Administrative Package Cover Page

This file contains the following documents:

1. Summary of application (in plain language)
   - English
   - Alternative Language (Spanish)
2. First Notice (NORI-Notice of Receipt of Application and Intent to Obtain a Permit)
   - English
   - Alternative Language (Spanish)
3. Application materials

Portada de Paquete Administrativo

Este archivo contiene los siguientes documentos:

1. Resumen en lenguaje sencillo (PLS, por sus siglas en inglés) de la actividad propuesta
   - Inglés
   - Idioma alternativo (español)
2. Primer aviso (NORI, por sus siglas en inglés)
   - Inglés
   - Idioma alternativo (español)
3. Solicitud original

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PLAIN LANGUAGE SUMMARY FOR TPDES OR TLAP PERMIT APPLICATIONS

ENGLISH TEMPLATE FOR TPDES or TLAP NEW/RENEWAL/AMENDMENT APPLICATIONS DOMESTIC WASTEWATER/STORMWATER

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 TAC Chapter 39. The information provided in this summary may change during the technical review of the application and is not a federal enforceable representation of the permit application.

Travis County Municipal Utility District No. 22 (CN605721349) proposes to operate Travis County MUD No. 22 WWTP (RN107010209), a 0.45MGD wastewater treatment plant. The facility will be located at approximately 3.2 miles West from the intersection of State Hwy 71 and Hamilton Pool Road off of Hamilton Pool Road, in Bee Cave, Travis County, Texas 78738. This is a new application to disperse 450,000 gallons per day of processed wastewater on an intermittent and flow-variable basis.

Discharges from the facility are expected to contain five-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia nitrogen (NH_3-N), total phosphorus (P), and Escherichia Coli. Domestic wastewater will be treated by a future WWTP consisting of a packaged single stage nitrification plant, including headworks (bar screening), aeration, clarification, chlorination, chlorine contact & aerobic digestion. Treated effluent will be stored in a holding tank for six days in the initial phase, three days in the interim phase and three days in the final phase prior to disposal using subsurface drip irrigation near the treatment plant on land owned by the applicant. Sludge will be disposed of by hauling off-site by a licensed hauler, to a permitted landfill.

PLANTILLA EN ESPAÑOL PARA SOLICITUDES NUEVAS/RENOVACIONES/ENMIENDAS TPDES o TLAP

AGUAS RESIDUALES DOMÉSTICAS

El siguiente resumen se proporciona para esta solicitud de permiso de calidad del agua pendiente que está siendo revisada por la Comisión de Calidad Ambiental de Texas según lo requerido por el Capítulo 39 del Código Administrativo de Texas 30. La información proporcionada en este resumen puede cambiar durante la revisión técnica de la solicitud y no son representaciones federales exigibles de la solicitud de permiso.

El Distrito Municipal de Servicios Públicos n.° 22 del Condado de Travis (CN605721349) propone operar la Planta de Tratamiento de Aguas Residuales (PTAR) MUD n.° 22 del Condado de Travis (RN107010209), una planta de tratamiento de aguas residuales de 0,45 MGD. La instalación estará ubicada aproximadamente a 5,1 km al oeste de la intersección de la Carretera Estatal 71 y Hamilton Pool Road, en Bee Cave, Condado de Travis, Texas 78738. Esta nueva solicitud permitirá dispersar 175.000 litros diarios de aguas residuales procesadas de forma intermitente y con caudal variable. Este permiso no autorizará una descarga de contaminantes en el agua en el estado.

Se espera que las descargas de la instalación contengan la demanda bioquímica de oxígeno carbonoso (DBO5) de cinco días, sólidos suspendidos totales (SST), nitrógeno amoniacal (NH_3-N), fósforo total (P) y Escherichia coli. Las aguas residuales domésticas serán tratadas por una futura PTAR que constará de una planta de nitrificación compacta de una sola etapa, que incluye obras de cabecera (cribado de barras), aireación, clarificación, cloración, contacto con cloro y digestión aeróbica. El efluente tratado se almacenará en un tanque de retención durante seis días en la fase inicial, tres días en la fase intermedia y tres días en la fase final antes de su eliminación mediante riego por goteo subterráneo cerca de la planta de tratamiento en terrenos propiedad del solicitante. Los lodos se eliminarán mediante transporte fuera del sitio por un transportista autorizado, a un vertedero autorizado.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

NOTICE OF RECEIPT OF APPLICATION AND INTENT TO OBTAIN WATER QUALITY PERMIT AMENDMENT

PERMIT NO. WQ0015201001

APPLICATION. Travis County Municipal Utility District No. 22, 4301 Westbank Drive, Suite B-130, Austin, Texas 78746, has applied to the Texas Commission on Environmental Quality (TCEQ) to amend Texas Land Application Permit (TLAP) No. WQ0015201001 to authorize relocating the effluent disposal areas. The domestic wastewater treatment facility and disposal site are located at 16925 1/2 Lavondre Drive, approximately 3.2 miles west of the intersection of Hamilton Pool Road and State Highway 71, near the city of Bee Cave, in Travis County, Texas 78738. TCEQ received this application on February 25, 2025. The permit application will be available for viewing and copying at Bee Cave City Hall, 4000 Galleria Parkway, Bee Cave, in Travis County, Texas prior to the date this notice is published in the newspaper. The application, including any updates, and associated notices are available electronically at the following webpage:
https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.
This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For the exact location, refer to the application.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-98.02194,30.30833&level=18

ALTERNATIVE LANGUAGE NOTICE. Alternative language notice in Spanish is available at:
https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.
El aviso de idioma alternativo en español está disponible en
https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

ADDITIONAL NOTICE. TCEQ's Executive Director has determined the application is administratively complete and will conduct a technical review of the application. After technical review of the application is complete, the Executive Director may prepare a draft permit and will issue a preliminary decision on the application. **Notice of the Application and Preliminary Decision will be published and mailed to those who are on the county-wide mailing list and to those who are on the mailing list for this application. That notice will contain the deadline for submitting public comments.**

PUBLIC COMMENT / PUBLIC MEETING. You may submit public comments or request a public meeting on this application. The purpose of a public meeting is to provide the opportunity to submit comments or to ask questions about the application. TCEQ will hold a public meeting if the Executive Director determines that there is a significant degree of public interest in the application or if requested by a local legislator. A public meeting is not a contested case hearing.

OPPORTUNITY FOR A CONTESTED CASE HEARING. After the deadline for submitting public comments, the Executive Director will consider all timely comments and prepare a response to all relevant and material, or significant public comments. **Unless the application is directly referred for a contested case hearing, the response to comments, and the Executive Director's decision on the application, will be mailed to everyone who submitted public comments and to those persons who are on the mailing list for this application. If comments are received, the mailing will also provide instructions for requesting reconsideration of the Executive Director's decision and for requesting a contested case hearing.** A contested case hearing is a legal proceeding similar to a civil trial in state district court.

TO REQUEST A CONTESTED CASE HEARING, YOU MUST INCLUDE THE FOLLOWING ITEMS IN YOUR REQUEST: your name, address, phone number; applicant's name and proposed permit number; the location and distance of your property/activities relative to the proposed facility; a specific description of how you would be adversely affected by the facility in a way not common to the general public; a list of all disputed issues of fact that you submit during the comment period and, the statement "[I/we] request a contested case hearing." If the request for contested case hearing is filed on behalf of a group or association, the request must designate the group's representative for receiving future correspondence; identify by name and physical address an individual member of the group who would be adversely affected by the proposed facility or activity; provide the information discussed above regarding the affected member's location and distance from the facility or activity; explain how and why the member would be affected; and explain how the interests the group seeks to protect are relevant to the group's purpose.

Following the close of all applicable comment and request periods, the Executive Director will forward the application and any requests for reconsideration or for a contested case hearing to the TCEQ Commissioners for their consideration at a scheduled Commission meeting.

The Commission may only grant a request for a contested case hearing on issues the requestor submitted in their timely comments that were not subsequently withdrawn. **If a hearing is granted, the subject of a hearing will be limited to disputed issues of fact or mixed questions of fact and law relating to relevant and material water quality concerns submitted during the comment period.**

MAILING LIST. If you submit public comments, a request for a contested case hearing or a reconsideration of the Executive Director's decision, you will be added to the mailing list for this specific application to receive future public notices mailed by the Office of the Chief Clerk. In addition, you may request to be placed on: (1) the permanent mailing list for a specific applicant name and permit number; and/or (2) the mailing list for a specific county. If you wish to be placed on the permanent and/or the county mailing list, clearly specify which list(s) and send your request to TCEQ Office of the Chief Clerk at the address below.

INFORMATION AVAILABLE ONLINE. For details about the status of the application, visit the Commissioners' Integrated Database at www.tceq.texas.gov/goto/cid. Search the database using the permit number for this application, which is provided at the top of this notice.

AGENCY CONTACTS AND INFORMATION. All public comments and requests must be submitted either electronically at **https://www14.tceq.texas.gov/epic/eComment/**, or in writing to the Texas Commission on Environmental Quality, Office of the Chief Clerk, MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Please be aware that any contact information you provide, including your name, phone number, email address and physical address will become part of the agency's public record. For more information about this permit application or the permitting process, please call the TCEQ Public Education Program, Toll Free, at 1-800-687-4040 or visit their website at www.tceq.texas.gov/goto/pep. Si desea información en Español, puede llamar al 1-800-687-4040.

Further information may also be obtained from Travis County Municipal Utility District No. 22 at the address stated above or by calling Ms. Lauren Crone, P.E., LJA Engineering, Inc., at 512-439-4700.

Issuance Date: March 21, 2025

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD E
INTENCION DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA
MODIFICACION

PERMISO NO. WQ0015201001

SOLICITUD. El Distrito Municipal de Servicios Públicos del Condado de Travis No. 22, 4301 Westbank Drive, Suite B-130, Austin, Texas 78746, ha solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) la modificación del Permiso de Solicitud de Tierras de Texas (TLAP) No. WQ0015201001 para autorizar la reubicación de las áreas de disposición de efluentes. La planta de tratamiento de aguas residuales domésticas y el vertedero se encuentran en 16925 1/2 Lavondre Drive, aproximadamente a 3.2 millas al oeste de la intersección de Hamilton Pool Road y la Carretera Estatal 71, cerca de la ciudad de Bee Cave, en el Condado de Travis, Texas 78738. La TCEQ recibió esta solicitud el 25 de febrero de 2025. La solicitud de permiso estará disponible para su consulta y copia en el Ayuntamiento de Bee Cave, 4000 Galleria Parkway, Bee Cave, en el Condado de Travis, Texas, antes de la fecha de publicación de este aviso en el periódico. La solicitud, incluyendo cualquier actualización, y los avisos asociados están disponibles electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications. Este enlace a un mapa electrónico de la ubicación general del sitio o instalación se proporciona como cortesía pública y no forma parte de la solicitud ni del aviso. Para conocer la ubicación exacta, consulte la solicitud.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-98.02194,30.30833&level=18

AVISO DE IDIOMA ALTERNATIVO. El aviso de idioma alternativo en español está disponible en https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.**

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios.

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Además, puede pedir que la TCEQ ponga su nombre en una o más de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos del solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

INFORMACIÓN DISPONIBLE EN LÍNEA. Para detalles sobre el estado de la solicitud, favor de visitar la Base de Datos Integrada de los Comisionados en www.tceq.texas.gov/goto/cid. Para buscar en la base de datos, utilizar el número de permiso para esta solicitud que aparece en la parte superior de este aviso.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También puede obtener más información del Distrito Municipal de Servicios Públicos No. 22 del Condado de Travis, en la dirección indicada anteriormente, o llamando a la Sra. Lauren Crone, P.E., LJA Engineering, Inc., al 512-439-4700.

Fecha de emisión el 21 de marzo de 2025

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT
MAJOR AMENDMENT

FOR

TRAVIS COUNTY MUD NO.22 WASTEWATER TREATEMENT PLANT

FEBURARY 2025

PREPARED FOR
TRAVIS COUNTY MUNICIPAL UTILITY DISTRICT NO. 22
4301 WESTBANK DRIVE SUITE B – 130
AUSTIN, TEXAS 78746

PREPARED BY

LJA Engineering, Inc.
7500 RIALTO BLVD
BUILDING II, SUITE 100
Austin, Texas 78735
(512) 439-4700

Lauren Crone

STATE OF TEXAS
LAUREN CRONE
128018
LICENSED
PROFESSIONAL ENGINEER

2/5/25

TABLE OF CONTENTS

EXHIBIT 1

ADMINISTRATIVE REPORT 1.0 AND 1.1

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST

Complete and submit this checklist with the application.

APPLICANT NAME: Travis County Municipal Utility District No. 22

PERMIT NUMBER (If new, leave blank): WQ00 15201001

Indicate if each of the following items is included in your application.

	Y	N
Administrative Report 1.0	☒	☐
Administrative Report 1.1	☒	☐
SPIF	☐	☒
Core Data Form	☒	☐
Public Involvement Plan Form	☒	☐
Technical Report 1.0	☒	☐
Technical Report 1.1	☒	☐
Worksheet 2.0	☐	☒
Worksheet 2.1	☐	☒
Worksheet 3.0	☒	☐
Worksheet 3.1	☐	☒
Worksheet 3.2	☐	☒
Worksheet 3.3	☒	☐
Worksheet 4.0	☐	☒
Worksheet 5.0	☐	☒
Worksheet 6.0	☐	☒
Worksheet 7.0	☒	☐

	Y	N
Original USGS Map	☒	☐
Affected Landowners Map	☒	☐
Landowner Disk or Labels	☒	☐
Buffer Zone Map	☒	☐
Flow Diagram	☒	☐
Site Drawing	☒	☐
Original Photographs	☒	☐
Design Calculations	☒	☐
Solids Management Plan	☒	☐
Water Balance	☐	☒

For TCEQ Use Only

Segment Number ___________________________________ County ______________________
Expiration Date ___________________________________ Region ______________________
Permit Number ____

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION ADMINISTRATIVE REPORT 1.0

For any questions about this form, please contact the Applications Review and Processing Team at 512-239-4671.

Section 1. Application Fees (Instructions Page 26)

Indicate the amount submitted for the application fee (check only one).

Flow	**New/Major Amendment**	**Renewal**
<0.05 MGD	$350.00 ☐	$315.00 ☐
≥0.05 but <0.10 MGD	$550.00 ☐	$515.00 ☐
≥0.10 but <0.25 MGD	$850.00 ☐	$815.00 ☐
≥0.25 but <0.50 MGD	$1,250.00 ☒	$1,215.00 ☐
≥0.50 but <1.0 MGD	$1,650.00 ☐	$1,615.00 ☐
≥1.0 MGD	$2,050.00 ☐	$2,015.00 ☐

Minor Amendment (for any flow) $150.00 ☐

Payment Information:

Mailed Check/Money Order Number: Click to enter text.

Check/Money Order Amount: Click to enter text.

Name Printed on Check: Click to enter text.

EPAY Voucher Number: Click to enter text.

Copy of Payment Voucher enclosed? Yes ☐

Section 2. Type of Application (Instructions Page 26)

a. Check the box next to the appropriate authorization type.

☐ Publicly-Owned Domestic Wastewater

☐ Privately-Owned Domestic Wastewater

☒ Conventional Wastewater Treatment

b. Check the box next to the appropriate facility status.

☒ Active ☐ Inactive

c. Check the box next to the appropriate permit type.

☐ TPDES Permit

☒ TLAP

☐ TPDES Permit with TLAP component

☒ Subsurface Area Drip Dispersal System (SADDS)

d. Check the box next to the appropriate application type

☐ New

☐ Major Amendment *with* Renewal ☐ Minor Amendment *with* Renewal

☒ Major Amendment *without* Renewal ☐ Minor Amendment *without* Renewal

☐ Renewal without changes ☐ Minor Modification of permit

e. For amendments or modifications, describe the proposed changes: Relocating effluent disposal areas and adjusting flow phases, while keeping the final flow rate the same as the existing permit.

f. **For existing permits**:

Permit Number: WQ00 15201001

EPA I.D. (TPDES only): TX Click to enter text.

Expiration Date: September 18th, 2029

Section 3. Facility Owner (Applicant) and Co-Applicant Information (Instructions Page 26)

A. The owner of the facility must apply for the permit.

What is the Legal Name of the entity (applicant) applying for this permit?

Travis County Municipal Utility District No. 22

(The legal name must be spelled exactly as filed with the Texas Secretary of State, County, or in the legal documents forming the entity.)

If the applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at http://www15.tceq.texas.gov/crpub/

CN: 605721349

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

B. Co-applicant information. Complete this section only if another person or entity is required to apply as a co-permittee.

What is the Legal Name of the co-applicant applying for this permit?

Click to enter text.

(The legal name must be spelled exactly as filed with the TX SOS, with the County, or in the

legal documents forming the entity.)

If the co-applicant is currently a customer with the TCEQ, what is the Customer Number (CN)? You may search for your CN on the TCEQ website at: http://www15.tceq.texas.gov/crpub/

CN: Click to enter text.

What is the name and title of the person signing the application? The person must be an executive official meeting signatory requirements in *30 TAC § 305.44*.

Prefix: Click to enter text. Last Name, First Name: Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

Provide a brief description of the need for a co-permittee:

C. Core Data Form

Complete the Core Data Form for each customer and include as an attachment. If the customer type selected on the Core Data Form is **Individual**, complete **Attachment 1** of Administrative Report 1.0. Appendix A

Section 4. Application Contact Information (Instructions Page 27)

This is the person(s) TCEQ will contact if additional information is needed about this application. Provide a contact for administrative questions and technical questions.

A. Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II, Suite 100 City, State, Zip Code: Austin, Texas 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

Check one or both: ☒ Administrative Contact ☒ Technical Contact

B. Prefix: Mr. Last Name, First Name: Ryan, Daniel

Title: Vice President Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd, Bldg II, Ste 100 City, State, Zip Code: Austin, Texas 78735

Phone No.: (512) 439-4700 E-mail Address: dryan@lja.com

Check one or both: ☒ Administrative Contact ☒ Technical Contact

Section 5. Permit Contact Information (Instructions Page 27)

Provide the names and contact information for two individuals that can be contacted throughout the permit term.

A. Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

Organization Name: Travis County Municipal Utility District No. 22

Mailing Address: 4301 Westbank Drive Suite B-130 City, State, Zip Code: Austin, Texas 78746

Phone No.: (512) 614-0901 E-mail Address: john@carltonlawaustin.com

B. Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

Section 6. Billing Contact Information (Instructions Page 27)

The permittee is responsible for paying the annual fee. The annual fee will be assessed to permits ***in effect on September 1 of each year***. The TCEQ will send a bill to the address provided in this section. The permittee is responsible for terminating the permit when it is no longer needed (using form TCEQ-20029).

Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

Organization Name: Travis County Municipal Utility District No. 22

Mailing Address: 4301 Westbank Drive Suite B-130 City, State, Zip Code: Austin, Texas 78746

Phone No.: (512) 614-0901 E-mail Address: john@carltonlawaustin.com

Section 7. DMR/MER Contact Information (Instructions Page 27)

Provide the name and complete mailing address of the person delegated to receive and submit Discharge Monitoring Reports (DMR) (EPA 3320-1) or maintain Monthly Effluent Reports (MER).

Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

Organization Name:

Mailing Address: 4301 Westbank Drive Suite B-130 City, State, Zip Code: Austin, Texas 78746

Phone No.: (512) 614-0901 E-mail Address: john@carltonlawaustin.com

Section 8. Public Notice Information (Instructions Page 27)

A. Individual Publishing the Notices

Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc.

Mailing Address: 7500 Rialto Blvd Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

B. Method for Receiving Notice of Receipt and Intent to Obtain a Water Quality Permit Package

Indicate by a check mark the preferred method for receiving the first notice and instructions:

☒ E-mail Address

☐ Fax

☐ Regular Mail

C. Contact permit to be listed in the Notices

Prefix: Ms. Last Name, First Name: Crone, Lauren

Title: Senior Project Manager Credential: P.E.

Organization Name: LJA Engineering, Inc

Mailing Address: 7500 Rialto Blvd. Bldg II Suite 100 City, State, Zip Code: Austin, TX 78735

Phone No.: 512-439-4700 E-mail Address: lcrone@lja.com

D. Public Viewing Information

If the facility or outfall is located in more than one county, a public viewing place for each county must be provided.

Public building name: Bee Cave City Hall

Location within the building: Administrative Desk

Physical Address of Building: 4000 Galleria Pkwy, Bee Cave, TX 78738

City: Bee Cave, TX 78738 County: Travis

Contact (Last Name, First Name): Click to enter text.

Phone No.: (512) 767- 6600 Ext.: Click to enter text.

E. Bilingual Notice Requirements

This information **is required** for **new, major amendment, minor amendment or minor modification, and renewal** applications.

This section of the application is only used to determine if alternative language notices will be needed. Complete instructions on publishing the alternative language notices will be in your public notice package.

Please call the bilingual/ESL coordinator at the nearest elementary and middle schools and obtain the following information to determine whether an alternative language notices are required.

1. Is a bilingual education program required by the Texas Education Code at the elementary or middle school nearest to the facility or proposed facility?

   ☐ Yes ☒ No

   If **no**, publication of an alternative language notice is not required; **skip to** Section 9 below.

2. Are the students who attend either the elementary school or the middle school enrolled in a bilingual education program at that school?

   ☐ Yes ☒ No

3. Do the students at these schools attend a bilingual education program at another location?

☐ Yes ☒ No

4. Would the school be required to provide a bilingual education program but the school has waived out of this requirement under 19 TAC §89.1205(g)?

☐ Yes ☐ No

5. If the answer is **yes** to **question 1, 2, 3, or 4**, public notices in an alternative language are required. Which language is required by the bilingual program? Click to enter text.

F. Plain Language Summary Template

Complete the Plain Language Summary (TCEQ Form 20972) and include as an attachment.

Attachment: Appendix C

G. Public Involvement Plan Form

Complete the Public Involvement Plan Form (TCEQ Form 20960) for each application for a **new permit or major amendment to a permit** and include as an attachment.

Attachment: Appendix C

Section 9. Regulated Entity and Permitted Site Information (Instructions Page 29)

A. If the site is currently regulated by TCEQ, provide the Regulated Entity Number (RN) issued to this site. **RN 107010209**

Search the TCEQ's Central Registry at http://www15.tceq.texas.gov/crpub/ to determine if the site is currently regulated by TCEQ.

B. Name of project or site (the name known by the community where located):

Travis County MUD No. 22 Wastewater Treatment Plant

C. Owner of treatment facility: Travis County Municipal Utility District No. 22

Ownership of Facility: ☒ Public ☐ Private ☐ Both ☐ Federal

D. Owner of land where treatment facility is or will be:

Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

Organization Name: Travis County Municipal Utility District No. 22

Mailing Address: 4301 Westbank Drive Suite B-130 City, State, Zip Code: Austin, Texas 78746

Phone No.: (512) 614-0901 E-mail Address: john@carltonlawaustin.com

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

E. Owner of effluent disposal site:

Prefix: Click to enter text. Last Name, First Name:

Title: Credential: Click to enter text.

Organization Name: Masonwood HP LTD

Mailing Address: 4301 Westbank Drive Bldg A Suite 110 City, State, Zip Code: Austin, Texas 78746

Phone No.: 512-306-8300 E-mail Address:

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

F. Owner sewage sludge disposal site (if authorization is requested for sludge disposal on property owned or controlled by the applicant)::

Prefix: N/A Last Name, First Name: Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

Organization Name: Click to enter text.

Mailing Address: Click to enter text. City, State, Zip Code: Click to enter text.

Phone No.: Click to enter text. E-mail Address: Click to enter text.

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

Section 10. TPDES Discharge Information (Instructions Page 31)

A. Is the wastewater treatment facility location in the existing permit accurate?

☒ Yes ☐ No

If **no, or a new permit application**, please give an accurate description:

N/A

B. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☐ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description of the point of discharge and the discharge route to the nearest classified segment as defined in 30 TAC Chapter 307:

N/A

City nearest the outfall(s): Click to enter text.

County in which the outfalls(s) is/are located: Click to enter text.

C. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or a flood control district drainage ditch?

☐ Yes ☐ No

If **yes**, indicate by a check mark if:

☐ Authorization granted ☐ Authorization pending

For **new and amendment** applications, provide copies of letters that show proof of contact and the approval letter upon receipt.

Attachment: Click to enter text.

D. For all applications involving an average daily discharge of 5 MGD or more, provide the names of all counties located within 100 statute miles downstream of the point(s) of discharge: Click to enter text.

Section 11. TLAP Disposal Information (Instructions Page 32)

A. For TLAPs, is the location of the effluent disposal site in the existing permit accurate?

☒ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description of the disposal site location:

Major Amendment Permit Application: The project site is located 3.2 miles west of the intersection of State Hwy 71 and Hamilton Pool Road off of Hamilton Pool Road in Travis County, Texas.

B. City nearest the disposal site: Bee Cave

C. County in which the disposal site is located: Travis County

D. For **TLAPs**, describe the routing of effluent from the treatment facility to the disposal site:

The effluent gravity flows from the treatment facility to an effluent storage tank. The effluent is then pumped from the storage tank to the effluent disposal areas within the disposal site boundaries.

E. For **TLAPs**, please identify the nearest watercourse to the disposal site to which rainfall runoff might flow if not contained: Little Barton Creek

Section 12. Miscellaneous Information (Instructions Page 32)

A. Is the facility located on or does the treated effluent cross American Indian Land?

☐ Yes ☒ No

B. If the existing permit contains an onsite sludge disposal authorization, is the location of the sewage sludge disposal site in the existing permit accurate?

☐ Yes ☐ No ☒ Not Applicable

If No, or if a new onsite sludge disposal authorization is being requested in this permit application, provide an accurate location description of the sewage sludge disposal site.

Click to enter text.

C. Did any person formerly employed by the TCEQ represent your company and get paid for service regarding this application?

☐ Yes ☒ No

If yes, list each person formerly employed by the TCEQ who represented your company and was paid for service regarding the application: Click to enter text.

D. Do you owe any fees to the TCEQ?

☐ Yes ☒ No

If **yes**, provide the following information:

Account number: Click to enter text.

Amount past due: Click to enter text.

E. Do you owe any penalties to the TCEQ?

☐ Yes ☒ No

If **yes**, please provide the following information:

Enforcement order number: Click to enter text.

Amount past due: Click to enter text.

Section 13. Attachments (Instructions Page 33)

Indicate which attachments are included with the Administrative Report. Check all that apply:

☐ Lease agreement or deed recorded easement, if the land where the treatment facility is located or the effluent disposal site are not owned by the applicant or co-applicant.

☒ Original full-size USGS Topographic Map with the following information:

- Applicant's property boundary
- Treatment facility boundary
- Labeled point of discharge for each discharge point (TPDES only)
- Highlighted discharge route for each discharge point (TPDES only)
- Onsite sewage sludge disposal site (if applicable)
- Effluent disposal site boundaries (TLAP only)
- New and future construction (if applicable)
- 1 mile radius information
- 3 miles downstream information (TPDES only)
- All ponds.

☐ Attachment 1 for Individuals as co-applicants

☐ Other Attachments. Please specify: Click to enter text.

Section 14. Signature Page (Instructions Page 34)

If co-applicants are necessary, each entity must submit an original, separate signature page.

Permit Number: Click to enter text.

Applicant: Travis County Municipal Utility District No.22

Certification:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

I further certify that I am authorized under 30 Texas Administrative Code § 305.44 to sign and submit this document, and can provide documentation in proof of such authorization upon request.

Signatory name (typed or printed): Nate Gilbert

Signatory title: President

Signature: Nathan [signature] Date: 02/25/2025

(Use blue ink)

Subscribed and Sworn to before me by the said Nate Gilbert

on this 25th day of February, 2025.

My commission expires on the 18th day of May, 2025.

Katy Henning

Notary Public

[SEAL]

NOTARY PUBLIC STATE OF TEXAS
Katy Hennings
Notary Public, State of Texas
Comm. Expires 05/18/2025
Notary ID 1232582-4

Travis

County, Texas

DOMESTIC WASTEWATER PERMIT APPLICATION ADMINISTRATIVE REPORT 1.0

The following information is required for new and amendment applications.

Section 1. Affected Landowner Information (Instructions Page 36)

A. Indicate by a check mark that the landowners map or drawing, with scale, includes the following information, as applicable:

- ☒ The applicant's property boundaries
- ☒ The facility site boundaries within the applicant's property boundaries
- ☐ The distance the buffer zone falls into adjacent properties and the property boundaries of the landowners located within the buffer zone
- ☒ The property boundaries of all landowners surrounding the applicant's property (Note: if the application is a major amendment for a lignite mine, the map must include the property boundaries of all landowners adjacent to the new facility (ponds).)
- ☐ The point(s) of discharge and highlighted discharge route(s) clearly shown for one mile downstream
- ☐ The property boundaries of the landowners located on both sides of the discharge route for one full stream mile downstream of the point of discharge
- ☐ The property boundaries of the landowners along the watercourse for a one-half mile radius from the point of discharge if the point of discharge is into a lake, bay, estuary, or affected by tides
- ☒ The boundaries of the effluent disposal site (for example, irrigation area or subsurface drainfield site) and all evaporation/holding ponds within the applicant's property
- ☒ The property boundaries of all landowners surrounding the effluent disposal site
- ☐ The boundaries of the sludge land application site (for land application of sewage sludge for beneficial use) and the property boundaries of landowners surrounding the applicant's property boundaries where the sewage sludge land application site is located
- ☐ The property boundaries of landowners within one-half mile in all directions from the applicant's property boundaries where the sewage sludge disposal site (for example, sludge surface disposal site or sludge monofill) is located

B. ☒ Indicate by a check mark that a separate list with the landowners' names and mailing addresses cross-referenced to the landowner's map has been provided.

C. Indicate by a check mark in which format the landowners list is submitted:

☐ USB Drive ☒ Four sets of labels

D. Provide the source of the landowners' names and mailing addresses: Travis County Central Appraisal District

E. As required by *Texas Water Code § 5.115*, is any permanent school fund land affected by this application?

☐ Yes ☒ No

If **yes**, provide the location and foreseeable impacts and effects this application has on the land(s):

Click to enter text.

Section 2. Original Photographs (Instructions Page 38)

Provide original ground level photographs. Indicate with checkmarks that the following information is provided.

☒ At least one original photograph of the new or expanded treatment unit location

☒ At least two photographs of the existing/proposed point of discharge and as much area downstream (photo 1) and upstream (photo 2) as can be captured. If the discharge is to an open water body (e.g., lake, bay), the point of discharge should be in the right or left edge of each photograph showing the open water and with as much area on each respective side of the discharge as can be captured.

☒ At least one photograph of the existing/proposed effluent disposal site

☒ A plot plan or map showing the location and direction of each photograph

Section 3. Buffer Zone Map (Instructions Page 38)

A. Buffer zone map. Provide a buffer zone map on 8.5 x 11-inch paper with all of the following information. The applicant's property line and the buffer zone line may be distinguished by using dashes or symbols and appropriate labels.

- The applicant's property boundary;
- The required buffer zone; and
- Each treatment unit; and
- The distance from each treatment unit to the property boundaries.

B. Buffer zone compliance method. Indicate how the buffer zone requirements will be met. Check all that apply.

☒ Ownership

☐ Restrictive easement

☐ Nuisance odor control

☐ Variance

C. Unsuitable site characteristics. Does the facility comply with the requirements regarding unsuitable site characteristic found in 30 TAC § 309.13(a) through (d)?

☒ Yes ☐ No

DOMESTIC WASTEWATER PERMIT APPLICATION

SUPPLEMENTAL PERMIT INFORMATION FORM (SPIF)

This form applies to TPDES permit applications only. Complete and attach the Supplemental Permit information Form (SPIF) (TCEQ Form 20971).

Attachment: N/A

DOMESTIC WASTEWATER PERMIT APPLICATION CHECKLIST OF COMMON DEFICIENCIES

Below is a list of common deficiencies found during the administrative review of domestic wastewater permit applications. To ensure the timely processing of this application, please review the items below and indicate by checking Yes that each item is complete and in accordance applicable rules at 30 TAC Chapters 21, 281, and 305. If an item is not required this application, indicate by checking N/A where appropriate. Please do not submit the application until the items below have been addressed.

Core Data Form (TCEQ Form No. 10400) ☒ Yes
(Required for all application types. Must be completed in its entirety and signed. Note: Form may be signed by applicant representative.)

Correct and Current Industrial Wastewater Permit Application Forms ☒ Yes
(TCEQ Form Nos. 10053 and 10054. Version dated 6/25/2018 or later.)

Water Quality Permit Payment Submittal Form (Page 19) ☒ Yes
(Original payment sent to TCEQ Revenue Section. See instructions for mailing address.)

7.5 Minute USGS Quadrangle Topographic Map Attached ☒ Yes
(Full–size map if seeking "New" permit.
8 ½ x 11 acceptable for Renewals and Amendments)

Current/Non-Expired, Executed Lease Agreement or Easement ☐ N/A ☒ Yes

Landowners Map ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Things to Know:

- All the items shown on the map must be labeled.
- The applicant's complete property boundaries must be delineated which includes boundaries of contiguous property owned by the applicant.
- The applicant cannot be its own adjacent landowner. You must identify the landowners immediately adjacent to their property, regardless of how far they are from the actual facility.
- If the applicant's property is adjacent to a road, creek, or stream, the landowners on the opposite side must be identified. Although the properties are not adjacent to applicant's property boundary, they are considered potentially affected landowners. If the adjacent road is a divided highway as identified on the USGS topographic map, the applicant does not have to identify the landowners on the opposite side of the highway.

Landowners Cross Reference List ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Landowners Labels or USB Drive attached ☐ N/A ☒ Yes
(See instructions for landowner requirements)

Original signature per 30 TAC § 305.44 – Blue Ink Preferred ☒ Yes
(If signature page is not signed by an elected official or principle executive officer, a copy of signature authority/delegation letter must be attached)

Plain Language Summary ☒ Yes

EXHIBIT 2

DOMESTIC TECHNICAL REPORT 1.0
DOMESTIC TECHNICAL REPORT 1.1
DOMESTIC TECHNICAL REPORT 3.0
DOMESTIC TECHNICAL REPORT 3.1
DOMESTIC TECHNICAL REPORT 7.0

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

DOMESTIC WASTEWATER PERMIT APPLICATION TECHNICAL REPORT 1.0

For any questions about this form, please contact the Domestic Wastewater Permitting Team at 512-239-4671.

The following information is required for all renewal, new, and amendment applications.

Section 1. Permitted or Proposed Flows (Instructions Page 43)

A. Existing/Interim I Phase

Design Flow (MGD): 0.1

2-Hr Peak Flow (MGD): 0.4

Estimated construction start date: Completed

Estimated waste disposal start date: Completed

B. Interim II Phase

Design Flow (MGD): 0.15

2-Hr Peak Flow (MGD): 0.6

Estimated construction start date: 03/2025

Estimated waste disposal start date: 03/2025

C. Final Phase

Design Flow (MGD): 0.45

2-Hr Peak Flow (MGD): 1.8

Estimated construction start date: 03/2029

Estimated waste disposal start date: 03/2030

D. Current Operating Phase: Phase 1, 0.1 MGD

Provide the startup date of the facility: March 2021

Section 2. Treatment Process (Instructions Page 43)

A. Current Operating Phase

Provide a detailed description of the treatment process. **Include the type of treatment plant, mode of operation, and all treatment units.** Start with the plant's head works and finish with the point of discharge. Include all sludge processing and drying units. **If more than one phase exists or is proposed, a description of *each phase* must be provided.**

The facility is to be constructed in three phases with a total design flow of 450,000 gpd. The first phase, which is existing, treats 100,000 gpd, the second phase will treat an additional 50,000 gpd and the final phase of the facility will treat an additional 300,000 gpd and operate as a suspended growth activated sludge process in the extended aeration mode. The treatment units include a bar screen, aeration basin, clarifier, and an aerobic digester. Wastewater will enter an influent lift station and be pumped to the plant where it will enter the aeration basin through a bar screen. The influent will then pass through the aeration zone and flow into the clarifier. From the clarifier the effluent will flow to an effluent storage tank. The effluent storage tank will provide three days of storage. The effluent will then be disposed of via subsurface disposal. This facility will also utilize a digester for sludge holding, prior to haul off

B. Treatment Units

In Table 1.0(1), provide the treatment unit type, the number of units, and dimensions (length, width, depth) **of each treatment unit, accounting for *all* phases of operation.**

Table 1.0(1) - Treatment Units

Treatment Unit Type	Number of Units	Dimensions (L x W x D)
Bar Screen	3	PHASE 1 (EXIST.): 2'-11" x 2'-1"x 2' ¾" PHASE 2 : 2'-11" x 2'-1"x 2' ¾" PHASE 3: 5' x 5 x 3'
A**erobic Digester**	4	PHASE 1 (EXIST.): (**2**) 28' x 1**2'** x 12' PHASE 2 : 28' x 12' x 12' PHASE 3: 46' x 18' x 12'
Clarifier	4	PHASE 1 (EXIST.): (**2**) 20' Dia x 13' PHASE 2 : 20' Diameter x 13' PHASE 3: 30' Diameter x 15'
Aeration Basin	4	PHASE 1 (EXIST.): (2) 45'x 12'x 12' PHASE 2 : 20' x 12' x 12' PHASE 3: 20' x 12' x 12'
Chlorine Contact Chamber	4	Phase 1(EXIST): (2) 15'L x 5'W x 10'D Phase 2 : 15'L x 5'W x 12'D Phase 3: 20'L x 15'W x 12'D

C. Process Flow Diagram

Provide flow diagrams for the existing facilities and **each** proposed phase of construction.

Attachment: Appendix H

Section 3. Site Information and Drawing (Instructions Page 44)

Provide the TPDES discharge outfall latitude and longitude. Enter N/A if not applicable.

- Latitude: N/A
- Longitude: N/A

Provide the TLAP disposal site latitude and longitude. Enter N/A if not applicable.

- Latitude: 30.30833
- Longitude: -98.02194

Provide a site drawing for the facility that shows the following:

- The boundaries of the treatment facility;
- The boundaries of the area served by the treatment facility;
- If land disposal of effluent, the boundaries of the disposal site and all storage/holding ponds; and
- If sludge disposal is authorized in the permit, the boundaries of the land application or disposal site.

Attachment: Appendix I

Provide the name **and** a description of the area served by the treatment facility.

The existing treatment facility will serve a 910 acre development known as Provence. This area is located in Travis county approximately 3.2 miles west of the intersection of Hwy 71 and Hamilton Pool Road. The tract will consist of 1816 single family residential units (at ultimate build out) as well as commercial development, and other mixed uses.

Collection System Information **for wastewater TPDES permits only**: Provide information for each **uniquely owned** collection system, existing and new, served by this facility, including satellite collection systems. **Please see the instructions for a detailed explanation and examples.**

Collection System Information

Collection System Name	Owner Name	Owner Type	Population Served
N/A		Choose an item.	
		Choose an item.	
		Choose an item.	
		Choose an item.	

Section 4. Unbuilt Phases (Instructions Page 45)

Is the application for a renewal of a permit that contains an unbuilt phase or phases?

☒ Yes ☐ No

If yes, does the existing permit contain a phase that has not been constructed **within five years** of being authorized by the TCEQ?

☒ Yes ☐ No

If yes, provide a detailed discussion regarding the continued need for the unbuilt phase. **Failure to provide sufficient justification may result in the Executive Director recommending denial of the unbuilt phase or phases.**

The plant is currently operating at Phase 1. Development is ongoing and unbuilt phases will be constructed in the future. Facilities are sized for the ultimate development, and no changes to the development plan have occurred. 31.93 acres out of the total 104.8 acres of previously permitted drip fields will be vacated. 31.93 acres of additional land will be dedicated elsewhere in the property to achieve a total of 104.8 acres of drip fields.

Section 5. Closure Plans (Instructions Page 45)

Have any treatment units been taken out of service permanently, or will any units be taken out of service in the next five years?

☐ Yes ☒ No

If yes, was a closure plan submitted to the TCEQ?

☐ Yes ☐ No

If yes, provide a brief description of the closure and the date of plan approval.

N/A

Section 6. Permit Specific Requirements (Instructions Page 45)

For applicants with an existing permit, check the Other Requirements or Special Provisions of the permit.

A. Summary transmittal

Have plans and specifications been approved for the existing facilities and each proposed phase?

☒ Yes ☐ No

If yes, provide the date(s) of approval for each phase: Approved December 2018

Provide information, including dates, on any actions taken to meet a *requirement or provision* pertaining to the submission of a summary transmittal letter. **Provide a copy of an approval letter from the TCEQ, if applicable**.

Prior to construction of the final phase, wastewater treatment facilities, the permittee shall submit to the TCEQ Wastewater Permitting Section of the Water Quality Division, a summary submittal letter according to the requirements of 30 TAC Section 217.6(c). If requested, the permittee shall submit plans, specifications and final engineering design report which comply with the requirements of 30 TAC Chapter 217.

B. Buffer zones

Have the buffer zone requirements been met?

☒ Yes ☐ No

Provide information below, including dates, on any actions taken to meet the conditions of the buffer zone. If available, provide any new documentation relevant to maintaining the buffer zones.

The permittee shall comply with the requirements of 30 TAC Section 309.13 (a) through (d). In addition, by ownership of the required buffer zone area, the permittee shall comply with the requirements of 30 TAC Section 309.13(e).

C. Other actions required by the current permit

Does the *Other Requirements* or *Special Provisions* section in the existing permit require submission of any other information or other required actions? Examples include Notification of Completion, progress reports, soil monitoring data, etc.

☒ Yes ☐ No

If yes, provide information below on the status of any actions taken to meet the conditions of an *Other Requirement* or *Special Provision*.

The permittee shall provide written notice to the Regional Office and the Applications Review and Processing Team at least 45 days prior to plant startup or anticipated discharge, whichever occurs first, and prior to the completion of each additional phase on Notification Completion Form 20007.25. The permittee shall obtain representative soil samples from the root zones of each drip application area. The permittee shall submit the results of the annual soil sample analyses with copies of the laboratory reports with a map depicting the permanent sampling fields to the Regional Office and the Water Quality Compliance Monitoring Team.

D. Grit and grease treatment

1. *Acceptance of grit and grease waste*

Does the facility have a grit and/or grease processing facility onsite that treats and decants or accepts transported loads of grit and grease waste that are discharged directly to the wastewater treatment plant prior to any treatment?

☐ Yes ☒ No

If No, stop here and continue with Subsection E. Stormwater Management.

2. *Grit and grease processing*

Describe below how the grit and grease waste is treated at the facility. In your description, include how and where the grit and grease is introduced to the treatment works and how it is separated or processed. Provide a flow diagram showing how grit and grease is processed at the facility.

N/A

3. ***Grit disposal***

Does the facility have a Municipal Solid Waste (MSW) registration or permit for grit disposal?

☐ Yes ☐ No

If No, contact the TCEQ Municipal Solid Waste team at 512-239-2335. Note: A registration or permit is required for grit disposal. Grit shall not be combined with treatment plant sludge. See the instruction booklet for additional information on grit disposal requirements and restrictions.

Describe the method of grit disposal.

N/A

4. ***Grease and decanted liquid disposal***

Note: A registration or permit is required for grease disposal. Grease shall not be combined with treatment plant sludge. For more information, contact the TCEQ Municipal Solid Waste team at 512-239-2335.

Describe how the decant and grease are treated and disposed of after grit separation.

N/A

E. Stormwater management

1. ***Applicability***

Does the facility have a design flow of 1.0 MGD or greater in any phase?

☐ Yes ☒ No

Does the facility have an approved pretreatment program, under 40 CFR Part 403?

☐ Yes ☒ No

If no to both of the above, then skip to Subsection F, Other Wastes Received.

2. *MSGP coverage*

   Is the stormwater runoff from the WWTP and dedicated lands for sewage disposal currently permitted under the TPDES Multi-Sector General Permit (MSGP), TXR050000?

   ☐ Yes ☒ No

   If yes, please provide MSGP Authorization Number and skip to Subsection F, Other Wastes Received:

   TXR05 Click to enter text. or TXRNE Click to enter text.

   If no, do you intend to seek coverage under TXR050000?

   ☐ Yes ☐ No

3. *Conditional exclusion*

   Alternatively, do you intend to apply for a conditional exclusion from permitting based TXR050000 (Multi Sector General Permit) Part II B.2 or TXR050000 (Multi Sector General Permit) Part V, Sector T 3(b)?

   ☐ Yes ☒ No

   If yes, please explain below then proceed to Subsection F, Other Wastes Received:

   Click to enter text.

4. *Existing coverage in individual permit*

   Is your stormwater discharge currently permitted through this individual TPDES or TLAP permit?

   ☐ Yes ☒ No

   If yes, provide a description of stormwater runoff management practices at the site that are authorized in the wastewater permit then skip to Subsection F, Other Wastes Received.

   Click to enter text.

5. *Zero stormwater discharge*

   Do you intend to have no discharge of stormwater via use of evaporation or other means?

   ☐ Yes ☒ No

   If yes, explain below then skip to Subsection F. Other Wastes Received.

Click to enter text.

Note: If there is a potential to discharge any stormwater to surface water in the state as the result of any storm event, then permit coverage is required under the MSGP or an individual discharge permit. This requirement applies to all areas of facilities with treatment plants or systems that treat, store, recycle, or reclaim domestic sewage, wastewater or sewage sludge (including dedicated lands for sewage sludge disposal located within the onsite property boundaries) that meet the applicability criteria of above. You have the option of obtaining coverage under the MSGP for direct discharges, (recommended), or obtaining coverage under this individual permit.

6. ***Request for coverage in individual permit***

Are you requesting coverage of stormwater discharges associated with your treatment plant under this individual permit?

☐ Yes ☒ No

If yes, provide a description of stormwater runoff management practices at the site for which you are requesting authorization in this individual wastewater permit and describe whether you intend to comingle this discharge with your treated effluent or discharge it via a separate dedicated stormwater outfall. Please also indicate if you intend to divert stormwater to the treatment plant headworks and indirectly discharge it to water in the state.

Click to enter text.

Note: Direct stormwater discharges to waters in the state authorized through this individual permit will require the development and implementation of a stormwater pollution prevention plan (SWPPP) and will be subject to additional monitoring and reporting requirements. Indirect discharges of stormwater via headworks recycling will require compliance with all individual permit requirements including 2-hour peak flow limitations. All stormwater discharge authorization requests will require additional information during the technical review of your application.

F. Discharges to the Lake Houston Watershed

Does the facility discharge in the Lake Houston watershed?

☐ Yes ☒ No

If yes, attach a Sewage Sludge Solids Management Plan. See Example 5 in the instructions. Click to enter text.

G. Other wastes received including sludge from other WWTPs and septic waste

1. ***Acceptance of sludge from other WWTPs***

Does or will the facility accept sludge from other treatment plants at the facility site?

☐ Yes ☒ No

If yes, attach sewage sludge solids management plan. See Example 5 of instructions.

In addition, provide the date the plant started or is anticipated to start accepting sludge, an estimate of monthly sludge acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the sludge, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

2. ***Acceptance of septic waste***

Is the facility accepting or will it accept septic waste?

☐ Yes ☒ No

If yes, does the facility have a Type V processing unit?

☐ Yes ☒ No

If yes, does the unit have a Municipal Solid Waste permit?

☐ Yes ☒ No

If yes to any of the above, provide the date the plant started or is anticipated to start accepting septic waste, an estimate of monthly septic waste acceptance (gallons or millions of gallons), an estimate of the BOD_5 concentration of the septic waste, and the design BOD_5 concentration of the influent from the collection system. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Note: Permits that accept sludge from other wastewater treatment plants may be required to have influent flow and organic loading monitoring.

3. ***Acceptance of other wastes (not including septic, grease, grit, or RCRA, CERCLA or as discharged by IUs listed in Worksheet 6)***

Is or will the facility accept wastes that are not domestic in nature excluding the categories listed above?

☐ Yes ☒ No

If yes, provide the date that the plant started accepting the waste, an estimate how much waste is accepted on a monthly basis (gallons or millions of gallons), a description of the entities generating the waste, and any distinguishing chemical or other physical characteristic of the waste. Also note if this information has or has not changed since the last permit action.

Click to enter text.

Section 7. Pollutant Analysis of Treated Effluent (Instructions Page 50)

Is the facility in operation?

☒ Yes ☐ No

If no, this section is not applicable. Proceed to Section 8.

If yes, provide effluent analysis data for the listed pollutants. ***Wastewater treatment facilities*** complete Table 1.0(2). W***ater treatment facilities*** discharging filter backwash water, complete Table 1.0(3). Provide copies of the laboratory results sheets. **These tables are not applicable for a minor amendment without renewal.** See the instructions for guidance.

Note: The sample date must be within 1 year of application submission.

Table1.0(2) – Pollutant Analysis for Wastewater Treatment Facilities

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
$CBOD_5$, mg/l	1		1	Grab	1/8/2025, 6:15
Total Suspended Solids, mg/l	5		1	Grab	12/5/2024
Ammonia Nitrogen, mg/l	<0.05		1	Grab	1/14/2025, 12:35
Nitrate Nitrogen, mg/l	41		1	Grab	1/15/2025, 7:00
Total Kjeldahl Nitrogen, mg/l	<0.20		1	Grab	1/14/2025, 12:49
Sulfate, mg/l	45.9		1	Grab	1/13/2025, 10:09
Chloride, mg/l	273		1	Grab	1/13/2025, 10:00
Total Phosphorus, mg/l	5,44		1	Grab	1/14/2025, 20:31
pH, standard units	7.2		1	Grab	1/07/2025, 11:09
Dissolved Oxygen*, mg/l	N/A	N/A	N/A	N/A	N/A

Chlorine Residual, mg/l	0.3		1	Grab	1/07/2025, 11:09
E.coli (CFU/100ml) freshwater	7.5		1	Grab	1/07/2025, 15:42
Entercocci (CFU/100ml) saltwater					
Total Dissolved Solids, mg/l	870		1	Grab	1/13/2025, 12:52
Electrical Conductivity, µmohs/cm, †	1480		1	Grab	
Oil & Grease, mg/l	<15.9		1	Grab	1/14/2025, 09:23
Alkalinity ($CaCO_3$)*, mg/l	N/A	N/A	N/A	N/A	N/A

*TPDES permits only
†TLAP permits only

Table1.0(3) – Pollutant Analysis for Water Treatment Facilities

Pollutant	Average Conc.	Max Conc.	No. of Samples	Sample Type	Sample Date/Time
Total Suspended Solids, mg/l					
Total Dissolved Solids, mg/l	870				
pH, standard units	7.2				
Fluoride, mg/l	N/A				
Aluminum, mg/l	N/A				
Alkalinity ($CaCO_3$), mg/l					

Section 8. Facility Operator (Instructions Page 50)

Facility Operator Name: Crossroads Utility Services

Facility Operator's License Classification and Level: Wastewater Operator Class A

Facility Operator's License Number: OC0000182

Section 9. Sludge and Biosolids Management and Disposal (Instructions Page 51)

A. WWTP's Biosolids Management Facility Type

Check all that apply. See instructions for guidance

☐ Design flow>= 1 MGD

☐ Serves >= 10,000 people

☐ Class I Sludge Management Facility (per 40 CFR § 503.9)

☒ Biosolids generator

☐ Biosolids end user – land application (onsite)

☐ Biosolids end user – surface disposal (onsite)

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: **2/4/25** **10:46**

I001299

Travis County MUD 22 WWTP Effluent

Collected: 01/07/25 11:09 by Brianna Burke
Received: 01/07/25 14:45 by Brianna Burke

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# I001299-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
Field Parameters											
Field pH	**7.2**	pH Units		0.01	0.01	0.1	*Austin*	At Collection	SM4500-H+ B 2011	M187556	*ANR*
Temperature	**9.4**	Deg. C		0.1	0.1	0.1	*Austin*	At Collection	SM2550 B 2000	M187556	*ANR*
General Chemistry											
Total Resudual Chlorine	**0.30**	mg/L			0.10	0.10	*Calc*	01/07/25 11:09 BEB	SM4500-Cl F 2011	[CALC]	*NEL*
Carbonaceous BOD (5 day)	**1**	mg/L		1	1	1	*Austin*	01/08/25 06:15 BAL	SM5210 B 2016	M187662	*NEL*
Total Dissolved Solids	**870**	mg/L		25.0	50.0	50.0	*Austin*	01/13/25 12:52 KHA	SM2540 C 2015	M187896	*NEL*
Ammonia as N	**<0.05**	mg/L		0.05	0.05	0.05	*Bryan*	01/14/25 12:35 KMA	SM4500-NH3 G 2011	M187955	*NEL*
Total Kjeldahl Nitrogen as N	**<0.20**	mg/L		0.13	0.13	0.20	*Bryan*	01/14/25 12:49 KMA	EPA 351.2 R2.0	M187946	*NEL*
Nitrate as N	**41**	mg/L			0.86	1.0	*Calc*	01/15/25 12:15 MSA	SM4500-NO3-F 2011	[CALC]	*NEL*
Nitrite as N	**<0.01**	mg/L		0.002	0.002	0.01	*Austin*	01/08/25 07:00 MSA	SM4500 NO2- B 2011	M187678	*NEL*
Nitrate/Nitrite as N	**41**	mg/L		0.02	0.86	1.0	*Bryan*	01/15/25 12:15 KMA	SM4500-NO3-F 2011	M188030	*ANR*
Oil & Grease (HEM)	**<15.9**	mg/L		4.4	15.9	15.9	*Bryan*	01/14/25 09:23 HDH	EPA 1664B	M187948	*NEL*
Chloride	**273**	mg/L		0.60	2.41	20.0	*Austin*	01/13/25 10:00 MSA	SM4500-Cl- B 2011	M187897	*NEL*
Sulfate as SO4(2-)	**45.9**	mg/L		2.63	10.5	20.0	*Austin*	01/13/25 10:09 BEB	ASTM D516-16	M187912	*NEL*
Specific Conductance (adjusted to 25.0°C)	**1480**	uS/cm		2.00	8.00	8.00	*Austin*	01/13/25 08:15 MSA	SM2510 B 2011	M187888	*NEL*
Microbiological Analyses											
E. Coli	**7.5**	MPN/100 mL		1.0	1.0	1.0	*Austin*	01/07/25 15:42 ACG	SM9223 B 2004	M187650	*NEL*

Results run by SM 9223B are reported as MPN (Most Probable Number). MPN is comparable to CFU (Colony Forming Units). Both MPN and CFU are allowed in most permits.

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
Metals (Total)											
Phosphorus (Total)	**5.44**	mg/L		0.082	0.041	0.050	*Austin*	01/14/25 20:31 KT	EPA 200.7 R4.4	M187885	*NEL*

Explanation of Notes

J	Analyte detected below the SQL but above the MDL.
RPD-01	Duplicate RPD is outside acceptable range. Acceptance of run is not based on matrix QC.

