CITY OF NEW BRAUNFELS, TEXAS
CITY COUNCIL MEETING

CITY HALL - COUNCIL CHAMBERS
550 LANDA STREET

MONDAY, JULY 26, 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 HINES

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) Retiree Recognition- Jose Castillo 21-671

B) Presentation regarding proposed amendments to the City of New Braunfels Drainage and Erosion Control Manual and the Code of Ordinances, Chapter 58, Floods. 21-632
Melissa Reynolds, First Assistant City Engineer

1. MINUTES

A) Discuss and consider approval of minutes of the City Council meeting of July 12, 2021 and the Executive Session of July 12, 2021. 21-723
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 the Mayoral appointment of Francisco Dionisio and Cheryl Denton and reappointment of Nathan Manlove and Mary Irwin to the New Braunfels Partnership Committee for terms ending August 1, 2024. 21-729
Caitlin Krobot, City Secretary

B) Approval of the Mayoral appointment of Jacob Yaklin and reappointment of John Malik and Tobin Hoffmann to the Reinvestment Zone No. 1 (TIRZ) Board of Directors and the New Braunfels Development Authority for terms ending May 29, 2023. 21-724
Caitlin Krobot, City Secretary

C) Approval of the Mayoral appointment of Tobin Hoffmann as the Chair of the Reinvestment Zone No. 1 (TIRZ) Board of Directors and the New Braunfels Development Authority. 21-733
Caitlin Krobot, City Secretary

D) Approval of an annual software maintenance renewal for Cityworks PLL through SHI. 21-716
Tony Gonzalez, Director of Information Technology

E) Approval of purchase of power systems through GTS, Inc. to support the networking and computing equipment in Fire Station 2, Fire Station 3 and Police Headquarters. 21-717
Tony Gonzalez, Director of Information Technology

F) Approval of a lease agreement with Ricoh USA for the Citywide rental and services of multi-function copier 21-703

devices through a BuyBoard cooperative agreement.
Barbara Coleman, Purchasing Manager

G) Approval of and authorization for the City Manager to execute an amendment to lease agreement between the City of New Braunfels and Connections Individual and Family Services, Inc relating to the property located at 705 Comal Avenue. 21-706
Matthew Eckmann, Facilities and Real Estate Manager

H) Discuss and consider approval for the City Manager to enter into a professional services agreement with Freese & Nichols, Inc. to update the City of New Braunfels Capital Improvement Plan. 21-701
Garry Ford, Jr., Assistant Public Works Director/City Engineer

I) Approval for the purchase of pursuit vehicles from Caldwell County Chevrolet for the Police Department and approval to declare replaced units as surplus. 21-730
Barbara Coleman, Purchasing Manager

Ordinances

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

J) Approval of the second and final reading of an ordinance amending Section 126-346 of the City of New Braunfels Code of Ordinances to restrict parking around the landscaped islands on the outside edges of Main Plaza. 21-720
Garry Ford, Jr., Assistant Public Works Director/City Engineer

K) Approval of the second and final reading of an ordinance amending Section 126-136 and Section 126-137 of the City of New Braunfels Code of Ordinances to create school speed zones on West Klein Road and South Walnut Avenue, respectively. 21-721
Garry Ford, Jr., Assistant Public Works Director/City Engineer

3. INDIVIDUAL ITEMS FOR CONSIDERATION

A) Discuss and Consider a Resolution Adopting a Tax Increment Financing Policy 21-712
Jeff Jewell, Economic and Community Development Director

B) Discuss and consider changes to the Bylaws of the 21-713

Workforce Housing Advisory Committee
Jeff Jewell, Director of Economic and Community Development

C) Discuss and consider approval of the appointment of one individual to the Airport Advisory Board for an unexpired term ending 5/12/2022. 21-715
Caitlin Krobot, City Secretary

D) Render decision on the petition for relief from apportionment of municipal infrastructure costs associated with the proposed 1845 Subdivision located at 1890 FM 1044. 21-725
Garry Ford, Jr., Assistant Public Works Director/City Engineer

E) Public hearing and first 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 696 Orion Drive, from "APD AH" Agricultural/Pre-Development, Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home, Airport Hazard Overlay District. 21-699
Christopher J. Looney, AICP, Planning and Development Services Director

F) Public hearing and first 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. 21-700
Jean Drew, AICP, CNU-A; Planning and Development Services Assistant 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 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: 21-736

- House Bill 1520

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.

Agenda Item No. A)

PRESENTER:
Melissa Reynolds, First Assistant City Engineer
SUBJECT:
Presentation regarding proposed amendments to the City of New Braunfels Drainage and Erosion Control Manual and the Code of Ordinances, Chapter 58, Floods.
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, the Community Rating System (CRS) Improvement Report, and the City's Comprehensive Plan, Envision New Braunfels. 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 for 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.

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. Constructive feedback was offered and discussion on additional changes to Chapter 7 of the DCM was recommended by the stakeholders and has been incorporated in these updates.

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.

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.

ISSUE:
Envision New Braunfels:
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:
This item will be presented for discussion and action at the next City Council meeting. Staff recommends approval of the recommended updates.

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: July XX, 2021

Effective Date: Month 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

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)

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 floodplain 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.

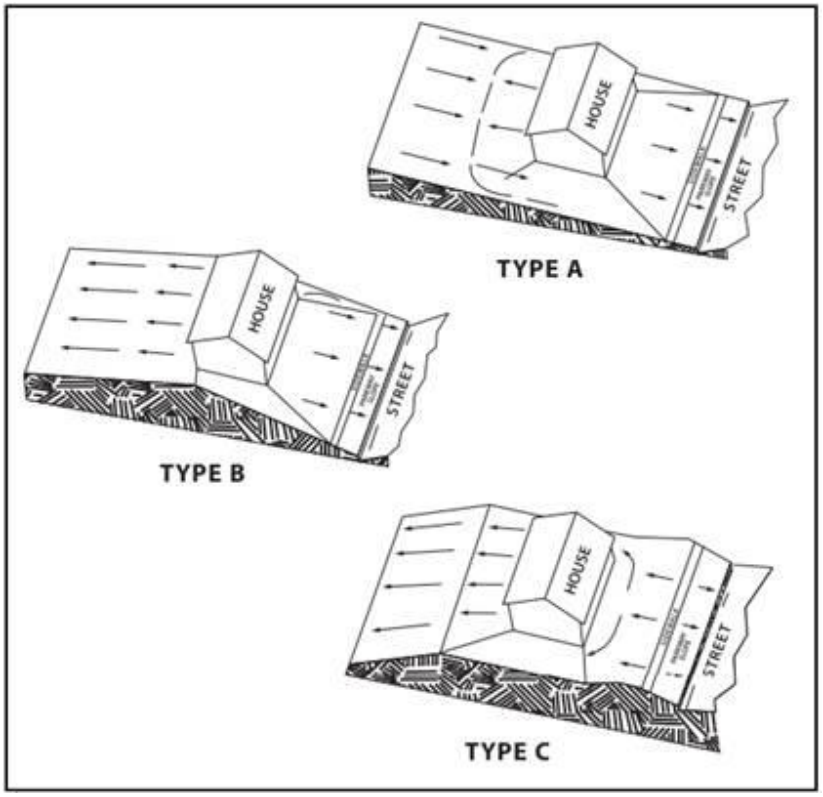
2.6 Finished Floor Elevations

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), 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.

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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 3-12) (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 3-2)
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 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.

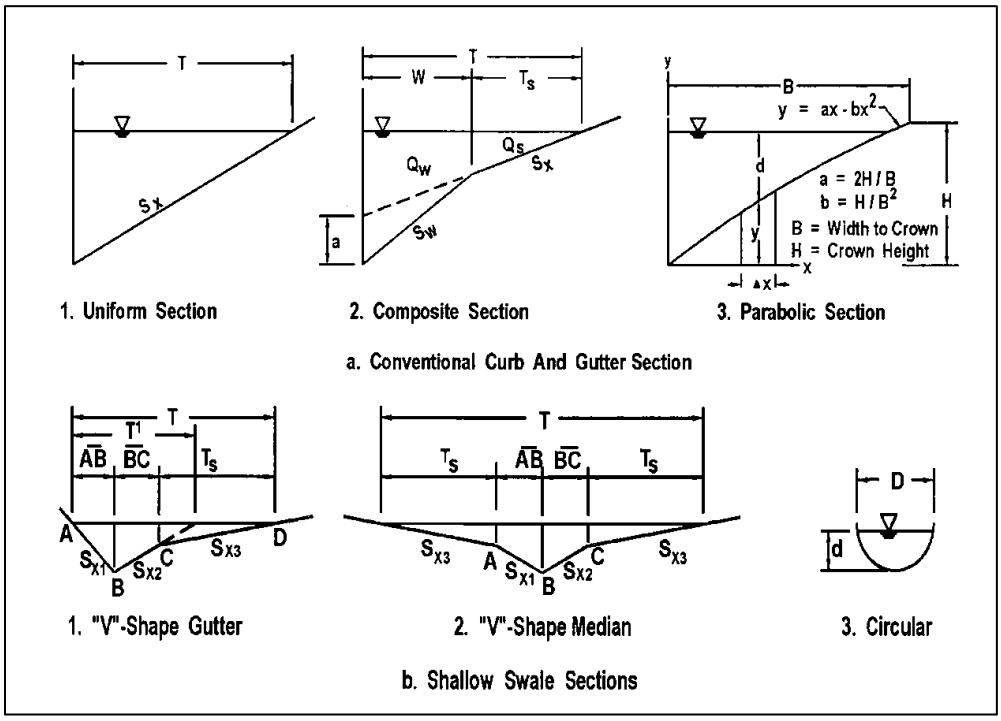
5.3 Street Flow Calculations

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.

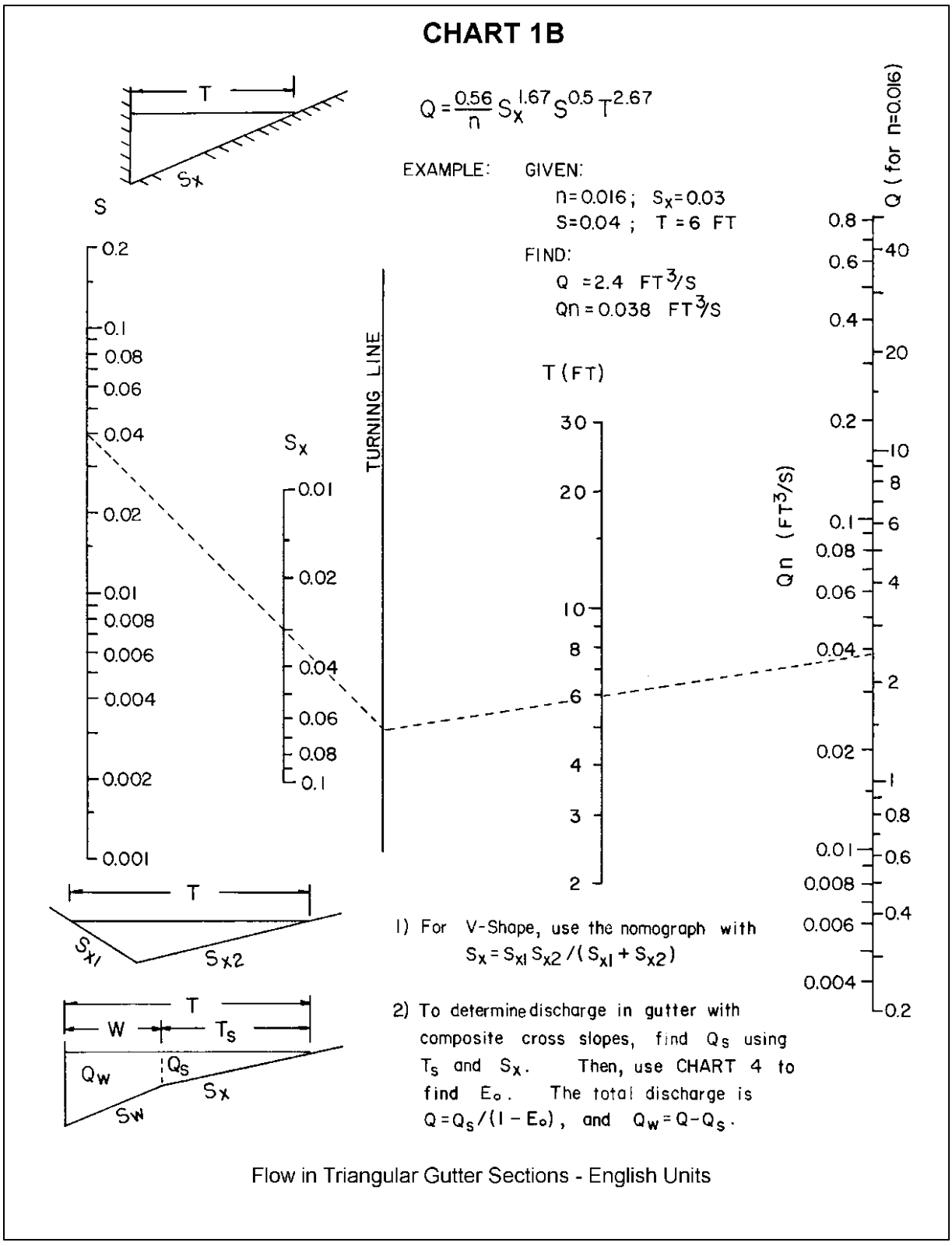
Spread on the pavement and flow depth at the curb are often used as criteria for spacing pavement drainage inlets. Figure 5-2 is a nomograph for solving Equation 5-1 and should be used as reference only, Figure 5-2 is not intended to replace equation 5-1. The chart can be used for either criterion with 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



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.

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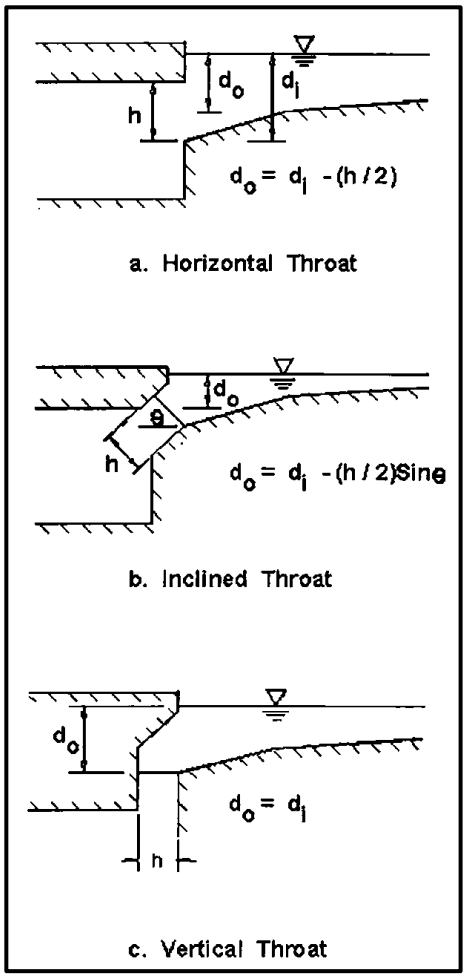
6 Inlet Design

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:

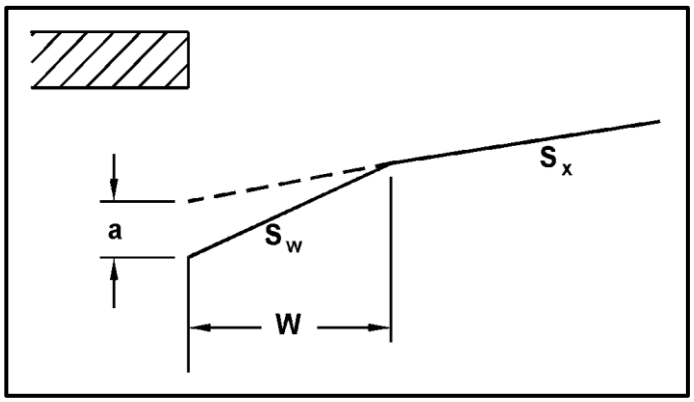
1. Inlets must be located where the allowable street flow capacities are exceeded, at low points (sumps or sags) and upstream of transition between normal and super-elevated street sections. Inlets should be located to intercept stormwater prior to traversing intersections.
2. In super-elevated sections 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



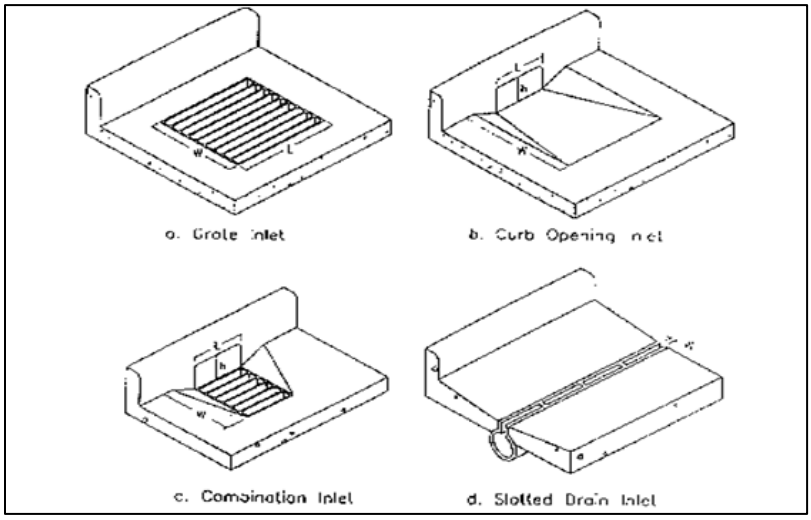
Source: *HEC 22* [5]

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:

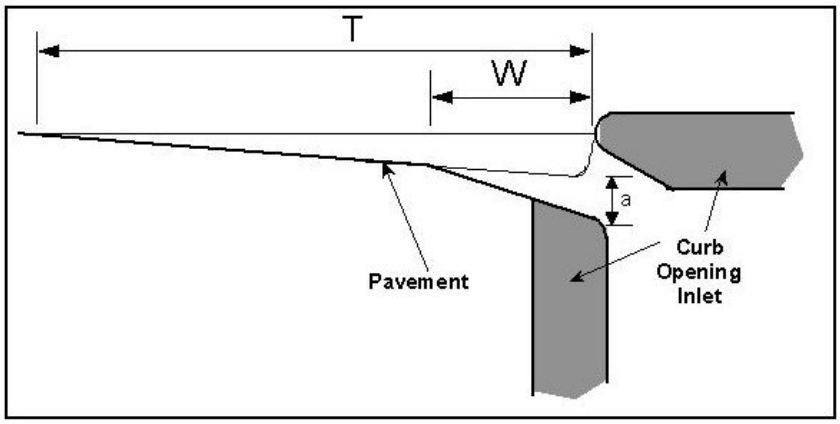
1. Compute depth of flow and ponded width (T) in the gutter section at the inlet.
2. Determine the ratio of the width of flow in the depressed section (W) to the width of total gutter flow (T) using Equation 6-1. Figure 6-4 shows the gutter cross section at an inlet.

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.

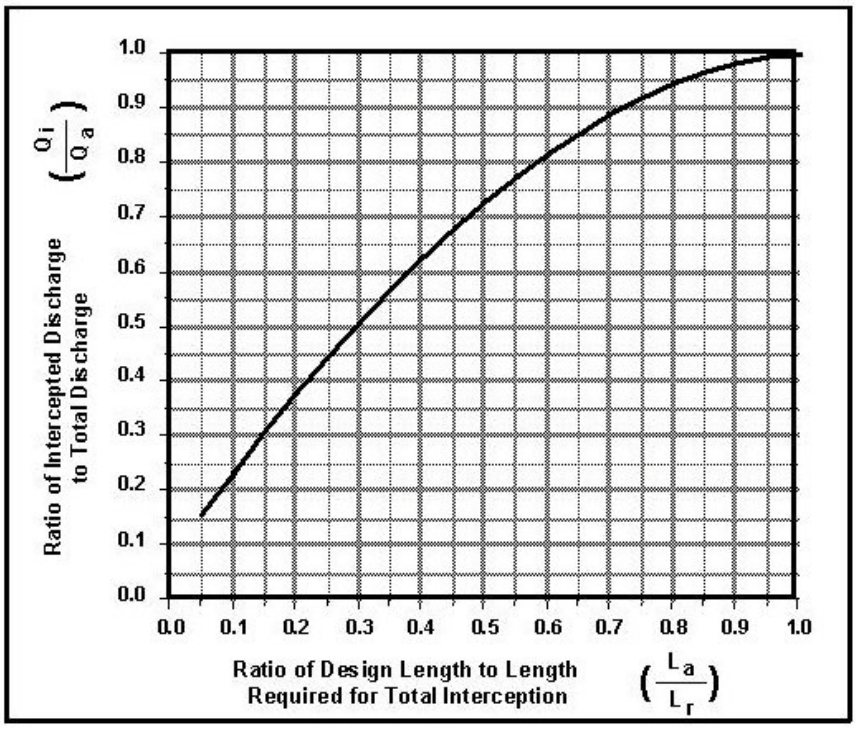
2. Select the desired design slotted drain length (L_a) based on standard inlet sizes. If $L_a < L_r$ the interception capacity may be estimated using Figure 6-5, multiplying the resulting discharge ratios by the total discharge. Alternatively, the carryover for a slotted drain inlet length may be directly 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:

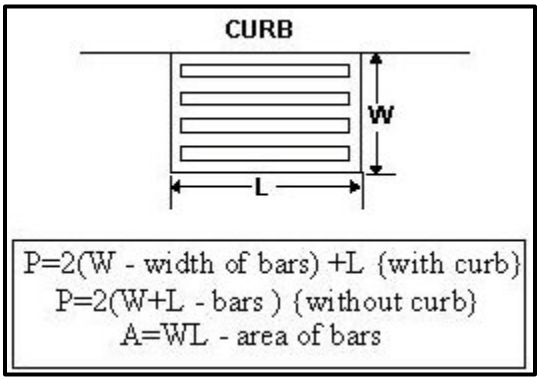
1. Choose a grate of standard dimensions to use as a basis for calculations.
2. Determine an allowable head (h) for the inlet location. This should be the lower of the curb height and the depth associated with the allowable ponded width. No gutter depression is applied at grate inlets.
3. Determine the 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.

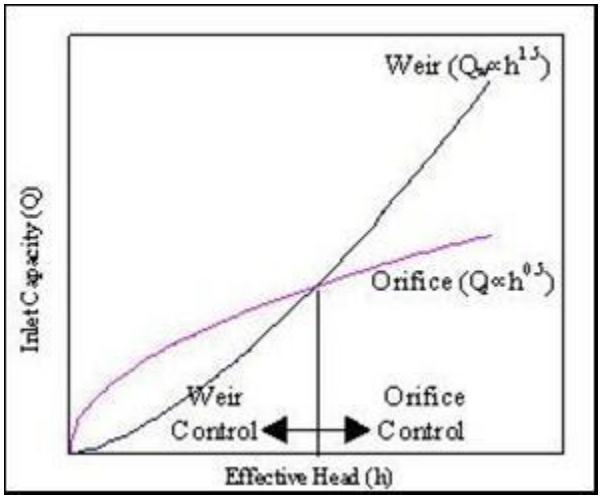
Equation 6-26

$$Q_o = C_o A \sqrt{2 g h}$$

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]

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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 at minimum 6 inches below 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.

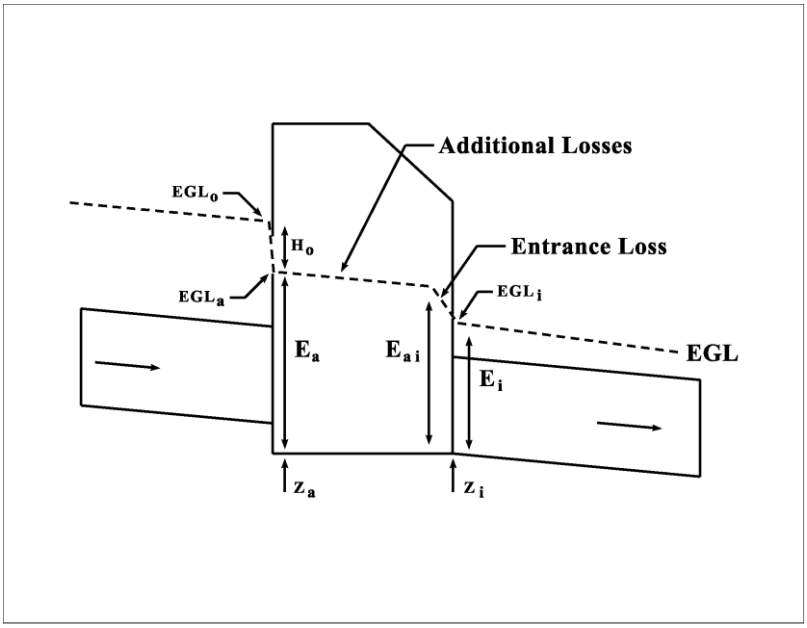
As a starting point, the outflow pipe energy head (E_i) is the difference between the energy gradeline in the outflow pipe (EGL_i) and the outflow pipe flowline (Z_i), as determined in Equation 7-6 and shown on Figure 7-1.

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:

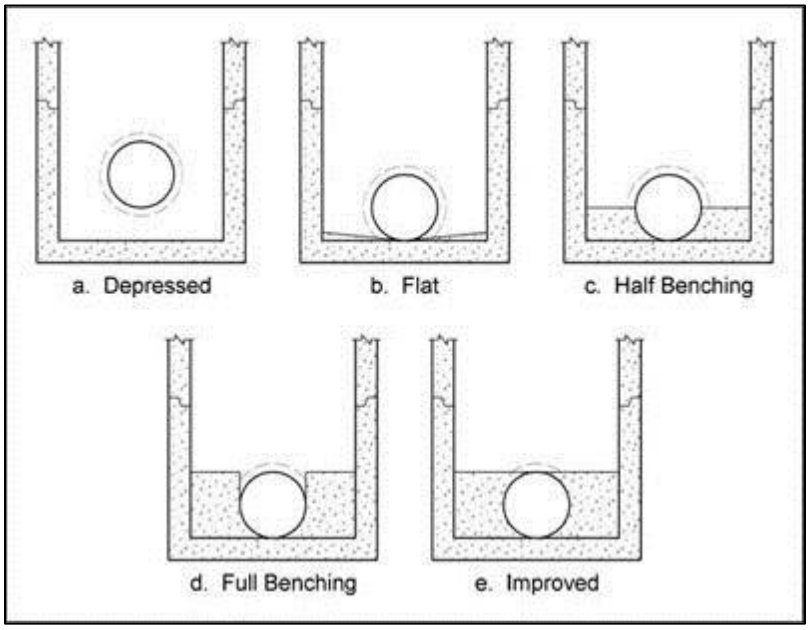
C_B = Coefficient for benching (floor configuration)
C_θ = Coefficient for angled flows
C_P = Coefficient for plunging flows.

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).

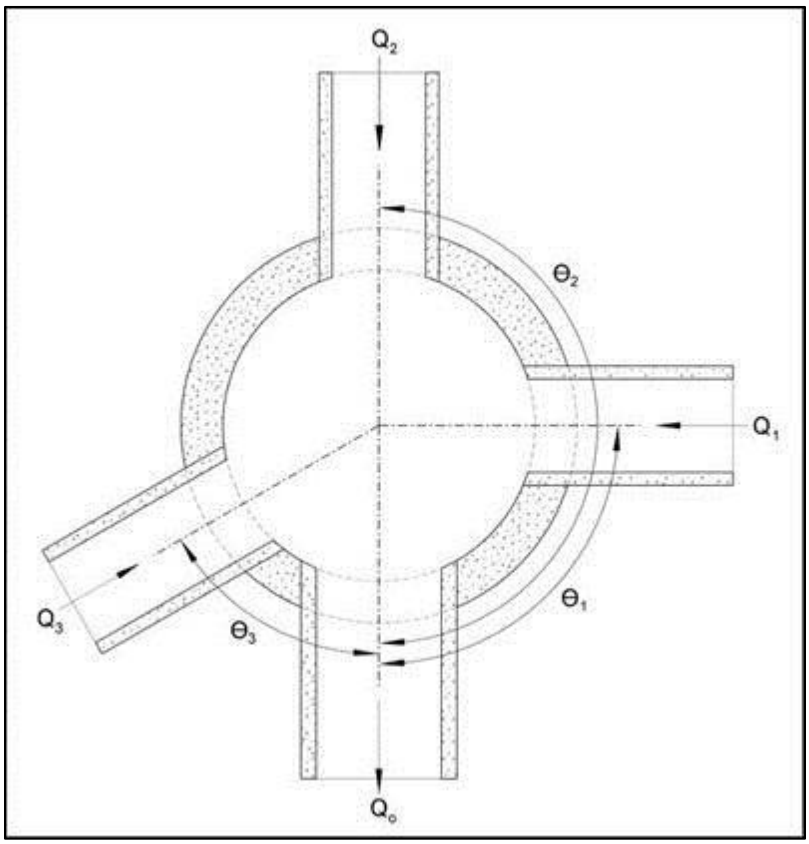
Figure 7-3 illustrates the orientation of the pipe inflow angle measurement. The angle for each inflow pipe is referenced to the outlet pipe, so that the angle is not greater than 180 degrees. A straight pipe angle is 180 degrees. If all flows are plunging, θ_w is set to 180 degrees; the angled inflow 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

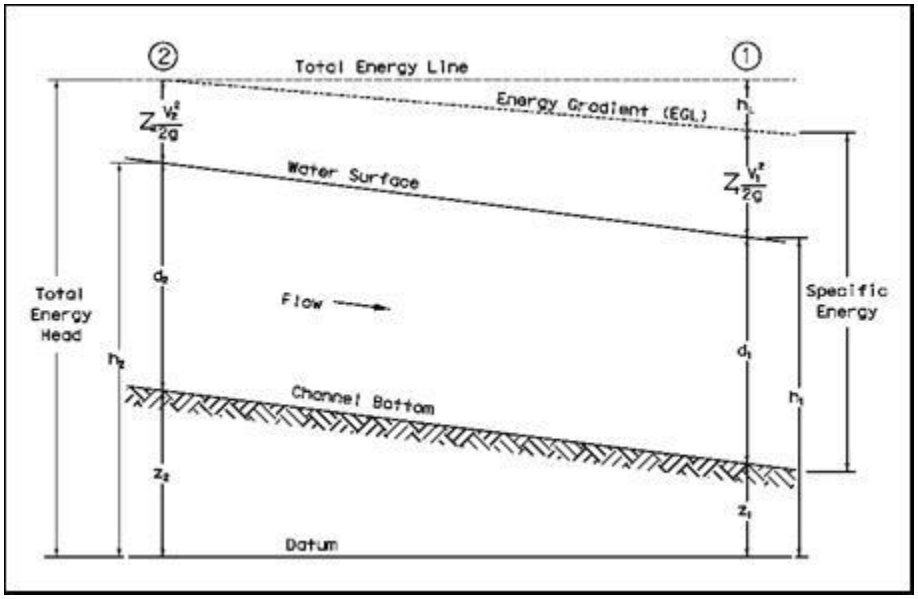
$$z_2 + d_2 + \alpha_2\left(\frac{v_2^2}{2g}\right) = z_1 + d_1 + \alpha_1\left(\frac{v_1^2}{2g}\right) + h_f + other\ losses$$

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.

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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.

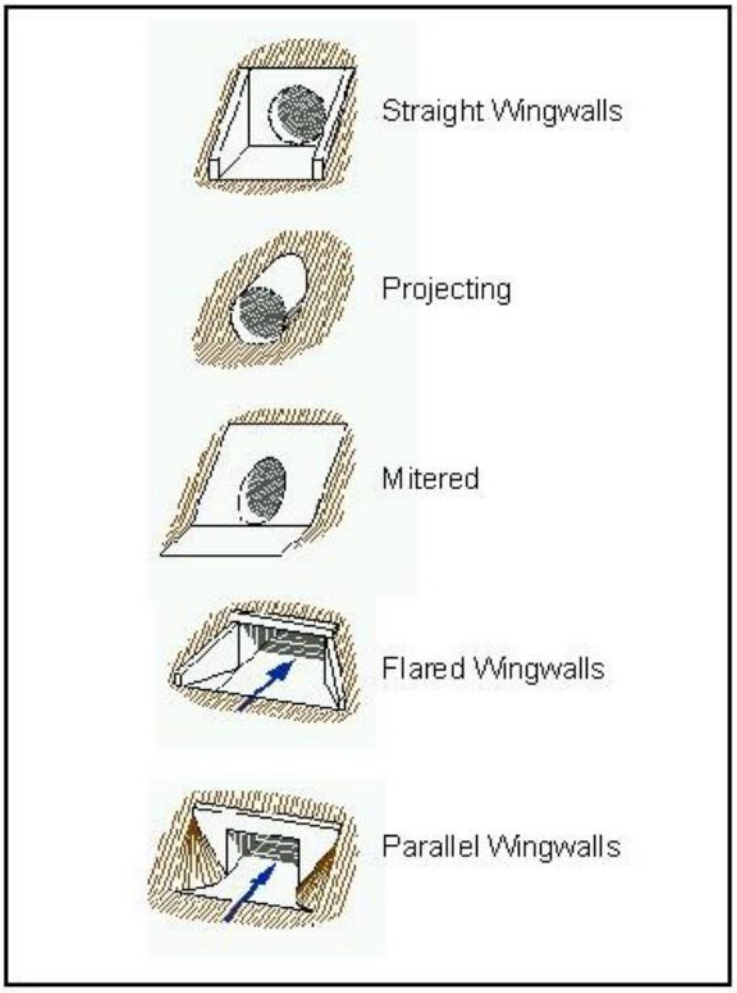
B. Alignment, location and grade of proposed culverts must be consistent with planned development of the drainage system for that watershed. In the event the particular watershed or waterway is not covered by a planned storm drainage system, the designer should proceed with the design from the nearest 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*.

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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

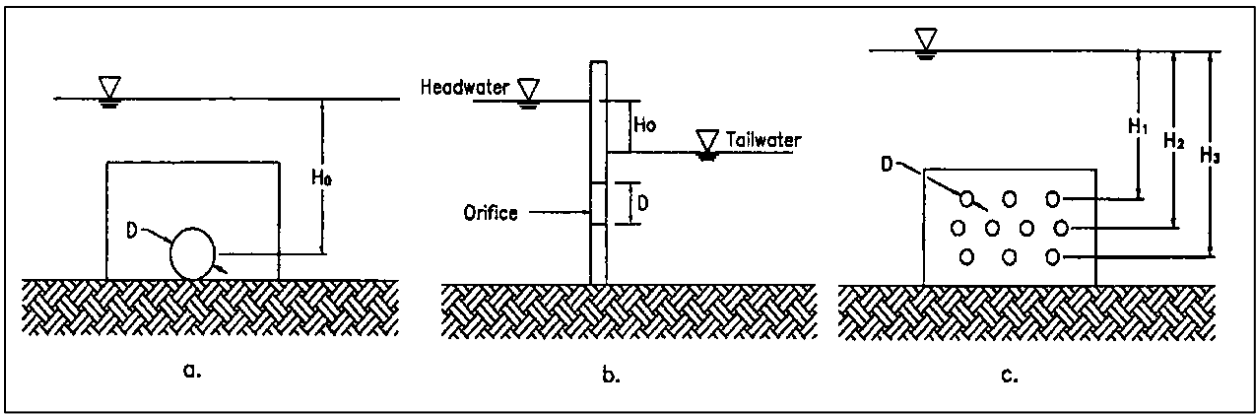
For a single orifice as illustrated in Figure 10-1 (a), orifice flow can be determined using Equation 10-1.

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

$$Q = C_{scw} L H^{1.5}$$

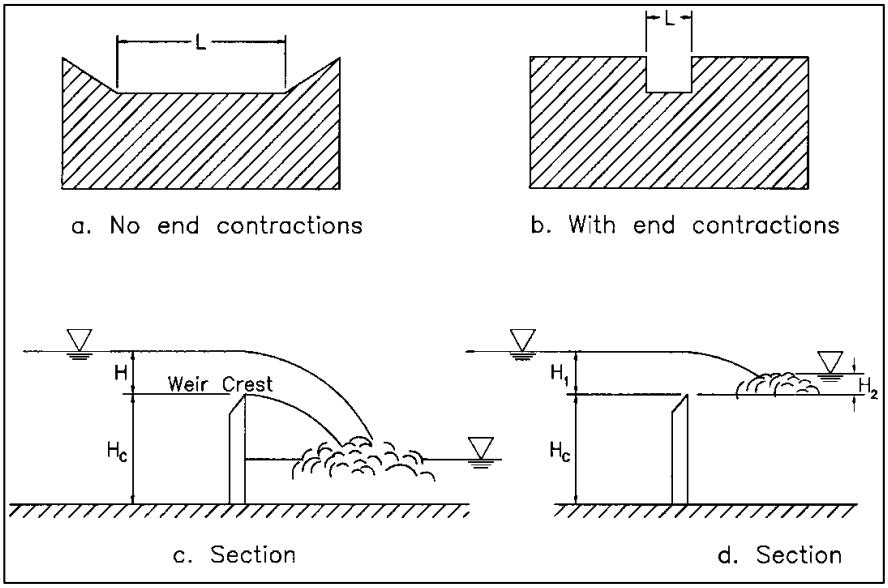
Where:
Q = Discharge (cfs)
L = Horizontal weir length (ft)
H = Head above weir crest excluding velocity head (ft)

$C_{SCW} = 3.27 + 0.4\ (H/H_C)$.

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

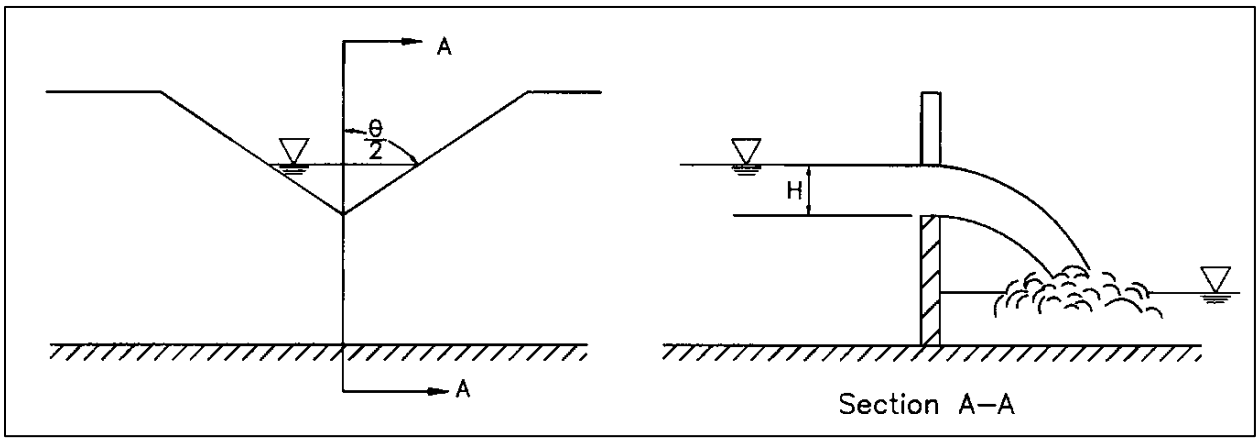
The discharge through a v-notch weir is shown in Figure 10-3 and can be calculated from the following equation:

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]

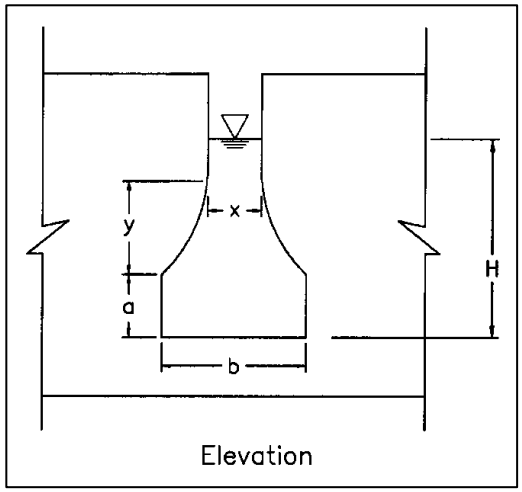
Equation 10-8

$$Q = K_u a^{0.5} b(H - a/3)$$

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.

