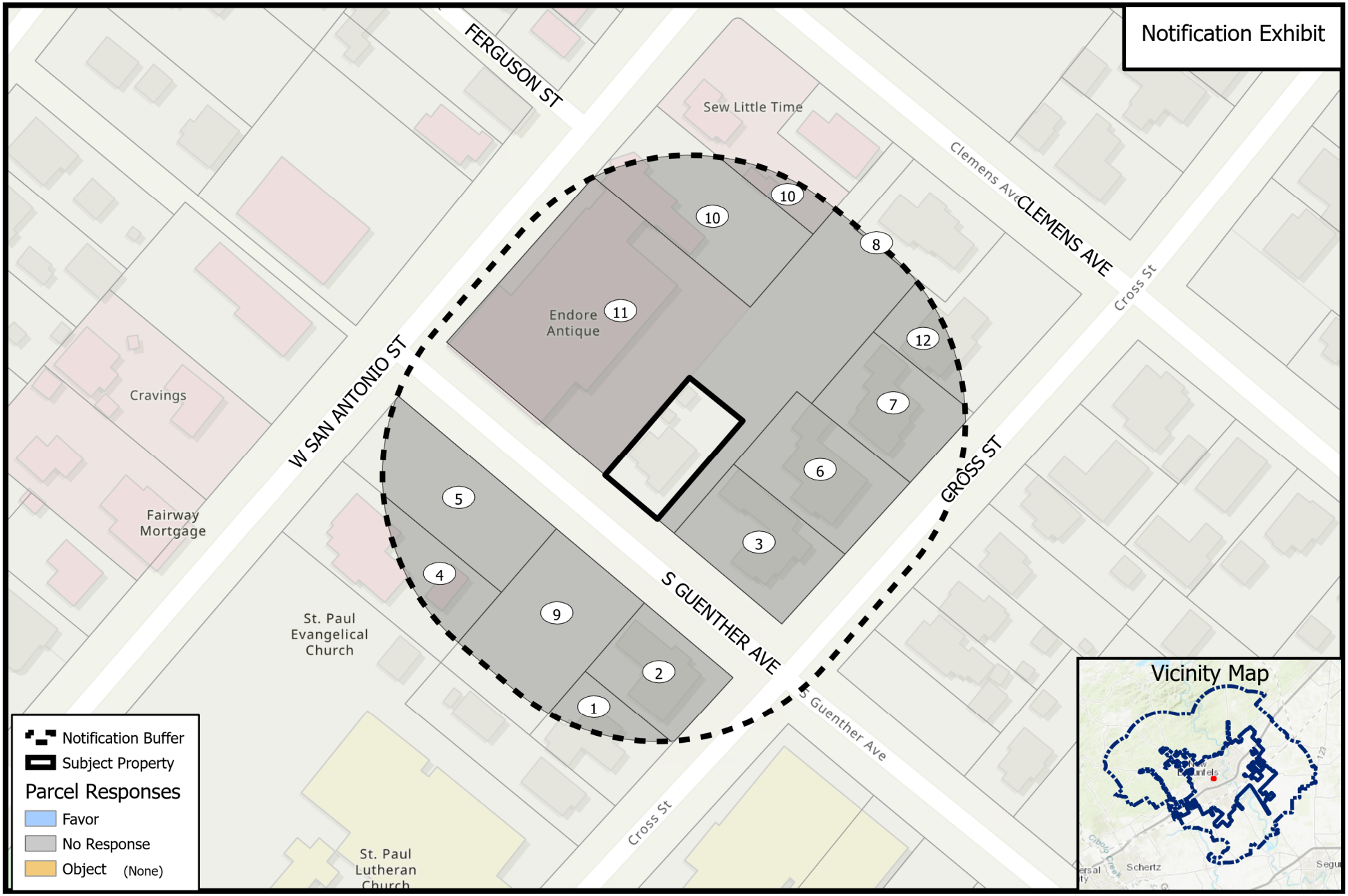
Address/Location: Approximately 0.167 acres located at 157 S Guenther Ave

PROPOSED ZONE CHANGE – CASE #PZ21-0233

The circled numbers on the map correspond to the property owners listed below. All information is from the Appraisal District Records. The property under consideration is marked as "Subject Property".