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Field Parameters - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Field pH - SM4500-H+ B 2011													*Austin*
Duplicate	7.0	pH Units		0.01	0.1	01/07/25 09:53 BEB		7.0			0.00	0.551	M187556
Temperature - SM2550 B 2000													*Austin*
Duplicate	20.7	Deg. C		0.1	0.1	01/07/25 09:53 BEB		20.7			0.00	2.48	M187556
Duplicate	21.2	Deg. C		0.1	0.1	01/07/25 09:53 BEB		21.2			0.00	2.48	M187556

General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Ammonia as N - SM4500-NH3 G 2011													*Bryan*
Initial Cal Check	0.97	mg/L				01/14/25 12:35 KMA	1.00		97.3	90 - 110			2501159
Low Cal Check	0.06	mg/L				01/14/25 12:35 KMA	0.0500		112	70 - 130			2501159
Blank	<0.05	mg/L		0.05	0.05	01/14/25 12:35 KMA							M187955
LCS	0.49	mg/L		0.05	0.05	01/14/25 12:35 KMA	0.500		97.4	85 - 115			M187955
LCS Dup	0.49	mg/L		0.05	0.05	01/14/25 12:35 KMA	0.500		98.0	85 - 115	0.614	20	M187955
Matrix Spike	0.52	mg/L		0.05	0.05	01/14/25 12:35 KMA	0.500	<0.05	93.2	70 - 130			M187955
Matrix Spike Dup	0.52	mg/L		0.05	0.05	01/14/25 12:35 KMA	0.500	<0.05	93.8	70 - 130	0.642	20	M187955
Carbonaceous BOD (5 day) - SM5210 B 2016													*Austin*
Diln Water Blk	<0.20	mg/L		1	1	01/08/25 06:15 BAL		0.1		< or = 0.2 mg/L			2501068
GGA	175	mg/L		1	1	01/08/25 06:15 BAL	199		87.9	84.6 - 115.4			2501068
GGA	173	mg/L		1	1	01/08/25 06:15 BAL	199		86.9	84.6 - 115.4			2501068
GGA	183	mg/L		1	1	01/08/25 06:15 BAL	199		92.0	84.6 - 115.4			2501068
GGA	179	mg/L		1	1	01/08/25 06:15 BAL	199		89.9	84.6 - 115.4			2501068
Seed Blank	<1	mg/L		1	1	01/08/25 06:15 BAL							2501068
Seed Blank	<1	mg/L		1	1	01/08/25 06:15 BAL							2501068
Seed Blank	<1	mg/L		1	1	01/08/25 06:15 BAL							2501068
Seed Blank	<1	mg/L		1	1	01/08/25 06:15 BAL							2501068
Duplicate	<1	mg/L		1	1	01/08/25 06:15 BAL		<1				47.7	M187662

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General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Chloride - SM4500-Cl- B 2011													*Austin*
Initial Cal Check	49.1	mg/L				01/13/25 10:00 MSA	50.0		98.1	90 - 110			2501141
Low Cal Check	5.61	mg/L				01/13/25 10:00 MSA	4.95		113	70 - 130			2501141
Blank	<5.00	mg/L		0.60	5.00	01/13/25 10:00 MSA							M187897
LCS	20.6	mg/L		0.60	5.00	01/13/25 10:00 MSA	19.8		104	90 - 110			M187897
LCS Dup	20.1	mg/L		0.60	5.00	01/13/25 10:00 MSA	19.8		101	90 - 110	2.30	5.86	M187897
Matrix Spike	273	mg/L		2.41	20.0	01/13/25 10:00 MSA	79.2	191	104	83.4 - 113			M187897
Matrix Spike Dup	271	mg/L		2.41	20.0	01/13/25 10:00 MSA	79.2	191	101	83.4 - 113	2.30	10.7	M187897
MRL Check	5.61	mg/L		0.60	5.00	01/13/25 10:00 MSA	4.95		113	70 - 130			M187897
Chlorine Residual, Total - SM4500-Cl F 2011													*Austin*
Duplicate	0.3	mg/L	*RPD-01*	0.1	0.1	01/07/25 09:51 BEB		<0.1				5.88	M187556
Mn Interference - SM4500-Cl F 2011													*Austin*
Duplicate	0.2	mg/L		0.1	0.1	01/22/25 13:24 BAL		0.2			0.00	7.47	M188300
Nitrate/Nitrite as N - SM4500-NO3-F 2011													*Bryan*
Initial Cal Check	1.0	mg/L				01/15/25 12:15 KMA	0.959		106	90 - 110			2501188
Interference Check A	2.0	mg/L				01/15/25 12:15 KMA	2.00		98.6	90 - 110			2501188
Low Cal Check	0.02	mg/L				01/15/25 12:15 KMA	0.0200		110	70 - 130			2501188
Blank	<0.02	mg/L		0.02	0.02	01/15/25 12:15 KMA							M188030
LCS	0.51	mg/L		0.02	0.02	01/15/25 12:15 KMA	0.500		102	92.6 - 108			M188030
LCS Dup	0.52	mg/L		0.02	0.02	01/15/25 12:15 KMA	0.500		105	92.6 - 108	2.90	3.59	M188030
Matrix Spike	21	mg/L		0.26	0.30	01/15/25 12:15 KMA	5.00	15	105	79.4 - 122			M188030
Matrix Spike Dup	21	mg/L		0.26	0.30	01/15/25 12:15 KMA	5.00	15	102	79.4 - 122	3.27	7.62	M188030
Nitrite as N - SM4500 NO2- B 2011													*Austin*
Initial Cal Check	0.08	mg/L				01/08/25 07:00 MSA	0.0740		104	90 - 110			2501070
Blank	<0.01	mg/L		0.002	0.01	01/08/25 07:00 MSA							M187678
LCS	0.08	mg/L		0.002	0.01	01/08/25 07:00 MSA	0.0800		101	90 - 110			M187678
LCS Dup	0.08	mg/L		0.002	0.01	01/08/25 07:00 MSA	0.0800		102	90 - 110	0.446	10	M187678
Matrix Spike	0.07	mg/L		0.002	0.01	01/08/25 07:00 MSA	0.0800	<0.01	84.5	57 - 116			M187678
Matrix Spike Dup	0.07	mg/L		0.002	0.01	01/08/25 07:00 MSA	0.0800	<0.01	86.3	57 - 116	2.12	10	M187678
MRL Check	<0.01	mg/L	*J (0.009)*	0.002	0.01	01/08/25 07:00 MSA	0.0100		85.5	70 - 130			M187678
Initial Cal Check	0.08	mg/L				10/04/24 08:45 MSA	0.0740		105	90 - 110			2410073

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General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Oil & Grease (HEM) - EPA 1664B													*Bryan*
Blank	<5.1	mg/L		5.1	5.1	01/14/25 09:23 HDH							M187948
LCS	33.7	mg/L		5.1	5.1	01/14/25 09:23 HDH	41.1		81.9	78 - 114			M187948
LCS Dup	36.7	mg/L		5.0	5.0	01/14/25 09:23 HDH	40.7		90.3	78 - 114	9.80	200	M187948
Matrix Spike	35.7	mg/L		5.3	5.3	01/14/25 09:23 HDH	42.8	<5.3	83.4	78 - 114			M187948
Specific Conductance (adjusted to 25.0°C) - SM2510 B 2011													*Austin*
ICV	518	uS/cm				01/13/25 08:15 MSA	515		101	90 - 110			2501138
Blank	<2.00	uS/cm		2.00	2.00	01/13/25 08:15 MSA							M187888
Duplicate	1480	uS/cm		8.00	8.00	01/13/25 08:15 MSA		1480			0.270	10	M187888
LCS	1400	uS/cm		2.00	2.00	01/13/25 08:15 MSA	1410		99.6	90 - 110			M187888
LCS Dup	1400	uS/cm		2.00	2.00	01/13/25 08:15 MSA	1410		99.5	90 - 110	0.142	10	M187888
Sulfate as SO4(2-) - ASTM D516-16													*Austin*
Initial Cal Check	31.4	mg/L				01/13/25 10:09 BEB	30.0		105	90 - 110			2501144
Low Cal Check	4.30	mg/L				01/13/25 10:09 BEB	5.00		86.0	70 - 130			2501144
Blank	<5.00	mg/L		2.63	5.00	01/13/25 10:09 BEB							M187912
Duplicate	46.5	mg/L		10.5	20.0	01/13/25 10:09 BEB		45.9			1.22	11.9	M187912
LCS	8.62	mg/L		2.63	5.00	01/13/25 10:09 BEB	10.0		86.2	85 - 115			M187912
LCS Dup	8.54	mg/L		2.63	5.00	01/13/25 10:09 BEB	10.0		85.4	85 - 115	0.847	13.8	M187912
Matrix Spike	92.5	mg/L		10.5	20.0	01/13/25 10:09 BEB	40.0	45.9	116	61.6 - 137			M187912
Matrix Spike Dup	90.5	mg/L		10.5	20.0	01/13/25 10:09 BEB	40.0	45.9	112	61.6 - 137	4.21	17.1	M187912
Initial Cal Check	27.8	mg/L				09/13/24 09:10 BEB	30.0		92.7	90 - 110			2409181
Total Dissolved Solids - SM2540 C 2015													*Austin*
Blank	<25.0	mg/L		25.0	25.0	01/13/25 12:52 KHA							M187896
Duplicate	890	mg/L		50.0	50.0	01/13/25 12:52 KHA		870			2.27	11.2	M187896
Reference	508	mg/L		100	100	01/13/25 12:52 KHA	502		101	75 - 127			M187896
Total Kjeldahl Nitrogen as N - EPA 351.2 R2.0													*Bryan*
Initial Cal Check	3.69	mg/L				01/14/25 12:49 KMA	3.38		109	90 - 110			2501163
Low Cal Check	0.22	mg/L				01/14/25 12:49 KMA	0.200		112	70 - 130			2501163
Blank	<0.20	mg/L		0.13	0.20	01/14/25 12:49 KMA							M187946
LCS	4.19	mg/L		0.13	0.20	01/14/25 12:49 KMA	4.00		105	96.9 - 112			M187946
LCS Dup	4.21	mg/L		0.13	0.20	01/14/25 12:49 KMA	4.00		105	96.9 - 112	0.476	3.77	M187946
Matrix Spike	164	mg/L		3.25	5.00	01/14/25 12:49 KMA	100	57.8	106	91.3 - 115			M187946
Matrix Spike Dup	159	mg/L		3.25	5.00	01/14/25 12:49 KMA	100	57.8	101	91.3 - 115	4.40	11.6	M187946

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Metals (Total) - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Phosphorus (Total) - EPA 200.7 R4.4													*Austin*
Blank	<0.050	mg/L		0.041	0.050	01/14/25 19:06 KT							M187885
LCS	2.54	mg/L		0.041	0.050	01/14/25 19:53 KT	2.50		102	84.5 - 115.4			M187885
LCS Dup	2.53	mg/L		0.041	0.050	01/14/25 19:56 KT	2.50		101	84.5 - 115.4	0.118	20	M187885
Matrix Spike	3.08	mg/L		0.041	0.050	01/14/25 20:01 KT	2.50	0.248	113	69.5 - 130.4			M187885
Duplicate	0.217	mg/L		0.041	0.050	01/17/25 15:56 KT		0.248			13.5	20	M187885

Microbiological Analyses - Quality Control

											Log10 Comparison		
	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	Range	Control Limit	Batch
E. Coli - SM9223 B 2004													*Austin*
Blank	<1.0	MPN/100 mL		1.0	1.0	01/07/25 14:56 ACG							M187650
Dup Log10 Range		MPN/100 mL		1.0	1.0	01/07/25 14:56 ACG					0.000		M187650
Duplicate	<1.0	MPN/100 mL		1.0	1.0	01/07/25 14:56 ACG		<1.0				0.5	M187650

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
I001299-01										
Ammonia as N	SM4500-NH3 G 2011	1/14/25 9:52 KMA	Bryan	A	10.0	mL	10.0	mL	1	M187955
Carbonaceous BOD (5 day)	SM5210 B 2016	1/8/25 6:15 BAL	Austin	B	300	mL	300	mL	1	M187662
Chloride	SM4500-Cl- B 2011	1/13/25 10:00 MSA	Austin	C	25.0	mL	100	mL	1	M187897
E. Coli	SM9223 B 2004	1/7/25 15:35 ACG	Austin	D	100	N/A	100	N/A	1	M187650
Nitrate/Nitrite as N	SM4500-NO3-F 2011	1/15/25 10:28 KMA	Bryan	A	1.00	mL	50.0	mL	1	M188030
Nitrite as N	SM4500 NO2- B 2011	1/8/25 7:00 MSA	Austin	F	25.0	mL	25.0	mL	1	M187678
Oil & Grease (HEM)	EPA 1664B	1/14/25 9:23 HDH	Bryan	G	314	mL	1000	mL	1	M187948
Phosphorus (Total)	EPA 200.7 R4.4	1/13/25 8:07 BGB	Austin	J	50.0	mL	25.0	mL	1	M187885
Specific Conductance (adjusted to 25.0°C)	SM2510 B 2011	1/13/25 8:15 MSA	Austin	C	12.5	mL	25.0	mL	2	M187888
Sulfate as SO4(2-)	ASTM D516-16	1/13/25 10:09 BEB	Austin	C	25.0	mL	100	mL	1	M187912
Total Dissolved Solids	SM2540 C 2015	1/13/25 12:52 KHA	Austin	C	50.0	mL	100	mL	1	M187896
Total Kjeldahl Nitrogen as N	EPA 351.2 R2.0	1/14/25 7:30 CTG	Bryan	A	25.0	mL	25.0	mL	1	M187946

BRYAN FACILITY
635 Phil Gramm Boulevard
Bryan, TX 77807
Phone: (979) 778-3707
Fax: (979) 778-3193

AQUA-TECH LABORATORIES

AUSTIN FACILITY
3512 Montopolis Dr. Suite A
Austin, TX 78744
Phone: (512) 301-9559
Fax: (512) 301-9552

Chain-of-Custody Summary

The following record summarizes custody for work orders sampled by Aqua-Tech Laboratories, Inc. personnel on route.

Original signatures are kept on file by Aqua-Tech Laboratories, Inc. and are available upon request.

WORK ORDER I001299

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
AQU7	1.9	Yes	Yes	Yes	Yes	

I001299-01 Grab Sampling Begun: 1/7/25 11:09 Sampling Ended: 1/7/25 11:09

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A AMM NO3 TKN 0.25LP H2SO4	pH<2	B CBOD 1LP		C Cl Cond SO4 TDS 1LP	
D Ecoli 0.15L StP Na2S2O3		E Mn Corr 0.25LP		F NO2 0.25LP	
G OG - 0.33LG Amber HCl		H OG - 0.33LG Amber HCl		I OG pH Chk - 0.33LP HCl	pH<2
J P 0.25LP H2SO4	pH<2				

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 1/7/25 14:45 By Brianna Burke (Austin)

☐ Heat Drying

☐ Thermophilic Aerobic Digestion

☐ Beta Ray Irradiation

☐ Gamma Ray Irradiation

☐ Pasteurization

☐ Preliminary Operation (e.g. grinding, de-gritting, blending)

☐ Thickening (e.g. gravity thickening, centrifugation, filter press, vacuum filter)

☐ Sludge Lagoon

☐ Temporary Storage (< 2 years)

☐ Long Term Storage (>= 2 years)

☐ Methane or Biogas Recovery

☐ Other Treatment Process: Click to enter text.

C. Biosolids Management

Provide information on the *intended* biosolids management practice. Do not enter every management practice that you want authorized in the permit, as the permit will authorize all biosolids management practices listed in the instructions. Rather indicate the management practice the facility plans to use.

Biosolids Management

Management Practice	Handler or Preparer Type	Bulk or Bag Container	Amount (dry metric tons)	Pathogen Reduction Options	Vector Attraction Reduction Option
Other	Off-site Third-Party Handler or Preparer	Choose an item.		Choose an item.	Choose an item.
Choose an item.	Choose an item.	Choose an item.		Choose an item.	Choose an item.
Choose an item.	Choose an item.	Choose an item.		Choose an item.	Choose an item.

If “Other” is selected for Management Practice, please explain (e.g. monofill or transport to another WWTP): Transported to another permitted WWTP.

D. Disposal site

Disposal site name: City of Austin Walnut Creek Wastewater Treatment Plant

TCEQ permit or registration number: 10543-011

County where disposal site is located: Travis

E. Transportation method

Method of transportation (truck, train, pipe, other): Tanker

Name of the hauler: Wastewater Transport Services

Hauler registration number: TCEQ #24343

Sludge is transported as a:

Liquid ☒ semi-liquid ☐ semi-solid ☐ solid ☐

Section 10. Permit Authorization for Sewage Sludge Disposal (Instructions Page 53)

A. Beneficial use authorization

Does the existing permit include authorization for land application of sewage sludge for beneficial use?

☐ Yes ☒ No

If yes, are you requesting to continue this authorization to land apply sewage sludge for beneficial use?

☐ Yes ☐ No

If yes, is the completed **Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)** attached to this permit application (see the instructions for details)?

☐ Yes ☐ No

B. Sludge processing authorization

Does the existing permit include authorization for any of the following sludge processing, storage or disposal options?

Sludge Composting	☐ Yes	☒ No
Marketing and Distribution of sludge	☐ Yes	☒ No
Sludge Surface Disposal or Sludge Monofill	☐ Yes	☒ No
Temporary storage in sludge lagoons	☐ Yes	☒ No

If yes to any of the above sludge options and the applicant is requesting to continue this authorization, is the completed **Domestic Wastewater Permit Application: Sewage Sludge Technical Report (TCEQ Form No. 10056)** attached to this permit application?

☐ Yes ☐ No

Section 11. Sewage Sludge Lagoons (Instructions Page 53)

Does this facility include sewage sludge lagoons?

☐ Yes ☒ No

If yes, complete the remainder of this section. If no, proceed to Section 12.

A. Location information

The following maps are required to be submitted as part of the application. For each map, provide the Attachment Number.

- Original General Highway (County) Map:

Attachment: Click to enter text.

- USDA Natural Resources Conservation Service Soil Map:

  Attachment: Click to enter text.

- Federal Emergency Management Map:

  Attachment: Click to enter text.

- Site map:

  Attachment: Click to enter text.

Discuss in a description if any of the following exist within the lagoon area. Check all that apply.

- ☐ Overlap a designated 100-year frequency flood plain
- ☐ Soils with flooding classification
- ☐ Overlap an unstable area
- ☐ Wetlands
- ☐ Located less than 60 meters from a fault
- ☐ None of the above

Attachment: Click to enter text.

If a portion of the lagoon(s) is located within the 100-year frequency flood plain, provide the protective measures to be utilized including type and size of protective structures:

Click to enter text.

B. Temporary storage information

Provide the results for the pollutant screening of sludge lagoons. These results are in addition to pollutant results in *Section 7 of Technical Report 1.0.*

Nitrate Nitrogen, mg/kg: Click to enter text.

Total Kjeldahl Nitrogen, mg/kg: Click to enter text.

Total Nitrogen (=nitrate nitrogen + TKN), mg/kg: Click to enter text.

Phosphorus, mg/kg: Click to enter text.

Potassium, mg/kg: Click to enter text.

pH, standard units: Click to enter text.

Ammonia Nitrogen mg/kg: Click to enter text.

Arsenic: Click to enter text.

Cadmium: Click to enter text.

Chromium: Click to enter text.

Copper: Click to enter text.

Lead: Click to enter text.

Mercury: Click to enter text.

Molybdenum: Click to enter text.

Nickel: Click to enter text.

Selenium: Click to enter text.

Zinc: Click to enter text.

Total PCBs: Click to enter text.

Provide the following information:

Volume and frequency of sludge to the lagoon(s): Click to enter text.

Total dry tons stored in the lagoons(s) per 365-day period: Click to enter text.

Total dry tons stored in the lagoons(s) over the life of the unit: Click to enter text.

C. Liner information

Does the active/proposed sludge lagoon(s) have a liner with a maximum hydraulic conductivity of $1x10^{-7}$ cm/sec?

☐ Yes ☐ No

If yes, describe the liner below. Please note that a liner is required.

Click to enter text.

D. Site development plan

Provide a detailed description of the methods used to deposit sludge in the lagoon(s):

Click to enter text.

Attach the following documents to the application.

- Plan view and cross-section of the sludge lagoon(s)

  Attachment: Click to enter text.
- Copy of the closure plan

  Attachment: Click to enter text.
- Copy of deed recordation for the site

  Attachment: Click to enter text.
- Size of the sludge lagoon(s) in surface acres and capacity in cubic feet and gallons

Attachment: Click to enter text.

- Description of the method of controlling infiltration of groundwater and surface water from entering the site

  Attachment: Click to enter text.

- Procedures to prevent the occurrence of nuisance conditions

  Attachment: Click to enter text.

E. Groundwater monitoring

Is groundwater monitoring currently conducted at this site, or are any wells available for groundwater monitoring, or are groundwater monitoring data otherwise available for the sludge lagoon(s)?

☐ Yes ☐ No

If groundwater monitoring data are available, provide a copy. Provide a profile of soil types encountered down to the groundwater table and the depth to the shallowest groundwater as a separate attachment.

Attachment: Click to enter text.

Section 12. Authorizations/Compliance/Enforcement (Instructions Page 55)

A. Additional authorizations

Does the permittee have additional authorizations for this facility, such as reuse authorization, sludge permit, etc?

☐ Yes ☒ No

If yes, provide the TCEQ authorization number and description of the authorization:

Click to enter text.

B. Permittee enforcement status

Is the permittee currently under enforcement for this facility?

☐ Yes ☒ No

Is the permittee required to meet an implementation schedule for compliance or enforcement?

☐ Yes ☒ No

If yes to either question, provide a brief summary of the enforcement, the implementation schedule, and the current status:

Click to enter text.

Section 13. RCRA/CERCLA Wastes (Instructions Page 55)

A. RCRA hazardous wastes

Has the facility received in the past three years, does it currently receive, or will it receive RCRA hazardous waste?

☐ Yes ☒ No

B. Remediation activity wastewater

Has the facility received in the past three years, does it currently receive, or will it receive CERCLA wastewater, RCRA remediation/corrective action wastewater or other remediation activity wastewater?

☐ Yes ☒ No

C. Details about wastes received

If yes to either Subsection A or B above, provide detailed information concerning these wastes with the application.

Attachment: Click to enter text.

Section 14. Laboratory Accreditation (Instructions Page 56)

All laboratory tests performed must meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification*, which includes the following general exemptions from National Environmental Laboratory Accreditation Program (NELAP) certification requirements:

- The laboratory is an in-house laboratory and is:
  - periodically inspected by the TCEQ; or
  - located in another state and is accredited or inspected by that state; or
  - performing work for another company with a unit located in the same site; or
  - performing pro bono work for a governmental agency or charitable organization.
- The laboratory is accredited under federal law.
- The data are needed for emergency-response activities, and a laboratory accredited under the Texas Laboratory Accreditation Program is not available.
- The laboratory supplies data for which the TCEQ does not offer accreditation.

The applicant should review 30 TAC Chapter 25 for specific requirements.

The following certification statement shall be signed and submitted with every application. See the Signature Page section in the Instructions, for a list of designated representatives who may sign the certification.

CERTIFICATION:

I certify that all laboratory tests submitted with this application meet the requirements of *30 TAC Chapter 25, Environmental Testing Laboratory Accreditation and Certification.*

Printed Name: Nate Gilbert

Title: President

Signature: Nathan Gilbert

Date: 02/25/2025

DOMESTIC WASTEWATER PERMIT APPLICATION TECHNICAL REPORT 1.1

The following information is required for new and amendment major applications.

Section 1. Justification for Permit (Instructions Page 57)

A. Justification of permit need

Provide a detailed discussion regarding the need for any phase(s) not currently permitted. Failure to provide sufficient justification may result in the Executive Director recommending denial of the proposed phase(s) or permit.

The wastewater treatment plant will serve the proposed residential development. Based on easement and right-of-way limitations, no route exists from this site to an organized wastewater treatment facility. The use of a central collection treatment and disposal system is being preferred to an equivalent number of private residential septic tank/drain field units. Design flows are based on Living Unit Equivalents (LUEs) or connections associated with the service area. A basis of 245 gallons of wastewater per day per connection (maximum 30-day wet weather average) was assumed for flow projections. The ultimate flow is based on the total number of LUEs (1836 LUEs). The total flow needed at full build would be 1836 connections x 245 gal/day/connection = 450,000 gal/day assumed.

B. Regionalization of facilities

For additional guidance, please review TCEQ's Regionalization Policy for Wastewater Treatment[1].

Provide the following information concerning the potential for regionalization of domestic wastewater treatment facilities:

1. Municipally incorporated areas

If the applicant is a city, then Item 1 is not applicable. Proceed to Item 2 Utility CCN areas.

Is any portion of the proposed service area located in an incorporated city?

☐ Yes ☒ No ☐ Not Applicable

If yes, within the city limits of: Click to enter text.

If yes, attach correspondence from the city.

Attachment: Click to enter text.

If consent to provide service is available from the city, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the city versus the cost of the proposed facility or expansion attached.

Attachment: Click to enter text.

[1] https://www.tceq.texas.gov/permitting/wastewater/tceq-regionalization-for-wastewater

2. ***Utility CCN areas***

Is any portion of the proposed service area located inside another utility's CCN area?

☐ Yes ☒ No

If yes, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the CCN facilities versus the cost of the proposed facility or expansion.

Attachment: Click to enter text.

3. ***Nearby WWTPs or collection systems***

Are there any domestic permitted wastewater treatment facilities or collection systems located within a three-mile radius of the proposed facility?

☐ Yes ☒ No

If yes, attach a list of these facilities and collection systems that includes each permittee's name and permit number, and an area map showing the location of these facilities and collection systems.

Attachment:

If yes, attach proof of mailing a request for service to each facility and collection system, the letters requesting service, and correspondence from each facility and collection system.

Attachment: Click to enter text.

If the facility or collection system agrees to provide service, attach a justification for the proposed facility and a cost analysis of expenditures that includes the cost of connecting to the facility or collection system versus the cost of the proposed facility or expansion.

Attachment: Click to enter text.

Section 2. Proposed Organic Loading (Instructions Page 59)

Is this facility in operation?

☒ Yes ☐ No

If no, proceed to Item B, Proposed Organic Loading.

If yes, provide organic loading information in Item A, Current Organic Loading

A. Current organic loading

Facility Design Flow (flow being requested in application): 0.45 MGD

Average Influent Organic Strength or BOD_5 Concentration in mg/l: 400

Average Influent Loading (lbs/day = total average flow X average BOD_5 conc. X 8.34): 3.34 E 10 lbs/day

Provide the source of the average organic strength or BOD_5 concentration.

DRAFT

Source: Domestic wastewater from residential properties.

B. Proposed organic loading

This table must be completed if this application is for a facility that is not in operation or if this application is to request an increased flow that will impact organic loading.

Table 1.1(1) – Design Organic Loading

Source	Total Average Flow (MGD)	Influent BOD5 Concentration (mg/l)
Municipality		
Subdivision	0.45	400
Trailer park – transient		
Mobile home park		
School with cafeteria and showers		
School with cafeteria, no showers		
Recreational park, overnight use		
Recreational park, day use		
Office building or factory		
Motel		
Restaurant		
Hospital		
Nursing home		
Other		
TOTAL FLOW from all sources	0.45	
AVERAGE BOD_5 from all sources		400

Section 3. Proposed Effluent Quality and Disinfection (Instructions Page 59)

A. Existing/Interim I Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: N/A

Total Phosphorus, mg/l: N/A

Dissolved Oxygen, mg/l: 5.0

Other: Click to enter text.

B. Interim II Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: N/A

Total Phosphorus, mg/l: N/A

Dissolved Oxygen, mg/l: 5.0

Other: Click to enter text.

C. Final Phase Design Effluent Quality

Biochemical Oxygen Demand (5-day), mg/l: 10.0

Total Suspended Solids, mg/l: 15.0

Ammonia Nitrogen, mg/l: N/A

Total Phosphorus, mg/l: N/A

Dissolved Oxygen, mg/l: 5.0

Other: Click to enter text.

D. Disinfection Method

Identify the proposed method of disinfection.

☒ Chlorine: 1 mg/l after 20 minutes detention time at peak flow

Dechlorination process: N/A

☐ Ultraviolet Light: Click to enter text. seconds contact time at peak flow

☐ Other: Click to enter text.

Section 4. Design Calculations (Instructions Page 59)

Attach design calculations and plant features for each proposed phase. Example 4 of the instructions includes sample design calculations and plant features.

Attachment: APPENDIX J

Section 5. Facility Site (Instructions Page 60)

A. 100-year floodplain

Will the proposed facilities be located above the 100-year frequency flood level?

☒ Yes ☐ No

If no, describe measures used to protect the facility during a flood event. Include a site map showing the location of the treatment plant within the 100-year frequency flood level. If applicable, provide the size and types of protective structures.

Provide the source(s) used to determine 100-year frequency flood plain.

FEMA Map #48453C0395J (See Appendix K)

For a new or expansion of a facility, will a wetland or part of a wetland be filled?

☐ Yes ☒ No

If yes, has the applicant applied for a US Corps of Engineers 404 Dredge and Fill Permit?

☐ Yes ☒ No

If yes, provide the permit number: Click to enter text.

If no, provide the approximate date you anticipate submitting your application to the Corps: Click to enter text.

B. Wind rose

Attach a wind rose: Appendix K

Section 6. Permit Authorization for Sewage Sludge Disposal (Instructions Page 60)

A. Beneficial use authorization

Are you requesting to include authorization to land apply sewage sludge for beneficial use on property located adjacent to the wastewater treatment facility under the wastewater permit?

☐ Yes ☒ No

If yes, attach the completed **Application for Permit for Beneficial Land Use of Sewage Sludge (TCEQ Form No. 10451)**: Click to enter text.

B. Sludge processing authorization

Identify the sludge processing, storage or disposal options that will be conducted at the wastewater treatment facility:

☐ Sludge Composting

☐ Marketing and Distribution of sludge

☐ Sludge Surface Disposal or Sludge Monofill

If any of the above, sludge options are selected, attach the completed **Domestic Wastewater Permit Application: Sewage Sludge Technical Report (TCEQ Form No. 10056)**: Click to enter text.

Section 7. Sewage Sludge Solids Management Plan (Instructions Page 61)

Attach a solids management plan to the application.

Attachment: Appendix L

The sewage sludge solids management plan must contain the following information:

- Treatment units and processes dimensions and capacities
- Solids generated at 100, 75, 50, and 25 percent of design flow
- Mixed liquor suspended solids operating range at design and projected actual flow
- Quantity of solids to be removed and a schedule for solids removal
- Identification and ownership of the ultimate sludge disposal site
- For facultative lagoons, design life calculations, monitoring well locations and depths, and the ultimate disposal method for the sludge from the facultative lagoon

An example of a sewage sludge solids management plan has been included as Example 5 of the instructions.

DOMESTIC WASTEWATER PERMIT APPLICATION
WORKSHEET 3.0: LAND DISPOSAL OF EFFLUENT

The following is required for renewal, new, and amendment permit applications.

Section 1. Type of Disposal System (Instructions Page 68)

Identify the method of land disposal:

- ☐ Surface application
- ☐ Subsurface application
- ☐ Irrigation
- ☐ Subsurface soils absorption
- ☐ Drip irrigation system
- ☒ Subsurface area drip dispersal system
- ☐ Evaporation
- ☐ Evapotranspiration beds
- ☐ Other (describe in detail): Click to enter text.

NOTE: All applicants without authorization or proposing new/amended subsurface disposal MUST complete and submit Worksheet 7.0.

For existing authorizations, provide Registration Number: 107010209

Section 2. Land Application Site(s) (Instructions Page 68)

In table 3.0(1), provide the requested information for the land application sites. Include the agricultural or cover crop type (wheat, cotton, alfalfa, bermuda grass, native grasses, etc.), land use (golf course, hayland, pastureland, park, row crop, etc.), irrigation area, amount of effluent applied, and whether or not the public has access to the area. Specify the amount of land area and the amount of effluent that will be allotted to each agricultural or cover crop, if more than one crop will be used.

Table 3.0(1) – Land Application Site Crops

Crop Type & Land Use	Irrigation Area (acres)	Effluent Application (GPD)	Public Access? Y/N
Green Space, Bermuda	PH1: 23.3 PH2: 34.9 PH3: 104.8	PH1: 100,000 PH2: 150,000 PH3: 450,000	N
Green Space, Winter Rye	PH1: 23.3 PH2: 34.9 PH3: 104.8	PH1: 100,000 PH2: 150,000 PH3: 450,000	N

Section 3. Storage and Evaporation Lagoons/Ponds (Instructions Page 68)

Table 3.0(2) – Storage and Evaporation Ponds

Pond Number	Surface Area (acres)	Storage Volume (acre-feet)	Dimensions	Liner Type

Attach a copy of a liner certification that was prepared, signed, and sealed by a Texas licensed professional engineer for each pond.

Attachment:

Section 4. Flood and Runoff Protection (Instructions Page 68)

Is the land application site within the 100-year frequency flood level?

☐ Yes ☒ No

If yes, describe how the site will be protected from inundation.

Click to enter text.

Provide the source used to determine the 100-year frequency flood level:

FEMA FIRM No. 48453C03395J, Dated January 22nd, 2020

Provide a description of tailwater controls and rainfall run-on controls used for the land application site.

The subsurface disposal areas will be designed with appropriate site grading to mitigate effects of storm events and to control tailwater. Run-on will be minimized through selection of areas for effluent irrigation downstream of roads and improvements which will intercept run-off.

Section 5. Annual Cropping Plan (Instructions Page 68)

Attach an Annual Cropping Plan which includes a discussion of each of the following items. If not applicable, provide a detailed explanation indicating why. **Attachment**: APPENDIX M

- Soils map with crops
- Cool and warm season plant species
- Crop yield goals
- Crop growing season
- Crop nutrient requirements
- Additional fertilizer requirements
- Minimum/maximum harvest height (for grass crops)
- Supplemental watering requirements
- Crop salt tolerances
- Harvesting method/number of harvests
- Justification for not removing existing vegetation to be irrigated

Section 6. Well and Map Information (Instructions Page 69)

Attach a USGS map with the following information shown and labeled. If not applicable, provide a detailed explanation indicating why. **Attachment**: APPENDIX N

- The boundaries of the land application site(s)
- Waste disposal or treatment facility site(s)
- On-site buildings
- Buffer zones
- Effluent storage and tailwater control facilities
- All water wells within 1-mile radius of the disposal site or property boundaries
- All springs and seeps onsite and within 500 feet of the property boundaries
- All surface waters in the state onsite and within 500 feet of the property boundaries
- All faults and sinkholes onsite and within 500 feet of the property

List and cross reference all water wells located within a half-mile radius of the disposal site or property boundaries shown on the USGS map in the following table. Attach additional pages as necessary to include all of the wells.

Table 3.0(3) – Water Well Data

Well ID	Well Use	Producing? Y/N	Open, cased, capped, or plugged?	Proposed Best Management Practice
See attachment			Choose an item.	See Attachment
			Choose an item.	
			Choose an item.	
			Choose an item.	
			Choose an item.	

If water quality data or well log information is available please include the information in an attachment listed by Well ID.

Attachment: APPENDIX N

Section 7. Groundwater Quality (Instructions Page 69)

Attach a Groundwater Quality Technical Report which assesses the impact of the wastewater disposal system on groundwater. This report shall include an evaluation of the water wells (including the information in the well table provided in Item 6. above), the wastewater application rate, and pond liners. Indicate by a check mark that this report is provided.

Attachment: APPENDIX O

Are groundwater monitoring wells available onsite? ☐ Yes ☒ No

Do you plan to install ground water monitoring wells or lysimeters around the land application site? ☐ Yes ☒ No

If yes, provide the proposed location of the monitoring wells or lysimeters on a site map.

Attachment: Click to enter text.

Section 8. Soil Map and Soil Analyses (Instructions Page 70)

A. Soil map

Attach a USDA Soil Survey map that shows the area to be used for effluent disposal.

Attachment: APPENDIX P

B. Soil analyses

Attach the laboratory results sheets from the soil analyses. **Note**: for renewal applications, the current annual soil analyses required by the permit are acceptable as long as the test date is less than one year prior to the submission of the application.

Attachment: APPENDIX P

List all USDA designated soil series on the proposed land application site. Attach additional pages as necessary.

Table 3.0(4) – Soil Data

Soil Series	Depth from Surface	Permeability	Available Water Capacity	Curve Number
Brackett – Rock outcrop complex (BlD), 1-12% slopes	0-48 inches	0.48 in/hr	0.13 cm/cm	80
Brackett – Rock outcrop- Real complex (BoF), 8-30% slopes	14-40 inches	0.38 in/hr	0.13 cm/cm	80
Purves clay (PuC), 1-5% slopes, stony	19-40 inches	0.38 in/hr	0.15 cm/cm	80
Speck Clay Loam, moist (SsC), 1-2% slopes	0-14 inches	0.03 in/hr	0.18 cm/cm	80
Eckrant very stony clay (TaD), 1-8% slopes	8-30 inches	0.45 in/hr	0.08 cm/cm	80

Soil Series	Depth from Surface	Permeability	Available Water Capacity	Curve Number
Volente silty clay loam (VoD) 1 to 8% slopes	0-22 inches		0.18 cm/cm	

Section 9. Effluent Monitoring Data (Instructions Page 71)

Is the facility in operation?

☒ Yes ☐ No

If no, this section is not applicable and the worksheet is complete.

If yes, provide the effluent monitoring data for the parameters regulated in the existing permit. If a parameter is not regulated in the existing permit, enter N/A.

Table 3.0(5) – Effluent Monitoring Data

Date	30 Day Avg Flow MGD	BOD5 mg/l	TSS mg/l	pH	Chlorine Residual mg/l	Acres irrigated
12/06/2024	0.1	1	5	6.5	0.3	25.15
12/13/2024	0.1	2	12	6.5	0.3	25.15
12/20/2024	0.1	3	8	6.5	0.3	25.15
12/27/2024	0.1	<1	24	6.5	0.3	25.15

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Travis County MUD 22 WWTP Effluent

Collected: 12/05/24 12:19 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H038907-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**1**	mg/L		1	1	1	*Austin*	12/06/24 06:00 BAL	SM5210 B 2016	M186399	*NEL*
Total Suspended Solids	**5**	mg/L		1	1	1	*Bryan*	12/11/24 09:08 ARM	SM2540 D 2015	M186561	*NEL*

Travis County MUD 22 WWTP Effluent Monthly

Collected: 12/05/24 12:21 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H038908-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
Field Parameters											
Field pH	**6.5**	pH Units		0.01	0.01	0.1	*Austin*	At Collection	SM4500-H+ B 2011	M186075	*ANR*
Dissolved Oxygen	**7.0**	mg/L		0.1	0.1	0.1	*Austin*	At Collection	SM4500 O G 2011	M186075	*ANR*
Temperature	**20.1**	Deg. C		0.1	0.1	0.1	*Austin*	At Collection	SM2550 B 2000	M186075	*ANR*
Microbiological Analyses											
E. Coli	**<1.0**	MPN/100 mL		1.0	1.0	1.0	*Austin*	12/05/24 15:49 BLJ	SM9223 B 2004	M186372	*NEL*

Results run by SM 9223B are reported as MPN (Most Probable Number). MPN is comparable to CFU (Colony Forming Units). Both MPN and CFU are allowed in most permits.

Travis County MUD 22 WWTP Aeration 1

Collected: 12/05/24 12:23 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H038909-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**5280**	mg/L		1	200	200	*Austin*	12/06/24 11:19 CZ	SM2540 D 2015	M186416	*NEL*
Total Volatile Suspended Solids	**4300**	mg/L		1	200	200	*Austin*	12/06/24 11:19 CZ	SM2540 E 2015	M186416	*ANR*

Travis County MUD 22 WWTP Aeration 2

Collected: 12/05/24 12:25 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H038909-02

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**6400**	mg/L		1	333	333	*Austin*	12/06/24 11:19 CZ	SM2540 D 2015	M186416	*NEL*
Total Volatile Suspended Solids	**5000**	mg/L		1	333	333	*Austin*	12/06/24 11:19 CZ	SM2540 E 2015	M186416	*ANR*

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: 1/13/25 12:41

Multiple Work Orders

Travis County MUD 22 WWTP Digester

Collected: 12/05/24 12:27 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke
Type: Grab | *Matrix*: Solid | *C-O-C #*: N/A

Lab ID# H038910-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
% Solids	**0.63**	g/100g (%)		0.10	0.10	0.10	*Austin*	12/10/24 13:26 KHA	SM2540 G 2015	M186525	*NEL*

Travis County MUD 22 WWTP Influent

Collected: 12/05/24 12:29 by Brianna Burke
Received: 12/05/24 14:49 by Brianna Burke
Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H038911-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**416**	mg/L		1	100	100	*Austin*	12/06/24 06:00 BAL	SM5210 B 2016	M186401	*NEL*
Total Suspended Solids	**468**	mg/L	Visual	1	40	40	*Bryan*	12/09/24 13:47 ARM	SM2540 D 2015	M186492	*NEL*

Travis County MUD 22 WWTP Effluent

Collected: 12/12/24 12:27 by Brianna Burke
Received: 12/12/24 15:11 by Brianna Burke
Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H039743-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**2**	mg/L		1	1	1	*Austin*	12/13/24 06:30 BGB	SM5210 B 2016	M186720	*NEL*
Total Suspended Solids	**12**	mg/L		1	2	2	*Austin*	12/16/24 14:54 CES	SM2540 D 2015	M186815	*NEL*

Travis County MUD 22 WWTP Aeration 1

Collected: 12/12/24 12:29 by Brianna Burke
Received: 12/12/24 15:11 by Brianna Burke
Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H039744-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**4620**	mg/L		1	200	200	*Austin*	12/13/24 09:55 CES	SM2540 D 2015	M186733	*NEL*
Total Volatile Suspended Solids	**3780**	mg/L		1	200	200	*Austin*	12/13/24 09:55 CES	SM2540 E 2015	M186733	*ANR*

Travis County MUD 22 WWTP Aeration 2

Collected: 12/12/24 12:31 by Brianna Burke
Received: 12/12/24 15:11 by Brianna Burke
Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H039744-02

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**5700**	mg/L		1	250	250	*Austin*	12/13/24 09:55 CES	SM2540 D 2015	M186733	*NEL*
Total Volatile Suspended Solids	**4550**	mg/L		1	250	250	*Austin*	12/13/24 09:55 CES	SM2540 E 2015	M186733	*ANR*

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: **1/13/25** **12:41**

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Travis County MUD 22 WWTP Effluent

Collected: 12/19/24 12:47 by Brianna Burke
Received: 12/19/24 15:33 by Brianna Burke
Type: Grab
Matrix: Non Potable
C-O-C #: N/A

Lab ID# H040571-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**3**	mg/L		1	1	1	*Austin*	12/20/24 06:05 BAL	SM5210 B 2016	M187025	*NEL*
Total Suspended Solids	**8**	mg/L		1	1	1	*Austin*	12/24/24 08:18 CES	SM2540 D 2015	M187155	*NEL*

Travis County MUD 22 WWTP Aeration 1

Collected: 12/19/24 12:50 by Brianna Burke
Received: 12/19/24 15:33 by Brianna Burke
Type: Grab
Matrix: Non Potable
C-O-C #: N/A

Lab ID# H040572-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**4880**	mg/L		1	250	250	*Austin*	12/20/24 11:48 CES	SM2540 D 2015	M187065	*NEL*
Total Volatile Suspended Solids	**3900**	mg/L		1	250	250	*Austin*	12/20/24 11:48 CES	SM2540 E 2015	M187065	*ANR*

Travis County MUD 22 WWTP Aeration 2

Collected: 12/19/24 12:53 by Brianna Burke
Received: 12/19/24 15:33 by Brianna Burke
Type: Grab
Matrix: Non Potable
C-O-C #: N/A

Lab ID# H040572-02

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**6080**	mg/L		1	250	250	*Austin*	12/20/24 11:48 CES	SM2540 D 2015	M187065	*NEL*
Total Volatile Suspended Solids	**4780**	mg/L		1	250	250	*Austin*	12/20/24 11:48 CES	SM2540 E 2015	M187065	*ANR*

Travis County MUD 22 WWTP Effluent

Collected: 12/26/24 12:10 by Brendan Bourland
Received: 12/26/24 13:03 by Brendan Bourland
Type: Grab
Matrix: Non Potable
C-O-C #: N/A

Lab ID# H041085-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**<1**	mg/L		1	1	1	*Austin*	12/27/24 06:04 BAL	SM5210 B 2016	M187223	*NEL*
Total Suspended Solids	**24**	mg/L	RPD-04	1	2	2	*Austin*	12/27/24 15:18 CES	SM2540 D 2015	M187285	*NEL*

Travis County MUD 22 WWTP Aeration 1

Collected: 12/26/24 12:11 by Brendan Bourland
Received: 12/26/24 13:03 by Brendan Bourland
Type: Grab
Matrix: Non Potable
C-O-C #: N/A

Lab ID# H041086-01

	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**5630**	mg/L		1	333	333	*Austin*	12/27/24 12:30 CES	SM2540 D 2015	M187263	*NEL*
Total Volatile Suspended Solids	**4670**	mg/L		1	333	333	*Austin*	12/27/24 12:30 CES	SM2540 E 2015	M187263	*ANR*

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: **1/13/25** **12:41**

Multiple Work Orders

Travis County MUD 22 WWTP Aeration 2

Collected: 12/26/24 12:12 by Brendan Bourland
Received: 12/26/24 13:03 by Brendan Bourland

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H041086-02	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
Total Suspended Solids	**6830**	mg/L		1	333	333	*Austin*	12/27/24 12:30 CES	SM2540 D 2015	M187263	*NEL*
Total Volatile Suspended Solids	**5530**	mg/L		1	333	333	*Austin*	12/27/24 12:30 CES	SM2540 E 2015	M187263	*ANR*

Travis County MUD 22 WWTP Influent

Collected: 12/26/24 00:00 by Brianna Burke
Received: 12/26/24 00:00 by Suzanne Rudd

Type: Grab | *Matrix*: Non Potable | *C-O-C #*: N/A

Lab ID# H041236-01	Result	Units	Notes	MDL	Adj MDL	SQL	Lab	Analyzed	Method	Batch	
General Chemistry											
BOD (5 day)	**331**	mg/L		1	100	100	*Austin*	12/27/24 06:04 BAL	SM5210 B 2016	M187226	*NEL*

Explanation of Notes

BOD-02	The RPD between the highest and lowest value used for result calculation in the sample dilution series is greater than the method-specified 30%.
BOD-07	Optional second BOD/CBOD GG was outside expected range. Results accepted on one required passing GG.
RPD-02	RPD was not calculated in LIMS due to one or both of the sample / duplicate pair being less than the MRL.
RPD-04	Visual evaluation of the Duplicate sample indicates the RPD is above the control limit due to a non-homogeneous sample matrix. Acceptance of run is not based on matrix QC.
SL-01	The dried residue did not yield between 2.5 and 200 mg as specified in the method. Due to holding time constraints or insufficient sample volume, the sample cannot be reanalyzed.
Visual	Visual inspection done to confirm analytical results.

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: **1/13/25** **12:41**

Multiple Work Orders

Field Parameters - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Dissolved Oxygen - SM4500 O G 2011													*Austin*
Duplicate	7.5	mg/L		0.1	0.1	12/05/24 11:15 BEB		7.5			0.535	3.73	M186075
Field pH - SM4500-H+ B 2011													*Austin*
Duplicate	7.4	pH Units		0.01	0.1	12/05/24 11:15 BEB		7.4			0.00	0.551	M186075
Temperature - SM2550 B 2000													*Austin*
Duplicate	23.6	Deg. C		0.1	0.1	12/05/24 11:15 BEB		23.6			0.00	2.48	M186075

General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
% Solids - SM2540 G 2015													*Austin*
Blank	<0.10	g/100g (%)		0.10	0.10	12/10/24 13:26 KHA							M186525
Duplicate	12.8	g/100g (%)		0.10	0.10	12/10/24 13:26 KHA		13.7			6.80	10	M186525
BOD (5 day) - SM5210 B 2016													*Austin*
Diln Water Blk	<0.20	mg/L		1	1	12/06/24 06:00 BAL		0.0		< or = 0.2 mg/L			2412083
GGA	175	mg/L		1	1	12/06/24 06:00 BAL	198		88.4	84.6 - 115.4			2412083
GGA	175	mg/L		1	1	12/06/24 06:00 BAL	198		88.4	84.6 - 115.4			2412083
GGA	192	mg/L		1	1	12/06/24 06:00 BAL	198		97.0	84.6 - 115.4			2412083
GGA	194	mg/L		1	1	12/06/24 06:00 BAL	198		98.0	84.6 - 115.4			2412083
Seed Blank	<1	mg/L		1	1	12/06/24 06:00 BAL							2412083
Seed Blank	<1	mg/L		1	1	12/06/24 06:00 BAL							2412083
Seed Blank	<1	mg/L		1	1	12/06/24 06:00 BAL							2412083
Seed Blank	<1	mg/L		1	1	12/06/24 06:00 BAL							2412083
Duplicate	<1	mg/L	*RPD-02*	1	1	12/06/24 06:00 BAL		1				45.1	M186399
Duplicate	313	mg/L	*BOD-02*	38	38	12/06/24 06:00 BAL		234			28.9	45.1	M186401
Diln Water Blk	<0.20	mg/L		1	1	12/13/24 06:30 BGB		-0.1		< or = 0.2 mg/L			2412172
GGA	201	mg/L		1	1	12/13/24 06:30 BGB	198		102	84.6 - 115.4			2412172
GGA	186	mg/L		1	1	12/13/24 06:30 BGB	198		93.9	84.6 - 115.4			2412172
GGA	178	mg/L		1	1	12/13/24 06:30 BGB	198		89.9	84.6 - 115.4			2412172
Seed Blank	<1	mg/L		1	1	12/13/24 06:30 BGB							2412172
Seed Blank	<1	mg/L		1	1	12/13/24 06:30 BGB							2412172
Seed Blank	<1	mg/L		1	1	12/13/24 06:30 BGB							2412172
Duplicate	<1	mg/L		1	1	12/13/24 06:30 BGB		<1				45.1	M186720
Diln Water Blk	<0.20	mg/L		1	1	12/20/24 06:05 BAL		0.1		< or = 0.2 mg/L			2412264
GGA	211	mg/L		1	1	12/20/24 06:05 BAL	198		107	84.6 - 115.4			2412264
GGA	225	mg/L		1	1	12/20/24 06:05 BAL	198		114	84.6 - 115.4			2412264

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General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
BOD (5 day) - SM5210 B 2016													*Austin*
GGA	211	mg/L		1	1	12/20/24 06:05 BAL	198		107	84.6 - 115.4			2412264
GGA	242	mg/L	*BOD-07*	1	1	12/20/24 06:05 BAL	198		*122*	84.6 - 115.4			2412264
Seed Blank	<1	mg/L		1	1	12/20/24 06:05 BAL							2412264
Seed Blank	<1	mg/L		1	1	12/20/24 06:05 BAL							2412264
Seed Blank	<1	mg/L		1	1	12/20/24 06:05 BAL							2412264
Seed Blank	<1	mg/L		1	1	12/20/24 06:05 BAL							2412264
Duplicate	2	mg/L		1	1	12/20/24 06:05 BAL		3			28.6	45.1	M187025
Diln Water Blk	<0.20	mg/L		1	1	12/27/24 06:04 BAL		0.1		< or = 0.2 mg/L			2412320
GGA	199	mg/L		1	1	12/27/24 06:04 BAL	198		101	84.6 - 115.4			2412320
GGA	173	mg/L		1	1	12/27/24 06:04 BAL	198		87.4	84.6 - 115.4			2412320
GGA	181	mg/L		1	1	12/27/24 06:04 BAL	198		91.4	84.6 - 115.4			2412320
GGA	193	mg/L		1	1	12/27/24 06:04 BAL	198		97.5	84.6 - 115.4			2412320
Seed Blank	<1	mg/L		1	1	12/27/24 06:04 BAL							2412320
Seed Blank	<1	mg/L		1	1	12/27/24 06:04 BAL							2412320
Seed Blank	<1	mg/L		1	1	12/27/24 06:04 BAL							2412320
Seed Blank	<1	mg/L		1	1	12/27/24 06:04 BAL							2412320
Duplicate	1	mg/L		1	1	12/27/24 06:04 BAL		1			0.930	45.1	M187223
Duplicate	106	mg/L		38	38	12/27/24 06:04 BAL		109			2.80	45.1	M187226

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General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Total Suspended Solids - SM2540 D 2015													*Austin*
Blank	<1	mg/L		1	1	12/06/24 11:19 CZ							M186416
Duplicate	667	mg/L		67	67	12/06/24 11:19 CZ		780			15.7	20	M186416
Reference	97	mg/L		10	10	12/06/24 11:19 CZ	100		97.0	80 - 120			M186416
Blank	<1	mg/L		1	1	12/09/24 13:47 ARM							M186492
Duplicate	<1	mg/L	*RPD-02, SL-01*	1	1	12/09/24 13:47 ARM		<1				20	M186492
Reference	100	mg/L		10	10	12/09/24 13:47 ARM	100		100	80 - 120			M186492
Blank	<1	mg/L		1	1	12/11/24 09:08 ARM							M186561
Duplicate	5200	mg/L		400	400	12/11/24 09:08 ARM		5320			2.28	20	M186561
Reference	96	mg/L		10	10	12/11/24 09:08 ARM	100		96.0	80 - 120			M186561
Blank	<1	mg/L		1	1	12/13/24 09:55 CES							M186733
Duplicate	4520	mg/L		250	250	12/13/24 09:55 CES		4600			1.64	20	M186733
Reference	91	mg/L		10	10	12/13/24 09:55 CES	100		91.0	80 - 120			M186733
Blank	<1	mg/L		1	1	12/16/24 14:54 CES							M186815
Duplicate	2	mg/L	*SL-01*	1	1	12/16/24 14:54 CES		2			3.64	20	M186815
Reference	86	mg/L		10	10	12/16/24 14:54 CES	100		86.0	80 - 120			M186815
Blank	<1	mg/L		1	1	12/20/24 11:48 CES							M187065
Duplicate	5000	mg/L		250	250	12/20/24 11:48 CES		4880			2.53	20	M187065
Reference	106	mg/L		10	10	12/20/24 11:48 CES	103		103	80 - 120			M187065
Blank	<1	mg/L		1	1	12/24/24 08:18 CES							M187155
Duplicate	22	mg/L		4	4	12/24/24 08:18 CES		24			5.22	20	M187155
Reference	93	mg/L		10	10	12/24/24 08:18 CES	104		89.4	80 - 120			M187155
Blank	<1	mg/L		1	1	12/27/24 12:30 CES							M187263
Duplicate	5730	mg/L		333	333	12/27/24 12:30 CES		5630			1.76	20	M187263
Reference	98	mg/L		10	10	12/27/24 12:30 CES	104		94.2	80 - 120			M187263
Blank	<1	mg/L		1	1	12/27/24 15:18 CES							M187285
Duplicate	3	mg/L	*RPD-04, SL-01*	1	1	12/27/24 15:18 CES		2			*36.7*	20	M187285
Reference	95	mg/L		10	10	12/27/24 15:18 CES	104		91.3	80 - 120			M187285

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General Chemistry - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	RPD	RPD Limit	Batch
Total Volatile Suspended Solids - SM2540 E 2015													*Austin*
Blank	<1	mg/L		1	1	12/06/24 11:19 CZ							M186416
Duplicate	580	mg/L		67	67	12/06/24 11:19 CZ		653			11.9	20	M186416
Reference	102	mg/L		10	10	12/06/24 11:19 CZ	100		102	80 - 116			M186416
Blank	<1	mg/L		1	1	12/13/24 09:55 CES							M186733
Duplicate	3850	mg/L		250	250	12/13/24 09:55 CES		3850			0.00	20	M186733
Reference	94	mg/L		10	10	12/13/24 09:55 CES	100		94.0	80 - 116			M186733
Blank	<1	mg/L		1	1	12/20/24 11:48 CES							M187065
Duplicate	4020	mg/L		250	250	12/20/24 11:48 CES		3900			3.15	20	M187065
Reference	106	mg/L		10	10	12/20/24 11:48 CES	103		103	80 - 116			M187065
Blank	<1	mg/L		1	1	12/27/24 12:30 CES							M187263
Duplicate	4770	mg/L		333	333	12/27/24 12:30 CES		4670			2.12	20	M187263
Reference	98	mg/L		10	10	12/27/24 12:30 CES	104		94.2	80 - 116			M187263

Microbiological Analyses - Quality Control

	Result	Units	Notes	MDL	SQL	Analyzed	Spike Amount	Source Result	%R	%R Limits	Log10 Comparison Range	Control Limit	Batch
E. Coli - SM9223 B 2004													*Austin*
Blank	<1.0	MPN/100 mL		1.0	1.0	12/05/24 14:22 BLJ							M186372
Dup Log10 Range		MPN/100 mL		1.0	1.0	12/05/24 15:49 BLJ					0.000		M186372
Duplicate	<1.0	MPN/100 mL		1.0	1.0	12/05/24 15:49 BLJ		<1.0				0.5	M186372

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Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H038907-01										
BOD (5 day)	SM5210 B 2016	12/6/24 6:00 BAL	Austin	A	300	mL	300	mL	1	M186399
Total Suspended Solids	SM2540 D 2015	12/11/24 9:08 ARM	Bryan	B	1000	mL	1000	mL	1	M186561

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H038908-01										
E. Coli	SM9223 B 2004	12/5/24 15:42 BLJ	Austin	A	100	N/A	100	N/A	1	M186372

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H038909-01										
Total Suspended Solids	SM2540 D 2015	12/6/24 11:19 CZ	Austin	A	5.00	mL	1000	mL	1	M186416
Total Volatile Suspended Solids	SM2540 E 2015	12/6/24 11:19 CZ	Austin	A	5.00	mL	1000	mL	1	M186416
H038909-02										
Total Suspended Solids	SM2540 D 2015	12/6/24 11:19 CZ	Austin	A	3.00	mL	1000	mL	1	M186416
Total Volatile Suspended Solids	SM2540 E 2015	12/6/24 11:19 CZ	Austin	A	3.00	mL	1000	mL	1	M186416

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H038910-01										
% Solids	SM2540 G 2015	12/10/24 13:26 KHA	Austin	A	10.0	g	10.0	mL	1	M186525

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H038911-01										
BOD (5 day)	SM5210 B 2016	12/6/24 6:00 BAL	Austin	A	3.00	mL	300	mL	1	M186401
Total Suspended Solids	SM2540 D 2015	12/9/24 13:47 ARM	Bryan	B	25.0	mL	1000	mL	1	M186492

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch

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Analytical Report

Travis County MUD 22 % Crossroads Utilities

Report Printed: **1/13/25** **12:41**

Multiple Work Orders

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H039743-01										
BOD (5 day)	SM5210 B 2016	12/13/24 6:30 BGB	Austin	A	300	mL	300	mL	1	M186720
Total Suspended Solids	SM2540 D 2015	12/16/24 14:54 CES	Austin	B	500	mL	1000	mL	1	M186815

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H039744-01										
Total Suspended Solids	SM2540 D 2015	12/13/24 9:55 CES	Austin	A	5.00	mL	1000	mL	1	M186733
Total Volatile Suspended Solids	SM2540 E 2015	12/13/24 9:55 CES	Austin	A	5.00	mL	1000	mL	1	M186733
H039744-02										
Total Suspended Solids	SM2540 D 2015	12/13/24 9:55 CES	Austin	A	4.00	mL	1000	mL	1	M186733
Total Volatile Suspended Solids	SM2540 E 2015	12/13/24 9:55 CES	Austin	A	4.00	mL	1000	mL	1	M186733

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H040571-01										
BOD (5 day)	SM5210 B 2016	12/20/24 6:05 BAL	Austin	A	300	mL	300	mL	1	M187025
Total Suspended Solids	SM2540 D 2015	12/24/24 8:18 CES	Austin	B	1000	mL	1000	mL	1	M187155

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H040572-01										
Total Suspended Solids	SM2540 D 2015	12/20/24 11:48 CES	Austin	A	4.00	mL	1000	mL	1	M187065
Total Volatile Suspended Solids	SM2540 E 2015	12/20/24 11:48 CES	Austin	A	4.00	mL	1000	mL	1	M187065
H040572-02										
Total Suspended Solids	SM2540 D 2015	12/20/24 11:48 CES	Austin	A	4.00	mL	1000	mL	1	M187065
Total Volatile Suspended Solids	SM2540 E 2015	12/20/24 11:48 CES	Austin	A	4.00	mL	1000	mL	1	M187065

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H041085-01										
BOD (5 day)	SM5210 B 2016	12/27/24 6:04 BAL	Austin	A	300	mL	300	mL	1	M187223
Total Suspended Solids	SM2540 D 2015	12/27/24 15:18 CES	Austin	B	500	mL	1000	mL	1	M187285

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Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H041086-01										
Total Suspended Solids	SM2540 D 2015	12/27/24 12:30 CES	Austin	A	3.00	mL	1000	mL	1	M187263
Total Volatile Suspended Solids	SM2540 E 2015	12/27/24 12:30 CES	Austin	A	3.00	mL	1000	mL	1	M187263
H041086-02										
Total Suspended Solids	SM2540 D 2015	12/27/24 12:30 CES	Austin	A	3.00	mL	1000	mL	1	M187263
Total Volatile Suspended Solids	SM2540 E 2015	12/27/24 12:30 CES	Austin	A	3.00	mL	1000	mL	1	M187263

Sample Preparation Summary

Sample	Method	Prepared	Lab	Bottle	Initial	Units	Final	Units	External Dilution Factor	Batch
H041236-01										
BOD (5 day)	SM5210 B 2016	12/27/24 6:04 BAL	Austin	A	3.00	mL	300	mL	1	M187226

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Chain-of-Custody Summary

The following record summarizes custody for work orders sampled by Aqua-Tech Laboratories, Inc. personnel on route.