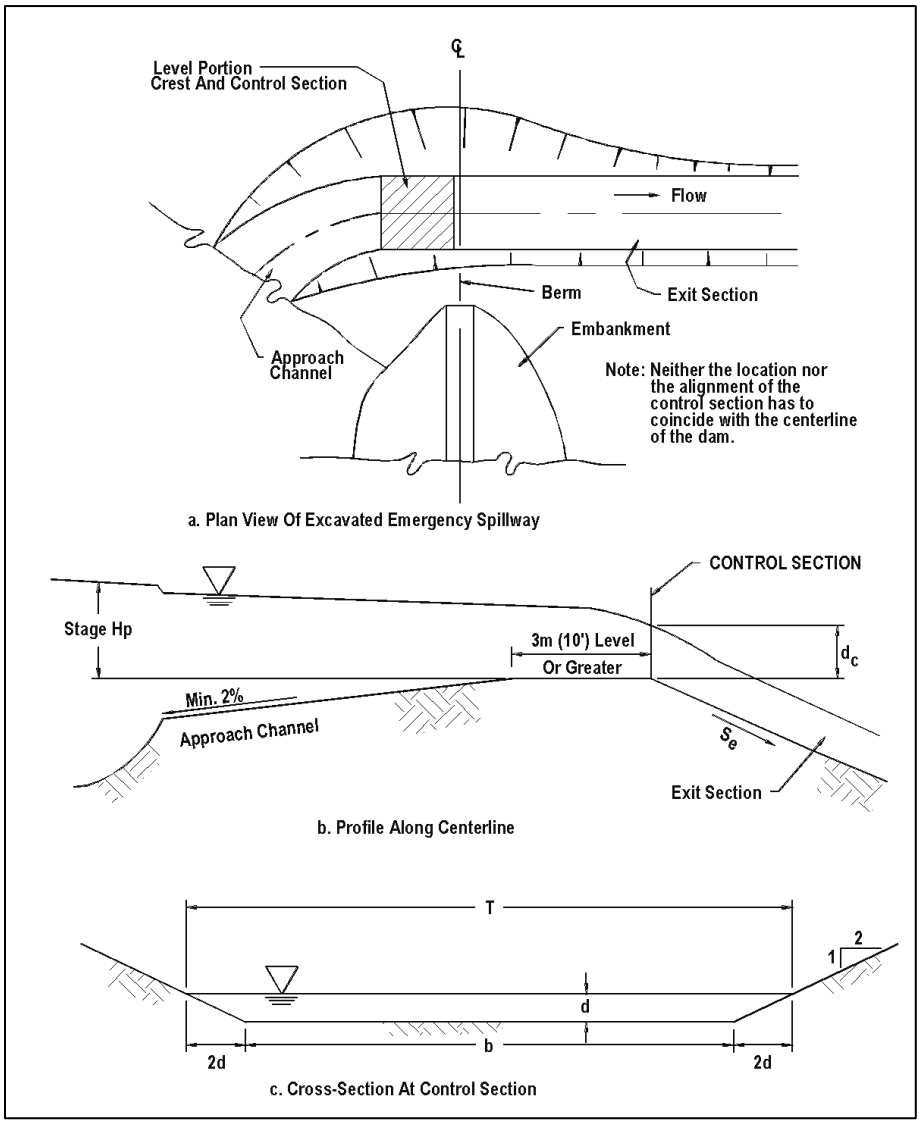
For multistage control structures, the inlet control structure would be designed considering the full range of flows. A stage-discharge curve would be developed for the full range of flows that the structure would experience. The design flows will typically be orifice flow through whatever shape the 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.

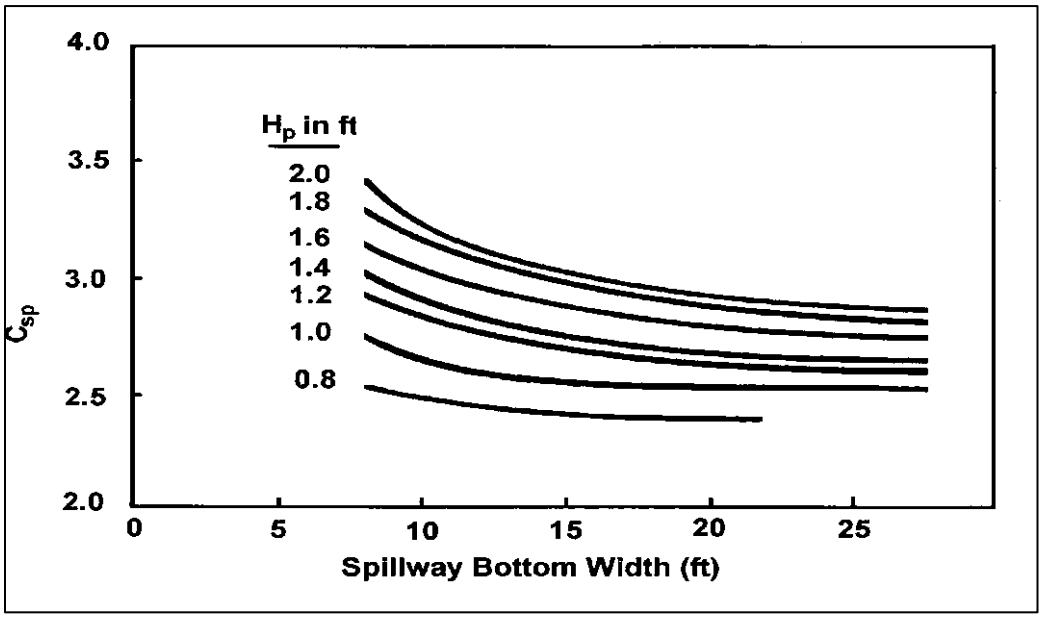
Equation 10-9

$$Q = C_{SP} b H_P{}^{1.5}$$

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]

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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.

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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.

Chapter 58 – FLOODS[1]

Footnotes:

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Cross reference- Buildings and building regulations, ch. 14; civil emergencies, ch. 34; environment, ch. 50; fire prevention and protection, ch. 54; health and sanitation, ch. 62; planning, ch. 98; platting, ch. 118; utilities, ch. 130; vegetation, ch. 134; vehicles for hire, ch. 138; zoning, ch. 144.

State Law reference- Municipal water control, V.T.C.A., Local Government Code§ 401.001 et seq.; municipal drainage utility systems, V.T.C.A., Local Government Code§ 402.041 et seq.; city-county water control, V.T.C.A., Local Government Code§§ 411.002, 411.003; Flood Control and Insurance Act, V.T.C.A., Water Code§ 16.311 et seq.; contracts with conservation districts for flood control and drainage, V.T.C.A., Agriculture Code§ 201.152; disaster prevention, V.T.C.A., Government Code§

418.121 et seq.

ARTICLE I. - IN GENERAL

Secs. 58-1-58-25. - Reserved.

ARTICLE II. - FLOOD DAMAGE PREVENTIONl.1J

Footnotes:

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Editor's note- 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.

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 his/her 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 RVs, 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 RVs, 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 Ciuncil 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 and plat the floodplain delineation as a drainage easement.

(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:

(7) 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.

(8) 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.

(9) 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.

ARTICLE III. - UNDERGROUND STORAGE TANK REGULATION

Sec. 58-56. - Definitions.

Edwards Recharge Zone. Generally, that area where the stratigraphic units constituting the Edwards Aquifer crop out, and including the outcrops of other formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features would create a potential for recharge of surface waters into the Edwards Aquifer. The recharge zone is identified as that area designated as such on official maps located in the offices of the Texas Natural Resource Conservation Commission (TNRCC) and the Edwards Aquifer Authority.

Tertiary protection. A method by which a third level of protection is provided for underground storage tank systems by means of either 1) a physical level to be installed around a double-walled tank and piping system, designed to prevent a release of the regulated substance as defined by the Environmental Protection Agency from migrating into the environment, should such a release go undetected at the secondary containment level; or 2) equivalent technology,

which shall include: a. continuous electronic leak detection for the entire system at a centralized location; b. site specific training; c. annual testing for system integrity; and d. reporting to the city sanitarian any release from the primary system.

Underground storage tank. Any one or combination of underground tanks and any connecting underground pipes used to contain an accumulation of regulated substances that is one percent or more under the natural level of the ground.

Underground storage tank system. An underground storage tank, all associated piping and ancillary equipment, spill and overfill prevention equipment, release detection equipment, corrosion protection system, secondary and tertiary containment equipment (as applicable), and all other related systems and equipment.

(Ord. No. 95-11, § 1(5-32), 3-13-95; Ord. No. 01-09, § I, 1-22-01)

Sec. 58-57. - Underground storage tanks.

(a) The installation of any new underground storage tank systems within the city limits of the City of New Braunfels and its extraterritorial jurisdiction is prohibited unless the underground storage tank system includes tertiary protection and meets all the requirements of this section.

(b) All new underground storage tanks shall meet the following standards:

(1) All new underground storage tank systems shall comply with this section and the most current regulations in 31 Texas Administrative Code, Chapter 334, Underground and Aboveground Storage Tanks, which is incorporated by reference as part of this chapter; and

(2) All new underground storage tanks shall require tertiary protection. A tertiary barrier shall consist of an artificially constructed material that is sufficiently thick and impermeable (at least 10-6 cm/sec or allow permeation at a rate of no more than 0.25 ounces per square foot per 24 hours for the regulated substance stored) and be able to direct a release to the monitoring point and permit its detection. The barrier material shall be compatible with the regulated substance stored so that a release from the underground storage tank system will not cause a deterioration of the barrier allowing a release to pass through undetected; or (and, if over the Edwards Recharge Zone)

(3) All new underground storage tank systems shall include a monitoring and leak detection system able to detect a release between the underground storage tank and the tertiary barrier. The monitoring and release detection system must be capable of detecting a two-tenths gallon per hour leak rate or a release of 150 gallons within 30 days such that the probability of detection shall be at least 90 percent and the probability of false alarm shall be no greater than five percent.

(4) In the event the new underground storage tank and underground storage tank system is located over the Edwards Recharge Zone, that facility shall comply with subsection 58-57(b)(1), (2) and (3).

(c) The property where a new underground storage tank is located shall contain a reasonable amount of impermeable material on the surface of the ground and an emergency drainage system to direct regulated substances to a safe location and to prevent any regulated substance from leaking into the ground. The city fire marshal! may require curbs, scuppers, or a special drainage system to carry out

the purpose of this section. The facility shall also be equipped with a hazardous material trap to prevent the discharge or leakage of regulated substances to public waterways, public sewers or adjoining property.

(Ord. No. 95-11, § I(5-33), 3-13-95; Ord. No. 01-09, § II, 1-22-01)

Sec. 58-58. - Reserved.

Sec. 58-59. - Nuisance.

The placement of any new underground storage tanks within the city limits or extraterritorial jurisdiction of the City of New Braunfels that are not in compliance with this section is hereby declared to be a nuisance.

(Ord. No. 01-09, § III, 1-22-01)

Sec. 58-60. - Penalty.

(a) *Criminal penalty.* It shall be unlawful and a Class C Misdemeanor for any person, firm, or corporation to violate any provision of this article. No culpable mental state shall be required and the requirement of a culpable mental state pursuant to Chapter 6.02 of the Texas Penal Code is hereby specifically negated. The fine for a violation of this article shall be not less than $500.00 nor more than $2,000.00. Each day the violation exist shall constitute a new offense.

(b) *Civil penalty.* Nothing in this article shall prohibit the City of New Braunfels from taking the appropriate civil action to enjoin and abate any action hereby prohibited.

(Ord. No. 01-09, § IV, 1-22-01)

Agenda Item No. A)

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Discuss and consider approval of minutes of the City Council meeting of July 12, 2021 and the Executive Session of July 12, 2021.

City of New Braunfels, Texas

550 Landa Street

Minutes

Monday, July 12, 2021

5:00 PM

Rusty Brockman, Mayor – excused absence
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) – excused absence
James Blakey, Councilmember (District 6) – present

City Council - Executive Session

Item 1A has been pulled from consideration.

The meeting was called to order by Mayor ProTem Meadows at 5:08 p.m.

1. 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 the purchase, exchange, lease or value of real estate in Accordance with Section 551.072 of the Texas Government Code, specifically

- City Facilities

B) Deliberate issues regarding economic development negotiations in

Accordance with section 551.087 of the Texas Government Code.

- Project Hot shots
- Taskus

Mayor ProTem Meadows stated caption A was pulled by staff and read the aforementioned caption B and recessed into Executive Session at 5:09 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).

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

Mayor ProTem Meadows reconvened into open session at 5:52 p.m.

No action was taken.

ADJOURNMENT

Mayor ProTem Meadows adjourned at 5:52 p.m.

_____
Justin Meadows, Mayor ProTem

\

_____
Caitlin Krobot, City Secretary

City of New Braunfels, Texas

550 LANDA STREET

Minutes

Monday, July 12, 2021

6:00 PM

CITY COUNCIL

Rusty Brockman, Mayor – excused absence
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) – excused absence
James Blakey, Councilmember (District 6) – present

The meeting was called to order by Mayor ProTem Meadows at 6:01 p.m. Councilmember Blakey gave the invocation and Mayor ProTem Meadows led the Pledge of Allegiance and 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.

Bill Schwind, Bob Moore, Jim Holster, Richard Zapata, and David Gonzalez spoke during Citizens Comments.

PRESENTATIONS:

A) Presentation and possible action directing staff to bring forward amendments to various development-related ordinances to streamline processes that require certain items to appear before City Council for final decision.

Mayor ProTem Meadows read the aforementioned caption.

Christopher Looney presented this item.

The consensus from Council was to proceed and bring a plan forward to Council.

B) Presentation regarding the alignment of City board and Commission terms to occur in the Fall and Spring.

Mayor ProTem Meadows read the aforementioned caption.

The following individual spoke on this item: Jim Holster

Caitlin Krobot presented this item.

1. MINUTES

A) Discuss and consider approval of the minutes of the Special City Council meeting of June 8, City Council meeting of June 28, the Executive Session meeting of June 28th, and the Special City Council meeting of June 30, 2021.

Mayor ProTem Meadows read the aforementioned caption.

Councilmember Hines moved to approve this item. Mayor ProTem Meadows seconded the motion which was approved 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) Approval for annual software maintenance renewal of Cityworks PLL software through Azteca Systems, LLC.

B) Approval for the submission of the Community Development Block Grant Annual

Action Plan, and associated funding recommendations, for Program Year 2021 to the. U.S Department of Housing and Urban Development.

Ordinances

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

C) Approval of the second and final reading of an ordinance regarding a proposed rezoning to apply a Special Use Permit to allow short term rental of a single-family dwelling in the "C-3" Commercial District, addressed at 218 South Peach Avenue.

D) Approval of the second and final reading of an ordinance regarding a proposed rezoning to apply a Type 2 Special Use Permit to adopt a site plan and establish development standards for an RV Resort on approximately 29 acres consisting of Lot 1D-R Walnut Heights Subdivision and approximately 25 acres out of the J. M. Veramendi A-2 Survey, located in the 700 block of N. Walnut Avenue.

E) Approval of the second and final reading of an ordinance regarding the requested abandonment of a 0.366-acre portion of Tolle Street Right-of-Way, located between South Gilbert Avenue and the terminus of Tolle Street.

F) Approval of the second and final reading of an ordinance to revise sections *144 -1.3, Definitions,* to define efficiency/studio apartments, and *144-5.1-3 Schedule of Required Spaces* to identify parking standards for efficiency/studio apartments.

G) Approval of the second and final reading of an Ordinance of the City Council of the City of New Braunfels, Texas Amending the Project Plan and Reinvestment Zone Financing the Reinvestment Zone Number One, City of New Braunfels, Texas; Approving a Second Amendment to the Economic Development Agreement Between the City of New Braunfels, Texas, and A-L 95 Creekside Town Center, L.P.; and Other Matters in Connection Therewith.

Mayor ProTem Meadows stated Consent item A was pulled by staff and Consent items D and E were pulled by William Rogers for individual consideration.

Mayor ProTem Meadows read the aforementioned captions, Consent items B,C,F, and G.

Councilmember Hines moved to approve Consent items B,C, F, and G. Councilmember Bowers seconded the motion which passed unanimously via roll call vote.

3. INDIVIDUAL ITEMS FOR CONSIDERATION

D) Approval of the second and final reading of an ordinance regarding a proposed rezoning to apply a Type 2 Special Use Permit to adopt a site plan and establish development standards for an RV Resort on approximately 29 acres consisting of Lot 1D-R Walnut Heights Subdivision and approximately 25 acres out of the J. M.

Veramendi A-2 Survey, located in the 700 block of N. Walnut Avenue.

Mayor ProTem Meadows read Consent item D into record.

Christopher Looney presented this item.

The following individuals spoke on this item: William Rogers and James Ingalls.

Councilmember Hines moved to approve this item. Councilmember Bowers seconded the motion which passed 4-1 with Councilmember Blakey in opposition.

E) Approval of the second and final reading of an ordinance regarding the requested abandonment of a 0.366-acre portion of Tolle Street Right-of-Way, located between South Gilbert Avenue and the terminus of Tolle Street.

Mayor ProTem Meadows read Consent item E into record.

Christopher Looney presented this item.

The following individuals spoke on this item: William Rogers, Richard Zapata, Timothy Davis,

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

Mayor ProTem Meadows took a break due to technical difficulties at 7:13 p.m. and reconvened at 7:20 p.m.

A) Discuss and consider approval of a resolution naming an alternate to the Alamo Area Council of Governments Board of Directors.

Mayor ProTem Meadows read the aforementioned caption.

Caitlin Krobot presented this item.

Councilmember Blakey nominated and moved to appoint Councilmember Spradley as an alternate for the Alamo Area Council of Governments Board of Directors (AACOG). Councilmember Hines seconded the motion which passed unanimously 4-0 via roll call vote. Councilmember Spradley abstained from voting.

B) Discuss and consider the second and final reading of an ordinance regarding a proposed rezoning of approximately 60.1 acres out of the J. Thompson Survey, A-608 and William H. Pate Survey, A-259 located east of the intersection of FM 1044 and Michelson Lane, from "APD" Agricultural/Pre-Development District to "ZH-A" Zero Lot Line Home District.

Mayor ProTem Meadows read the aforementioned caption.

Christopher Looney presented this item.

Councilmember Hines moved to approve this item. Councilmember Bowers seconded the motion

with passed 4-1 with Councilmember Spradley in opposition.

C) Discuss and consider approval of the installation of speed humps on Misty Acres Drive between SH 46 and Lake Front Avenue.

Mayor ProTem Meadows read the aforementioned caption.

Greg Malatek presented this item.

The following individuals spoke on this item: Richard Zapata, Aaron Mitchell, and Paula Burny.

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

D) Discuss and consider approval of the first reading of an ordinance to install an all-way stop at the intersection of W County Line Road and Chartwell Entry.

Mayor ProTem Meadows read the aforementioned caption.

Greg Malatek presented this item.

The following individuals spoke on this item: Linda Schmitt, Mr. Salazar, Gary Schmitt, Roy Chandler, Pedro Flores, Miguel Madero, Teresa Flores, Rebecca Byford, and John Maque.

Mayor ProTem Meadows moved to postpone this item with a date specific of August 9, 2021. Councilmember Blakey seconded the motion which passed unanimously via roll call vote.

E) Public hearing and first reading of an ordinance amending Section 126-346 of the City of New Braunfels Code of Ordinances to restrict parking around the landscaped islands on the outside edges of Main Plaza.

Mayor ProTem Meadows read the aforementioned caption.

Greg Malatek presented this item.

The following individual spoke on this item: Bob Moore

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

F) Public hearing and first reading of an ordinance amending Section 126-136 and Section 126-137 of the City of New Braunfels Code of Ordinances to create school speed zones on West Klein Road and South Walnut Avenue, respectively.

Mayor ProTem Meadows read the aforementioned caption.

Greg Malatek presented this item.

Councilmember Hines moved to approve this item. Councilmember Bowers 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 the purchase, exchange, lease, or value of real estate in Accordance with Section 551.072 of the Texas Government Code, specifically

- City Facilities

B) Deliberate issues regarding economic development negotiations in Accordance with section 551.087 of the Texas Government Code.

- Project Hot shots
- Taskus

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.

No action taken at this time.

ADJOURNMENT

Mayor ProTem Meadows adjourned at 8:48 p.m.

_____
Justin Meadows, Mayor ProTem

_____
Caitlin Krobot, City Secretary

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Approval of the Mayoral appointment of Francisco Dionisio and Cheryl Denton and reappointment of Nathan Manlove and Mary Irwin to the New Braunfels Partnership Committee for terms ending August 1, 2024.

DEPARTMENT: City Secretary's Office

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
Per Section 30-61 of the New Braunfels Code of Ordinances, the Mayor appoints members to the New Braunfels Partnership Committee with City Council approval. The Partnership Committee has 15 members serving three-year staggered terms, where members can reside in the city limits or in the ETJ.

ISSUE:
The New Braunfels Partnership Committee members are selected by the Mayor and confirmed by City Council.

FISCAL IMPACT:
No fiscal impact.

RECOMMENDATION:
Staff recommends approval.

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Approval of the Mayoral appointment of Jacob Yaklin and reappointment of John Malik and Tobin Hoffmann to the Reinvestment Zone No. 1 (TIRZ) Board of Directors and the New Braunfels Development Authority for terms ending May 29, 2023.

DEPARTMENT: City Secretary's Office

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
Reinvestment Zone No. 1 serves the Creekside Development by facilitating a program of public improvements within the Zone. The ordinance that created the Zone provides that the Mayor appoints the members with City Council approval. The TIRZ has seven members, designated by place number, serving two-year staggered terms. Place one through five are selected at-large, place six must be a representative of Comal County, and place seven must be a representative of the Comal Independent School District.

The following individuals are being appointed:
John Malik - Place 1 (reappointment)
Jacob Yaklin - Place 3
Tobin Hoffmann Place 5 (reappointment)

ISSUE:
The TIRZ Board appointments are selected by the Mayor and confirmed by City Council.

FISCAL IMPACT:
No fiscal impact.

RECOMMENDATION:
Staff recommends approval.

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Approval of the Mayoral appointment of Tobin Hoffmann as the Chair of the Reinvestment Zone No. 1 (TIRZ) Board of Directors and the New Braunfels Development Authority.

DEPARTMENT: City Secretary's Office

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
Reinvestment Zone No. 1 serves the Creekside Development by facilitating a program of public improvements within the Zone. The ordinance that created the Zone provides that The Mayor appoints a member annually to serve as Chair subject to City Council approval.

ISSUE:
The Chair of the TIRZ is appointed annually and approved by City Council.

FISCAL IMPACT:
No fiscal impact.

RECOMMENDATION:
Staff recommends approval.

PRESENTER:
Tony Gonzalez, Director of Information Technology

SUBJECT:
Approval of an annual software maintenance renewal for Cityworks PLL through SHI.

DEPARTMENT: Information Technology

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
In 2018 the City purchased Cityworks PLL (Permits, Licensing and Land) software to replace the outdated Accela software. Over the last three years the City has implemented Cityworks for Planning, Engineering, Building, Solid Waste and New Braunfels Fire Department. Many other departments are planned to become users of Cityworks, where appropriate. The City has made a sizeable time and financial commitment in Cityworks, including the launch of the Customer Portal, digital plan submission, automated workflows, reports, etc.

This renewal is offered through a State of Texas DIR contract, which satisfies all competitive bidding requirements. The annual cost is $63,158.

ISSUE:
The current software maintenance agreement expires on 8/26/2021.

FISCAL IMPACT:
The Cityworks annual software maintenance cost is incorporated into the Information Technology Department Operating Budget. Therefore, sufficient funds are available for this purchase.

RECOMMENDATION:
Staff recommends approval of the purchase of the Cityworks Annual Software Maintenance.

Pricing Proposal
Quotation #: 20718267
Created On: 7/9/2021
Valid Until: 7/30/2021

City of New Braunfels

Tony Gonzalez
TX
United States
Phone: 830-221-4339
Fax:
Email: TGonzalez@nbtexas.org

Inside Account Manager

Brett Yajcaji
SHI Government Solutions
3828 Pecana Trail
Austin, TX 78749
Send PO to: Texas@shi.com
Phone: 732-652-0255
Fax:
Email: Brett_Yajcaji@shi.com

All Prices are in US Dollar (USD)

	Product	Qty	Your Price	Total
1	Server PLL Standard ELA License cityworks - Part#: Contract Name: BuyBoard - Technology Contract #: 579-19 Coverage Term: 8/27/2021 – 8/26/2022	1	$63,158.00	$63,158.00

Subtotal	$63,158.00
Shipping	$0.00
Total	$63,158.00

Additional Comments

Hardware items on this quote may be updated to reflect changes due to industry wide constraints and fluctuations.

The products offered under this proposal are resold in accordance with the terms and conditions of the Contract referenced under that applicable line item.

PRESENTER:
Tony Gonzalez, Director of Information Technology

SUBJECT:
Approval of the purchase of power system units through GTS, Inc. to support the networking and computing equipment in Fire Station 2, Fire Station 3 and the Police Department Headquarters.

DEPARTMENT: Information Technology

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
As a part of the 2019 Bond, the new buildings being constructed for Fire Station 2, Fire Station 3 and the Police Department, the IT Department intends to purchase uninterruptible power supplies and power distribution units. These units provide power to various IT equipment that helps protect the equipment during power surges and outages, while also allowing the connected critical equipment to stay operational until generator supplied power kicks in for extended outages.

The costs are as follows:
Fire Station 2 - $1,535
Fire Station 3 - $1,535
Police Building - $52,170

This purchasing is through a State of Texas DIR contract, therefore meeting all competitive bid purchasing requirements.

ISSUE:
These devices provide power protection and computing resource uptime.

FISCAL IMPACT:
Funds for this purchase are available in the various projects approved through the 2019 Bond Package.

RECOMMENDATION:
Staff recommends approval of purchase of power systems through GTS, Inc. to support the networking and computing equipment in Fire Station 2, Fire Station 3 and Police Headquarters.

GTS Technology Solutions, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote

Quote #:	**QT0072344**
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
POWER FS2 EATON	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	5PX2200RTN: Eaton 5PX 2200RT+NETWORK-MS CARD	DIR-CPO-4751	1.00	EACH	$1,535.00	$1,535.00

Total Weight (EACH):	0	**Sales Total:**	$1,535.00
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$1,535.00

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, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote

Quote #:	**QT0072345**
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
POWER FS3 EATON	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	5PX2200RTN: Eaton 5PX 2200RT+NETWORK-MS CARD	DIR-CPO-4751	1.00	EACH	$1,535.00	$1,535.00

Total Weight (EACH):	0	**Sales Total:**	$1,535.00
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$1,535.00

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, Inc.
9211 Waterford Centre Blvd
Suite 275
Austin, TX, 78758
Phone: (512) 452-0651

Quote

Quote #:	**QT0072346**
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
POWER PD EATON	Due on receipt	Ben Horsey

SHIPPING TERMS	SHIP VIA

NO.	ITEM	CONTRACT	QTY.	UOM	PRICE	EXTENDED PRICE
1	MDF					
2	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	6.00	EACH	$3,800.00	$22,800.00
3	RK2PC: 2POST 9PX RAIL KIT	DIR-CPO-4751	2.00	EACH	$80.00	$160.00
4	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	2.00	EACH	$969.00	$1,938.00
5	EMI104-10: EPDU MI 38U-A IN L6-30P 24A OUT 36XC13	DIR-CPO-4751	4.00	EACH	$473.00	$1,892.00
6	IDF 1201					
7	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	1.00	EACH	$3,800.00	$3,800.00
8	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	1.00	EACH	$969.00	$969.00
9	IDF 1706					
10	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	1.00	EACH	$3,800.00	$3,800.00
11	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	1.00	EACH	$969.00	$969.00
12	IDF 2015					
13	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	1.00	EACH	$3,800.00	$3,800.00
14	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	1.00	EACH	$969.00	$969.00
15	IDF 1504					
16	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	1.00	EACH	$3,800.00	$3,800.00
17	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	1.00	EACH	$969.00	$969.00
18	IDF 2004					
19	9PX5K: 9PX 5KVA NEMA	DIR-CPO-4751	1.00	EACH	$3,800.00	$3,800.00
20	EMAT06-10: EPDU MA 1U IN L6-30P 24A 1P OUT 10XC13	DIR-CPO-4751	1.00	EACH	$969.00	$969.00
21	IDF-A124					
22	5PX2200RTN: Eaton 5PX 2200RT+NETWORK-MS CARD	DIR-CPO-4751	1.00	EACH	$1,535.00	$1,535.00

Total Weight (EACH):	0	**Sales Total:**	$52,170.00
Total Volume (EACH):	0	**Freight & Misc.:**	$0.00
		Tax Total:	$0.00
		Total (USD):	$52,170.00

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:
Barbara Coleman, Purchasing Manager

SUBJECT:
Approval of a lease agreement with Ricoh USA for the Citywide rental and services of multi-function copier devices through a BuyBoard cooperative agreement.

DEPARTMENT: Finance

COUNCIL DISTRICTS IMPACTED:
N/A

BACKGROUND INFORMATION:
The City is currently under a five-year contract with Ricoh USA for the lease of multi-function copier devices (MFD) which will expire September 30, 2021. Staff were surveyed to get a better understanding of vendor compatibility and equipment needs. Ricoh has provided excellent services and the equipment to support the City's needs. Staff are in support of the continued use of Ricoh equipment and services. The multifunction equipment is an office machine that incorporates the functionality of multiple devices into one that allows the user to make copies, send faxes, scan, and print documents from the city network. The recommended new contract will support the lease and maintenance of 33 pieces of equipment with an annual pool volume of copies and incorporates a cloud-based fax solution. The pooled allowances are developed based on historic annual volumes for black/white images and color.

Ricoh has been competitively bid and awarded through the BuyBoard Cooperative; therefore, satisfies procurement requirements. Staff are recommending this contract for a new five-year lease agreement. The estimated annual cost for all MFD equipment and services is $110,323 for a five-year (60-month) term effective October 1, 2021 through September 30, 2026. Annual costs may vary if the City exceeds their annual pooled copy allowances and as new equipment is added. Each department will be responsible for overage costs exceeding their copy allowances.

ISSUE:
City Plan/Council Priority: Maintain an ongoing program for improving customer service Maintain fiscal stability of City Operations.

FISCAL IMPACT:

The recurring cost for this contract is allocated in each individual department's budget and is incorporated into the FY22 Operating Budget.

RECOMMENDATION:
Staff recommends approval of a lease agreement with Ricoh USA for the Citywide rental and services of multi-function copier devices through a BuyBoard cooperative agreement.

PRESENTER:
Matthew Eckmann, Facilities and Real Estate Manager

SUBJECT:
Approval of and authorization for the City Manager to execute an amendment to lease agreement between the City of New Braunfels and Connections Individual and Family Services, Inc relating to the property located at 705 Comal Avenue.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: District 5

BACKGROUND INFORMATION:
The City and Connections entered into a lease agreement with an effective date of October 25, 2016 and an expiration date of October 24, 2021. The lease agreement contains a provision that allows for the extension of the lease for an additional five (5) years upon at least thirty (30) days written request from the Lessor. The lease extension is subject to modification in terms and conditions as agreed to by the City and Connections.

ISSUE:
Recently the City has updated our insurance requirements and in order to bring this agreement into compliance and allow for the requested extension, the City and Connections have agreed to the attached lease amendment. All other terms and conditions in the existing lease will remain in effect.

FISCAL IMPACT:
The consideration for the current lease and proposed amendment is $10.00 annually.

RECOMMENDATION:
Staff recommends approval of this amendment.

AMENDMENT TO LEASE AGREEMENT

STATE OF TEXAS §
§ **KNOW ALL MEN BY THESE PRESENTS:**
COUNTY OF COMAL §

WHEREAS, CONNECTIONS INDIVIDUAL AND FAMILY SERVICES, Inc. a Texas Non-Profit Corporations (Connections), hereinafter referred to as "Lessee" and, THE CITY OF NEW BRAUNFELS, TEXAS, a home rule municipal corporation (The City), acting by and through its City Manager, Robert Camareno, hereinafter referred to as "Lessor", entered into a lease agreement for the real property, together with improvements (including but not limited to building, parking lot and fencing) located at the intersection of Comal Avenue and Hampe Street, having dimensions of approximately 210 feet along the northeast side of Comal Avenue and approximately 189 feet along the southeast side of Hampe Street, known as 705 Comal Avenue, New Braunfels, TX 78130, as more particularly described in diagram attached as Exhibit "A" and incorporated herein by reference for all purposes (the "Property") with an effective date of October 25, 2016 (the "Lease").

WHEREAS, the Lessor and Lessee have agreed to amend the terms of the Lease pertaining to the extension of the initial term and the property insurance requirements for the Property as set forth below.

AGREEMENT:

1. Per the terms of the Lease, the Lessee has requested a five (5) year extension to their initial term. Section II of the Lease shall be amended to reflect the term of the Lease commencing on the 25th day of October, 2021 and ending on the 24th day of October 2026. With the amending of Section II, Section IX of the Lease pertaining to lease extensions shall be deleted in its entirety.

2. Section V; Item J of the Lease shall be amended to replace the existing requirements with the following:

   The Lessee shall maintain and keep in force the following insurance coverages and shall indemnify, protect and defend the Lessor from claims which may arise out of or in connection with Lessee's use of the Property:

   A. Commercial property insurance written on a causes of loss—special form covering the buildings located on the subject Property with all proceeds payable to Lessee, naming Lessor as "additional insured."

   B. Commercial property insurance written on a causes of loss—special form (formerly known as "all risks" form) covering Lessee's personal property, fixtures, and leasehold improvements on the

subject Property, and naming Lessor as "Building Owner Loss Payable."

C. Commercial general liability insurance written on an occurrence basis, including contractual liability, covering Lessor's operations within the Property, naming Lessor, as "additional insured," and having limits of not less than $1,000,000 each occurrence and $2,000,000 general aggregate.

D. Business auto liability insurance written on an occurrence basis and having a combined single limit of not less than $1,000,000.

E. Workers' compensation insurance in the statutory amount and employer's liability insurance having limits of not less than $500,000 each accident for bodily injury by accident, $500,000 each employee for bodily injury by disease, and $500,000 bodily injury by disease for entire policy.

F. All coverages set forth above must contain a waiver of subrogation in favor of the Lessor.

G. All coverages set forth above shall not exclude sexual abuse or sexual molestation of underage children.

The required insurance shall be written so that the Lessor will be notified in writing, in the event of cancellation, restrictive amendment or non-renewal at least thirty (30) days prior to action. Certificates of Insurance, and copies of additional insured and waiver of subrogation in favor of Lessor endorsements shall be filed with the Lessor at the annual commencement date of this Lease. All required insurance shall be written with the Lessor as an additional insured. In any event, the Lessee is fully responsible for all losses arising out of, resulting from or connected with its (and by extension the public's) use of the Leased Premises under this Lease whether or not the losses are covered by insurance. All insurance required under this section shall be primary over any other insurance coverage the City may have. The burden of maintaining proper insurance coverage and compliance with this subsection lies solely with the Lessee.

3. All other terms and conditions set forth in the Lease shall remain unchanged.

EXECUTED on this the _____day of _____, 2021 with an **EFFECTIVE DATE** of October 25, 2021.

LESSEE
CONNECTIONS INDIVIDUAL AND FAMILY SERVICES, INC.

By:_____
Name:_____
Title:_____

State of Texas
County of _____

On _____, _____, personally appeared _____, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he/she executed the same in his/her authorized capacity as _____ of CONNECTIONS INDIVIDUAL AND FAMILY SERVICES, INC.

_____
Notary Public's Signature

LESSOR
CITY OF NEW BRAUNFELS

By:_____
Robert Camareno, City Manager

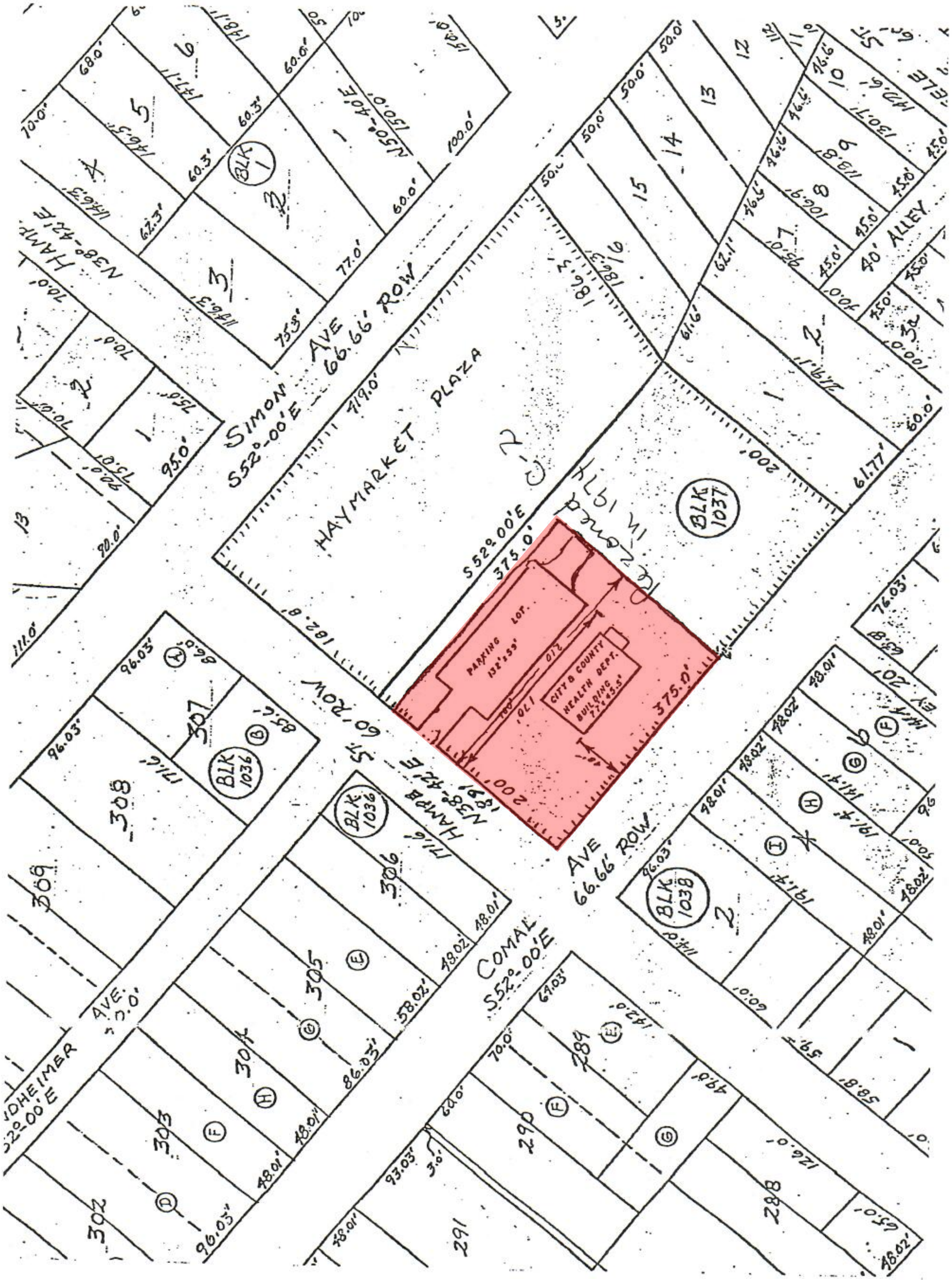
State of Texas
County of Comal

On _____, _____, personally appeared ROBERT CAMARENO, personally known to me (or proved to me on the basis of satisfactory evidence) to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same in his authorized capacity as City Manager of the CITY OF NEW BRAUNFELS, TEXAS.