1. ST PAULS EVANGELICAL LUTHERAN CONGREGATION OF NEW BRAUNFELS
2. PETERMAN ROBERT H & CINDY S
3. MCGURK GARY L & SUE
4. RANGEL NORMA & RANGEL RENE
5. ST PAUL LUTHERAN CHURCH
6. TURNER JEFFERY S & MARIA G
7. RABE RICHARD
8. EQUITY TRUST COMPANY
9. ST PAULS EVANGELICAL
10. PROVENANCE GROUP LLC
11. SEALS FAMILY PROPERTIES LLC
12. PROPERTY OWNER

SEE MAP



PZ21-0233
SND-1 to C-2A

0 60 120 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0233 - 157 S

Source: City of New Braunfels Planning
Date: 7/16/2021

DISCLAIMER: This map and information contained in it were developed ex for use by the City of New Braunfels. Any use or reliance on this map by else is at that party's risk and without liability to the City of New Braun officials or employees for any discrepancies, errors, or variances which may exist.

A) PZ21-0233 Public hearing and recommendation to City Council regarding a proposed rezoning of approximately 7,406 square feet (0.17-acre) being parts of Lots 6 & 7, Block 46, New City Block 4002, Guenther Addition, addressed at 157 S. Guenther Ave., from "SND-1" Special Neighborhood District – 1 to "C-2A" Central Business District. *Applicant: Geoffrey Bley; Owner: Seals Family Properties, LLC.; Case Manager: Matthew Simmont.*

Mr. Simmont presented and recommended approval.

Chair Edwards asked if there were any questions for staff.

Discussion followed on if the current structure on the property will be demolished.

Chair Edwards asked if the applicant would like to speak.

Jeff Bley elaborated on the intent of the request.

Discussion followed on the current structure on the property.

Chair Edwards asked if anyone would like to speak in favor of the request.

Rick Robby, 652 Cross St, number 7, asked for clarification on the project.

Discussion followed.

William Rodgers, 16 La Mesa Dr, asked about the posting of the meeting online.

Discussion followed.

Chair Edwards asked if there were any questions for the applicant.

Chair Edwards asked if there were further discussion or a motion.

Motion by Vice Chair Laskowski, seconded by Commissioner Sonier, to recommend approval to City Council of the proposed rezoning of approximately 7,406 square feet (0.17-acre) being parts of Lots 6 & 7, Block 46, New City Block 4002, Guenther Addition, addressed at 157 S. Guenther Ave., from "SND-1" Special Neighborhood District – 1 to "C-2A" Central Business District. Motion carried (8-0-0).

ORDINANCE NO. 2021-

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS REZONING APPROXIMATELY 7,406 SQUARE FEET (0.17 ACRE), BEING PARTS OF LOTS 6 & 7, BLOCK 46, NEW CITY BLOCK 4002, GUENTHER ADDITION, FROM "SND-1" SPECIAL NEIGHBORHOOD DISTRICT - 1 TO "C-2A" CENTRAL BUSINESS DISTRICT; REPEALING ALL ORDINANCES IN CONFLICT; CONTAINING A SAVINGS CLAUSE; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City Council of the City of New Braunfels has complied with all requirements of notice of public hearing as required by the Zoning Ordinance of the City of New Braunfels; and

WHEREAS, in keeping with the spirit and objectives of the "C-2A" Central Business District, the City Council has given due consideration to all components of said districts; and

WHEREAS, it is the intent of the City Council to provide harmony between existing zoning districts and proposed land uses; and

WHEREAS, the requested rezoning is in accordance with Envision New Braunfels, the City's Comprehensive Plan; and

WHEREAS, the City Council desires to amend the Zoning Map by rezoning approximately 7,406 square feet (0.17 acre), being parts of Lots 6 & 7, Block 46, New City Block 4002, Guenther Addition, from "SND-1" Special Neighborhood District – 1 to "C-2A" Central Business District; **now, therefore;**

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS:

SECTION 1

THAT pursuant to Section 1.2-3, Chapter 144 of the New Braunfels Code of Ordinances, the Zoning Map of the City of New Braunfels is revised by rezoning the following described tract of land from "SND-1" to:

"C-2A" Central Business District: 7,406 square feet (0.17 acre) being parts of Lots 6 & 7, Block 46, New City Block 4002, Guenther Addition, as illustrated in Exhibit "A" and described in Exhibit "B", attached.

SECTION 2

THAT all provisions of the Code of Ordinances of the City of New Braunfels not herein amended or repealed shall remain in full force and effect.

SECTION 3

THAT all other ordinances, or parts of ordinances, in conflict herewith are hereby repealed to the extent that they are in conflict.

SECTION 4

THAT if any provisions of this ordinance shall be held void or unconstitutional, it is hereby provided that all other parts of the same which are not held void or unconstitutional shall remain in full force and effect.

SECTION 5

THIS ordinance will take effect upon the second and final reading in accordance with the provisions of the Charter of the City of New Braunfels.

PASSED AND APPROVED: First reading this 23rd day of August, 2021.