Original signatures are kept on file by Aqua-Tech Laboratories, Inc. and are available upon request.

WORK ORDER H038907

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
901	3.4	Yes	Yes	Yes	Yes	

H038907-01 Grab Sampling Begun: 12/5/24 12:19 Sampling Ended: 12/5/24 12:19

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 1LP		B TSS 2LP			

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/5/24 14:49 By Brianna Burke (Austin)

WORK ORDER H038908

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
901	3.4	Yes	Yes	Yes	Yes	

H038908-01 Grab Sampling Begun: 12/5/24 12:21 Sampling Ended: 12/5/24 12:21

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A Ecoli 0.15L StP Na2S2O3					

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/5/24 14:49 By Brianna Burke (Austin)

WORK ORDER H038909

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
901	3.4	Yes	Yes	Yes	Yes	

H038909-01 Grab Sampling Begun: 12/5/24 12:23 Sampling Ended: 12/5/24 12:23

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

H038909-02 Grab Sampling Begun: 12/5/24 12:25 Sampling Ended: 12/5/24 12:25

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

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Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/5/24 14:49 By Brianna Burke (Austin)

WORK ORDER H038910

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
901	3.4	Yes	Yes	Yes	Yes	

H038910-01 Grab Sampling Begun: 12/5/24 12:27 Sampling Ended: 12/5/24 12:27

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TS 0.1LP					

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/5/24 14:49 By Brianna Burke (Austin)

WORK ORDER H038911

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
901	3.4	Yes	Yes	Yes	Yes	

H038911-01 Grab Sampling Begun: 12/5/24 12:29 Sampling Ended: 12/5/24 12:29

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 0.25LP		B TSS 0.25LP			

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/5/24 14:49 By Brianna Burke (Austin)

WORK ORDER H039743

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
T030	5.5	Yes	Yes	Yes	Yes	

H039743-01 Grab Sampling Begun: 12/12/24 12:27 Sampling Ended: 12/12/24 12:27

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 1LP		B TSS 2LP			

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/12/24 15:11 By Brianna Burke (Austin)

WORK ORDER H039744

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
T030	5.5	Yes	Yes	Yes	Yes	

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WORK ORDER H039744

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
T030	5.5	Yes	Yes	Yes	Yes	

H039744-01 Grab Sampling Begun: 12/12/24 12:29 Sampling Ended: 12/12/24 12:29

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

H039744-02 Grab Sampling Begun: 12/12/24 12:31 Sampling Ended: 12/12/24 12:31

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/12/24 15:11 By Brianna Burke (Austin)

WORK ORDER H040571

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
B014	4.0	Yes	Yes	Yes	Yes	

H040571-01 Grab Sampling Begun: 12/19/24 12:47 Sampling Ended: 12/19/24 12:47

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 1LP		B TSS 2LP			

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/19/24 15:33 By Brianna Burke (Austin)

WORK ORDER H040572

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
B014	4.0	Yes	Yes	Yes	Yes	

H040572-01 Grab Sampling Begun: 12/19/24 12:50 Sampling Ended: 12/19/24 12:50

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

H040572-02 Grab Sampling Begun: 12/19/24 12:53 Sampling Ended: 12/19/24 12:53

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments

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WORK ORDER H040572

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
B014	4.0	Yes	Yes	Yes	Yes	

H040572-02 Grab Sampling Begun: 12/19/24 12:53 Sampling Ended: 12/19/24 12:53

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/19/24 15:33 By Brianna Burke (Austin)

WORK ORDER H040573

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
B014	4.0	Yes	Yes	Yes	Yes	

H040573-01 Grab Sampling Begun: 12/19/24 12:55 Sampling Ended: 12/19/24 12:55

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 0.25LP		B TSS 0.25LP			

Sampled & Submitted to Lab by: Brianna Burke (Route Driver) Received: 12/19/24 15:33 By Brianna Burke (Austin)

WORK ORDER H041085

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
Y010	2.8	Yes	Yes	Yes	Yes	

H041085-01 Grab Sampling Begun: 12/26/24 12:10 Sampling Ended: 12/26/24 12:10

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A BOD 1LP		B TSS 2LP			

Sampled & Submitted to Lab by: Brendan Bourland (Route Driver) Received: 12/26/24 13:03 By Brendan Bourland (Austin)

WORK ORDER H041086

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
Y010	2.8	Yes	Yes	Yes	Yes	

H041086-01 Grab Sampling Begun: 12/26/24 12:11 Sampling Ended: 12/26/24 12:11

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments

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WORK ORDER H041086

Cooler ID	Temperature °C	Condition Good?	On Ice?	Preservation Correct?	Custody Maintained by ATL?	See comments below or comments and qualifiers with analytical results explaining any "No" answers.
Y010	2.8	Yes	Yes	Yes	Yes	

H041086-01 Grab Sampling Begun: 12/26/24 12:11 Sampling Ended: 12/26/24 12:11

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

H041086-02 Grab Sampling Begun: 12/26/24 12:12 Sampling Ended: 12/26/24 12:12

Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments	Container & Description	pH Checks / Comments
A TSS VSS 0.1LP					

Sampled & Submitted to Lab by: Brendan Bourland (Route Driver) Received: 12/26/24 13:03 By Brendan Bourland (Austin)

Date	30 Day Avg Flow MGD	BOD5 mg/l	TSS mg/l	pH	Chlorine Residual mg/l	Acres irrigated

Provide a discussion of all persistent excursions above the permitted limits and any corrective actions taken.

Click to enter text.

DOMESTIC WASTEWATER PERMIT APPLICATION WORKSHEET 3.3: SUBSURFACE AREA DRIP DISPERSAL (SADDS) LAND DISPOSAL OF EFFLUENT

The following **is required** for **new and major amendment** subsurface area drip dispersal system permit applications. Renewal and minor amendments applicants may be asked for the worksheet on a case by case basis.

NOTE: All applicants proposing new/amended subsurface disposal MUST complete and submit Worksheet 7.0. This worksheet applies to any subsurface disposal system that **meets** the definition of a subsurface area drip dispersal system as defined in *30 TAC Chapter 222, Subsurface Area Drip Dispersal System.*

Section 1. Administrative Information (Instructions Page 75)

A. Provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the treatment facility:

B. Travis County Municipal Utility District No. 22 Is the owner of the land where the treatment facility is located the same as the owner of the treatment facility?

☒ Yes ☐ No

If **no**, provide the legal name of all corporations or other business entities managed, owned, or otherwise closely related to the owner of the land where the treatment facility is located.

Click to enter text.

C. Owner of the subsurface area drip dispersal system: Travis County Municipal Utility District No. 22

D. Is the owner of the subsurface area drip dispersal system the same as the owner of the wastewater treatment facility or the site where the wastewater treatment facility is located?

☒ Yes ☐ No

If **no**, identify the names of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in Item 1.C.

Click to enter text.

E. Owner of the land where the subsurface area drip dispersal system is located: Masonwood HP LTD, John and Sandra Hatchett

F. Is the owner of the land where the subsurface area drip dispersal system is located the same as owner of the wastewater treatment facility, the site where the wastewater treatment facility is located, or the owner of the subsurface area drip dispersal system?

☐ Yes ☒ No

If **no**, identify the names of all corporations or other business entities managed, owned, or otherwise closely related to the entity identified in item 1.E.

Masonwood HP LTD, John and Sandra Hatchett

Section 2. Subsurface Area Drip Dispersal System (Instructions Page 75)

A. Type of system

☒ Subsurface Drip Irrigation

☐ Surface Drip Irrigation

☐ Other, specify: Click to enter text.

B. Irrigation operations

Application area, in acres: 104.8

Infiltration Rate, in inches/hour: 0.20-0.63

Average slope of the application area, percent (%): 2.0

Maximum slope of the application area, percent (%): 15

Storage volume, in gallons: 450,000

Major soil series: Brackett (BID), Purves Clay (PuC), Speck Clay Loam (SsC), Eckrant (TaD)

Depth to groundwater, in feet: Approximately 230'

C. Application rate

Is the facility located **west** of the boundary shown in *30 TAC § 222.83* **and** also using a vegetative cover of non-native grasses over seeded with cool season grasses during the winter months (October-March)?

☒ Yes ☐ No

If yes, then the facility may propose a hydraulic application rate not to exceed 0.1 gal/square foot/day.

Is the facility located **east** of the boundary shown in *30 TAC § 222.83* **or** in any part of the state when the vegetative cover is any crop other than non-native grasses?

☐ Yes ☒ No

If **yes**, the facility must use the formula in *30 TAC §222.83* to calculate the maximum hydraulic application rate.

Do you plan to submit an alternative method to calculate the hydraulic application rate for approval by the executive director?

☐ Yes ☒ No

Hydraulic application rate, in gal/square foot/day: 0.10

Nitrogen application rate, in lbs/gal/day: Click to enter text.

D. Dosing information

Number of doses per day: 3

Dosing duration per area, in hours: 0.467

Rest period between doses, in hours: 8 hrs

Dosing amount per area, in inches/day: 0.16

Number of zones: 36

Does the proposed subsurface drip irrigation system use tree vegetative cover as a crop?

☐ Yes ☒ No

If **yes**, provide a vegetation survey by a certified arborist. Please call the Water Quality Assessment Team at (512) 239-4671 to schedule a pre-application meeting.

Attachment: Click to enter text.

Section 3. Required Plans (Instructions Page 75)

A. Recharge feature plan

Attach a Recharge Feature Plan with all information required in *30 TAC §222.79*.

Attachment: Appendix Q

B. Soil evaluation

Attach a Soil Evaluation with all information required in *30 TAC §222.73*.

Attachment: Appendix P

C. Site preparation plan

Attach a Site Preparation Plan with all information required in *30 TAC §222.75*.

Attachment: Appendix R

D. Soil sampling/testing

Attach soil sampling and testing that includes all information required in *30 TAC §222.157*.

Attachment: Appendix P

Section 4. Floodway Designation (Instructions Page 76)

A. Site location

Is the existing/proposed land application site within a designated floodway?

☐ Yes ☒ No

B. Flood map

Attach either the FEMA flood map or alternate information used to determine the floodway.

Attachment: Appendix K

Section 5. Surface Waters in the State (Instructions Page 76)

A. Buffer Map

Attach a map showing appropriate buffers on surface waters in the state, water wells, and springs/seeps.

Attachment: Appendix G

B. Buffer variance request

Do you plan to request a buffer variance from water wells or waters in the state?

☐ Yes ☒ No

If yes, then attach the additional information required in *30 TAC § 222.81(c).*

Attachment: Click to enter text.

Section 6. Edwards Aquifer (Instructions Page 76)

A. Is the SADDS located over the Edwards Aquifer Recharge Zone as mapped by TCEQ?

☐ Yes ☒ No

B. Is the SADDS located over the Edwards Aquifer Transition Zone as mapped by TCEQ?

☐ Yes ☒ No

If yes to either question, then the SADDS may be prohibited by *30 TAC §213.8*. Please call the Municipal Permits Team at 512-239-4671 to schedule a pre-application meeting.

WORKSHEET 7.0

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

CLASS V INJECTION WELL INVENTORY/AUTHORIZATION FORM

Submit the completed form to:

TCEQ
IUC Permits Team
Radioactive Materials Division
MC-233
PO Box 13087
Austin, Texas 78711-3087
512-239-6466

For TCEQ Use Only
Reg. No.______________
Date Received__________
Date Authorized_________

Section 1. General Information (Instructions Page 92)

1. **TCEQ Program Area**

   Program Area (PST, VCP, IHW, etc.): Water Quality Division; Wastewater Permitting

   Program ID: Click to enter text.

   Contact Name: Click to enter text.

   Phone Number: Click to enter text.

2. **Agent/Consultant Contact Information**

   Contact Name: Lauren Crone, P.E.

   Address: 7500 Rialto Boulevard Building II, Suite 100

   City, State, and Zip Code: Austin, Texas 78735

   Phone Number: 512-439-4700

3. **Owner/Operator Contact Information**

   ☐ Owner ☒ Operator

   Owner/Operator Name: Crossroads

   Contact Name:

   Address: Click to enter text.

   City, State, and Zip Code: Click to enter text.

   Phone Number:

4. **Facility Contact Information**

   Facility Name: Travis County MUD No. 22 Wastewater Treatment Plant

   Address: Click to enter text.

   City, State, and Zip Code: Click to enter text.

   Location description (if no address is available): 3.2 miles West of the intersection of Hamilton Pool Road and Hwy 71, in Travis County, Texas.

   Facility Contact Person: John J. Carlton

   Phone Number: (512) 614-0901

5. **Latitude and Longitude, in degrees-minutes-seconds**

Latitude: 30°18'30.0"N

Longitude: 98°01'19.0"W

Method of determination (GPS, TOPO, etc.): Based on State Plane Coordinates

Attach topographic quadrangle map as attachment A.

6. **Well Information**

Type of Well Construction, select one:

- ☐ Vertical Injection
- ☒ Subsurface Fluid Distribution System
- ☐ Infiltration Gallery
- ☐ Temporary Injection Points
- ☐ Other, Specify: Click to enter text.

Number of Injection Wells: N/A

7. **Purpose**

Detailed Description regarding purpose of Injection System:

Disposal of treated domestic wastewater from the Travis County MUD No. 22 WWTP via drip irrigation areas.

Attach a Site Map as Attachment B (Attach the Approved Remediation Plan, if appropriate.)

8. **Water Well Driller/Installer**

Water Well Driller/Installer Name: N/A

City, State, and Zip Code: Click to enter text.

Phone Number: Click to enter text.

License Number: Click to enter text.

Section 2. Proposed Down Hole Design

Attach a diagram signed and sealed by a licensed engineer as Attachment C.

Table 7.0(1) – Down Hole Design Table

Name of String	Size	Setting Depth	Sacks Cement/Grout – Slurry Volume – Top of Cement	Hole Size	Weight (lbs/ft) PVC/Steel
Casing	N/A	N/A	N/A	N/A	N/A
Tubing	N/A	N/A	N/A	N/A	N/A
Screen	N/A	N/A	N/A	N/A	N/A

Section 3. Proposed Trench System, Subsurface Fluid Distribution System, or Infiltration Gallery

Attach a diagram signed and sealed by a licensed engineer as Attachment D.

System(s) Dimensions: 104.8 Acres

System(s) Construction: Subsurface drip irrigation system.

Section 4. Site Hydrogeological and Injection Zone Data

1. Name of Contaminated Aquifer: N/A

2. Receiving Formation Name of Injection Zone: Subsurface drip irrigation system

3. Well/Trench Total Depth: 6 inches

4. Surface Elevation: 1100-1180 MSL

5. Depth to Ground Water: 630’ (based on driller logs)

6. Injection Zone Depth: 12”

7. Injection Zone vertically isolated geologically? ☒ Yes ☐ No

Impervious Strata between Injection Zone and nearest Underground Source of Drinking Water:

Name: Edwards Limestone

Thickness: Unknown

8. Provide a list of contaminants and the levels (ppm) in contaminated aquifer

Attach as Attachment E.

9. Horizontal and Vertical extent of contamination and injection plume

Attach as Attachment F.

10. Formation (Injection Zone) Water Chemistry (Background levels) TDS, etc.

Attach as Attachment G.

11. Injection Fluid Chemistry in PPM at point of injection

Attach as Attachment H.

12. Lowest Known Depth of Ground Water with < 10,000 PPM TDS: N/A

13. Maximum injection Rate/Volume/Pressure: 0.1 gpd/sf/day, 450,000 gpd, pressure is negligible (drip irrigation system)

14. Water wells within 1/4 mile radius (attach map as Attachment I): Please refer to attached USGS map

15. Injection wells within 1/4 mile radius (attach map as Attachment J): Please refer to attached USGS map.

16. Monitor wells within 1/4 mile radius (attach drillers logs and map as Attachment K): Please refer to attached USGS map

17. Sampling frequency: Once per week as required by TCEQ TLAP permit

18. Known hazardous components in injection fluid: None

Section 5. Site History

1. Type of Facility: Wastewater Treatment Plant
2. Contamination Dates: N/A
3. Original Contamination (VOCs, TPH, BTEX, etc.) and Concentrations (attach as Attachment L): N/A
4. Previous Remediation (attach results of any previous remediation as attachment M): N/A

NOTE: Authorization Form should be completed in detail and authorization given by the TCEQ before construction, operation, and/or conversion can begin. Attach additional pages as necessary.

Class V Injection Well Designations

5A07 Heat Pump/AC return (IW used for groundwater to heat and/or cool buildings)
5A19 Industrial Cooling Water Return Flow (IW used to cool industrial process equipment)
5B22 Salt Water Intrusion Barrier (IW used to inject fluids to prevent the intrusion of salt water into an aquifer)
5D02 Storm Water Drainage (IW designed for the disposal of rain water)
5D04 Industrial Stormwater Drainage Wells (IW designed for the disposal of rain water associated with industrial facilities)
5F01 Agricultural Drainage (IW that receive agricultural runoff)
5R21 Aquifer Recharge (IW used to inject fluids to recharge an aquifer)
5S23 Subsidence Control Wells (IW used to control land subsidence caused by ground water withdrawal)
5W09 Untreated Sewage
5W10 Large Capacity Cesspools (Cesspools that are designed for 5,000 gpd or greater)
5W11 Large Capacity Septic systems (Septic systems designed for 5,000 gpd or greater)
5W12 WTTP disposal
5W20 Industrial Process Waste Disposal Wells
5W31 Septic System (Well Disposal method)
5W32 Septic System Drainfield Disposal
5X13 Mine Backfill (IW used to control subsidence, dispose of mining byproducts, and/or fill sections of a mine)
5X25 Experimental Wells (Pilot Test) (IW used to test new technologies or tracer dye studies)
5X26 Aquifer Remediation (IW used to clean up, treat, or prevent contamination of a USDW)
5X27 Other Wells
5X28 Motor Vehicle Waste Disposal Wells (IW used to dispose of waste from a motor vehicle site - These are currently banned)
5X29 Abandoned Drinking Water Wells (waste disposal)

APPENDIX A

CORE DATA FORM

TCEQ Use Only

TCEQ Core Data Form

For detailed instructions on completing this form, please read the Core Data Form Instructions or call 512-239-5175.

SECTION I: General Information

1. Reason for Submission *(If other is checked please describe in space provided.)*

☐ New Permit, Registration or Authorization (*Core Data Form should be submitted with the program application.)*

☐ Renewal *(Core Data Form should be submitted with the renewal form)* ☒ Other **TLAP Major Amendment**

2. Customer Reference Number *(if issued)*	Follow this link to search for CN or RN numbers in Central Registry**	**3. Regulated Entity Reference Number** *(if issued)*
CN 605721349		**RN 107010209**

SECTION II: Customer Information

4. General Customer Information | **5. Effective Date for Customer Information Updates** (mm/dd/yyyy) 3/6/2023

☐ New Customer ☒ Update to Customer Information ☐ Change in Regulated Entity Ownership
☐ Change in Legal Name (Verifiable with the Texas Secretary of State or Texas Comptroller of Public Accounts)

The Customer Name submitted here may be updated automatically based on what is current and active with the Texas Secretary of State (SOS) or Texas Comptroller of Public Accounts (CPA).

6. Customer Legal Name *(If an individual, print last name first: eg: Doe, John)* — *If new Customer, enter previous Customer below:*

Travis County Municipal Utility District No. 22

7. TX SOS/CPA Filing Number	**8. TX State Tax ID** (11 digits)	**9. Federal Tax ID** (9 digits)	**10. DUNS Number** *(if applicable)*

11. Type of Customer: ☐ Corporation ☐ Individual Partnership: ☐ General ☐ Limited
Government: ☐ City ☐ County ☐ Federal ☐ Local ☐ State ☒ Other ☐ Sole Proprietorship ☐ Other:

12. Number of Employees
☒ 0-20 ☐ 21-100 ☐ 101-250 ☐ 251-500 ☐ 501 and higher

13. Independently Owned and Operated?
☐ **Yes** ☐ **No**

14. Customer Role (Proposed or Actual) – *as it relates to the Regulated Entity listed on this form. Please check one of the following*

☒ Owner ☐ Operator ☐ Owner & Operator ☐ Other:
☐ Occupational Licensee ☐ Responsible Party ☐ VCP/BSA Applicant

15. Mailing Address:
4301 Westbank Drive Suite B-130

City	Austin	**State**	TX	**ZIP**	78746	**ZIP + 4**	

16. Country Mailing Information *(if outside USA)*

17. E-Mail Address *(if applicable)*
john@carltonlawaustin.com

18. Telephone Number	**19. Extension or Code**	**20. Fax Number** *(if applicable)*

(512) 614-0901		( ) -

SECTION III: Regulated Entity Information

21. General Regulated Entity Information *(If 'New Regulated Entity" is selected, a new permit application is also required.)*

☐ New Regulated Entity ☐ Update to Regulated Entity Name ☒ Update to Regulated Entity Information

The Regulated Entity Name submitted may be updated, in order to meet TCEQ Core Data Standards (removal of organizational endings such as Inc, LP, or LLC).

22. Regulated Entity Name *(Enter name of the site where the regulated action is taking place.)*

Travis County Municipal Utility District No. 22 Wastewater Treatment Plant

23. Street Address of the Regulated Entity: ***(No PO Boxes)***							
	16925 1/2 Lavondre Drive						
	City	Austin	**State**	TX	**ZIP**	78738	**ZIP + 4**
24. County							

If no Street Address is provided, fields 25-28 are required.

25. Description to Physical Location:	The project site is located 3.2 miles west of the intersection of State Hwy 71 and Hamilton Pool Road off of Hamilton Pool Road in Travis County, Texas.

26. Nearest City	**State**	**Nearest ZIP Code**
Bee Cave	TX	78738

Latitude/Longitude are required and may be added/updated to meet TCEQ Core Data Standards. (Geocoding of the Physical Address may be used to supply coordinates where none have been provided or to gain accuracy).

27. Latitude (N) In Decimal:	30.30833		**28. Longitude (W) In Decimal:**	-98.02194	
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
30	19	29.99	-98	1	18.98

29. Primary SIC Code (4 digits)	**30. Secondary SIC Code** (4 digits)	**31. Primary NAICS Code** (5 or 6 digits)	**32. Secondary NAICS Code** (5 or 6 digits)
4952		22132	

33. What is the Primary Business of this entity? *(Do not repeat the SIC or NAICS description.)*

Wastewater Treatment Facility

34. Mailing Address:	4301 Westbank Drive						
	Suite 130						
	City	Austin	**State**	TX	**ZIP**	78731	**ZIP + 4**
35. E-Mail Address:	john@carltonlawaustin.com						

36. Telephone Number	**37. Extension or Code**	**38. Fax Number** *(if applicable)*
(512) 614-0901		( ) -

DRAFT

39. TCEQ Programs and ID Numbers Check all Programs and write in the permits/registration numbers that will be affected by the updates submitted on this form. See the Core Data Form instructions for additional guidance.

☐ Dam Safety	☐ Districts	☐ Edwards Aquifer	☐ Emissions Inventory Air	☐ Industrial Hazardous Waste
☐ Municipal Solid Waste	☐ New Source Review Air	☐ OSSF	☐ Petroleum Storage Tank	☐ PWS
☐ Sludge	☐ Storm Water	☐ Title V Air	☐ Tires	☐ Used Oil
☐ Voluntary Cleanup	☒ Wastewater	☐ Wastewater Agriculture	☐ Water Rights	☐ Other:
	WQ0015201001			

SECTION IV: Preparer Information

40. Name:	Lauren Crone, P.E.	**41. Title:**	Senior Project Manager
42. Telephone Number	**43. Ext./Code**	**44. Fax Number**	**45. E-Mail Address**
(512) 439-4700		( ) -	lcrone@lja.com

SECTION V: Authorized Signature

46. By my signature below, I certify, to the best of my knowledge, that the information provided in this form is true and complete, and that I have signature authority to submit this form on behalf of the entity specified in Section II, Field 6 and/or as required for the updates to the ID numbers identified in field 39.

Company:	Travis County MUD No. 22	**Job Title:**	President
Name *(In Print)*:	Nate Gilbert	**Phone:**	(512) 614- 0901
Signature:	Nathan Gilbert	**Date:**	02/25/2025

APPENDIX B

EFFLUENT DISPOSAL LEASE

FILED AND RECORDED
OFFICIAL PUBLIC RECORDS
Dana DeBeauvoir
Dana DeBeauvoir, County Clerk
Travis County, Texas
Apr 16, 2019 11:09 AM Fee: $70.00
2019053328
Electronically Recorded

This page is intentionally added for electronic file stamp.

NOTICE OF CONFIDENTIALITY RIGHTS: IF YOU ARE A NATURAL PERSON, YOU MAY REMOVE OR STRIKE ANY OF THE FOLLOWING INFORMATION FROM THIS INSTRUMENT BEFORE IT IS FILED FOR RECORD IN THE PUBLIC RECORDS: YOUR SOCIAL SECURITY NUMBER OR YOUR DRIVER'S LICENSE NUMBER.

GENERAL WARRANTY DEED

(Wastewater Treatment Plant and Effluent Irrigation Lands)

THE STATE OF TEXAS	§	
	§	KNOW ALL PERSONS BY THESE PRESENTS:
COUNTY OF TRAVIS	§	

That **MASONWOOD HP, LTD.**, a Texas general partnership ("Grantor") for and in consideration of the sum of TEN AND NO/100 DOLLARS ($10.00) and other valuable consideration to the undersigned paid by the Grantee herein named, the receipt and sufficiency of which are hereby acknowledged, and to secure the payment of which no lien, express or implied, is retained, has GRANTED, SOLD and CONVEYED, and by these presents does GRANT, SELL and CONVEY unto **TRAVIS COUNTY MUNICIPAL UTILITY DISTRICT NO. 22**, a political subdivision of the State of Texas ("Grantee"), all of the real property in Travis County, Texas described on **Exhibit "A"** and **Exhibit "B"** attached hereto and incorporated herein (collectively, the "**Property**").

GRANTOR HEREBY SPECIFICALLY DISCLAIMS ANY WARRANTY, GUARANTY OR REPRESENTATION, ORAL OR WRITTEN, PAST, PRESENT OR FUTURE, OF, AS TO, OR CONCERNING (i) THE NATURE AND CONDITION OF THE PROPERTY, INCLUDING, WITHOUT LIMITATION, THE WATER, SOIL AND GEOLOGY, AND THE SUITABILITY THEREOF AND OF THE PROPERTY FOR ANY AND ALL ACTIVITIES AND USES WHICH GRANTEE MAY ELECT TO CONDUCT THEREON, AND THE EXISTENCE OF ANY ENVIRONMENTAL HAZARDS OR CONDITIONS THEREON (INCLUDING THE PRESENCE OF ASBESTOS) OR COMPLIANCE WITH ALL APPLICABLE LAWS, RULES OR REGULATIONS; OR (ii) THE COMPLIANCE OF THE PROPERTY OR ITS OPERATION WITH ANY LAWS, ORDINANCES OR REGULATIONS OF ANY GOVERNMENT OR OTHER BODY. GRANTEE ACKNOWLEDGES THAT IT HAS INSPECTED THE PROPERTY AND GRANTEE IS RELYING SOLELY ON ITS OWN INVESTIGATION OF THE PROPERTY AND NOT ON ANY INFORMATION PROVIDED BY GRANTOR. THE CONVEYANCE OF THE PROPERTY IS MADE ON AN "AS IS" BASIS, AND GRANTEE EXPRESSLY ACKNOWLEDGES THAT, IN CONSIDERATION OF THE AGREEMENTS OF GRANTOR HEREIN, EXCEPT AS OTHERWISE SPECIFIED HEREIN, GRANTOR MAKES NO WARRANTY OR REPRESENTATION, EXPRESS OR IMPLIED, OR ARISING BY OPERATION OF LAW, INCLUDING, BUT NOT LIMITED TO, ANY WARRANTY OF CONDITION, HABITABILITY, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE PROPERTY.

TO HAVE AND TO HOLD the Property, together with all and singular the rights and appurtenances thereto in anywise belonging, unto Grantee, its successors and assigns forever; and Grantor does hereby bind itself, its successors and assigns to WARRANT AND FOREVER DEFEND all and singular the Property unto Grantee, its successors and assigns, against every person whomsoever lawfully claiming or to claim the same or any part thereof.

This conveyance is made by Grantor and accepted by Grantee subject to any and all easements, covenants, rights-of-way, conditions, restrictions, outstanding mineral interests and royalty interests, if any, relating to the Property, to the extent, and only to the extent, that the same may still be in force and effect, and either shown of record in the office of the County Clerk of Travis County, Texas, or apparent on the Property.

Grantee acknowledges and agrees that this conveyance shall not alter or impair Grantee's obligation to provide reimbursement for eligible costs relating to the Property, and any such obligation shall survive conveyance of the Property from Grantor to Grantee.

Grantor does hereby assume and agree to pay any and all ad valorem taxes pertaining to the Property that may be assessed for 2019 and prior years. Grantee, by its acceptance hereof, does hereby assume and agree to pay any and all ad valorem taxes pertaining to the Property that may be assessed for calendar year 2020 and for subsequent years.

EXECUTED to be effective the 1 day of April, 2019.

MASONWOOD HP, LTD., a Texas General Partnership

By: Jim Meredith

Name: Jim Meredith

Title: Manager

ACKNOWLEDGEMENT

THE STATE OF TEXAS §
§
COUNTY OF TRAVIS §

This instrument was acknowledged before me on the 1 day of April, 2019, by Jim meredith, President of Masonwood HP, Ltd., a Texas general partnership, on behalf of said general partnership.

MIRIAH NICOLE TROUT
Notary Public, State of Texas
Comm. Expires 12-03-2022
Notary ID 131812706

Miriah Trout
Notary Public, State of Texas

Address for Grantee:
Travis County Municipal Utility District No. 18
c/o McLean & Howard, LLP
Barton Oaks Plaza, Building II
901 South MoPac Expy., Suite 225
Austin, Texas 78746

EXHIBIT A

(Description of Wastewater Treatment Plant Site and Effluent Disposal Tract)

Lot 1, Block J; PROVENCE PHASE 1 SECTION 1, a subdivision in Travis County, Texas according to the map or plat thereof, recorded in Document No. 201900014, Official Public Records, Travis County, Texas.

EXHIBIT "B"

(Legal Description and Sketch of 8.50-Acre Effluent Disposal Tract)

Landesign Services, Inc.
1220 McNeil Road, Suite 200
Round Rock, Texas 78681
TBPLS Firm No. 10001800
512-238-7901 office
512-238-7902 fax

EXHIBIT " B "
METES AND BOUNDS DESCRIPTION

BEING 8.50 ACRES OF LAND, SURVEYED BY LANDESIGN SERVICES, INC., SITUATED IN THE W. FAWCETT SURVEY NO. 420, ABSTRACT NO. 298, AND IN THE E. HALLMAN SURVEY NO. 61, ABSTRACT NO. 2245, IN TRAVIS COUNTY, TEXAS, AND BEING A PORTION OF A CALLED 318.405 ACRE TRACT DESCRIBED IN DEED TO MASONWOOD HP, LTD., RECORDED IN DOCUMENT NUMBER 2017038374 OF THE OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS (O.P.R.T.C.T.), AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING at a 1/2-inch rebar with cap stamped "DODD" found for an interior corner of said 318.405 acre tract and the West corner of Lot 24, Block A, DESTINY HILLS, SECTION TWO, a subdivision recorded in Document No. 201400230, of said O.P.R.T.C.T;

THENCE **South 32°52'34" East** with the Northeast line of said 318.405 acre tract and the Southwest line of said Block A, at a distance of 133.35 feet pass a 1/2-inch rebar with cap stamped "DODD" found for a common corner of said Lot 24 and Lot 23, of said Block A, and continue for a total distance of **225.87** feet to a Calculated Point for the Southeast corner of the herein described tract, from which a 1/2-inch rebar with cap stamped "DODD" found for a common corner of said Lot 23 and Lot 22, of said Block A, bears South 32°52'34" East 148.94 feet;

THENCE departing said Southwest line of Block A, over and across said 318.405 acre tract, the following thirty-seven (37) courses and distances:

1. **North 47°10'14" West** a distance of **29.27** feet to a Calculated Point;
2. **North 63°37'36" West** a distance of **30.68** feet to a Calculated Point;
3. **North 73°36'09" West** a distance of **19.68** feet to a Calculated Point;
4. **North 49°54'33" West** a distance of **23.49** feet to a Calculated Point;
5. **North 58°18'38" West** a distance of **43.64** feet to a Calculated Point;
6. **North 53°21'44" West** a distance of **20.66** feet to a Calculated Point;
7. **North 67°46'37" West** a distance of **36.45** feet to a Calculated Point;
8. **North 86°48'33" West** a distance of **97.90** feet to a Calculated Point;

9. **North 07°06'28" West** a distance of **36.66** feet to a Calculated Point;

10. **North 18°00'06" West** a distance of **27.24** feet to a Calculated Point;

11. **North 10°10'49" East** a distance of **19.15** feet to a Calculated Point;

12. **North 03°09'04" East** a distance of **11.49** feet to a Calculated Point;

13. **North 12°55'21" East** a distance of **10.97** feet to a Calculated Point;

14. **North 01°37'35" East** a distance of **29.42** feet to a Calculated Point;

15. **North 08°37'16" West** a distance of **30.34** feet to a Calculated Point;

16. **North 12°15'00" West** a distance of **6.00** feet to a Calculated Point;

17. **North 62°46'41" West** a distance of **2.97** feet to a Calculated Point;

18. **North 20°14'45" West** a distance of **13.75** feet to a Calculated Point;

19. **North 25°17'15" West** a distance of **13.10** feet to a Calculated Point for a Point of Curvature;

20. Along a curve to the **Left**, having a radius of **288.01** feet, an arc length of **145.08** feet, a delta angle of **28° 51' 45"**, and a chord which bears **North 44°07'45" West** a distance of **143.56** feet to a Calculated Point for a Point of Reverse Curvature;

21. Along a curve to the **Right**, having a radius of **426.83** feet, an arc length of **49.53** feet, a delta angle of **06° 38' 56"**, and a chord which bears **North 54°29'20" West** a distance of **49.50** feet to a Calculated Point for a Point of Reverse Curvature;

22. Along a curve to the **Left**, having a radius of **207.09** feet, an arc length of **65.69** feet, a delta angle of **18° 10' 25"**, and a chord which bears **North 58°30'42" West** a distance of **65.41** feet to a Calculated Point for a Point of Tangency;

23. **North 68°23'32" West** a distance of **33.00** feet to a Calculated Point;

24. **North 75°08'37" West** a distance of **17.85** feet to a Calculated Point;

25. **North 49°37'49" West** a distance of **27.57** feet to a Calculated Point;

26. **North 44°31'03" West** a distance of **19.99** feet to a Calculated Point;

27. **North 39°22'09" West** a distance of **16.18** feet to a Calculated Point;

28. **North 34°18'55" West** a distance of **14.31** feet to a Calculated Point;

29. **North 27°40'01" West** a distance of **49.46** feet to a Calculated Point;

30. **North 27°50'37" West** a distance of **44.69** feet to a Calculated Point;

31. **North 29°35'28" West** a distance of **21.46** feet to a Calculated Point;

32. **North 31°04'02" West** a distance of **41.75** feet to a Calculated Point;

33. **North 33°01'01" West** a distance of **48.60** feet to a Calculated Point;

34. **North 34°40'47" West** a distance of **54.72** feet to a Calculated Point;

35. **North 34°20'50" West** a distance of **31.37** feet to a Calculated Point;

36. **North 32°46'08" West** a distance of **16.78** feet to a Calculated Point; and

37. **North 31°08'56" West** a distance of **6.47** feet to a Calculated Point in the common line of said 318.408 acre tract and a called 129.55 acre tract of land described in Deed to JPH Capital, Ltd., recorded in Document No. 2004153389 of said O.P.R.T.C.T.;

THENCE with said common line of the 318.405 acre tract and the 129.55 acre tract, the following twelve (12) courses and distances;

1. Along a curve to the **Left**, having a radius of **326.54** feet, an arc length of **234.59** feet, a delta angle of **41° 09' 42"**, and a chord which bears **North 37°52'43" East** a distance of **229.57** feet to a Calculated Point for the North corner of said 318.405 acre tract;

2. **South 69°55'23" East** a distance of **290.00** feet to a Calculated Point;

3. **South 66°38'29" East** a distance of **64.59** feet to a Calculated Point;

4. **South 46°08'53" East** a distance of **63.45** feet to a Calculated Point;

5. **South 41°15'31" East** a distance of **140.00** feet to a Calculated Point;

6. **South 48°44'29" West** a distance of **32.09** feet to a Calculated Point;

7. **South 41°42'35" East** a distance of **142.03** feet to a Calculated Point;

8. **South 64°00'06" East** a distance of **72.03** feet to a Calculated Point;

9. **South 87°05'11" East** a distance of **80.03** feet to a Calculated Point;

10. **North 68°35'52" East** a distance of **80.03** feet to a Calculated Point;

11. **North 44°16'56" East** a distance of **80.03** feet to a Calculated Point; and

12. **South 49°18'07" East** a distance of **50.65** feet to a Calculated Point in the Northwest line of Lot 25, of said Block A, from which a 1/2-inch rebar with cap stamped "DODD" found for the North corner of said Lot 25, bears North 40°41'53" East a distance of 28.98 feet;

THENCE **South 40°41'53" West** with said Northwest line of Lot 25, at a distance of 418.41 feet pass a 1/2-inch rebar with cap stamped "DODD" found for a common corner of said Lot 25 and said Lot 24, and continue for a total distance of **553.09** feet to the **POINT OF BEGINNING** and containing 8.50 acres of land, more or less.

This project is referenced for all and coordinate basis to the Texas State Plane Coordinate System, North American Datum of 1983 (NAD83 - 2011 adjustment), Central Zone (4203).

Distances shown hereon are surface values represented in U.S. survey feet based on a grid-to-surface combined adjustment factor of 1.0000925.

This property description was prepared by an on the ground survey made under my supervision during the month of July, 2017.

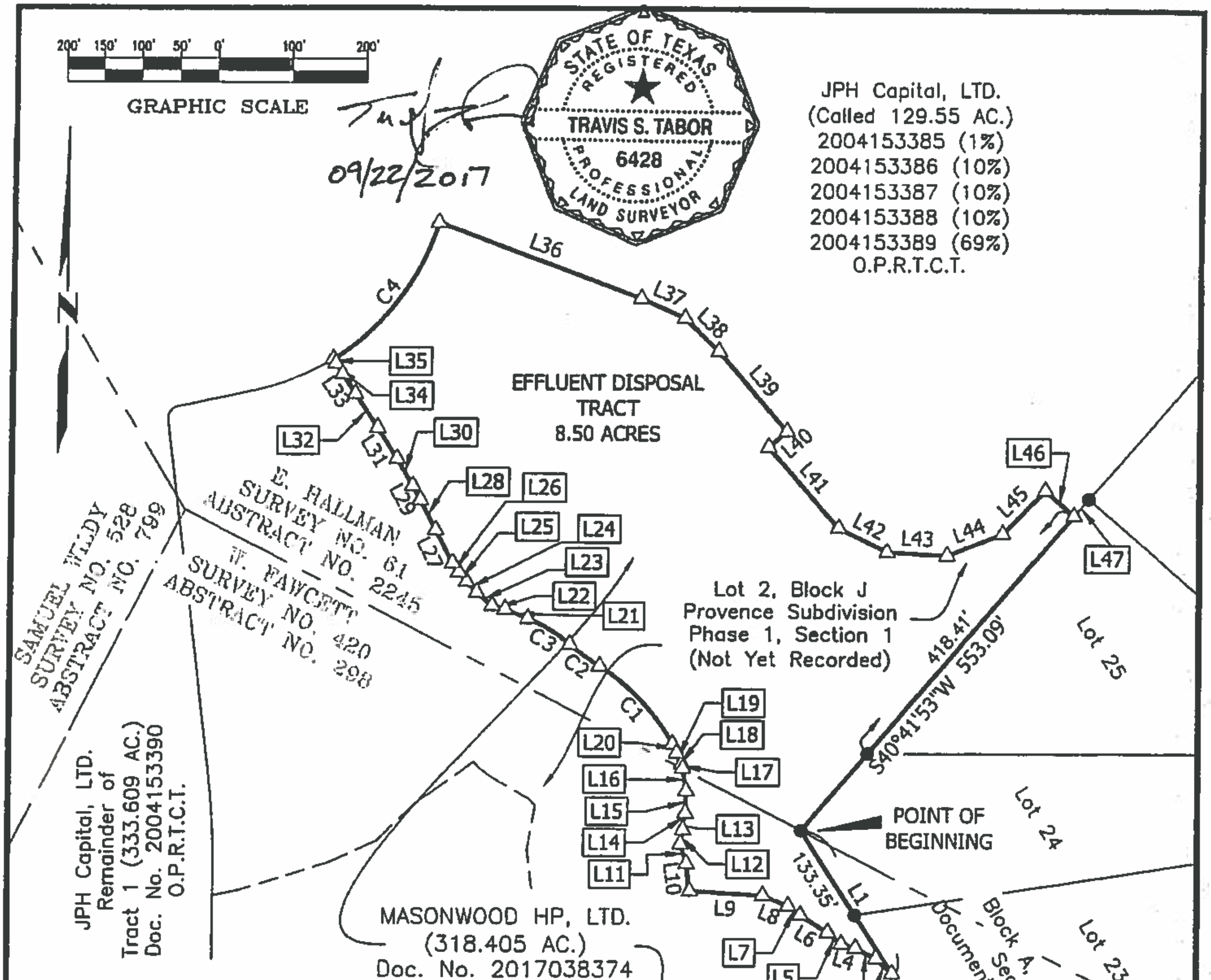
09/22/2017

Travis S. Tabor — Date
Registered Professional Land Surveyor
State of Texas No. 6428

STATE OF TEXAS REGISTERED TRAVIS S. TABOR 6428 PROFESSIONAL LAND SURVEYOR

Job Number: 191-16-5
Attachments: Survey Drawing L:\Hatchett 923\DWGS\Provence Esmts\PRO DRNG- EFFLUENT DISPOSAL.dwg

DRAFT



LEGEND

△	CALCULATED POINT NOT SET
●	1/2-inch rebar stamped "DODD" found
O.P.R.T.C.T.	OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS
R.O.W.	RIGHT-OF-WAY

THIS PROJECT IS REFERENCED FOR ALL BEARING AND COORDINATE BASIS TO THE TEXAS STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83 - 2011 ADJUSTMENT), CENTRAL ZONE (4203).

DISTANCES SHOWN HEREON ARE SURFACE VALUES REPRESENTED IN U.S. SURVEY FEET BASED ON A GRID-TO-SURFACE COMBINED ADJUSTMENT FACTOR OF 1.0000925

JOB NUMBER: 321-15-2 | DATE: 09/08/2017
PROJECT NAME: Hatchett 923
DRAWING NAME: PRO DRNG- EFFLUENT DISPOSAL
DRAWING FILE PATH:
L:\Hatchett 923\DWGS
METES AND BOUNDS FILE PATH:
L:\Hatchett 923\Metes and Bounds
RPLS: TST | TECH: CDS | PARTY CHIEF: | CHK BY: TST
SHEET 05 of 06 | FIELDBOOKS | SCALE: 1"=200"

DRAFT

LANDESIGN SERVICES, INC. LAND SURVEYORS EST. 2002

LANDESIGN SERVICES, INC.
512-238-7901
1220 MCNEIL ROAD
SUITE 200
ROUND ROCK, TEXAS 78681
FIRM REGISTRATION NO. 10001800

Line Table		
Line #	Direction	Length
L1	S32° 52' 34"E	225.87'
L2	N47° 10' 14"W	29.27'
L3	N63° 37' 36"W	30.68'
L4	N73° 36' 09"W	19.68'
L5	N49° 54' 33"W	23.49'
L6	N58° 18' 38"W	43.64'
L7	N53° 21' 44"W	20.66'
L8	N67° 46' 37"W	36.45'
L9	N86° 48' 33"W	97.90'
L10	N07° 06' 28"W	36.66'
L11	N18° 00' 06"W	27.24'
L12	N10° 10' 49"E	19.15'
L13	N03° 09' 04"E	11.49'
L14	N12° 55' 21"E	10.97'
L15	N01° 37' 35"E	29.42'
L16	N08° 37' 16"W	30.34'
L17	N12° 15' 00"W	6.00'
L18	N62° 46' 41"W	2.97'
L19	N20° 14' 45"W	13.75'
L20	N25° 17' 15"W	13.10'
L21	N68° 23' 32"W	33.00'
L22	N75° 08' 37"W	17.85'
L23	N49° 37' 49"W	27.57'
L24	N44° 31' 03"W	19.99'
L25	N39° 22' 09"W	16.18'
L26	N34° 18' 55"W	14.31'
L27	N27° 40' 01"W	49.46'
L28	N27° 50' 37"W	44.69'
L29	N29° 35' 28"W	21.46'
L30	N31° 04' 02"W	41.75'

Line Table		
Line #	Direction	Length
L31	N33° 01' 01"W	48.60'
L32	N34° 40' 47"W	54.72'
L33	N34° 20' 50"W	31.37'
L34	N32° 46' 08"W	16.78'
L35	N31° 08' 56"W	6.47'
L36	S69° 55' 23"E	290.00'
L37	S66° 38' 29"E	64.59'
L38	S46° 08' 53"E	63.45'
L39	S41° 15' 31"E	140.00'
L40	S48° 44' 29"W	32.09'
L41	S41° 42' 35"E	142.03'
L42	S64° 00' 06"E	72.03'
L43	S87° 05' 11"E	80.03'
L44	N68° 35' 52"E	80.03'
L45	N44° 16' 56"E	80.03'
L46	S49° 18' 07"E	50.65'
L47	N40° 41' 53"E	28.98'

Curve Table					
Curve #	Radius	Length	Delta	Chord Bearing	Chord
C1	288.01'	145.08'	28°51'45"	N44° 07' 45"W	143.56'
C2	426.83'	49.53'	6°38'56"	N54° 29' 20"W	49.50'
C3	207.09'	65.69'	18°10'25"	N58° 30' 42"W	65.41'
C4	326.54'	234.59'	41°09'42"	N37° 52' 43"E	229.57'

JOB NUMBER: 321-15-2 | DATE: 09/08/2017
PROJECT NAME: Hatchett 923
DRAWING NAME: PRO DRNG- EFFLUENT DISPOSAL
DRAWING [illegible]PAT[illegible]:
L:\Hatche[illegible] 92[illegible]\[illegible]WGS
DRAFT
METES AN[illegible] [illegible]S [illegible]E PAT[illegible]
L:\Hatchett 923\Metes and Bounds
RPLS: TST | TECH: CDS | PARTY CHIEF: | CHK BY: TST
SHEET 06 of 06 | FIELDBOOKS | SCALE: N.T.S.

LANDESIGN SERVICES, INC. LAND SURVEYORS EST. 2002

LANDESIGN SERVICES, INC.
512-238-7901
1220 MCNEIL ROAD
SUITE 200
ROUND ROCK, TEXAS 78681
FIRM REGISTRATION NO. 10001800

APPENDIX C

PLAIN LANGUAGE SUMMARY AND PUBLIC INVOLVMENT PLAN FORM

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PLAIN LANGUAGE SUMMARY FOR TPDES OR TLAP PERMIT APPLICATIONS

ENGLISH TEMPLATE FOR TPDES or TLAP NEW/RENEWAL/AMENDMENT APPLICATIONS DOMESTIC WASTEWATER/STORMWATER

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 TAC Chapter 39. The information provided in this summary may change during the technical review of the application and is not a federal enforceable representation of the permit application.

Travis County Municipal Utility District No. 22 (CN605721349) proposes to operate Travis County MUD No. 22 WWTP (RN107010209), a 0.45MGD wastewater treatment plant. The facility will be located at approximately 3.2 miles West from the intersection of State Hwy 71 and Hamilton Pool Road off of Hamilton Pool Road, in Bee Cave, Travis County, Texas 78738. This is a new application to discharge 450,000 gallons per day of processed wastewater on an intermittent and flow-variable basis.

Discharges from the facility are expected to contain five-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia nitrogen (NH_3-N), total phosphorus (P), and Escherichia Coli. Domestic wastewater will be treated by a future WWTP consisting of a packaged single stage nitrification plant, including headworks (bar screening), aeration, clarification, chlorination, chlorine contact & aerobic digestion. Treated effluent will be stored in a holding tank for six days in the initial phase, three days in the interim phase and three days in the final phase prior to disposal using subsurface drip irrigation near the treatment plant on land owned by the applicant. Sludge will be disposed of by hauling off-site by a licensed hauler, to a permitted landfill.

Texas Commission on Environmental Quality

Public Involvement Plan Form for Permit and Registration Applications

The Public Involvement Plan is intended to provide applicants and the agency with information about how public outreach will be accomplished for certain types of applications in certain geographical areas of the state. It is intended to apply to new activities; major changes at existing plants, facilities, and processes; and to activities which are likely to have significant interest from the public. This preliminary screening is designed to identify applications that will benefit from an initial assessment of the need for enhanced public outreach.

All applicable sections of this form should be completed and submitted with the permit or registration application. For instructions on how to complete this form, see TCEQ-20960-inst.

Section 1. Preliminary Screening

☐ New Permit or Registration Application

☒ New Activity – modification, registration, amendment, facility, etc. (see instructions)

If neither of the above boxes are checked, completion of the form is not required and does not need to be submitted.

Section 2. Secondary Screening

☒ Requires public notice,

☒ Considered to have significant public interest, **and**

☒ Located within any of the following geographical locations:

- Austin
- Dallas
- Fort Worth
- Houston
- San Antonio
- West Texas
- Texas Panhandle
- Along the Texas/Mexico Border
- Other geographical locations should be decided on a case-by-case basis

If all the above boxes are not checked, a Public Involvement Plan is not necessary. Stop after Section 2 and submit the form.

☐ Public Involvement Plan not applicable to this application. Provide **brief** explanation.

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Section 3. Application Information

Type of Application (check all that apply):

Air ☐ Initial ☐ Federal ☐ Amendment ☐ Standard Permit ☐ Title V

Waste ☐ Municipal Solid Waste ☐ Industrial and Hazardous Waste ☐ Scrap Tire
☐ Radioactive Material Licensing ☐ Underground Injection Control

Water Quality

☐ Texas Pollutant Discharge Elimination System (TPDES)

☒ Texas Land Application Permit (TLAP)

☐ State Only Concentrated Animal Feeding Operation (CAFO)

☐ Water Treatment Plant Residuals Disposal Permit

☐ Class B Biosolids Land Application Permit

☐ Domestic Septage Land Application Registration

Water Rights New Permit

☐ New Appropriation of Water

☐ New or existing reservoir

Amendment to an Existing Water Right

☐ Add a New Appropriation of Water

☐ Add a New or Existing Reservoir

☐ Major Amendment that could affect other water rights or the environment

Section 4. Plain Language Summary

Provide a brief description of planned activities.