_____
Notary Public's Signature

APPROVED AS TO FORM:

_____
Valeria M. Acevedo, City Attorney



SIMON AVE
S52°-00'E 66.66' ROW
HAYMARKET PLAZA
S52°00'E
375.0'
PARKING LOT
CITY & COUNTY HEALTH DEPT. BUILDING
BLK 1037
BLK 1036
BLK 1038
BLK 1
COMAL AVE 66.66' ROW
S52°00'E
40' ALLEY

Exhibit "A"

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

SUBJECT:
Discuss and consider approval for the City Manager to enter into a professional services agreement with Freese & Nichols, Inc. to update the City of New Braunfels Capital Improvement Plan.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: Citywide

BACKGROUND INFORMATION:
The Capital Improvement Plan (CIP) is a community planning and fiscal management tool used to coordinate the timing and financing of city capital projects over a five-year period. The CIP was last updated in 2012 and staff is proposing a new update in preparation for a potential bond election in 2023.

A Request for Qualifications was issued on May 11, 2021 for professional services to support City staff in updating the CIP and preparing for a potential bond election. The City received three (3) responses and staff is recommending Freese and Nichols, Inc for the services based on qualifications and selection interviews.

The scope of services was developed in two phases. The first phase, Phase I, includes identifying capital needs by reviewing current plans, coordinating with stakeholders, and engaging the community. Capital projects will be developed with objectives, descriptions, and “high level” capital cost estimates for inclusion in the CIP. It is anticipated that capital projects will be developed for transportation, drainage, parks, and facilities supporting various city departments and community needs. The CIP will include a preliminary list of capital projects to be evaluated and prioritized by the Bond Advisory Committee and City Council.

Phase II will include conducting preliminary design to finalize the CIP through the Bond Advisory Committee and City Council. It will also identify projects and prepare for a potential bond election in 2023.

The proposed services agreement with Freese and Nichols, Inc is for Phase I for an amount not to exceed $300,000. Phase II is identified as “additional services” and will be determined at the end of Phase I.

ISSUE:
Define Project Priorities and funding strategies Use a variety of funding sources for operational and capital needs.

FISCAL IMPACT:
The total cost for Phase I of professional services to update the CIP is $300,000. Funding will be incorporated into the FY 2022 Proposed Budget to support the services as described above, therefore sufficient funds will be available.

RECOMMENDATION:
Staff recommends approval for the City Manager to enter into a professional services agreement with Freese & Nichols, Inc. to update the City of New Braunfels Capital Improvement Plan.

PRESENTER:
Barbara Coleman, Purchasing Manager

SUBJECT:
Approval for the purchase of pursuit vehicles from Caldwell County Chevrolet for the Police Department and approval to declare replaced units as surplus.

DEPARTMENT: Police Department

COUNCIL DISTRICTS IMPACTED: Maintain fiscal stability of city operations.

BACKGROUND INFORMATION:
Staff is requesting approval to purchase 15 vehicles which are a combination of replacement vehicles that are being retired from service, and new vehicles for Police departmental use to support several positions that were added to the organization. These vehicles have been identified as high priority and critical for the Police Department. The vehicles are a combination of replacements and new units to accommodate Police Officers that have been or will be proposed to be added in FY 2022. The City is recommending the purchase of Chevrolet Tahoe model vehicles from Caldwell County Chevrolet using a BuyBoard cooperative contract which has been competitively vetted. The cost for 15 new Chevrolet Tahoe's is $565,000.

City staff is currently evaluating and prioritizing additional vehicle needs for city operations along with the needed ancillary equipment for the above referenced vehicles. These purchases will be brought to City Council for approval at a later date.

ISSUE:
General Motors Corporation is currently taking orders for government contracts which will start being placed in the manufacturing queue July 29, 2021. Orders are backlogged with outstanding requests from last fiscal year and new orders currently being taken. Orders will be filled as they are received. While our standard practice has always been to order vehicles at the beginning of the fiscal year, supply chain concerns require consideration to place our order earlier. At this time the delivery is based on production schedules and are estimated at the end of the 4th quarter of 2021 or 1st quarter of 2022.

FISCAL IMPACT:
Funding will be incorporated into the FY 2022 Equipment Replacement Fund. Therefore, sufficient funds are available to purchase the vehicles as described above.

RECOMMENDATION:
Staff recommends approval for the purchase of vehicles from Caldwell County Chevrolet for the Police Department and approval to declare replaced units as surplus.

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

SUBJECT:
Approval of the second and final reading of an ordinance amending Section 126-346 of the City of New Braunfels Code of Ordinances to restrict parking around the landscaped islands on the outside edges of Main Plaza.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: 5

BACKGROUND INFORMATION:
City Council unanimously approved the first reading of an ordinance amending Section 126-346 of the City of New Braunfels Code of Ordinances to restrict parking around the landscaped islands on the outside edges of Main Plaza on July 12, 2021.

Staff received a request from the Parks and Recreation Department to restrict parking around the landscaped islands on the outside edges of Main Plaza. The attached photo shows vehicles parked along the landscaped islands in the west side of Main Plaza, obstructing the flow of traffic in these areas as well as preventing the Parks employees from accessing the landscaping and downtown public restrooms to perform cleaning and maintenance. This parking around the landscaped island on the west side of Main Plaza has also been a concern from business owners downtown, per the Economic and Community Development Coordinator.

Engineering staff reached out to the Police Department to confirm that this request for restricted parking was not already covered under an existing ordinance. The Police Department did confirm this and requested that the parking restriction be extended to all four landscaped islands around Main Plaza to avoid confusion for drivers on where parking is allowed.

Because Main Plaza is on the Texas Department of Transportation (TxDOT) system, staff reached out to TxDOT with the proposed parking restriction; TxDOT does not have any concerns.

ISSUE:
Proposed parking restriction around the landscaped islands on the outside edges of Main Plaza to ensure safety and accessibility in these areas for the drivers utilizing the angled parking and Parks employees.

FISCAL IMPACT:

Traffic control signs cost approximately $150 each. Sufficient funding is available in the FY 2021 approved streets and drainage budget.

RECOMMENDATION:

Transportation and Traffic Advisory Board

This item was considered and discussed by the Transportation and Traffic Advisory Board at their meeting on June 10, 2021. The Board unanimously voted to recommend the creation of no parking zones around the outside edges of the landscaped islands on the outside of Main Plaza.

Staff

Staff recommends creating no parking zones around the outside edges of the landscaped islands on the outside of Main Plaza.

City of New Braunfels

Proposed Main Plaza No Parking Zones

0 2,000 4,000 Feet

1:60,000

Source: City of New Braunfels GIS
Date: 5/26/2021

ELIZABETH
DETOUR
Moody Bank
BANK
MOODY

ORDINANCE NO. 2021-____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, AMENDING SECTION 126-346 TO RESTRICT PARKING AROUND THE OUTSIDE EDGES OF THE LANDSCAPED ISLANDS ON THE OUTSIDE OF MAIN PLAZA.

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 126-346 (f) is hereby amended as follows:

(130) On the outside edges of the landscaped islands on the outside of Main Plaza. Such no parking zone shall be designated as a tow away zone.

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

SUBJECT:
Approval of the second and final reading of an ordinance amending Section 126-136 and Section 126-137 of the City of New Braunfels Code of Ordinances to create school speed zones on West Klein Road and South Walnut Avenue, respectively.

DEPARTMENT: Public Works

COUNCIL DISTRICTS IMPACTED: 2

BACKGROUND INFORMATION:
City Council unanimously approved the first reading of an ordinance amending Section 126-136 and Section 126-137 of the City of New Braunfels Code of Ordinances to create school speed zones on West Klein Road and South Walnut Avenue, respectively, on July 12, 2021.

The new New Braunfels Middle School on Settlers Crossing will open in Fall 2021. Two separate school speed zones are proposed to be created at this time for this new school as well as the existing Klein Road Elementary. A school zone is a section of roadway adjacent to a school or a school crosswalk where signs designating a school are present. A school speed zone is a special reduced speed zone for schools allowed by ordinance and defined by school speed signs. Ideally, school speed zones should be kept short to enhance driver compliance. School speed zones are intended for pedestrian safety and not to facilitate vehicle movements.

A 20 mph school speed zone on South Walnut Avenue is proposed to begin at a point 250 feet northwest of the intersection with Settlers Crossing and extend southeast to 250 feet southeast of the intersection with Settlers Crossing. A separate 20 mph school zone on West Klein Road is proposed to begin 325 feet southwest of the intersection with Klein Way and extend northeast to 300 feet northeast of the intersection with Klein Way. The proposed school zones and associated traffic control are based on a school route plan serving the existing elementary and proposed middle school.

ISSUE:
Consideration of the requested speed humps is consistent with the following action from Envision New Braunfels:

Action 7.21: Ensure that there is connected multi-modal access to all public facilities and from all parts of town.

FISCAL IMPACT:
Traffic control signs cost approximately $150 each. Sufficient funding is available in the FY 2021 approved streets and drainage budget.

The school zone signs on South Walnut Avenue will be installed by the contractor for the New Braunfels Middle School and will be funded by New Braunfels ISD.

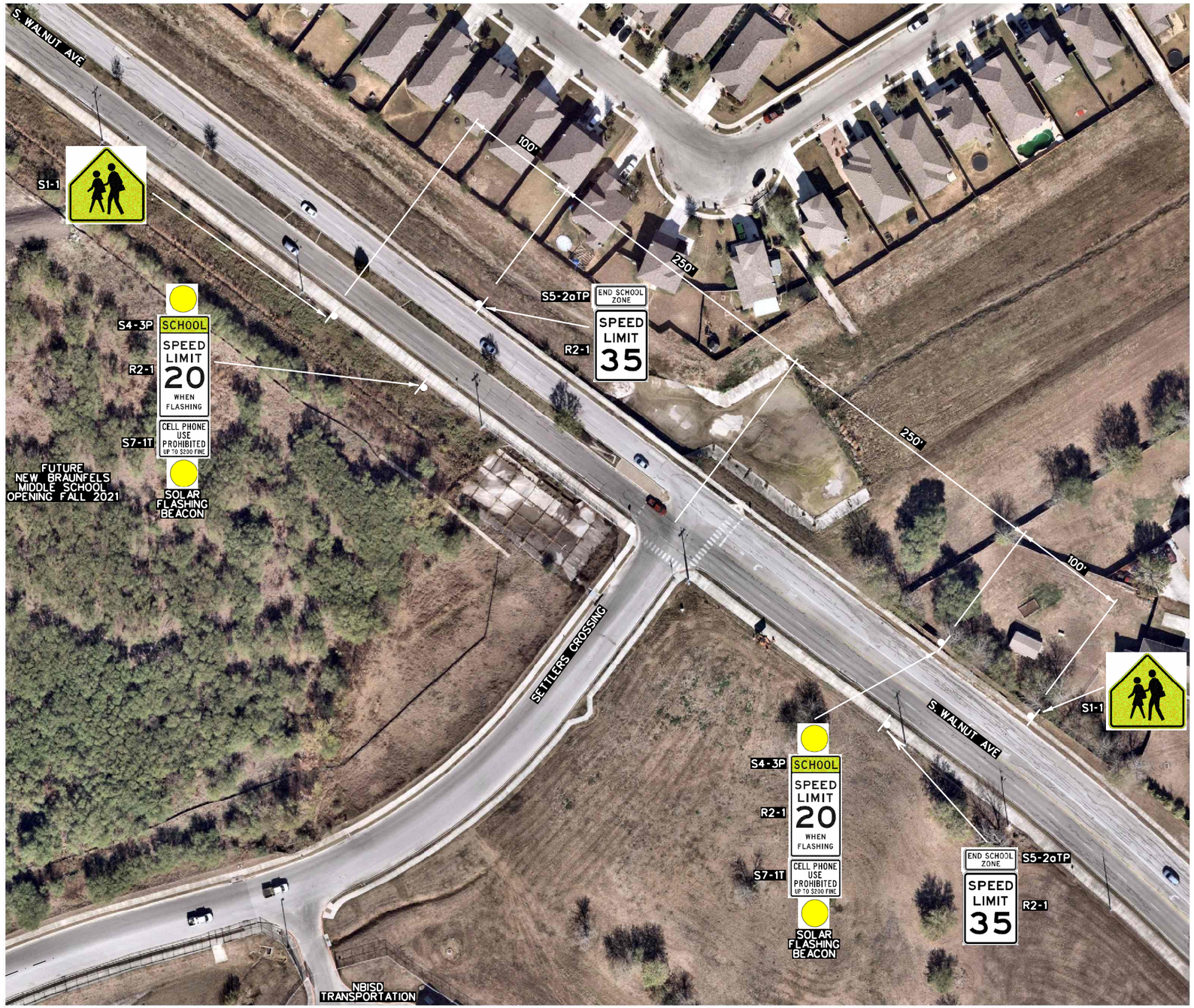
RECOMMENDATION:

Transportation and Traffic Advisory Board

The Transportation and Traffic Advisory Board unanimously voted to recommend approval of establishing 20 mph school speed zones on South Walnut Avenue and West Klein Road for the new New Braunfels Middle School at their July 8, 2021 meeting.

Staff

Staff recommends establishing two 20 mph school speed zones: (1) on South Walnut Avenue to begin at a point 250 feet northwest of the intersection with Settlers Crossing and extending southeast to 250 feet southeast of the intersection with Settlers Crossing and (2) on West Klein Road to begin 325 feet southwest of the intersection with Klein Way and extending northeast to 300 feet northeast of the intersection with Klein Way



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NOTE:

TO BE INSTALLED BY NBISD.

NO.	DATE	REVISION	APPROV.

City of New Braunfels

ENGINEERING DIVISION

KLEIN ELEMENTARY
PROPOSED SIGNING LAYOUT

SCALE: 1"=100'	SHEET: 1 OF 2	
COUNTY	PROJECT NO.	
GUADALUPE		

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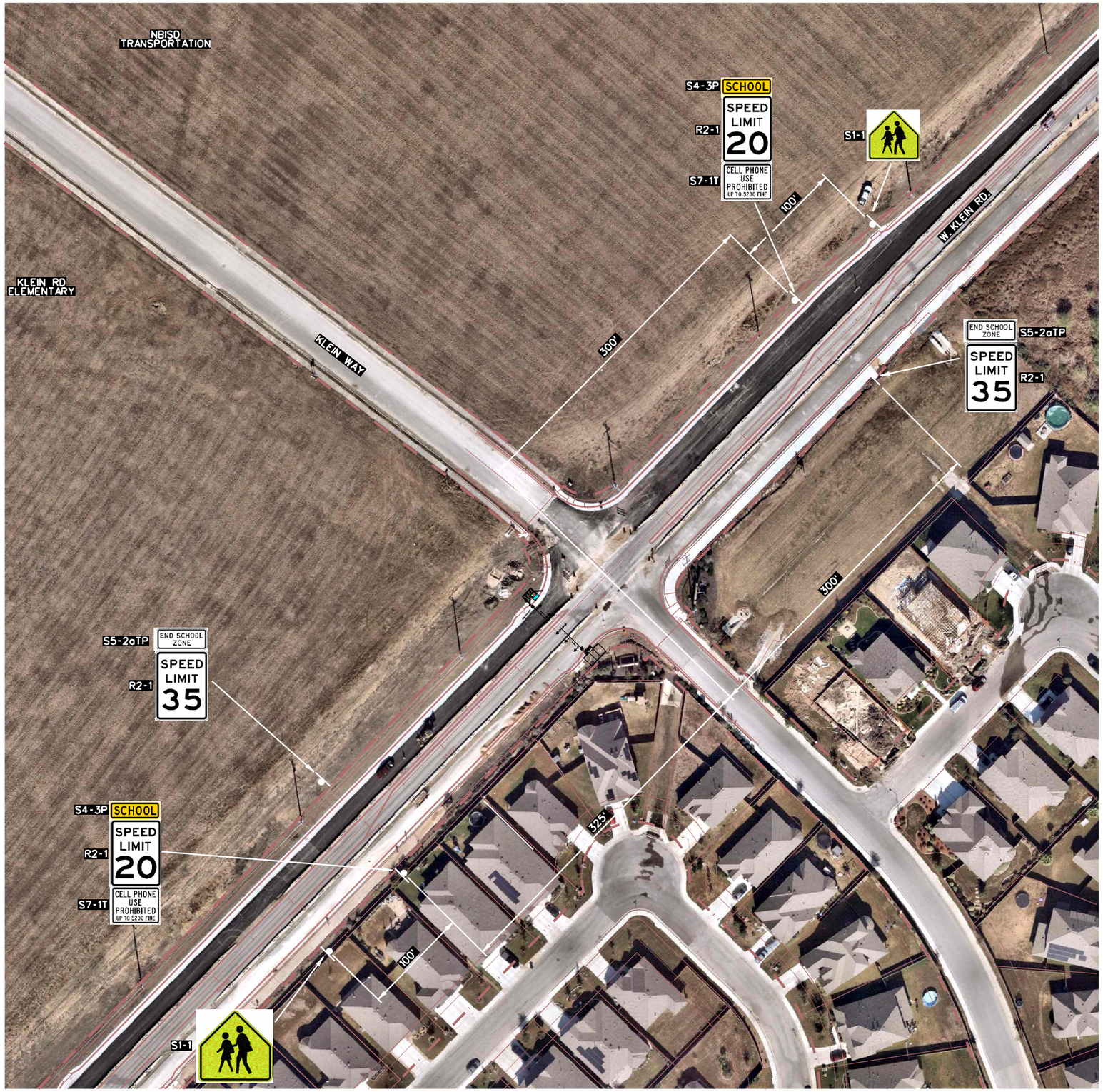

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NO.	DATE	REVISION	APPROV.

City of New Braunfels

ENGINEERING DIVISION

KLEIN ELEMENTARY
PROPOSED SIGNING LAYOUT

SCALE: 1"=100'	SHEET: 2 OF 2	
COUNTY	PROJECT NO.	
GUADALUPE		

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ORDINANCE NO. 2021-____

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, AMENDING SECTIONS 126-136 (a) AND 126-137 (a) OF THE CITY OF NEW BRAUNFELS CODE OF ORDINANCES TO CREATE SCHOOL SPEED ZONES ON SOUTH WALNUT AVENUE AND WEST KLEIN ROAD.

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:

West Klein Road from 325 feet southwest of the intersection with Klein Way to a point 300 feet northeast of the intersection with Klein Way.

II.

THAT the City of New Braunfels Code of Ordinances Section 126-137 (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 35 miles per hour at every other time:

S. Walnut Avenue from 250 feet northwest of the intersection with Settlers Crossing to a point 250 feet southeast of the intersection with Settlers Crossing.

III.

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.

IV.

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.

V.

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:
Jeff Jewell, Economic and Community Development Director

SUBJECT:
Discuss and Consider a Resolution Adopting a Tax Increment Financing Policy

DEPARTMENT: Economic and Community Development

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
Tax Increment Financing (TIF) is a tool available to municipalities under Chapter 311 of the Texas Tax Code. TIF utilizes the increase in property and/or sales taxes within a defined geographic area as a source of revenue for public improvements as defined in a Project and Finance Plan. The fundamental purpose of TIF is to encourage economic development or redevelopment within a geographic area known as a Tax Increment Reinvestment Zone (TIRZ) that would not occur without the assistance provided through TIF. The policies and guidelines are established to sustain, develop, and expand the City's economic base by leveraging private investment for specific types of development and to provide guidance to staff, applicants and the recommending and approving bodies for use of the incentive.

The policy outlines goals of TIF deployment, as well as establishes expectations and requirements for the level of due diligence that will be undertaken. The purpose of such due diligence is to provide some reasonable assurance that the any project applying for TIF assistance would not occur but for the incentive and that the improvements proposed will be constructed within a reasonable timeframe.

The creation of a TIRZ is a multi-step process. Below is a brief overview of the steps required to create a TIRZ:

- Prepare a preliminary financing plan (showing details how the improvements will be paid for)
- Hold a public hearing (and publish notice of such) to gain public input
- Designate a reinvestment zone (through adoption of an Ordinance), outlining the zone timeframe, formally establishing the zone, noting certain findings that indicate the zone meets criteria, and creating the TIRZ Board of Directors
- Prepare a project plan and a financing plan (Final Plans) to be consistent with preliminary plans and be approved by the TIRZ Board and City Council
- Seek approval of other participating taxing units (County) through public hearing and formal consideration by that taxing unit’s governing body
- Implement TIRZ (begin implementation of the outlined plan) through the TIRZ Board and City Council

actions

- Submit an Annual Report (once the TIRZ is in place, the governing body produces an annual report indicating the status of the zone)

TIRZ board membership may not exceed 15 and if a county participates in the TIRZ, they are entitled to two (2) appointments to the board.

ISSUE:
The adoption of a policy will provide guidance to applicants, staff, elected and appointed officials as to when TIF is appropriate and how the City will evaluate their creation and applications for TIF funding.

FISCAL IMPACT:
N/A

RECOMMENDATION:
Staff presented and received input from the City Council's Audit and Finance Committee as well as the New Braunfels Economic Development Corporation's Board of Directors during the policy's formation.

Staff recommends approval of the Resolution.

TAX INCREMENT FINANCING POLICY AND PROCEDURES

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AS ADOPTED BY THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, JULY 2021

I. Overview

Tax Increment Financing is defined as a public financing mechanism through which the growth in taxes (increment) associated with new development or redevelopment can be captured and used to pay costs

associated with economic development for the public good.

Certain acronyms are used throughout this policy and have the following meaning:

TIF	Tax Increment Financing
TIRZ	Tax Increment Reinvestment Zone
ENB	Envision New Braunfels (City's Comprehensive Plan)
EDSP	2017 Economic Development Strategic Plan
DIP	2010 Downtown Implementation Plan
SCAMP	South Castell Area Master Plan

II. Authority

Under the authority of Chapter 311 of the Texas Tax Code (the "TIF Act"), municipalities are permitted to establish TIRZs. The City of New Braunfels (the "City") will comply with all requirements of the TIF Act regarding TIF expenditures. Investments that identify and target underutilized neighborhoods where additional public investments are needed to draw private dollars will also be considered. The City adopted the Tax Increment Financing Policy and Procedures and Tax Increment Financing Assistance Application in ____ 2021.

III. Purpose

The fundamental purpose of TIF is to encourage economic development or redevelopment within a geographic area known as a TIRZ that would not occur without the assistance provided through TIF. The policies and guidelines contained herein are established to sustain, develop, and expand the City's economic base by leveraging private investment for specific types of development.

It is the policy of the City Council and appropriate TIRZ Boards to consider the judicious use of TIF establishment and expenditures for those projects that demonstrate a substantial and significant public benefit and promote development of an area if such development would not occur solely through private investment in the reasonably foreseeable future. Judicious use of the incentive means those projects that fulfill one or more of the following principles:

- Financing **public** infrastructure/improvements
- Funding **extraordinary** costs
- Subsidizing a proposed project that is **"above market,"** non-market driven or helping to establish an unproven market
- Obtaining **higher quality** development than the market will generate on its own
- Incentivizing to **attract or retain investment** in a strategic area

Goals envisioned include strengthening the employment and economic base of the City by creating a diversity of mixed ENB land uses, making planned improvements and investments in areas identified in City plans, undertaking additional investments that encourage vertical growth, infill development and the development of key areas to take advantage of existing infrastructure capacity (Actions 1.3, 1.6, 2.33 ENB).

IV. Criteria for Establishment of a Reinvestment Zone

A fundamental consideration for the establishment of either petition or city created TIRZ is whether the proposed public investments are targeted in underutilized neighborhoods and where it can be reasonably asserted that the investments are needed to draw private dollars. To be designated as a reinvestment zone, the area must substantially arrest or impair the sound growth of the municipality designating the zone,

retard the provision of housing accommodations, or constitute an economic or social liability and be a menace to the public health, safety, morals, or welfare in its present condition and use because of the presence of:

- a substantial number of substandard, slum, deteriorated, or deteriorating structures;
- the predominance of defective or inadequate sidewalk or street layout;
- faulty lot layout in relation to size, adequacy, accessibility, or usefulness;
- unsanitary or unsafe conditions;
- the deterioration of site or other improvements;
- tax or special assessment delinquency exceeding the fair value of the land;
- defective or unusual conditions of title;
- conditions that endanger life or property by fire or other cause;
- structures, other than single-family residential structures, less than 10 percent of the square footage of which has been used for commercial, industrial, or residential purposes during the preceding 12 years, if the municipality has a population of 100,000 or more;

Additionally, the area can be predominantly open or undeveloped and, because of obsolete platting, deterioration of structures or site improvements, or other factors, substantially impair or arrest the sound growth of the City or be an area described in a petition requesting that the area be designated as a reinvestment zone, if the petition is submitted to the City Council by the owners of property constituting at least 50 percent of the appraised value of the property in the area according to the most recent certified appraisal roll for the county in which the area is located.

V. Public Benefits and Qualifying Projects

Per Chapter 311.004 and as a required finding, improvements in the TIRZ must significantly enhance the value of all taxable real property in the TIRZ and must be of general benefit to the City. Care will be exercised in the use of TIF by thoroughly evaluating each project to ensure that the benefits, which will accrue from the approval of a TIF investment project, are appropriate for the costs that will result.

In addition to the ENB goals identified in Section III, the policies and guidelines herein exist to achieve, as permitted by the TIF Act the following public goals and benefits:

- To promote a desirable mix of uses including residential, commercial, and industrial developments that would otherwise not occur
- To increase and diversify the long-term tax base of New Braunfels
- To remove blight by encouraging redevelopment of residential, commercial, or industrial structures and/or areas
- To finance appropriate public improvements to support a growing population in preferred locations. (Action 1.7 ENB)
- To revitalize the core of New Braunfels to ensure balanced development (Action 3.4 ENB)
- To undertake area improvements planned and identified in the DIP, SCAMP, or the EDSP (Action 1.15 ENB)
- To encourage additional unsubsidized private development either directly or indirectly into areas as designated in the ENB and EDSP
- Encourage diversification of commercial activity Downtown to build on and sustain existing historic resources and maximize structure utilization for economic expansion (Action 2.5 ENB)
- To increase the local employment base and provide economic diversity
- To connect existing and new destinations and experiences (Action 2.12 ENB)

- To promote aesthetically appropriate architectural designs
- To encourage the use of existing facilities to expand to year-round facilities through public/ private partnerships with booking policies that encourage sports, market shows, conventions, and meetings (Action 2.23 ENB)
- To 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 3.13 ENB)
- To build a performing arts center that can accommodate performances that attract larger audiences and increases the diversity and value of the performing/visual arts (Action 2.28 ENB)
- To make unifying and transitional connections to and from Downtown through efforts like the South Castell Visioning Plan that encourages thoughtful mixed-use projects that blend in with the character and design of the community (Action 7.27 ENB)
- To implement recommendations as they relate to parking in the 2016 Downtown Parking Study and from Action 7.28 of ENB
- To reduce or abate environmental hazards which create a barrier to development or to achieve any of the objectives above
- To accomplish goals, strategies, or objectives as set forth in an approved TIRZ Project and Financing Plan

VI. Other Public Policy Considerations

The City will utilize TIFs to attract investment in underutilized areas and provide some tangible benefits and mitigate impacts to area residents, if any. TIF projects can exacerbate property value increases that compound existing housing affordability issues and that potentially displace residents. Proactive planning and the inclusion of workforce housing in the project, however, can help avoid displacement and mitigate impacts to existing residents. When appropriate, the City will consider utilizing additional policy tools such as a Neighborhood Empowerment Zones (NEZ) that can help the City provide tax and other incentives to achieve community and economic development goals in a particular area. Other community development objectives such as public space, parks and trail connections should also be considered in the project plan.

VII. General Policy Requirements

Per Chapter 311.006, the City may not designate a reinvestment zone if more than 30 percent of the property in the proposed zone, excluding property that is publicly owned, is used for residential purposes or 50 percent of the total appraised value of taxable real property in the City and in the industrial districts created by the City.

The City Council will determine the extent of tax increment participation based upon the project and after the due diligence period is completed.

"Pay as you go" financing and reimbursement for eligible project costs are preferred. Bond financing is discouraged until tax revenues are available from the improvements for the TIRZ to issue bonds that can sufficiently support the bond's debt service.

VIII. TIRZ Administration

State law provides for the appointment of a TIRZ Board of Directors (the "Board"), which is charged with implementing the Project Plan. TIRZ administration is a shared responsibility of the City and the Board whether City-initiated or Petition-driven. The TIF Act requires the City Council to establish a Board of Directors for each TIRZ that is created. Each Board member is appointed for terms of two years,

which are staggered and commence on December 1 in which they were appointed. Each year, the City Council shall appoint one member of the Board to serve as Chairperson for a term of one year that begins on January 1 of the following year.

For a petition created TIRZ, the following requirements for membership on the Board apply:

- An individual must be at least 18 years of age and must own real property in the zone or be an employee or agent of a person that owns real property in the zone;
- Each taxing unit that designated the zone can appoint a majority of members to the Board so that the composition of the Board is at least five and not more than fifteen (15) members;
- The County that levies taxes on real property in the zone and has approved the payment of all or part of the tax increment produced by the unit into the tax increment fund for the zone is entitled to two (2) appointments to the Board;
- Each taxing unit, other than the City that designated the zone and the County that receives appointments as detailed above, that levies taxes on real property in the zone and has approved the payment of all or part of the tax increment produced by the unit into the tax increment fund for the zone, is entitled to one member;
- The members of the state senate and state house of representative in whose districts the zone is located are each a member of the board, except that either may designate another individual to serve in the member's place.

In a city or county created TIRZ, the following requirements for membership on the Board apply:

- An individual must be at least 18 years of age and own real property in the zone, whether or not the individual resides in the county in which the zone is located or a county adjacent to that county;
- The Board may consist of at least five and not more than fifteen (15) members;
- The County that levies taxes on real property in the zone and has approved the payment of all or part of the tax increment produced by the unit into the tax increment fund for the zone is entitled to two (2) appointments to the Board;
- The governing body of the municipality or county that designated the zone may appoint not more than 10 directors to the board; except that if there are fewer than five directors appointed by taxing units other than the municipality or county, the governing body of the municipality or county may appoint more than 10 members as long as the total membership of the board does not exceed 15.

The City administers each tax increment fund on behalf of each TIRZ board. The City is responsible for invoicing, collecting, and depositing tax increment revenues from participating taxing entities. The City is also responsible for the investment, disbursement, and general accounting of funds. The City reviews all requests for tax increment funds, including reimbursement invoices, for compliance with provisions of the Project Plan, Financing Plan, Development Agreement, and Interlocal Agreement(s) and presents such requests for payment to the TIRZ boards for approval prior to making distributions.

In addition, the City is responsible for submitting regular reports to the other taxing entities and to the State Comptroller on the status of the TIRZ. Those reports must include, among other things, the amount and source of revenue in the fund, the amount and purpose of expenditures, the amount of principal and interest due on outstanding bonded indebtedness, if applicable, the total amount of tax increment revenues received, the tax increment base and current captured appraised value retained by the TIRZ, the captured appraised value shared by the municipality or county and other taxing units within the TIRZ, and other

information pertaining to the tax increment funds.

IX. Interlocal Cooperation

TIF is designed to maximize the TIF incentive by pursuing public-private and interagency cooperation. More resources can be dedicated to a reinvestment goal when organizations coordinate their efforts. To accomplish this, the City could at its discretion identify a collaborator or collaborators at designation or at any point throughout the TIF process. As partnerships are identified the City can make an application or formal request for participation in the TIF. If the proposed partner has adopted a formal policy governing their participation in the TIF, the Interlocal Cooperation Agreement should reflect those guidelines to the greatest extent possible and as practicable.

X. General Application and Submittal Requirements

Projects seeking TIF assistance must provide the following as part of their application. In order to accurately communicate the value of the TIF incentive, and to satisfy statutory requirements that development or redevelopment in the proposed TIRZ would not occur solely through private investment in the reasonably foreseeable future, each application for TIRZ funding must demonstrate a quantifiable need for public assistance. This analysis determines the amount of tax increment to be generated by the TIRZ, as well as the length of time the TIRZ will be in existence. The information is required to evaluate and establish a demonstrable gap in financing for the project to fulfill "but for" requirements promulgated by TIF Act and as required by this policy. Such information shall include:

- Demonstrate financial wherewithal to meet project costs and complete project (i.e. the most current three years of financial statements, complete Sources and Uses budget, and/or Letters of Credit from Bank), including but not limited to:
    - All sources and uses of funds, including other public sources, private financing, and developer equity contribution into the project.
    - Details of the debt and equity composition and the parties providing sources. Include letters of interest or commitment along with term sheets, signed by agents authorized to provide such commitments.
- Detailed project development budget, including acquisition, construction, soft and hard costs, financing costs, including capitalized reserves or other requirements by a lender, if applicable– include any estimated tax credit basis and the basis for construction estimate i.e. construction bids or architect estimate on cost per square foot etc.
- Detailed pro-forma that identifies the pre-TIF rate of return and gap in project financing
- Detailed pro-forma that identifies project-plus-TIF rate of return and financial structure
- Identify proposed security, collateralization, or credit enhancement
- Development team structure with roles and responsibilities detailed. Statement of Qualifications & References for the development team (include experience with public financing sources)
- Most recent financial Statement of owner/developer
- Appraisal of property or as-built appraisal of proposed improvement conducted not more than twelve (12) months from the date of submittal (if applicable)
- Environmental - Phase I (Phase II if applicable)
- Elevations, engineering plans, schematics or site plans of the proposed improvement(s)
- A complete and detailed market feasibility study that addresses the feasibility (viability) of the proposed uses of the development (absorption, vacancy, expenses, capture rates, etc.), unless a sufficient market study is included in the appraisal

- Information to describe the estimated employment, wages, market value of new development, housing benefits- number of new rental or ownership benefits related to the project, parking impacts, etc.)
- A schedule indicating timing of improvements (i.e. commencement and completion dates).

XI. Qualifying Expenditures

Tax incentives must be used as authorized by the TIF Act. Money may be disbursed from the tax increment fund only to satisfy claims of holders of tax increment bonds or notes issued for the TIRZ, to pay project costs for the zone, to make payments pursuant to an agreement made under Section 311.010(b) dedicating revenue from the tax increment fund, or to repay other obligations incurred for the zone. Examples of eligible projects include but are not limited to the following:

- Public infrastructure within the TIRZ
- Purchase of land for public infrastructure
- Public utility upgrades including electric, water, wastewater, gas, and telecommunications
- Parks and landscaping
- Pedestrian malls and walkways
- Streets, Sidewalks, Streetscapes
- Road improvements
- Façade improvements
- Demolition of existing structures
- Street lighting
- Public parking facilities
- Abatement and remediation of environmental hazards
- Land acquisition
- Administrative fees and operational costs of TIRZ

XII. TIF Project Process

The creation of a TIRZ is a multi-step process. Below is a brief overview of the steps required to create a TIRZ:

- Prepare a preliminary financing plan (showing details how the improvements will be paid for)
- Hold a public hearing (and publish notice of such) to gain public input
- Designate a reinvestment zone (through adoption of an Ordinance), outlining the zone timeframe, formally establishing the zone, noting certain findings that indicate the zone meets criteria, and creating the TIRZ Board of Directors
- Prepare a project plan and a financing plan (Final Plans) to be consistent with preliminary plans and be approved by the TIRZ Board and City Council
- Seek approval of other participating taxing units (County) through public hearing and formal consideration by that taxing unit's governing body
- Implement TIRZ (begin implementation of the outlined plan) through the TIRZ Board and City Council actions
- Submit an Annual Report (once the TIRZ is in place, the governing body produces an annual report indicating the status of the zone)

Once a TIRZ is established the procedures for TIF project approval, management and funding include:

- Pre-Application Meeting: Meeting is held with City staff and may include TIRZ Board members (if appropriate), to discuss the proposed project, potential TIF eligibility, and the TIF Application Process and Forms. TIRZ Board members may attend meetings as necessary.
- After the required pre-application meeting, the applicant (including the City) may submit a fully completed "Application for Tax Increment Financing Assistance" to the designated City staff member. If assistance requested is $50,000 or less, the applicant may submit a "Short Form Application."
- Preliminary Review: City staff will review the application within 10 working days of receipt to ensure substantial compliance with the guidelines. If City staff determines that an application materially fails to meet the specified criteria, the applicant will be so notified of any additional information needed. The applicant will have 60 days to submit the requested information without having to submit a new application.
- TIRZ Board Review (if applicable): Once City staff has completed the preliminary review, staff will place the proposed project on the next regularly scheduled TIRZ Board agenda for discussion. Once City staff and the applicant have come to agreement on a proposed incentive, staff will develop a "Proposed Term Sheet" and present the draft proposal with a recommendation for TIF funding to the applicable TIRZ Board for consideration. Final terms will be negotiated between the TIRZ Board and applicant.
- If the TIRZ Board recommends approval of the project, the Board will direct staff to prepare the final Term Sheet which will be forwarded with Board recommendation to the City Council and other appropriate governing entities for review and final approval.
    - If the project is not approved, the applicant may submit an amended application.
    - Once approved by the City Council, appropriate officials representing the City, TIRZ Board, and applicant will execute the Development Agreement.
    - TIF eligible expenses will only be paid if all conditions of the Development Agreement are met.
    - Once a project is approved, the TIRZ Chair, Vice Chair and Comal County or Guadalupe County Representative(s) (if appliable), as a committee, are authorized to grant adjustments in the project time line throughout the duration of the project, without further TIRZ Board action, up to a cumulative total of 180 days.
    - Upon submission of an application, all project information provided to or developed by the City is subject to provisions of the Texas Public Information Act and could become public information.
    - Exceptions include certain information made confidential by law; certain personnel information; information relating to litigation; information related to competitive bidding; certain commercial information; location and price of property; legislative documents; certain law enforcement records; and attorney-client privileged information.