, 2021.

PASSED AND APPROVED: Second reading this 13th day of September, 2021.

CITY OF NEW BRAUNFELS

_____

RUSTY BROCKMAN, Mayor

ATTEST:

_____

CAITLIN KROBOT, Assistant City Secretary

APPROVED AS TO FORM:

_____

VALERIA M. ACEVEDO, City Attorney

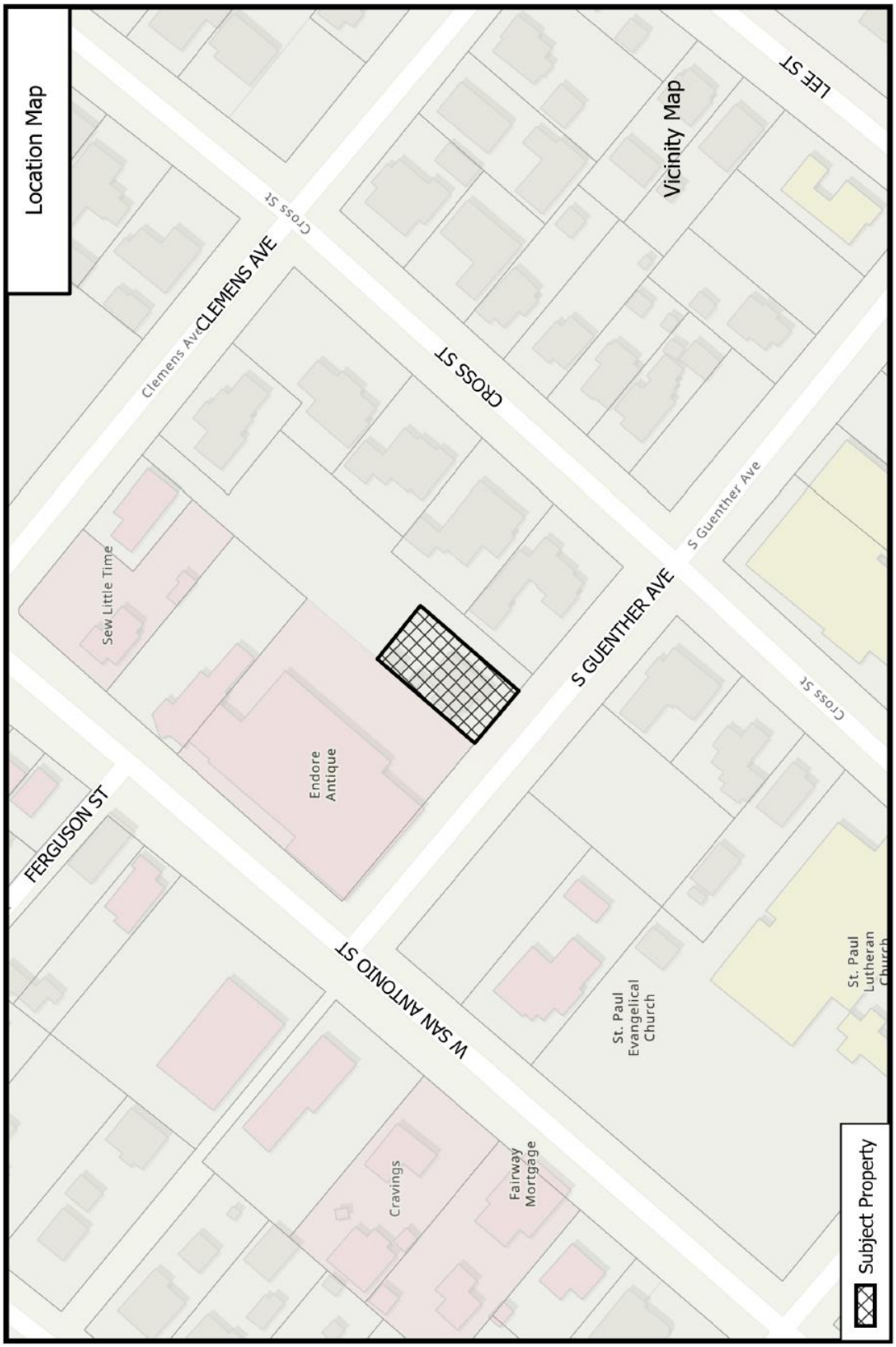

Location Map
Vicinity Map
CLEMENS AVE
Clemens Ave
CROSS ST
Cross St
LEE ST
S Guenther Ave
S GUENTHER AVE
Cross St
FERGUSON ST
W SAN ANTONIO ST
Sew Little Time
Endore Antique
St. Paul Evangelical Church
St. Paul Lutheran Church
Cravings
Fairway Mortgage
Subject Property