Travis County Municipal Utility District, proposes to operate Travis County MUD No. 22 Wastewater Treatment Plant, a 0.45 MGD WWTP facility. The facility will be located approximately 3.2 miles West from the intersection of Hamilton Pool Road and Hwy 71, off Hamilton Pool Road, in Bee Cave, Travis County, Texas 78738. This application is for a major Amendment to an existing TLAP Permit.

The wastewater treatment plant consists of three phases, with the first phase treating 100,000 gpd, the second phase treating and additional 50,000 gpd, and the final phase treating an additional 300,000 gpd resulting in a total capacity of 450,000 gpd at full completion.The treatment units include a bar screen, aeration basin, clarifier, and an aerobic digester. Wastewater will enter an influent lift station and be pumped to the plant where it will enter the aeration basin through a bar screen. The influent will then pass through the aeration zone and flow into the clarifier. From the clarifier the effluent will flow to an effluent storage tank. The effluent storage tank will provide three days of storage. The effluent will then be disposed of via subsurface disposal. This facility will also utilize a digester for sludge holding, prior to haul off.

Section 5. Community and Demographic Information

Community information can be found using EPA's EJ Screen, U.S. Census Bureau information, or generally available demographic tools.

Information gathered in this section can assist with the determination of whether alternative language notice is necessary. Please provide the following information.

Bee Cave

(City)

Travis

(County)

0365.0

(Census Tract)

Please indicate which of these three is the level used for gathering the following information.

☐ City ☐ County ☒ Census Tract

(a) Percent of people over 25 years of age who at least graduated from high school

97%

(b) Per capita income for population near the specified location

$73,670

(c) Percent of minority population and percent of population by race within the specified location

48.0% ; 8.0% Hispanic or Latino; 10.0% Black or African American; 30.0% Asian, 0% Other

(d) Percent of Linguistically Isolated Households by language within the specified location

100% Spanish; 0% Asian and Pacific Islander Languages; 0% Other languages

(e) Languages commonly spoken in area by percentage

71.0% English, 29%.0 Total Non- English, 9.0% Spanish; 8.0% Other Indo-European, 8.0% Other Asian and Pacific Island Languages; 1.0% Arabic, 1.0% Other and Unspecified

(f) Community and/or Stakeholder Groups

City of Bee Cave, adjacent property owners

(g) Historic public interest or involvement

N/A

DRAFT

Section 6. Planned Public Outreach Activities

(a) Is this application subject to the public participation requirements of Title 30 Texas Administrative Code (30 TAC) Chapter 39?

☒ Yes ☐ No

(b) If yes, do you intend at this time to provide public outreach other than what is required by rule?

☐ Yes ☐ No

If Yes, please describe.

If you answered "yes" that this application is subject to 30 TAC Chapter 39, answering the remaining questions in Section 6 is not required.

(c) Will you provide notice of this application in alternative languages?

☐ Yes ☐ No

Please refer to Section 5. If more than 5% of the population potentially affected by your application is Limited English Proficient, then you are required to provide notice in the alternative language.

If yes, how will you provide notice in alternative languages?

☐ Publish in alternative language newspaper
☐ Posted on Commissioner's Integrated Database Website
☐ Mailed by TCEQ's Office of the Chief Clerk
☐ Other (specify)

(d) Is there an opportunity for some type of public meeting, including after notice?

☐ Yes ☐ No

(e) If a public meeting is held, will a translator be provided if requested?

☐ Yes ☐ No

(f) Hard copies of the application will be available at the following (check all that apply):

☐ TCEQ Regional Office ☐ TCEQ Central Office
☐ Public Place (specify)

Section 7. Voluntary Submittal

For applicants voluntarily providing this Public Involvement Plan, who are not subject to formal public participation requirements.

Will you provide notice of this application, including notice in alternative languages?

☐ Yes ☐ No

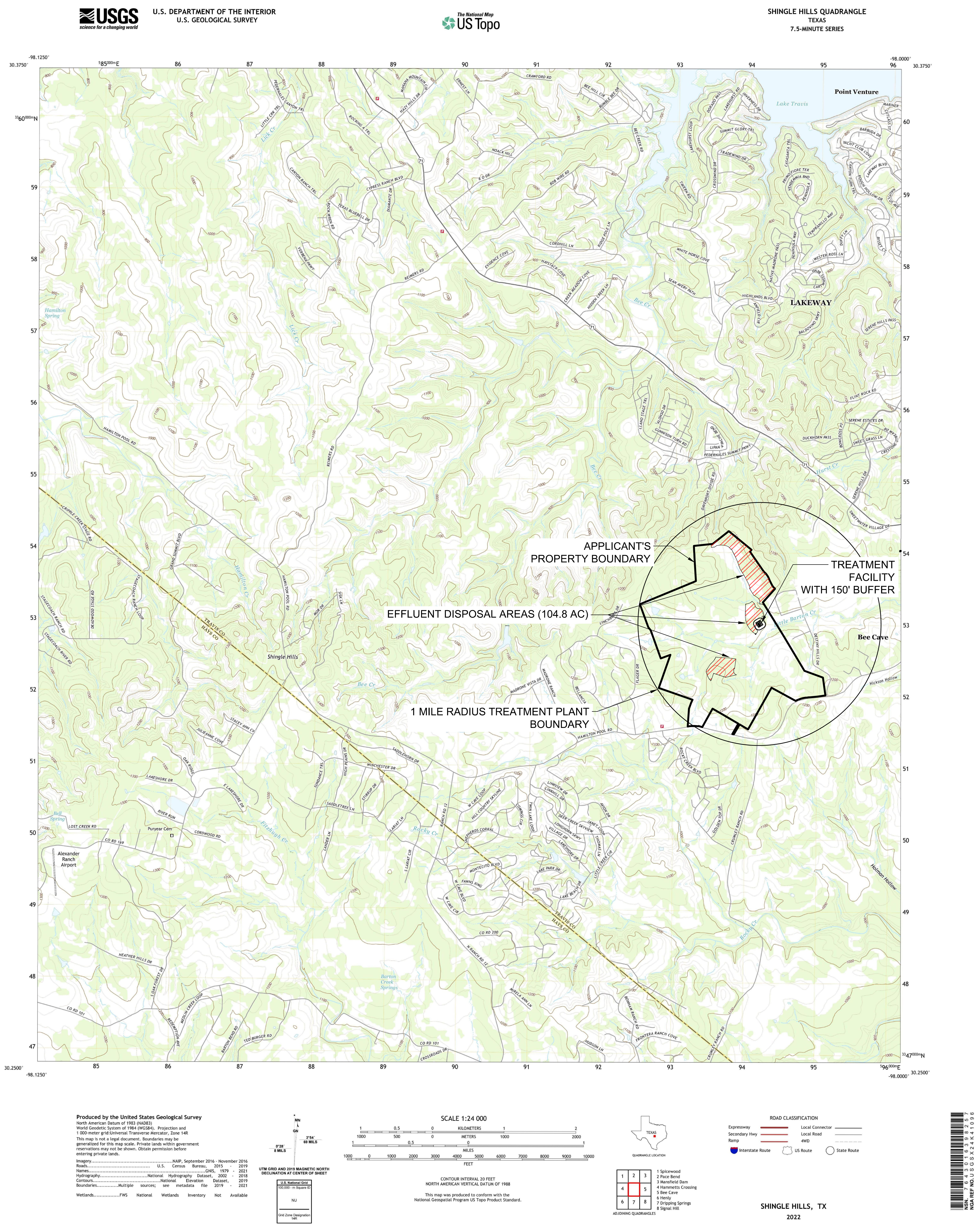
What types of notice will be provided?

☐ Publish in alternative language newspaper
☐ Posted on Commissioner's Integrated Database Website
☐ Mailed by TCEQ's Office of the Chief Clerk
☐ Other (specify)

APPENDIX D

USGS MAP

DRAFT



I:\A336 (formul 22)\TC MUD 22 Major Permit Amendment\Exhibits\USGS Map.dwg

1 OF 1

LJA Engineering, Inc.
LJA
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

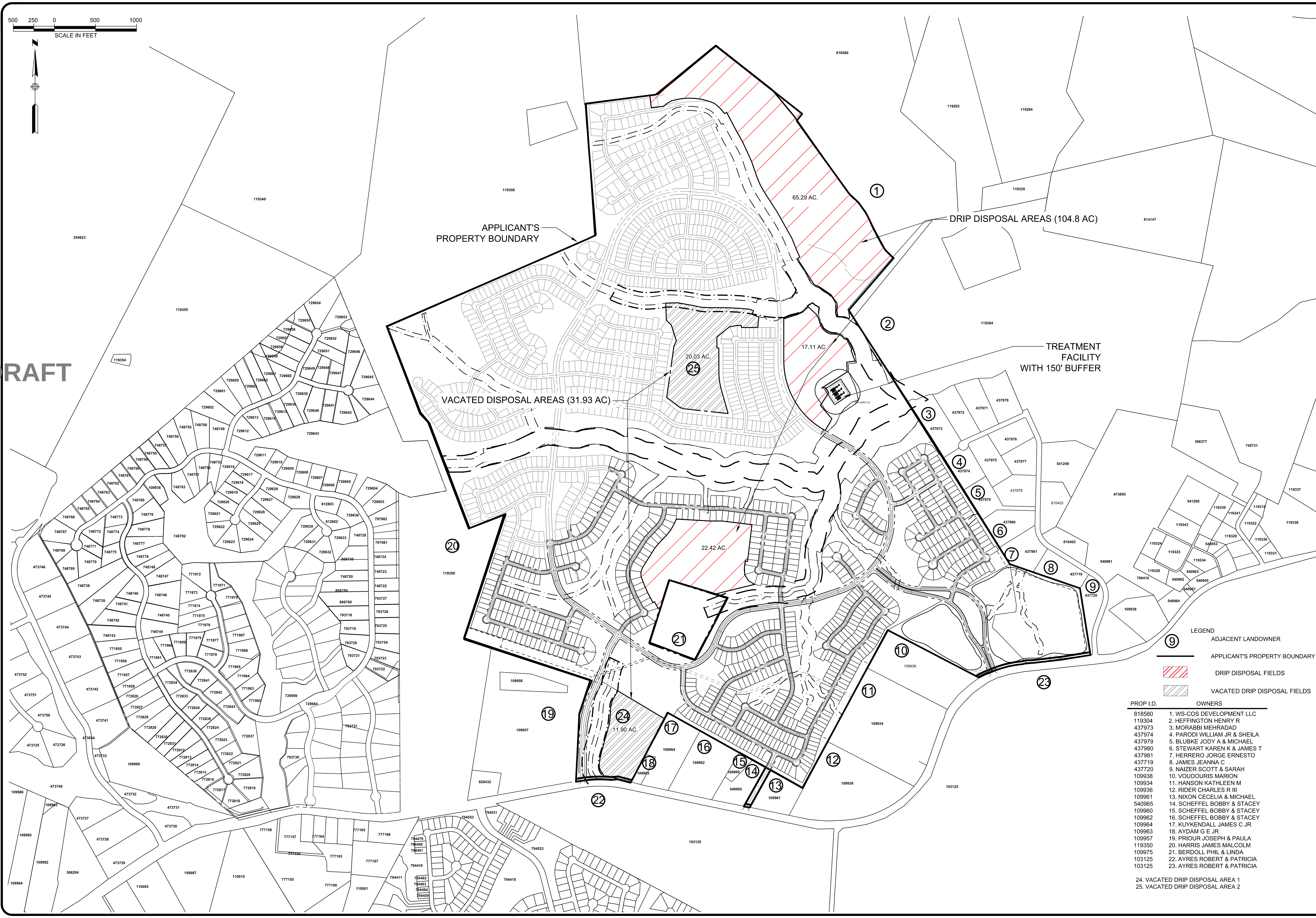
TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

USGS MAP
SHINGLE HILLS, TX

APPENDIX E

AFFECTED LANDOWNER MAP



PROP I.D.	OWNERS
818580	1. WS-COS DEVELOPMENT LLC
119304	2. HEFFINGTON HENRY R
437973	3. MORABBI MEHRADAD
437974	4. PARODI WILLIAM JR & SHEILA
437979	5. BLUBKE JODY A & MICHAEL
437980	6. STEWART KAREN K & JAMES T
437981	7. HERRERO JORGE ERNESTO
437719	8. JAMES JEANNA C
437720	9. NAIZER SCOTT & SARAH
109938	10. VOUDOURIS MARION
109934	11. HANSON KATHLEEN M
109936	12. RIDER CHARLES R III
109961	13. NIXON CECELIA & MICHAEL
540965	14. SCHEFFEL BOBBY & STACEY
109960	15. SCHEFFEL BOBBY & STACEY
109962	16. SCHEFFEL BOBBY & STACEY
109964	17. KUYKENDALL JAMES C JR
109963	18. AYDAM G E JR
109957	19. PRIOUR JOSEPH & PAULA
119350	20. HARRIS JAMES MALCOLM
109975	21. BERDOLL PHIL & LINDA
103125	22. AYRES ROBERT & PATRICIA
103125	23. AYRES ROBERT & PATRICIA

24. VACATED DRIP DISPOSAL AREA 1
25. VACATED DRIP DISPOSAL AREA 2

ADJACENT PROPERTY OWNERS MAP

TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
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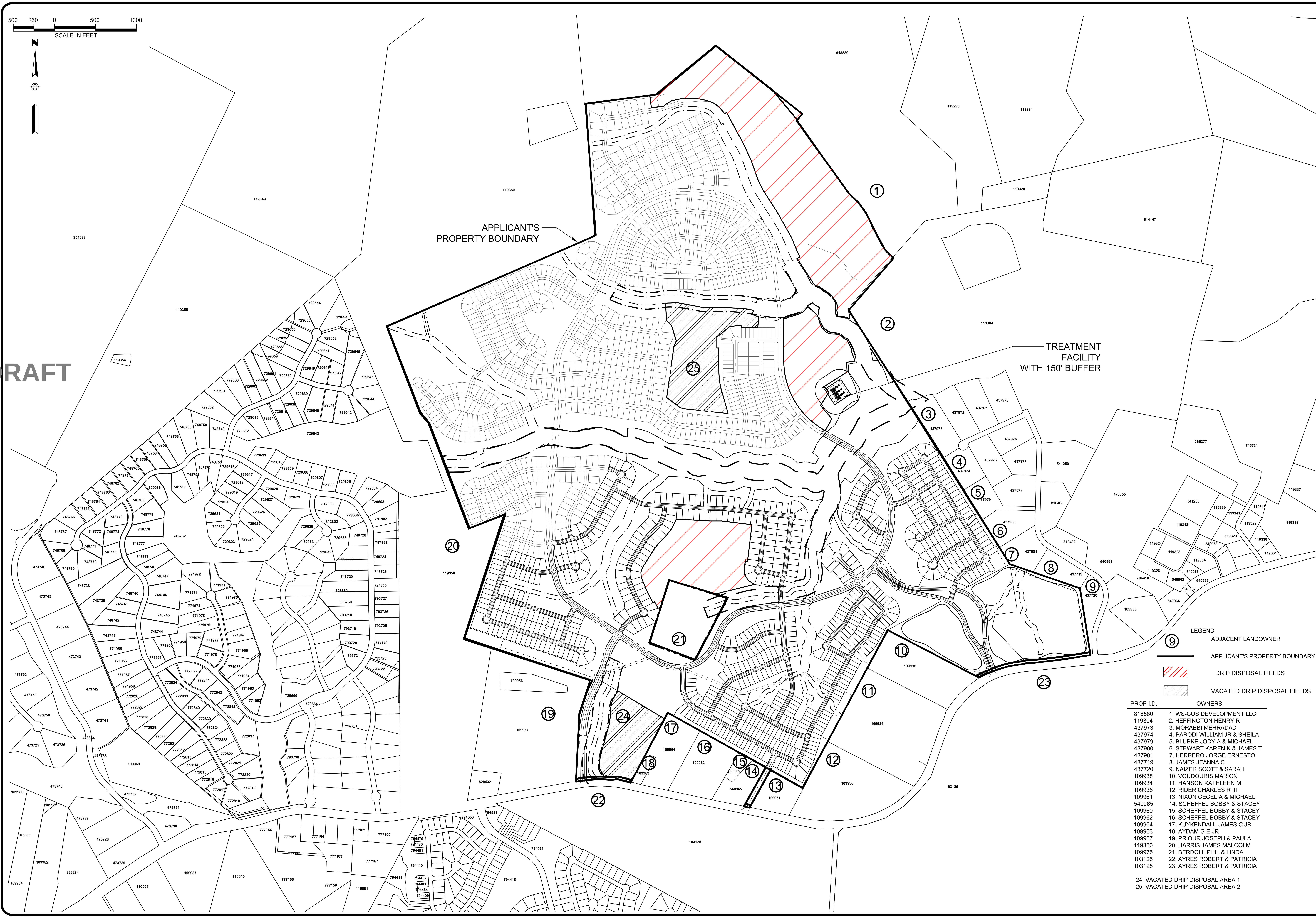

LEGEND

9 ADJACENT LANDOWNER

APPLICANT'S PROPERTY BOUNDARY

DRIP DISPOSAL FIELDS

VACATED DRIP DISPOSAL FIELDS

PROP I.D.	OWNERS
818580	1. WS-COS DEVELOPMENT LLC
119304	2. HEFFINGTON HENRY R
437973	3. MORABBI MEHRADAD
437974	4. PARODI WILLIAM JR & SHEILA
437979	5. BLUBKE JODY A & MICHAEL
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109938	10. VOUDOURIS MARION
109934	11. HANSON KATHLEEN M
109936	12. RIDER CHARLES R III
109961	13. NIXON CECELIA & MICHAEL
540965	14. SCHEFFEL BOBBY & STACEY
109960	15. SCHEFFEL BOBBY & STACEY
109962	16. SCHEFFEL BOBBY & STACEY
109964	17. KUYKENDALL JAMES C JR
109963	18. AYDAM G E JR
109957	19. PRIOUR JOSEPH & PAULA
119350	20. HARRIS JAMES MALCOLM
109975	21. BERDOLL PHIL & LINDA
103125	22. AYRES ROBERT & PATRICIA
103125	23. AYRES ROBERT & PATRICIA

24. VACATED DRIP DISPOSAL AREA 1
25. VACATED DRIP DISPOSAL AREA 2

ADJACENT PROPERTY OWNERS MAP

TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

LJA Engineering, Inc.
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Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

I:\A336 (tcmud 22)\TC MUD 22 Major Permit Amendment\exhibits\ADJACENT NEIGHBORS.dwg

WS-COS INVESTMENTS
52 MASON ST
GREENWICH CT 06830-5431

HENRY HEFFINGTON
6801 DESTINY HILLS DR
AUSTIN TX 78738

MEHRDAD MORABBI
12004 FORTUNA CV
AUSTIN TX 78738

MR AND MRS PARODI
16705 DESTINY CV
AUSTIN TX 78738

MR AND MRS BLUBKE
7008 DESTINY HILLS DR
AUSTIN TX 78738

MR AND MRS STEWART
7016 DESTINY HILLS DR
AUSTIN TX 78738

JORGE HERRERO
7100 DESTINY HILLS DR
AUSTIN TX 78738

JEANNA JAMES
7114 DESTINY HILLS DR
AUSTIN TX 78738

MR AND MRS NAIZER
7200 DESTINY HILLS DR
AUSTIN TX 78738

MARION VOUDOURIS
PO BOX 130
DRIPPING SPRINGS TX 78620

MR AND MRS HANSON
16400 HAMILTON POOL RD
AUSTIN TX 78738

CHARLES RIDER III
PO BOX 26962
AUSTIN TX 78755-0962

MR AND MRS NIXON
16614 HAMILTON POOL RD
AUSTIN TX 78738

MR AND MRS SCHEFFEL
16712 HAMILTON POOL RD
AUSTIN TX 78738

MR AND MRS KUYKENDALL
16910 HAMILTON POOL RD
AUSTIN TX 78738

MR AND MRS AYDAM
15100 HORNSBY HILL RD
AUSTIN TX 78734

MR AND MRS PRIOUR
17120 HAMILTON POOL RD
AUSTIN TX 78738

JAMES HARRIS
13501 RANCH ROAD 12
WIMBERLY TX 78676-5353

MR AND MRS BERDOLL
17008 HAMILTON POOL RD
AUSTIN TX 78738

MR AND MRS AYRES
707 W 10TH ST
AUSTIN TX 78701

ROCKY CREEK PROPERTY OWNERS ASSOC.
7 LAKEWAY CENTRE CT., STE 200
AUSTIN, TX 78734

DESTINY HILLS PROPERTY OWNERS ASSOC.
16100 HAMILTON POOL RD
AUSTIN, TX 78738

KIM BIGLEY, BELVEDERE HOA
ALLIANCE ASSOC. MGMT.
115 WILD BASIN RD.
AUSTIN, TX 78746

SWEETWATER PROPERTY OWNERS ASSOC.
5348 PERDERNALES SUMMIT PKWY
AUSTIN, TX 78738

APPENDIX F

ORIGINAL PHOTOGRAPHS

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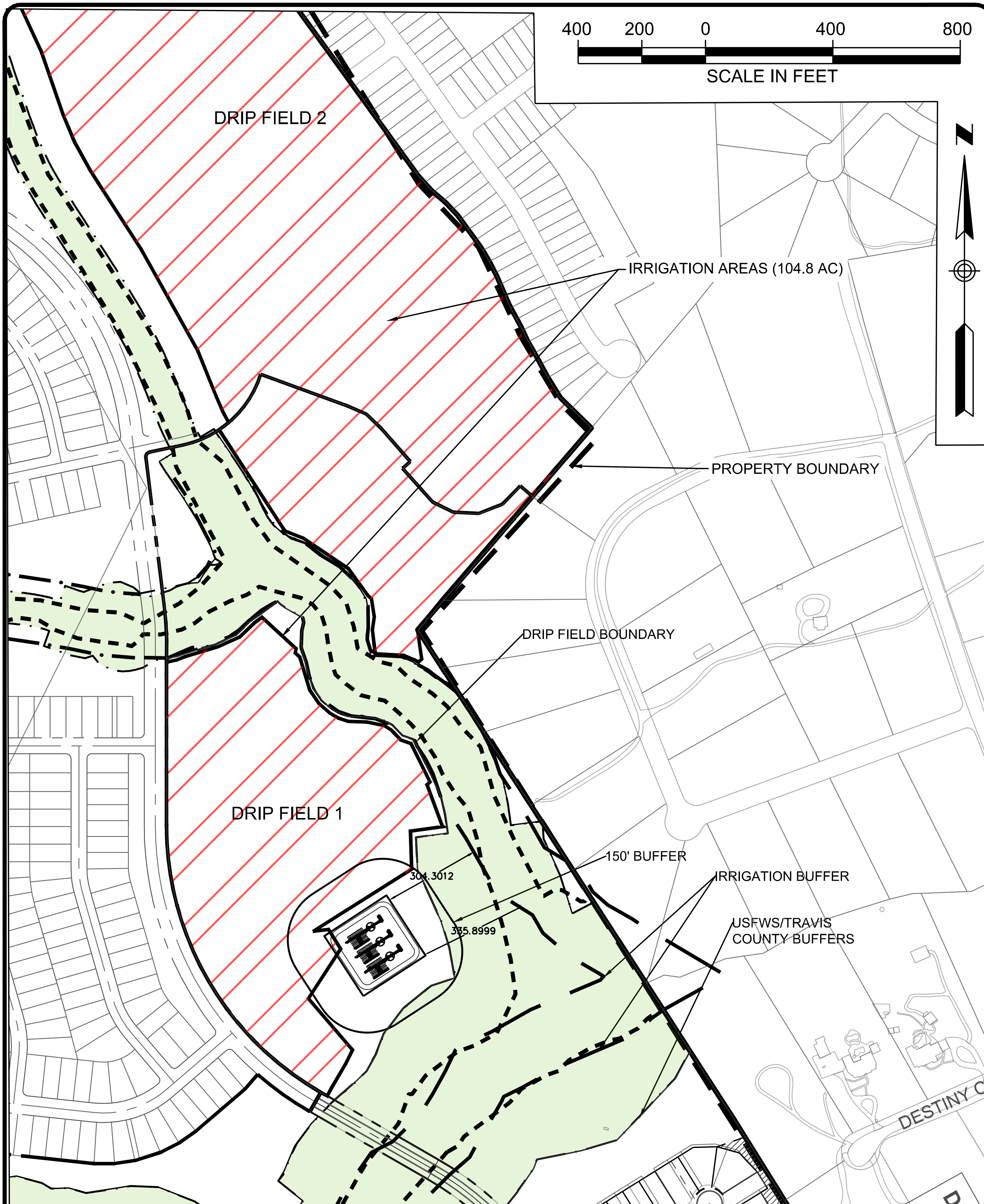
APPENDIX G

BUFFER ZONE MAP



LJA Engineering, Inc.
LJA
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

TRAVIS COUNTY MUD NO. 22 WWTP

TRAVIS COUNTY, TX

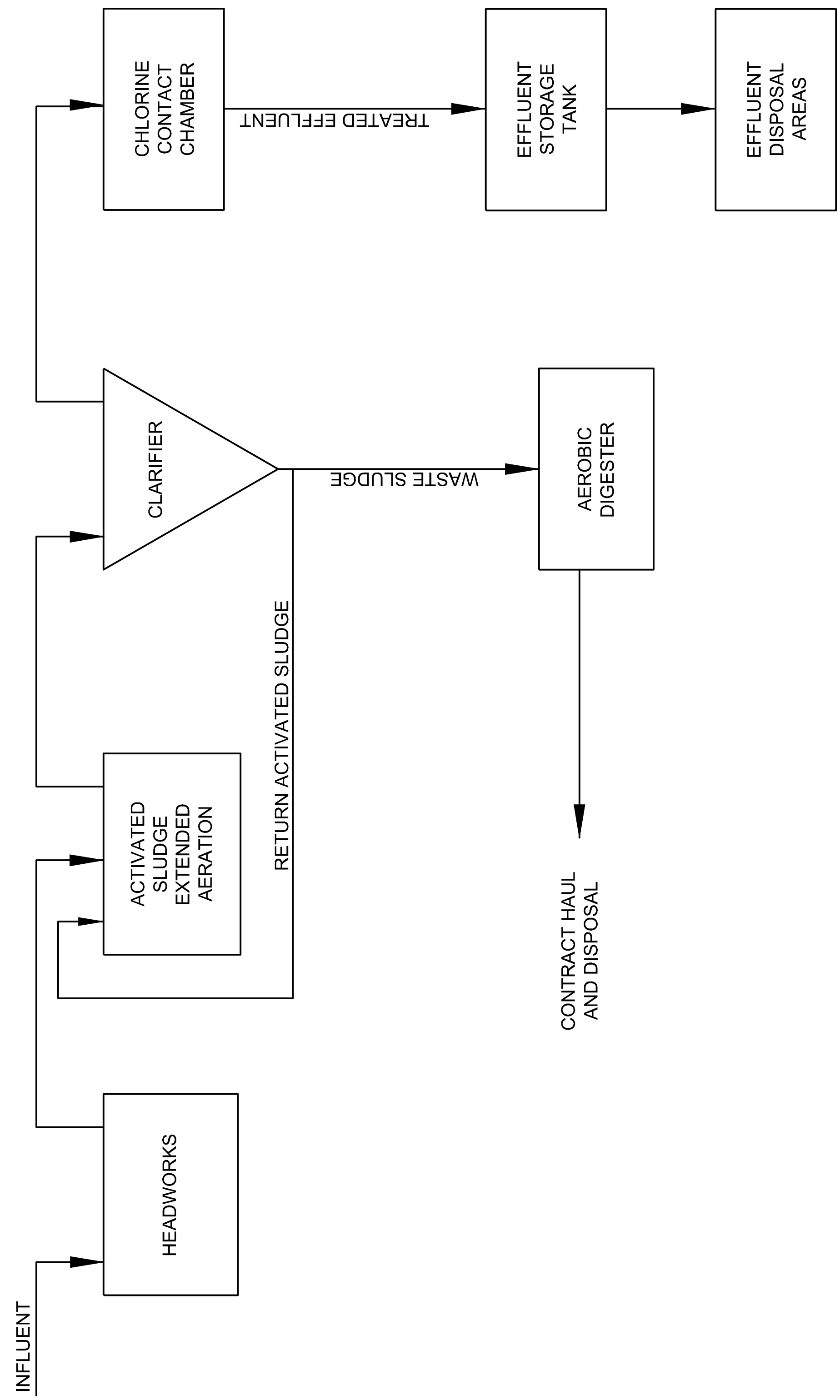
BUFFER ZONE MAP

1 OF 1

APPENDIX H

PROCESS FLOW DIAGRAM

FOR PLANNING PURPOSES ONLY



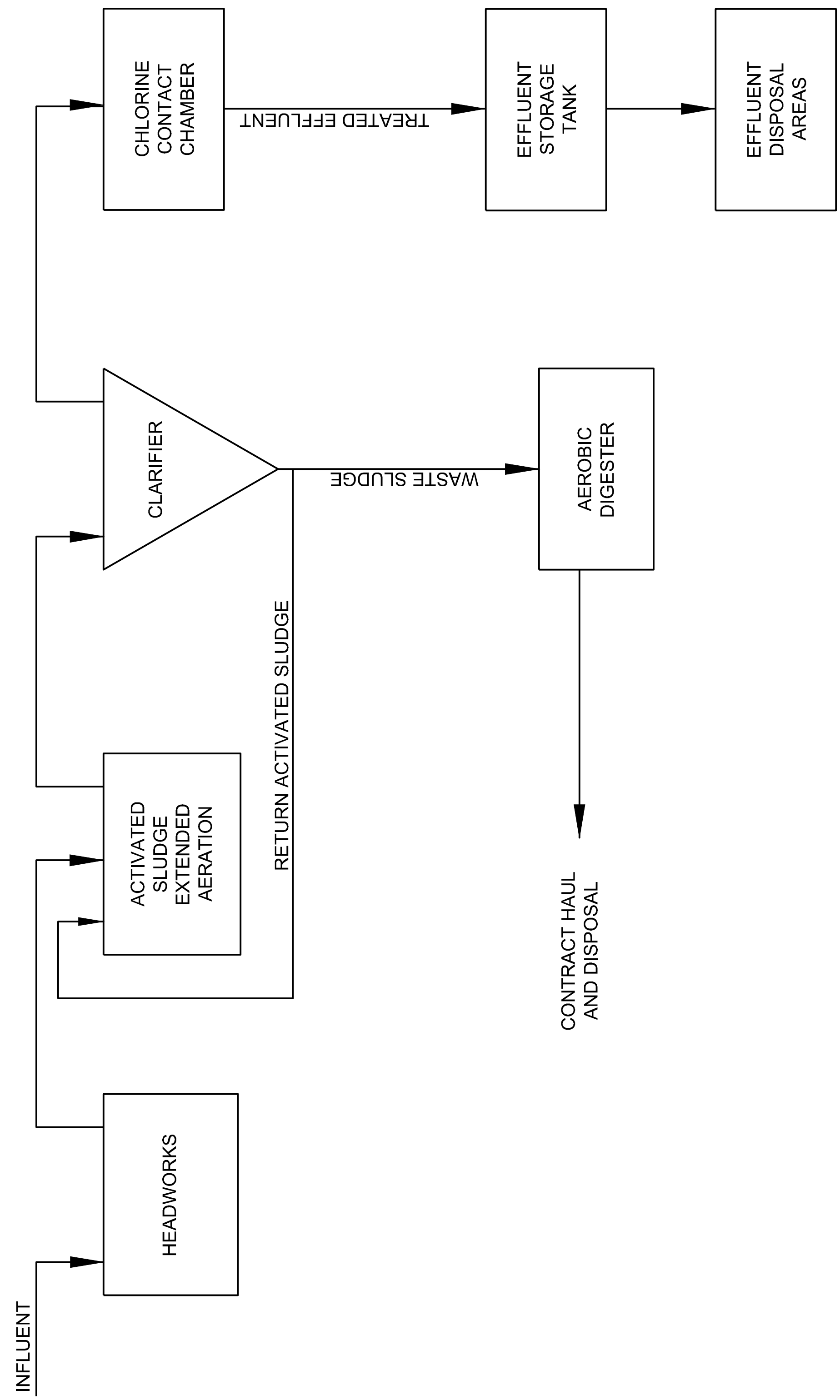
INTERIM I PHASE

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

TRAVIS COUNTY MUD NO. 22 WWTP
TRAVIS COUNTY, TX

PROCESS FLOW DIAGRAM

FOR PLANNING PURPOSES ONLY



INTERIM II PHASE

LJA Engineering, Inc.

7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735

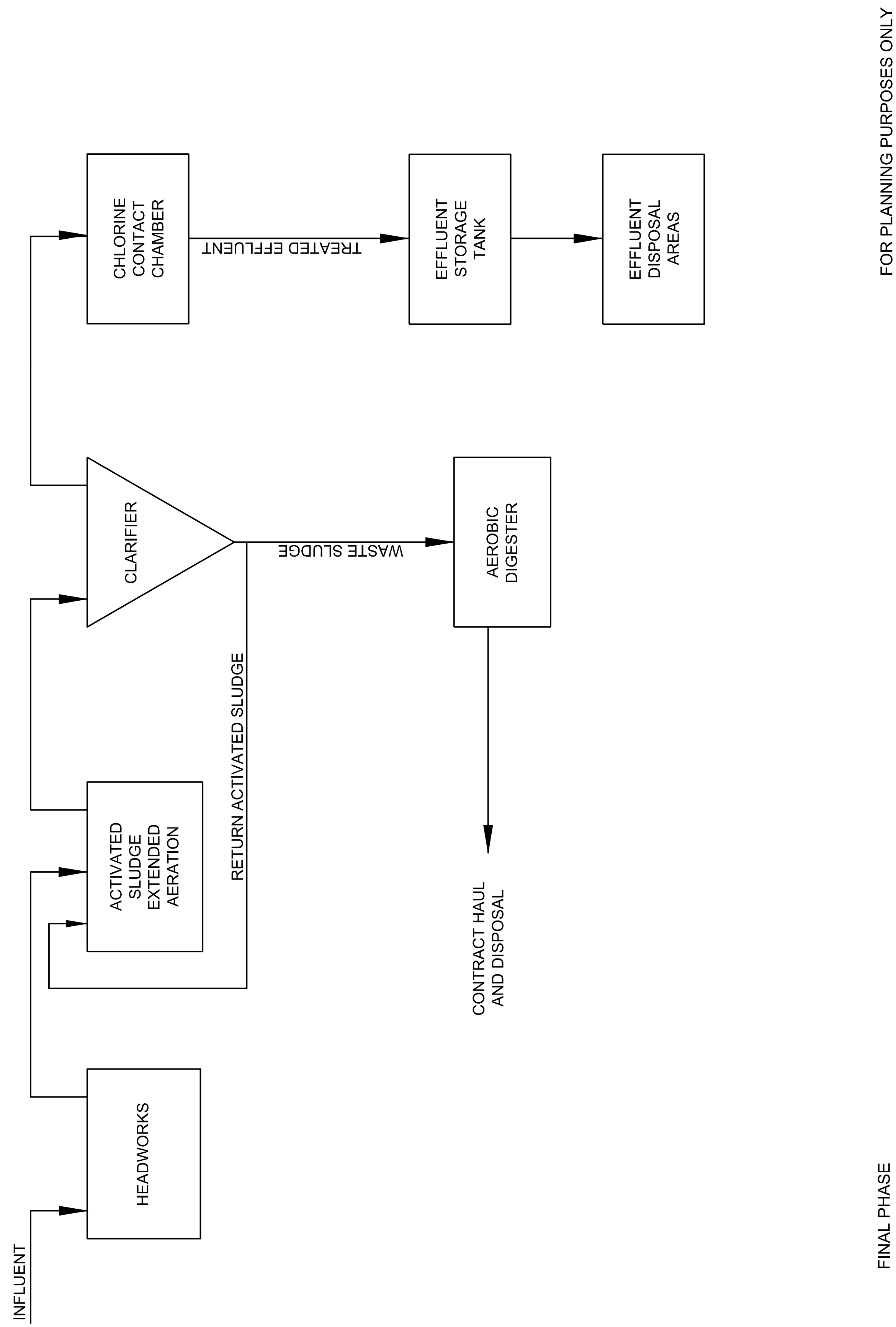
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

TRAVIS COUNTY MUD NO. 22 WWTP

TRAVIS COUNTY, TX

PROCESS FLOW DIAGRAM

1 OF 1



LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

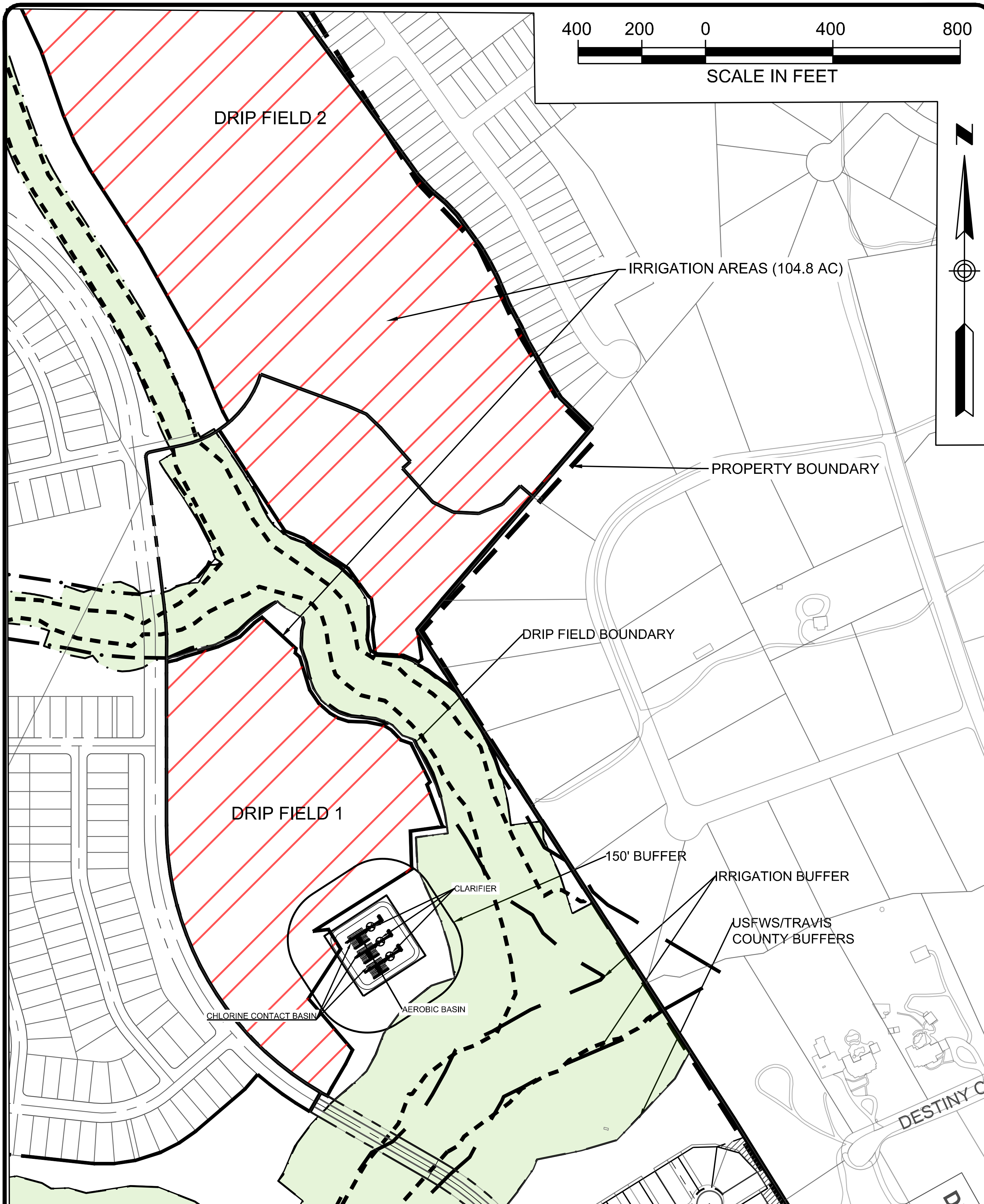
TRAVIS COUNTY MUD NO. 22 WWTP
TRAVIS COUNTY, TX

PROCESS FLOW DIAGRAM

1 OF 1

APPENDIX I

SITE DRAWING



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7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

TRAVIS COUNTY MUD NO. 22 WWTP
TRAVIS COUNTY, TX

SITE DRAWING

APPENDIX J

DESIGN CALCULATIONS

TC MUD No. 22 - WWTP FLOW PHASES

Phase 1			Phase 2			Phase 3		
Assumptions			**Assumptions**			**Assumptions**		
Average Flow per LUE =	245	gpd	Average Flow per LUE =	245	gpd	Average Flow per LUE =	245	gpd
Average Density	3	LUEs/Ac	Average Density	3	LUEs/Ac	Average Density	3	LUEs/Ac
I/I for Wet Peak	750	gpd/Ac	I/I for Wet Peak	750	gpd/Ac	I/I for Wet Peak	750	gpd/Ac
LUEs	408		LUEs	612		LUEs	1,816	
Average Daily Flow	**99,960**	gpd	Average Daily Flow	**149,940**	gpd	Average Daily Flow	**444,920**	gpd
	69	gpm	Average Daily Flow	104	gpm	Average Daily Flow	309	gpm
Dry Peaking Factor	3.69		Dry Peaking Factor	3.56		Dry Peaking Factor	3.15	
Peak Dry Flow	256	gpm	Peak Dry Flow	371	gpm	Peak Dry Flow	972	gpm
Service Area	104.80	acres	Service Area	104.80	acres	Service Area	104.80	acres
I/I for Peak Wet	78,600	gpd	I/I for Peak Wet	78,600	gpd	I/I for Peak Wet	78,600	gpd
	55	gpm		55	gpm		55	gpm
Total Peak Wet Flow	311	gpm	Total Peak Wet Flow	425	gpm	Total Peak Wet Flow	1,027	gpm
Minimum Flow Factor	0.20		Minimum Flow Factor	0.22		Minimum Flow Factor	0.27	
Minimum Flow	14	gpm	Minimum Flow	23	gpm	Minimum Flow	83	gpm

TC MUD No. 22 WWTP Extended Air Process Design (TCEQ Checklist)

Phase 1	0.1	
Design Flow (from Summary Sheet)	0.100	mgd
Peak Flow (from Summary Sheet)	0.400	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	444.4	ft^2
Surface Area Required (Design Flow)	222.2	ft^2
Volume Required (Peak Flow)	4,456	ft^3
Volume Required (Design Flow)	2,228	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

Proposed Sidewater Depth	13	ft
Proposed Clarifier Diameter	20	ft
Clarifier Surface Area	314	ft^2
Clarifier Volume	4,084	ft^3
Maximum Return Sludge Underflow Rate	87	gpm
Minimum Return Sludge Underflow Rate	44	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Aeration System Design

(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3	
Actual Design Load	400		
Required Volume	26667	ft^3	
Required Air Flow	3200	scf / lb BOD	(assumes 4.0% transfer efficiency)

(Calculations)

Proposed Sidewater Depth	12	ft	*Note - Min SWD is 8 ft*
Surface Area	2,222	ft^2	
Air Flow	889	scfm	

Aerobic Digester Design

(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	12	ft
Surface Area	667	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design

(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

(Calculations)

Proposed Volume	743	ft^3
Proposed Sidewater Depth	10	ft
Surface Area	74	ft^2

TC MUD No. 22 WWTP Extended Air Process Design (TCEQ Checklist)

Phase 2	0.05	
Design Flow (from Summary Sheet)	0.150	mgd
Peak Flow (from Summary Sheet)	0.600	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	666.7	ft^2
Surface Area Required (Design Flow)	333.3	ft^2
Volume Required (Peak Flow)	6,684	ft^3
Volume Required (Design Flow)	3,342	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Proposed Sidewater Depth	13	ft
Proposed Clarifier Diameter	20	ft
Clarifier Surface Area	314	ft^2
Clarifier Volume	4,084	ft^3
Maximum Return Sludge Underflow Rate	87	gpm
Minimum Return Sludge Underflow Rate	44	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

DRAFT

Aeration System Design
(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3
Actual Design Load	400	lb BOD/day
Required Volume	26667	ft^3
Required Air Flow	3200	scf / lb BOD (assumes 4.0% transfer efficiency)

(Calculations)

Proposed Sidewater Depth	12	ft
Surface Area	2,222	ft^2
Air Flow	889	scfm

Note - Min SWD is 8 ft

Aerobic Digester Design
(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	12	ft
Surface Area	667	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design
(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

(Calculations)

Proposed Volume	1,114	ft^3
Proposed Sidewater Depth	12	ft
Surface Area	93	ft^2

TC MUD No. 22 WWTP Extended Air Process Design (TCEQ Checklist)

Phase 3	0.3	
Design Flow (from Summary Sheet)	0.450	mgd
Peak Flow (from Summary Sheet)	1.800	mgd
Design Organic Load	400	lb BOD / day

Clarifier Design

(Criteria)

Maximum Surface Loading @ Peak Flow	900	gpd/ft^2
Minimum Detention Time @ Peak Flow	2	hrs
Maximum Surface Loading @ Design Flow	450	gpd/ft^2
Minimum Detention Time @ Design Flow	4	hrs
Surface Area Required (Peak Flow)	2000.0	ft^2
Surface Area Required (Design Flow)	1000.00	ft^2
Volume Required (Peak Flow)	20,053	ft^3
Volume Required (Design Flow)	10,027	ft^3
Depth Required (Peak Flow)	10.0	ft
Depth Required (Design Flow)	10.0	ft
Maximum Return Sludge Underflow Rate	400.0	gpd/ft^2
Minimum Return Sludge Underflow Rate	200.0	gpd/ft^2

(Calculations)

Note - Min SWD is 8 ft, 10 ft if area > 1250 ft^2

Proposed Sidewater Depth	15	ft
Proposed Clarifier Diameter	30	ft
Clarifier Surface Area	707	ft^2
Clarifier Volume	10,603	ft^3
Maximum Return Sludge Underflow Rate	196	gpm
Minimum Return Sludge Underflow Rate	98	gpm
RAS Line Size (min 3 ft/sec velocity)	4	inches

Aeration System Design

(Criteria)

Organic Loading	15	lb BOD/day/1000 ft^3
Actual Design Load	400	lb BOD/day
Required Volume	26667	ft^3
Required Air Flow	3200	scf / lb BOD (assumes 4.0% transfer efficiency)

(Calculations)

Note - Min SWD

(Criteria)

Volume Required	20	ft^3 / lb BOD
or	15	days SRT
Air Required	30	scfm/ 1000 ft^3 volume

(Calculations)

Proposed Volume	8,000	ft^3
Proposed Sidewater Depth	12	ft
Surface Area	667	ft^2
Required Air Flow	240	scfm

Chlorine Contact Design

(Criteria)

Minimum Contact Time	20	minutes @ Peak Flow

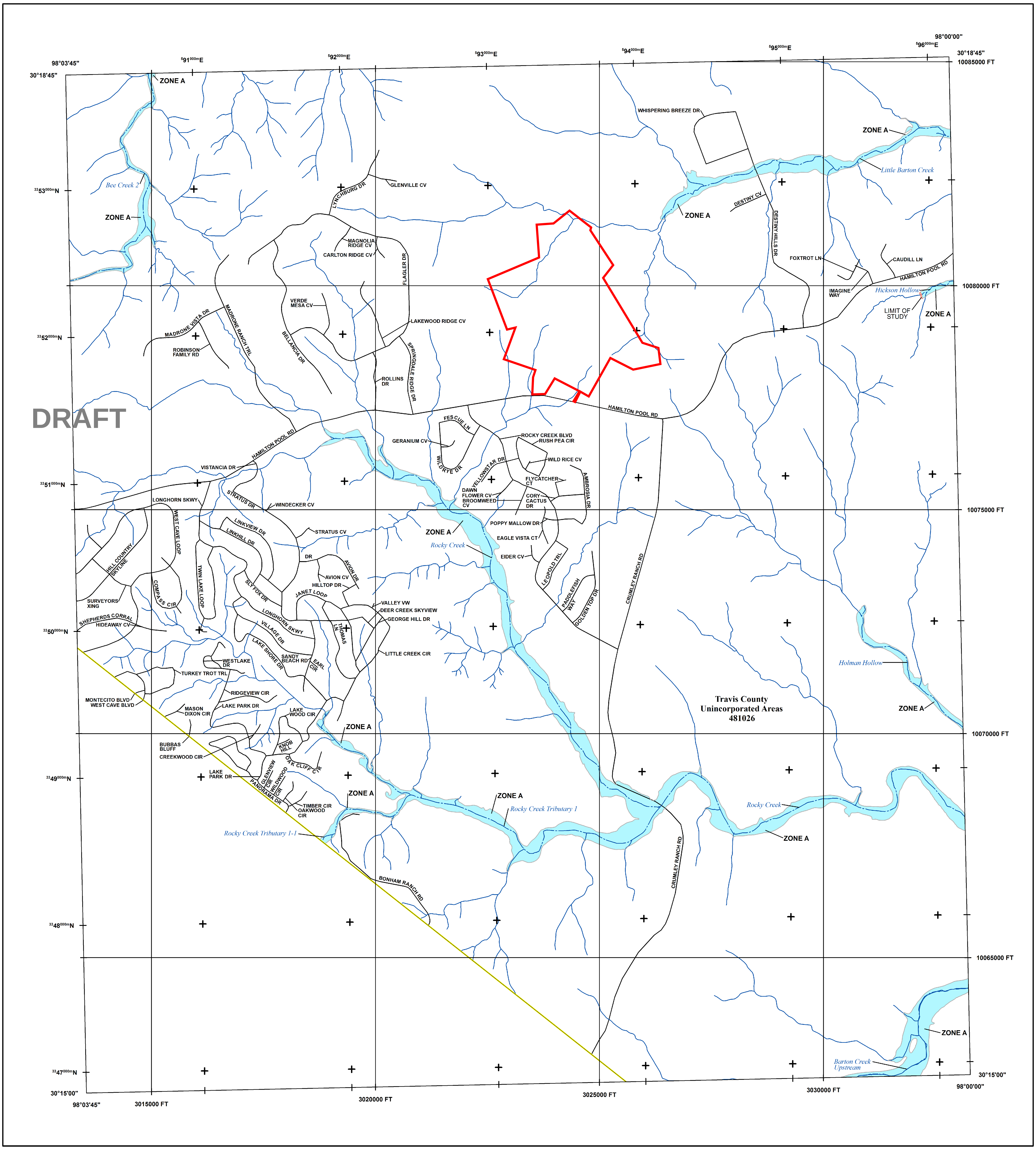
(Calculations)

Proposed Volume	3,342	ft^3
Proposed Sidewater Depth	12	ft
Surface Area	279	ft^2

APPENDIX K

FEMA MAPS AND WIND ROSE

DRAFT



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
	E 18.2 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
OTHER FEATURES	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this Flood Insurance Rate Map (FIRM), available products associated with this FIRM, including historic versions, the current map date for each FIRM panel, how to order products, or the National Flood Insurance Program (NFIP) in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Flood Map Service Center website at https://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Flood Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study Report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was derived from digital data obtained from City of Austin dated 2016, NFHL dated 2014, and CAPCOG dated 2014 and 2016.