RESOLUTION NO. 2021-R _____

A RESOLUTION OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS, ADOPTING THE TAX INCREMENT FINANCING POLICY AND PROCEDURES; INCLUDING CRITERIA AND GUIDELIENS GOVENRING TAX ABATEMENT REINVESTMENT ZONES; AND DECLARING AN EFFECTIVE DATE.

WHEREAS, the City of New Braunfels is committed to establishing long-term economic vitality, an essential key to the growth of any community, by responding and preparing for challenges and changes in an environment characterized by ongoing competition for sustained economic advantage and identity; and

WHEREAS, Tax Increment Financing ("TIF") is defined as a public financing mechanism through which the growth in taxes associated with new development or redevelopment can be captured and used to pay costs associated with economic development for the public good; and

WHEREAS, under the authority of Chapter 311 of the Texas Tax Code (the "TIF Act"), municipalities are permitted to establish Tax Increment Reinvestment Zones ("TIRZs") to utilize the TIF incentive; and

WHEREAS, the City Council will consider the judicious use of TIF establishment and expenditures for those projects that demonstrate a substantial and significant public benefit and promote development of an area if such development would not occur solely through private investment in the reasonably foreseeable future; and

WHEREAS, the City desires to utilize TIF to achieve the goals envisioned in various city plans, including Envision New Braunfels, Economic Development Strategic Plan, South Castell Area Master Plan and other relevant documents; and

WHEREAS, this resolution approves and authorizes the adoption of the Tax Increment Financing Policy and Procedures ("the TIF Policy"); and

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

SECTION 1: That the Tax Increment Financing Policies and Procedures attached as Exhibit A are hereby approved.

SECTION 2: That the City will periodically reevaluate the TIF Policy.

SECTION 3: That this Resolution shall become effective from and after the date of its passage.

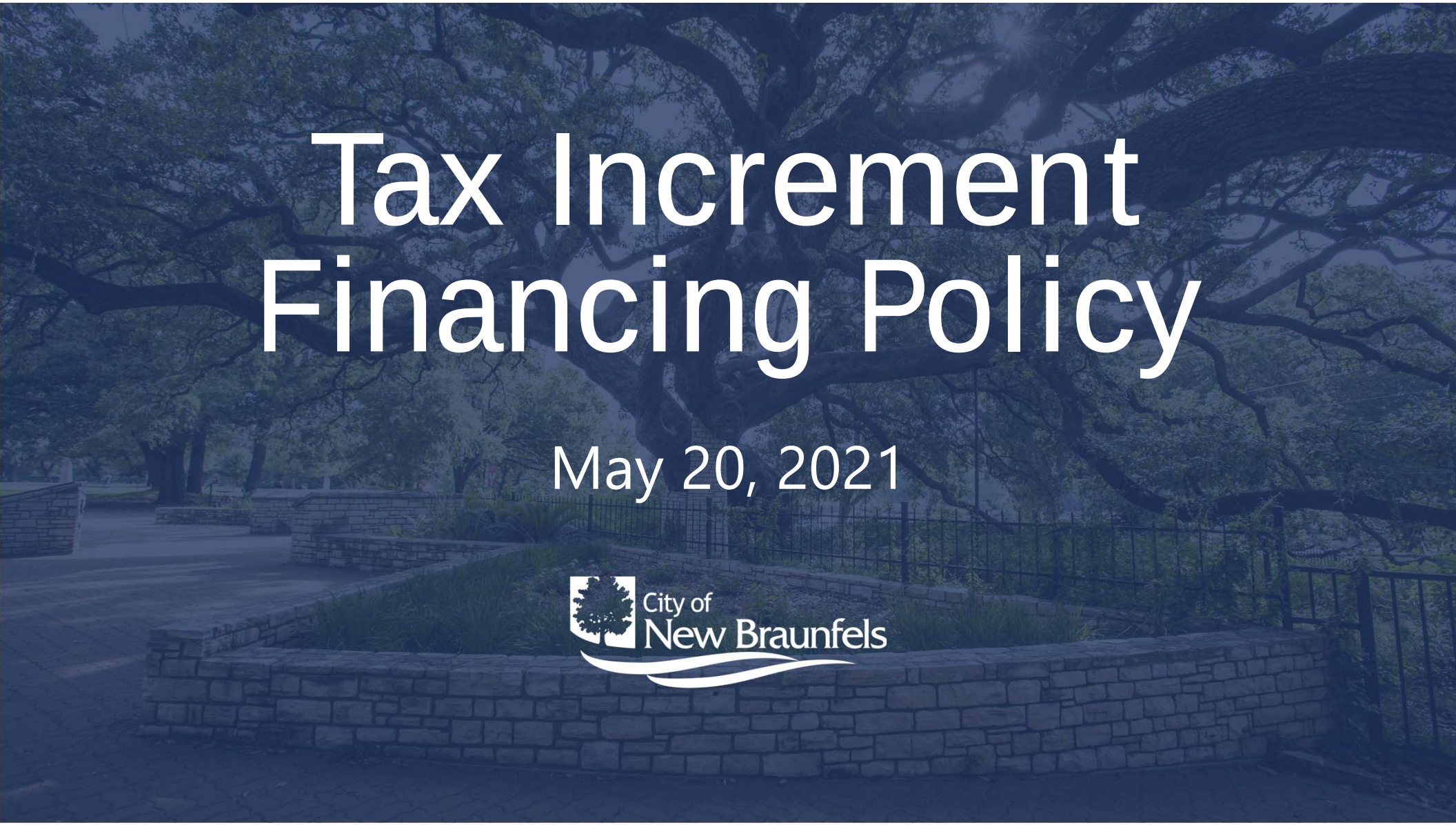
PASSED, ADOPTED AND APPROVED this 26th day of July 2021.

CITY OF NEW BRAUNFELS, TEXAS

By: _____
Rusty Brockman, Mayor

ATTEST:

_____
Caitlin Krobot, City Secretary


Tax Increment Financing Policy
May 20, 2021
City of New Braunfels

Agenda

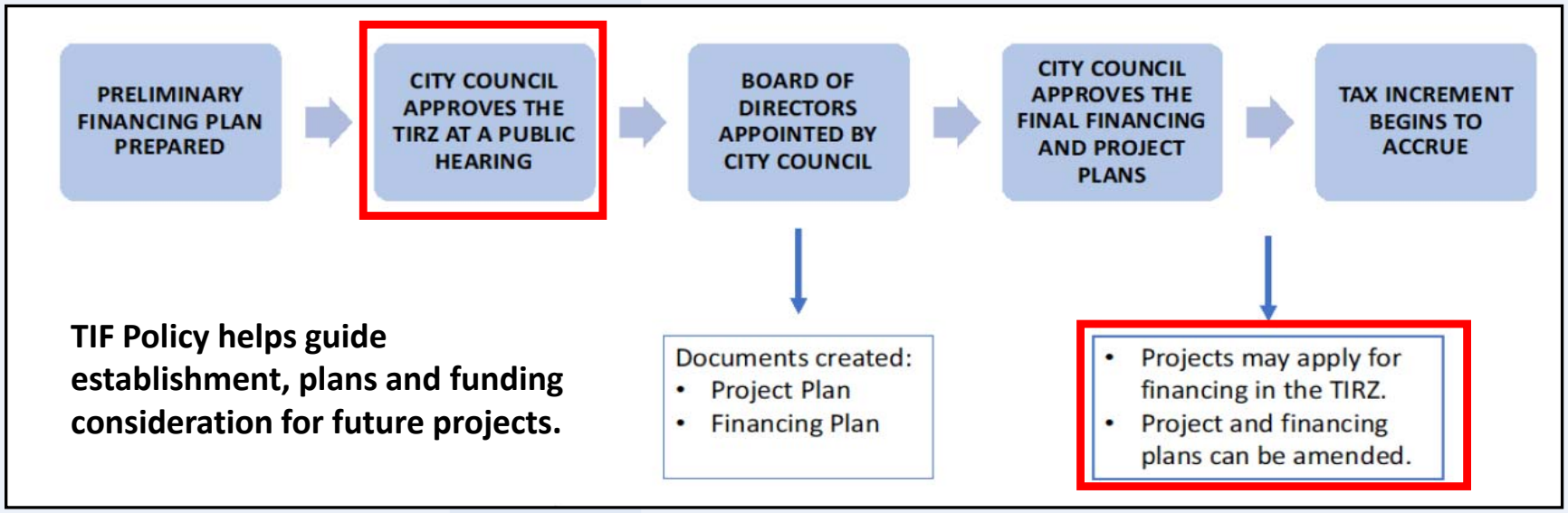
- TIF background and process
- Common Uses of TIF
- Purpose of a Policy
- Policy Highlights

Tax Increment Financing (TIF)

- TIF is a tool that allows taxing units to utilize the incremental tax revenues to pay for improvements in a particular area
  - Chapter 311, Property Tax Code
- First TIF in California in 1952. Now 48 states allow them.
- Legal mechanism in Texas is referred to as **Tax Increment Reinvestment Zones (TIRZ)**
- Historically viewed as a blight remediation tool to mitigate development risks
- Benefits of TIF as a tool is to ultimately offset the costs of needed public infrastructure to attract additional private investment
- Can be initiated by a taxing entity or private actor

Tax Increment Financing (TIF)- Process

- City or property owners petition for creation of the TIF
- Governing body prepares a reinvestment zone preliminary project and financing plan
- Public hearing by governing body and designation of reinvestment zone
- Preparation of final project and financing plan
- Contribution to the tax increment fund by other taxing entities



Common Uses of TIF with Private Development

- Financing **public infrastructure/improvements**
- Funding **extraordinary costs**
- Subsidizing a proposed project that is **"above market," non-market driven or helping to establish an unproven market**
- Obtaining **higher quality development**
- Incentivizing to **attract or retain investment** in a strategic area
- Achieve **public policy** goals

TIF- Three Main Types of Criticism

- Development/tax revenues would have occurred/been realized anyway
  - Originated to mitigate blighted areas but have been used to accelerate development in areas where it would likely occur anyway
  - Value increases through normal appreciation often captured in the TIF
- Diverts tax revenue from needed services
  - provision of public services brought about by increased development not accounted for and needs to be funded from elsewhere in the budget
- Exacerbates issues of property value increases and gentrification
  - As TIFs attract investment, real estate values increase, and gentrification occurs

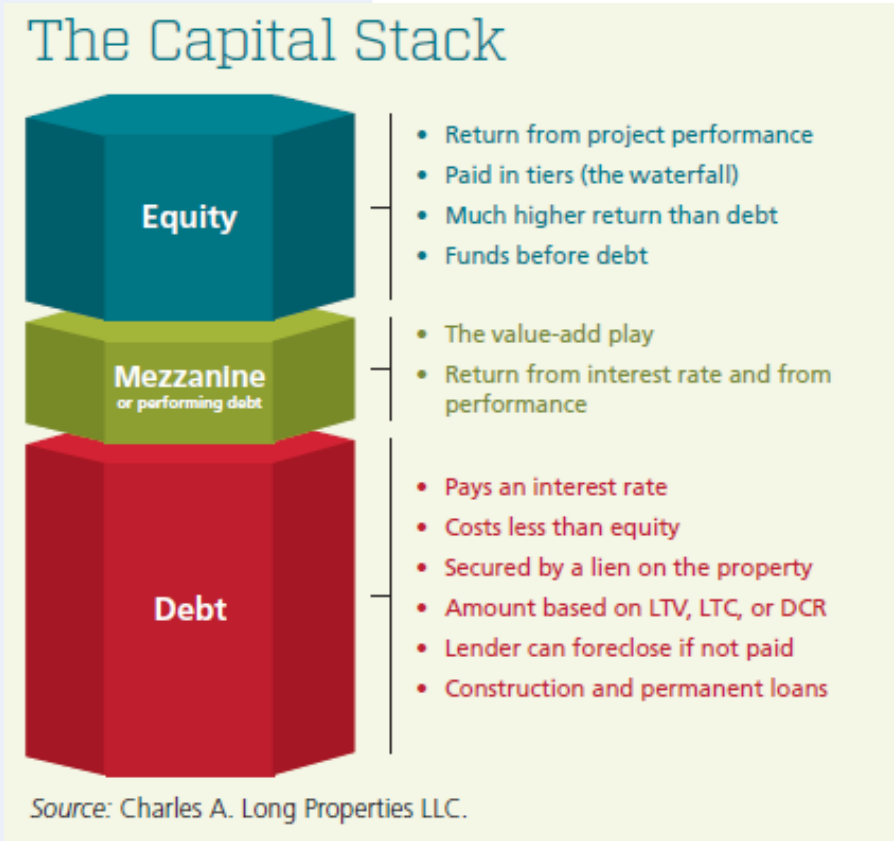
TIF Program and Policy Considerations

- TIF should focus on capturing desired real estate projects with infrastructure support or gap financing
- Four primary conditions:
  - The project should **contribute to public policy goals**
  - Project is **economically feasible** and has a reasonable chance of success
  - Project would not proceed as desired **'but for'** the assistance
  - Project **pays for itself though generated revenues or justifies the investment with economic and/or community impacts**
- Undertaken with developers with an established track record, financial capacity and known financial partners
- In most instances, shift risk to the private sector through reimbursement mechanisms after completion

Establishing the Need for TIF Assistance

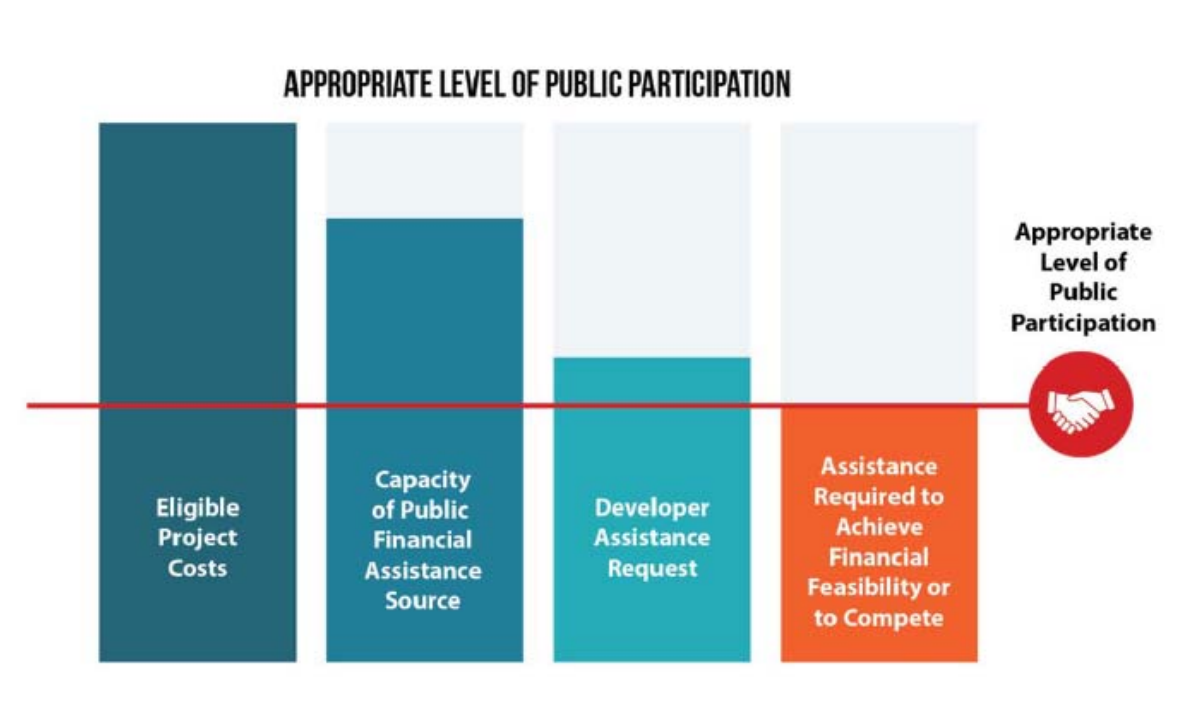
The "But For" Approach:

- Real estate investment levels are a function of value and not of cost
- Establish a "financing gap" – shortfall between a project's cost and its market value under current conditions
- Understand the project's economics and returns
- Attraction of capital to a project is a function an assessment of its overall financial feasibility



Determining Level of Need

- Evaluation of project in accordance with underwriting/due diligence requirements
- Establishes level of assistance required to achieve financial feasibility
- Amount of assistance required to achieve the rate of return for the project to be financially feasible



Benefits of Approach:

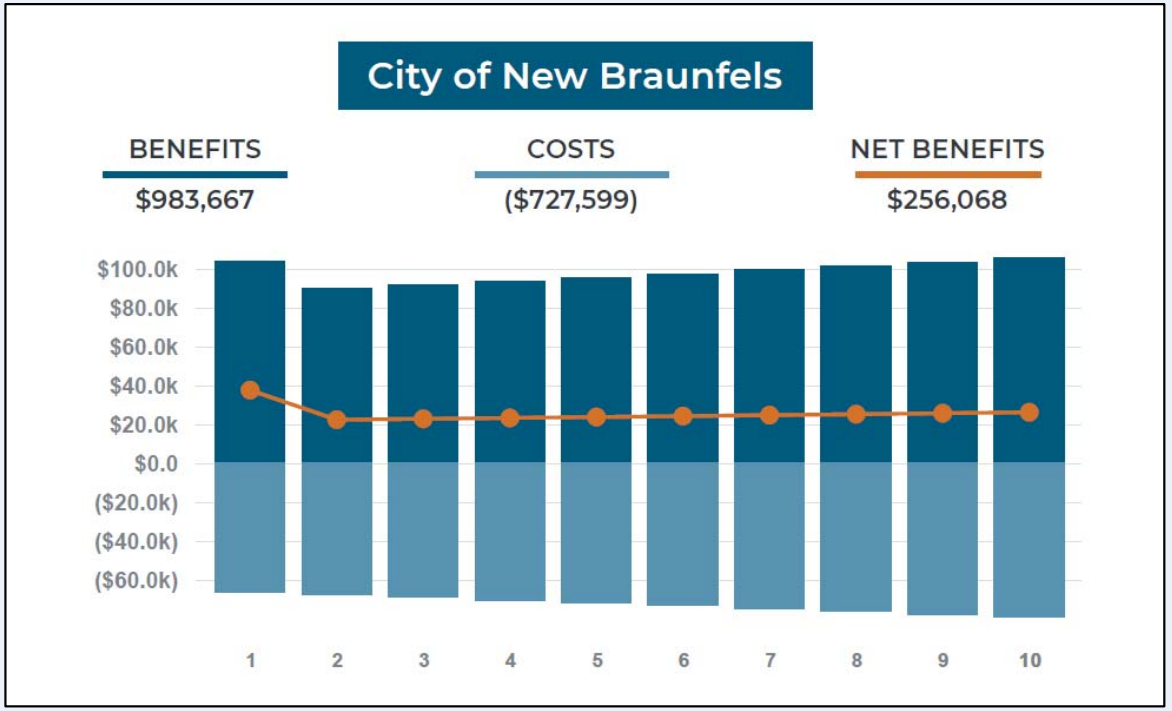
- **Guards against over-subsidizing projects**
- Demonstrates judicious use of incentive
- Helps articulate the case for (or against) use of TIF for a project

Types of Information Requested in Application

- Development proformas
- Development budgets
- Lender and equity term sheets
- Market analysis
- Financial statements
- Ownership interests

Fiscal Impact Analysis

- Establishes the revenues and costs of the project to the taxing entities
- Helps determine whether the project will pay for itself through increased revenues
- Some benefits may not be directly quantifiable



Population and Neighborhood Impacts

- TIF projects can exacerbate property value increases, compounding existing affordability issues and displacing residents
- Public policy can help avoid displacement and harness the increased values in area to power an area's revitalization
- Proactive planning to foster a mixed-income neighborhood can mitigate these impacts to residents
- Other policy tools such as Neighborhood Empowerment Zones (NEZ) can help cities provide tax and other incentives to achieve community and economic development goals in a particular area
  - Chapter 378 of Texas LGC
- Other community development objectives such as public spaces, parks and trails can also be pursued

Policy Overview

- Purpose Statement
- Public Benefits
- Other Policy Considerations
- General Policy
- TIRZ Administration
- Interlocal Cooperation
- Qualifying Expenditures
- Application and Submittal Requirements


QUESTIONS?
City of
New Braunfels

PRESENTER:
Jeff Jewell, Director of Economic and Community Development

SUBJECT:
Discuss and consider changes to the Bylaws of the Workforce Housing Advisory Committee

DEPARTMENT: Economic and Community Development

COUNCIL DISTRICTS IMPACTED: All

BACKGROUND INFORMATION:
City Council created the Workforce Housing Advisory Committee (WHAC) to address the community's affordable and workforce housing needs. The bylaws amendments make some changes to clarify some questions that have arisen as time has progressed.

ISSUE:
The proposed changes clarify some outstanding questions that have arisen as the committee has operated. Specifically, the major revisions/changes are as proposed:

1. Separates Qualifications from Membership and establishes a new section (3.02) that delineates the qualifications of those applicants that will be considered by City Council;

2. Clarifies that the designated organizations can have a maximum of one representative on the Committee;

3. Clarifies that if qualified applicants are not available to represent the aforementioned organizations, the City Council may appoint additional at-large committee members;

4. Removes "unexcused" absences;

5. Clarifies that special called meetings do not count against a member for attendance requirement purposes;

6. Specifies that the Committee will accept nominations and put forward a slate of candidates (or candidate) for City Council's consideration for the Chair position; and

7. Minor grammatical and spelling corrections.

FISCAL IMPACT:
N/A

RECOMMENDATION:
The Workforce Housing Advisory Committee met on July 21, 2021 to consider the proposed changes. Their decision was not available at the time of City Council agenda publication.

BYLAWS
OF THE
WORKFORCE HOUSING ADVISORY COMMITTEE

ARTICLE I
Name

The name of this organization shall be the Workforce Housing Advisory Committee (WHAC).

ARTICLE II
Purpose

The purpose of the Workforce Housing Advisory Committee is to address the community's affordable and workforce housing needs. The Committee will raise awareness about the challenges of affordable and available workforce housing. The WHAC will advise the City Council on providing solutions for a full range of workforce housing choices for households of all incomes, ages, and abilities.

ARTICLE III
Membership, Terms, Attendance

3.01 MEMBERSHIP AND APPOINTMENTS

The WHAC shall be comprised of fifteen (15) members who shall be appointed by the City Council. Members shall be appointed, to the extent available in the community, as described in Section 3.02. City Council will consider nominations from the qualified applicants.

3.02 QUALIFICATIONS

Applicants to the WHAC shall be residents of New Braunfels and demonstrate qualifications for the WHAC to the City Secretary via their application prior to appointment. If a member does not retain the said qualification during his or her term, such failure shall constitute a resignation from the Committee.

By filing an application for the WHAC, eachapplicant agrees to abide by these bylaws, ordinances, rules, and regulations of the City of New Braunfels (including its Code of Ethics) and county, state and federal laws, rules and regulations related to the activities of the WHAC and further agrees to participate incommittee work, required trainings, special called meetings and volunteer activities of the WHAC.

To the greatest extent possible, the committee shall be composed of the following:

a) Twelve (12) members from the following groups or organizations with a maximum of one designated representative per entity: Community Development Advisory Committee, Four Rivers Association of Realtors, GNB Home Builders Association, McKenna Foundation, GNB Chamber of Commerce, NBEDC, NB Housing Authority, New Braunfels Utilities, Planning Commission, local banking or mortgage industry, NB

Housing Partnership, and Habitat for Humanity. Each organization shall designate an applicant for these positions and provide written notice to the City Secretary upon the organization's designation of the applicant.

b) Three (3) at-large members selected from within the New Braunfels City Limits.

If applicants from the above preferred categories 3.01a are not available, City Council may appoint additional at-large committee members. A City staff member, designated by the City Manager, will serve as staff liaison to the Workforce Housing Advisory Committee but will not be a voting member.

3.03 TERMS

The initial term for each Committee member shall be for staggered terms of three (3) years. At the first meeting of the Committee, the members shall draw for terms so that eight (8) members shall serve an initial two-year term, and seven (7) shall serve an initial three-year term. Thereafter, any member appointed or reappointed to the Committee shall serve a ~~yea~~three-year term unlessthe appointment is to fulfill an unexpired vacant term.

3.04 ATTENDANCE

A member of the Committee shall assume to have resigned his or her position as a member of the WHAC thereby forfeiting his or her unexpired term of office is he or she accrues three (3) consecutive absences or a total of any four (4) absences during a calendar year. This provision can be waived upon a finding by a quorum of the Committee that one or more absences should be excused.

Special called meetings do not count against a member for attendance and absence purposes.

3.05 REMOVAL

Each Committee member serves at the pleasure of the City Council and may be removed at the discretion of the City Council.

3.06 RESIGNATION

Any member resigning from the committee shall submit their resignation in writing to the City Secretary and/or the staff liaison for the committee.

3.07 VACANCIES

When vacancies occur on the WHAC, the City Council shall appoint, by majority vote, a replacement to serve out the remainder of the vacant term.

ARTICLE IV
Officers

4.01 ELECTION OF OFFICERS

The City Council will appoint the Chair of the Committee by a majority vote of the City

Council. The Committee may hold an election of the full Committee for a Vice Chair. The Chair will serve until and unless the City Council appoints a new Chair of the committee.

The Committee shall accept nominations for the Chair position and put forward the candidate(s) for the City Council's consideration.

4.02 DUTIES OF OFFICERS

4.02.1 Chair

The Chair shall preside and participate at all meetings of the WHAC and shall have voting power.

4.02.2 Vice-Chair

The Vice-Chair shall assist the Chair as needed and shall serve as the presiding officer in the absence of the Chair. The Vice-Chair shall have voting power.

4.0.3 VACANCIES

Vacancies will be filled by the City Council.

ARTICLE V
Meetings

5.01 DATE, TIME, PLACE

The regularly scheduled meetings are held the third Wednesday of every month at 4:00 pm at City Hall, unless otherwise noted. .

5.02 OPEN MEETINGS

All meetings shall be held in accordance with the Texas Open Meetings Act.

5.03 QUORUM

A majority of the members of the WHAC shall constitute a quorum.

5.04 PARLIAMENTARY AUTHORITY

The rules contained in the current edition of Robert's Rules of Order Newly Revised shall govern the WHAC in~~s~~ all cases in which they are applicable and in which they are not inconsistent with these bylaws. The WHAC shall conduct themselves in accordance with the City Charter of the City of New Braunfels and the Laws of the State of Texas.

PRESENTER:
Caitlin Krobot, City Secretary

SUBJECT:
Discuss and consider approval of the appointment of one individual to the Airport Advisory Board for an unexpired term ending 5/12/2022.

DEPARTMENT: City Secretary's Office

COUNCIL DISTRICTS IMPACTED: City-wide

BACKGROUND INFORMATION:
The Airport Advisory Board makes general studies of airport construction, improvement and operation and acts in advisory capacity towards the general improvement of the airport and the advancement of the City as an air transportation center.

The Board is comprised of five regular members that are resident citizens of the city and appointed by a majority of the city council for three-year staggered terms and two regular members that reside in the city or its extra-territorial jurisdiction of the city that have aviation related experience and will be appointed for a three-year term.

The current opening requires the individual be a city resident. The City Secretary's Office received the following applicants meeting the city resident qualification:

- Francisco Dionisio
- Jason Kern
- Sean Burque
- Travis Krug

ISSUE:
Airport Advisory Board appointments require City Council approval.

FISCAL IMPACT:
There is no fiscal impact.

RECOMMENDATION:

Staff recommends the appointment of 1 individual to the Airport Advisory Board for an unexpired term ending 5/12/2022.

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

SUBJECT:
Render decision on the petition for relief from apportionment of municipal infrastructure costs associated with the proposed 1845 Subdivision located at 1890 FM 1044.

DEPARTMENT: Public Works/Planning & Development Services

COUNCIL DISTRICTS IMPACTED: 1

BACKGROUND INFORMATION:
The City of New Braunfels city engineer received a petition to city council to appeal for relief from an apportionment requirement associated with the proposed 1845 Subdivision located at 1890 FM 1044 in the New Braunfels city limit and Comal County. The purpose of the appeal is for the right-of-way dedication of a minor arterial street on the thoroughfare plan as required in Code of Ordinances Section 118-46 (t), *Responsibility for right-of-way dedication and public street construction*. The code also states that the developer may also be required to construct at least two lanes of an arterial street if such is supported by a traffic impact analysis (TIA).

City staff communicated the thoroughfare requirements with the property owner through predevelopment meetings, TIA scoping meeting, and a meeting with the property owners and their attorneys. In March 2020, New Braunfels Utilities (NBU) notified the city that they received a request for electric service design and that subdivision layout was inconsistent with the city's thoroughfare plan. The city and NBU informed the property owner that the subdivision site plan was noncompliant with the city's subdivision regulations and could not be accepted.

City staff received a request for a rough proportionality analysis for the noncompliant site plan in accordance with State Law and Code of Ordinances Section 118-13. Jeff Whitacre, P.E. with Kimley-Horn and Associates was retained by the city and the analysis shows the apportionment of the right-of-way dedication is roughly proportionate for the noncompliant site plan. Furthermore, city staff notified that applicant that the thoroughfare is subject to modification to fit local conditions and are willing to work on a solution to fully develop the site and meet the city's development requirements. Additionally, a rough proportionality analysis should be conducted for a complaint site plan that meets the city's subdivision regulations.

In addition to the rough proportionality analysis, the city received a request to remove the minor arterial from the thoroughfare plan required with the development of the proposed 1845 Subdivision. The request was presented to the planning commission for a recommendation to city council. Planning commission considered the item on February 2, 2021 and unanimously recommended not to remove the thoroughfare and requested the

applicant to work with city staff on a solution that would meet the city's development requirements. City council considered the item on June 28, 2021 and did not approve the applicant's request to remove the minor collector from the thoroughfare plan that crosses the proposed 1845 Subdivision.

City staff received a petition to appeal the city's retained engineer's proportionality analysis to city council. The petition included the same noncompliant site plan and observations about the analysis. The petitioner did not provide any additional evidence, as stated in the petition, that would change the city's analysis that shows the apportionment of the right-of-way dedication is proportionate. Furthermore, the analysis and decision should be conducted on a complaint site plan to determine a more accurate cost.

Per code, the city council shall consider the request after an appeal hearing is held and make a final decision within 30 days following the final submission of any evidence by the petitioner at the appeal hearing. In deciding the appeal for relief, the city council shall determine whether the petitioner has demonstrated that the city apportionment is not roughly proportionate to the proposed development impact on municipal infrastructure. City council's decision shall be final.

The appeal hearing was conducted at the city council meeting on June 28, 2021. City staff presented the item and the applicant was provided the opportunity to submit and present evidence demonstrating that the apportionment requirement is not roughly proportionate to the impact of the development. City council considered all the evidence presented at the appeal hearing.

A revised site plan including the subject thoroughfare roadway was submitted as part of the applicant's evidence. The site plan appears to include 76 single-family detached housing units and approximately 19,800 square foot of commercial land use. The commercial land use was estimated utilizing the ratio of lot size to commercial size from the applicant's traffic impact analysis for the original non-compliant site plan. Based on the adopted 2019 Roadway Impact Fee Study, the proposed development will generate 509.35 vehicle-miles traveled and the cost per vehicle-mile is $1,371 in Service Area 5. The total demand cost of the development with the revised site plan is roughly $698,318.85. The total demand cost of the development with the original site plan is roughly $988,203.09. Note that the two site plans submitted by the applicant are non-compliant and the property is not properly zoned for the land uses shown on the site plan.

City code requires right-of-way dedication for the thoroughfare and construction of two lanes if required by the development. The right-of-way supply cost would be between $197,439 - $253,475 based on information provided by the applicant. Construction is dependent on the development traffic impacts and the remaining would be available for construction to serve the development. An updated and conforming site plan including zoning would need to be completed to evaluate the construction requirements.

City Council shall consider the petition for relief, the analysis prepared by the city, and the evidence presented by the applicant, and shall take one of the following actions:

1. Deny the appeal for relief, and impose the standard or condition in accordance with the initial decision;

2. Deny the appeal for relief, upon finding that the proposed requirements are inadequate to offset the impacts of the development on the municipal infrastructure, and either deny the application or require that additional apportionments for municipal infrastructure be made as a condition of approval of the application;

3. Grant the appeal in part and add such conditions of approval to the application as it deems appropriate;

4. Grant the appeal for relief, and waive in whole or in part any apportionment requirement necessary to meet the criteria for approval; or

5. Grant the appeal for relief, in whole or in part, and direct that the city participate in the costs of the particular municipal infrastructure pursuant to standard participation policies.

ISSUE:
Appeal hearing for relief from apportionment of municipal infrastructure costs associated with the proposed 1845 Subdivision located at 1890 FM 1044.

FISCAL IMPACT:
City may be required to participate in or cover the costs of the right-of-way dedication required in the city's subdivision regulations.

RECOMMENDATION:
Analysis prepared by the city shows the apportionment of the right-of-way dedication associated with apportionment of municipal infrastructure costs associated with the proposed 1845 Subdivision located at 1890 FM 1044 is roughly proportionate for the noncompliant site plan. Staff recommends City Council deny the appeal for relief, and impose the standard or condition in accordance with the initial decision that the analysis and decisions should be conducted on a compliant site plan.

October 13, 2020

Via CMRRR and E-Mail

Mr. Garry Ford, Jr., P.E.
City Engineer
City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

E-mail (gford@nbtexas.org)

Re: Kramm Family – proposed 1845 Subdivision

Dear Mr. Ford:

I represent the Kramm family which owns a 25.641-acre tract located on FM 1044 in New Braunfels. Attached is an aerial photograph depicting the boundaries of the tract. The property is currently zoned APD but, as you can see, it is surrounded by existing single family residential developments.

On September 15, 2018, the Kramms entered a contract to sell the property to ECS Development, LLC for $1,000,000. As part of its due diligence on the project, the buyer's engineer met with the City to discuss, among other things, future infrastructure needs and the possibility of exactions. The buyer was told that the property will be crossed by a minor arterial as set out in the Throughfare Plan and that it would be required to dedicate the necessary right-of-way and construct at least a portion of the future roadway. Upon receipt of this information, the buyer terminated the contract under the feasibility review provision.

Subsequently, on January 17, 2019, the Kramm Family, accompanied by its attorneys, met with City staff and Counsel to discuss the situation. City officials confirmed that a minor arterial was to be placed through the middle of the property and confirmed the required exactions. At this meeting, the City Representatives declined to waive the requirements and suggested that the landowners would have to exhaust administrative remedies before seeking relief in the courts.

In response, the landowners spent significant money to develop a subdivision plan so as to exhaust administrative remedies. As required by City rules, the plan was first submitted to New Braunfels Utilities and to TxDOT. The entities did not reply. Instead the City Engineer responded that the proposed plan did not comply with the Thoroughfare Plan and was unacceptable to the City. It is apparent that the City intends to insist on compliance with its Throughfare Plan. The purpose of this letter is to ask that our property be removed from that Plan. Alternatively, we want to initiate a rough proportionality study under State Law and the applicable provisions of the City Code.

Also attached is a plat of the proposed subdivision with the proposed future roadway superimposed upon it. Compliance with the Plan would require the landowner to dedicate about 5.5-acres for right-of-way; more than 20% of its property. It will also divide the property into three remnant tracts, the smallest of which has no development potential at all. It would entirely eliminate the small commercial development proposed along FM 1044 and would also significantly diminish the number of residential lots which could be developed on the remaining land. The landowner would not be allowed any access to the proposed arterial except for the limited opportunity to dedicate land and build additional internal streets to serve what is left of the land. The adjusted average daily traffic count upon build-out of the subdivision, without consideration of the arterial, is 3052 vehicle trips per day. After the loss of the proposed commercial and significant reduction in residential yield, the actual traffic impact would only be a fraction of that number.

Please consider this as a formal request that the City Engineer or some other Texas Registered Engineer conduct a rough proportionality analysis and provide it to us within the 14-day period required by State law. I thank you in advance for your cooperation.