EXHIBIT "A"

EXHIBIT A
Legal Description

BEING A 0.167 OF AN ACRE TRACT OF LAND, BEING PART OF LOTS 6 AND 7, BLOCK 46, NEW CITY BLOCK 4002, GUENTHER ADDITION, NEW BRAUNFELS, TEXAS, RECORDED IN VOLUME 34, PAGE 59, DEED RECORDS, COMAL COUNTY, TEXAS, AND BEING COMPRISED OF THOSE CERTAIN TRACTS RECORDED IN VOLUME 1011, PAGE 160 AND VOLUME 1011, PAGE 162, BOTH OF OFFICIAL PUBLIC RECORDS, COMAL COUNTY, TEXAS; SAID 0.167 OF AN ACRE TRACT OF LAND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING AT A 1 3/4" IRON ROD FOUND IN THE NORTHEAST RIGHT-OF-WAY LINE OF S. GUENTHER AVE. FOR THE WEST CORNER OF THIS TRACT AND A RE-ENTRANT CORNER OF THE FERGUSON TRACT, CALLED 2.067 ACRES (TRACT I) RECORDED IN VOLUME 679, PAGE 15, OFFICIAL PUBLIC RECORDS, COMAL COUNTY, TEXAS, SAME BEING THE SOUTH CORNER OF LOT 5 AND THE WEST CORNER OF LOT 6;

THENCE DEPARTING SAID RIGHT-OF-WAY LINE, ALONG THE COMMON LINE OF SAID LOTS 5, 6 AND AN UNIDENTIFIED TRACT IN SAID BLOCK 46, SAME BEING A COMMON LINE OF THIS TRACT AND SAID FERGUSON TRACT, N 41 DEGREES 45' 00" E, A DISTANCE OF 114.52 FEET (CALLED N 41 DEGREES 45' E, 114.85') TO A 1/2" IRON ROD SET FOR THE NORTH CORNER OF THIS TRACT AND AN INTERIOR CORNER OF SAID FERGUSON TRACT;

THENCE DEPARTING THE NORTHWEST BOUNDARY LINE OF SAID LOT 6, CONTINUING ALONG A COMMON LINE OF THIS TRACT AND SAID FERGUSON TRACT, S 48 DEGREES 53' 44" E, AT APPROXIMATELY 50' PASSING THE COMMON LINE OF SAID LOTS 6 AND 7, IN ALL A DISTANCE OF 64.13 FEET (CALLED S 49 DEGREES 37' E, 64') TO A 1/2" IRON ROD FOUND AT AN INTERIOR CORNER OF A CONCRETE CURB FOR THE EAST CORNER OF THIS TRACT AND AN INTERIOR CORNER OF SAID FERGUSON TRACT;

THENCE CONTINUING ALONG A COMMON LINE OF THIS TRACT AND SAID FERGUSON TRACT, S 41 DEGREES 45' 00" W (BASIS OF BEARINGS), A DISTANCE OF 114.52 FEET (CALLED S 41 DEGREES 45' W, 114.85') TO A 1/2" IRON ROD FOUND IN THE AFOREMENTIONED RIGHT-OF-WAY LINE OF S. GUENTHER AVE. FOR THE SOUTH CORNER OF THIS TRACT AND A RE-ENTRANT CORNER OF SAID FERGUSON TRACT, FROM WHICH A 1/2" IRON ROD FOUND AT THE SOUTH CORNER OF SAID NEW CITY BLOCK BEARS S 49 DEGREES 03' 10" E, A DISTANCE OF 143.35 FEET;

THENCE ALONG THE COMMON LINE OF THIS TRACT AND SAID RIGHT-OF-WAY LINE, N 48 DEGREES 53' 44" W, A DISTANCE OF 64.13 FEET (CALLED N 49 DEGREES 37' W. 64') TO THE POINT OF BEGINNING AND CONTAINING 0.167 OF AN ACRE OF LAND.

EXHIBIT "B"

Agenda Item No. A)

Deliberate issues regarding economic development negotiations in accordance with section 551.087 of the Texas Government Code; and, Deliberate pending/contemplated litigation, settlement offers, and matters related to privileged and unprivileged client information deemed confidential by Rule 1.05 of the Texas Disciplinary Rules of Professional Conduct in accordance with Section 551.071 of the Texas Government Code, specifically:

- HD Supply Facilities Maintenance, Ltd.

Agenda Item No. B)

Deliberate issues regarding economic development negotiations in accordance with section 551.087 of the Texas Government Code.

- Project Origin
- Project Encore