SCALE

N

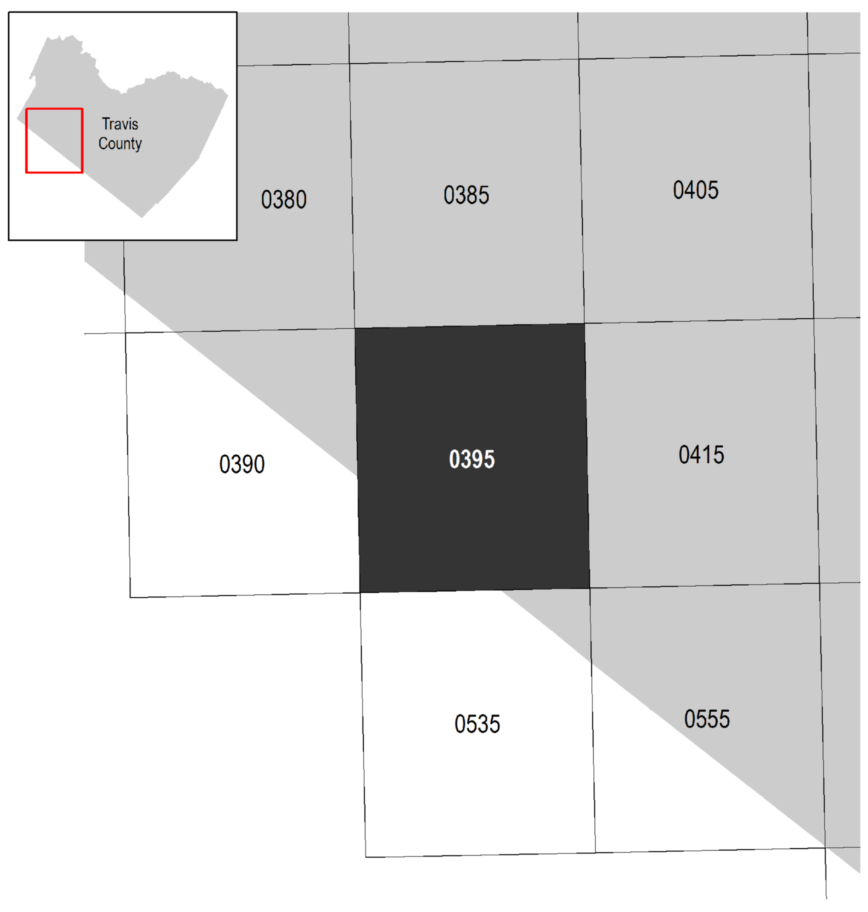
Map Projection:
State Plane Lambert Conformal Conic, Texas Central Zone FIPS 4203; North American Datum 1983; Western Hemisphere; Vertical Datum: NAVD 88

1 inch = 1,000 feet 1:12,000

0 1,000 2,000 4,000 feet

0 250 500 1,000 meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

TRAVIS COUNTY, TEXAS
and Incorporated Areas

PANEL **395** OF **730**

FEMA

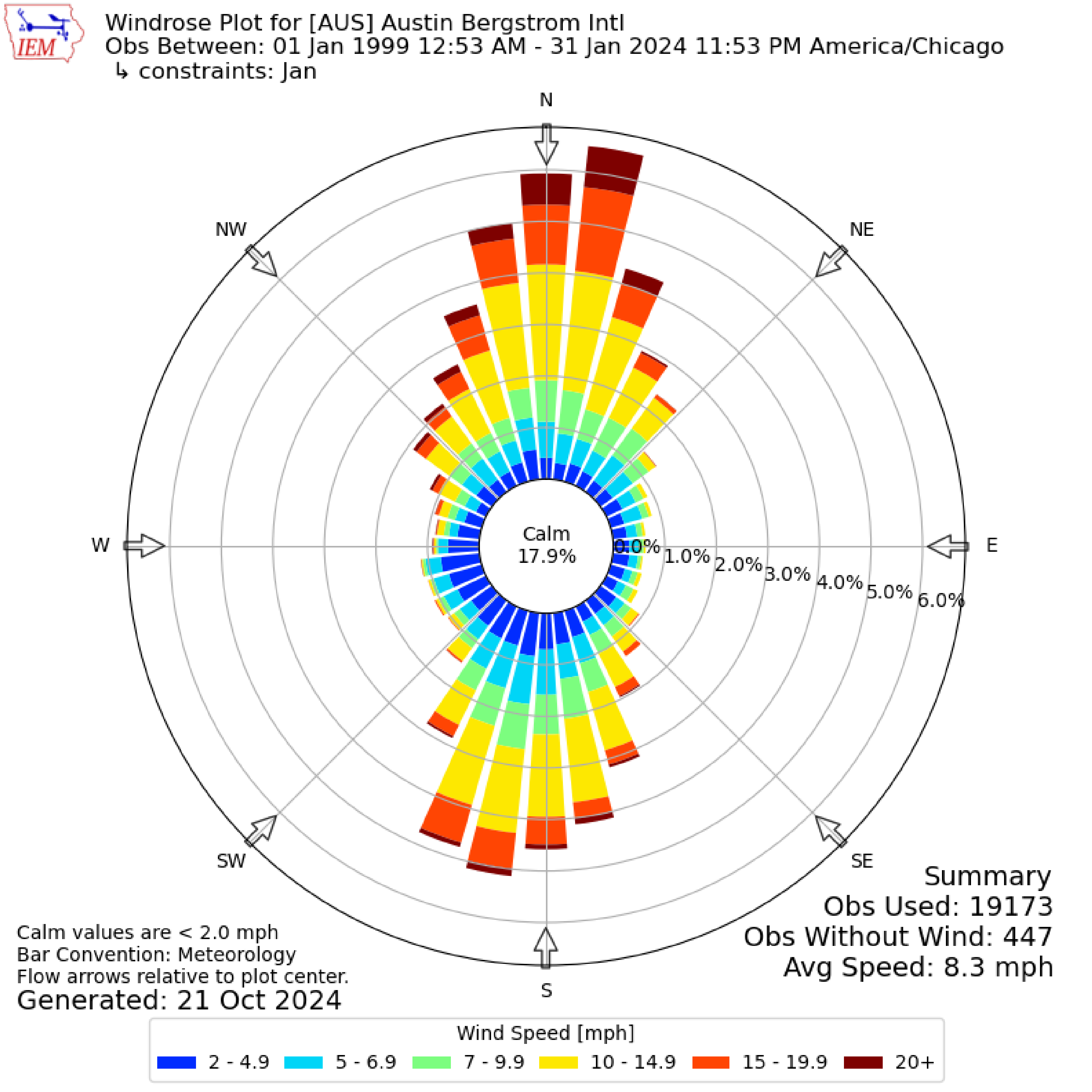
Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
TRAVIS COUNTY	481026	0395	J

VERSION NUMBER
2.3.3.3

MAP NUMBER
48453C0395J

MAP REVISED
JANUARY 22, 2020


IEM
Windrose Plot for [AUS] Austin Bergstrom Intl
Obs Between: 01 Jan 1999 12:53 AM - 31 Jan 2024 11:53 PM America/Chicago
↳ constraints: Jan
N
NE
E
SE
S
SW
W
NW
Calm
17.9%
0.0%
1.0%
2.0%
3.0%
4.0%
5.0%
6.0%
Summary
Obs Used: 19173
Obs Without Wind: 447
Avg Speed: 8.3 mph
Calm values are < 2.0 mph
Bar Convention: Meteorology
Flow arrows relative to plot center.
Generated: 21 Oct 2024
Wind Speed [mph]
2 - 4.9
5 - 6.9
7 - 9.9
10 - 14.9
15 - 19.9
20+

APPENDIX L

SEWAGE SOLIDS MANAGEMENT PLAN

DRAFT

TC MD NO. 22 - WWTP SOLIDS MANAGEMENT PLAN

Interim I Phase

Design Flow	**Vol Dig**	**Percentage**	**Flow**	**P_x**	**$P_{x\ (ss)}$**	**Q_{Sldg}**	**HRT_{Sldg}**
gpd	*ft^3 (gal)*		*gpd*	*lbs VSS/day*	*lbs SS/day*	*gpd*	*days*
100,000	8,000	25%	25,000	22	27	410	146
		50%	50,000	44	55	819	73
	59,844	75%	75,000	66	82	1,229	49
		100%	100,000	87	109	1,639	37

Interim II Phase

Design Flow	**Vol Dig**	**Percentage**	**Flow**	**P_x**	**$P_{x\ (ss)}$**	**Q_{Sldg}**	**HRT_{Sldg}**
gpd	*ft^3 (gal)*		*gpd*	*lbs VSS/day*	*lbs SS/day*	*gpd*	*days*
150,000	16,000	25%	37,500	33	41	614	195
		50%	75,000	66	82	1,229	97
	119,680	75%	112,500	98	123	1,843	65
		100%	150,000	131	164	2,458	49

Final Phase

Design Flow	**Vol Dig**	**Percentage**	**Flow**	**P_x**	**$P_{x\ (ss)}$**	**Q_{Sldg}**	**HRT_{Sldg}**
gpd	*ft^3 (gal)*		*gpd*	*lbs VSS/day*	*lbs SS/day*	*gpd*	*days*
450,000	24,000	25%	112,500	98	123	1,843	97
		50%	225,000	197	246	3,687	49
	179,520	75%	337,500	295	369	5,530	32
		100%	450,000	394	492	7,373	24

Sludge will be wasted from the clarifier underflow to the digester. Sludge will stay in the digester with the decant returned to the headworks of the plant. Sludge will be removed from the digester on a schedule approximate to the HRT of the digester. The liquid sludge will be hauled by truck for further treatment.

APPENDIX M

ANNUAL CROPPING PLAN

CROPPING PLAN

FOR

TRAVIS COUNTY MUD NO. 22 WASTEWATER TREATEMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT
MAJOR AMENDMENT

January 2025

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD, BUILDING II, SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

DRAFT

CROPPING PLAN

The proposal for the wastewater application areas is to remove the smaller ashe juniper trees, import soil, construct grading, install the Subsurface Area Drip Disposal System and overseed with Bermuda and Winter Rye Grass. The irrigation areas will be over seeded with turf grasses year-round to ensure consistent uptake of water and nutrients. The irrigation areas will be mowed regularly, and maintain a height of approximately 0-2 inches, to ensure that the grasses will be actively growing at all times. No supplemental irrigation will be needed.

There are no plans to fertilize the grasses other than germination. Fertility recommendations for the grasses to be used at this site are generally 100-150 lbs/arcre of N. The grasses will be fertilized for germination and it is not anticipated to fertilize in the future.

Bermuda and Winter Rye grasses are very salt tolerant, and this site is not expected to develop any salinity problems.

Site Preparation
Preparing the site involves removing trees and debris, planning for drainage, and grading the site.

1. Remove debris. Insist that the builder not use the site as a dumping ground for paint, concrete, and other materials.
2. Remove trees and surface rocks and debris from the site.
3. Soil depth of 19 inches minimum is required. Measure soil depths and import as necessary.
4. Plan for easy maintenance and a pleasing appearance. Avoid terraces, steep grades, poorly drained areas, and heavily shaded spots. Grading shall not exceed 8% on areas to be irrigated.
5. Shape the underlying subsoil to the desired contour and redistribute topsoil uniformly above the subsoil. A percent slope minimum is needed for proper drainage away from buildings. Make certain the soil is firmed after shaping. There should be no visible footprints after walking on it.
6. Water the area to enhance settling. Fill areas that settle unevenly to avoid standing water.

Soil Preparation
Well-prepared soil with adequate nutrients for growing grass encourages the development of a healthy field.

1. Take soil samples from the irrigation areas to determine soil pH and nutrient requirements. A single soil test may be all that is necessary if there are no obvious differences in soil texture, terrain, or troubled areas of the front yard and backyard. If the soils seem different, collect soil samples to a depth of 3 to 4 inches from several (10-15) locations and mix them together to produce a composite sample.

2. Based on the soil test report recommendations of the fertilization guidelines presented below, incorporate lime and fertilizer into the top 6 to 8 inches of the soil using a disk or rototiller. Regardless of the region, a deeper root system is able to extract more moisture and nutrients from the soil, improving drought tolerance and overall health of the plant.

3. Rake or harrow the site to establish a smooth and level final grade. Soil particles should be no larger than marble size, and pea gravel size is even better. Hand raking is the best way to level the soil and work out hills and hollows. Allow time for rain or irrigation to settle the soil and roll or cultipack lightly to firm the soil before planting seed. Hand rake again to break up the crusty surface before planting.

4. Prior to irrigation, a minimum of 19 inches of soil must be present in all proposed irrigation areas.

Winter Rye and Bermuda

Winter Rye grass is mainly used as a permanent lawn grass in cooler northern climates and as winter grass for dormant Bermuda grass or to overseed Bermuda grass lawns in southern climates. is highly resistant to foot traffic so it is popular for residential and commercial lawns and turfs.

Common Bermudagrass, which is the most coarsely textured, can be seeded. Several newer cultivars, however, can also be seeded that have a medium texture. Bermudagrass should be seeded at 1 to 2 pounds per 1,000 sq ft.

Establishing a healthy, attractive field means planting the best grass for your site at the right time and in a careful manner. Grass can be seeded or established using vegetation in the form of sprigs, plugs, or sod. The type of grass and the planting method you select will determine the best time of year to plant. Site and soil preparation, including fertilization, are especially important.

Mowing

Use a rotary (centrifugal) mower.

1. Keep the mower blades sharp and balanced. The leanest cut and best mowing are obtained when the mower blades are sharp. Dull mower blades reduce field quality by tearing instead of cleanly cutting the grass. Tearing creates many ragged leaf ends that quickly wither and bleach and are easy ports of entry for disease. Using a sharp mower is especially important for difficult-to-mow grasses, such as Bermudagrass. A properly sharpened and balanced mower blade will also reduce mower vibration, lengthen mower life, and reduce fuel consumption by as much as 22 percent.

2. Mow at the proper height. The frequency of mowing is governed by the desired grass height and by the amount of growth, which depends on temperature, fertility, moisture conditions, season, and the natural growth rate of the grass. In most instances, this may amount to biweekly and weekly mowing. To maintain a high-quality field, turfgrass should be cut often enough that less than 50 percent of the leaf surface is removed with each mowing. If the field gets too high during wet seasons, rise the mower and cut off a fourth to a half of the present growth. Then lower the mower to its proper height and mow again in a day or two.

3. Rake, bag, and remove the clippings when harvesting is required. If prolonged periods of rainfall prevent mowing, clippings may be long enough to shade or smother the grass. In this case, rake, bag, and remove clippings. Collected clippings can be used as mulch around trees and shrubs or added to compost.

Fertilization

As recommended above, its best to submit a soil sample for testing when establishing a new field to determine how much lime fertilizer should be added to your soil. Fertilize before planting. Apply fertilizer and lime when soil is prepared based on these guidelines:

If you obtained a soil test: Apply the amount of line and fertilizer recommended for your soil by the soil testing laboratory.

1. Apply 75 pounds of ground limestone per 1,000 sq ft.
2. Apply a starter type fertilizer (one that is high in phosphorous based on the type of grass and the planting method. Fertilizer bags have a three-number system indicating the primary nutrients, such as 8-8-8 or 5-10-10. These numbers denote the N-P0K ratio – the percentage of each nutrient in a fertilizer. The percentages are always noted in the following order:
    a. N Nitrogen for green color and growth
    b. P2O5 Phosphorous for good establishment and rooting
    c. K20 Potassium to enhance past and environmental stress tolerance.

Some common examples of starter type fertilizers required for a 1,000 sq ft area include 40 pounds of 5-10-10, 20 pounds of 10-20-20, or 16 pounds of 18-24-6. For sandy soils, fertilizer rates should be increased by 20 percent.

APPENDIX N

USGS WELL MAP AND WELL INFORMATION

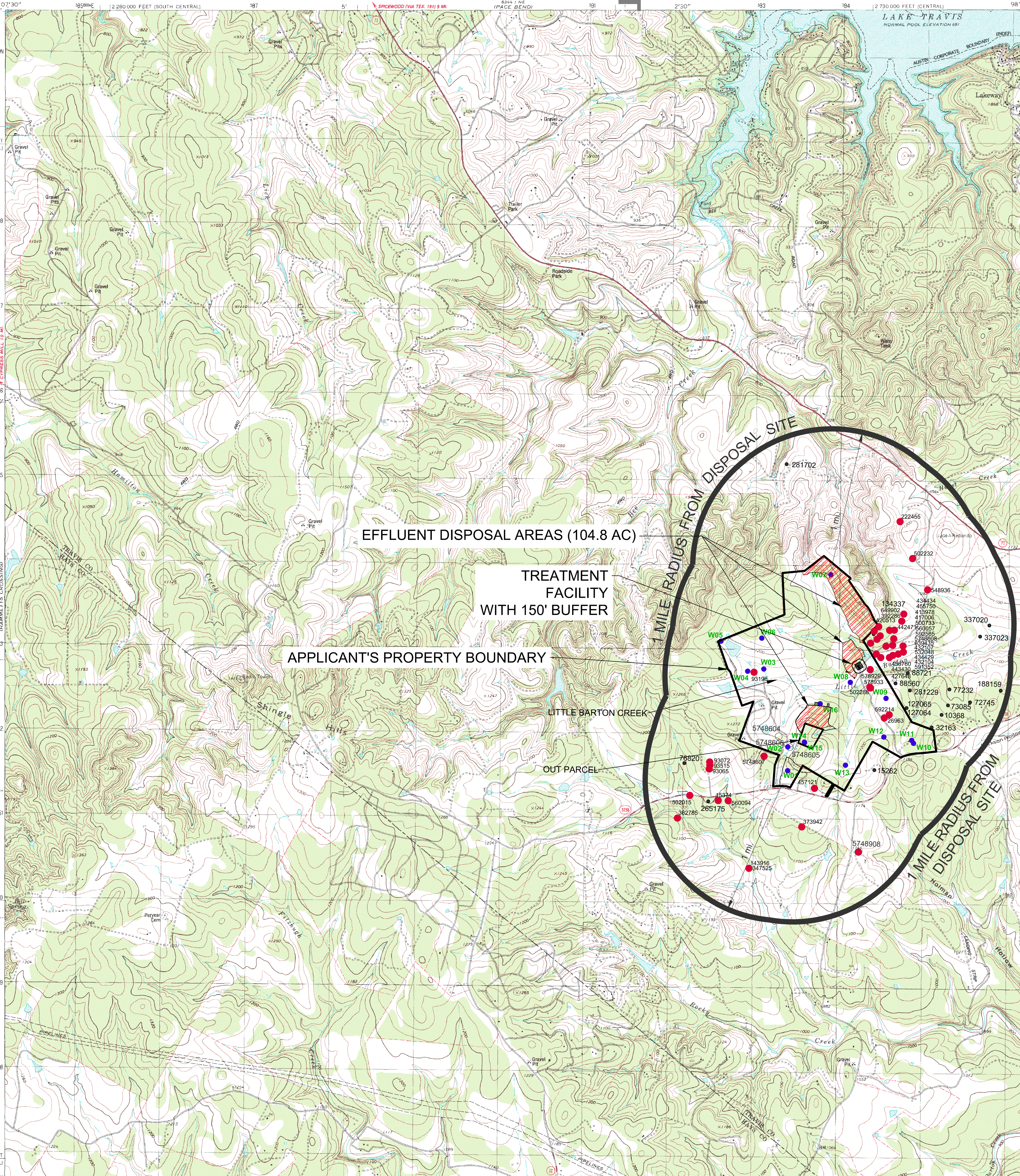
I:\A336 (tcmud 22)\TC MUD 22 Major Permit Amendment\exhibits\USGS 1 MILE.dwg
User: enaranjo
Last Modified: Jan. 31, 25 - 16:07
Plot Date/Time: Feb. 03, 25 - 16:03:06

: ..\Drip Areas.dwg
: ..\WWTP and Buffer.dwg

DRAFT

UNITED STATES DEPARTMENT OF THE INTERIOR GEOLOGICAL SURVEY

SHINGLE HILLS QUADRANGLE
TEXAS
7.5 MINUTE SERIES (TOPOGRAPHIC)
SE/4 SPICEWOOD 15' QUADRANGLE



Mapped, edited, and published by the Geological Survey
Revised in cooperation with the Texas Water Development Board

Control by USGS and NOS/NOAA

Topography by photogrammetric methods from aerial photographs taken 1967. Field checked 1968. Revised from aerial photographs taken 1985. Field checked 1986. Map edited 1986

Projection: Texas coordinate system, central zone (Lambert conformal conic)
10,000-foot grid ticks based on Texas coordinate system, central and south central zones
1000-meter Universal Transverse Mercator grid, zone 14
1927 North American Datum
To place on the predicted North American Datum 1983 move the projection lines 18 meters south and 28 meters east as shown by dashed corner ticks

Fine red dashed lines indicate selected fence lines

UTM GRID AND 1986 MAGNETIC NORTH DECLINATION AT CENTER OF MAP DIAGRAM IS APPROXIMATE

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

THIS MAP COMPLIES WITH NATIONAL MAP ACCURACY STANDARDS
FOR SALE BY U. S. GEOLOGICAL SURVEY, DENVER, COLORADO 80225, OR RESTON, VIRGINIA 22092
A FOLDER DESCRIBING TOPOGRAPHIC MAPS AND SYMBOLS IS AVAILABLE ON REQUEST

QUADRANGLE LOCATION

3098-141

ROAD CLASSIFICATION
Primary highway, hard surface
Light-duty road, hard or improved surface
Secondary highway, hard surface
Unimproved road
Interstate Route
U. S. Route
State Route

SHINGLE HILLS, TEX.
SE/4 SPICEWOOD 15' QUADRANGLE
30098-C1-TF-024

1986

DMA 6344 I SE-SERIES V882

LEGEND

(black line)	1 MILE RADUIS
5748908 (red dot)	WELLS LOCATED IN T.W.D.B. DATA BASE AND 150' BUFFER
W03 (blue dot)	WELLS LOCATED ON-SITE AND 150' BUFFER
88560 (black dot)	SUBMITTED DRILLER'S REPORTS AND 150' BUFFER
(hatched)	IRRIGATION AREAS

2000 1000 0 2000 4000
SCALE IN FEET

SHEET NO.	1
OF	1 SHEETS
JOB NUMBER:	A252

LJA Engineering, Inc.
5316 Highway 290 West
Suite 150
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

DATE:	1/20/14
DESIGNED BY:	DWR
DRAWN BY:	LP
CHECKED BY:	DWR
DRAWING NAME:	USGS 1 MILE.dwg

REVISIONS

NO.	DESCRIPTION	BY	DATE

USGS MAP
SHINGLE HILLS, TX
WELL MAP
1 MILE RADIUS MAP

Well ID	Well use	Producing (Y/N)	Open Cased Capped or Plugged?	Proposed Best Management Practice
W01	Domestic	Not known	Cased	Plug Well
W02	Domestic	Not known	Capped	Maintaining 150' Buffer
W03	Domestic	Not known	Capped	Maintaining 150' Buffer
W04	Domestic	Not known	Open	Maintaining 150' Buffer
W05	Domestic	Not known	Cased	Maintaining 150' Buffer
W06	Domestic	Not known	Plugged	Maintaining 150' Buffer
W07	Domestic	Not known	Plugged	Maintaining 150' Buffer
W08	Domestic	Not known	Capped	Maintaining 150' Buffer
W09	Domestic	Not known	Capped	Maintaining 150' Buffer
W10	Domestic	Not known	Plugged	Maintaining 150' Buffer
W11	Domestic	Not known	Plugged	Maintaining 150' Buffer
W12	Domestic	Not known	Capped	Maintaining 150' Buffer
W13	Domestic	Not known	Cased	Maintaining 150' Buffer
W14	Domestic	Not known	Plugged	Maintaining 150' Buffer
W15	Domestic	Not known	Cased	Maintaining 150' Buffer
W16	Domestic	Not known	Cased	Plug Well
362785	Domestic	Y	Open	150' Buffer zone
502015	Domestic	Y	Open	150' Buffer zone
15374	Withdrawal of Water	N	Plugged	150' Buffer zone
560094	Irrigation	Y	Open	150' Buffer zone
347525	Closed-Loop Geothermal	Y	Open	150' Buffer zone
143916	Closed-Loop Geothermal	N	Plugged	150' Buffer zone
373942	Closed-Loop Geothermal	Y	Open	150' Buffer zone
222455	Withdrawal of Water	N	Plugged	150' Buffer zone
502232	Domestic	Y	Open	150' Buffer zone
548936	Domestic	Y	Open	150' Buffer zone
649902	Domestic	Y	Open	150' Buffer zone
392286	Domestic	Y	Open	150' Buffer zone
420513	Domestic	Y	Open	150' Buffer zone
413978	Domestic	Y	Open	150' Buffer zone
134337	Domestic	Y	Open	150' Buffer zone
442471	Domestic	Y	Open	150' Buffer zone
455750	Domestic	Y	Open	150' Buffer zone
417006	Domestic	Y	Open	150' Buffer zone
434434	Domestic	Y	Open	150' Buffer zone

443430	Domestic	Y	Open	150' Buffer zone
458760	Domestic	Y	Open	150' Buffer zone
591352	Domestic	Y	Open	150' Buffer zone
432104	Domestic	Y	Open	150' Buffer zone
432107	Domestic	Y	Open	150' Buffer zone
639435	Domestic	Y	Open	150' Buffer zone
532048	Domestic	Y	Open	150' Buffer zone
434429	Domestic	Y	Open	150' Buffer zone
5748608	Withdrawal of Water	Y	Open	150' Buffer zone
592565	Domestic	Y	Open	150' Buffer zone
442471	Domestic	Y	Open	150' Buffer zone
560057	Domestic	Y	Open	150' Buffer zone
500733	Domestic	Y	Open	150' Buffer zone
427648	Domestic	Y	Open	150' Buffer zone
592214	Domestic	Y	Open	150' Buffer zone
26963	Withdrawal of Water	N	Plugged	150' Buffer zone
578933	Irrigation	Y	Open	150' Buffer zone
502288	Irrigation	Y	Open	150' Buffer zone
457121	Domestic	Y	Open	150' Buffer zone
93198	Domestic	Y	Open	150' Buffer zone
5748607	Domestic	Y	Open	150' Buffer zone
93065	Withdrawal of Water	N	Plugged	150' Buffer zone
93515	Withdrawal of Water	N	Plugged	150' Buffer zone
93072	Withdrawal of Water	N	Plugged	150' Buffer zone

APPENDIX O

GROUNDWATER QUALITY TECHNICAL REPORT

DRAFT

GROUNDWATER QUALITY ASSESSMENT

FOR

TRAVIS COUNTY MUD NO. 22 WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT
MAJOR AMENDMENT

January 2025

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD, BUILDING II, SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

GROUNDWATER QUALITY ASSESSMENT

The purpose of this report is to assess the impact of the disposal of treated effluent on uses of local groundwater resources, as a part of the requirements of Title 30 of the Texas Administrative Code, Chapter 309, Subchapter C, Rule §309.20(a)(4). This report is provided as a supplement to the information included in the Domestic Worksheet 3.0, Section 7.

(A) All water wells within a mile radius of the disposal areas have been identified using the current Texas Water Development Board (TWDB) database. Where available, the uses of the wells have been identified. It should be noted that several of the wells labeled as public supply on the driller's logs appear to be for private use currently.

Water quality data is available for 5748608 and 5748607. A review of the water quality indicates a range of water quality in the area. The total dissolved solids values averaged approximately 1570.31 mg/L. Other values, including nitrate nitrogen solids values averaged 0.473 mg/L as NO3 and hardness was measured at 1233.19 mg/L as CACO3.

Based on the data for the driller's logs, the wells were tested between September 1st, 2023 and November 22nd, 2002. Given the similarity in data between the available water quality tests, it is reasonable to assume the water quality in this formation is generally similar for this area.
There are no anticipated impacts to the existing groundwater resources quality as a result of this proposed plan due to the measures required by rule and additional voluntary measures taken by the applicant to prevent effluent from reaching potential recharge areas. These include creek setbacks, weather stations to prevent irrigation during wet conditions and a reduced application rate.

(B) Groundwater resources serving as sources or potential sources of domestic raw water supply by limiting wastewater application rates. Application rates will be limited to the values calculated in the attached water balance. In addition, moisture sensors will be installed to allow for preventive warning of saturated conditions and prevent irrigation in this condition.

Treated effluent will be held in in an onsite storage tank until routed to the subsurface drip irrigation areas near the treatment plant.

Well Data

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5748607
County	Travis
River Basin	Colorado
Groundwater Management Area	9
Regional Water Planning Area	K - Lower Colorado
Groundwater Conservation District	Southwestern Travis County GCD
Latitude (decimal degrees)	30.2955444
Latitude (degrees minutes seconds)	30° 17' 43.96" N
Longitude (decimal degrees)	-98.03195
Longitude (degrees minutes seconds)	098° 01' 55.02" W
Coordinate Source	Global Positioning System - GPS
Aquifer Code	218GRLH - Glen Rose Limestone, Lower and Hensell Shale Mbr of Pearsall Formation
Aquifer	Trinity
Aquifer Pick Method	Provided by Groundwater Conservation District
Land Surface Elevation (feet above sea level)	1173
Land Surface Elevation Method	Digital Elevation Model -DEM
Well Depth (feet below land surface)	500
Well Depth Source	Other (see remarks)
Drilling Start Date	
Drilling End Date	
Drilling Method	
Borehole Completion	

Well Type	Withdrawal of Water
Well Use	Domestic
Water Level Observation	Miscellaneous Measurements
Water Quality Available	Yes
Pump	Submersible
Pump Depth (feet below land surface)	480
Power Type	Electric Motor
Annular Seal Method	
Surface Completion	
Owner	J J Priour
Driller	
Other Data Available	
Well Report Tracking Number	
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Groundwater Conservation District
Created Date	11/5/2018
Last Update Date	3/4/2020

Remarks	Well depth written on well house wall. Estimated flow rate 10 GPM.

Casing - No Data

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

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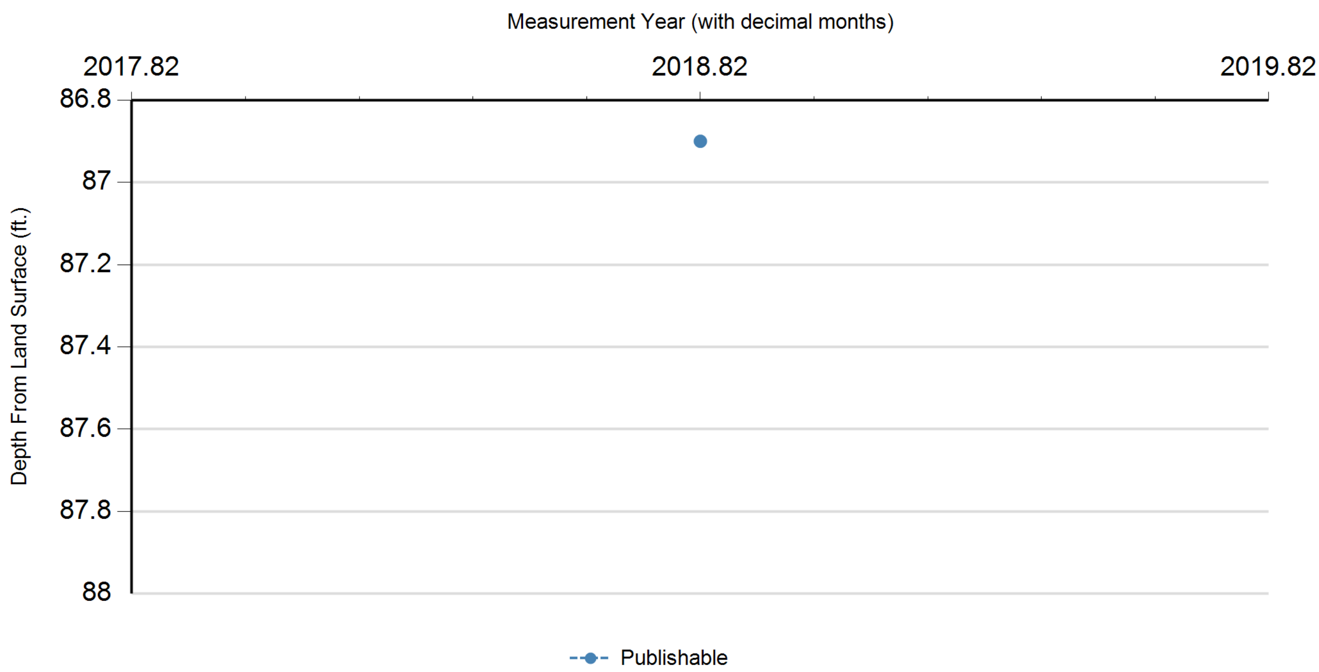
Water Level Measurements



Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	10/31/2018		86.9		1086.1	1	Groundwater Conservation District	Unknown		

Code Descriptions

Status Code	Status Description
P	Publishable

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Water Quality Analysis

Sample Date: 10/31/2018 **Sample Time:** 1558 **Sample Number:** 1 **Collection Entity:** Barton Springs/Edwards Aquifer CD

Sampled Aquifer: Glen Rose Limestone, Lower and Hensell Shale Mbr of Pearsall Formation

Analyzed Lab: LCRA - Lower Colorado River Authority **Reliability:** Sampled using TWDB protocols

Collection Remarks: Lab Calculated Anion/Cation Chg Bal set to TWDB Calculated Value due to an error in the lab calculated formula

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00425	ALKALINITY, BICARBONATE DISSOLVED (MG/L), LAB		282	mg/L	
00430	ALKALINITY, CARBONATE DISSOLVED (MG/L), LAB		0	mg/L	
00420	ALKALINITY, HYDROXIDE DISSOLVED (MG/L), LAB		0	mg/L	
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		282	mg/L as CACO3	
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	<	5	ug/L	
50938	ANION/CATION CHG BAL, PERCENT		2.9496	PCT	
01095	ANTIMONY, DISSOLVED (UG/L AS SB)	<	1	ug/L	
01000	ARSENIC, DISSOLVED (UG/L AS AS)	<	1	ug/L	
01005	BARIUM, DISSOLVED (UG/L AS BA)	<	1	ug/L	
01010	BERYLLIUM, DISSOLVED (UG/L AS BE)	<	1	ug/L	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		344.138	mg/L	
01020	BORON, DISSOLVED (UG/L AS B)	<	50	ug/L	
71870	BROMIDE, DISSOLVED, (MG/L AS BR)		0.0749	mg/L	
01025	CADMIUM, DISSOLVED (UG/L AS CD)	<	1	ug/L	
00915	CALCIUM, DISSOLVED (MG/L AS CA)		570	mg/L	
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00941	CHLORIDE, DISSOLVED (MG/L AS CL)		14.9	mg/L	
01030	CHROMIUM, DISSOLVED (UG/L AS CR)		1.58	ug/L	
01035	COBALT, DISSOLVED (UG/L AS CO)	<	1	ug/L	
01040	COPPER, DISSOLVED (UG/L AS CU)		2.63	ug/L	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		0.602	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		1669.421	mg/L as CACO3	
01046	IRON, DISSOLVED (UG/L AS FE)	<	50	ug/L	
01049	LEAD, DISSOLVED (UG/L AS PB)	<	1	ug/L	
01130	LITHIUM, DISSOLVED (UG/L AS LI)		26.1	ug/L	
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)		54.4	mg/L	
01056	MANGANESE, DISSOLVED (UG/L AS MN)	<	1	ug/L	
71890	MERCURY, DISSOLVED (UG/L AS HG)	<	0.2	ug/L	
01060	MOLYBDENUM, DISSOLVED (UG/L AS MO)		3.56	ug/L	

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		0.26	mg/L as NO3	
00631	NITRITE PLUS NITRATE, DISSOLVED (MG/L AS N)		0.0588	mg/L as N	
00666	PHOSPHORUS, DISSOLVED (MG/L AS P)	<	0.02	mg/L as P	
00935	POTASSIUM, DISSOLVED (MG/L AS K)		4.67	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
01145	SELENIUM, DISSOLVED (UG/L AS SE)	<	5	ug/L	
00955	SILICA, DISSOLVED (MG/L AS SI02)		13.5	mg/L as SIO2	
01075	SILVER, DISSOLVED (UG/L AS AG)	<	1	ug/L	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		0.093		
00932	SODIUM, CALCULATED, PERCENT		1.138	PCT	
00930	SODIUM, DISSOLVED (MG/L AS NA)		8.71	mg/L	
01080	STRONTIUM, DISSOLVED (UG/L AS SR)		19100	ug/L	
00946	SULFATE, DISSOLVED (MG/L AS SO4)		1240	mg/L as SO4	
01057	THALLIUM, DISSOLVED (UG/L AS TL)	<	1	ug/L	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		2095.355	mg/L	
22703	URANIUM, NATURAL, DISSOLVED (UG/L AS U)	<	1	ug/L	
01085	VANADIUM, DISSOLVED (UG/L AS V)	<	1	ug/L	
01090	ZINC, DISSOLVED (UG/L AS ZN)	<	5	ug/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

Texas Water Development Board (TWDB)
Groundwater Database (GWDB)
Well Information Report for State Well Number 57-48-608

GWDB Reports and Downloads

Well Basic Details

Scanned Documents

State Well Number	5748608
County	Travis
River Basin	Colorado
Groundwater Management Area	9
Regional Water Planning Area	K - Lower Colorado
Groundwater Conservation District	Southwestern Travis County GCD
Latitude (decimal degrees)	30.3081639
Latitude (degrees minutes seconds)	30° 18' 29.39" N
Longitude (decimal degrees)	-98.0161528
Longitude (degrees minutes seconds)	098° 00' 58.15" W
Coordinate Source	Global Positioning System - GPS
Aquifer Code	218HSCC - Hensell Sand and Cow Creek Limestone
Aquifer	Trinity
Aquifer Pick Method	Provided by Groundwater Conservation District
Land Surface Elevation (feet above sea level)	1126
Land Surface Elevation Method	Digital Elevation Model -DEM
Well Depth (feet below land surface)	630
Well Depth Source	Driller's Log
Drilling Start Date	12/16/2021
Drilling End Date	12/16/2021
Drilling Method	
Borehole Completion	

Well Type	Withdrawal of Water
Well Use	Domestic
Water Level Observation	GCD Current Sensor
Water Quality Available	Yes
Pump	Submersible
Pump Depth (feet below land surface)	600
Power Type	
Annular Seal Method	
Surface Completion	
Owner	John Burer
Driller	Centex Pump & Supply, Inc.
Other Data Available	Drillers Log
Well Report Tracking Number	592565
Plugging Report Tracking Number	
U.S. Geological Survey Site Number	
Texas Commission on Environmental Quality Source Id	
Groundwater Conservation District Well Number	
Owner Well Number	
Other Well Number	
Previous State Well Number	
Reporting Agency	Groundwater Conservation District
Created Date	8/25/2022
Last Update Date	11/20/2024

Remarks	

Casing - No Data

Well Tests - No Data

Lithology - No Data

Annular Seal Range - No Data

Borehole - No Data

Plugged Back - No Data

Filter Pack - No Data

Packers - No Data

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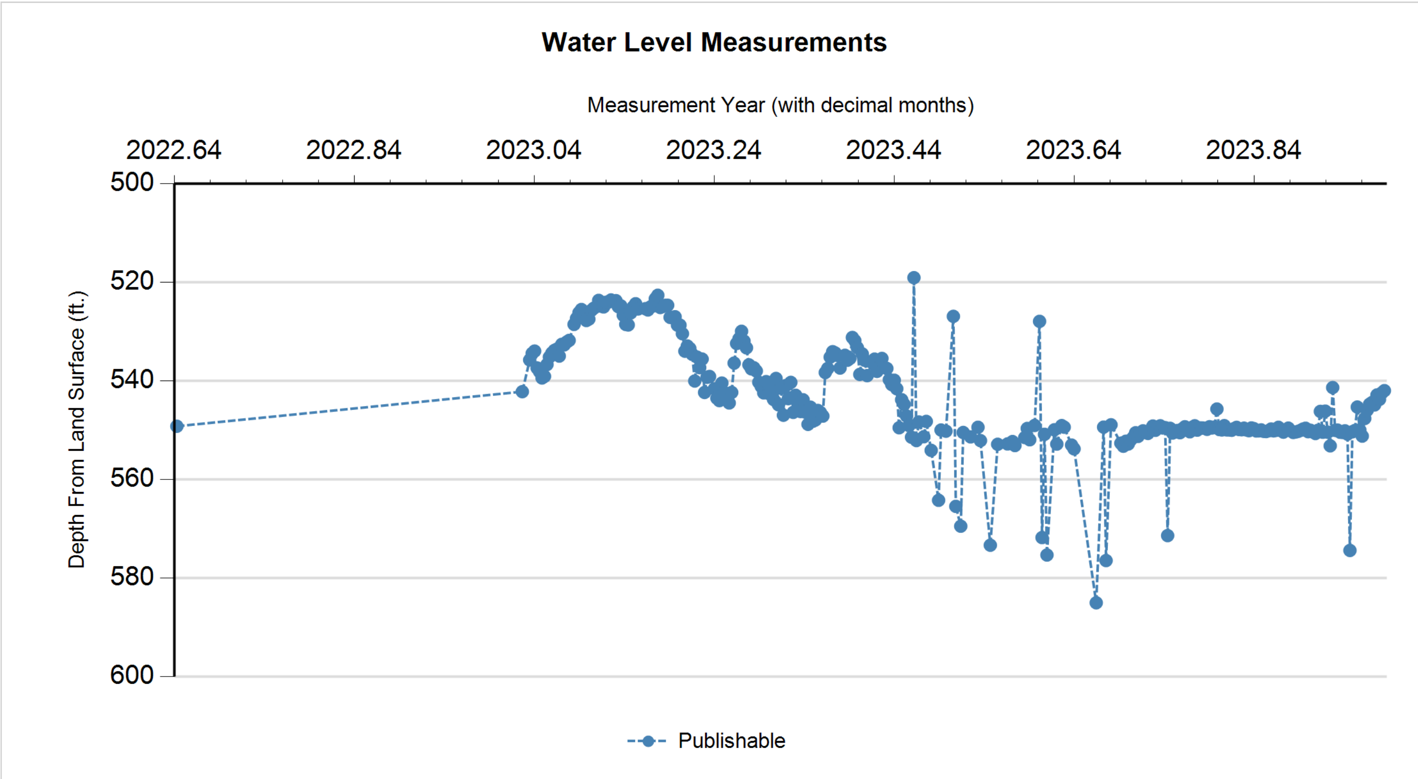

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	8/26/2022	1445	549.2		576.8	1	Groundwater Conservation District	Electric Line		
P	1/11/2023	1405	542.19	(7.01)	583.81	1	Groundwater Conservation District	Electric Line		
P	1/14/2023		535.76	(6.43)	590.24	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/15/2023		534.42	(1.34)	591.58	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/16/2023		533.96	(0.46)	592.04	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/17/2023		537.39	3.43	588.61	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/18/2023		538.13	0.74	587.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/19/2023		539.41	1.28	586.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/20/2023		539.09	(0.32)	586.91	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/21/2023		536.69	(2.40)	589.31	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	1/22/2023		535.17	(1.52)	590.83	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/23/2023		534.36	(0.81)	591.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/24/2023		533.83	(0.53)	592.17	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/25/2023		533.59	(0.24)	592.41	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/26/2023		534.97	1.38	591.03	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/27/2023		532.6	(2.37)	593.4	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/28/2023		532.7	0.10	593.3	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/29/2023		532.13	(0.57)	593.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	1/30/2023		531.8	(0.33)	594.2	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/2/2023		528.55	(3.25)	597.45	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/3/2023		527.34	(1.21)	598.66	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/4/2023		526.18	(1.16)	599.82	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/5/2023		525.53	(0.65)	600.47	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/6/2023		526.65	1.12	599.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/7/2023		527.76	1.11	598.24	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/8/2023		527.49	(0.27)	598.51	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/9/2023		525.71	(1.78)	600.29	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/10/2023		525.28	(0.43)	600.72	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/12/2023		523.6[illegible]	(1.60)	602.32	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	2/13/2023		524.86	1.18	601.14	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/14/2023		525.01	0.15	600.99	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/15/2023		524.07	(0.94)	601.93	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/16/2023		524.02	(0.05)	601.98	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/17/2023		523.6	(0.42)	602.4	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/19/2023		523.74	0.14	602.26	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/20/2023		524.96	1.22	601.04	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/21/2023		524.79	(0.17)	601.21	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/22/2023		526.72	1.93	599.28	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/23/2023		528.56	1.84	597.44	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/24/2023		528.66	0.10	597.34	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/25/2023		526.23	(2.43)	599.77	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/26/2023		525.02	(1.21)	600.98	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/27/2023		524.36	(0.66)	601.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	2/28/2023		525.42	1.06	600.58	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/1/2023		525.37	(0.05)	600.63	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/2/2023		525.62	0.25	600.38	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/3/2023		525.01	(0.61)	600.99	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/4/2023		524.82	(0.19)	601.18	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	3/5/2023		523.35	(1.47)	602.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/6/2023		522.65	(0.70)	603.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/7/2023		525.13	2.48	600.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/8/2023		524.93	(0.20)	601.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/9/2023		524.68	(0.25)	601.32	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/10/2023		524.67	(0.01)	601.33	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/11/2023		527.12	2.45	598.88	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/12/2023		527.2	0.08	598.8	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/13/2023		527	(0.20)	599	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/14/2023		528.7	1.70	597.3	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/15/2023		528.7	0.00	597.3	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/16/2023		530.44	1.74	595.56	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/17/2023		533.98	3.54	592.02	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/18/2023		532.93	(1.05)	593.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/19/2023		533.43	0.50	592.57	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/20/2023		534.62	1.19	591.38	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/21/2023		540.03	5.41	585.97	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/22/2023		535.2	(4.83)	590.8	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/23/2023		537.3[illegible]	[illegible].12	588.68	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	3/24/2023		535.58	(1.74)	590.42	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/25/2023		542.35	6.77	583.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/26/2023		539.27	(3.08)	586.73	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/27/2023		539.11	(0.16)	586.89	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/29/2023		541.6	2.49	584.4	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	3/30/2023		543.52	1.92	582.48	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/1/2023		544	0.48	582	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/2/2023		540.45	(3.55)	585.55	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/3/2023		542.36	1.91	583.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/4/2023		542.81	0.45	583.19	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/5/2023		544.48	1.67	581.52	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/6/2023		542.35	(2.13)	583.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/7/2023		536.4	(5.95)	589.6	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/8/2023		532.42	(3.98)	593.58	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/9/2023		531.44	(0.98)	594.56	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/10/2023		529.95	(1.49)	596.05	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/11/2023		531.93	1.98	594.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/12/2023		533.3	1.37	592.7	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/13/2023		[illegible]	[illegible]	589.25	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	4/14/2023		537.57	0.82	588.43	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/15/2023		537.35	(0.22)	588.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/16/2023		538	0.65	588	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/17/2023		540.28	2.28	585.72	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/18/2023		541.14	0.86	584.86	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/19/2023		542.43	1.29	583.57	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/20/2023		540.16	(2.27)	585.84	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/21/2023		542.55	2.39	583.45	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/22/2023		541.64	(0.91)	584.36	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/23/2023		543.78	2.14	582.22	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/24/2023		539.51	(4.27)	586.49	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/25/2023		544.85	5.34	581.15	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/26/2023		541.47	(3.38)	584.53	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/27/2023		546.96	5.49	579.04	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/28/2023		540.94	(6.02)	585.06	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/29/2023		543.61	2.67	582.39	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	4/30/2023		540.31	(3.30)	585.69	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/1/2023		546.39	6.08	579.61	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/2/2023		542.93	(3.46)	583.07	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	5/3/2023		544.93	2.00	581.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/4/2023		546.22	1.29	579.78	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/5/2023		543.84	(2.38)	582.16	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/6/2023		546.35	2.51	579.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/7/2023		548.81	2.46	577.19	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/8/2023		545.34	(3.47)	580.66	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/9/2023		548.18	2.84	577.82	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/10/2023		547.93	(0.25)	578.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/11/2023		546	(1.93)	580	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/12/2023		546.4	0.40	579.6	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/13/2023		547.14	0.74	578.86	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/14/2023		538.31	(8.83)	587.69	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/15/2023		537.48	(0.83)	588.52	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/16/2023		535.19	(2.29)	590.81	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/17/2023		534.09	(1.10)	591.91	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/18/2023		534.33	0.24	591.67	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/19/2023		534.86	0.53	591.14	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/20/2023		537.4	2.54	588.6	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/22/2023		534.82	(2.58)	591.18	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	5/23/2023		535.82	1.00	590.18	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/24/2023		535.45	(0.37)	590.55	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/25/2023		531.2	(4.25)	594.8	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/26/2023		531.85	0.65	594.15	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/27/2023		533.26	1.41	592.74	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/28/2023		538.69	5.43	587.31	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/29/2023		534.53	(4.16)	591.47	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/30/2023		535.83	1.30	590.17	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	5/31/2023		538.94	3.11	587.06	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/1/2023		534.04	(4.90)	591.96	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/3/2023		536.29	2.25	589.71	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/4/2023		535.6	(0.69)	590.4	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/5/2023		538.07	2.47	587.93	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/6/2023		537.27	(0.80)	588.73	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/7/2023		535.45	(1.82)	590.55	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/8/2023		537.25	1.80	588.75	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/9/2023		537.49	0.24	588.51	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/10/2023		539.77	2.28	586.23	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/11/2023		540.76	0.99	585.24	1	Groundwater Conservation District	Continuous Acoustic Technology		

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Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	6/12/2023		539.87	(0.89)	586.13	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/13/2023		541.59	1.72	584.41	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/14/2023		549.5	7.91	576.5	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/15/2023		543.82	(5.68)	582.18	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/16/2023		544.76	0.94	581.24	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/17/2023		547.12	2.36	578.88	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/18/2023		549.06	1.94	576.94	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/19/2023		551.42	2.36	574.58	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/20/2023		519.08	(32.34)	606.92	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/21/2023		552.1	33.02	573.9	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/22/2023		548.33	(3.77)	577.67	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/24/2023		551.33	3.00	574.67	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/25/2023		548.22	(3.11)	577.78	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/27/2023		554.09	5.87	571.91	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	6/30/2023		564.21	10.12	561.79	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/1/2023		549.97	(14.24)	576.03	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/3/2023		550.2	0.23	575.8	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/6/2023		526.92	(23.28)	599.08	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/7/2023		565.4[illegible]	3[illegible].52	560.56	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	7/9/2023		569.46	4.02	556.54	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/10/2023		550.47	(18.99)	575.53	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/13/2023		551.36	0.89	574.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/16/2023		549.41	(1.95)	576.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/17/2023		552.11	2.70	573.89	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/21/2023		573.32	21.21	552.68	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/24/2023		552.86	(20.46)	573.14	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/28/2023		552.79	(0.07)	573.21	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/30/2023		552.31	(0.48)	573.69	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	7/31/2023		553.11	0.80	572.89	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/5/2023		551.49	(1.62)	574.51	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/6/2023		549.65	(1.84)	576.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/7/2023		551.94	2.29	574.06	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/9/2023		549.04	(2.90)	576.96	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/11/2023		527.93	(21.11)	598.07	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/12/2023		571.77	43.84	554.23	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/13/2023		550.84	(20.93)	575.16	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/14/2023		575.3	24.46	550.7	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/17/2023		549.92	(25.38)	576.08	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	8/18/2023		552.82	2.90	573.18	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/20/2023		549.07	(3.75)	576.93	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/21/2023		549.39	0.32	576.61	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/24/2023		553.02	3.63	572.98	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	8/25/2023		553.78	0.76	572.22	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/4/2023		584.99	31.21	541.01	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/7/2023		549.38	(35.61)	576.62	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/8/2023		576.43	27.05	549.57	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/10/2023		548.91	(27.52)	577.09	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/14/2023		552.64	3.73	573.36	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/15/2023		553.25	0.61	572.75	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/16/2023		552.25	(1.00)	573.75	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/17/2023		552.8	0.55	573.2	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/18/2023		551.97	(0.83)	574.03	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/19/2023		551.47	(0.50)	574.53	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/20/2023		550.52	(0.95)	575.48	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/21/2023		551.25	0.73	574.75	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/22/2023		550.65	(0.60)	575.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/23/2023		[illegible]	(0.52)	575.87	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	9/24/2023		550.43	0.30	575.57	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/25/2023		550.65	0.22	575.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/26/2023		549.96	(0.69)	576.04	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/27/2023		549.16	(0.80)	576.84	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/28/2023		550.03	0.87	575.97	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/29/2023		549.33	(0.70)	576.67	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	9/30/2023		549.11	(0.22)	576.89	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/1/2023		549.55	0.44	576.45	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/2/2023		549.49	(0.06)	576.51	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/3/2023		571.37	21.88	554.63	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/4/2023		549.62	(21.75)	576.38	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/5/2023		550.57	0.95	575.43	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/6/2023		550.37	(0.20)	575.63	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/7/2023		550.06	(0.31)	575.94	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/8/2023		550.51	0.45	575.49	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/9/2023		549.71	(0.80)	576.29	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/10/2023		549.31	(0.40)	576.69	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/11/2023		549.65	0.34	576.35	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/1[illegible]/202[illegible]		[illegible]50.3[illegible]	[illegible].67	575.68	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	10/13/2023		549.41	(0.91)	576.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/14/2023		549.11	(0.30)	576.89	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/15/2023		549.99	0.88	576.01	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/16/2023		549.54	(0.45)	576.46	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/17/2023		549.54	0.00	576.46	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/18/2023		549.62	0.08	576.38	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/19/2023		549.82	0.20	576.18	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/20/2023		549.3	(0.52)	576.7	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/21/2023		549.55	0.25	576.45	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/22/2023		549.36	(0.19)	576.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/23/2023		545.71	(3.65)	580.29	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/24/2023		549.87	4.16	576.13	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/25/2023		549.95	0.08	576.05	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/26/2023		549.08	(0.87)	576.92	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/27/2023		549.94	0.86	576.06	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/28/2023		549.94	0.00	576.06	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/29/2023		550.01	0.07	575.99	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/30/2023		549.67	(0.34)	576.33	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	10/3[illegible]/202[illegible]		[illegible]49.[illegible]	([illegible]24)	576.57	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	11/1/2023		549.54	0.11	576.46	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/2/2023		549.86	0.32	576.14	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/3/2023		549.91	0.05	576.09	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/4/2023		549.59	(0.32)	576.41	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/5/2023		549.95	0.36	576.05	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/6/2023		550.1	0.15	575.9	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/7/2023		549.55	(0.55)	576.45	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/8/2023		549.68	0.13	576.32	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/9/2023		550.16	0.48	575.84	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/10/2023		550.13	(0.03)	575.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/11/2023		549.95	(0.18)	576.05	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/12/2023		550.23	0.28	575.77	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/13/2023		550.26	0.03	575.74	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/14/2023		550.12	(0.14)	575.88	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/15/2023		549.76	(0.36)	576.24	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/16/2023		550.13	0.37	575.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/17/2023		550.04	(0.09)	575.96	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/18/2023		549.42	(0.62)	576.58	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/19/2023		550.06	0.64	575.94	1	Groundwater Conservation District	Continuous Acoustic Technology		

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P	11/20/2023		550.39	0.33	575.61	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/21/2023		550.06	(0.33)	575.94	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/22/2023		549.58	(0.48)	576.42	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/23/2023		550.1	0.52	575.9	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/24/2023		550.46	0.36	575.54	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/25/2023		550.36	(0.10)	575.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/26/2023		550.23	(0.13)	575.77	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/27/2023		550.03	(0.20)	575.97	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/28/2023		549.77	(0.26)	576.23	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/29/2023		549.61	(0.16)	576.39	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	11/30/2023		550.3	0.69	575.7	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/1/2023		550.02	(0.28)	575.98	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/2/2023		550.35	0.33	575.65	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/3/2023		550.67	0.32	575.33	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/4/2023		550.03	(0.64)	575.97	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/5/2023		546.19	(3.84)	579.81	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/6/2023		550.41	4.22	575.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/7/2023		546.14	(4.27)	579.86	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/8/2023		550.4[illegible]	[illegible].27	575.59	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	12/9/2023		553.17	2.76	572.83	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/10/2023		541.36	(11.81)	584.64	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/11/2023		550.04	8.68	575.96	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/12/2023		549.99	(0.05)	576.01	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/13/2023		550.41	0.42	575.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/14/2023		550.46	0.05	575.54	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/15/2023		550.13	(0.33)	575.87	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/16/2023		550.79	0.66	575.21	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/17/2023		574.38	23.59	551.62	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/18/2023		550.32	(24.06)	575.68	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/19/2023		550.07	(0.25)	575.93	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/20/2023		545.31	(4.76)	580.69	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/21/2023		549.95	4.64	576.05	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/22/2023		551.2	1.25	574.8	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/23/2023		547.63	(3.57)	578.37	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/24/2023		545.96	(1.67)	580.04	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/25/2023		544.72	(1.24)	581.28	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/26/2023		544.38	(0.34)	581.62	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/2[illegible]/202[illegible]		[illegible]44.8[illegible]	[illegible].50	581.12	1	Groundwater Conservation District	Continuous Acoustic Technology		

Status Code	Date	Time	Water Level (ft. below land surface)	Change value in ( ) indicates rise in level	Water Elevation (ft. above sea level)	Meas #	Measuring Agency	Method	Remark ID	Comments
P	12/28/2023		542.86	(2.02)	583.14	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/29/2023		543.76	0.90	582.24	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/30/2023		542.41	(1.35)	583.59	1	Groundwater Conservation District	Continuous Acoustic Technology		
P	12/31/2023		541.98	(0.43)	584.02	1	Groundwater Conservation District	Continuous Acoustic Technology		

Code Descriptions

Status Code	Status Description
P	Publishable

Texas Water Development Board (TWDB) Groundwater Database (GWDB) Well Information Report for State Well Number 57-48-608

Water Quality Analysis

Sample Date: 8/26/2022 **Sample Time:** 1535 **Sample Number:** 1 **Collection Entity:** Groundwater Conservation District (general)

Sampled Aquifer: Hensell Sand and Cow Creek Limestone

Analyzed Lab: LCRA - Lower Colorado River Authority **Reliability:** Sampled using TWDB protocols

Collection Remarks: Sampled by Southwestern Travis Co. GCD

Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
00425	ALKALINITY, BICARBONATE DISSOLVED (MG/L), LAB		355	mg/L	
00430	ALKALINITY, CARBONATE DISSOLVED (MG/L), LAB		0	mg/L	
00420	ALKALINITY, HYDROXIDE DISSOLVED (MG/L), LAB		0	mg/L	
00415	ALKALINITY, PHENOLPHTHALEIN (MG/L)		0	mg/L	
00410	ALKALINITY, TOTAL (MG/L AS CACO3)		355	mg/L as CACO3	
01106	ALUMINUM, DISSOLVED (UG/L AS AL)	<	5	ug/L	
50938	ANION/CATION CHG BAL, PERCENT		-2.15	PCT	
01095	ANTIMONY, DISSOLVED (UG/L AS SB)	<	1	ug/L	
01000	ARSENIC, DISSOLVED (UG/L AS AS)	<	1	ug/L	
01005	BARIUM, DISSOLVED (UG/L AS BA)		24.7	ug/L	
01010	BERYLLIUM, DISSOLVED (UG/L AS BE)	<	1	ug/L	
00440	BICARBONATE ION, CALCULATED (MG/L AS HCO3)		433.223	mg/L	
01020	BORON, DISSOLVED (UG/L AS B)		241	ug/L	
71870	BROMIDE, DISSOLVED, (MG/L AS BR)		0.0949	mg/L	
01025	CADMIUM, DISSOLVED (UG/L AS CD)	<	1	ug/L	
00915	CALCIUM, DISSOLVED (MG/L AS CA)		169	mg/L	
28004	CARBON-14 DISS APPARENT AGE (YEARS BP)		15540	Y-BP	
82172	CARBON-14 FRACTION MODERN		0.1445		0.0007
00445	CARBONATE ION, CALCULATED (MG/L AS CO3)		0	mg/L	
00941	CHLORIDE, DISSOLVED (MG/L AS CL)		17.3	mg/L	
01030	CHROMIUM, DISSOLVED (UG/L AS CR)		1.37	ug/L	
01035	COBALT, DISSOLVED (UG/L AS CO)	<	1	ug/L	
01040	COPPER, DISSOLVED (UG/L AS CU)	<	1	ug/L	
82081	DELTA CARBON 13 C13/C12 PER MIL		-0.5	0/00	
50791	DEUTERIUM, EXPRESSED AS PERMIL VSMOW		-25.95	0/00	
00950	FLUORIDE, DISSOLVED (MG/L AS F)		2.46	mg/L	
00900	HARDNESS, TOTAL, CALCULATED (MG/L AS CACO3)		796.97	mg/L as CACO3	
01046	IRON, DISSOLVED (UG/L AS FE)	<	50	ug/L	
01049	LEAD, DISSOLVED (UG/L AS PB)	<	1	ug/L	
01130	LITHIUM, DISSOLVED (UG/L AS LI)		55.7	ug/L	
00925	MAGNESIUM, DISSOLVED (MG/L AS MG)		83.1	mg/L	

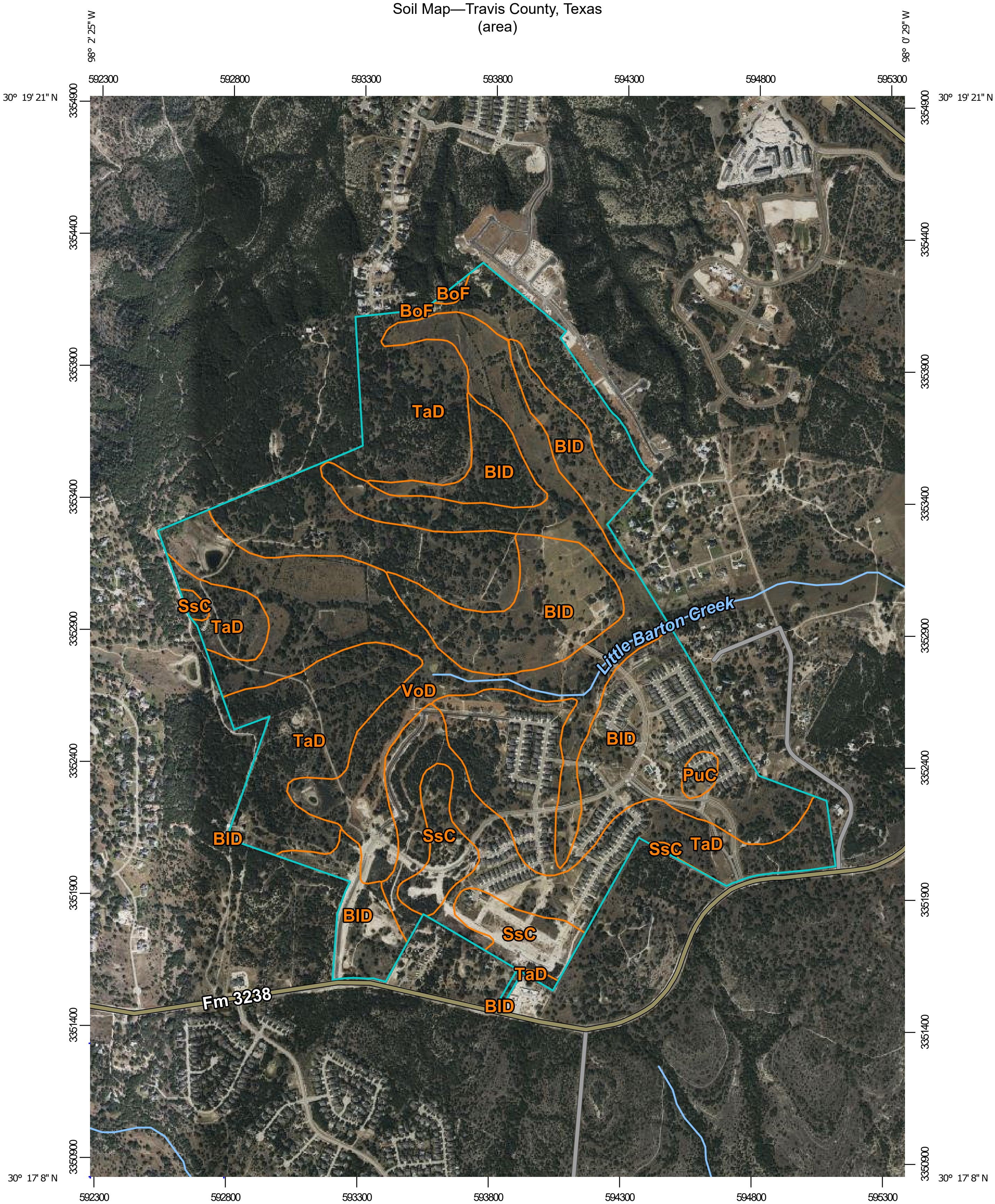
Parameter Code	Parameter Description	Flag	Value*	Units	Plus/Minus
01056	MANGANESE, DISSOLVED (UG/L AS MN)	<	1	ug/L	
71890	MERCURY, DISSOLVED (UG/L AS HG)	<	0.2	ug/L	
01060	MOLYBDENUM, DISSOLVED (UG/L AS MO)		7.48	ug/L	
71851	NITRATE NITROGEN, DISSOLVED, CALCULATED (MG/L AS NO3)		0.686	mg/L as NO3	
00631	NITRITE PLUS NITRATE, DISSOLVED (MG/L AS N)		0.155	mg/L as N	
50790	OXYGEN-18, EXPRESSED AS PERMIL VSMOW		-4.84	0/00	
00400	PH (STANDARD UNITS), FIELD		6.51	SU	
00666	PHOSPHORUS, DISSOLVED (MG/L AS P)	<	0.02	mg/L as P	
00935	POTASSIUM, DISSOLVED (MG/L AS K)		10.1	mg/L	
71860	RESIDUAL SODIUM CARBONATE, CALCULATED		0		
01145	SELENIUM, DISSOLVED (UG/L AS SE)	<	5	ug/L	
00955	SILICA, DISSOLVED (MG/L AS SI02)		10.7	mg/L as SIO2	
01075	SILVER, DISSOLVED (UG/L AS AG)	<	1	ug/L	
00931	SODIUM ADSORPTION RATIO, CALCULATED (SAR)		0.351		
00932	SODIUM, CALCULATED, PERCENT		5.973	PCT	
00930	SODIUM, DISSOLVED (MG/L AS NA)		22.3	mg/L	
00094	SPECIFIC CONDUCTANCE, FIELD (UMHOS/CM AT 25C)		1600	MICR	
01080	STRONTIUM, DISSOLVED (UG/L AS SR)		28600	ug/L	
48297	STRONTIUM, ISOTOPE OF MASS 86 AND 87 RATIO		0.70751	N/A	0.0008
00946	SULFATE, DISSOLVED (MG/L AS SO4)		488	mg/L as SO4	
00010	TEMPERATURE, WATER (CELSIUS)		27.9	C	
01057	THALLIUM, DISSOLVED (UG/L AS TL)	<	1	ug/L	
70301	TOTAL DISSOLVED SOLIDS , SUM OF CONSTITUENTS (MG/L)		1045.262	mg/L	
07012	TRITIUM IN WATER (TRITIUM UNITS)		0.17	TU	0.09
22703	URANIUM, NATURAL, DISSOLVED (UG/L AS U)		1.2	ug/L	
01085	VANADIUM, DISSOLVED (UG/L AS V)	<	1	ug/L	
01090	ZINC, DISSOLVED (UG/L AS ZN)	<	5	ug/L	

** Value may not display all significant digits for parameter in results, check Scanned Documents for laboratory paperwork..*

APPENDIX P

USDA SOIL SURVEY AND SOIL ANALYSIS

Soil Map—Travis County, Texas
(area)



DRAFT

Map Scale: 1:20,000 if printed on A portrait (8.5" x 11") sheet.