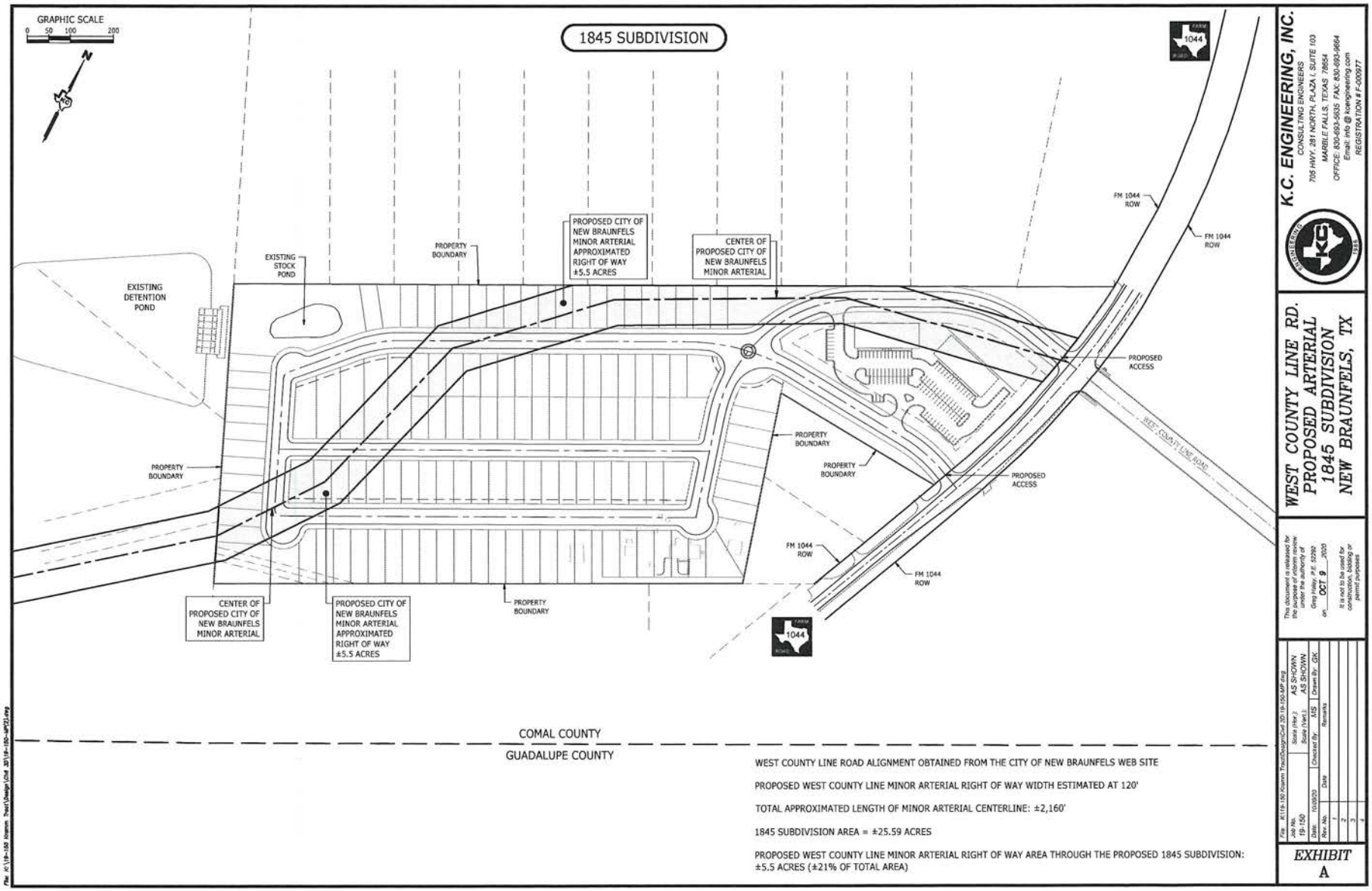
Very truly yours,

John McClish
Brady & Hamilton • Womack McClish
john@bhlawgroup.com

JM/br
Enclosures
cc: Kramm family

Aerial


Lou Ann Dr
Lou Ann Dr
1044
Logans Pass
Joy Spring
W County Line Rd
W County Line Rd
Water Ln
Nicholas Cove
Sawmill Ln
Northforest
Mayberry Hill
1044
Michelson Ln



WEST COUNTY LINE ROAD ALIGNMENT OBTAINED FROM THE CITY OF NEW BRAUNFELS WEB SITE

PROPOSED WEST COUNTY LINE MINOR ARTERIAL RIGHT OF WAY WIDTH ESTIMATED AT 120'

TOTAL APPROXIMATED LENGTH OF MINOR ARTERIAL CENTERLINE: ±2,160'

1845 SUBDIVISION AREA = ±25.59 ACRES

PROPOSED WEST COUNTY LINE MINOR ARTERIAL RIGHT OF WAY AREA THROUGH THE PROPOSED 1845 SUBDIVISION: ±5.5 ACRES (±21% OF TOTAL AREA)

K.C. ENGINEERING, INC.
CONSULTING ENGINEERS
705 HWY. 281 NORTH, PLAZA I, SUITE 103
MARBLE FALLS, TEXAS 78654
OFFICE: 830-693-5535 FAX: 830-693-9664
Email: info @ kcengineering.com
REGISTRATION # F-009977

WEST COUNTY LINE RD. PROPOSED ARTERIAL 1845 SUBDIVISION NEW BRAUNFELS, TX

This document is released for the purpose of plan review under the authority of Greg Haley, P.E. 52292 on OCT 9 2020
It is not to be used for construction, bidding or permit purposes.

File: K:\19-150 Kramm Tract\Design\Civil 3D\19-150-MP.dwg
Job No. 19-150
Date: 10/09/20
Scale (Hor.): AS SHOWN
Scale (Vert.): AS SHOWN
Checked By: MS
Drawn By: GK

Rev. No.	Date	Remarks
1		
2		
3		
4		

EXHIBIT A

Plot: M:\19-150 Kramm Tract\Design\Civil 3D\19-150-MP(2).dwg

October 20, 2020

Via E-Mail

Mr. Garry Ford, Jr., P.E. *E-mail (gford@nbtexas.org)*
City Engineer
City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Re: Kramm Family – proposed 1845 Subdivision

Dear Mr. Ford:

I write to amend my letter of October 13, 2020. In that letter I suggested that State law requires your response within 14 days. You actually have 30 days in which to tender your rough proportionality analysis. I apologize for any inconvenience that may have caused.

Very truly yours,

John McClish
Brady & Hamilton • Womack McClish
john@bhlawgroup.com

JM/br
Enclosures
cc: Kramm family
Mr. Frank Onion
(fonion@nbtexas.org)

City of New Braunfels

PUBLIC WORKS

November 5, 2020
John McClish
Brady & Hamilton * Womack McClish
1801 Lavaca, Suite 120
Austin, TX 78701

Re: Kramm Family – proposed 1845 Subdivision

Dear Mr. McClish:

This is in response to your letter dated October 13, 2020 concerning the removal of the County Line Road Minor Arterial from the City of New Braunfels Regional Transportation Plan and a rough proportionality analysis of the proposed 1845 Subdivision associated with the Kramm Family tract located on FM 1044. We also received your letter dated October 20, 2020 amending the State law required response from 14 days to 30 days.

The City utilized the professional services of Jeff Whitacre, P.E. with Kimley-Horn and Associates, Inc. to conduct a rough proportionality analysis of the proposed 1845 Subdivision. Mr. Whitacre is a Texas Registered Engineer, License Number 102469. Mr. Whitacre prepared the enclosed Technical Memorandum concluding that the County Line Road Minor Arterial right-of-way dedication is roughly proportionate to the proposed 1845 Subdivision as presented to the City of New Braunfels. The proposed site plan, land use, and intensity were based on information provided with the letter request and additional information provided by K.C. Engineering, Inc. associated with a formal application received on October 22, 2020 to remove the County Line Road Minor Arterial from the City of New Braunfels Regional Transportation Plan. You may appeal the analysis in accordance with the City of New Braunfels Code of Ordnances Section 118-13.

Your letter states that a "plat" of the proposed subdivision with the proposed future roadway superimposed was attached; however, the exhibit provided with the request represents a preliminary site plan that does not comply with the City's zoning and platting requirements. The tract is currently zoned agricultural/pre-development (APD) and the single-family lots shown on the preliminary site plan don't appear to meet the minimum standards. The engineers for the project are responsible to prepare plans, including a traffic impact analysis, that conform to the provisions of local codes and ordinances including platting requirements.

The County Line Road Minor Arterial superimposed on the subject tract represents a generalized location and is subject to modification to fit local conditions and subject to refinement. Furthermore, the City is currently updating the Regional Transportation Plan and is proposing to reduce the right-of-way requirements of a minor arterial from 120 feet to 100 feet and may be applicable to the subject tract. This update is ongoing and planned for approval by City Council in 2021. Furthermore, modifications to the site plan, zoning of the tract, and other adjustments to the roadway network, drainage facilities, intersections, and access will allow for various development scenarios. An additional rough proportionality analysis can be conducted based on an alternate development plan.

As noted above, we have received a formal application to remove the County Line Road Minor Arterial from the Regional Transportation Plan. The request requires staff review and local and state agency coordination to prepare a recommendation. The recommendation will be presented to Planning Commission for a recommendation to City Council. City Council will consider the recommendation and make a determinate on the thoroughfare. We anticipate this process to take up to 90 days.

We are willing to work with the Kramm family and engineers for the tract to fully develop the site and meet the City's development requirements. Feel free to contact me if you have any questions.

Sincerely,

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

Enclosures

cc: Christopher J. Looney, AICP, Planning and Development Services Director
Greg A. Malatek, PE, Public Works Director

Kimley»Horn

TECHNICAL MEMORANDUM

11/4/2020

To: Garry Ford, P.E.
City Engineer
City of New Braunfels

From: Jeff Whitacre, P.E., AICP, PTP
Kimley-Horn and Associates, Inc.
TBPE Firm Number F-928

Date: November 4, 2020

Subject: Kramm Family Rough Proportionality Analysis
City of New Braunfels, Texas

Purpose

On October 13, 2020 the City of New Braunfels (City) received a request for the City Engineer to conduct a rough proportionality analysis for the Kramm Family proposed 1845 Subdivision. Under Section 118-46 (b) (2) "*whenever a tract to be platted borders on or embraces any part of any street shown on the thoroughfare plan, such part of such proposed street shall be shown on the master plan or the plat."* The letter stated that a subdivision plan was submitted that did not comply with the Thoroughfare Plan after a previous meeting was held outlining this requirement. Currently a subdivision plan has not been submitted that complies with the Subdivision Platting requirements. However, the memo requests a proportionality analysis to be completed. For a rough proportionality assessment, a compliant plan should be presented to make an accurate determination. This determination will be made on the current submitted plan but should be revised once a compliant plan is submitted.

The purpose of this memorandum is to provide a "rough proportionality" calculation of the submitted Kramm Family proposed 1845 Subdivision. For roads, the rough proportionality calculation is a comparison of the capacity provided by a development to the traffic impacts of the proposed development.

Proportionality Methodology

Traffic generation of new development impacts the area roadway system by using available capacity. To measure system impacts, an analysis using vehicle-miles of travel in the PM peak hour was conducted. Using the vehicle-miles of travel (demand), the cost of the provided by roadway improvements (supply) can be compared with the cost of traffic generated by a proposed development.

Kimley»Horn

Demand

Based upon information provided by the City from a March 16,2020 Traffic Impact Analysis (TIA) worksheet (submitted after the October 13, 2020 letter) the Kramm Family proposed 1845 Subdivision will ultimately consist of the following land use and intensity:

- 125 single-family detached housing
- 18,000 square feet of commercial

Based on the adopted 2019 Roadway Impact Fee Study the following are the vehicle-miles traveled generated by the proposed development:

- 125 dwelling units * 4.61 vehicle-miles/dwelling unit
  - 576.25 vehicle-miles
- 18.0 1,000 square feet * 8.03 vehicle-miles/1,000 square feet
  - 144.54 vehicle-miles

TOTAL DEMAND: 650.04 vehicle-miles

The cost per vehicle-mile indicated in the 2019 Roadway Impact Fee Study is $1,371 per vehicle mile in Service Area 5.

- 720.79 vehicle-miles * $1,371/vehicle-mile

TOTAL DEMAND: $988,203.09

The total impact of the proposed development on the transportation network in the City of New Braunfels Service Area 5 is $988,203.09.

Supply

Based upon information provided by the City of New Braunfels and the applicant, the Kramm Family proposed 1845 Subdivision is requested to dedicate the right-of-way for the County Line Road minor arterial extension and potentially build two-lanes of the roadway to serve the proposed development. The current Thoroughfare Plan illustrates 120’ of right-of-way for County Line Road extension the while a proposed amendment shows 100’ of right-of-way. This would result in 4.861 (211,745 sq. ft.) acres or 5.819 acres (253,475 sq. ft).

Based on the October 13, 2020 letter the land was approximately $1 per square foot, so the right-of-way request would be between $211,745 - $253,475 which is below the demand calculated. Note Comal County Appraisal District shows a market value of $630,690 which is 63% of the value indicated in the October 13, 2020 letter.

The remaining $734,728.09 ($988,203.09 -$253,475). would be available to the construction of the needed County Line Road extension to serve this development. An updated site plan would need to be completed to evaluate this requirement.

Analysis

Based on information provided by the applicant in the March 16, 2020 preliminary drainage site plan, TIA worksheet and October 13, 2020 letter the request for right-of-way dedication ($253,475) is less than then demand of $988,203.09 and as a result is a roughly proportional request.

It is anticipated that if the alignment was properly drawn three areas would be created, 15.437 acres, 4.523 acre tract, and 0.769 acre tract. The 0.769 acre tract is in the same location that was identified in the March 16, 2020 as a proposed water quality and detention pond and is anticipated could remain as such. The commercial tract could remain and the remaining residential areas would be to be revaluated.

Conclusion

Based on the current information the request of the Kramm Family proposed 1845 Subdivision to dedicate right-of-way for the County Line Road minor arterial extension as requested is roughly proportionate to this development.

This analysis should be updated based on a compliant site plan that considers this roadway based on the guidance that was previously provided.

February 2, 2021

Via Email (gford@nbtexas.org)

Mr. Garry Ford, Jr., P.E.
City Public Works Director
City Engineer
City of New Braunfels
550 Landa Street
New Braunfels, TX 78130

Re: Kramm Family – proposed 1845 Subdivision

Dear Mr. Ford:

This is a petition to the City Council alleging that the exactions proposed by the City on the proposed 1845 Subdivision owned by the Kramm Family are not roughly proportional to the burdens imposed on City infrastructure by the development proposed. I file it with you in compliance with the applicable City Ordinance. I trust that you will make it available to the City Council as appropriate.

I attach for your consideration another copy of the site plan proposed by the Kramms as burdened by the proposed minor arterial.

I first want to make an observation about the proposed City process. The Ordinance states that the burden of proof is on the landowner to demonstrate that the City's exactions are not roughly proportional. State Statute and the decisions of the United States Supreme Court make it clear that the burden of proof is actually on the City to demonstrate that its demands are roughly proportional to an increased burden on City infrastructure.

In an effort to meet this burden, the City has provided a rough proportionality analysis sealed by Jefferey A. Whitaker, P.E. with Kimley-Horn & Associates, Inc. I make the following observations about his analysis.

Under current regulations, the landowner would be required to dedicate 5.819-acres or almost 23% of his land. The analysis concedes that the Kramm Family could be liable to build two lanes of the proposed roadway but ignores the cost of this construction. In addition to these costs, the routing of the roadway through the property severs it into two triangles and an extremely irregular 15-acre remainder that would not be allowed any access to FM 1044 under current TxDOT spacing regulations. As a practical matter, if they wanted to make any profitable use of the land, the Kramms would have to build a portion of the roadway to get legal access, whether the City required it or not. If you consider the full extent of the value taken from the

Kramms, it will be several times the engineer's estimate of the right-of-way value alone.

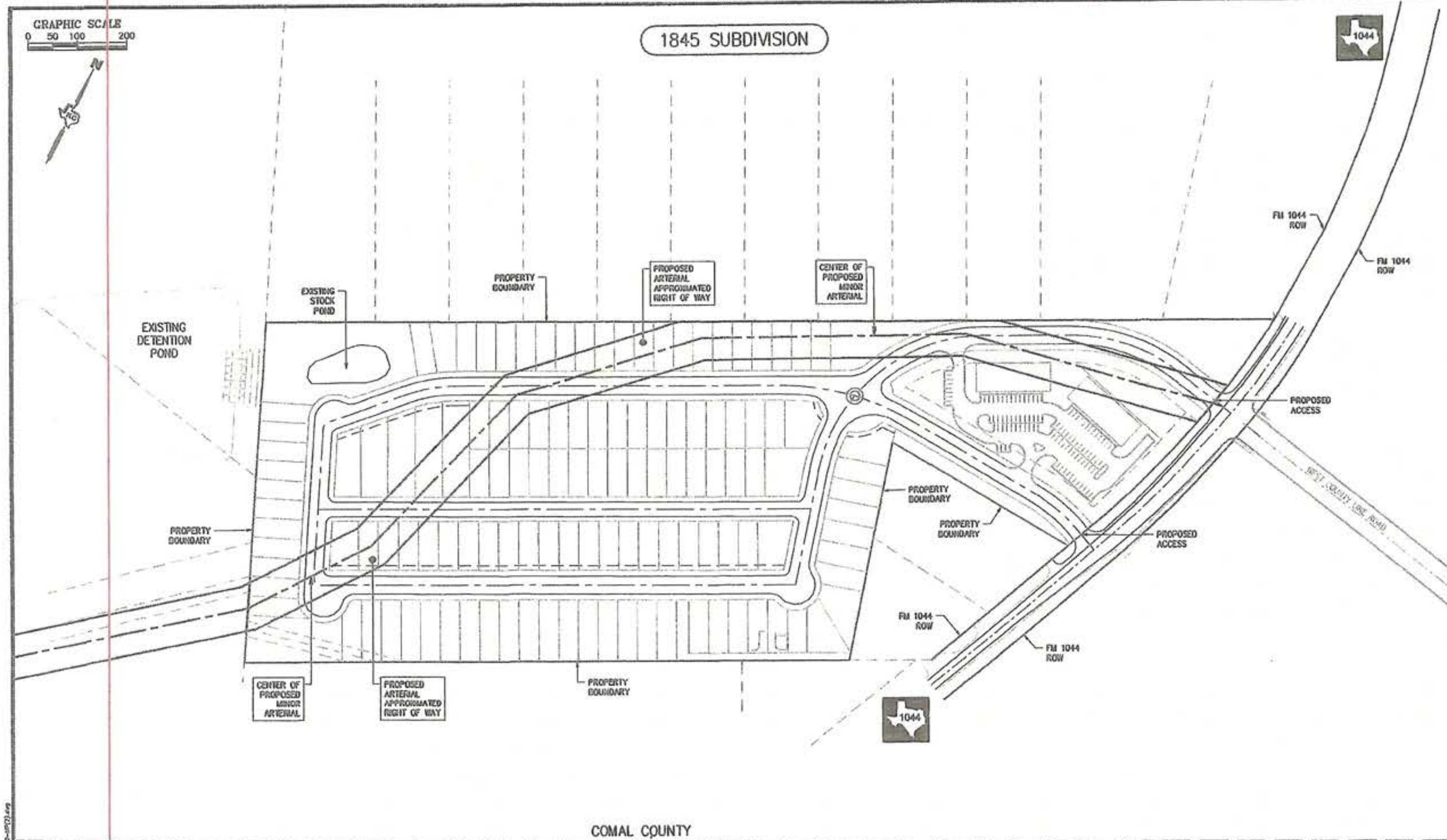
I also take issue with Mr. Whitaker's proportionality numbers. As I understand it, by his estimate an exaction of $988,203.09 would be justified, utilizing the City's 2019 Roadway Impact Fee Study. I should point out that the property was appraised as of January 18, 2018 at $870,000 by Byron K. Setser, MAI. I will also remind you that all this erupted because the property was under contract to a developer for $1,000,000 who killed the deal when he learned about the City's roadway requirements. Mr. Whitaker's conclusion that the City could demand the entire value of the tract and pass rough proportionality muster is simply not credible. It appears that the City's estimate of $1,371 / vehicle-mile might need to reworked.

In any event, consider this an appeal of the City's attempt to justify its actions. We will submit additional evidence within the 90-days allowed.

Very truly yours,

John McClish
Brady & Hamilton • Womack McClish
john@bhlawgroup.com

JM/br
Enclosure
cc: Kramm Family
Mr. Greg Haley



WEST COUNTY LINE ROAD ALIGNMENT OBTAINED FROM THE CITY OF NEW BRAUNFELS WEBSITE

PROPOSED WEST COUNTY LINE ARTERIAL RIGHT OF WAY WIDTH ESTIMATED AT 90' (EXTRAPOLATED FROM THE PUBLICATION "CITY OF NEW BRAUNFELS REGIONAL TRANSPORTATION PLAN RIGHT-OF-WAY DETERMINATION"

TOTAL APPROXIMATED LENGTH OF ARTERIAL CENTERLINE: ±2,160'

1845 SUBDIVISION AREA = ±25.59 ACRES

PROPOSED WEST COUNTY LINE ARTERIAL RIGHT OF WAY AREA THROUGH THE PROPOSED 1845 SUBDIVISION: ±4.2 ACRES (±16% OF TOTAL AREA)

K.C. ENGINEERING, INC.
CONSULTING ENGINEERS
705 HWY. 281 NORTH, PLAZA I, SUITE 103
MARBLE FALLS, TEXAS 78654
OFFICE: 830-693-5535 FAX: 830-693-5664
Email: info@kcengineering.com
REGISTRATION # F-000977

WEST COUNTY LINE RD.
PROPOSED ARTERIAL
1845 SUBDIVISION
NEW BRAUNFELS, TX

This document is released for the purpose of interim review under the authority of Greg Haley, P.E. 93280 on SEPT 27 2020

It is not to be used for construction, bidding or permit purposes

File: K:\19-150 Haven Tract\Design\Civil 2010\19-150-MP.dwg

Job No.	Scale (Hor.):	AS SHOWN
19-150	Scale (Vert.):	AS SHOWN
Date: 6/02/20	Checked By: MS	Drawn By: GK
Rev. No.	Date	Remarks
1		
2		
3		
4		

EXHIBIT A

Written evidence presented on behalf of the appellant at the June 28, 2021 Appeal Hearing. Submitted by email on June 22, 2021 by:

John McClish
BRADY & HAMILTON • WOMACK MCCLISH
805 E. 32nd Street, Suite 200
Austin, Texas 78705
Tel: 512.474-9875
Fax: 512.474-9894
Email: john@bhlawgroup.com

Vernon's Texas Statutes and Codes Annotated
Local Government Code (Refs & Annos)
Title 7. Regulation of Land Use, Structures, Businesses, and Related Activities
Subtitle A. Municipal Regulatory Authority
Chapter 212. Municipal Regulation of Subdivisions and Property Development (Refs & Annos)
Subchapter Z. Miscellaneous Provisions

V.T.C.A., Local Government Code § 212.904

§ 212.904. Apportionment of Municipal Infrastructure Costs

Effective: June 10, 2019
Currentness

(a) If a municipality requires, including under an agreement under Chapter 242, as a condition of approval for a property development project that the developer bear a portion of the costs of municipal infrastructure improvements by the making of dedications, the payment of fees, or the payment of construction costs, the developer's portion of the costs may not exceed the amount required for infrastructure improvements that are roughly proportionate to the proposed development as approved by a professional engineer who holds a license issued under Chapter 1001, Occupations Code, and is retained by the municipality. The municipality's determination shall be completed within thirty days following the submission of the developer's application for determination under this subsection.

(b) A developer who disputes the determination made under Subsection (a) may appeal to the governing body of the municipality. At the appeal, the developer may present evidence and testimony under procedures adopted by the governing body. After hearing any testimony and reviewing the evidence, the governing body shall make the applicable determination within 30 days following the final submission of any testimony or evidence by the developer.

(c) A developer may appeal the determination of the governing body to a county or district court of the county in which the development project is located within 30 days of the final determination by the governing body.

(d) A municipality may not require a developer to waive the right of appeal authorized by this section as a condition of approval for a development project.

(e) A developer who prevails in an appeal under this section is entitled to applicable costs and to reasonable attorney's fees, including expert witness fees.

(f) This section does not diminish the authority or modify the procedures specified by Chapter 395.

Credits
Added by Acts 2005, 79th Leg., ch. 982, § 1, eff. June 18, 2005. Amended by Acts 2019, 86th Leg., ch. 635 (S.B. 1510), § 1, eff. June 10, 2019.

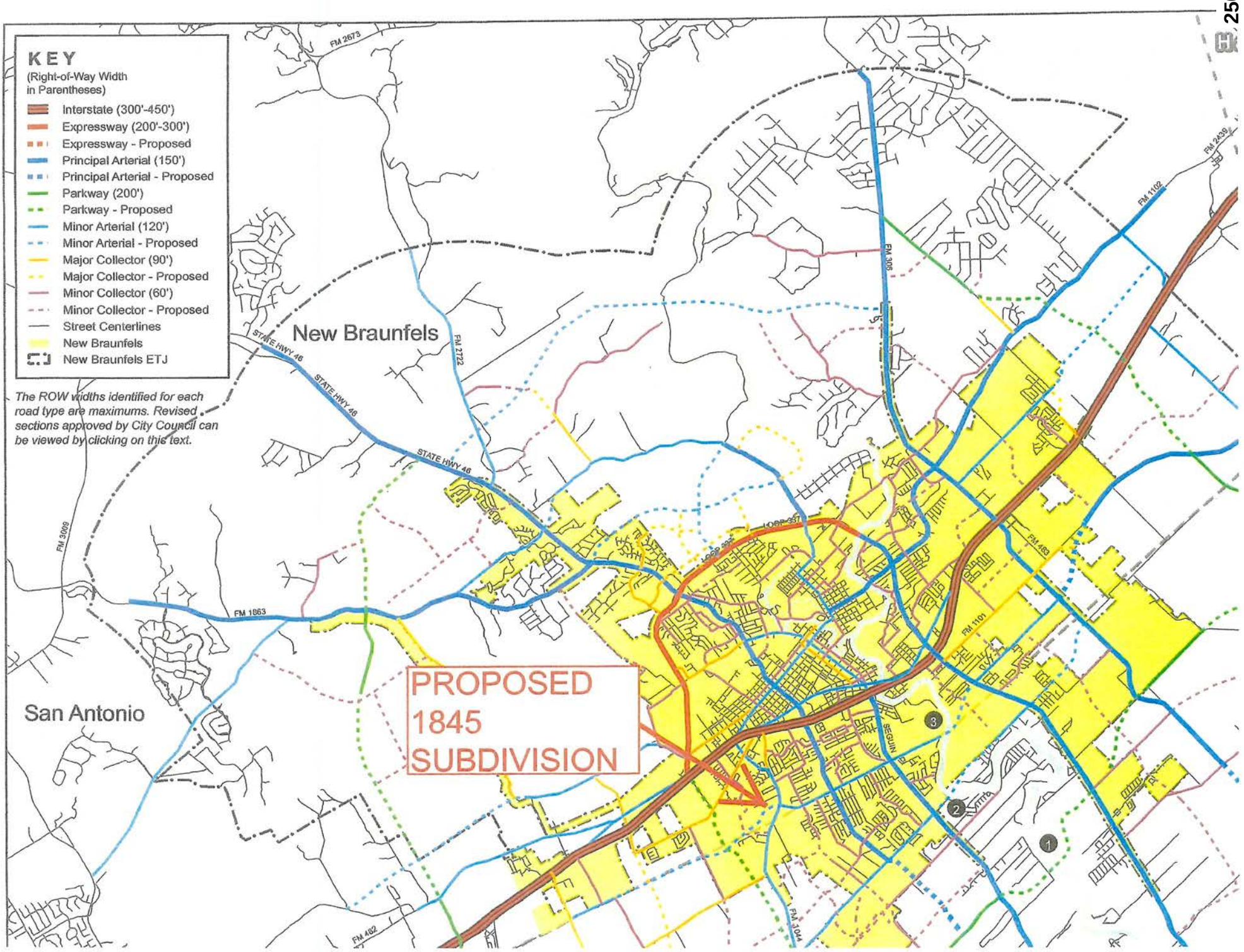
Notes of Decisions (2)

V. T. C. A., Local Government Code § 212.904, TX LOCAL GOVT § 212.904
Current through the end of the 2019 Regular Session of the 86th Legislature

End of Document

Aerial


Lou Ann Dr
Lou Ann Dr
1044
Logans Pass
Joy Spring
W County Line Rd
W County Line Rd
Nicholas Cove
Water Ln
Sawmill Ln
Noel Forest
Maybeck Mill
1044
Mitchelson Ln


KEY
(Right-of-Way Width
in Parentheses)
Interstate (300'-450')
Expressway (200'-300')
Expressway - Proposed
Principal Arterial (150')
Principal Arterial - Proposed
Parkway (200')
Parkway - Proposed
Minor Arterial (120')
Minor Arterial - Proposed
Major Collector (90')
Major Collector - Proposed
Minor Collector (60')
Minor Collector - Proposed
Street Centerlines
New Braunfels
New Braunfels ETJ
The ROW widths identified for each road type are maximums. Revised sections approved by City Council can be viewed by clicking on this text.
New Braunfels
San Antonio
PROPOSED
1845
SUBDIVISION
FM 2673
FM 2722
FM 306
FM 2439
FM 1102
STATE HWY 46
FM 3009
FM 1863
FM 482
FM 483
FM 1044
LOOP 337
SEGUIN

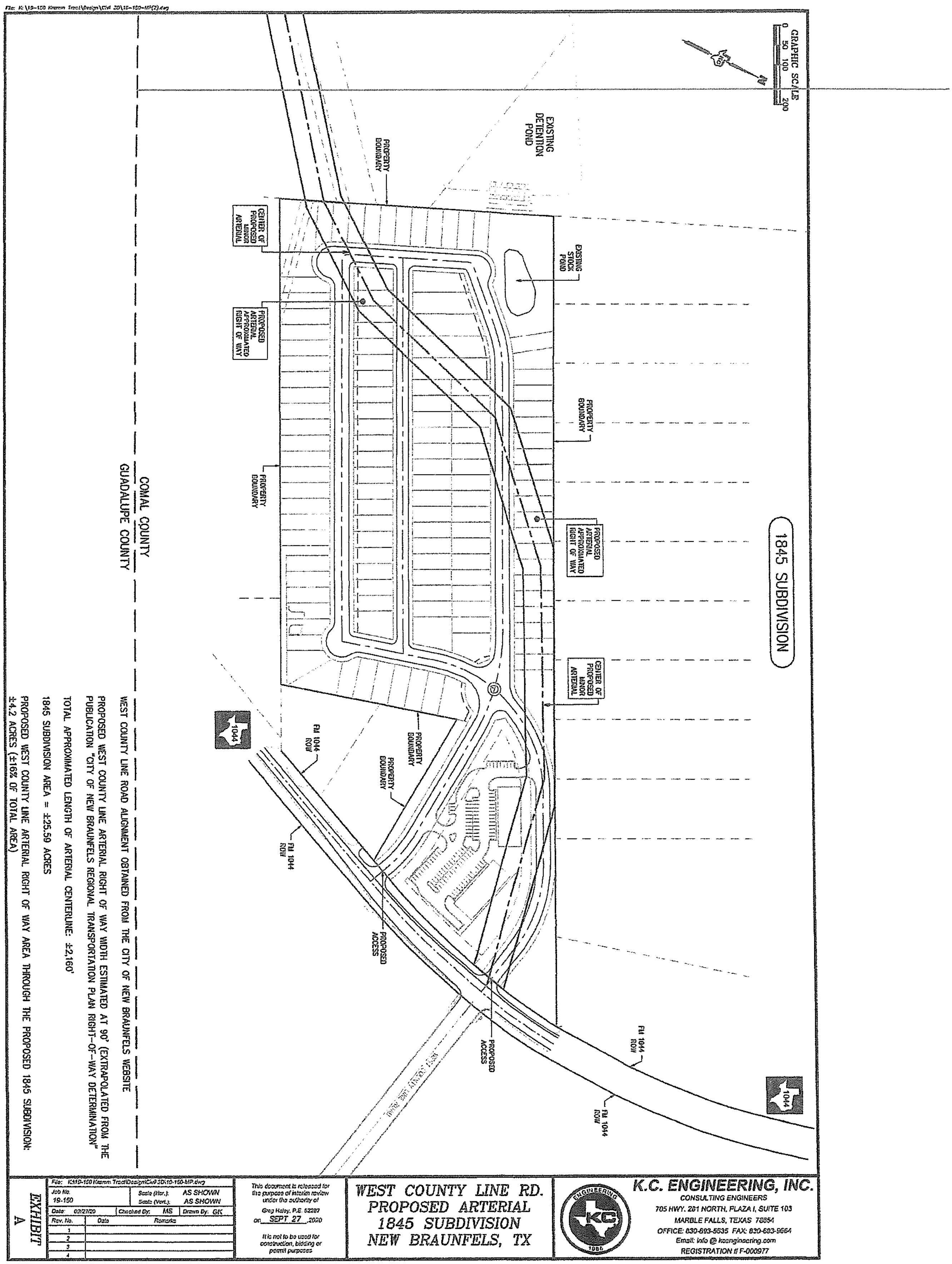

GRAPHIC SCALE
0 50 100 200
EXISTING DETENTION POND
PROPERTY BOUNDARY
CENTER OF PROPOSED MINOR ARTERIAL
EXISTING STOCK POND
PROPOSED ARTERIAL APPROXIMATED RIGHT OF WAY
1845 SUBDIVISION
COMAL COUNTY
GUADALUPE COUNTY
FM 1044 ROW
1044
PROPOSED ACCESS
WEST COUNTY LINE ROAD ALIGNMENT OBTAINED FROM THE CITY OF NEW BRAUNFELS WEBSITE
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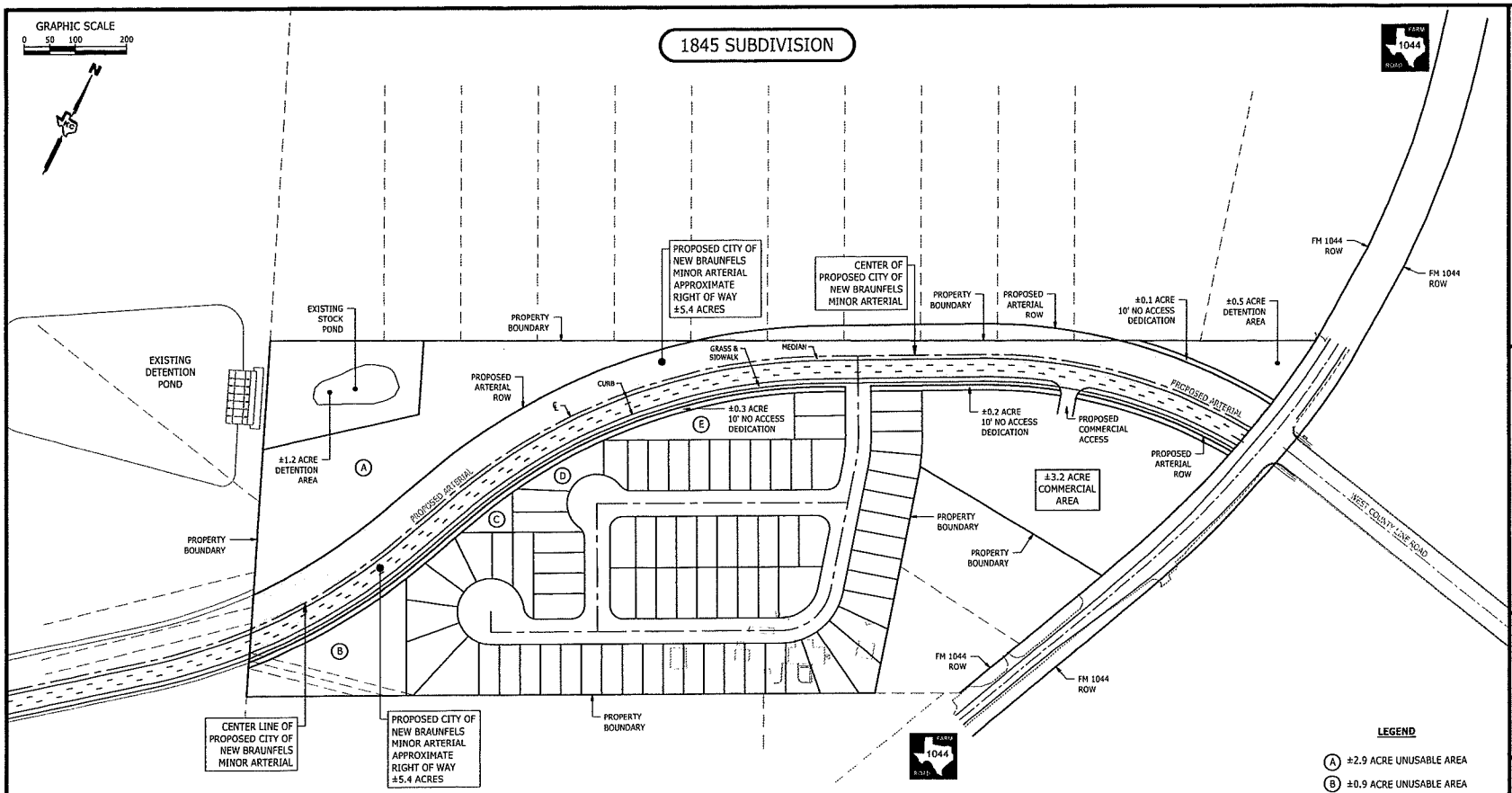
EXHIBIT A
Job No. 19-150
Scale (Hor.): AS SHOWN
Scale (Vert.): AS SHOWN
Date: 03/27/20
Checked By: MS
Drawn By: GK
Rev. No. Date Remarks
1
2
3
4
This document is released for the purpose of interim review under the authority of Greg Haley, P.E. 52287 on SEPT 27 2020
It is not to be used for construction, bidding or permit purposes
WEST COUNTY LINE RD.
PROPOSED ARTERIAL
1845 SUBDIVISION
NEW BRAUNFELS, TX
ENGINEERING
KC
1986
K.C. ENGINEERING, INC.
CONSULTING ENGINEERS
705 HWY. 281 NORTH, PLAZA I, SUITE 103
MARBLE FALLS, TEXAS 78654
OFFICE: 830-693-5635 FAX: 830-693-9664
Email: info @ kcengineering.com
REGISTRATION # F-000977



1845 SUBDIVISION AREA = ±25.59 ACRES

NUMBER OF LOTS	76
DEVELOPED AREA (LOTS & DETENTION)	±11.8 ACRES (±46%)
DEVELOPED AREA (COMMERCIAL)	±3.2 ACRES (±13%)
ARTERIAL ROW AREA	±5.4 ACRES
UNUSABLE AREA	±4.6 ACRES
10' NO ACCESS DEDICATION AREA	±0.6 ACRES
TOTAL AREA ATTRIBUTED TO ARTERIAL	±10.6 ACRES(±41%)

WEST COUNTY LINE ROAD ARTERIAL ALIGNMENT OBTAINED FROM THE CITY OF NEW BRAUNFELS WEB SITE AND MODIFIED TO APPROXIMATE THE PROPOSED FUTURE ALIGNMENT

PROPOSED WEST COUNTY LINE ROAD MINOR ARTERIAL RIGHT OF WAY WIDTH ESTIMATED AT 120'

TOTAL APPROXIMATE LENGTH OF WEST COUNTY LINE ROAD MINOR ARTERIAL CENTERLINE: ±2,130'

SEE EXHIBIT B FOR TYPICAL SECTION

EXHIBIT A BASED UPON "EXISTING CROSS SECTION (120' ROW)"

K.C. ENGINEERING, INC.
CONSULTING ENGINEERS
705 HWY. 281 NORTH, PLAZA I, SUITE 103
MARBLE FALLS, TEXAS 78654
OFFICE: 830-693-5535 FAX: 830-693-9664
Email: info @ kcengineering.com
REGISTRATION # F-000977

WEST COUNTY LINE RD.
PROPOSED ARTERIAL
1845 SUBDIVISION
NEW BRAUNFELS, TX

This document is released for the purpose of interim review under the authority of Greg Haley, P.E. 92292 on June 22, 2021

It is not to be used for construction, bidding or permit purposes

File: K:\19-150 Kramm Tract\Design\Civil 3D\19-150-MP40.dwg			
Job No. 19-150	Scale (Hor.): AS SHOWN		
Date: June 22, 2021	Scale (Vert.): AS SHOWN		
Rev. No.	Date	Checked By: MS	Drawn By: GK
		Remarks	
1			
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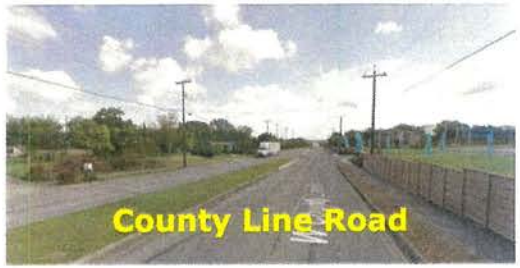
EXHIBIT A

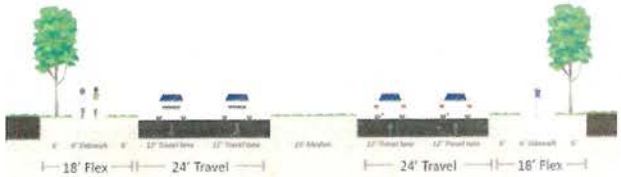
File: K:\19-150 Kramm Tract\Design\Civil 3D\19-150-MP40.dwg

Proposed Cross Sections: Minor Arterials

Existing Cross Section (120' ROW)



Proposed Option (100' ROW)



- Four-lane facility with median or turn lane
- Six-foot sidewalks
- Buffer space to separate pedestrians from roadway

20

FROM "THOROUGHFARE PLAN UPDATE"
NOVEMBER 5, 2019

K.C. ENGINEERING, INC.
CONSULTING ENGINEERS
705 HWY. 281 NORTH, PLAZA 1, SUITE 103
MARBLE FALLS, TEXAS 78654
OFFICE: 830-693-5635 FAX: 830-693-9664
www.kcengineering.com
REGISTRATION # F-977

WEST COUNTY LINE RD.
TYPICAL SECTION
1845 SUBDIVISION
NEW BRAUNFELS, TX

This document is released for the purpose of interim review under the authority of Greg Haley, P.E. 52292 on June 22, 2021. It is not to be used for construction, bidding or permit purposes

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EXHIBIT
B

City of New Braunfels

PUBLIC WORKS

November 5, 2020
John McClish
Brady & Hamilton * Womack McClish
1801 Lavaca, Suite 120
Austin, TX 78701

Re: Kramm Family – proposed 1845 Subdivision

Dear Mr. McClish:

This is in response to your letter dated October 13, 2020 concerning the removal of the County Line Road Minor Arterial from the City of New Braunfels Regional Transportation Plan and a rough proportionality analysis of the proposed 1845 Subdivision associated with the Kramm Family tract located on FM 1044. We also received your letter dated October 20, 2020 amending the State law required response from 14 days to 30 days.