0 250 500 1000 1500 Meters

0 500 1000 2000 3000 Feet

N

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 14N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Map Unit Polygons

Soil Map Unit Lines

Soil Map Unit Points

Special Point Features

Blowout

Borrow Pit

Clay Spot

Closed Depression

Gravel Pit

Gravelly Spot

Landfill

Lava Flow

Marsh or swamp

Mine or Quarry

Miscellaneous Water

Perennial Water

Rock Outcrop

Saline Spot

Sandy Spot

Severely Eroded Spot

Sinkhole

Slide or Slip

Sodic Spot

Spoil Area

Stony Spot

Very Stony Spot

Wet Spot

Other

Special Line Features

Water Features

Streams and Canals

Transportation

Rails

Interstate Highways

US Routes

Major Roads

Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Travis County, Texas
Survey Area Data: Version 26, Aug 30, 2024

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Nov 15, 2020—Oct 21, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BID	Brackett-Rock outcrop complex, 1 to 12 percent slopes	281.7	30.5%
BoF	Brackett-Rock outcrop-Real complex, 8 to 30 percent slopes	1.4	0.2%
PuC	Purves clay, 1 to 5 percent slopes	4.5	0.5%
SsC	Speck clay loam, moist, 1 to 5 percent slopes, stony	44.6	4.8%
TaD	Eckrant very stony clay, 5 to 18 percent slopes	366.8	39.7%
VoD	Volente silty clay loam, 1 to 8 percent slopes	225.7	24.4%
Totals for Area of Interest		**924.7**	**100.0%**

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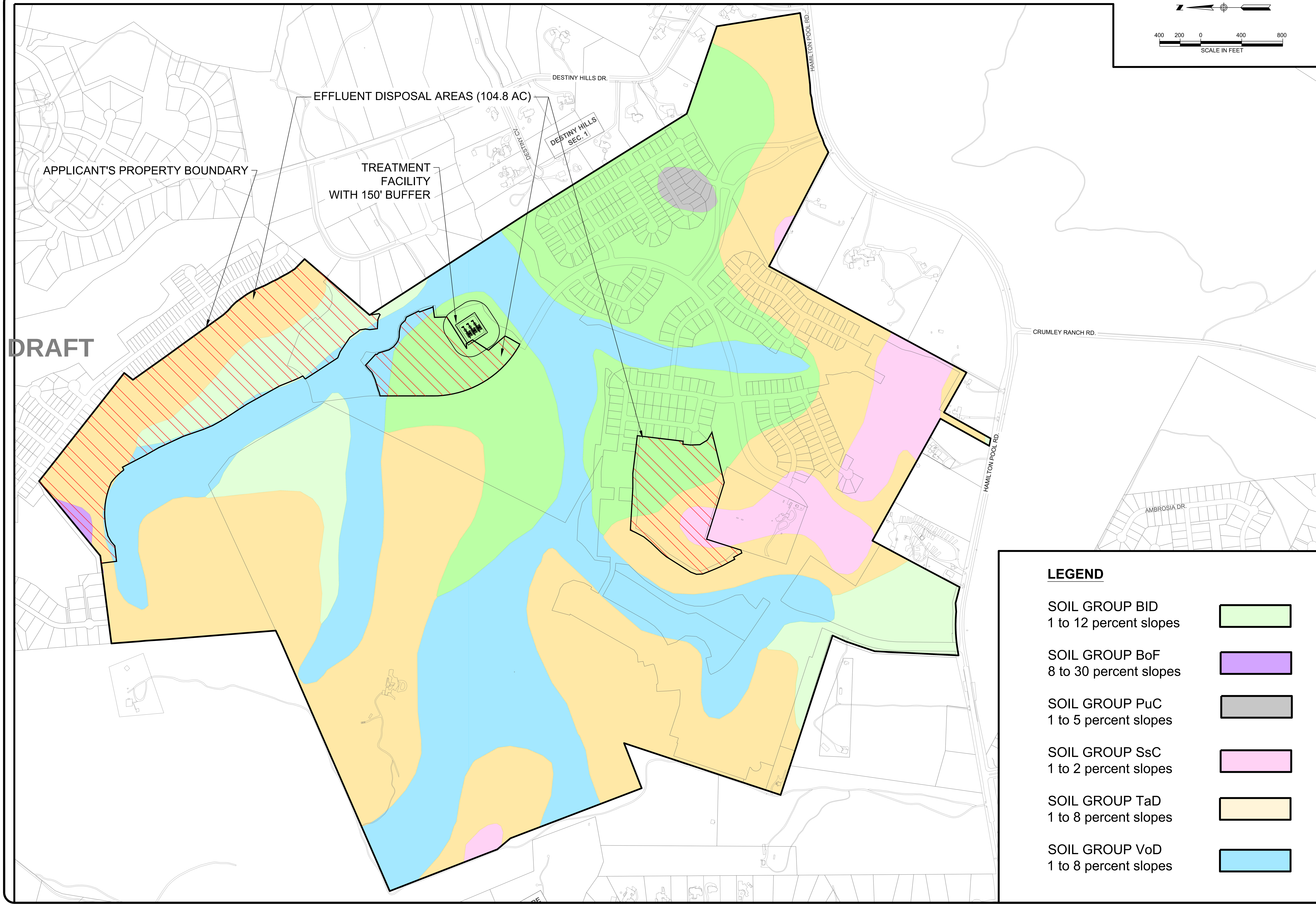

SOIL MAP

TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

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APPENDIX Q

RECHARGE FEATURE PLAN

RECHARGE FEATURE PLAN

FOR

TRAVIS COUNTY MUNICIPAL UTILITY DISTRICT NO. 22
WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT
MAJOR AMENDMENT

JANUARY 2025

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD. BUILDING II SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

RECHARGE FEATURE PLAN

The purpose of this report is to document the presence of any recharge features on any tracts of land owned, operated, controlled, rented, or leased by the applicant and to be used as a part of the facility to satisfy the requirements of Title 30 of the Texas Administrative Code, Chapter 222, Subchapter C, Rule §222.79.

(1) The following recharge features, as defined in 30 TAC Chapter 222.5 were identified on land owned, operated, controlled, rented, or leased by the applicant and proposed to be used as a part of the facility. Due to the location of the project on the Glen Rose Formation, which functions as a recharge zone for the Middle Trinity Aquifer, typically through creek bottoms; existing water courses, including stock ponds are considered recharge features. Existing water wells are considered artificial recharge features.

The watercourses located within and around the project connect directly to Little Barton Creek, with the exception of one minor drainage way to the south which is located in the Barton Creek watershed, and a small area to the north which drains to Bee Creek and ultimately to Lake Travis.

(2) The following sources were used to document the presence of natural and artificial recharge features on the applicant's property:

A. Railroad Commission of Texas

The Railroad Commission of Texas online Public GIS Map Viewer was used to search for artificial recharge features (gas wells). No artificial recharge features were found through this search except existing water wells, as shown on the attached map (Appendix A).

B. A groundwater conservation district

Not applicable.

C. Texas Water Development Board

The locations of all water wells within one mile of the site were located using the Texas Water Development Board's Water Information Integration and Dissemination (WIID) GIS database. Well information is included as Appendix M to the Supplemental Technical Report. The well locations are shown on the USGS map presented as Appendix M to the Supplemental Technical Report.

D. Texas Commission on Environmental Quality

Per our conversations with TCEQ staff, there are no maps produced by TCEQ that would show the presence of any recharge features on the applicant's site. The site is located within the recharge zone for the Trinity Aquifer.

LJA also reviewed the paper well logs stored at TCEQ Central Records. Wells located within a one mile radius of the disposal site are shown on the USGS map presented as Appendix M to the Supplemental Technical Report.

E. Natural Resources Conservation Service

A map showing the NRCS soil types for the proposed irrigation areas is presented as Appendix O to the Supplemental Technical Report.

F. Previous owner of the site, if available

John Hatchett, the current owner of the site, identified a number of wells that were not listed in any public data source. These wells were identified on Appendix M. John Hatchett and his wife, Sandra Hatchett, purchased the initial 517 acre tract in 1998, adding various adjacent smaller tracts in subsequent years and constructing a personal residence in 2001.

G. On-site inspection

No direct recharge features were found during onsite inspections by LJA Engineering, Inc. and WWD Engineering.

Because the site overlies the Glen Rose Formation, which is a recharge zone for the Trinity Aquifer, watercourses including the existing ponds are treated as potential recharge features as defined in 30 TAC 222.5.

The only exposed limestone located on-site was within the abandoned quarry, which does not have any means of draining and will be filled in as part of the development plan. This quarry pit is not located within any proposed irrigation areas.

(3) A narrative description of the site-specific geology and groundwater at the facility is provided below:

A. The proposed project is located west of the intersection of Highway 71 and Hamilton Pool Road and is underlain by the Glen Rose Formation. This Cretaceous formation is composed of alternating layers of hard limestone and soft marl which typically erode into a stairstep topography. Two soil units are mapped within the proposed project area on Sheet 13 of the Travis County soil survey dated June, 1974. The uplands areas are generally gently rolling Tarrant and Brackett soils, while the valley areas are Volente series soils. Tarrant soils generally are very shallow, well-drained stony clayey soils overlying limestone. Brackett soils are generally shallow clay loam, well drained soils overlying limestone. Volente soils (VoD) are generally deep, well drained soils developed in slope alluvium.
The project location is situated on the Llano Sheet of the Geologic Atlas of Texas published by the University of Texas at Austin, Bureau of Economic Geology.

A copy of TWDB Report 377 Groundwater Availability Model: Hill Country Portion of the Trinity Aquifer of Texas, is also enclosed as it is the most recent study of the Trinity Aquifer underlying the project, having been published in 2011. This report identifies recharge to the Middle Trinity from stream beds located within the study area. The study also indicates that hydraulic conductivity is greater over the Balcones Fault Zone compared to the rest of the aquifer system. This project is located outside the Fault Zone. The Middle Trinity Aquifer is generally located between elevation 640 ft-msl and 900 ft-msl in this area. Overall, the model indicated a recharge rate of 3.5 percent for the aquifer outside the Balcones Fault Zone (page 158, TWDB Report 377).

B. Depth to groundwater is approximately 420', based on well driller reports. This matches the levels predicted by the TWDB Report 377.

C. Groundwater generally flows downdip southeast and east in this area. See Figure 5-9 from TWDB Report 377 attached.

D. The only known uses for groundwater are the existing domestic water wells shown on the attached USGS map (Appendix M to the Supplemental Technical Report).

E. Well drillers' logs and water quality data are included as Appendix M to the Supplemental Technical Report.

(4) Measures to prevent impact to groundwater include:

A. Protective Measures:

a. All wells, except W01 and W16 (1 Mile Radius Map), will be protected with a 150' minimum buffer. Wells W01 and W16 will be capped and plugged as they are located within proposed drip irrigation areas.

b. Stream buffers will be provided from watercourses which could convey runoff to Little Barton Creek. Drainage ways draining between 5 and 40 acres will have a 25 foot buffer from the stream centerline, those draining between 40 and 128 acres will have a 50 foot buffer from the stream centerline, those draining between 128 and 320 acres will have a buffer of 100 feet from the stream centerline, those draining between 320 and 640 acres will have a buffer of 200 feet from the stream centerline, and those draining over 640 acres will have a buffer of 300 feet from the stream centerline.

The proposed buffers for the majority of the waterways on the project exceed what would normally be required (100 feet minimum for all drainage ways labeled on a USGS map). For example, the buffers from Little Barton Creek are 300 feet.

c. The proposed drip irrigation fields have been located to minimize the opportunities for stormwater to run on to the fields; however, berms to prevent run-on of stormwater will be located along the perimeter of fields where there is localized upstream drainage.

d. Existing off-channel stock ponds that are located within the proposed irrigation areas will be filled in to ensure there are no opportunities for ponding of stormwater over the field.

B. The combination of run-on control and moisture monitoring in the drip system will prevent any runoff of effluent. No direct recharge features were located on the applicant's property, and a review of available literature on groundwater in the area indicates recharge through surface runoff is minimal in this area. With this in mind, and with the safeguards proposed above, a groundwater monitoring plan is not provided.

Appendix A

Texas Railroad Commission Map

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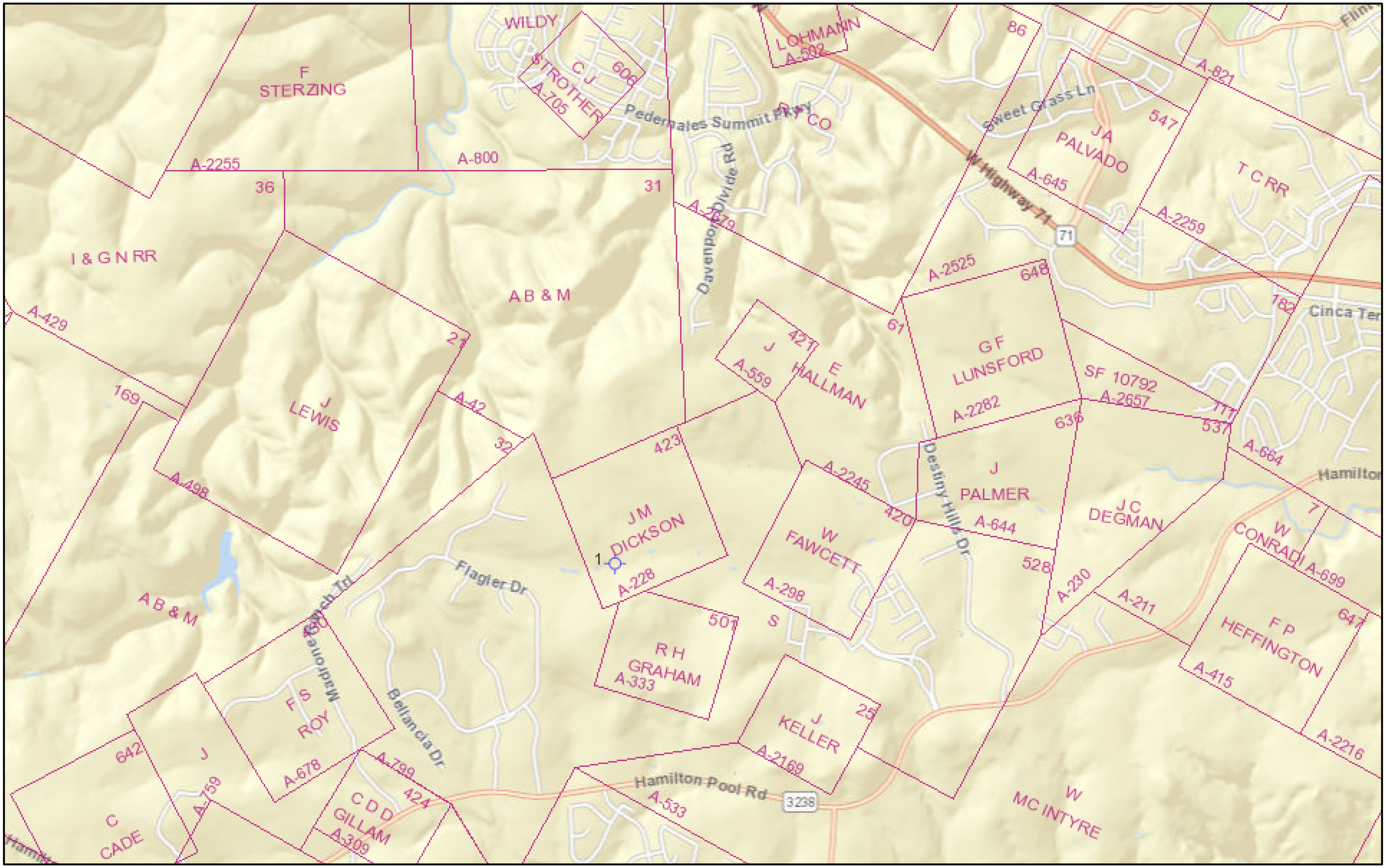


January 20, 2025

1:36,112

0 0.28 0.55 1.1 mi

0 0.42 0.85 1.7 km

Esri, HERE, Garmin, INCREMENT P, NGA, USGS

Appendix B

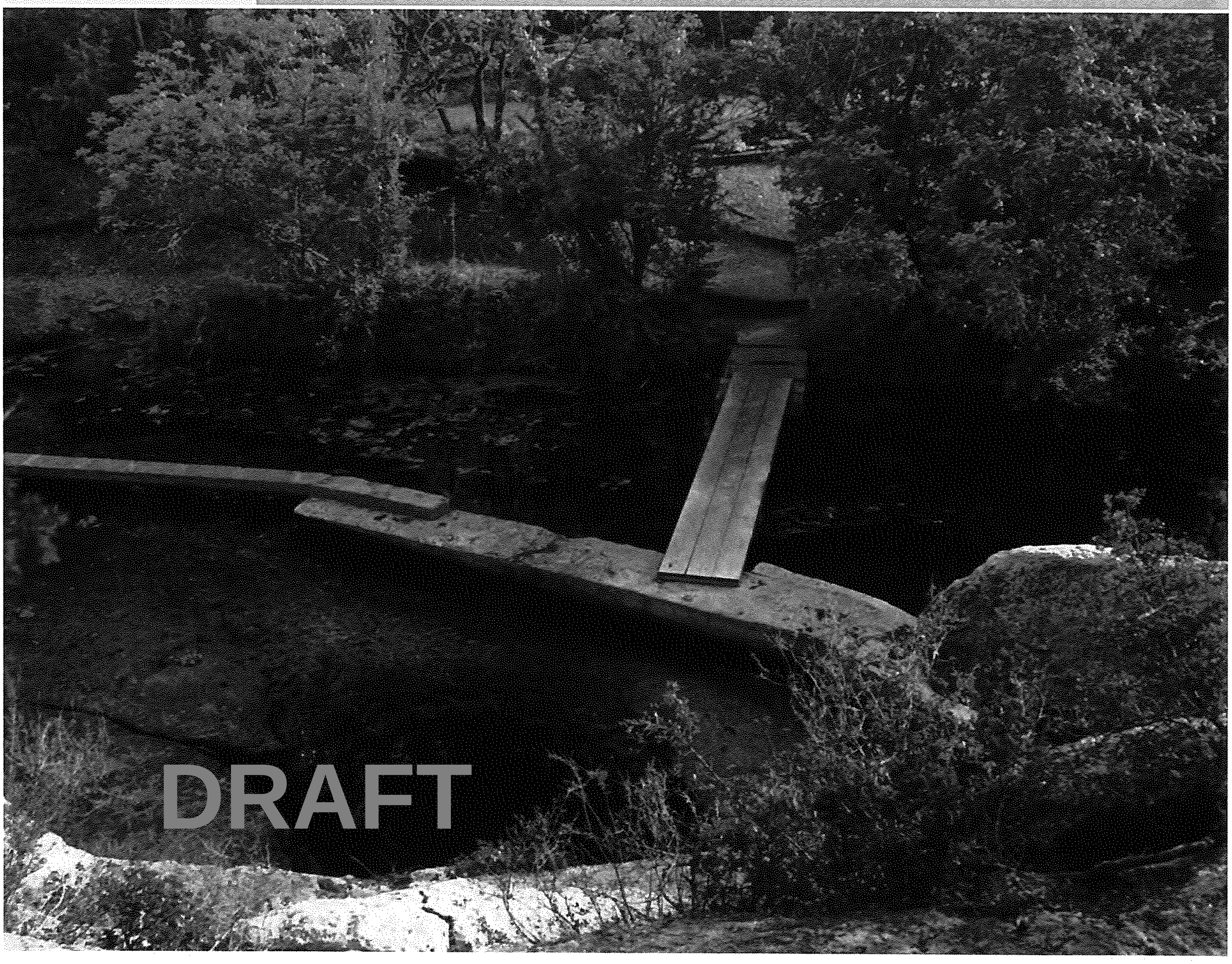
Texas Water Development Board Report 358

Groundwater Availability Model: Hill Country Portion of the Trinity Aquifer of Texas

by Ian C. Jones, Ph.D., P.G. • Roberto Anaya, P.G. • Shirley C. Wade, Ph.D., P.G.

Report 377
June 2011

Texas Water Development Board
www.twdb.texas.gov



DRAFT

Texas Water Development Board

Report 377

Groundwater Availability Model: Hill Country Portion of the Trinity Aquifer of Texas

by
Ian C. Jones, Ph.D., P.G.
Roberto Anaya, P.G.
Shirley C. Wade, Ph.D., P.G.

June 2011

DRAFT

Geoscientist Seal

The contents of this report (including figures and tables) document the work of the following licensed Texas geoscientists:

Ian C. Jones, Ph.D., P.G. No. 477
Dr. Jones was the project manager for this work and was responsible for oversight of the project, organization of the report, the modeling approach, and the steady-state and transient model calibration.

The seal appearing on this document was authorized on June 22, 2011 by

Ian. C. Jones

Roberto Anaya, P.G No. 480
Mr. Anaya changed the map projection of the model and assisted with revising the structural geology.

The seal appearing on this document was authorized on June 22, 2011 by

Roberto Anaya

Shirley C. Wade, Ph.D., P.G. No. 525
Dr. Wade revised the structural geology used in the model.

The seal appearing on this document was authorized on June 22, 2011 by

Shirley C. Wade

Cover photo: Jacob's Well ©Todd Seibel

Edited by [illegible]

Texas Water Development Board

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June 2011
(Printed on recycled paper)

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1.0 Executive Summary

Mace and others (2000) constructed a groundwater availability model simulating groundwater flow through the Hill Country portion of the Trinity Aquifer System as a groundwater resource management tool. The purpose of this report is to document updates to this earlier model. We updated the model by (1) adding the Lower Trinity Aquifer as another layer to the model, (2) revising the spatial distribution of parameters, such as recharge and pumping, and (3) calibrating to steady-state water level and river discharge conditions for 1980 and historical transient water level and discharge conditions for 1981 through 1997. The calibrated model can be used to predict future water level changes that may result from various projected pumping rates and/or changes in climatic conditions.

Our conceptual model subdivides the Hill Country portion of the Trinity Aquifer System into three main components: the Upper, Middle, and Lower Trinity aquifers. The Upper Trinity Aquifer is composed of the upper member of the Glen Rose Limestone. The Middle Trinity Aquifer is composed of the lower member of the Glen Rose Limestone, Hensell Sand, and Cow Creek Limestone. The Lower Trinity Aquifer is composed of the Sycamore Sand, Sligo Formation, and Hosston Formation. The Middle and Lower Trinity aquifers are separated by the Hammett Shale, which acts as a confining unit and is not explicitly included in the model. The model study area also includes easternmost parts of the Edwards-Trinity (Plateau) Aquifer.

Recharge in the updated model is a combination of infiltration of precipitation that falls on the aquifer outcrop and infiltration from losing intermittent streams within the model area. Estimates of recharge due to infiltration of precipitation in this updated model vary spatially and are equivalent to 3.5 to 5 percent of average annual precipitation. The highest of these recharge rates coincide with the Balcones Fault Zone. In addition to recharge from precipitation, recharge of about 70,000 acre-feet per year results from streamflow losses in the downstream parts of the Cibolo Creek watershed to the underlying aquifers.

Groundwater in the aquifer generally flows toward the south and east. The Hill Country portion of the Trinity Aquifer System discharges naturally as base flow to gaining streams, such as the Guadalupe, Blanco, and Medina rivers, and as cross-formational flow to the adjacent Edwards (Balcones Fault Zone) Aquifer. This cross-formational flow accounts for about 100,000 acre-feet per year of discharge. Pumping discharge from the Hill Country portion of the Trinity Aquifer System increased over the period 1980 through 1997. This increase in pumping is most apparent in Bexar, Hays, Kendall, and Kerr counties—counties adjacent to the two largest metropolitan areas in the region, San Antonio and Austin. In some of these counties pumping has doubled during this period.

The updated model does a good job of reproducing observed water level fluctuations. Comparison of measured and simulated 1997 water levels indicates a mean absolute error of 57 feet, or approximately 5.3 percent of the range of measured water levels. This precision is a slight improvement over that of the original model. Overall, the updated model also does a good job of mimicking base-flow fluctuations. The ability of the model to simulate spring discharge varies widely. Simulating discharge to springs using a regional-scale model is commonly difficult because of spatial and temporal scale issues. Of 17 springs, 6 display a good comparison between measured and simulated discharge values.

The main improvements in the updated model over the original model are due to the addition of the Lower Trinity Aquifer to the model and the revised recharge distribution. The addition of the Lower Trinity Aquifer is important because the Lower Trinity Aquifer is an increasingly important source of groundwater in the study area. The revision of the recharge distribution in the updated model, along with associated changes in the hydraulic conductivity distribution, takes into consideration the major contribution to recharge from Cibolo Creek and will result in better simulation of groundwater flow in Bexar and surrounding counties.

2.0 Introduction

This report describes updates to the earlier developed groundwater availability model for the Hill Country portion of the Trinity Aquifer System by Mace and others (2000). These updates include (1) addition of the Lower Trinity Aquifer to the model, (2) revisions to the model layers' structural geometry, and recharge, hydraulic conductivity, and pumping distribution, and (3) changes to the model calibration periods to bring the model in line with Texas Water Development Board (TWDB) groundwater availability modeling standards that were developed after the earlier model was constructed (http://www.twdb.state.tx.us/gam/gam_documents/GAM_RFQ_Oct2005.pdf).

In this report, we use the term *Trinity Aquifer System.* The term *aquifer system* has not previously been used in TWDB publications but is commonly used by the U.S. Geological Survey, for example, the Edwards-Trinity Aquifer System (Barker and others, 1994), where multiple aquifers are grouped together. In this case, the Hill Country portion of the Trinity Aquifer System is subdivided into the Upper, Middle, and Lower Trinity aquifers.

The Trinity Aquifer System is an important source of groundwater to municipalities, industries, and landowners in the Hill Country. Rapid population growth and recent droughts have increased interest in the Trinity Aquifer System and led to a greater need for quantitative tools to assist in the estimation of groundwater availability in the area. Many groundwater conservation districts and the groundwater management area in the region need to assess the impacts of groundwater pumping and drought on the groundwater resources of the area. Regional water planning groups are required to plan for future water needs under drought conditions and are similarly interested in the groundwater availability of the Hill Country.

Several studies have noted the vulnerability of the Hill Country portion of the Trinity Aquifer System to drought and increased pumping. Ashworth (1983) concluded that heavy pumping is resulting in rapid water level declines in certain areas and that continued growth would result in continued water level declines. Bluntzer (1992), Simpson Company Limited and Guyton and Associates (1993), and Kalaswad and Mills (2000) noted that intense pumping has resulted in water level declines, decreased well yields, increased potential for the encroachment of saline groundwater into the aquifer, and depletion of base flow in nearby streams.

Calibrated groundwater flow models are simplified mathematical representations of groundwater flow systems that can be used to refine and confirm the conceptual understanding of a groundwater flow system. Once the model is successfully calibrated, it can be used as a quantitative tool to investigate the effects of pumping, drought, and different water management scenarios on the groundwater flow system.

In this study, we enhanced and recalibrated the three-dimensional finite-difference groundwater flow model for the Hill Country portion of the Trinity Aquifer System to improve our conceptual understanding of groundwater flow in the region. Our goal was to develop a management tool to support water planning efforts for regional water planning groups, groundwater conservation districts, groundwater management areas, and river authorities in the study area. This report describes the construction and recalibration of the numerical model owing to the addition of the Lower Trinity Aquifer and revisions to recharge, hydraulic conductivity, and pumping distribution in the earlier model.

Our general approach involved (1) revising the conceptual groundwater flow model, (2) organizing and distributing aquifer parameters for the model, (3) calibrating a steady-state model for 1980 water level conditions, and (4) calibrating a transient model for the period 1981 through 1997. This report describes the study area, previous work, the hydrogeologic setting used to develop the conceptual model, and model calibration results.

3.0 Study Area

The study area is located in the Hill Country of south-central Texas and includes all or parts of Bandera, Bexar, Blanco, Comal, Gillespie, Hays, Kendall, Kerr, Kimble, Medina, Travis, and Uvalde counties (Figure 3-1). Hydrologic boundaries define the extent of the study area. These boundaries include (1) major faults of the Balcones Fault Zone in the east and south, (2) presumed groundwater flow paths in the west, and (3) aquifer outcrops and/or rivers in the north (Figure 3-1). Because we selected groundwater flow paths to the west to assign a model boundary, the study area does not include the entire Hill Country area, such as parts of western Bandera and northeastern Uvalde counties, and includes the easternmost parts of the Edwards-Trinity (Plateau) Aquifer System (Ashworth and Hopkins, 1995) in Bandera, Gillespie, Kendall, and Kerr counties (Figure 3-2).

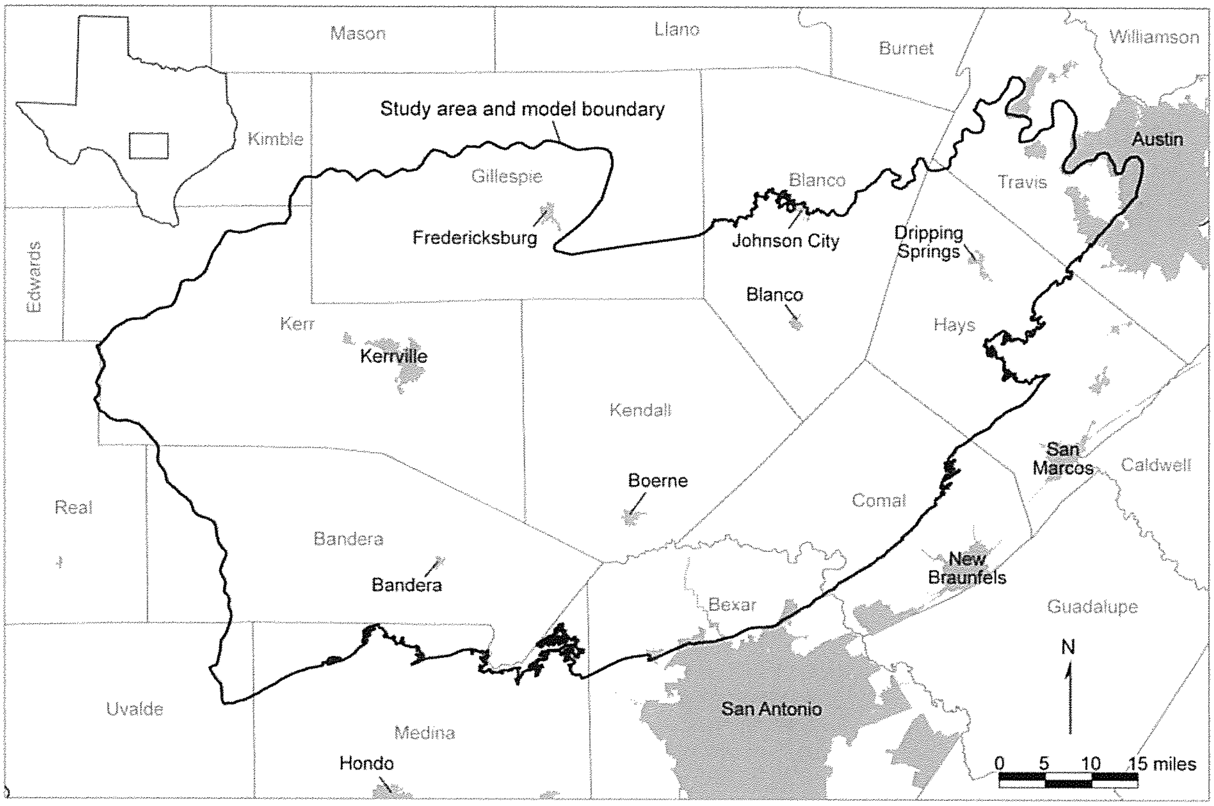

Figure 3-1. **Location of the study area relative to major cities and towns (modified from Mace and others, 2000).**

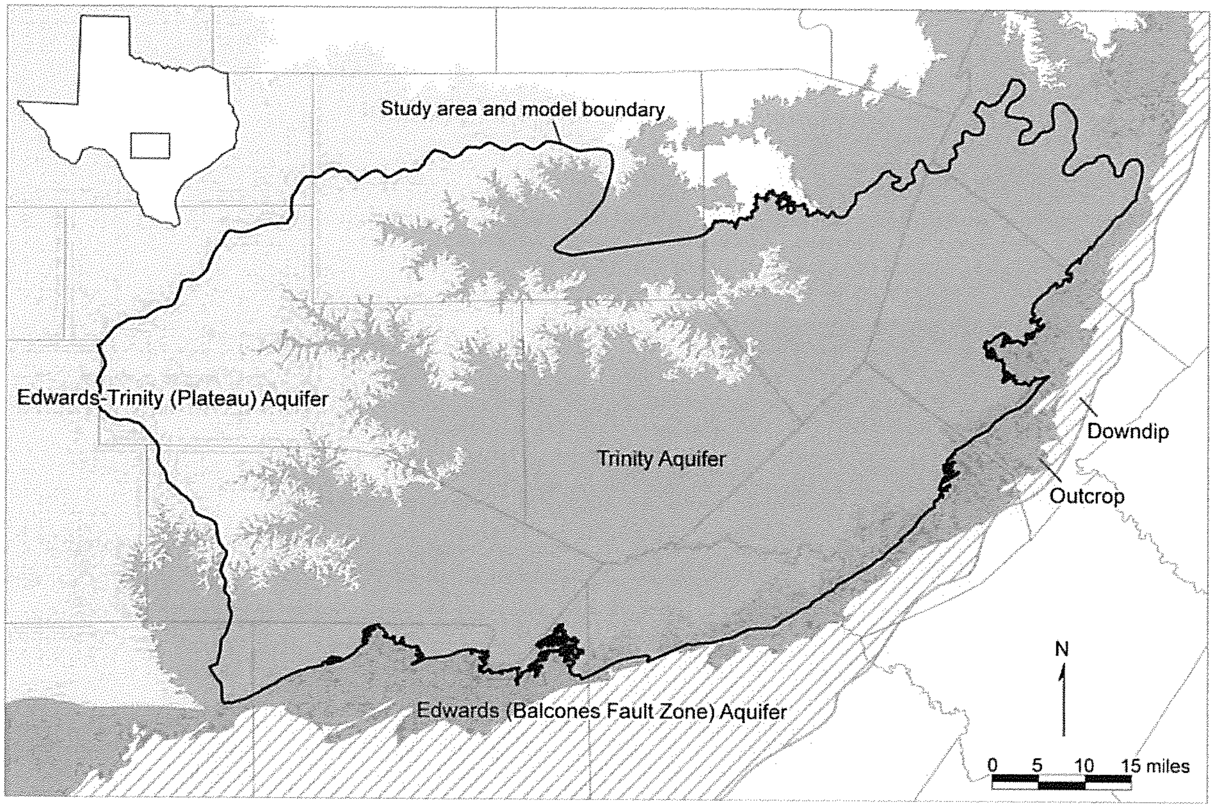

Figure 3-2. **Map of outcrop of the major aquifers in the study area. Trinity sediments in the study area include sediments that are part of the Edwards-Trinity (Plateau) Aquifer System to the west and underlie the Edwards (Balcones Fault Zone) Aquifer to the south and east (modified from Mace and others, 2000).**

The study area includes parts of three regional water planning areas: the Lower Colorado Region (Region K), the South Central Texas Region (Region L), and the Plateau Region (Region J) (Figure 3-3). The study area includes all or parts of several groundwater conservation districts, including Bandera County River Authority and Groundwater District, Blanco-Pedernales Groundwater Conservation District, Cow Creek Groundwater Conservation District, Edwards Aquifer Authority, Hays Trinity Groundwater Conservation District, Headwaters Groundwater Conservation District, Hill Country Underground Water Conservation District, Kimble County Groundwater Conservation District, Medina County Groundwater Conservation District, Trinity Glen Rose Groundwater Conservation District, and Uvalde County Underground Water Conservation District (Figure 3-4). The study area approximately coincides with Groundwater Management Area 9 (Figure 3-5). The study area also extends over four major river basins—the Colorado, Guadalupe, San Antonio, and Nueces rivers—and five river authorities—the Lower Colorado River Authority (that includes Blanco and Travis counties in the study area), the Guadalupe-Blanco River Authority (that includes Comal, Hays, and Kendall counties in the study area), the Upper Guadalupe River Authority (that includes Kerr County), the Nueces River Authority (that includes Bandera, Medina, and Uvalde counties), and the San Antonio River Authority (that includes Bexar County in the study area) (Figure 3-6).

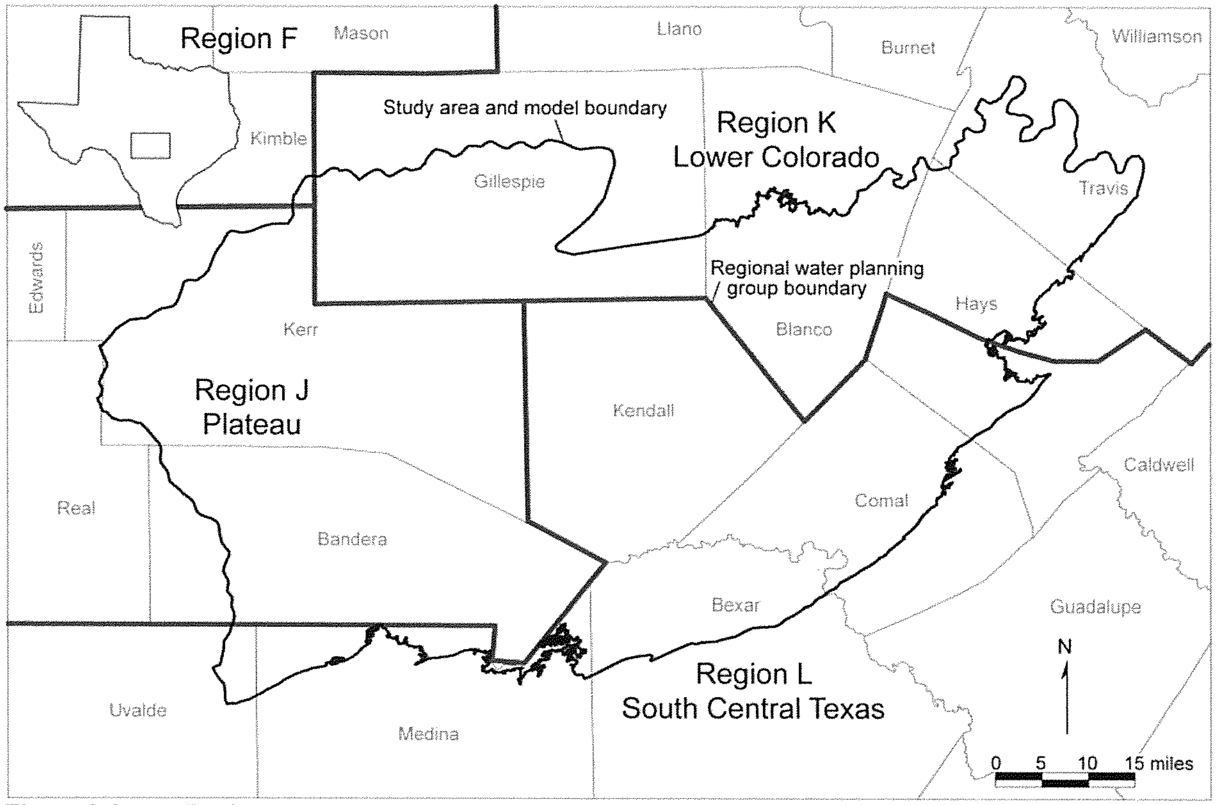

Figure 3-3. Regional water planning groups in the study area (modified from Mace and others, 2000).

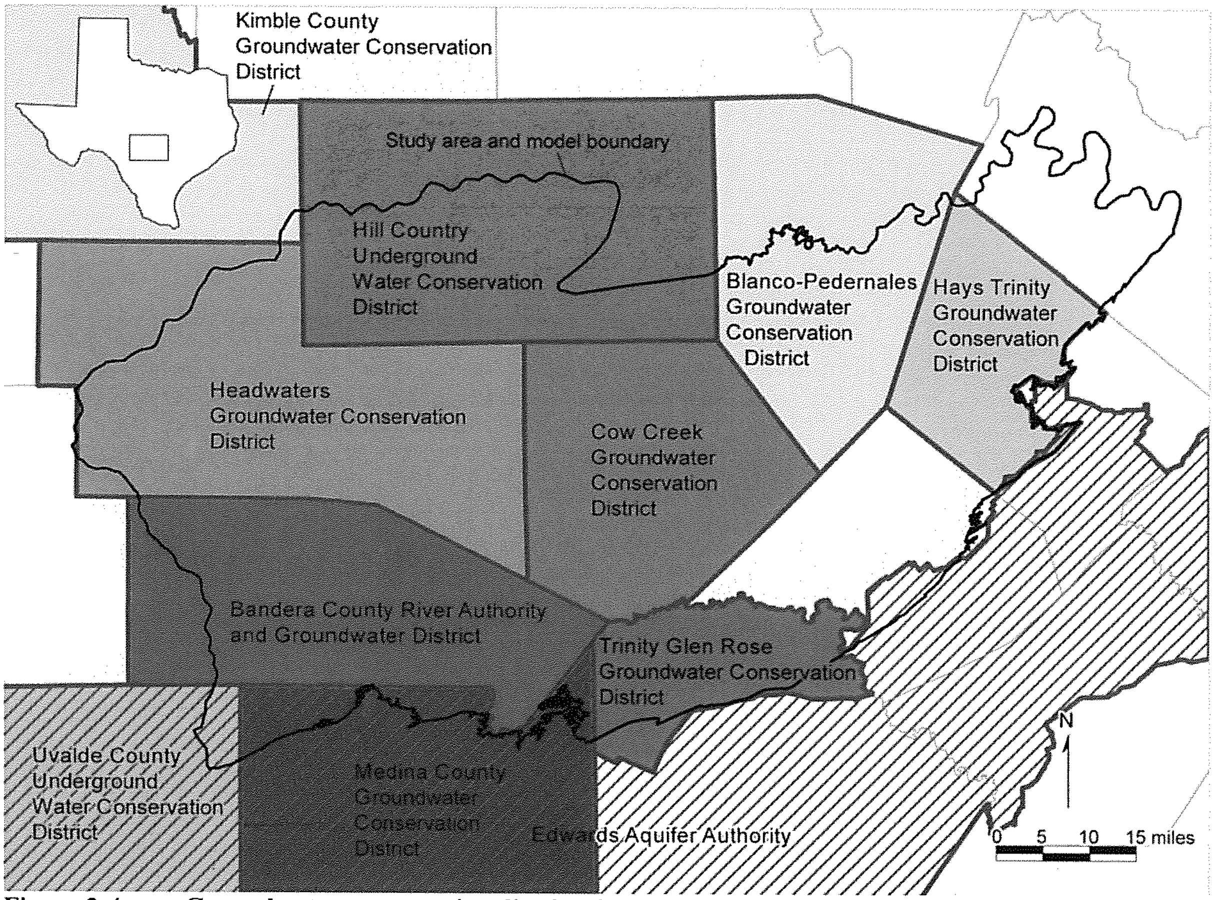

Figure 3-4. **Groundwater conservation districts in the study area as of June 2011 (area with diagonal hatch lines represents the Edwards Aquifer Authority).**

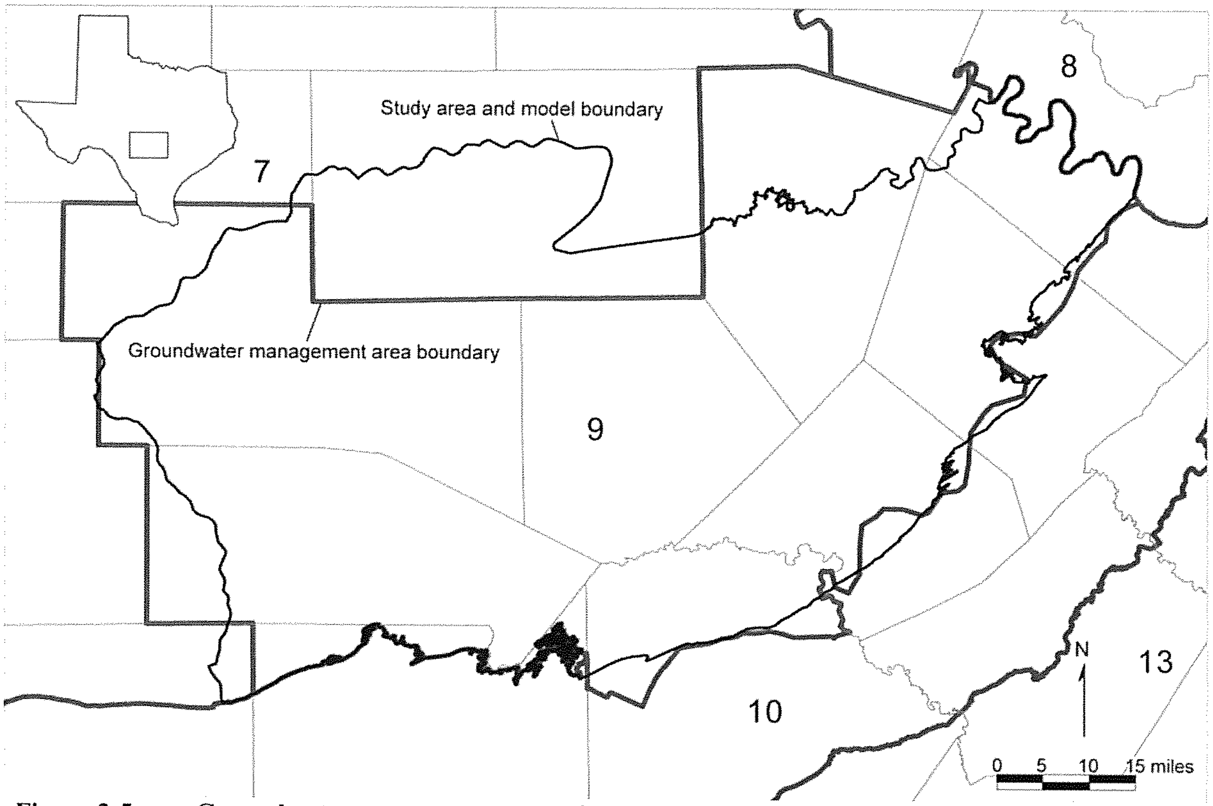

Figure 3-5. Groundwater management areas in the study area.

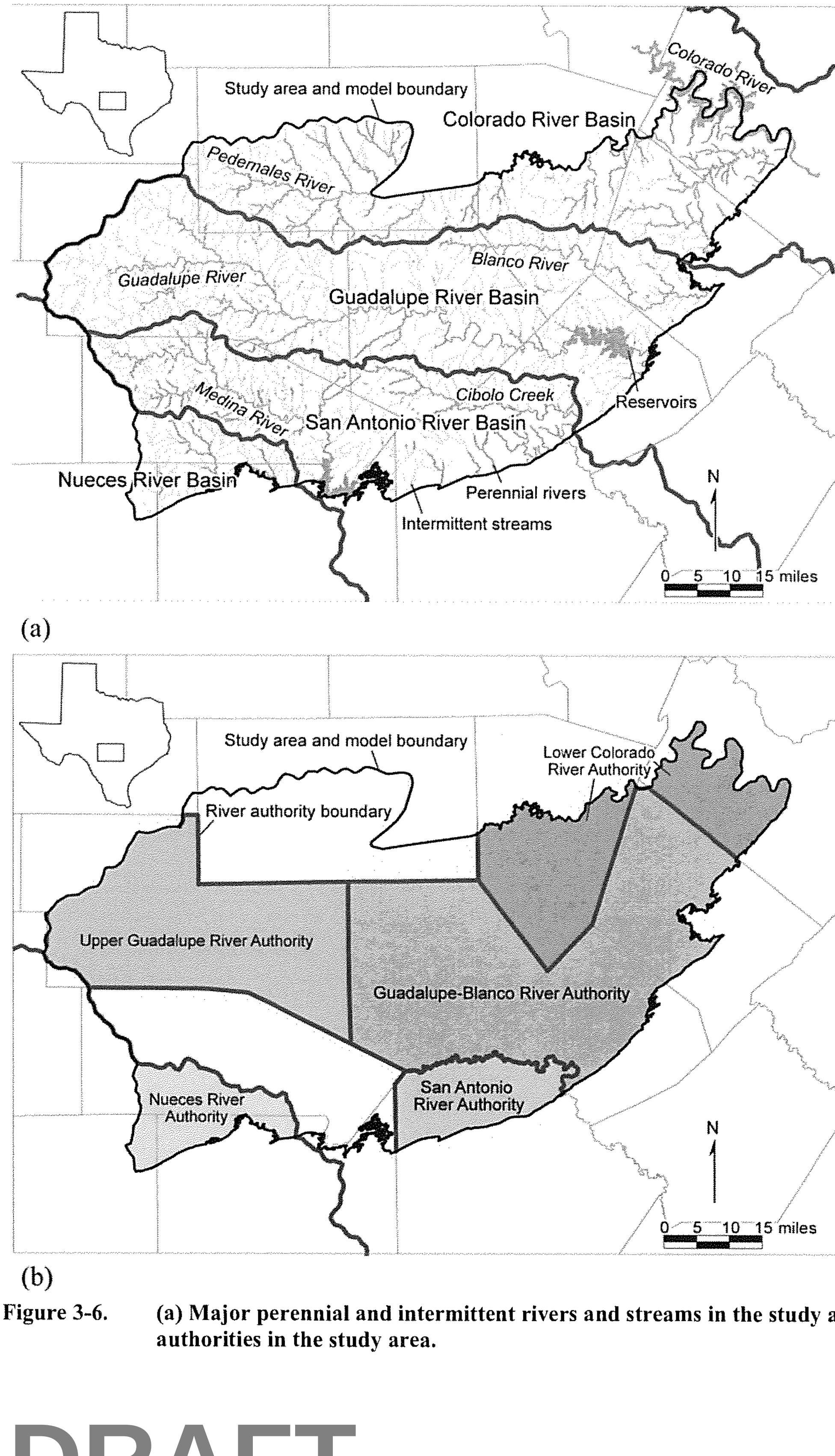

Figure 3-6. **(a) Major perennial and intermittent rivers and streams in the study area. (b) River authorities in the study area.**

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3.1 Physiography and Climate

The study area is located along the southeastern margin of the Edwards Plateau region in a region commonly referred to as the Texas Hill Country (Figure 3-7). The Texas Hill Country is also known as the Balcones Canyonlands subregion, a deeply dissected terrain formed by the headward erosion of major streams between the Edwards Plateau and the Balcones Escarpment (Thornbury, 1965; Riskind and Diamond, 1986). Land surface elevations across the study area range from 2,400 feet above sea level in the west to about 600 feet along the eastern margin of the study area (Figure 3-8).

The more massive and resistant carbonate members of the Edwards Group form the nearly flat uplands of the Edwards Plateau in the west and the topographic divides in the central portion of the study area (Figure 3-7). The differential weathering of alternating beds of limestone and dolostone with soft marl and shale in the upper member of the Glen Rose Limestone forms the characteristic stair-step topography of the Balcones Canyonlands. In general, the upper member of the Glen Rose Limestone is much less resistant to erosion than the overlying Edwards Group caprock.

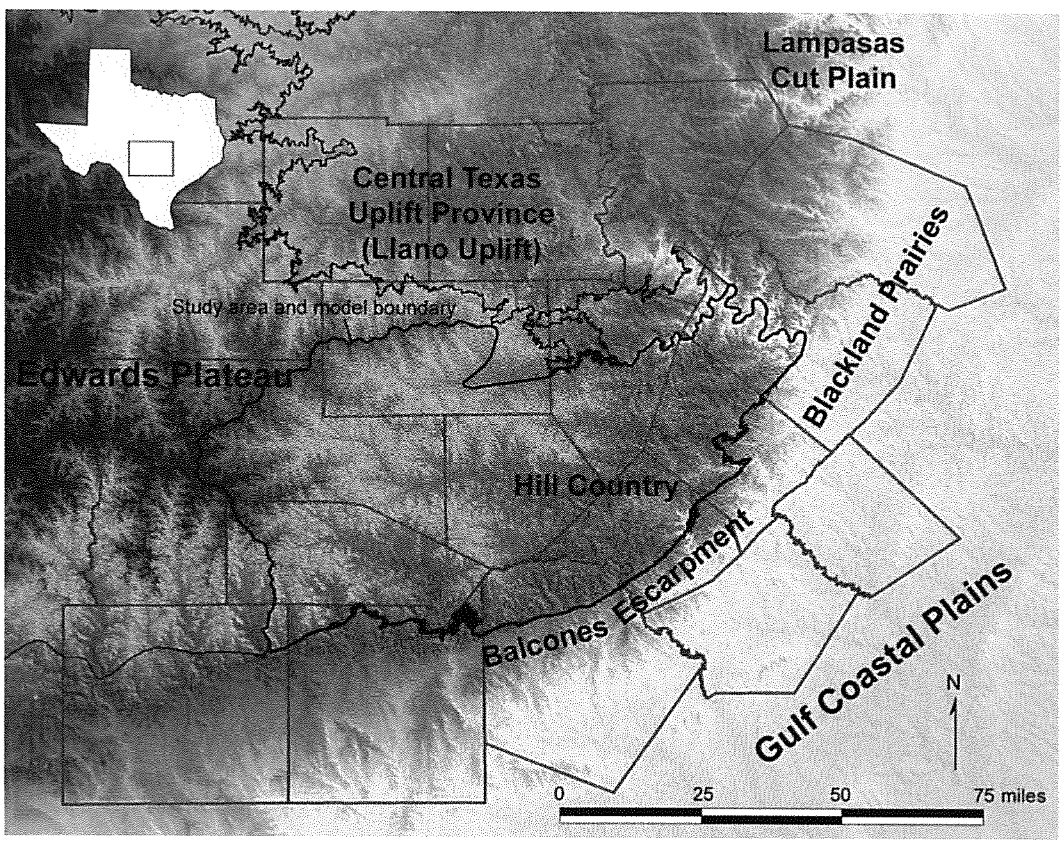

Figure 3-7. Physiographic provinces in the study area (modified from Anaya and Jones, 2009).

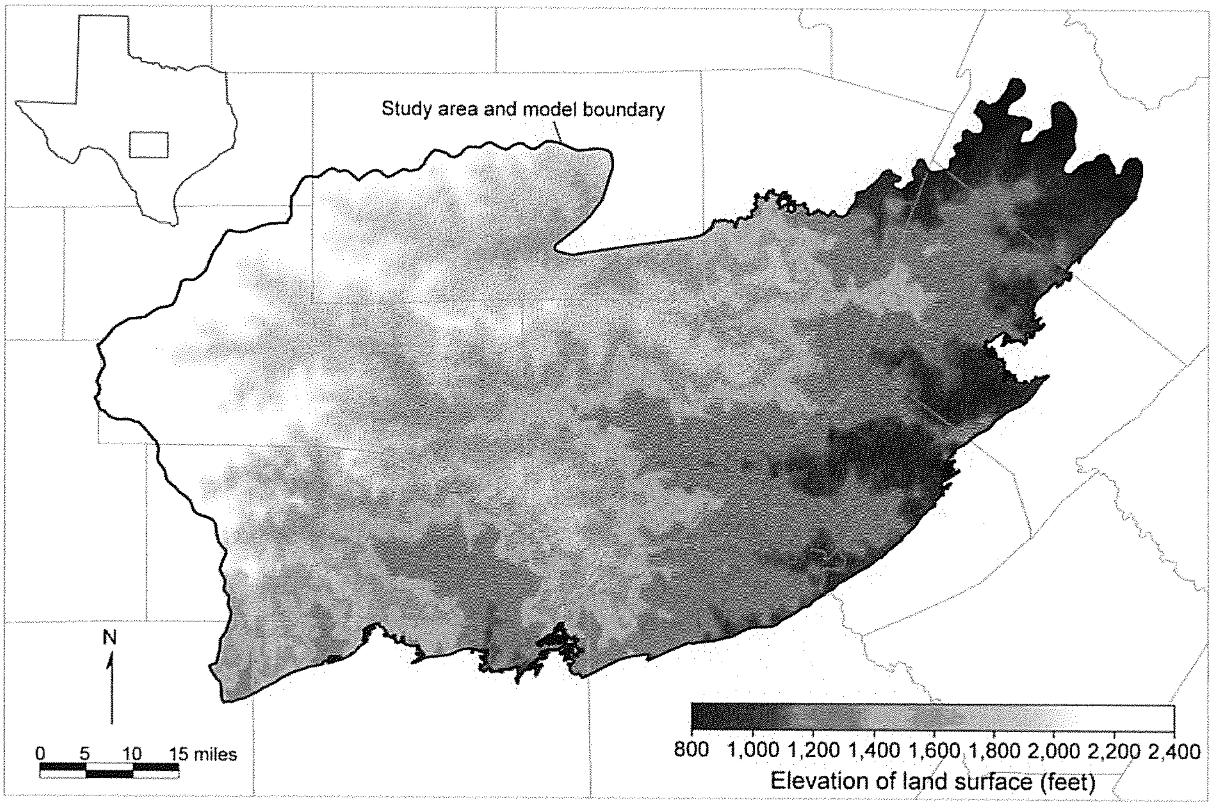

Figure 3-8. Land surface elevation in the study area (modified from Mace and others, 2000).

The study area is characterized by a subhumid to semiarid climate. Average annual precipitation gradually decreases from east to west (35 to 25 inches) owing to increasing distance from the Gulf of Mexico (Carr, 1967) (Figure 3-9). Additionally, local precipitation is highest in the central part of the study area and decreases to the north and south. Historical annual precipitation ranges from less than 10 inches to more than 60 inches (Figure 3-10). Precipitation has a bimodal distribution during the year with most of the rainfall occurring in the spring and fall (Figure 3-11). During the spring, weak cold fronts begin to stall and interact with warm moist air from the Gulf of Mexico. During the summer, sparse rainfall is due to infrequent convectional thunderstorms. In early fall, rainfall is due to more frequent convectional thunderstorms and occasional tropical cyclones that make landfall along the Texas coast. Rainfall frequency continues to increase in late fall as cold fronts once again begin to strengthen and interact with the warm moist air masses of the Gulf of Mexico.

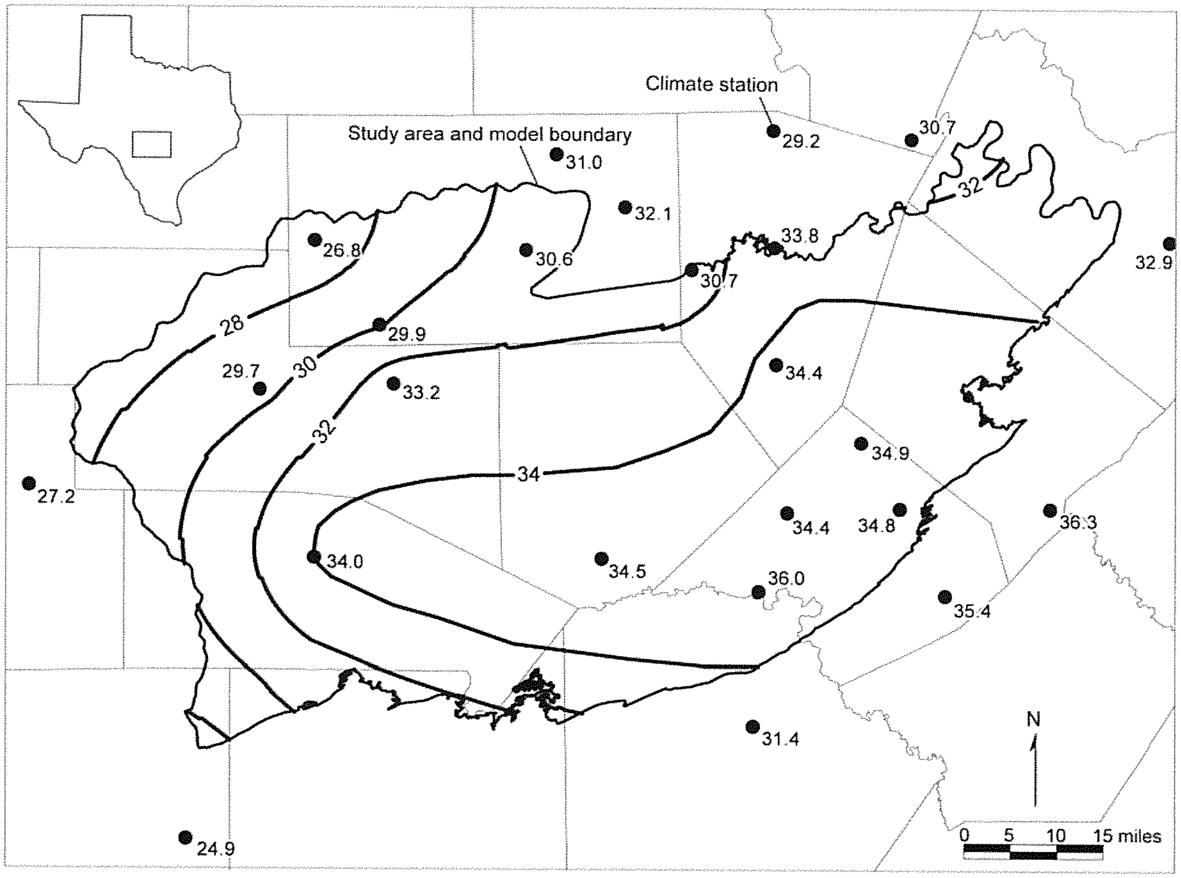

Figure 3-9. **Average annual rainfall distribution for the period 1960 through 1996 (data from National Climate Data Center). Contours represent annual precipitation in inches.**

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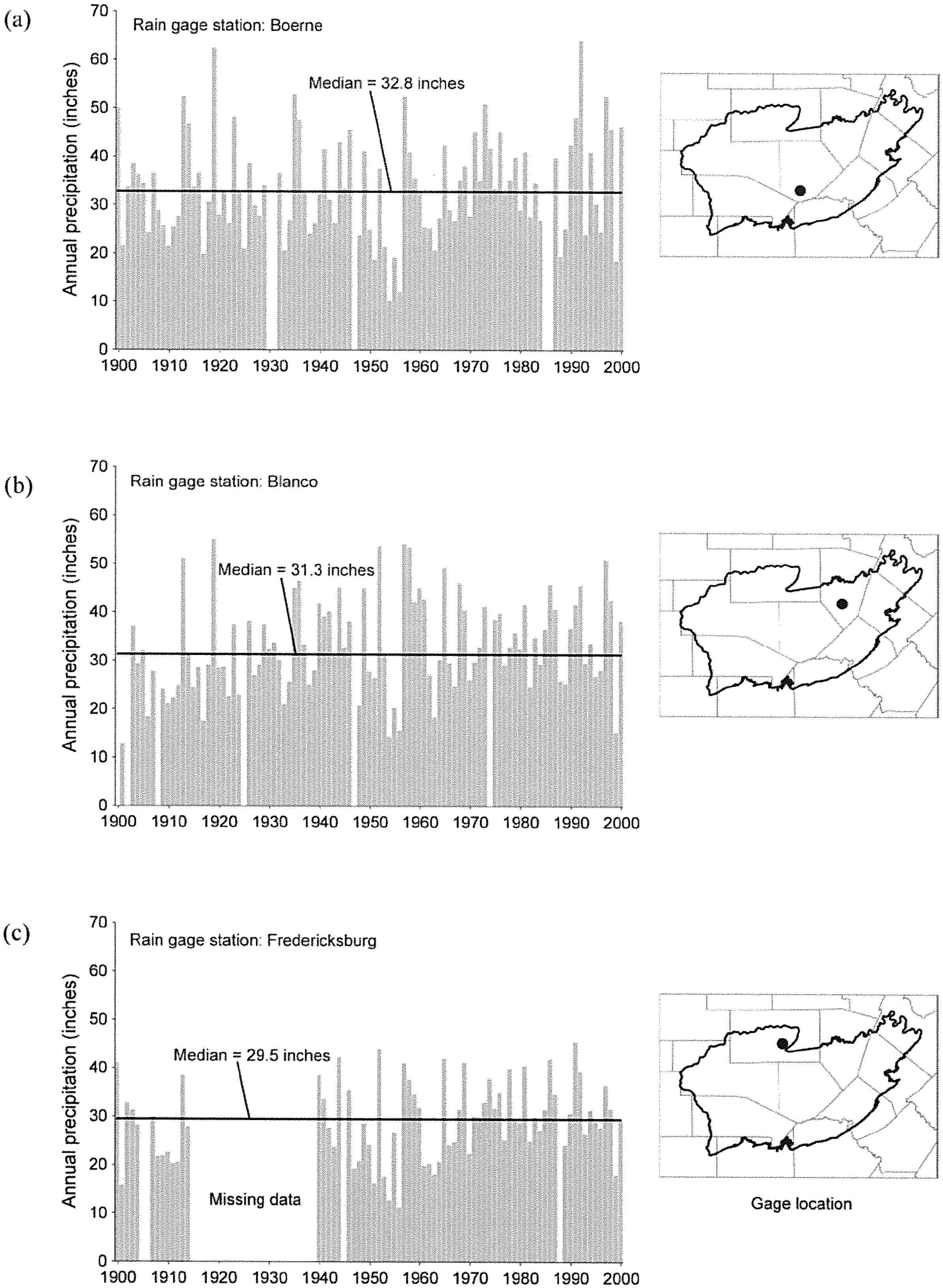


Figure 3-[illegible]. Historical annual precipitation for three rain gage stations in the study area (modified from Mace and others, 2000).

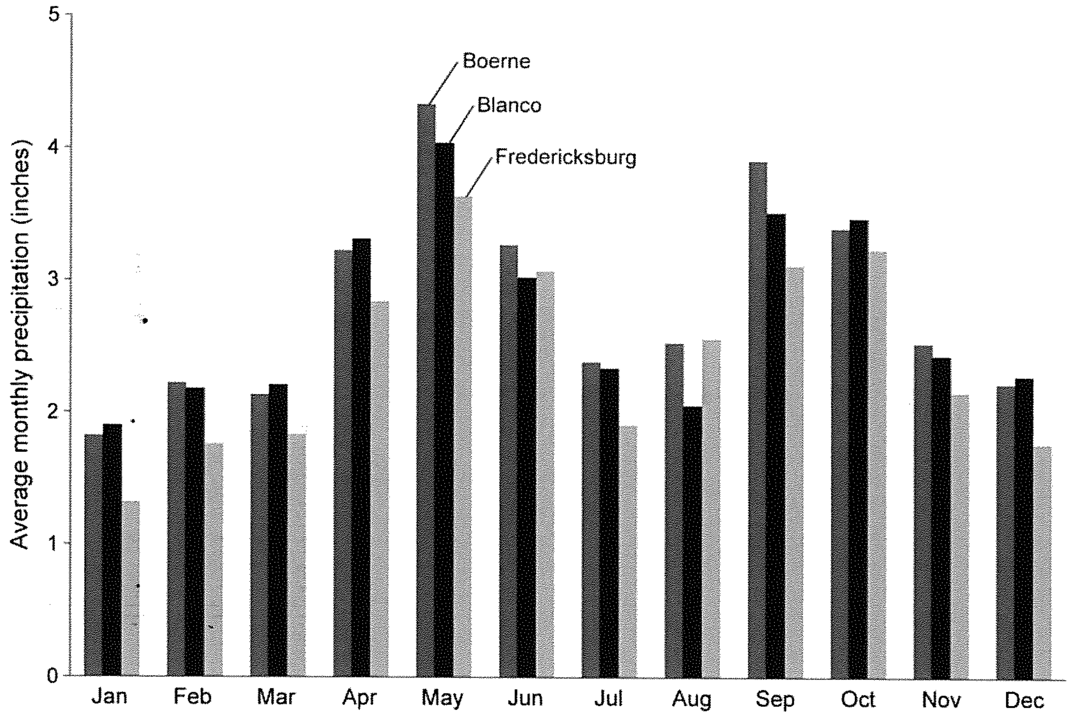


Figure 3-11. Average monthly precipitation for three rain gages in the study area for the period 1960 through 1996 (data from National Climate Data Center).

The average annual maximum temperature ranges from 76°F in the west to 78°F in the east and south (Figure 3-12). Average monthly temperatures range from about 60°F during winter months to about 95°F during summer months (Larkin and Bomar, 1983). The average annual (1950 to 1979) gross lake surface evaporation is more than twice the average annual precipitation and ranges from 63 inches in the east to 68 inches in the west (Figure 3-13). Seasonally, average monthly gross lake surface evaporation ranges from about 2.5 inches during winter months to more than 9 inches during summer months (Larkin and Bomar, 1983).

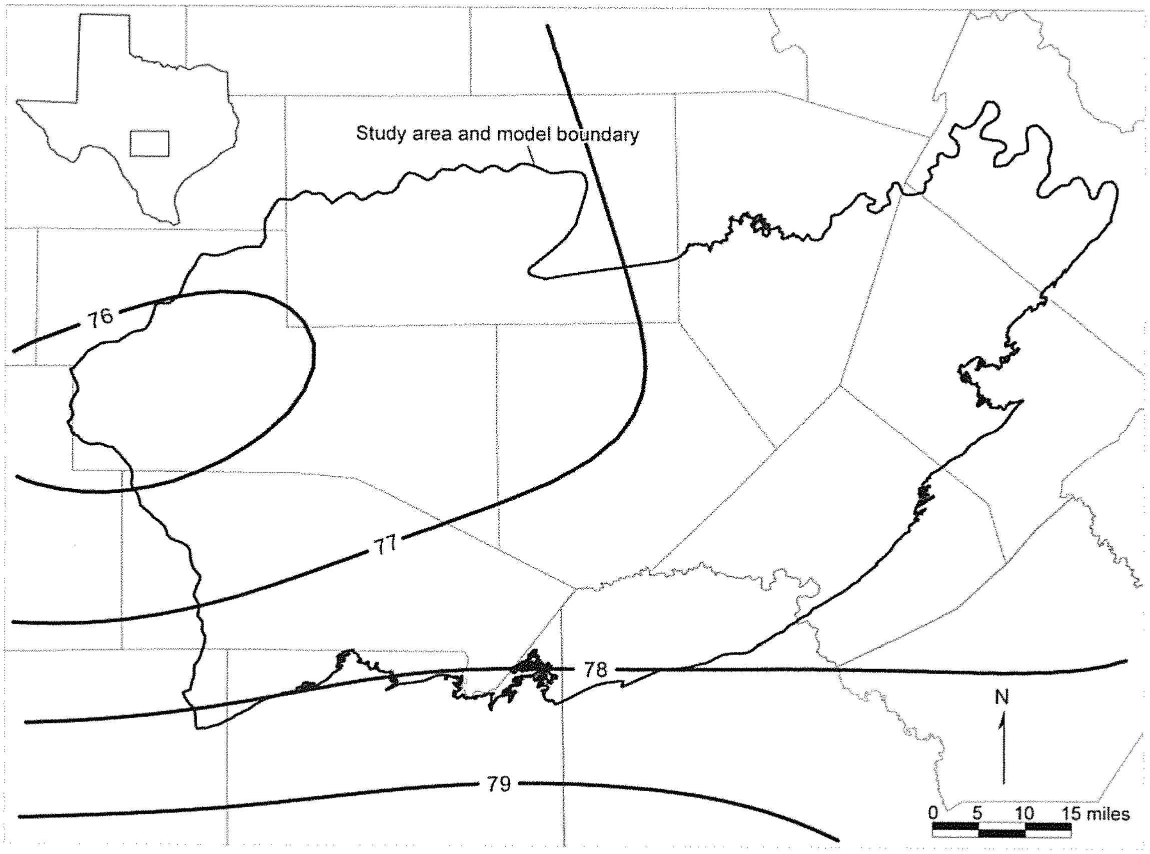


Figure 3-12. **Average annual maximum temperature for 1971 through 2000. The contours are expressed in degrees Fahrenheit (modified from data from Spatial Climate Analysis Service, 2004).**

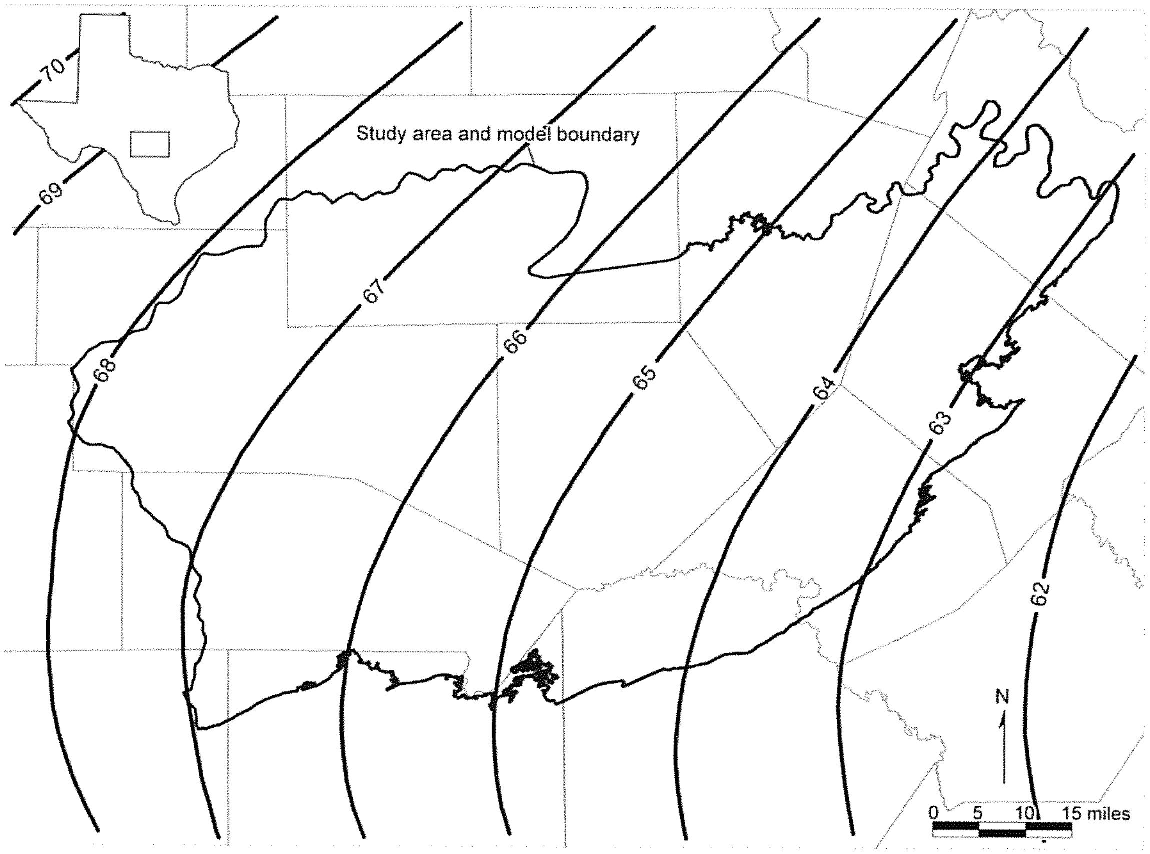


Figure 3-13. **Average annual gross lake evaporation for 1950 through 1979. Contours are expressed in inches (modified from Larkin and Bomar, 1983).**

3.2 Geology

Lower Cretaceous rocks of the Trinity Group that compose the Hill Country portion of the Trinity Aquifer System unconformably overlie Paleozoic rocks in the study area (Figure 3-14). These Lower Cretaceous rocks consist of (from oldest to youngest) the Hosston Formation (known as Sycamore Sand where it crops out at the surface), Sligo Formation, Hammett Shale, Cow Creek Limestone, Hensell Sand, lower and upper members of the Glen Rose Limestone, and the Fort Terrett and Segovia Formations of the Edwards Group (Figure 3-14). The Trinity Group sediments are locally covered by Quaternary alluvium along streams and rivers and capped by Edwards Group sediments in the west.

Era	System	Group	Stratigraphic unit		Hydrologic unit	
Cenozoic	Quaternary		Alluvium		Alluvium	
Mesozoic	Cretaceous	Edwards	Segovia Formation		Edwards Group	
			Fort Terrett Formation			
		Trinity	Glen Rose Limestone	Upper Member	Trinity Aquifer System	Upper Trinity
				Lower Member		Middle Trinity
			Hensell Sand/Bexar Shale			
			Cow Creek Limestone			
			Hammett Shale			Confining unit
			Sligo Formation			Lower Trinity
			Sycamore Sand/Hosston Formation			
Paleozoic			Undifferentiated Pre-Cretaceous rock			

Figure 3-14. Stratigraphic and hydrostratigraphic column of the Hill Country area.

The stratigraphic units of the Hill Country portion of the Trinity Aquifer System were deposited during a period of rifting and subsidence in the ancestral Gulf of Mexico (Barker and others, 1994). These units were deposited on the landward margin of a broad continental shelf under shallow marine conditions. The Llano Uplift was a dominant structural high, forming islands of Precambrian metamorphic and igneous rock and Paleozoic sedimentary rock that were sources of terrigenous sediment occurring in the Trinity Group (Figure 3-15).

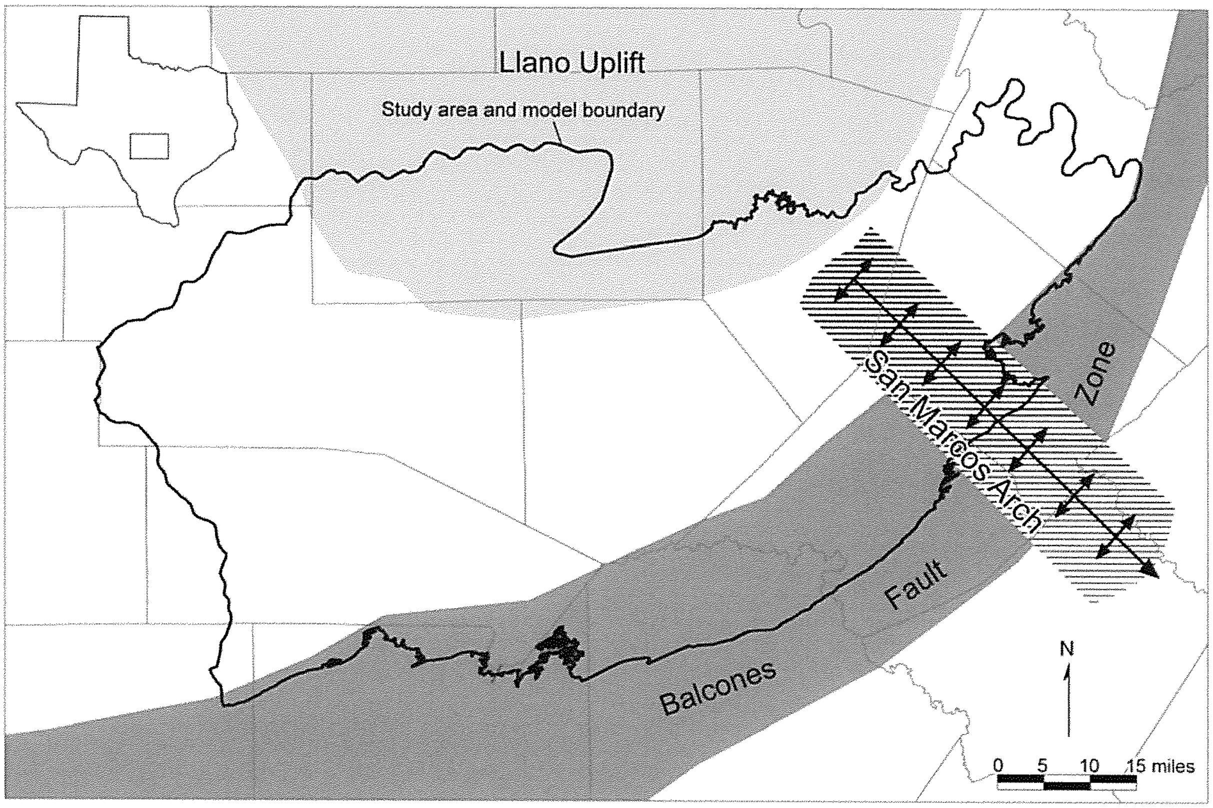


Figure 3-15. Main geologic structures in the study area (modified from Mace and others, 2000).

The Hosston Formation is dominantly composed of siliciclastic siltstone and sandstone in updip areas and dolomitic mudstone and grainstone downdip derived from the Llano Uplift (Barker and others, 1994). This formation, which is as much as 900 feet thick, grades upward into the Sligo Formation and where it is exposed at the surface is known as the Sycamore Sand. The Sycamore Sand is composed of quartz sand and gravel as much as 50 feet thick (Barker and others, 1994). The Sycamore Sand also contains some feldspar and dolomite derived from the Llano Uplift.

The Sligo Formation is composed of as much as 250 feet of evaporites, limestone, and dolostone (Barker and others, 1994). The evaporites were deposited in a supratidal environment, whereas the limestone and dolostone were deposited in an intertidal environment. In the updip regions, the Sligo Formation sediments display a greater contribution of terrestrial sediments from the Llano Uplift (Barker and others, 1994).

The Hammett Shale is highly burrowed and is made up of mixed clay, silt, and calcareous mud as much as 130 feet thick (Barker and others, 1994). This stratigraphic unit interfingers vertically with the overlying Cow Creek Limestone.

The Cow Creek Limestone, a beach deposit on the southern flank of the Llano Uplift, is as much as 90 feet thick (Barker and others, 1994). The lower part of the Cow Creek Limestone is composed of fine- to coarse-grained calcareous sandstone. The middle part of the Cow Creek Limestone is composed of silty calcareous sandstone, and the upper part is composed of coarse-grained fossiliferous calcareous sandstone with poorly sorted quartz grains and chert pebbles.

The Hensell Sand crops out in the northern part of the study area in Gillespie County (Figure 3-16). The Hensell Sand is composed of poorly cemented clay, quartz, and calcareous sand and chert and dolomite gravel as much as 200 feet thick (Barker and others, 1994). The gravel beds occur at the base of this stratigraphic unit. The shallow marine deposits of the Bexar Shale Member of the Pearsall Formation are the downdip equivalent of the Hensell Sand (Barker and others, 1994).

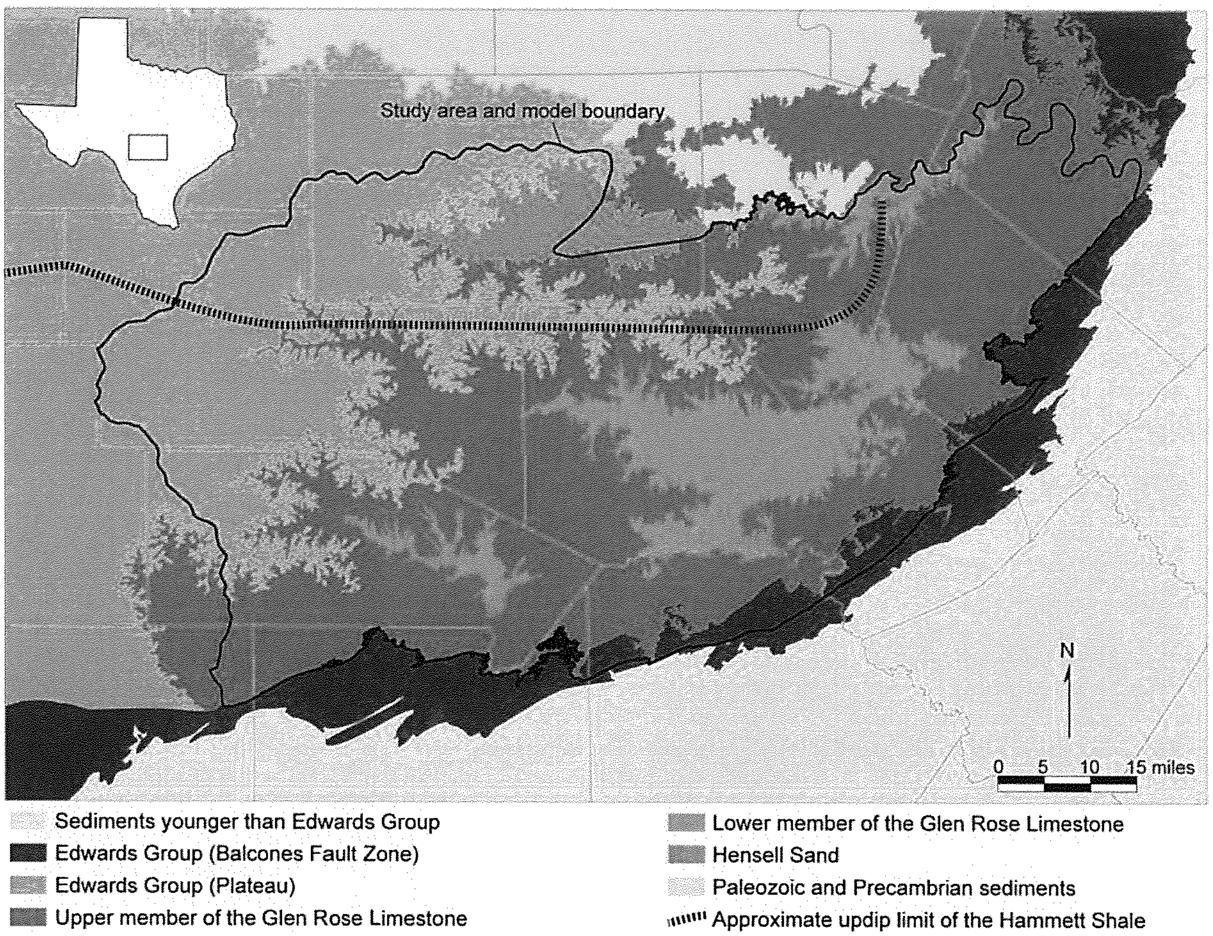


Figure 3-16. Surface geology of the study area (modified from Mace and others, 2000). Please note that this map excludes isolated outliers of the Edwards Group that overlie the upper member of the Glen Rose Limestone, some of which are included in the original and updated models. Approximate updip limit of Hammett Shale is modified from Amsbury (1974) and Barker and others (1994).

The Glen Rose Limestone is composed of sandy fossiliferous limestone and dolostone that are characterized by beds of calcareous marl, clay, and shale and include thin layers of gypsum and anhydrite (Barker and others, 1994). The Glen Rose Limestone has a maximum thickness of 1,500 feet. The lower member of the Glen Rose Limestone is composed of medium-thick beds of limestone, dolostone, and fossiliferous dolomitic limestone (Barker and others, 1994). The Glen Rose Limestone was deposited in a shallow marine to intertidal environment and grades northward into the terrestrial Hensell Sand. The upper member of the Glen Rose Limestone is exposed at land surface in most of the study area except where it is (1) removed by erosion exposing the lower member of the Glen Rose Limestone and (2) overlain by the Edwards Group in the Edwards Plateau to the west and in the Balcones Fault Zone to the south and east (Figure 3-16). The upper member of the Glen Rose Limestone is characterized by a thin- to medium-bedded sequence of alternating nonresistant marl and resistant limestone and dolostone. The alternating layers of resistant and nonresistant rock result in uneven erosion that produces the stair-step topography characteristic of much of the Hill Country.

The basal parts of the Hosston Formation, the Sycamore Sand, and updip parts of the Hensell Sand are mostly sandy and contain some of the most permeable sediments in the Hill Country portion of the Trinity Aquifer System (Barker and others, 1994). The Cow Creek Limestone is highly permeable in the outcrop owing to carbonate dissolution and preservation of the pores but has relatively low permeability in the subsurface owing to precipitation of calcite cements (Barker and others, 1994). Similarly, the lower member of the Glen Rose Limestone is more permeable in the outcrop than at depth (Barker and others, 1994). The Sligo Formation may yield small to large quantities of water (Ashworth, 1983).

The Lower Trinity Aquifer is not exposed at land surface within the study area and exists only in the southern half of the study area (Figures 3-14 and 3-16). The study area is completely underlain by sediments of the Middle Trinity Aquifer. The Upper Trinity Aquifer exists in most of the study area except where it has been removed by erosion along and near the lower reaches of the Pedernales, Blanco, Guadalupe, Cibolo, and Medina rivers (Figure 3-16). In the western part of the study area, the Fort Terrett and Segovia formations of the Edwards Group (Figure 3-16) cap the Trinity Aquifer sediments. The Edwards Group may produce large amounts of water where it is saturated and has high transmissivity.

The Llano Uplift is a regional dome formed by a massive Precambrian granitic pluton (Figure 3-15). The Llano Uplift remained a structural high throughout the Ouachita Orogeny that folded and uplifted the Paleozoic rocks of this area and provided a source of sediments for terrigenous and near-shore facies of the Trinity Group (Ashworth, 1983; Barker and others, 1994). The San Marcos Arch is a broad anticlinal (upward-folded ridge) extension of the Llano Uplift with a southeast-plunging axis. The San Marcos Arch extends through central Blanco and southwest Hays counties (Ashworth, 1983) (Figure 3-15). This arch contributed to the formation of a carbonate platform with thinning sediments along the anticlinal axis. The Balcones Fault Zone is a northeast-southwest-trending system of high-angle normal faults with downthrown blocks toward the Gulf of Mexico (Figure 3-15). The faulting occurred along the subsurface axis of the Ouachita Fold Belt as a result of extensional forces created by the subsidence of basin sediments in the Gulf of Mexico during the Tertiary Period. The last episode of movement in the fault zone is thought to have occurred in the late Early Miocene, approximately 15 million years ago (Young, 1972). The Balcones Fault Zone is a structural feature that laterally juxtaposes Trinity Group sediments against Edwards Group sediments of the Edwards (Balcones Fault Zone) Aquifer (Figures 3-15 and 3-17).

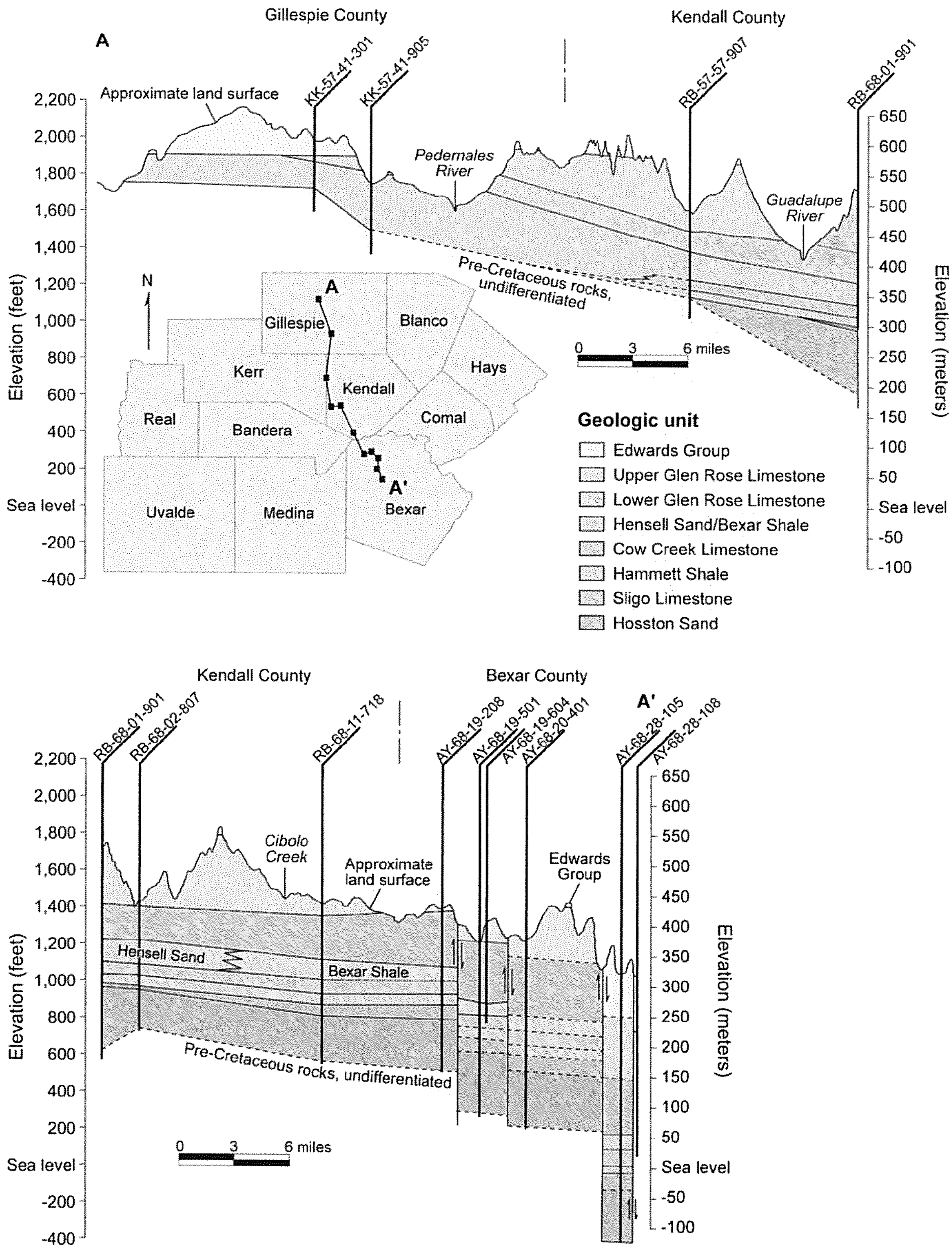


Figure 3-17. Geologic cross sections through the study area (modified from Ashworth, 1983; Mace and others, 2000). Inset map shows cross-section line A-A´.

The structural geometry of Lower Cretaceous sediments in the study area is characterized by (1) a southeast regional dip, (2) an uneven base of the Trinity Group, and (3) the occurrence of the San Marcos Arch in the southeast, Llano Uplift to the north, and Balcones Fault Zone to the south and east (Figures 3-15 and 3-17). Both Trinity Group and Edwards Group sediments have a regional dip to the south and southeast. The dip increases from a rate of about 10 to 15 feet per mile near the Llano Uplift to about 100 feet per mile near the Balcones Fault Zone (Ashworth, 1983). These Lower Cretaceous sediments may be described as a series of stacked wedges that pinch out against the Llano Uplift and thicken downdip toward the Gulf of Mexico (Figure 3-17). At the base of the Trinity Group sediments, underlying Paleozoic rocks have been moderately folded, uplifted, and eroded to form an unconformable surface upon which the Trinity Group sediments were deposited (Figure 3-17). Along the northern margin of the study area, the Middle and Upper Trinity sediments directly overlie Paleozoic and Precambrian rocks (Figure 3-17).

4.0 Previous Work

The TWDB and the U.S. Geological Survey have conducted a number of hydrogeologic studies in the Hill Country area. Ashworth (1983), Bluntzer (1992), and Barker and others (1994) provided a thorough review of much of the previous geologic and hydrogeologic work done in the area.

A regional numerical groundwater flow model was developed and published for the area by the U.S. Geological Survey (Kuniansky and Holligan, 1994). Besides the Trinity Aquifer in the Hill Country, this U.S. Geological Survey model includes the Edwards-Trinity (Plateau) and Edwards (Balcones Fault Zone) aquifers and extends almost 400 miles across the state (Figure 4-1). The purpose of the U.S. Geological Survey model was to better understand and describe the regional groundwater flow system. Using the model, Kuniansky and Holligan (1994) defined transmissivity ranges, estimated total flow through and recharge to the aquifer system, and simulated groundwater flow from the Trinity Aquifer into the Edwards (Balcones Fault Zone) Aquifer. The two-dimensional, finite-element, steady-state model was developed as the simplest approximation of the regional flow system. The U.S. Geological Survey model is inappropriate for regional water planning because (1) it does not simulate water level changes with time, and (2) it simulates all aquifers in the study area as a single layer. Subsequently, Anaya and Jones (2009) developed a transient finite-difference model covering a study area similar to that used in the model by Kuniansky and Holligan (1994). The model by Anaya and Jones (2009) simulates the Trinity Aquifer System as a single layer (Figure 4-1).

The TWDB developed a regional transient groundwater flow model for the Hill Country area of the Trinity Aquifer (Mace and others, 2000) (Figure 4-1). Mace and others (2000) calibrated this model to 1975 steady-state conditions and 1996 through 1997 transient conditions. This model simulates groundwater flow through the Edwards Group and the Upper and Middle Trinity aquifers. Our updated model includes the Lower Trinity Aquifer previously excluded from the model by Mace and others (2000).

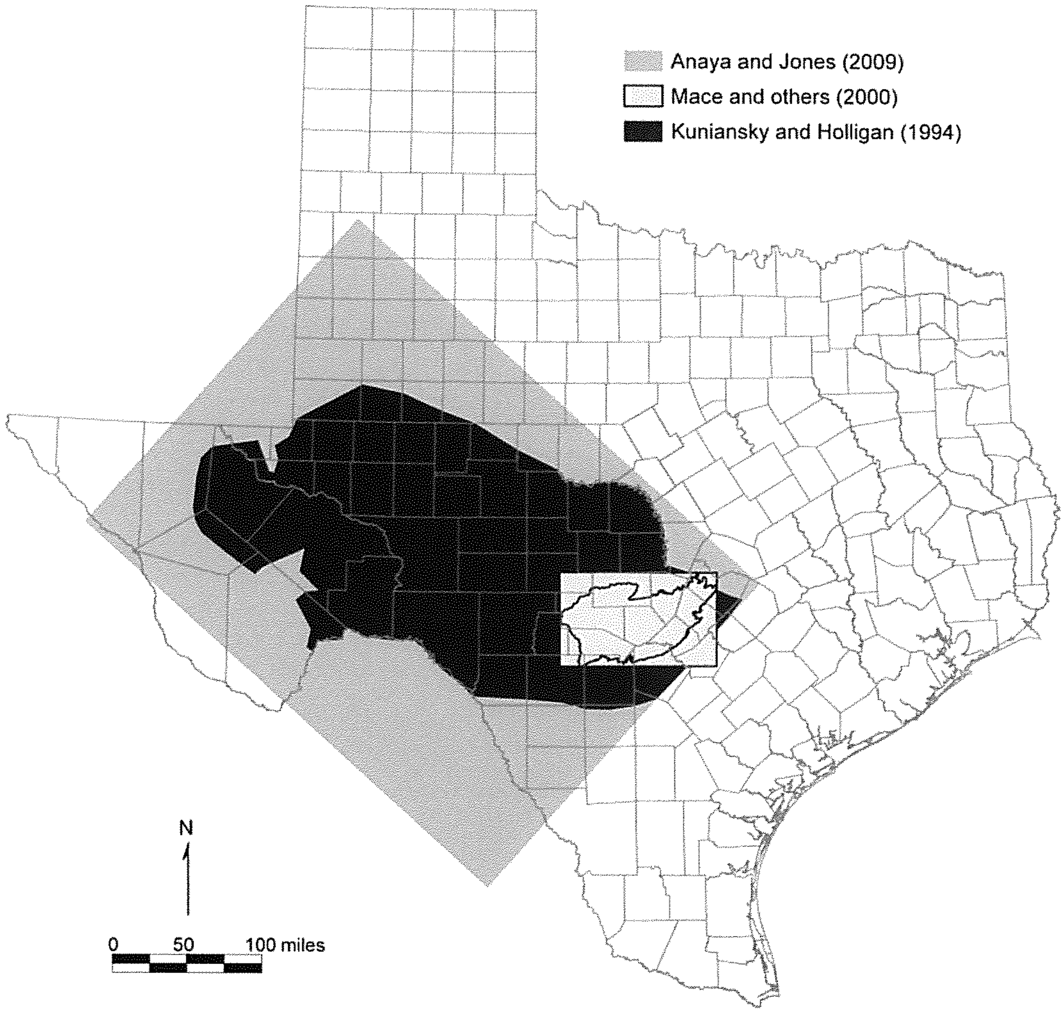


Figure 4-1. **Approximate extents of previous model grids for models used for simulating groundwater flow through the study area.**

5.0 Hydrogeologic Setting

The hydrogeologic setting describes the aquifer, hydrologic features, and hydraulic properties that influence groundwater flow in the aquifer. We based the hydrogeologic setting for the Hill Country portion of the Trinity Aquifer System on previous work (for example, Ashworth, 1983; Bluntzer, 1992; Barker and others, 1994; Kuniansky and Holligan, 1994) and additional studies we conducted in support of the modeling effort (Mace and others, 2000). These additional studies included assembling structure maps, developing water level maps and hydrographs, estimating base flow to streams, investigating recharge rates, conducting aquifer tests, and assembling pumping information.

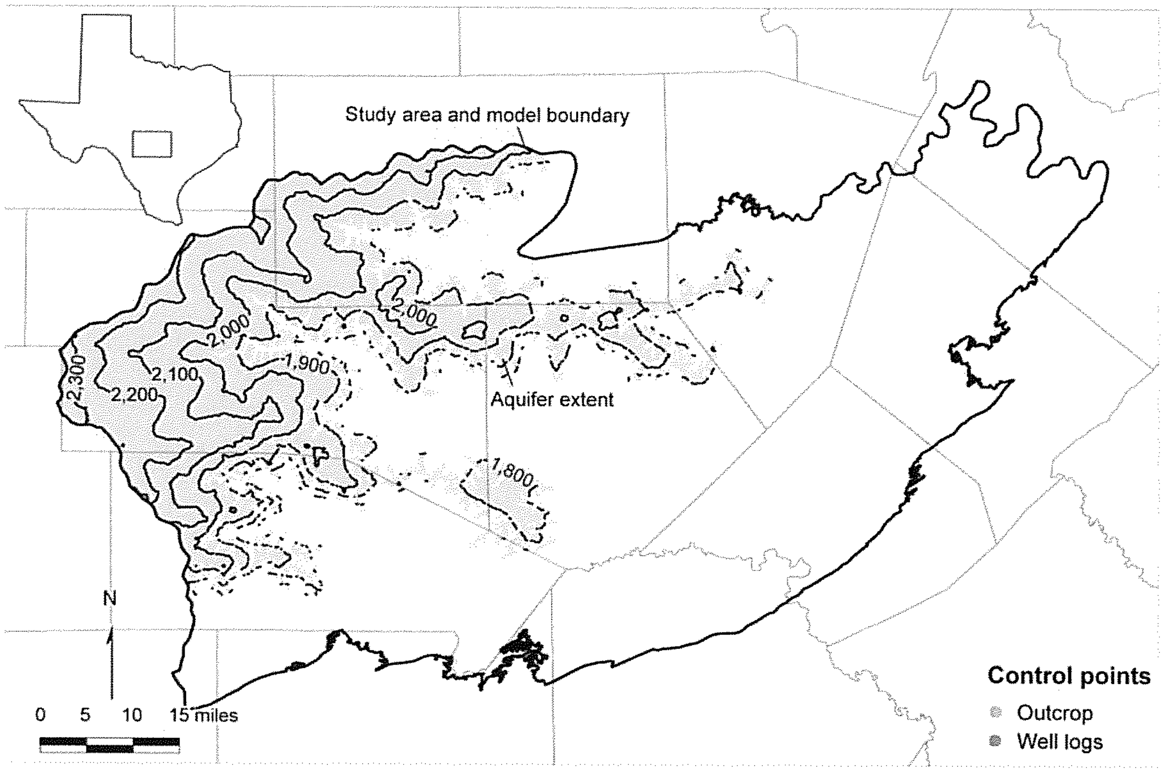
5.1 Hydrostratigraphy

The Hill Country portion of the Trinity Aquifer System comprises sediments of the Trinity Group and is divided into lower, middle, and upper aquifers (Figure 3-14) on the basis of hydraulic characteristics of the sediments (Barker and others, 1994). The Lower Trinity Aquifer consists of the Hosston (and the Sycamore Sand in outcrop) and Sligo formations; the Middle Trinity Aquifer consists of the Cow Creek Limestone, the Hensell Sand, and the lower member of the Glen Rose Limestone; and the Upper Trinity Aquifer consists of the upper member of the Glen Rose Limestone. Low-permeability sediments throughout the upper member of the Glen Rose Limestone separate the Middle and Upper Trinity aquifers. The Lower and Middle Trinity aquifers are separated by the low-permeability Hammett Shale, except where the Hammett Shale pinches out in the northern part of the study area (Amsbury, 1974; Barker and Ardis, 1996) (Figure 3-16).