The City utilized the professional services of Jeff Whitacre, P.E. with Kimley-Horn and Associates, Inc. to conduct a rough proportionality analysis of the proposed 1845 Subdivision. Mr. Whitacre is a Texas Registered Engineer, License Number 102469. Mr. Whitacre prepared the enclosed Technical Memorandum concluding that the County Line Road Minor Arterial right-of-way dedication is roughly proportionate to the proposed 1845 Subdivision as presented to the City of New Braunfels. The proposed site plan, land use, and intensity were based on information provided with the letter request and additional information provided by K.C. Engineering, Inc. associated with a formal application received on October 22, 2020 to remove the County Line Road Minor Arterial from the City of New Braunfels Regional Transportation Plan. You may appeal the analysis in accordance with the City of New Braunfels Code of Ordnances Section 118-13.

Your letter states that a "plat" of the proposed subdivision with the proposed future roadway superimposed was attached; however, the exhibit provided with the request represents a preliminary site plan that does not comply with the City's zoning and platting requirements. The tract is currently zoned agricultural/pre-development (APD) and the single-family lots shown on the preliminary site plan don't appear to meet the minimum standards. The engineers for the project are responsible to prepare plans, including a traffic impact analysis, that conform to the provisions of local codes and ordinances including platting requirements.

The County Line Road Minor Arterial superimposed on the subject tract represents a generalized location and is subject to modification to fit local conditions and subject to refinement. Furthermore, the City is currently updating the Regional Transportation Plan and is proposing to reduce the right-of-way requirements of a minor arterial from 120 feet to 100 feet and may be applicable to the subject tract. This update is ongoing and planned for approval by City Council in 2021. Furthermore, modifications to the site plan, zoning of the tract, and other adjustments to the roadway network, drainage facilities, intersections, and access will allow for various development scenarios. An additional rough proportionality analysis can be conducted based on an alternate development plan.

As noted above, we have received a formal application to remove the County Line Road Minor Arterial from the Regional Transportation Plan. The request requires staff review and local and state agency coordination to prepare a recommendation. The recommendation will be presented to Planning Commission for a recommendation to City Council. City Council will consider the recommendation and make a determinate on the thoroughfare. We anticipate this process to take up to 90 days.

We are willing to work with the Kramm family and engineers for the tract to fully develop the site and meet the City's development requirements. Feel free to contact me if you have any questions.

Sincerely,

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

Enclosures

cc: Christopher J. Looney, AICP, Planning and Development Services Director
Greg A. Malatek, PE, Public Works Director

Kimley»Horn

TECHNICAL MEMORANDUM

11/4/2020

To: Garry Ford, P.E.
City Engineer
City of New Braunfels

From: Jeff Whitacre, P.E., AICP, PTP
Kimley-Horn and Associates, Inc.
TBPE Firm Number F-928

Date: November 4, 2020

Subject: Kramm Family Rough Proportionality Analysis
City of New Braunfels, Texas

Purpose

On October 13, 2020 the City of New Braunfels (City) received a request for the City Engineer to conduct a rough proportionality analysis for the Kramm Family proposed 1845 Subdivision. Under Section 118-46 (b) (2) "*whenever a tract to be platted borders on or embraces any part of any street shown on the thoroughfare plan, such part of such proposed street shall be shown on the master plan or the plat.*" The letter stated that a subdivision plan was submitted that did not comply with the Thoroughfare Plan after a previous meeting was held outlining this requirement. Currently a subdivision plan has not been submitted that complies with the Subdivision Platting requirements. However, the memo requests a proportionality analysis to be completed. For a rough proportionality assessment, a compliant plan should be presented to make an accurate determination. This determination will be made on the current submitted plan but should be revised once a compliant plan is submitted.

The purpose of this memorandum is to provide a "rough proportionality" calculation of the submitted Kramm Family proposed 1845 Subdivision. For roads, the rough proportionality calculation is a comparison of the capacity provided by a development to the traffic impacts of the proposed development.

Proportionality Methodology

Traffic generation of new development impacts the area roadway system by using available capacity. To measure system impacts, an analysis using vehicle-miles of travel in the PM peak hour was conducted. Using the vehicle-miles of travel (demand), the cost of the provided by roadway improvements (supply) can be compared with the cost of traffic generated by a proposed development.

Kimley»Horn

Demand

Based upon information provided by the City from a March 16,2020 Traffic Impact Analysis (TIA) worksheet (submitted after the October 13, 2020 letter) the Kramm Family proposed 1845 Subdivision will ultimately consist of the following land use and intensity:

- 125 single-family detached housing
- 18,000 square feet of commercial

Based on the adopted 2019 Roadway Impact Fee Study the following are the vehicle-miles traveled generated by the proposed development:

- 125 dwelling units * 4.61 vehicle-miles/dwelling unit
  - 576.25 vehicle-miles
- 18.0 1,000 square feet * 8.03 vehicle-miles/1,000 square feet
  - 144.54 vehicle-miles

TOTAL DEMAND: 650.04 vehicle-miles

The cost per vehicle-mile indicated in the 2019 Roadway Impact Fee Study is $1,371 per vehicle mile in Service Area 5.

- 720.79 vehicle-miles * $1,371/vehicle-mile

TOTAL DEMAND: $988,203.09

The total impact of the proposed development on the transportation network in the City of New Braunfels Service Area 5 is $988,203.09.

Supply

Based upon information provided by the City of New Braunfels and the applicant, the Kramm Family proposed 1845 Subdivision is requested to dedicate the right-of-way for the County Line Road minor arterial extension and potentially build two-lanes of the roadway to serve the proposed development. The current Thoroughfare Plan illustrates 120' of right-of-way for County Line Road extension the while a proposed amendment shows 100' of right-of-way. This would result in 4.861 (211,745 sq. ft.) acres or 5.819 acres (253,475 sq. ft).

Based on the October 13, 2020 letter the land was approximately $1 per square foot, so the right-of-way request would be between $211,745 - $253,475 which is below the demand calculated. Note Comal County Appraisal District shows a market value of $630,690 which is 63% of the value indicated in the October 13, 2020 letter.

The remaining $734,728.09 ($988,203.09 -$253,475). would be available to the construction of the needed County Line Road extension to serve this development. An updated site plan would need to be completed to evaluate this requirement.

Analysis

Based on information provided by the applicant in the March 16, 2020 preliminary drainage site plan, TIA worksheet and October 13, 2020 letter the request for right-of-way dedication ($253,475) is less than then demand of $988,203.09 and as a result is a roughly proportional request.

It is anticipated that if the alignment was properly drawn three areas would be created, 15.437 acres, 4.523 acre tract, and 0.769 acre tract. The 0.769 acre tract is in the same location that was identified in the March 16, 2020 as a proposed water quality and detention pond and is anticipated could remain as such. The commercial tract could remain and the remaining residential areas would be to be revaluated.

Conclusion

Based on the current information the request of the Kramm Family proposed 1845 Subdivision to dedicate right-of-way for the County Line Road minor arterial extension as requested is roughly proportionate to this development.

This analysis should be updated based on a compliant site plan that considers this roadway based on the guidance that was previously provided.

PRELIMINARY OPINION OF
PROBABLE CONSTRUCTION COST FOR
MINOR ARTERIAL THROUGH KRAMM TRACT
NEW BRAUNFELS, TEXAS

The Pay Item reference indicates the controlling specification for each Pay Item of K.C. Engineering, Inc. Standard Specifications (3rd Edition). Pay Items containing a reference to TxDOT are from *Texas Department of Transportation Standard Specifications for Construction and Maintenance of Highways, Streets, and Bridges, 2014*.

Prepared By:
K.C. Engineering, Inc. - Firm Registration No. F-977

PAY ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE IN NUMBERS	AMOUNT (Quantity x Unit Price)
	GENERAL REQUIREMENTS				
010.16.1	SEQUENCE OF CONSTRUCTION	1	LS	$ 10,000.00	$ 10,000.00
010.16.2	FIELD ENGINEERING	1	LS	$ 20,000.00	$ 20,000.00
010.16.3	MOBILIZATION	1	LS	$ 20,000.00	$ 20,000.00
010.16.4	AS-BUILT DRAWINGS	1	LS	$ 3,300.00	$ 3,300.00
GEN. COND. ART. 5	BONDS AND INSURANCE	1	LS	$ 10,000.00	$ 10,000.00
	TOTAL GENERAL REQUIREMENTS			**$**	**63,300.00**
	ROADWAY IMPROVEMENTS				
102.4.2	CLEARING AND GRUBBING	22	STA	$ 500.00	$ 11,000.00
TxDOT 260.6.2	LIME TREATMENT (6")	9,840	SY	$ 3.00	$ 29,520.00
106.4.1	SUBGRADE PREPARATION (6")	9,840	SY	$ 3.00	$ 29,520.00
200.5.1	EXCAVATION	3,280	CY	$ 9.00	$ 29,520.00
220.4.1	EMBANKMENT	1,640	CY	$ 6.00	$ 9,840.00
240.6.1	FLEXIBLE BASE, 12" DEPTH, DENSITY CONTROLLED	2,590	CY	$ 45.00	$ 116,550.00
TxDOT 315	PRIME COAT (MC-30 OR AE-P)	8,640	SY	$ 1.00	$ 8,640.00
330.5.1	CONCRETE CURB AND GUTTER	4,320	LF	$ 15.00	$ 64,800.00
TxDOT 531	CONCRETE SIDEWALKS (5' WIDTH, 4" DEPTH)	2,160	LF	$ 25.00	$ 54,000.00
410.12	HOT MIX (TYPE C) (TxDOT ITEM 340)	8,640	SY	$ 12.00	$ 103,680.00
	TOTAL ROADWAY IMPROVEMENTS			**$**	**457,070.00**

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Prepared By:
K.C. Engineering, Inc. - Firm Registration No. F-977

PAY ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE IN NUMBERS	AMOUNT (Quantity x Unit Price)
	DRAINAGE IMPROVEMENTS				
600.5.1	PIPE RCP CLASS III STORM SEWER MAIN - 24"	1,100	LF	$ 75.00	$ 82,500.00
600.5.1	PIPE RCP CLASS III STORM SEWER MAIN LATERAL - 18"	176	LF	$ 65.00	$ 11,440.00
625.7.1	CONCRETE JUNCTION BOX	8	EA	$ 4,000.00	$ 32,000.00
TxDOT 496	10' CURB INLET	8	EA	$ 5,000.00	$ 40,000.00
1100.9.1	TRENCH SAFETY, ALL DEPTHS	1,276	LF	$ 2.00	$ 2,552.00
	TOTAL DRAINAGE IMPROVEMENTS			**$**	**168,492.00**
	SIGNS, STRIPING & TRAFFIC CONTROL				
TxDOT 502	BARRICADES, SIGNS, AND TRAFFIC HANDLING	1	LS	$ 10,000.00	$ 10,000.00
TxDOT 644	INSTALL SMALL ROADSIDE SIGN, SUPPORTS, AND ASSEMBLIES	5	EA	$ 600.00	$ 3,000.00
TxDOT 666	REFL PAV MRK TY I (Y) 4" (SLD) (100 MIL)	4,320	LF	$ 1.00	$ 4,320.00
TxDOT 666	REFL PAV MRK TY I (Y) 4" (BRK) (100 MIL)	540	LF	$ 1.00	$ 540.00
TxDOT 672	REFL PAV MRK TY II-A-A	54	EA	$ 5.00	$ 270.00
	TOTAL SIGNS, STRIPING & TRAFFIC CONTROL			**$**	**18,130.00**
	EROSION AND SEDIMENTATION CONTROL				
900.5.1	SILT FENCE	900	LF	$ 2.50	$ 2,250.00
900.5.1	SILT FENCE - REMOVE	900	LF	$ 1.00	$ 900.00
905.5.1	CONCRETE WASHOUTS	1	LS	$ 1,000.00	$ 1,000.00
910.8.1	REVEGETATION (TOPSOIL AND SEEDING)	3,600	SY	$ 3.00	$ 10,800.00
920.3.1	ROCK FILTER DAM, TYPE 2	40	LF	$ 30.00	$ 1,200.00
920.3.1	ROCK FILTER DAM, TYPE 2 - REMOVE	40	LF	$ 10.00	$ 400.00
	TOTAL EROSION AND SEDIMENTATION CONTROL			**$**	**16,550.00**

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NEW BRAUNFELS, TEXAS

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Prepared By:
K.C. Engineering, Inc. - Firm Registration No. F-977

PAY ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE IN NUMBERS	AMOUNT (Quantity x Unit Price)
	MISCELLANEOUS WORK ITEMS				
750.10.1	LOCATING EXISTING UNDERGROUND FACILITIES	1	LS	$ 5,000.00	$ 5,000.00
	TOTAL MISCELLANEOUS WORK ITEMS			**$**	**5,000.00**
	TOTAL BID (TOTAL OF ITEMS IN THE COLUMNS ABOVE)			**$**	**728,542.00**
	CONTINGENCY (~10%)			**$**	**72,858.00**
	TOTAL BID (TOTAL OF ITEMS IN THE COLUMNS ABOVE)			**$**	**801,400.00**

The unit prices contained herein are based upon recent availiable bidding data from TxDOT's Average Low Bid Unit Price for the Austin District, other bid histories, other information, and the opinions of the preparer. As such, these prices may not accurately reflect future bid prices because bidding trends change and opinions of probable cost reflect prior bidding history.

This document is released for the purposes of interim review under the authority of **Greg Haley, P.E. 52292** on

June 22, 2021
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The unit prices contained herein are based upon the judgment of K.C. Engineering, Inc. (KCE) As such, these prices may not accurately reflect future bid prices because bidding trends change and opinions of probable cost reflect prior bidding history. KCE cannot and does not warrant or represent that bids or negotiated prices will not vary from an estimate of construction cost or evaluation prepared or agreed to by KCE

Appeal hearing for relief from apportionment of municipal infrastructure costs associated with the proposed 1845 Subdivision located at 1890 FM 1044

June 28, 2021

City of New Braunfels

Request for Rough Proportionality Analysis

- The City received a formal request for a “rough proportionality analysis” of the Minor Arterial thoroughfare costs for the Proposed 1845 Subdivision

- The request follows process and procedures set forth in the City’s Code of Ordinances, Section 118-13, Appeal for relief from apportionment of municipal infrastructure costs

Development Process

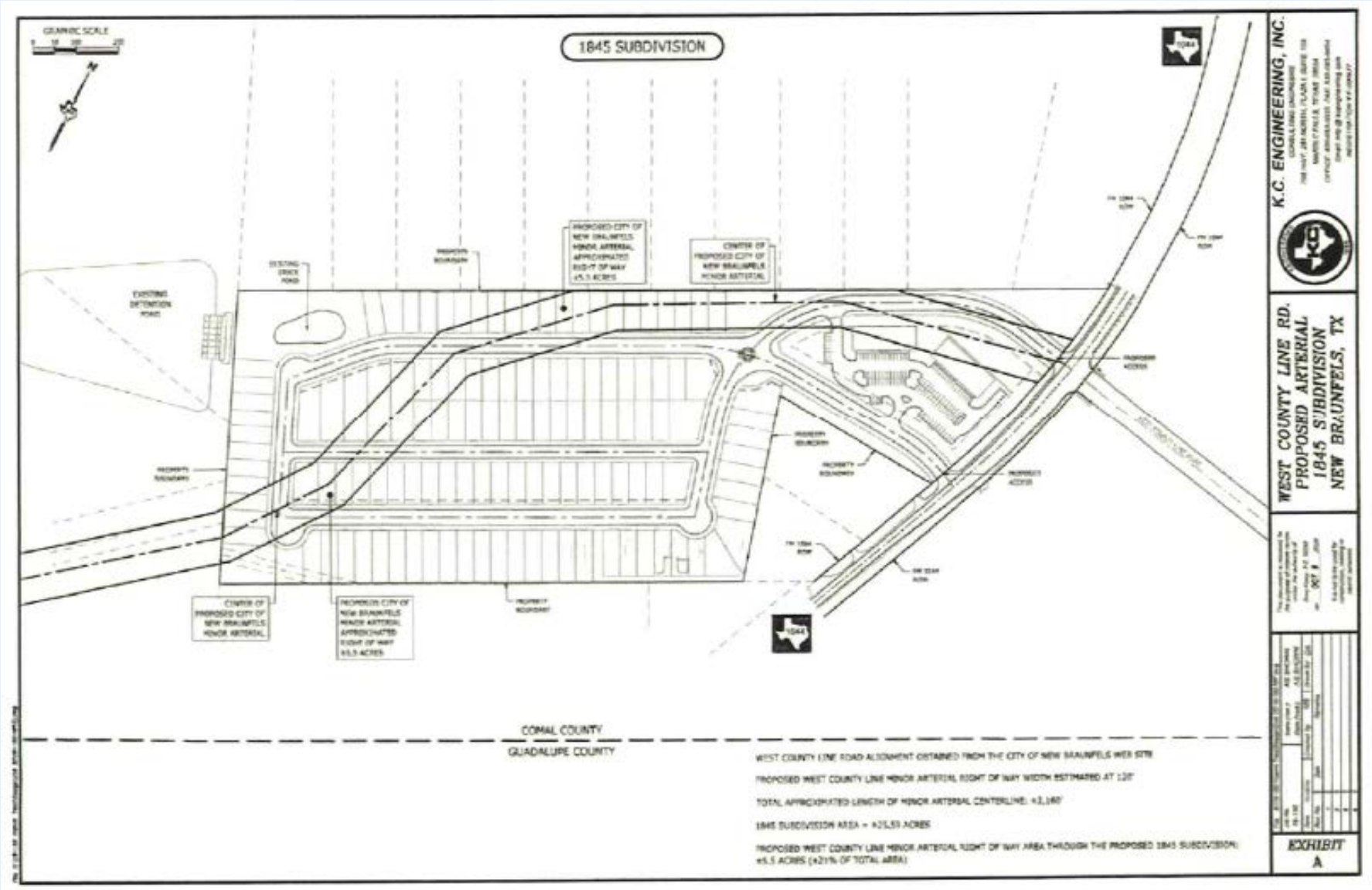
- Buyer and engineers notified of throughfare requirement in predevelopment and traffic impact analysis (TIA) meetings
- Engineer submitted *noncompliant* site plan to NBU
  - NBU notified the City
  - Site plan did not show streets on the thoroughfare plan
  - Site plan included land use that does not appear to be authorized with current Agricultural/Pre-development District zoning
- City notified engineer that the site plan was unacceptable
- City received request for rough proportionality analysis

Site Aerial

Submitted by Brady & Hamilton – Womack McClish 10/13/2020

Noncompliant Site Plan

Submitted by Brady & Hamilton – Womack McClish 10/13/2020



Purpose of Appeal

- Assure that the application of apportionment of municipal infrastructure costs of a development is “roughly proportionate” to the proposed development

- The developer’s portion of the dedication costs, payment of fees, or payment of construction costs, may not exceed the amount that are “roughly proportionate” to the proposed development

Rough Proportionality

- Two landmark U.S. Supreme Court decisions – *Nollan vs. California Coastal Commission* (1987) and *Dolan vs. City of Tigard* (1994) – established the basic rule that conditioning development approval on dedication of land constitutes an unconstitutional "taking" of property unless the dedication is reasonably related and ***roughly proportionate*** to the impacts of development on the community.

- General accepted methodology is to compare the demand of the development to the transportation system to the supply provided by the exaction

Rough Proportionality Analysis

- City retained a licensed professional engineer experienced in the subject matter to prepare a rough proportionality analysis based on:
  - Generally accepted rough proportionality analysis methodology
  - City's thoroughfare dedication and construction requirements
  - Applicant's noncompliant site plan
  - Applicant's TIA including land use and intensity
  - Applicant's stated property value of $1M for 25.641 acres

Rough Proportionality Analysis

- Proposed Development
  - 125 single-family detached housing
  - 18,000 square feet of commercial

- Total **demand** generated by the proposed development
  - 720.79 vehicle-miles
  - $1,371/vehicle-mile
    Based on 2019 roadway impact fee study, Service Area 5
    (Generally accepted methodology)
  - $988,203.09

Rough Proportionality Analysis

- Right-of-way (supply)
  - Analysis determined approximate 5.819 acres required (120 feet) *(More than the 5.5 acres – benefits developer)*
  - $1M indicated in 10/13/20 request = $253,475 *(Rounded up to $1/sq ft – benefits developer)*
  - $870,000 appraised in 2/2/21 letter = $197,439 *(Updated based on noted appraisal)*

- Construction (supply)
  - Dependent on TIA and need of development
  - Developer responsible for construction costs + right-of-way ($197,439-$253,475) up to $988,203.09

Rough Proportionality Analysis

- Minor Arterial requirements are roughly proportionate based on noncompliant site plan and right-of-way costs
- Developer responsible for constructing the Minor Arterial as required by the TIA and to serve the development
- Developer is responsible for roughly $734,727-$790,764 in construction costs for the Minor Arterial
- **Analysis should be updated on a compliant site plan**

Applicants Observations/City Responses

- Analysis ignores cost of construction
  - Construction dependent on a compliant site plan and traffic impact analysis (TIA) to determine improvements necessary to serve the development
  - Analysis provides approximate construction costs responsible by the developer

- Developer concerned that splitting the tract, TxDOT spacing requirements, and having to build the minor arterial would limit the owner to make any profitable use of the land
  - City has not received financial information or pro forma financial statements to review and evaluate the profitability claim
  - Current zoning for the subject tract is APD and the land uses shown on the site plan are not allowed

Applicants Observations/City Responses

- Request that the cost per demand ($1,371/vehicle-mile) be "reworked" based on the right-of-way costs
  - Cost of demand is based on the 2019 Roadway Impact Fee Study (accepted methodology)
  - Cost of demand is not based on the specific right-of-way costs

- Applicant disagrees with the rough proportionality analysis and requested formal appeal to City Council

Appeal to City Council

- City received a petition that the application of the standard or the imposition of conditions relating to the apportionment ***is not roughly proportionate*** to the nature and extent of the impacts created by the proposed development on municipal infrastructure

- Code: The petitioner shall demonstrate the requirement is not roughly proportional to the proposed development and may include evidence that addresses any of the following information:
  - Total capacity to be utilized, consumed, and supplied by the development
  - Comparison of the capacity to be supplied by the apportionment
  - Effects of any credits or city participation of oversizing the apportionments

Evidence Received June 22, 2021

- Texas Local Government Code 212.904. Apportionment of Municipal Infrastructure Costs
- Property Aerial
- Location of the proposed 1845 Subdivision on the City's 2012 Thoroughfare Plan
- Original noncompliant site plan with Minor Arterial overlay
- Revised site plan showing current 120' Minor Arterial right-of-way and a 3-lane roadway, revised land use, and unusable area
- Proposed Cross Sections: Minor Arterials presentation slide from the Thoroughfare Plan Update presented by City staff in 2019
- City's Rough Proportionality Response Letter and Analysis
- Preliminary Opinion of Probable Construction Cost for Minor Arterial Through Kramm Tract

City Engineer Evaluation

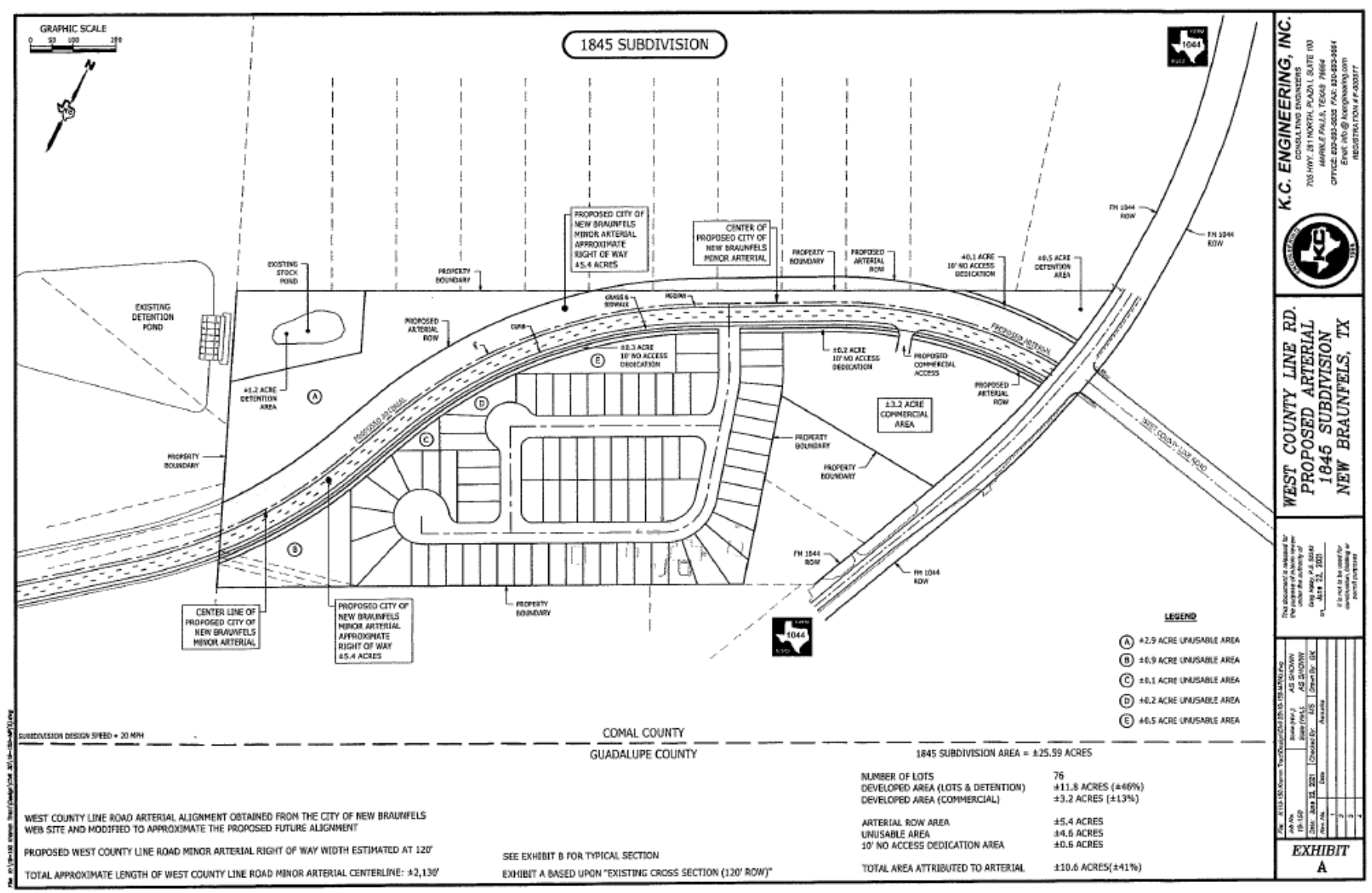
- City Engineer shall evaluate the petition and supporting study and other evidence, and shall make a recommendation to City Council based on information contained in the study and any comments from the city's planning and development services department

- New evidence provided for evaluation includes:
  - Revised site plan
  - Proposed Cross Sections
  - Applicant's Preliminary Opinion of Probable Construction Cost

- A supporting study was not provided

Revised Site Plan

Submitted by Brady & Hamilton – Womack McClish 6/22/2021



City Engineer Evaluation – Revised Site Plan

1. The land use shown is not allowed under current zoning
2. It appears that only two lanes of the arterial should be constructed to the farthest intersection (to be confirmed with a traffic study)
3. Unusable and detention areas are not supported by drainage and utility studies
4. Drainage channels and water quality improvements are not shown
5. Unusable areas could be developed based on final zoning, used to enlarge lot size, or provide park requirements

City Engineer Evaluation – Revised Site Plan

6. Unclear why “10’ No Access Dedication” is shown (not a city requirement)
7. Does not include existing utility easements
8. “Total Area Attributed to Arterial” cannot be confirmed
9. Minor arterial curvature cannot be confirmed
10. There appears to be no consideration for minor arterial modification

City Engineer Evaluation

Proposed Cross Sections

1. There is no consideration for a reduced minor arterial right-of-way width to match proposed thoroughfare plan update as mentioned in correspondence

Preliminary Opinion of Probable Construction Cost

1. Cannot be confirmed without preliminary design layout
2. Disagree based on revised site plan minor arterial comments (project limits, roadway section, etc)

City Engineer Recommendation

- Deny the appeal for relief
- Impose the standard that the development
  - Applies and receives the zoning to allow proposed land uses, and
  - Submits a master plan or plat application meeting zoning and plat requirements, or
  - Requests an updated roughly proportionate analysis based on a master plan or plat meeting zoning and plat requirements
- Work with staff to develop a site plan that meet city requirements and discuss potential thoroughfare modifications and potential roadway impact fee credits/participation

Applicant’s Presentation of Evidence

City Council Discussion/Action

- City Council shall consider the request **after** an appeal hearing on the subject is held
- City Council shall hold the appeal hearing and consider the petition within 30 days of the submission of the study and another other evidence submitted on behalf of the appellant in support of the appeal (**June 22, 2021**)
- City Council shall make a final decision within 30 days following the final submission of any testimony or evidence by the developer at the appeal hearing (**July 26, 2021**)

QUESTIONS?

City of New Braunfels

Agenda Item No. E)

PRESENTER:
Christopher J. Looney, AICP, Planning and Development Services Director
SUBJECT:
Public hearing and first 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 696 Orion Drive, from "APD AH" Agricultural/Pre-Development, Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home, Airport Hazard Overlay District.
DEPARTMENT: Planning and Development Services
COUNCIL DISTRICTS IMPACTED: 4

BACKGROUND INFORMATION:
Case #: PZ21-0198

Applicant: Ink Civil (James Ingalls, P.E.)
2021 SH 46W, Ste. 105
New Braunfels, TX 78132
(830) 358-7127 jamesingalls@ink-civil.com

Owner: Rexford & Sally Michie
696 Orion Drive
New Braunfels, TX 78130
(830) 730-6427 wrecksmick@outlook.com

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

The 2-acre tract is located approximately 920 feet north of the intersection of Goodwin Lane and Orion Drive. The subject property is developed with a single-family residence.

The applicant is requesting a change of the base zoning district from "APD" Agricultural/Pre-Development to "ZH-A" Zero Lot Line Home District. The applicant is not requesting removal or modification of the "AH" Overlay District. A base district comparison chart (attached) shows the proposed zoning allows residential.

Surrounding Zoning and Land Use:
North - ZH-A / Undeveloped
South - ZH-A / Undeveloped
East - ZH-A / Undeveloped
West - Across Orion Drive, R-1A-6.6 / Single family residence

ISSUE:
The current APD zoning district is intended for newly annexed areas, agricultural, farm and ranch uses and for

areas where development is premature because a lack of utilities, capacity, or service, or where future use has not been determined.

The proposed ZH-A district is intended for development of detached single-family residences on minimum 4,000 square-foot lots. In this district, homes may be constructed with typical 5-foot wide setbacks, or located closer to one side property line to maximize the usable yard on the other side (garden/patio homes).

This property is located within the Transition Zone and the Horizontal Zone of the Airport Hazard Overlay for building height. The ZH-A zoning district allows a maximum building height of 35 feet, which is not further restricted by the Airport Overlay Zones.

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 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.
- *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 Oak Creek Sub-Area, in close proximity to Employment, Market and Education Centers.

The permitted uses within the proposed zoning district create opportunities for encouraged housing variety which is generally compatible with the expanding neighborhood of residential use.

FISCAL IMPACT:
N/A
RECOMMENDATION:
The Planning Commission held a public hearing on July 6, 2021 and recommended approval (9-0).

Staff recommends approval. The applicants' proposal would allow the tract to be incorporated into abutting property for a contiguous future residential neighborhood. This would be consistent with ongoing development in the area as this immediate vicinity transitions from what was once mostly industrially zoned property into opportunities for more residential neighborhoods.

Mailed notification pursuant to state statute:
Public hearing notices were sent to owners of 5 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

PZ21-0198

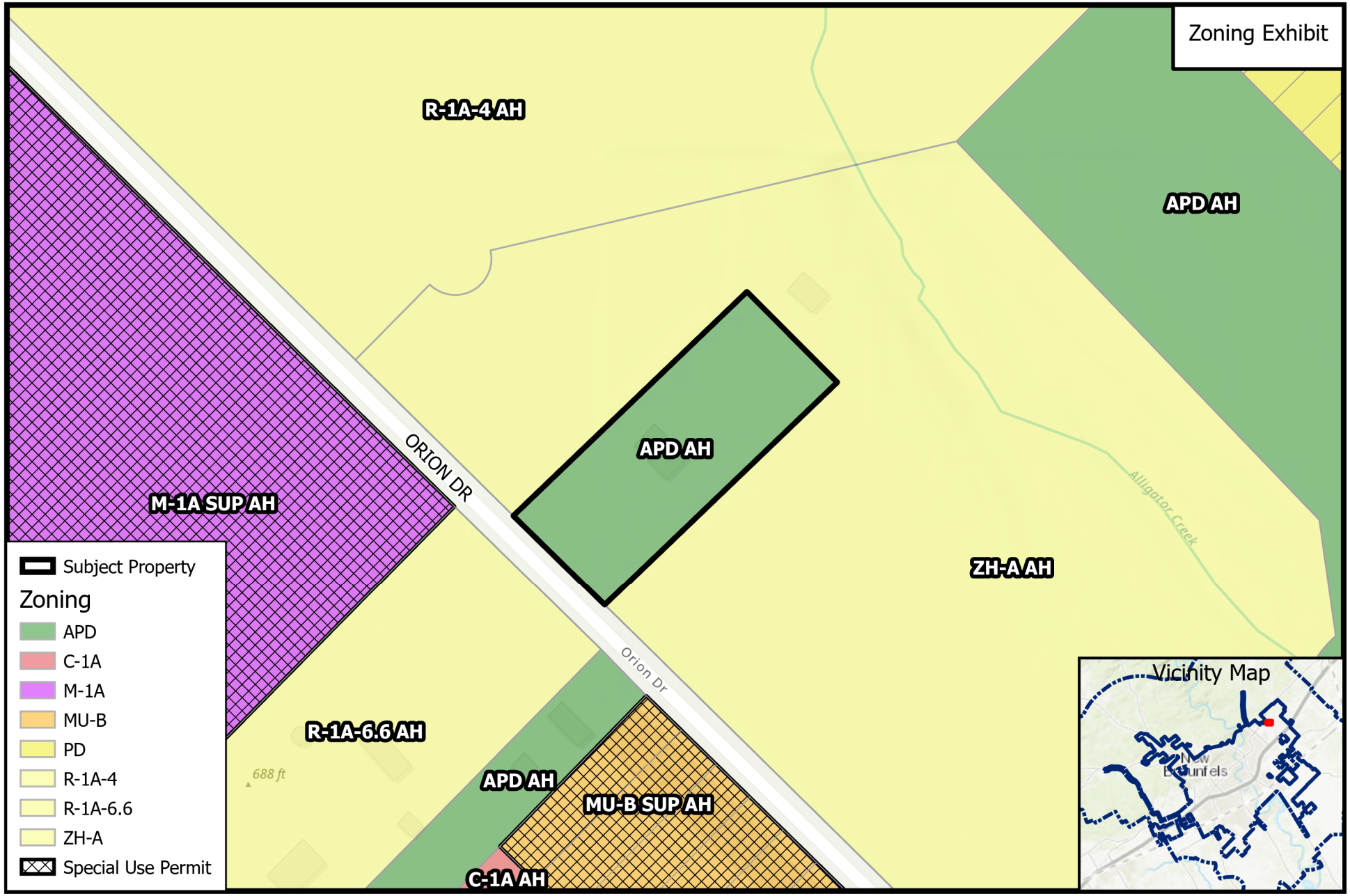
APD to ZH-A

0 110 220 Feet

N

Path:
\\chfs-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0198 - Orion Dr &

Source: City of New Braunfels Planning
Date: 6/18/2021



PZ21-0198

APD AH to ZH-A AH

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Source: City of New Braunfels Planning
Date: 6/23/2021

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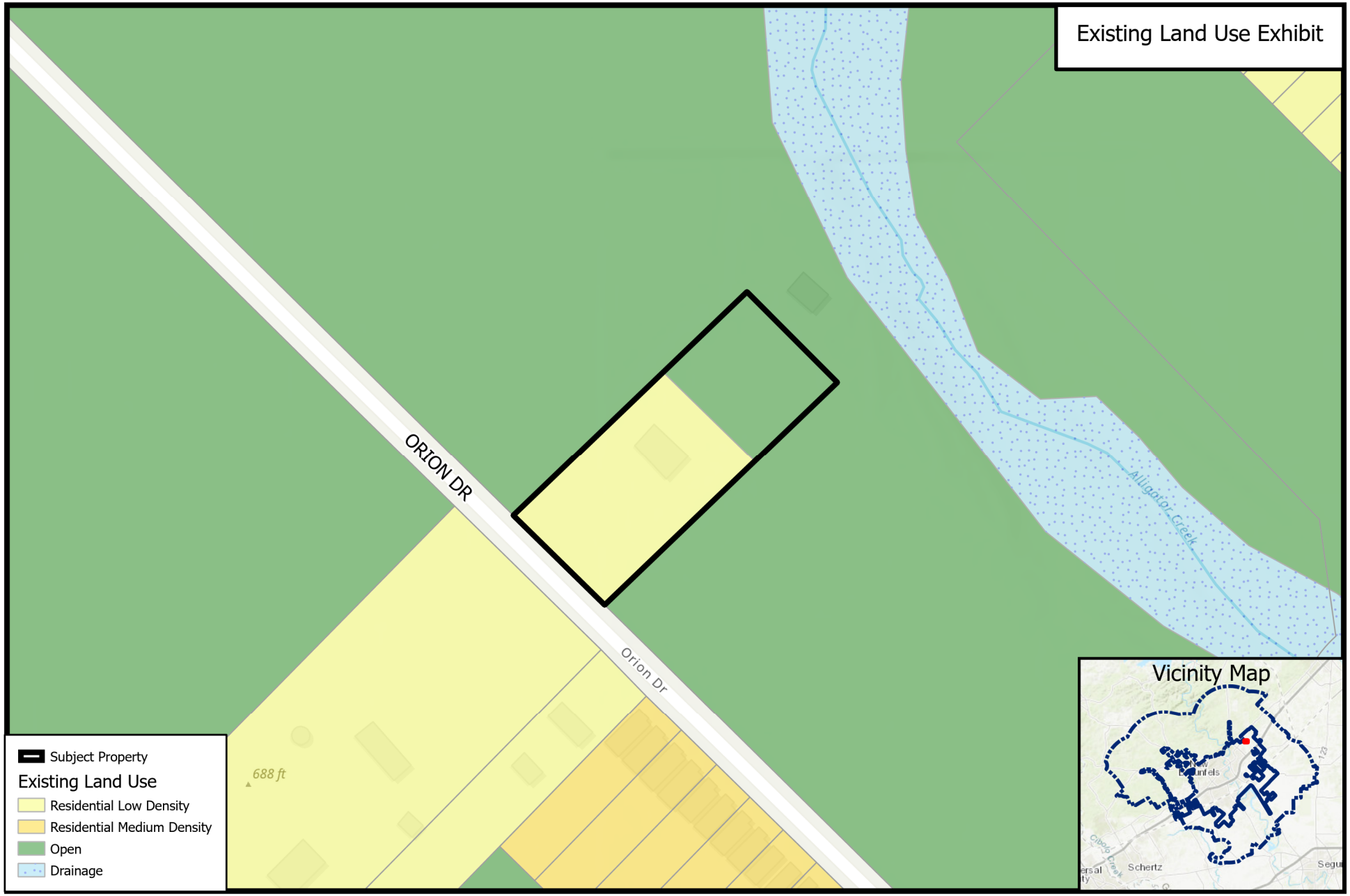

City of New Braunfels

PZ21-0198

APD to ZH-A

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Source: City of New Braunfels Planning
Date: 6/18/2021

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

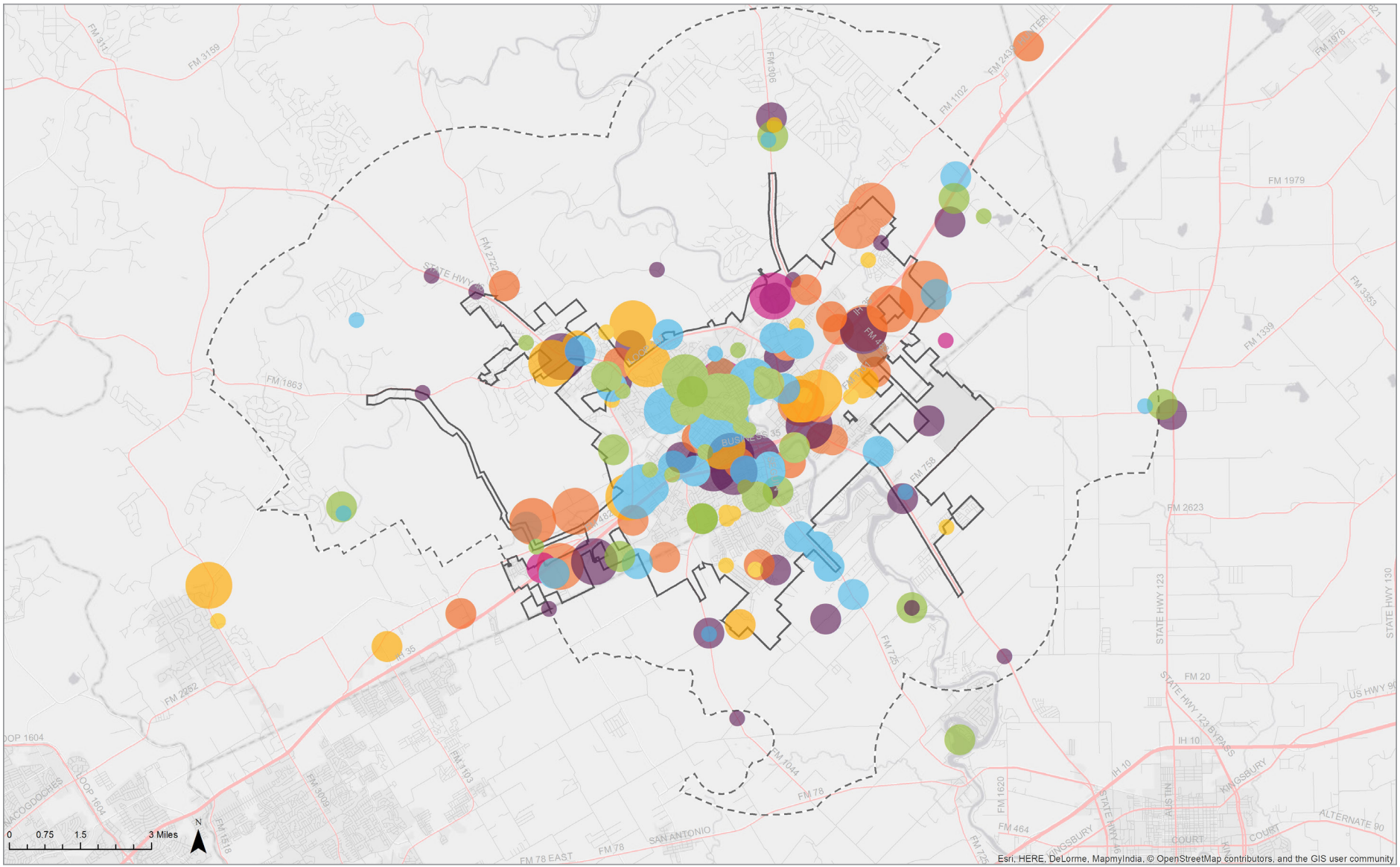
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

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.

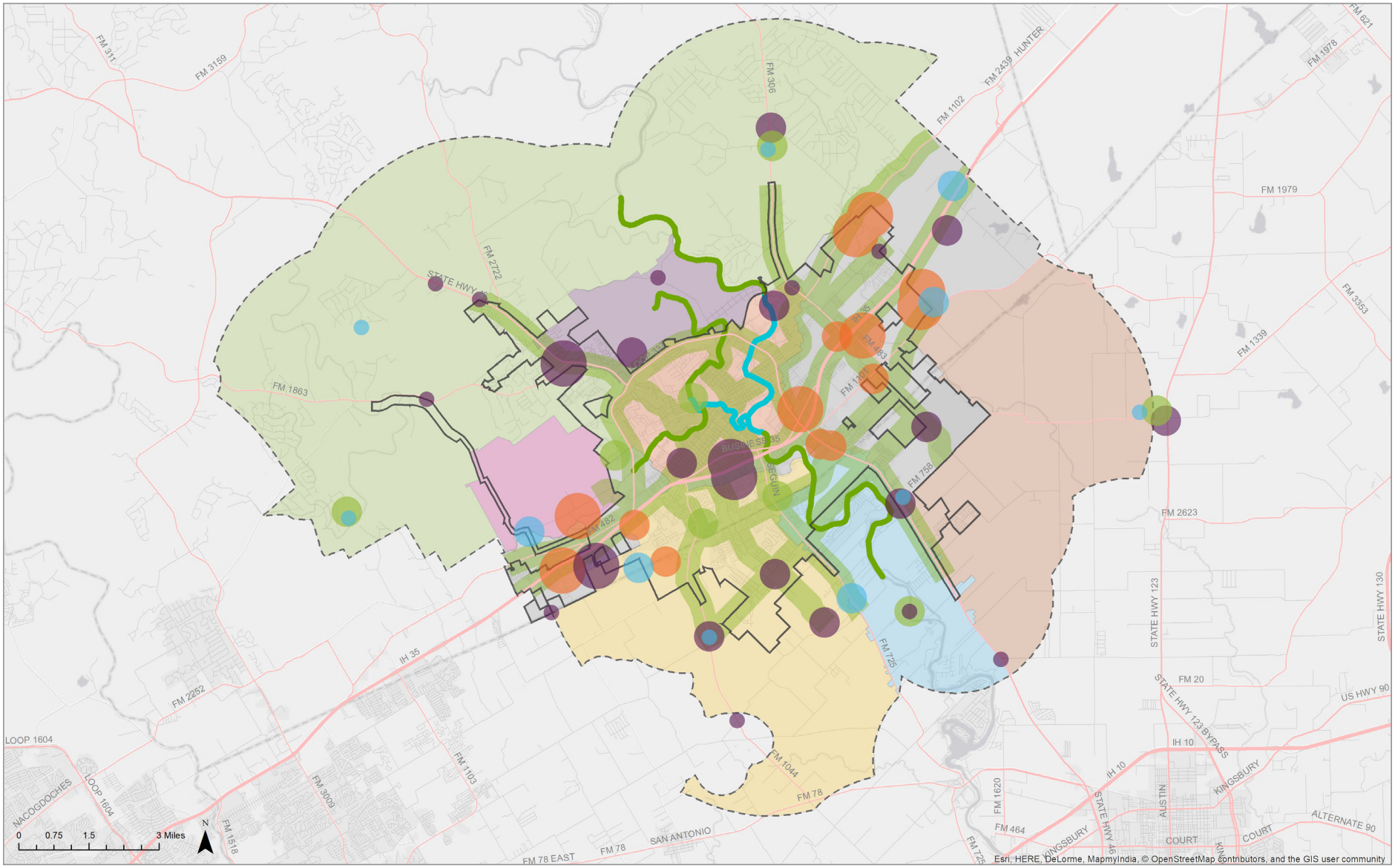
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

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	Proposed
	APD	ZH-A
Accessory building/structure (see section 144-5.4)	P	P
Accessory dwelling (one accessory dwelling per lot, no kitchen)	P	P
Barns and farm equipment storage (related to agricultural uses)	P	P
Cemetery and/or mausoleum	P	
Church/place of religious assembly	P	P
Community building (associated with residential uses)		P
Community home (see definition)	P	P
Contractor's temporary on-site construction office	P	P
Country club (private)	P	
Family home adult care	P	P
Family home child care	P	P
Farmers market (produce market—wholesale)	P	
Farms, general (crops) (see chapter 6 and section 144-5.9)	P	P
Farms, general (livestock/ranch) (see chapter 6 and section 144-5.9)	P	P
Flour mills, feed mills, and grain processing	P	
Golf course (public or private)	P	P
Government building or use with no outside storage (outside storage allowed in M-2 and M-2A)	P	P
Grain elevator	P	
Hay, grain, and/or feed sales (wholesale)	P	
Home occupation (see section 144-5.5)	P	P
Livestock sales/auction	P	
One-family dwelling, detached	P	
Park and/or playground (private and public)	P	P
Plant nursery (no retail sales on site)	P	
Recreation buildings (public)	P	P
Rodeo grounds	P	
School, K-12 public or private	P	P
Single-family industrialized home (see section 144-5.8)	P	P
Stables (as a business) (see chapter 6)	P	
Stables (private, accessory use) (see chapter 6)	P	
Water storage (surface, underground or overhead), water wells and pumping stations that are part of a public or municipal system	P	P
Zero lot line/patio homes		P

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) WORKSHEET

Complete this worksheet as a requirement for zoning, master plan, plat and permit as specified in City of New Braunfels Code of Ordinances Sections 114-99 and 118-46.
Note: The Code provides the minimum information for a TIA report and it is recommended that a scoping meeting be scheduled with the Engineering Division.

Section 1: General Information

Project Name: Goodwin Tract			Date: 06/01/2021
Subdivision Plat Name: Goodwin Tract		Project Address/Location:	
Location? ■ City of New Braunfels	☐ New Braunfels ETJ	■ Comal County	☐ Guadalupe County
Owner Name: EB Industries		Owner Email:	
Owner Address: 111 Bluebonnet Cir Justin, TX 76247		Owner Phone:	
Preparer Company: Moeller & Associates			
Preparer Name: Melanie Norris		Preparer Email: melanienorris@ma-tx.com	
Preparer Address: 2021 SH 46W, Ste. 105 New Braunfels TX 78132		Preparer Phone: (830) 358-7127	
TIA scoping meeting with City Engineering Division staff? (required for reports)	■ Yes. Date: 03/30/2021 ☐ No.	TIA Worksheet/Report approved with previous zoning, plan, plat or permit?	■ No. Complete Page 1 only. ☐ Yes. Complete Pages 1 and 2.

Application Type or Reason for TIA Worksheet/Report

■ Zoning/Concept Plan/Detail Plan ☐ Master Plan ☐ Preliminary Plat ☐ Final Plat ☐ Permit ☐ Other

TIA Submittal Type (A TIA Worksheet is required with all zoning, plan, plat and permit applications)

■ TIA Worksheet Only (100 peak hour trips or less)
☐ TIA Worksheet Only – Previous TIA Report Approved
☐ TIA Worksheet Only – Previous TIA Report not required (supporting documentation may be required)
☐ 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)

Section 2: Proposed Land Use and Trip Information for Application

Unit	Land Use	ITE Code[1]	ITE Unit[2]	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips	Daily Trips
1	Single Family	210	DU	15	5pm	0.76	1.0	0.93	9.44	11	15	14	142
Total from additional tabulation sheet (if necessary):													
									Total:	11	15	14	142

[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 is acceptable.	☐ TIA Worksheet requires corrections.	☐ TIA Report required.	☐ TIA Report not required.

PLANNING COMMISSION – JULY 6, 2021 – 6:00PM

New Braunfels City Hall Council Chambers

Applicant/Owner: INK Civil (James Ingalls, P.E.), agent for Rexford Michie, owner

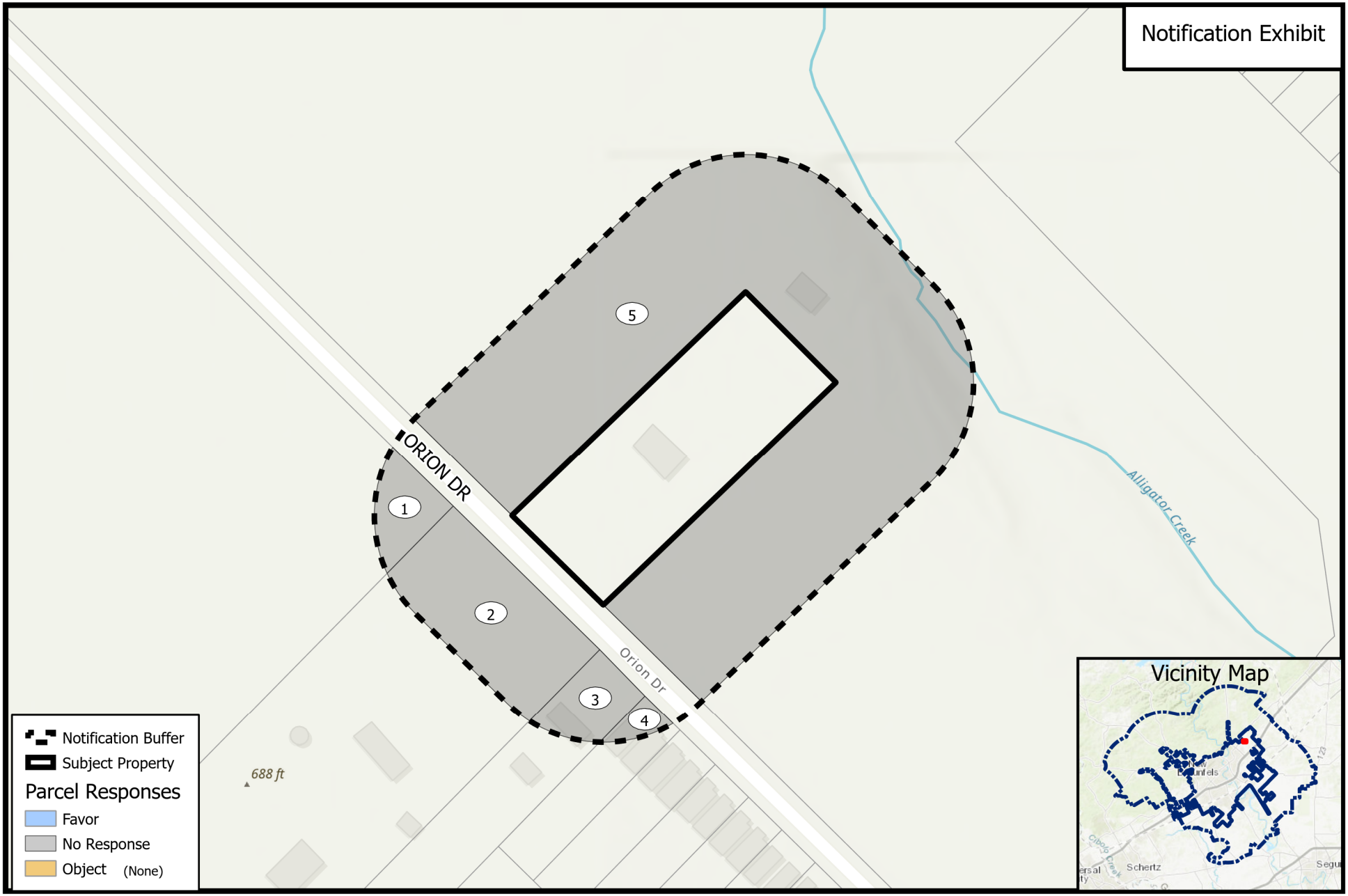
Address/Location: Approximately 2 acres located at 696 Orion Drive

PROPOSED ZONE CHANGE – CASE #PZ21-0198

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. YES ACQUISITIONS LLC
2. WHIPKEY ROBERT D & PAULA J
3. SEBA PETER E
4. SADDLER DAVID L & CRYSTAL M SADDLER
5. E B INDUSTRIES

SEE MAP



PZ21-0198
APD to ZH-A

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Source: City of New Braunfels Planning
Date: 6/18/2021

B) PZ21-0198 Public hearing and recommendation to City Council regarding a proposed rezoning of approximately 2.0 acres out of the Orilla Russell Survey No. 2, A-485 address at 696 Orion Drive, from "APD AH" Agricultural/Pre-Development Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home Airport Hazard Overlay District. *Applicant: James Ingalls, P.E., Ink Civil; Owner: Rexford & Sally Michie; Case Manager: Matthew Simmont.*

Mr. Simmont presented and recommended approval.

Chair Edwards asked if there were any questions for staff.

Chair Edwards asked if the applicant would like to speak.

James Ingalls stated they are present to answer any questions for staff.

Discussion followed on access.

Chair Edwards opened the public hearing and asked if anyone wished to speak.

No one spoke.

Chair Edwards closed the public hearing.

Chair Edwards asked if there were any further questions or a motion.

Motion by Vice Chair Laskowski, seconded by Commissioner Mathis, to recommend approval to City Council of the proposed rezoning of approximately 2.0 acres out of the Orilla Russell Survey No. 2, A-485 address at 696 Orion Drive, from "APD AH" Agricultural/Pre-Development Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home Airport Hazard Overlay District. Motion carried (9-0-0).

ORDINANCE NO. 2021-

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS REZONING APPROXIMATELY 2.0 ACRES OUT OF THE ORILLA RUSSELL SURVEY NO. 2, ABSTRACT 485, FROM "APD" AGRICULTURAL / PRE-DEVELOPMENT DISTRICT TO "ZH-A" ZERO LOT LINE HOME 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 "ZH-A" Zero Lot Line Home 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 2.0 acres out of the Orilla Russell Survey No. 2, Abstract 485, from "APD" Agricultural / Pre-Development District to "ZH-A" Zero Lot Line Home 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 "APD" to:

"ZH-A" Zero Lot Line Home District: 2.0 acres out of the Orilla Russell Survey No. 2, Abstract 485, 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 26th day of July, 2021.

PASSED AND APPROVED: Second reading this 9th day of August, 2021.

CITY OF NEW BRAUNFELS

_____

RUSTY BROCKMAN, Mayor

ATTEST:

_____

CAITLIN KROBOT, Assistant City Secretary

APPROVED AS TO FORM:

_____

VALERIA M. ACEVEDO, City Attorney

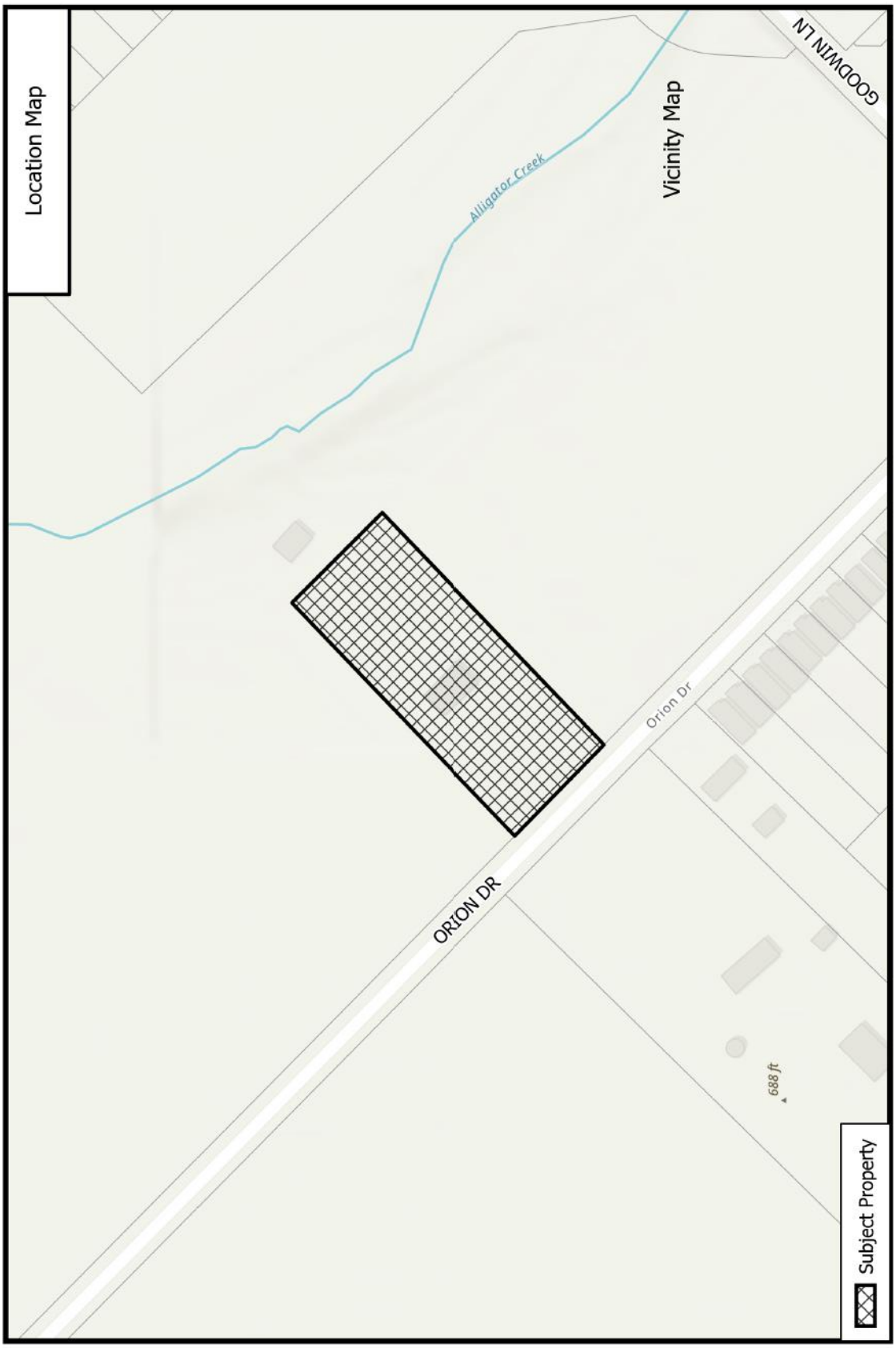

Location Map
Vicinity Map
GOODWIN LN
Alligator Creek
Orion Dr
ORION DR
688 ft
Subject Property

EXHIBIT "A"

D·A·MAWYER
LAND SURVEYING

METES AND BOUNDS DESCRIPTION
FOR A
2.00 ACRE TRACT OF LAND
"ZONING"

BEING a 2.00 acre tract of land situated in the Orilla Russell Survey No. 2, Abstract No. 485, in the City of New Braunfels, Comal County, Texas, being that same certain called 2.00 acre tract of land, as conveyed to Rexford J. Michie and Sally A. Weitz-Michie, husband and wife, and recorded in Document No. 201306029676, of the Official Public Records of Comal County, Texas, and said 2.00 acre tract of land being more particularly described by metes and bounds as follows:

COMMENCING at a point at the intersection of the Northwesterly Right-of-Way (R.O.W.) line of Goodwin Lane (a variable width R.O.W.) and the Northeasterly R.O.W. line of Orion Drive (a variable width R.O.W.), and being the most Southerly Southeast corner of the remaining portion of a called 100 acre tract of land, as conveyed to EB Industries, Inc., and recorded in Document No. 200206000300, of the Official Public Records of Comal County, Texas;

THENCE departing the intersection of the Northwesterly R.O.W. line of said Goodwin Lane and the Northeasterly R.O.W. line of said Orion Drive, with the Northeasterly R.O.W. line of said Orion Drive, and with the Southwesterly line of the remaining portion of said 100 acre tract of land, N 45° 14' 27" W, a distance of 920.16 feet to a point in the Northeasterly R.O.W. line of said Orion Drive, being a Southwesterly corner of the remaining portion of said 100 acre tract of land, being the most Southerly Southwest corner of said 2.00 acre tract of land and this herein described tract of land, and being the POINT OF BEGINNING;

THENCE continuing with the Northeasterly R.O.W. line of said Orion Drive, and with the Southwesterly line of said 2.00 acre tract of land, N 45° 18' 30" W, a distance of 186.07 feet to a point in the Northeasterly R.O.W. line of said Orion Drive, being a Southwesterly corner of the remaining portion of said 100 acre tract of land, and being the most Westerly Southwest corner of said 2.00 acre tract of land and this herein described tract of land;

THENCE departing the Northeasterly R.O.W. line of said Orion Drive, and with the common line between the remaining portion of said 100 acre tract of land and said 2.00 acre tract of land, the following courses:

N 45° 48' 08" E, a distance of 468.61 feet to a point for the most Northerly Northeast corner;

S 45° 26' 35" E, a distance of 185.80 feet to a point for the most Easterly Northeast corner;

THENCE continuing with the common line between the remaining portion of said 100 acre tract of land and said 2.00 acre tract of land, S 45° 46' 05" W, a distance of 469.04 feet to the POINT OF BEGINNING, and containing 2.00 acres of land.

Bearings based on the Texas State Plane Coordinate System, Texas South Central Zone (4204), North American Datum 1983.

"This document was prepared under 22 TAC §663.21, does not reflect the results of an on the ground survey, and is not to be used to convey or establish interests in real property except those rights and interests implied or established by the creation or reconfiguration of the boundary of the political subdivision for which it was prepared."

Drew A. Mawyer
Registered Professional Land Surveyor No. 5348
TBPLS Firm Registration #10191500
5151 W. SH 46, NEW BRAUNFELS, TX 78132
MOE426- ORION 1102- 2.00 AC MICHIE- 052721

EXHIBIT "B"

PRESENTER:
Jean Drew, AICP, CNU-A; Planning and Development Services Assistant Director

SUBJECT:
Public hearing and first 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.

DEPARTMENT: Planning and Development Services

COUNCIL DISTRICTS IMPACTED: Council District 2

BACKGROUND INFORMATION:

Applicant: Caroline Brown
Brown & Ortiz, PC
112 E. Pecan Street, Suite 1360
San Antonio, TX 78205
(210) 315-5137
caroline@brownortiz.law

Owners: Carole Bartram
437 Ogden Lane
New Braunfels, TX 78130
(830) 708-5301
rabarinc@gmail.com

John Bartram
309 McConnell Drive
West Lake Hills, TX 78746
(512) 619-9899
jbartram@anaustin.com

Lezlee Bartram Jurica
435 Ogden Lane
New Braunfels, TX 78130
(830) 237-2887
lezlee.jurica@gmail.com

Staff Contact: Holly Mullins
(830) 221-4054
hmullins@nbtexas.org

The subject property comprises 105 acres on FM 758, approximately 1,500 feet east of Highway 46 South and one-half mile from the New Braunfels Regional Airport. The current land use is agricultural with a single-family residence.

The applicant is requesting ZH-A zoning for a proposed zero lot line (patio/garden home) development. A district comparison chart for APD and ZH-A is attached.

Surrounding Zoning and Land Use:
North - APD AH, MU-B AH/ Undeveloped, mini-storage warehouse
South - Across FM 758, APD AH; Outside city limits/Single-family residence; undeveloped
East - APD AH/ Rural residential, agricultural
West - APD AH/ Single-family residence, agricultural

ISSUE:
The current APD zoning district is intended for newly annexed areas, agricultural uses, and areas where development is premature due to a lack of utility capacity, or where the ultimate use has not been determined.

The proposed ZH-A district is intended for development of detached single-family residences on minimum 4,000 square foot lots. Homes may be constructed with typical 5-foot wide side setbacks, or located closer to one side property line to maximize the usable yard on the other side (garden/patio homes).

This property is located with the Inner Turning Zone and the Horizontal Zone of the Airport Hazard Overlay for building height. The ZH-A zoning district allows a maximum building height of 35 feet, which is not further restricted by the Airport Overlay zones.

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 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.
- 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.

Future Land Use Plan: The subject property is located in the Oak Creek Sub-Area and between two Transitional Mixed-Use Corridors (Highway 46 and the Barbarosa extension of FM 306). It is one-half mile from the New Braunfels Regional Airport and the Central Texas Technology Center education center.

FISCAL IMPACT:
N/A

RECOMMENDATION:
Commission Recommendation:
The Planning Commission held a public hearing on July 6, 2021 and recommended approval (5-4), with

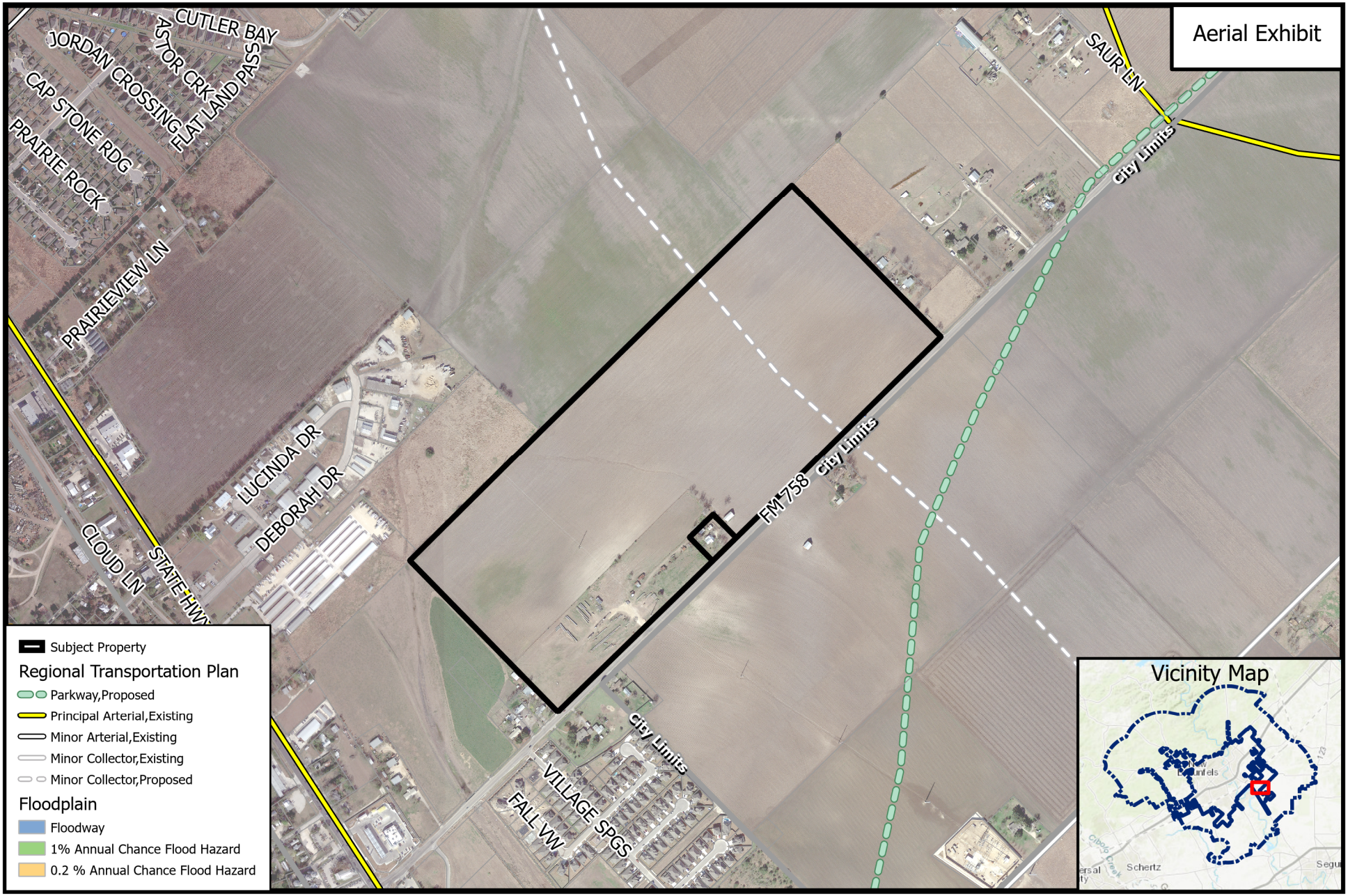
Commissioners Gibson, Mathis, Sonier and Laskowski opposed.

Staff Recommendation:
Approval. The applicant's proposal is consistent with development trends 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 9 properties within 200 feet of the request. To date, the City has received no responses in favor and one in objection (#4).

Resource Links:
Section 144-3.4-9. ZH-A Zero Lot Line Home District
Chapter 144 - ZONING | Code of Ordinances | New Braunfels, TX | Municode Library
<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, Airport Overlay, Future Land Use)
3. District Comparison Chart
4. TIA Worksheet
5. Notification Map
6. Draft Planning Commission Minutes
7. Ordinance



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Source: City of New Braunfels Planning
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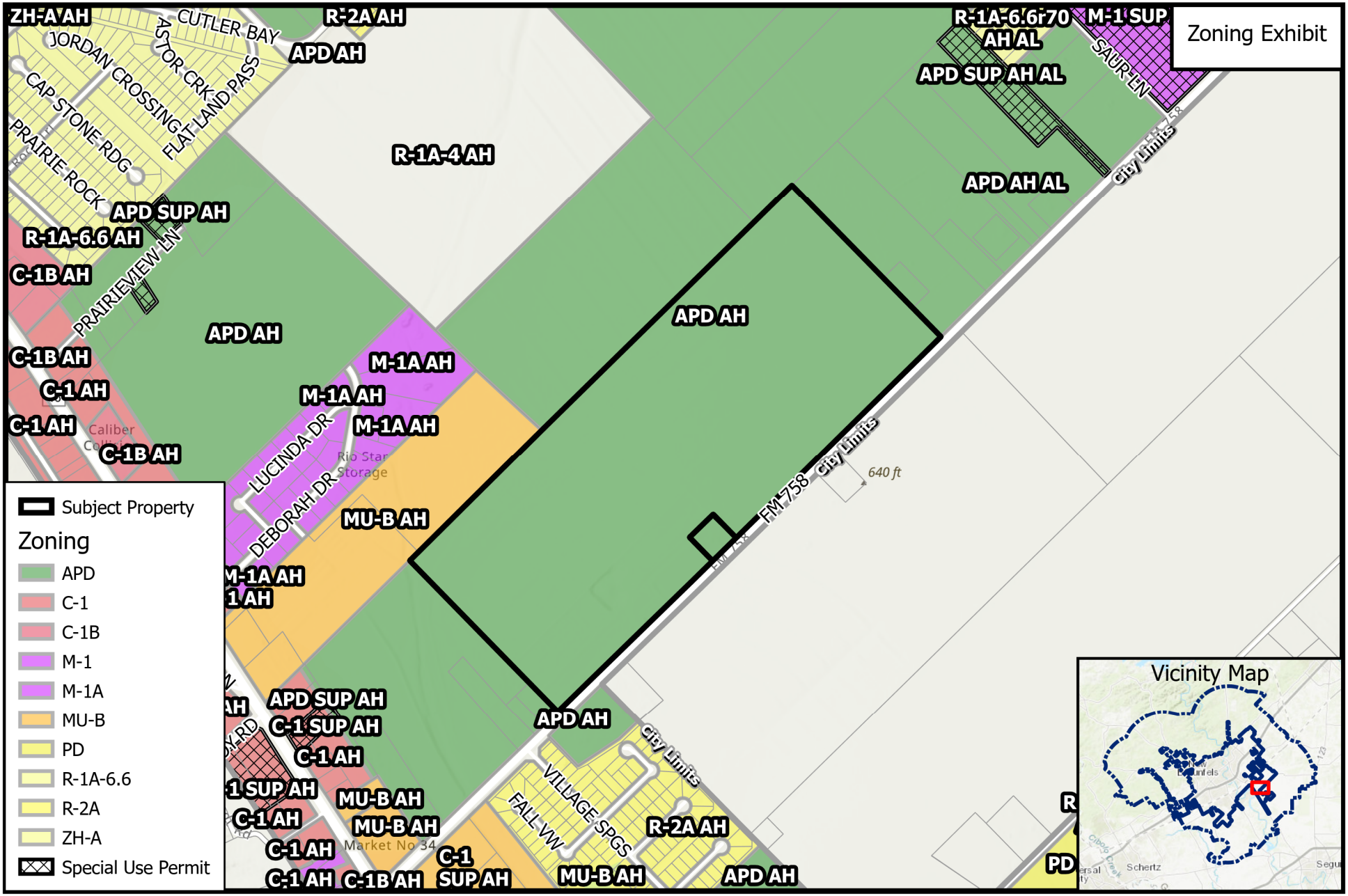

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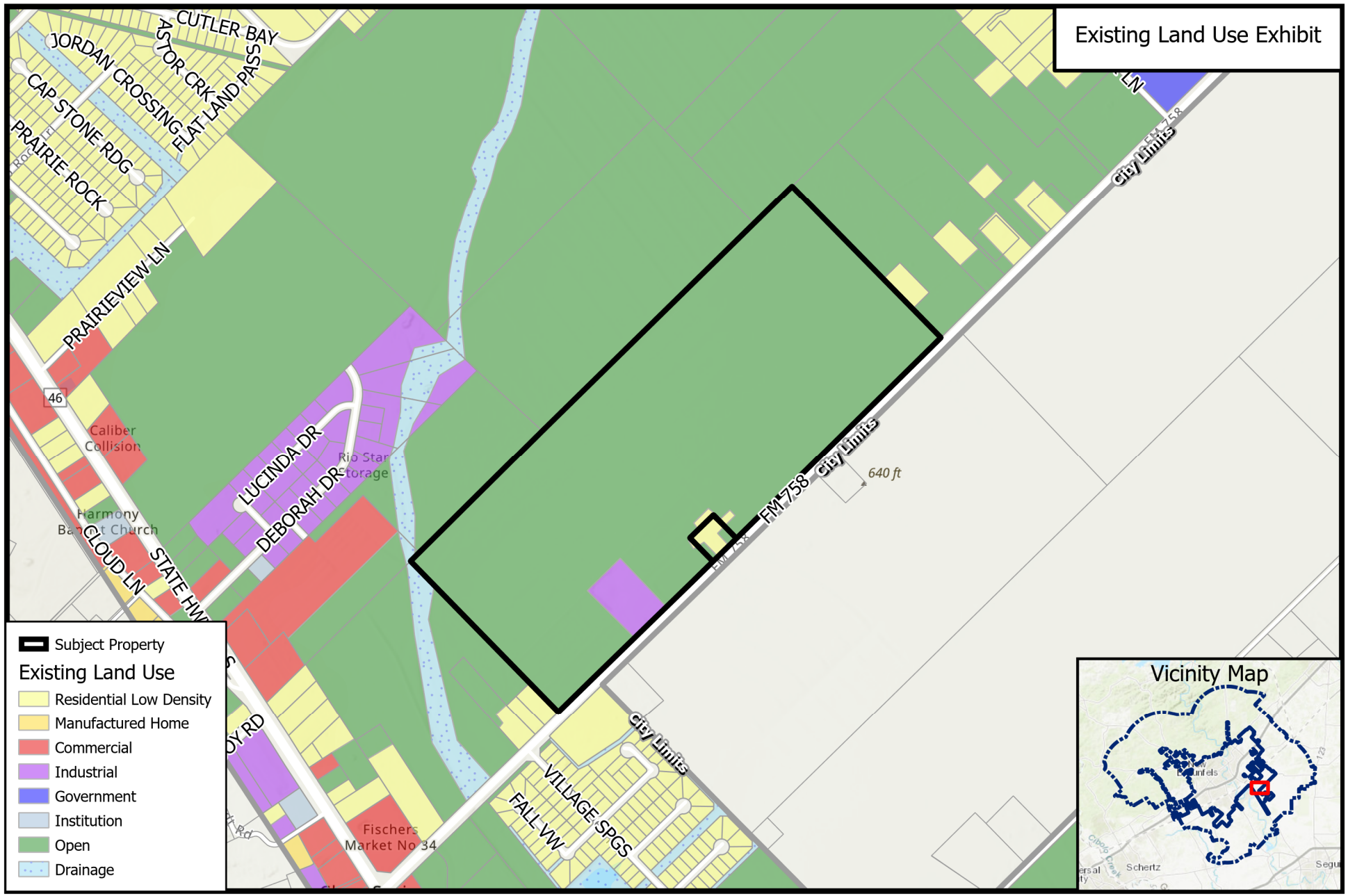

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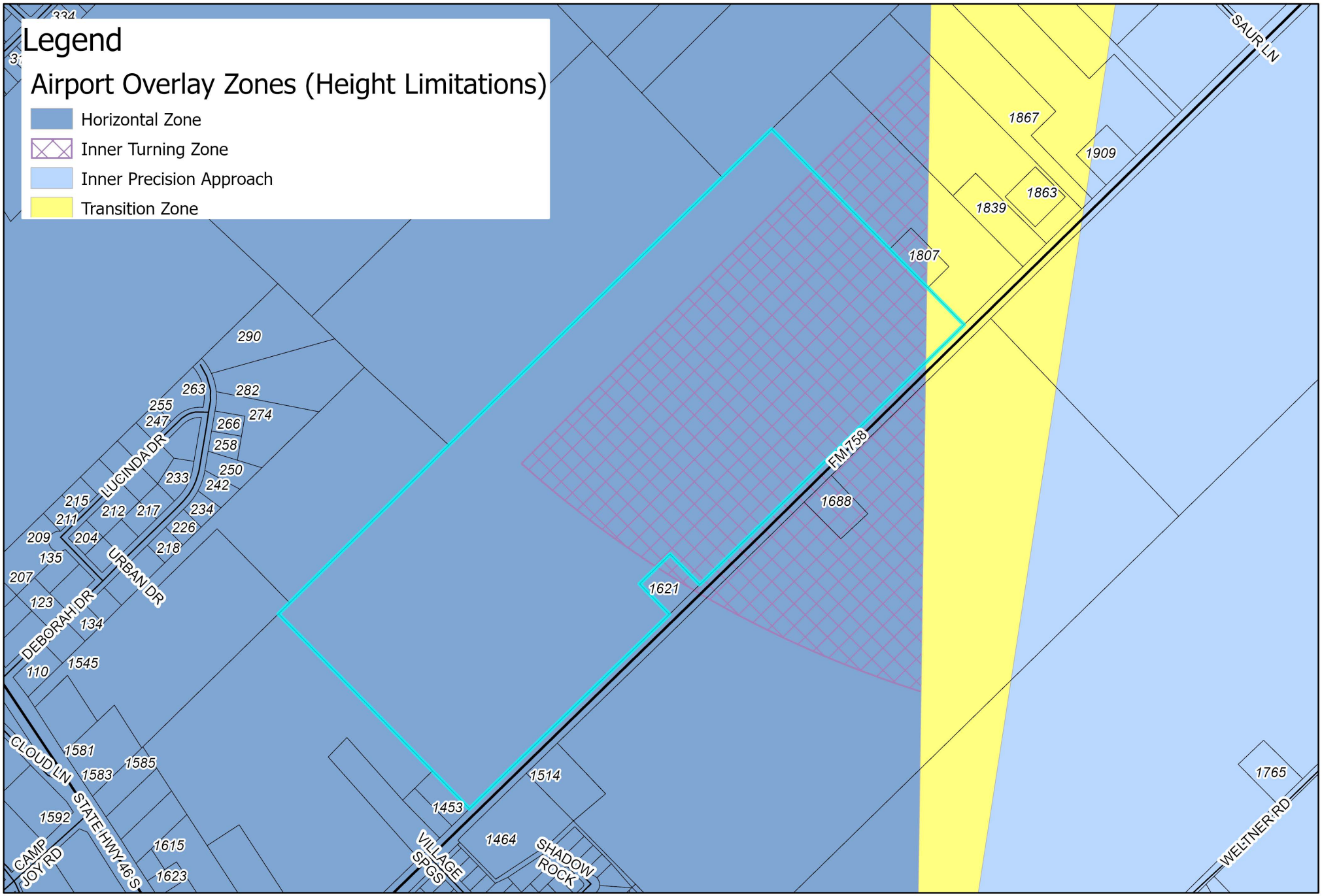


Airport Hazard Zone (Height Limitations)

City of New Braunfels

0 2,000 4,000 Feet

1:60,000

311

Document Path:
\\file-04\Users$\Planning\shunter\Desktop\Base Map.aprx

Source: City of New Braunfels GIS
Date: 6/23/2021

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

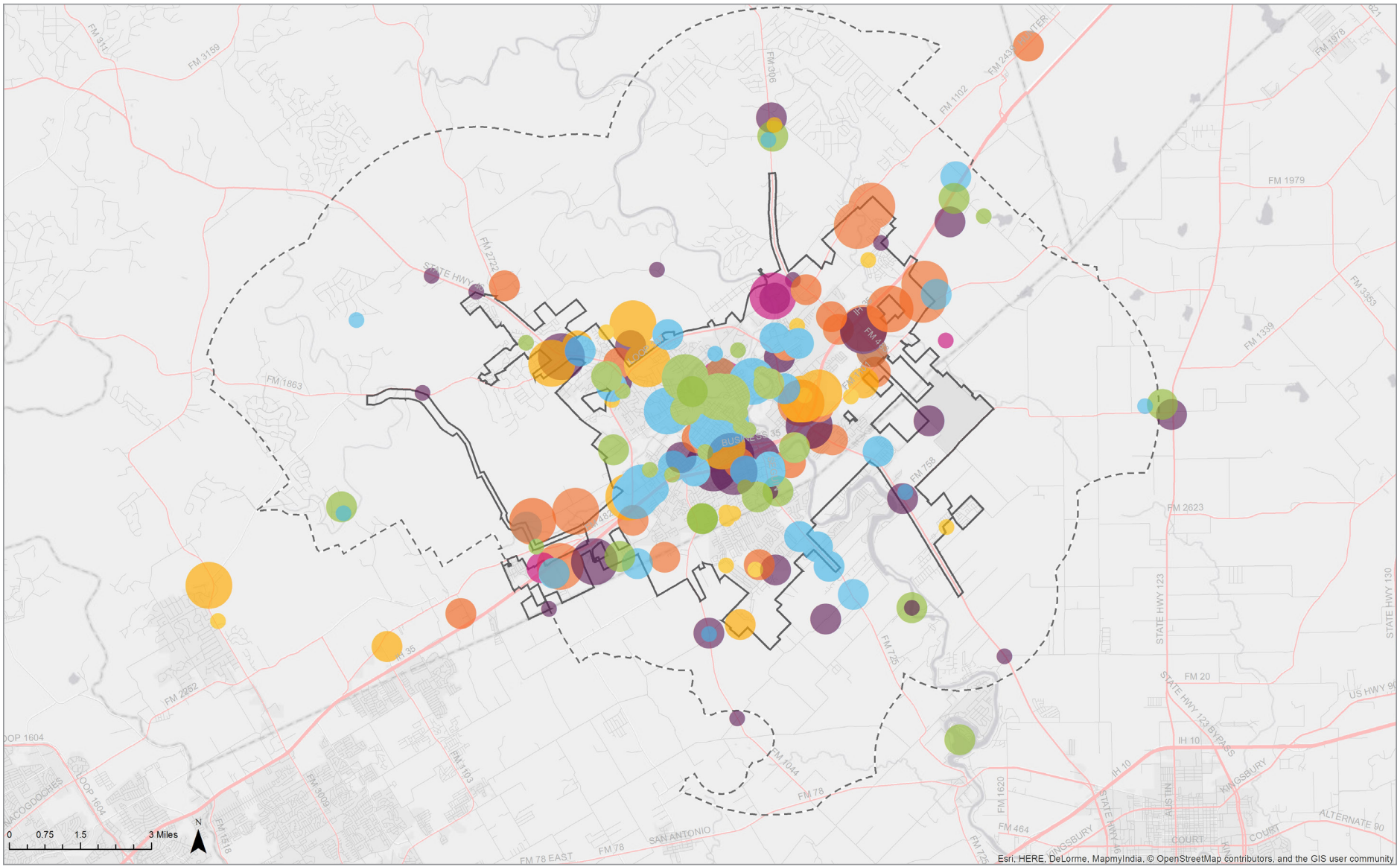
Outdoor Recreation Centers center around a public or private outdoor destination such as Landa Lake.

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.

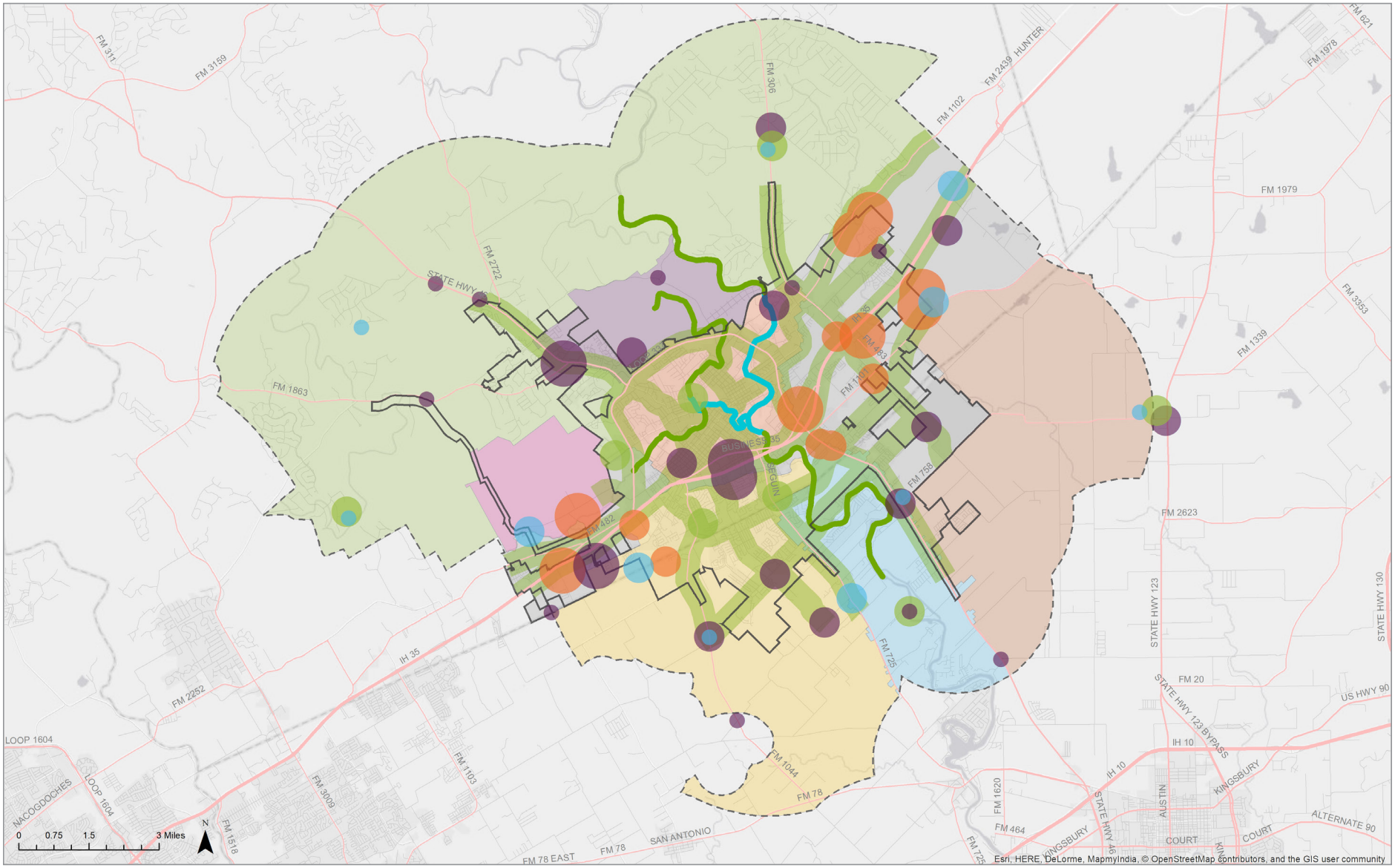
SUB AREA 4
At the heart of Sub Area 4 is Fischer Park. Proximity to IH-35, downtown and neighboring communities like McQueeney makes this area highly desirable and accessible.

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	Proposed
	APD	ZH-A
Accessory building/structure (see section 144-5.4)	P	P
Accessory dwelling (one accessory dwelling per lot, no kitchen)	P	P
Barns and farm equipment storage (related to agricultural uses)	P	P
Cemetery and/or mausoleum	P	
Church/place of religious assembly	P	P
Community building (associated with residential uses)		P
Community home (see definition)	P	P
Contractor's temporary on-site construction office	P	P
Country club (private)	P	
Family home adult care	P	P
Family home child care	P	P
Farmers market (produce market—wholesale)	P	
Farms, general (crops) (see chapter 6 and section 144-5.9)	P	P
Farms, general (livestock/ranch) (see chapter 6 and section 144-5.9)	P	P
Flour mills, feed mills, and grain processing	P	
Golf course (public or private)	P	P
Government building or use with no outside storage (outside storage allowed in M-2 and M-2A)	P	P
Grain elevator	P	
Hay, grain, and/or feed sales (wholesale)	P	
Home occupation (see section 144-5.5)	P	P
Livestock sales/auction	P	
One-family dwelling, detached	P	
Park and/or playground (private and public)	P	P
Plant nursery (no retail sales on site)	P	
Recreation buildings (public)	P	P
Rodeo grounds	P	
School, K-12 public or private	P	P
Single-family industrialized home (see section 144-5.8)	P	P
Stables (as a business) (see chapter 6)	P	
Stables (private, accessory use) (see chapter 6)	P	
Water storage (surface, underground or overhead), water wells and pumping stations that are part of a public or municipal system	P	P
Zero lot line/patio homes		P

CITY OF NEW BRAUNFELS TRAFFIC IMPACT ANALYSIS (TIA) WORKSHEET

Complete this worksheet as a requirement for zoning, master plan, plat and permit as specified in City of New Braunfels Code of Ordinances Sections 114-99 and 118-46.
Note: The Code provides the minimum information for a TIA report and it is recommended that a scoping meeting be scheduled with the Engineering Division.

Section 1: General Information

Project Name: BARTRAM RESIDENTIAL	Date: 05/17/2021
Subdivision Plat Name:	Project Address/Location: North of FM 758, ~ 1,700 feet west of SH 46
Location? ☐ City of New Braunfels ■ New Braunfels ETJ ☐ Comal County ■ Guadalupe County	
Owner Name: Pulte Homes of Texas, L.P. c/o Sean Miller	Owner Email:
Owner Address: 1718 Dry Creek Way, Ste 120 San Antonio, TX 78259	Owner Phone:
Preparer Company: PAPE-DAWSON ENGINEERS INC.	
Preparer Name: QUEENIE YE	Preparer Email: QYE@PAPE-DAWSON.COM
Preparer Address: 2000 NW LOOP 410, SAN ANTONIO , TX 78213	Preparer Phone: (210) 375-9000
TIA scoping meeting with City Engineering Division staff? (required for reports) ■ Yes. Date: ☐ No.	TIA Worksheet/Report approved with previous zoning, plan, plat or permit? ■ No. Complete Page 1 only. ☐ Yes. Complete Pages 1 and 2.

Application Type or Reason for TIA Worksheet/Report

■ Zoning/Concept Plan/Detail Plan ■ Master Plan ☐ Preliminary Plat ☐ Final Plat ☐ Permit ☐ Other

TIA Submittal Type (A TIA Worksheet is required with all zoning, plan, plat and permit applications)

☐ TIA Worksheet Only (100 peak hour trips or less)
☐ TIA Worksheet Only – Previous TIA Report Approved
☐ TIA Worksheet Only – Previous TIA Report not required (supporting documentation may be required)
☐ 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)

Section 2: Proposed Land Use and Trip Information for Application

Unit	Land Use	ITE Code[1]	ITE Unit[2]	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips	Daily Trips
1	SINGLE FAMILY DETACHED HOUSING	210	Dwelling Units	160	PM	0.74	0.99	N/A	9.44	30	544	N/A	1510
2	SINGLE FAMILY DETACHED HOUSING	210	Dwelling Units	197	PM	0.74	0.99	N/A	9.44	36	109	N/A	1860
3	SINGLE FAMILY DETACHED HOUSING	210	Dwelling Units	193	PM	0.74	0.99	N/A	9.44	36	107	N/A	1822
									Total from additional tabulation sheet (if necessary):				
									Total:	407	544		5,192

[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 is acceptable.	☐ TIA Worksheet requires corrections.	☐ TIA Report required.	☐ TIA Report not required.

Section 3: Previously Approved TIA Worksheet/Report

Project Name:				
Preparer Company:		Preparer Name:		Date:
Type:	☐ TIA Worksheet Only	☐ Level 1 TIA Report	☐ Level 2 TIA Report	☐ Level 3 TIA Report
Approved with:	☐ Zoning/Concept Plan/Detail Plan	☐ Master Plan	☐ Plat	☐ Permit ☐ Other

Section 4: Update to and Status of Land Use and Trip Information for Total Development with Approved TIA Worksheet/Report (All Subdivision Units)

Unit	Land Use	Status[3]	ITE Code[1]	ITE Unit[2]	Est. Project Units	Critical Peak Hour	AM Peak Hour Rate	PM Peak Hour Rate	WKND Peak Hour Rate	Daily Trip Rate	AM Peak Hour Trips	PM Peak Hour Trips	WKND Peak Hour Trips	Daily Trips
Total from additional tabulation sheet (if necessary):														
Total:														

[1]*Institute of Transportation Engineers (ITE) Trip Generation*, 10th Edition or most recent; [2]E.g., Dwelling Units, Acres, Employees, KSF, etc.;
[3]Specify current *approved* status of unit: PLAN – Zoning/Concept Plan/Detail Plan/Master Plan, PP – Preliminary Plat, FP – Final Plat, P – Permit, C – Completed, A – With this Application (current)

Section 5: Approved TIA Worksheet/Report Conformance

Approved TIA Conformance	AM Peak Hour Trips	PM Peak Hour Trips	WKD Peak Hour Trips	Daily Trips
Approved development total:				
Updated development total:				
Difference development total:				

New TIA Report Required?	
Increase in Peak Hour Trips (PHT) over 100?	☐ Yes. New TIA Report required to be approved prior to approval. ☐ No.

Section 6: Required TIA Mitigation Measures

Mitigation Measures	Unit	Total PHT
1.		
2.		
3.		
4.		
5.		
6.		

PLANNING COMMISSION – JULY 6, 2021 – 6:00PM

Zoom Meeting

Applicant/Owner: Brown & Ortiz PC, agent for Lezlee Jurica, Carole Bartram and John Bartram

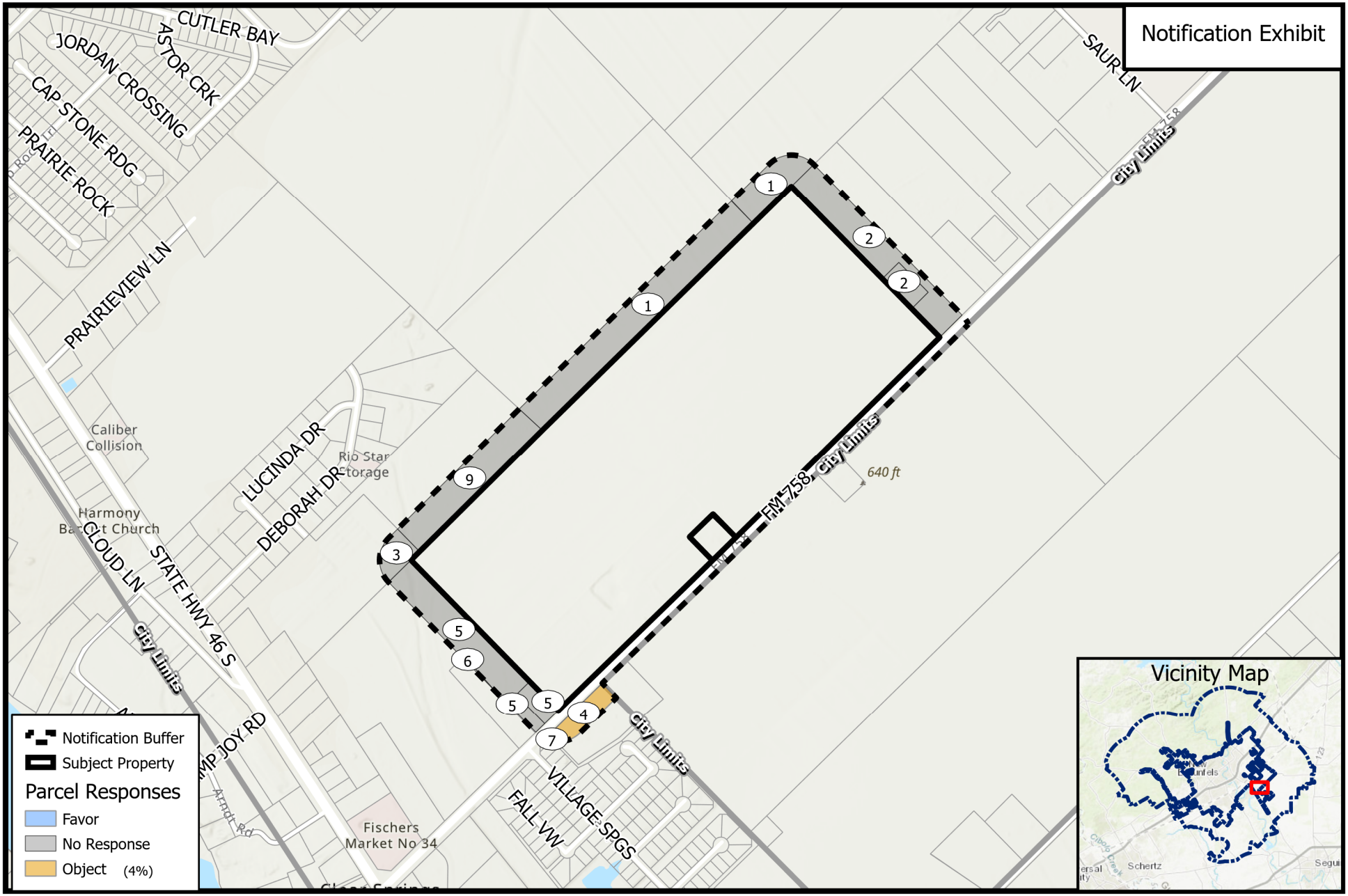
Address/Location: Approx. 105 acres addressed at 1621 FM 758

PROPOSED ZONE CHANGE – CASE #PZ21-0197

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. TIMMERMANN RONALD N
2. HEINEN MARY JANE
3. HCH STORE MORE LLC & BWCW LLC
4. HAAS JOHN EDMUND & MAUREEN
5. SISAK JOE & ELLARENE
6. MEURIN STEVE & KATHY
7. BUNDICK LAWRENCE W & JOYCE R
8. NB VILLAGE AT CLEAR SPRINGS HOMEOWNERS ASSOCIATION INC
9. STORAGE VENTURE LLC

SEE MAP



PZ21-0197

APH AH to ZH-A AH

0 490 980 Feet

N

Path:
\\CHFS-1\Departments\Planning\ZoneChange-SUP-Replats\2021\PZ21-0197 - FM 758 -

Source: City of New Braunfels Planning
Date: 6/30/2021

June 28, 2021

Case #PZ21-0197 (HM)

John and Maureen Haas #4

1464 FM 758

New Braunfels, Texas 78130

In reference to the request to rezone approximately 105 acres addressed at 1621 FM 758, New Braunfels, Texas, we submit our concerns:

1. This area has a creek that does not carry water unless the area experiences a large amount of rain. Much of the creek is shallow and narrow and therefore does not carry water well. Only a small portion of the creek has been excavated to allow for flow and retention. From the upper level to the west side of FM 758, the creek is narrow and shallow, which allows the water to spread out, causing flooding in surrounding areas. On the east side of FM 758, the creek has been excavated to allow for flow and retention in the area of the Village at Clear Springs. The properties from the Village at Clear Springs on down to Avery Park have not been excavated and do not allow for sufficient flow of water to prevent flooding.
2. With the addition of a zero lot line subdivision, the housing density would severely increase the flow of runoff rain water, that would then impact down -stream properties in a negative manner, causing not only property damage, but possibly injury or a loss of life.
3. Traffic flow on FM 758 has increased tremendously over the years due to the development of properties in the area. The addition of industry around the airport, subdivisions and the Creekside development have increase car and heavy truck traffic. Speed limits do not make the road safe for residents to enter and exit their properties. The addition of a high density subdivision would only exacerbate the situation. As more developments come to this area, the more dangerous the traffic becomes.
4. We are not against a property owner developing their property, nor are we against building needed housing. We do however object to creating a situation that places people in hazardous situations.

Thank you for your consideration of our concerns.

John Haas

ORDINANCE NO. 2021-

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF NEW BRAUNFELS, TEXAS REZONING APPROXIMATELY 105 ACRES OUT OF THE A. M. ESNAURIZAR A-20 SURVEY FROM "APD AH" AGRICULTURAL/PRE-DEVELOPMENT, AIRPORT HAZARD OVERLAY DISTRICT TO "ZH-A AH" ZERO LOT LINE HOME, AIRPORT HAZARD OVERLAY 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 "ZH-A" Zero Lot Line Home District, the City Council has given due consideration to all components of said district; 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 105 acres out of the A. M. Esnaurizar A-20 Survey from "APD AH" Agricultural/Pre-Development, Airport Hazard Overlay District to "ZH-A AH" Zero Lot Line Home, Airport Hazard Overlay 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 "APD AH" to "ZH-A AH" Zero Lot Line Home, Airport Hazard Overlay District:

105.316 acres out of the A. M. Esnaurizar A-20 Survey, 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 26th day of July, 2021.

PASSED AND APPROVED: Second reading this 9th day of August, 2021.

CITY OF NEW BRAUNFELS

_____
RUSTY BROCKMAN, Mayor

ATTEST:

_____
CAITLIN KROBOT, Assistant City Secretary

APPROVED AS TO FORM:

_____
VALERIA M. ACEVEDO, City Attorney

EXHIBIT “A”

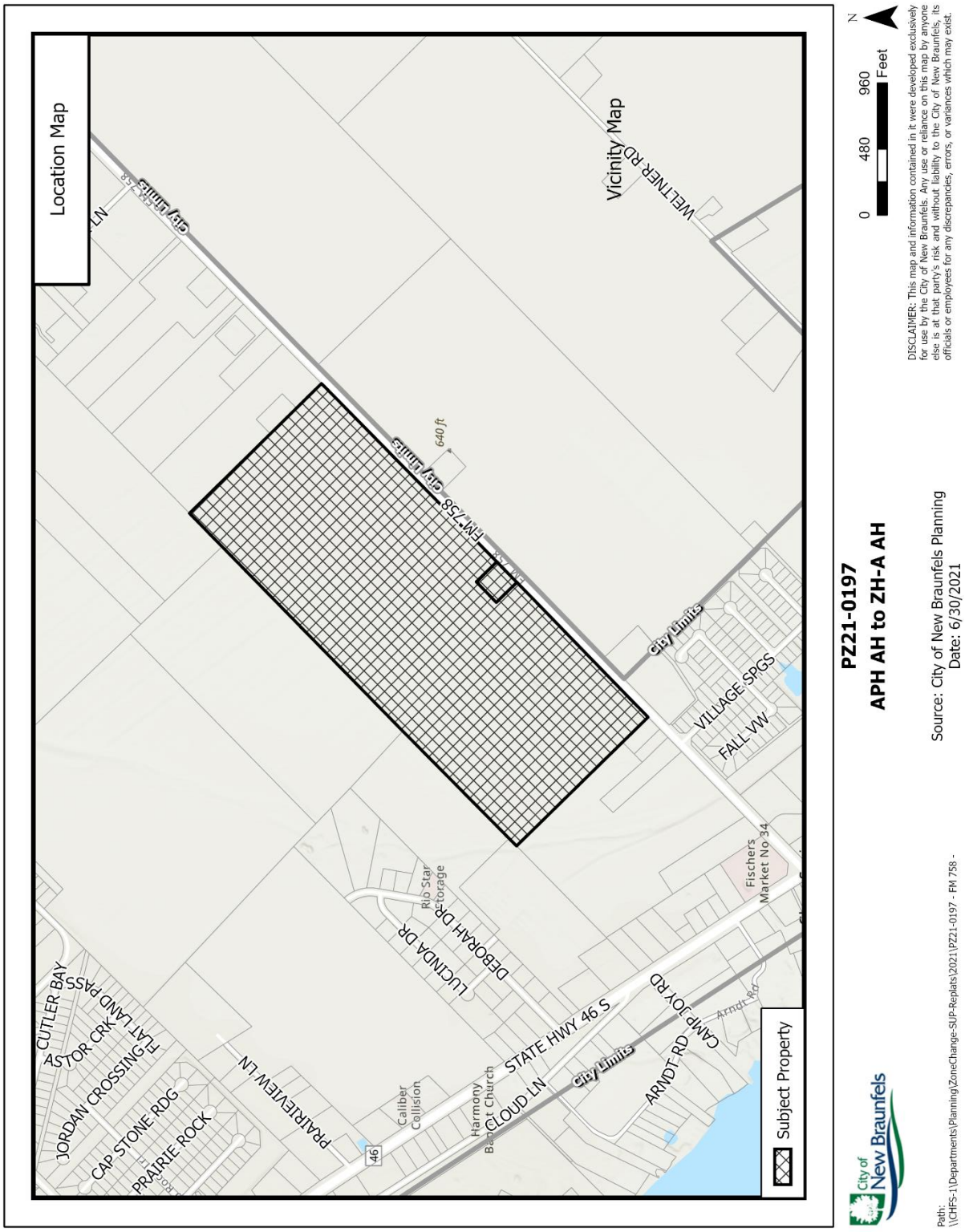

Location Map
Vicinity Map
WELTNER RD
City Limits
FM 758
640 ft
VILLAGE SPGS
FALL VW
Fischer's Market No 34
Rio Star Storage
DEBORAH DR
LUCINDA DR
STATE HWY 46 S
CAMP JOY RD
ARNDT RD
Arndt Rd
CLOUD LN
Harmony Baptist Church
Caliber Collision
PRAIRIEVIEW LN
CAP STONE RDG
PRAIRIE ROCK
JORDAN CROSSING TR
CUTLER BAY
ASTOR CRK
LAT LAND PASS
Subject Property
PZ21-0197
APH AH to ZH-A AH
Source: City of New Braunfels Planning
Date: 6/30/2021
0 480 960 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\PZ21-0197 - FM 758 -

EXHIBIT "B"

PAPE-DAWSON ENGINEERS

METES AND BOUNDS DESCRIPTION
FOR

A 105.316 acre, or 4,587,561 square feet more or less, tract of land out of that 107 acre tract described in a deed to Raymond Porter and Viola Porter, recorded in Volume 194, Page 384 of the Deed Records of Guadalupe County, Texas, being all of "Tract III", described as 107 acres of land, less save and excepting all that certain piece and parcel of land conveyed to Guadalupe County for roadway widening purposes, recorded in Volume 1561, Page 504, Volume 1561, Page 508, Volume 1561, Page 513, and Document No. 202199012927, all of the Official Public Records of Guadalupe County, Texas, with interests conveyed to John Wesley Bartram, a single man, in Volume 1561, Page 504 of the Official Public Records of Guadalupe County, Texas; Carole Bartram, Trustee, in Volume 1561, Page 508 of the Official Public Records of Guadalupe County, Texas; Carole Bartram, individually, in Volume 1561, Page 513 of the Official Public Records of Guadalupe County, Texas; and Lezlee Amber Bartram Jurica in Document No. 202199012927 of the Official Public Records of Guadalupe County, Texas; situated in the Antonio M. Esnaurizar 11 League Grant, Abstract 20, Guadalupe County, Texas. Said 105.316 acre tract being more fully described as follows, with bearings based on the Texas Coordinate System established for the South Central Zone from the North American Datum of 1983 (NA2011) epoch 2010.00:

BEGINNING: At a found concrete right-of-way monument on the northwest right-of-way line of F.M. 758, a 70-foot wide right-of-way, widened in deeds recorded in Volume 234, Page 337 of the Deed Records of Guadalupe County, Texas, Volume 234, Page 347 of the Deed Records of Guadalupe County, Texas, and Volume 234, Page 313 of the Deed Records of Guadalupe County, Texas, at the east corner of a 32.77 acre tract of land described in a deed recorded in Volume 670, Page 801 of the Deed Records of Guadalupe County, Texas, for the south corner of herein described 105.316 acres;

THENCE: N 44°30'49" W, departing the northwest right-of-way line of said F.M. 758, along the common line between said 32.77 acre tract and said 107 acre tract, a distance of 1,345.04 feet to a point on the southeast line of Lot 2, Discount Storage Subdivision recorded in Volume 8, Page 421 of the Map and Plat Records of Guadalupe County, Texas, at the north corner of said 32.77 acre tract, the west corner of said 107 acre tract and herein described 105.316 acres, from which a found 1-foot square wood fence post (held for line) bears S 44°30'49" E, a distance of 5.56 feet;

THENCE: N 45°30'52" E, along the northwest line of said 107 acre tract, the southeast line of said Discount Storage Subdivision, a 40.02 acre tract of land described in a deed recorded in Volume 2065, Page 555 of the Official Public Records of Guadalupe County, Texas, and a 26.062 acre tract of land described in Volume 625, Page 583 of the Deed Records of Guadalupe County, Texas, passing the east corner of said Lot 2, the south corner of Lot 3 of said Discount Storage Subdivision, at a distance of 79.30 feet, from which a found 1/2 inch iron rod bears S44°42'34" E, a distance of 1.63 feet, passing the east corner of said Lot 3, the south corner of said 40.02 acre tract at an additional distance of 1,096.42 feet, from which a found 1/2 inch PVC pipe at a wood fence corner bears N 42°45'12" W, a distance of 2.81 feet, passing the east corner of said 40.02 acre tract, the south corner of said 26.062 acre tract at an additional distance of 1,911.99 feet, from which a found 3 inch iron pipe bears N 44°29'09" W, a distance of 0.47 feet, continuing for an additional 310.97 feet, for a total distance of 3,398.68 feet to a found 3 inch iron pipe at the west corner of a 12.5 acre tract of land described in a deed recorded in Volume 701, Page 793 of the Official Records of Guadalupe County, Texas, the north corner of said 107 acre tract and herein described 105.316 acres;

THENCE: S 44°32'19" E, along the common line between said 12.5 acre tract and said 107 acre tract, a distance of 1,349.59 feet to a found 1 inch iron pipe on the northwest right-of-way line of said F.M. 758, at the south corner of said 12.5 acre tract, the east corner of herein described 105.316 acres;

THENCE: Along the northwest right-of-way line of said F.M. 758, over and across said 107 acre tract, the following courses and distances:

S 45°27'27" W, a distance of 2,036.79 feet to a set 1/2 inch iron rod with yellow cap marked "Pape-Dawson", and

S 45°47'27" W, a distance of 1,362.50 feet to the POINT OF BEGINNING and containing 105.316 acres in Guadalupe County, Texas. Said tract being described in conjunction with a survey made on the ground and a survey map prepared under job number 12435-00 by Pape-Dawson Engineers, Inc.

PREPARED BY: Pape-Dawson Engineers, Inc.
DATE: May 28, 2021
JOB NO. 12435-00
DOC. ID. N:\CIVIL\12435-00\Word\MB-12435-00_105.316 AC.docx

PAPE-DAWSON ENGINEERS

Agenda Item No. 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:

- House Bill 1520