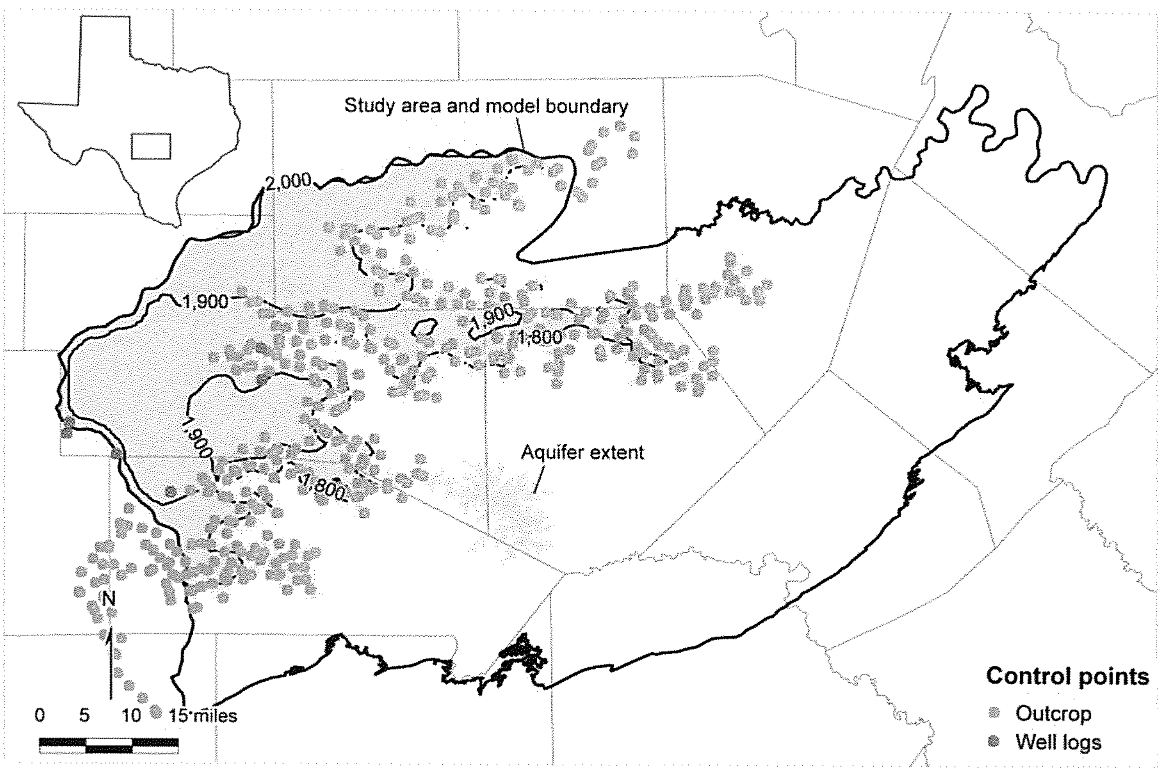
5.2 Structure

Building on the structural interpretations of Ashworth (1983) and using available drilling logs from the Hill Country Underground Water Conservation District, geophysical logs, and locations of outcrop areas, Mace and others (2000) developed structural elevation maps for the bases of the Edwards Group and the Upper and Middle Trinity aquifers (Figures 5-1 through 5-4). Mace and others (2000) collected geophysical logs from the TWDB, Edwards Aquifer Authority, Bandera County River Authority and Groundwater District, and private collections and used natural gamma logs to locate (1) the base of the Edwards Group, (2) the contact between the upper and lower members of the Glen Rose Limestone (as defined by the lower evaporite beds just above the Corbula marker bed or correlated equivalent), and (3) the base of the Middle Trinity sediments. Mace and others (2000) used resistivity logs to add control points in parts of the study area in the absence of gamma logs to complete the structure surfaces.

To further enhance the control of structural elevation point data, Mace and others (2000) supplemented the geophysical-log-based data with outcrop elevation points. Mace and others (2000) digitized the appropriate formation contacts for the base of the Edwards Group and Upper and Middle Trinity sediments from 1:250,000-scale maps of surface geology in the area (Brown and others, 1974; Proctor and others, 1974a, b; Barnes, 1981) using AutoCAD® (Autodesk, 1997) and converted the digitized contacts into an ArcInfo® (ESRI, 1991) geographic information system line coverage. Mace and others (2000) then georeferenced the line coverage, converted it into a point coverage from the arc vertices, and intersected it with a triangulated irregular network constructed from a U.S. Geological Survey 3-arc-second digital elevation model to determine their point elevations. Mace and others (2000) compiled the structural elevation information and organized it into ArcInfo® for the base of the Middle Trinity Aquifer, the base of the Upper Trinity Aquifer, and the base of the Edwards Group sediments. Mace and others (2000) then exported the point elevations from ArcInfo® into point coordinates and imported them into Surfer® (Golden Software, 1995) for spatial interpolation (Figures 5-1 through 5-4).

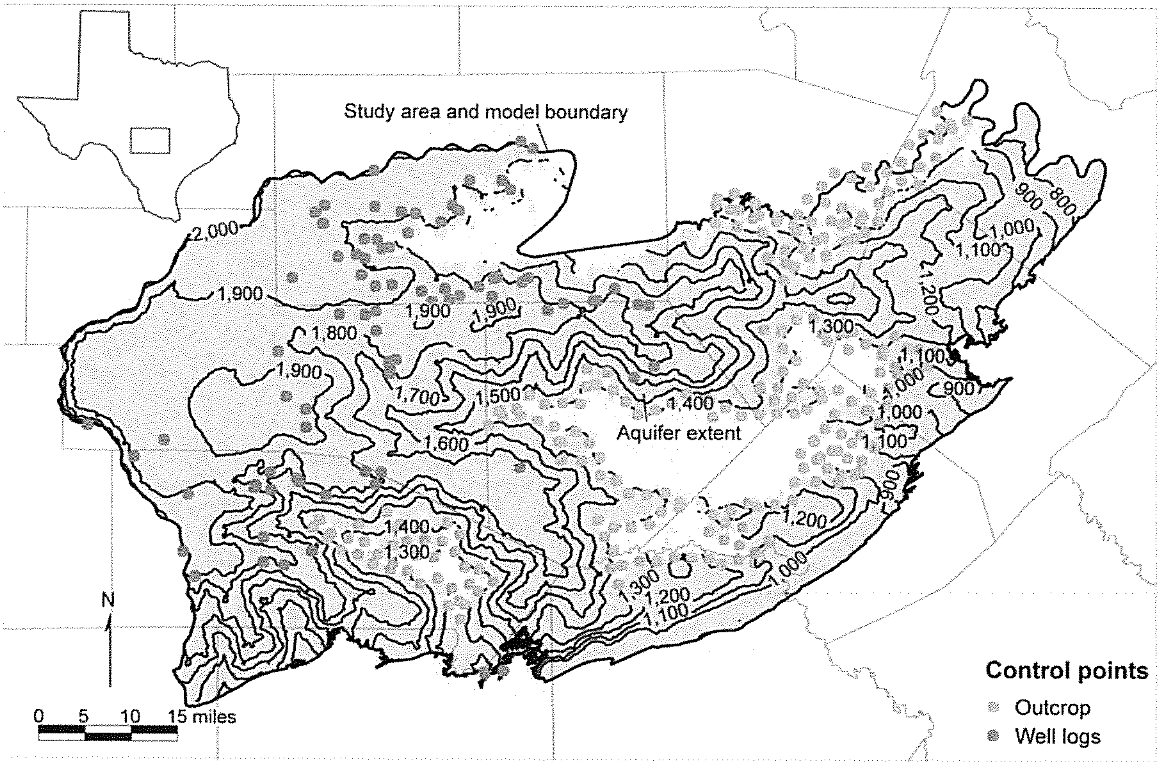


(a)

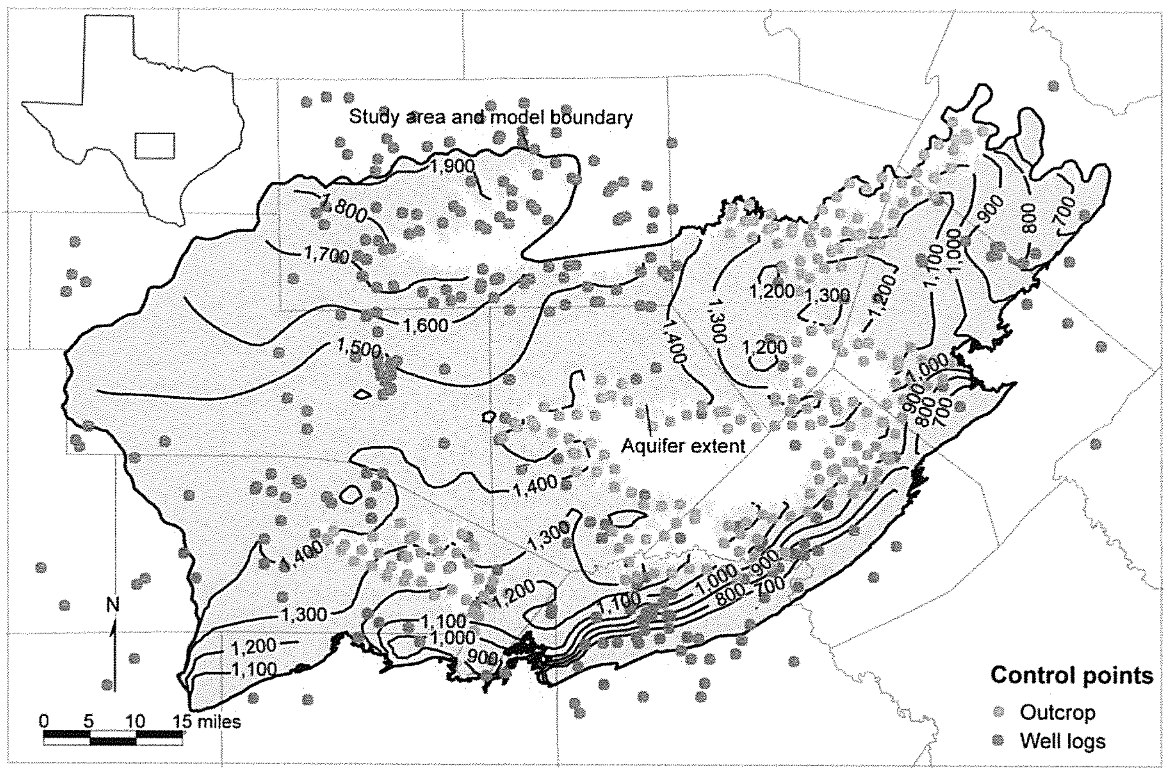


(b)

Figure 5-[illegible] Elevation of (a) the top and (b) the base of the Edwards Group. The contour interval is 100 feet (modified from Ashworth, 1983; Mace and others, 2000).

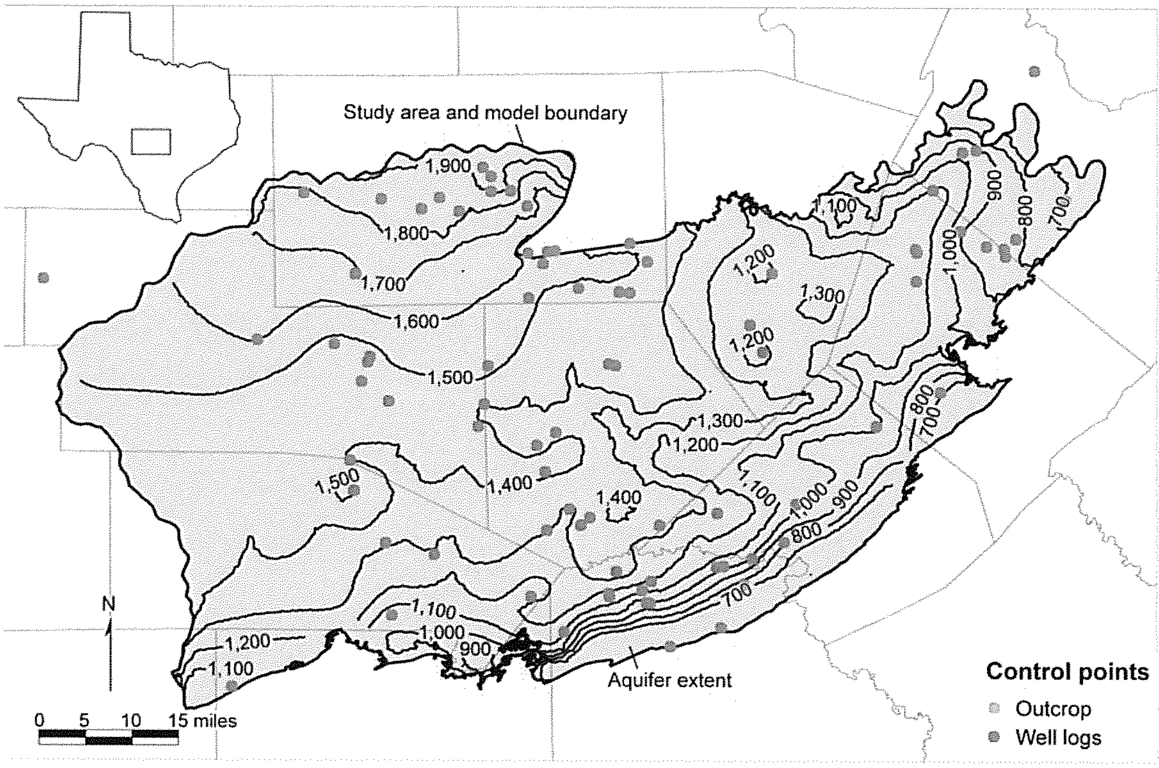


(a)

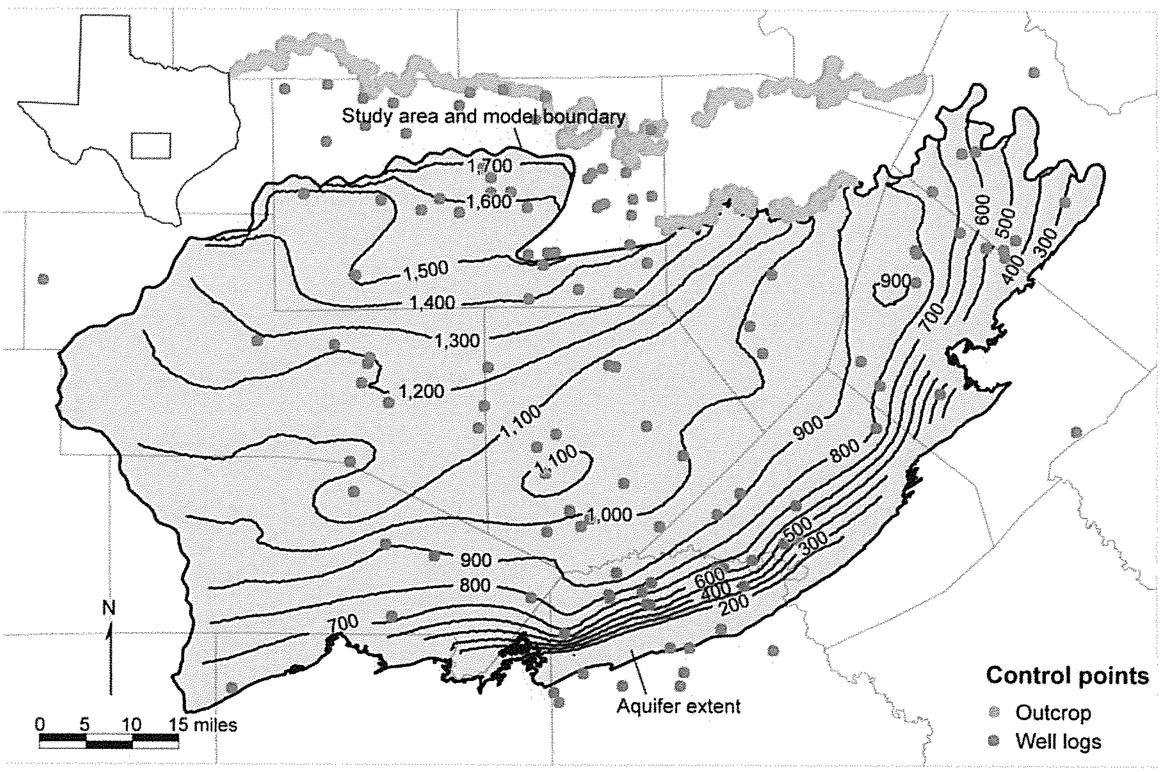


(b)

Figure 5-[illegible]: Elevations of (a) the top and (b) the base of the Upper Trinity Aquifer. The contour interval is 100 feet (modified from Ashworth, 1983; Mace and others, 2000).

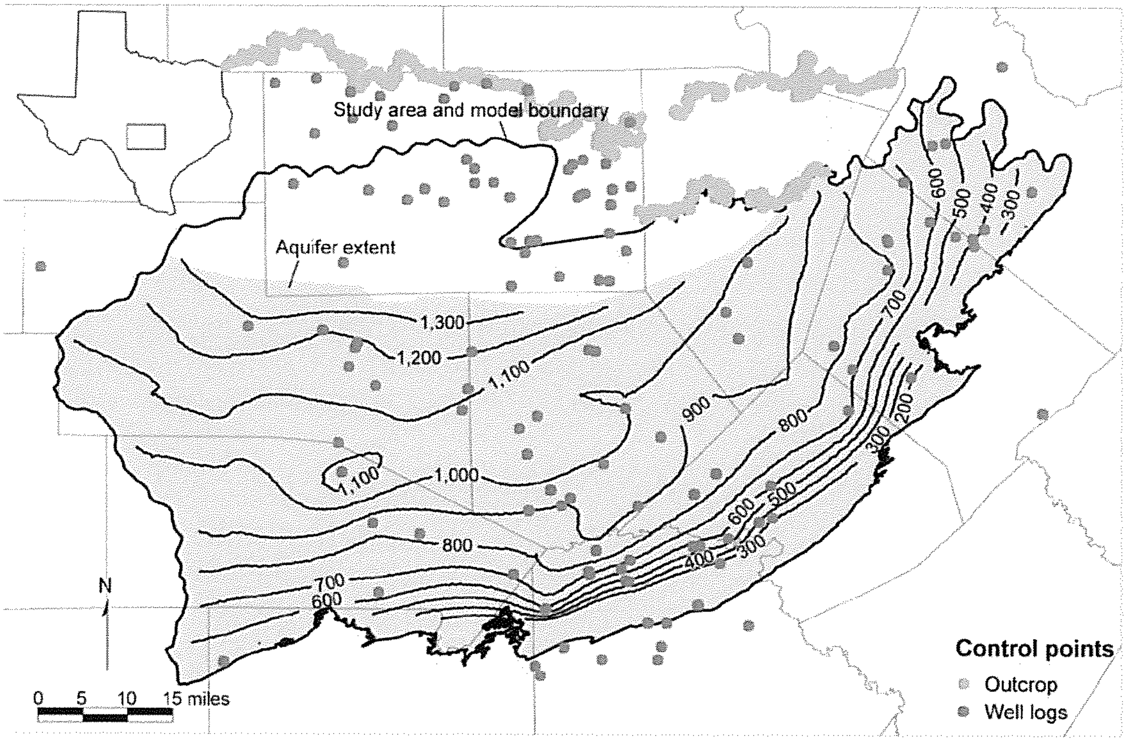


(a)

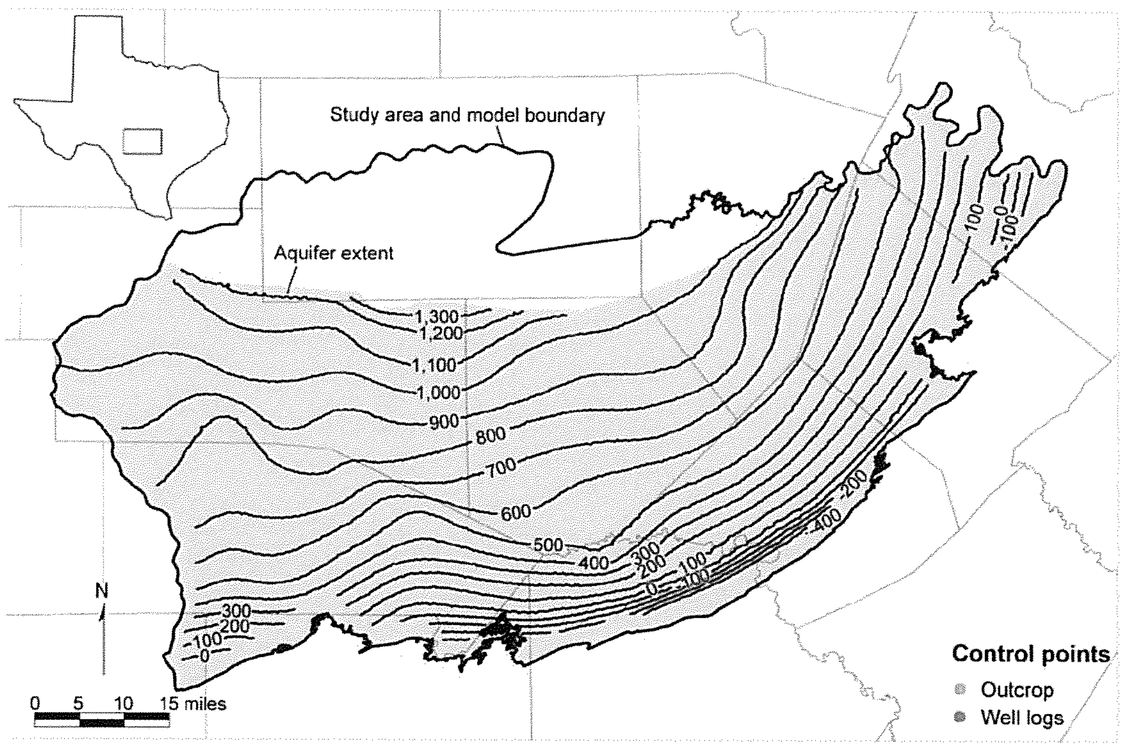


(b)

Figure 5-1. Elevations of (a) the top and (b) the base of the Middle Trinity Aquifer. The contour interval is 100 feet (modified from Ashworth, 1983; Mace and others, 2000).



(a)



(b)

Figure 5-4. **Elevations of (a) the top (modified from Ashworth, 1983; Mace and others, 2000) and (b) the base of the Lower Trinity Aquifer. The contour interval is 100 feet. Please note: the top of the Lower Trinity Aquifer coincides with the base of the Hammett Shale and thus differs from the base of the Middle Trinity Aquifer.**

As part of this project, we updated the model structure of Mace and others (2000) by revising the structure of the Middle Trinity Aquifer and adding the Lower Trinity Aquifer as a fourth layer. These changes were aided by structural interpretations from the Hays Trinity Groundwater Conservation District. The base of the Lower Trinity Aquifer was taken from the base of the Edwards-Trinity Aquifer System used in the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer System by Anaya and Jones (2009). When we compared the base elevation of the Middle Trinity Aquifer from the original model (Mace and others, 2000) with the base elevation of the Lower Trinity from the Edwards-Trinity (Plateau) Aquifer System model (Anaya and Jones, 2009), we noticed that the structures were not consistent because the base of the Middle Trinity dipped below the base of the Lower Trinity in Blanco County. To resolve this inconsistency between the two structures we revised the base of the Middle Trinity Aquifer using data from the Texas Commission on Environmental Quality Source Water Assessment and Protection geographic information system database developed by the U.S. Geological Survey. We used the Source Water Assessment and Protection data for the base of the Middle Trinity in Blanco County and merged it with the structural surface data from the original model (Mace and others, 2000) for the rest of the model. The two surfaces were merged through the use of a linear smoothing algorithm in ArcGIS® version 9.1 (ESRI, 2005).

We developed thickness maps by subtracting elevations for the tops and bases of the respective model layers using ArcGIS® 9.1 (Figures 5-5 through 5-8). The thickness of the relatively flat lying beds of the Edwards Group is controlled by the dendritic erosional pattern of the surface topography (Figures 5-1 and 5-5). Although mostly masked by the dendritic erosional pattern of the surface topography in the central and eastern portions of the study area, sediments of the Upper Trinity Aquifer thicken toward the Balcones Fault Zone (Figure 5-6). Sediments of the Middle and Lower Trinity aquifers also generally increase in thickness toward the Balcones Fault Zone (Figures 5-7 and 5-8).

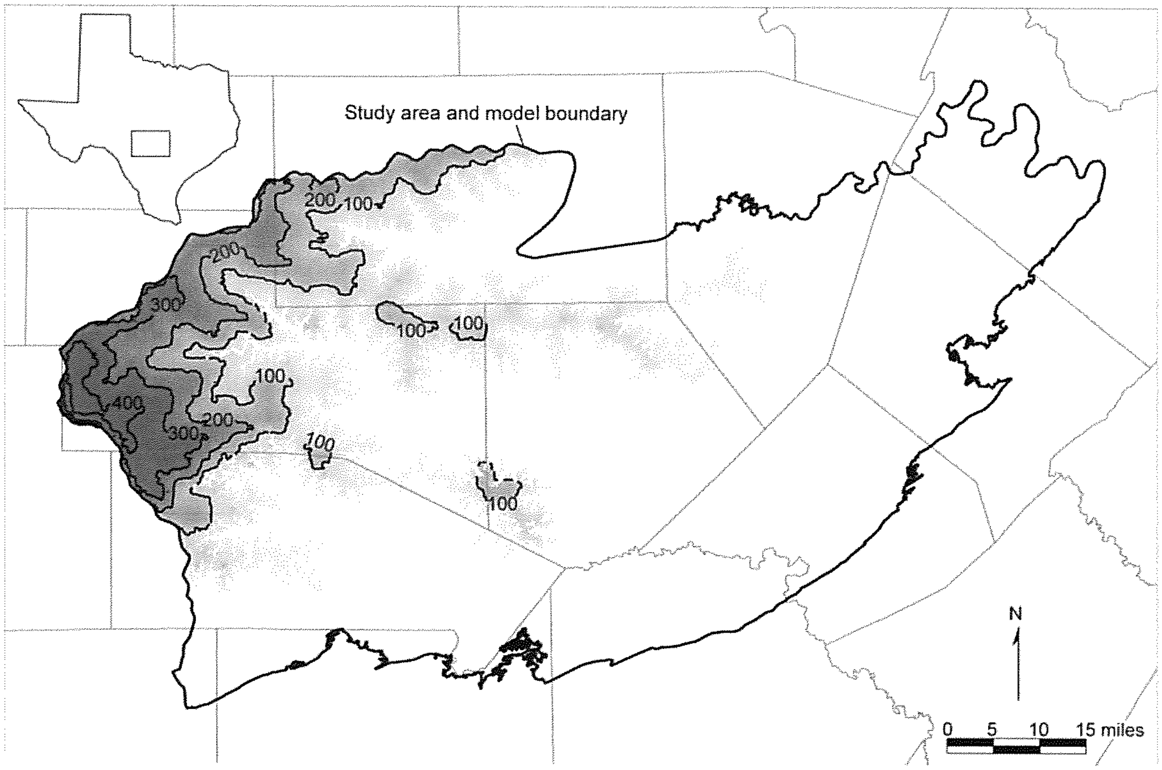


Figure 5-5. **Approximate thickness of the Edwards Group in the study area. The contour interval is 100 feet.**

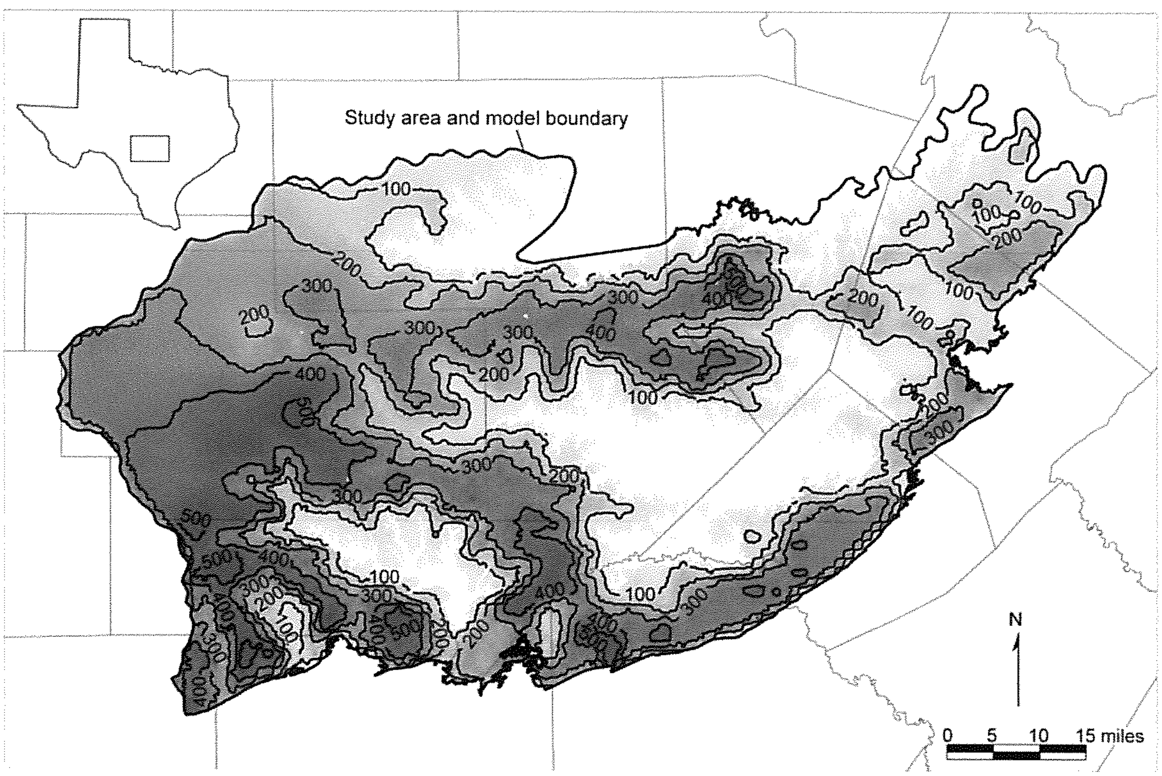


Figure 5-6. **Approximate thickness of the Upper Trinity Aquifer in the study area. The contour interval is 100 feet.**

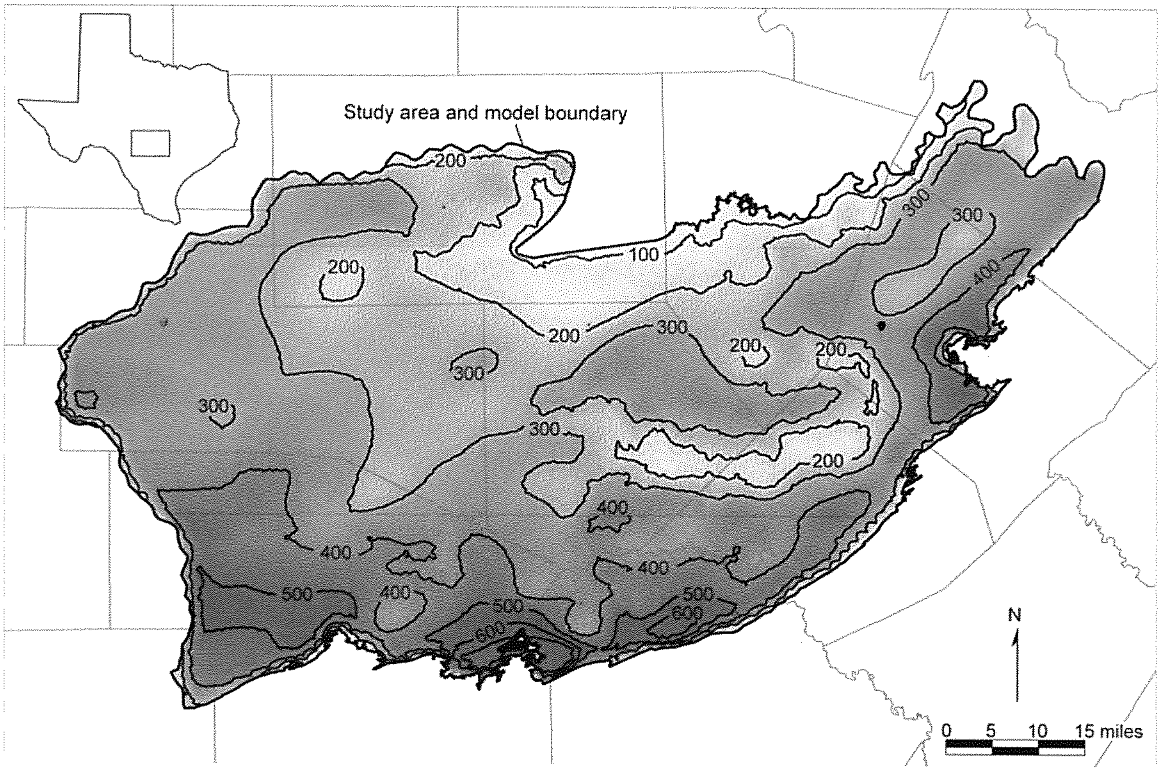


Figure 5-7. **Approximate thickness of the Middle Trinity Aquifer in the study area. The contour interval is 100 feet.**

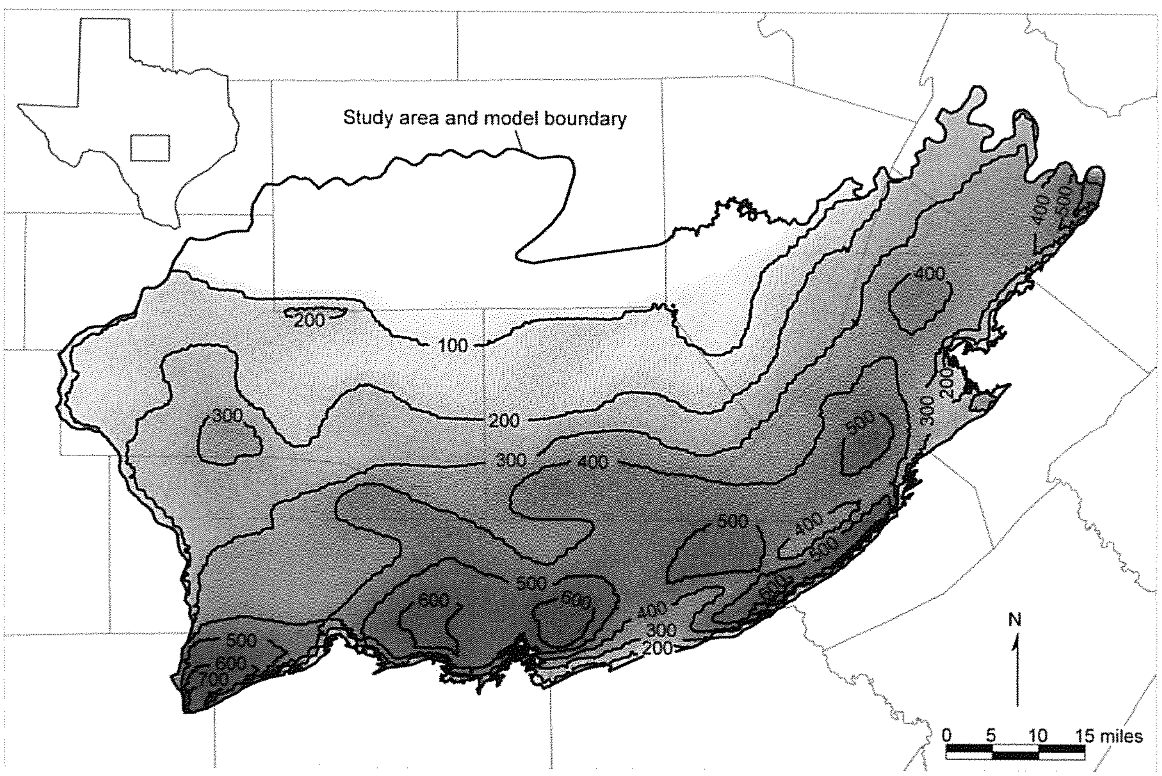


Figure 5-8. **Approximate thickness of the Lower Trinity Aquifer in the study area. The contour interval is 100 feet.**

5.3 Water Levels and Regional Groundwater Flow

We compiled water level measurements and developed generalized steady-state water level maps for the Edwards Group and the Upper, Middle, and Lower Trinity aquifers in the study area. To increase the number of measurement points, we expanded our time interval to lie between 1977 and 1985 to approximate steady-state water levels for the period about 1980. If a well had multiple water level measurements, we chose the average measurement for contouring the water level map.

Water levels in the aquifers generally follow topography (Figures 5-9 through 5-12). Kuniansky and Holligan (1994) noted that water levels in this area are a subdued representation of surface topography due to recharge in the uplands and discharge in the lowlands. Water level maps indicate that water levels are influenced by the location of rivers and springs. For example, the water level maps show that groundwater in the aquifer flows toward most of the rivers in the study area (Figures 5-9 through 5-12). In the case of the Edwards Group, groundwater flows east toward the escarpment, where there are numerous springs at the geologic contact between the Edwards Group and the upper member of the Glen Rose Limestone (Figure 5-9). Barker and Ardis (1996) also noted that water level elevations and the direction of groundwater flow in the Trinity Aquifer System are largely controlled by the position of springs and streams.

Groundwater flows from higher water level elevations toward lower water level elevations. The water level maps show that regional groundwater flow is from the northwest toward the southeast and east (Figures 5-9 through 5-12). Water level maps also show that groundwater in the Upper, Middle, and Lower Trinity aquifers flows out of the study area to the south and east into the Edwards (Balcones Fault Zone) Aquifer (Figures 5-10 through 5-12). Section 5.7 (Discharge) of this report discusses the estimated amount of groundwater flow from the Hill Country portion of the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer.

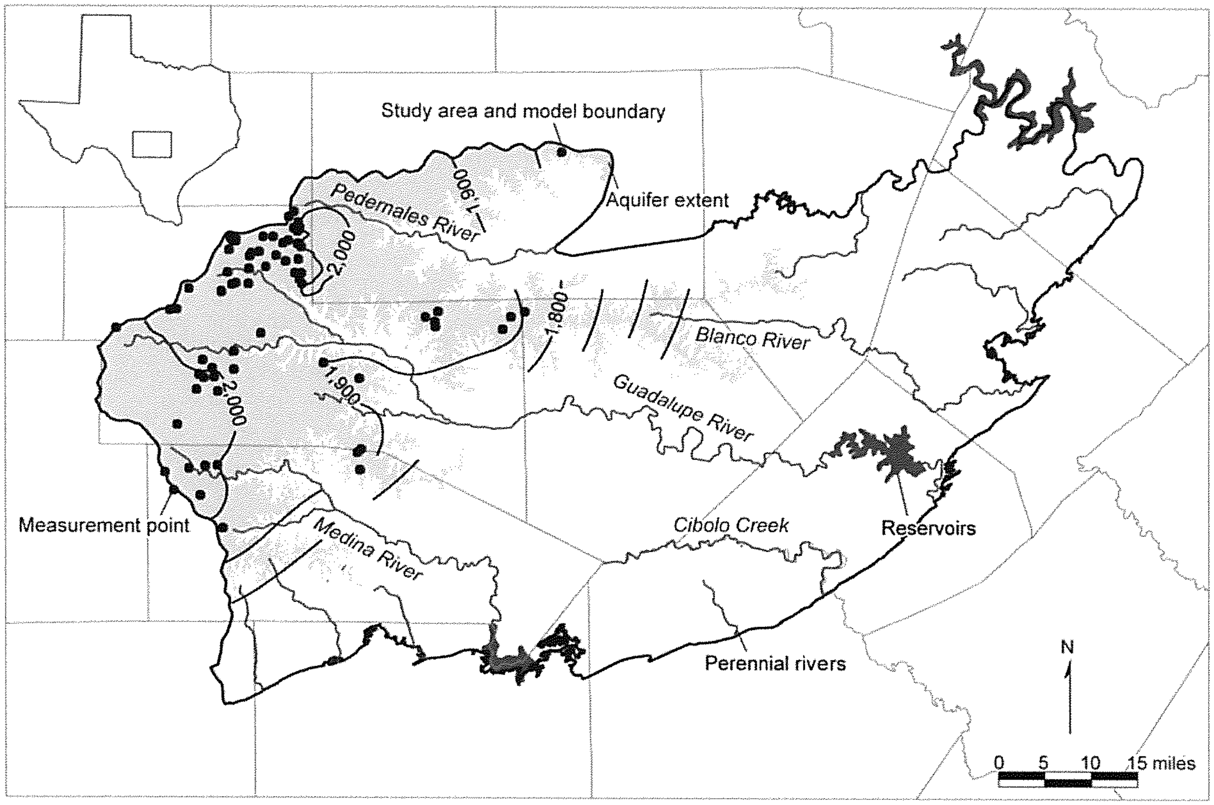


Figure 5-9. **Average water level elevations in the Edwards Group in the study area for the period 1977 through 1985. The contour interval is 100 feet.**

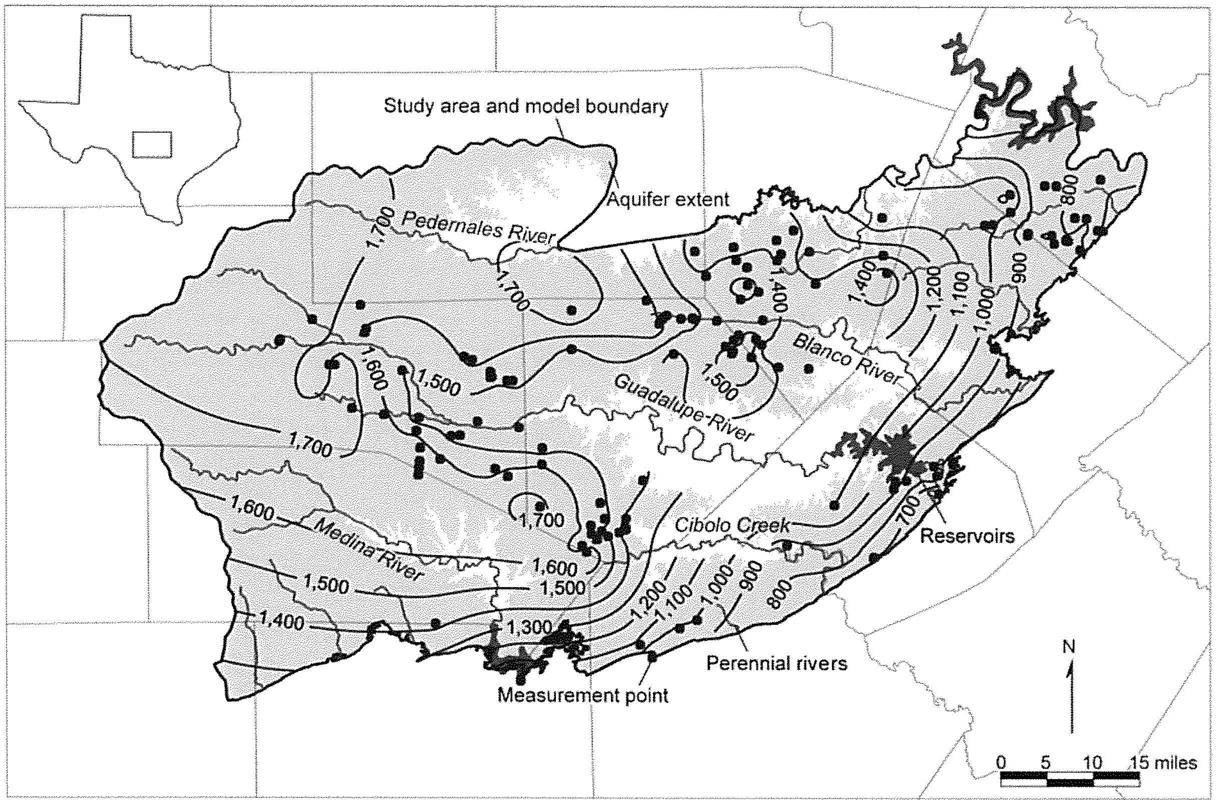


Figure 5-10. **Average water level elevations in the Upper Trinity Aquifer in the study area for the period 1977 through 1985. The contour interval is 100 feet.**

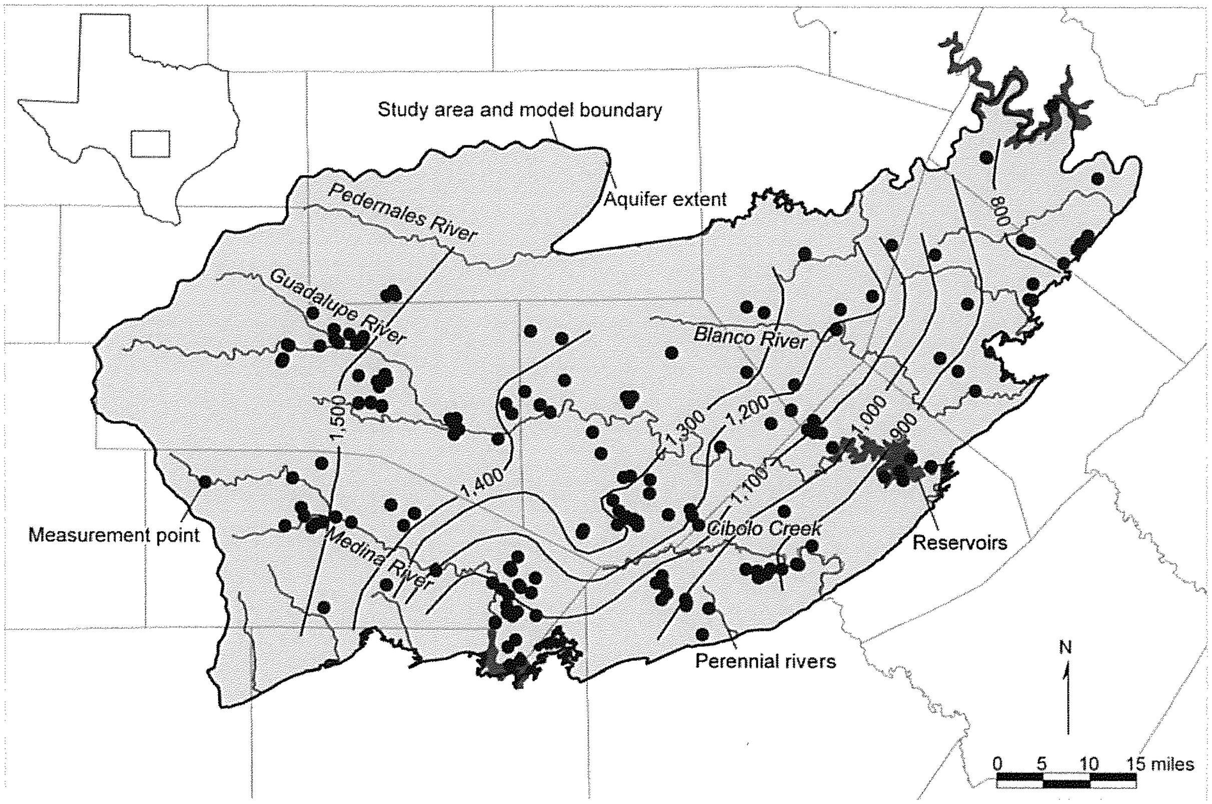


Figure 5-11. **Average water level elevations in the Middle Trinity Aquifer in the study area for the period 1977 through 1985. The contour interval is 100 feet.**

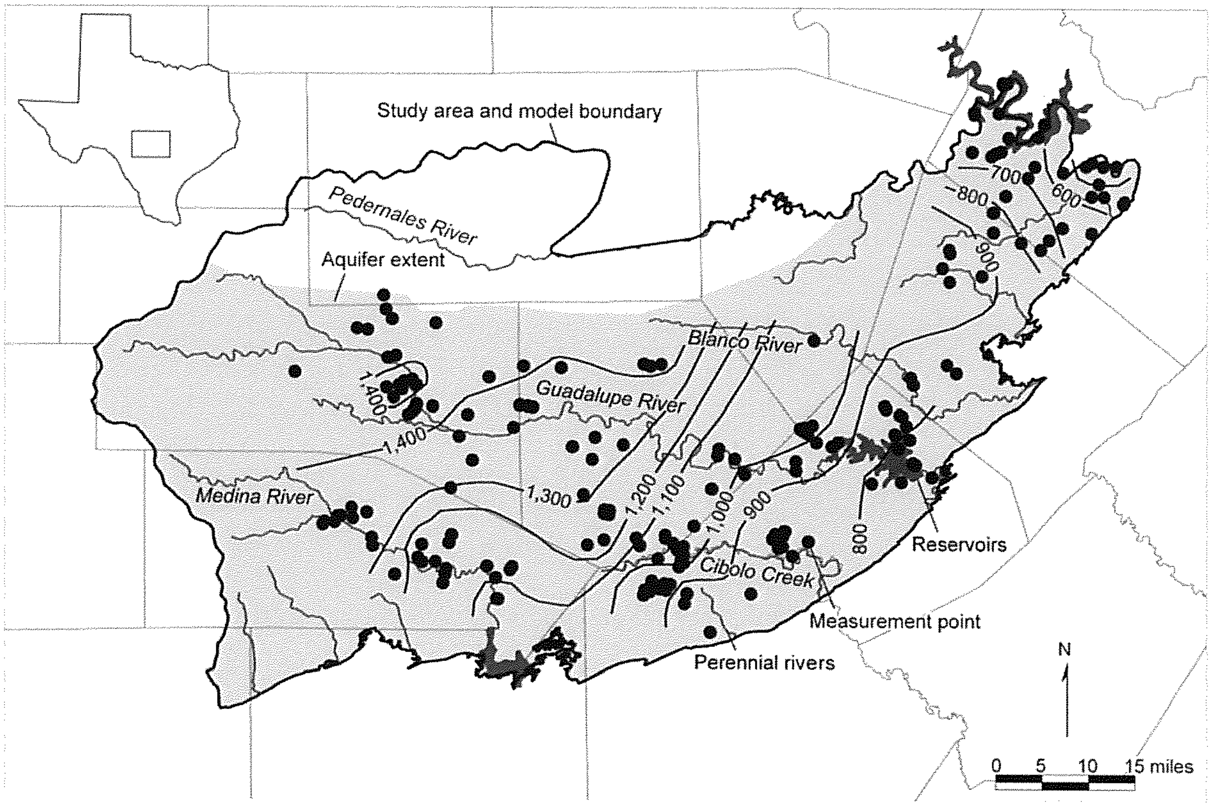


Figure 5-12. Average water level elevations in the Lower Trinity Aquifer in the study area for the period 1977 through 1985. The contour interval is 100 feet.

Water levels, especially in shallow wells (less than 100 feet deep), can seasonally vary by as much as 50 feet (Barker and Ardis, 1996) in response to rainfall events. Some wells show relatively small changes in water level over time, for example, wells 69-04-502, 56-48-301, 57-61-803, and 58-50-120, whereas others show large fluctuations, for example, wells 68-19-806 and 56-63-604 (Figures 5-13 through 5-16). Wells with detailed measurements, for example, wells 68-19-806, 68-02-609, and 68-01-314, show seasonal fluctuations (Figures 5-15 and 5-16). Figures 5-13 through 5-16 suggest that overall there are no long-term trends of declining or rising water levels in the Hill Country portion of the Trinity Aquifer System; thus, water levels in the 1990s will be similar to those for the period 1977 through 1985 (Figures 5-9 through 5-12).

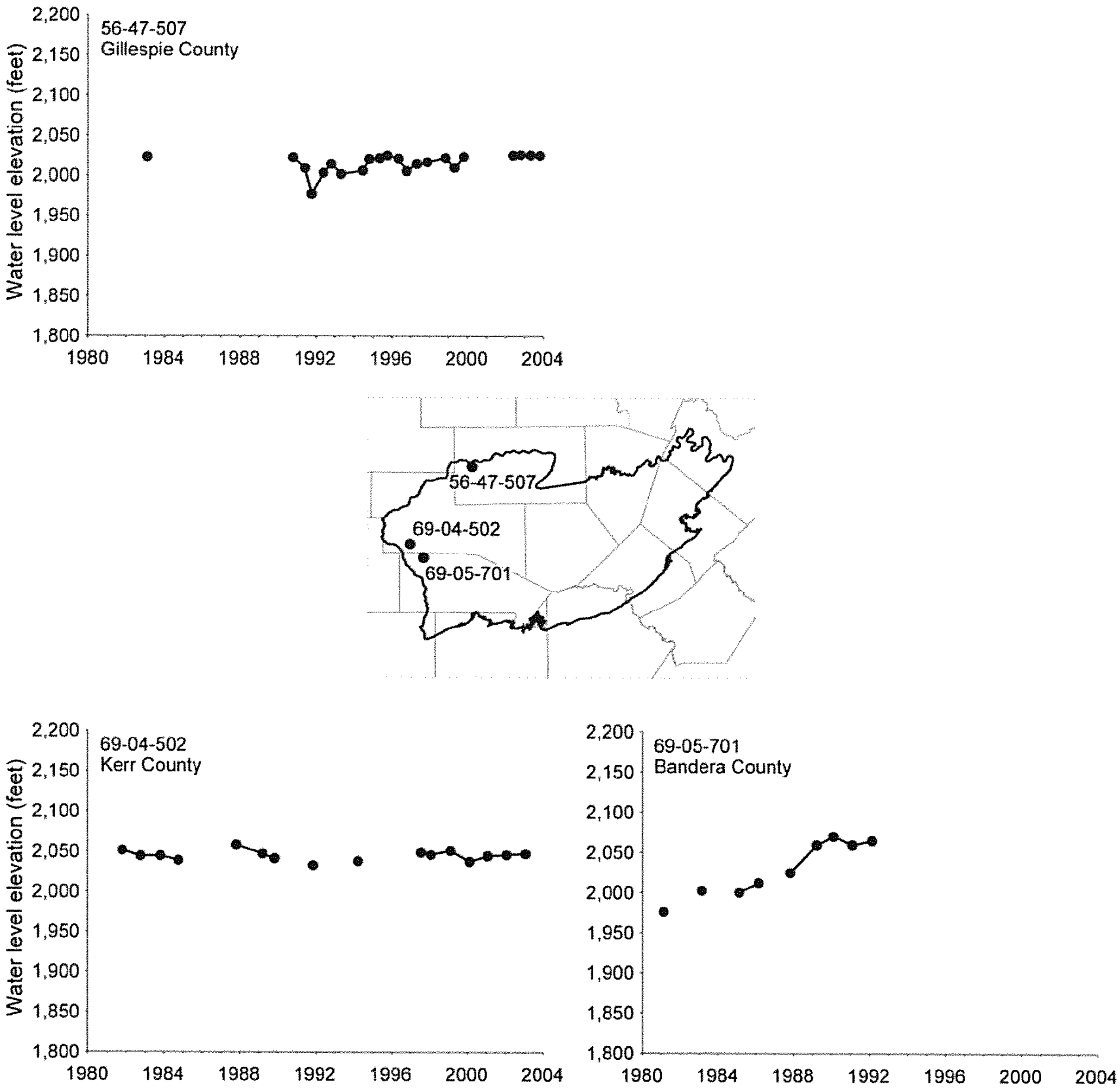


Figure 5-13. Hydrographs from selected Edwards Group wells in the study area.

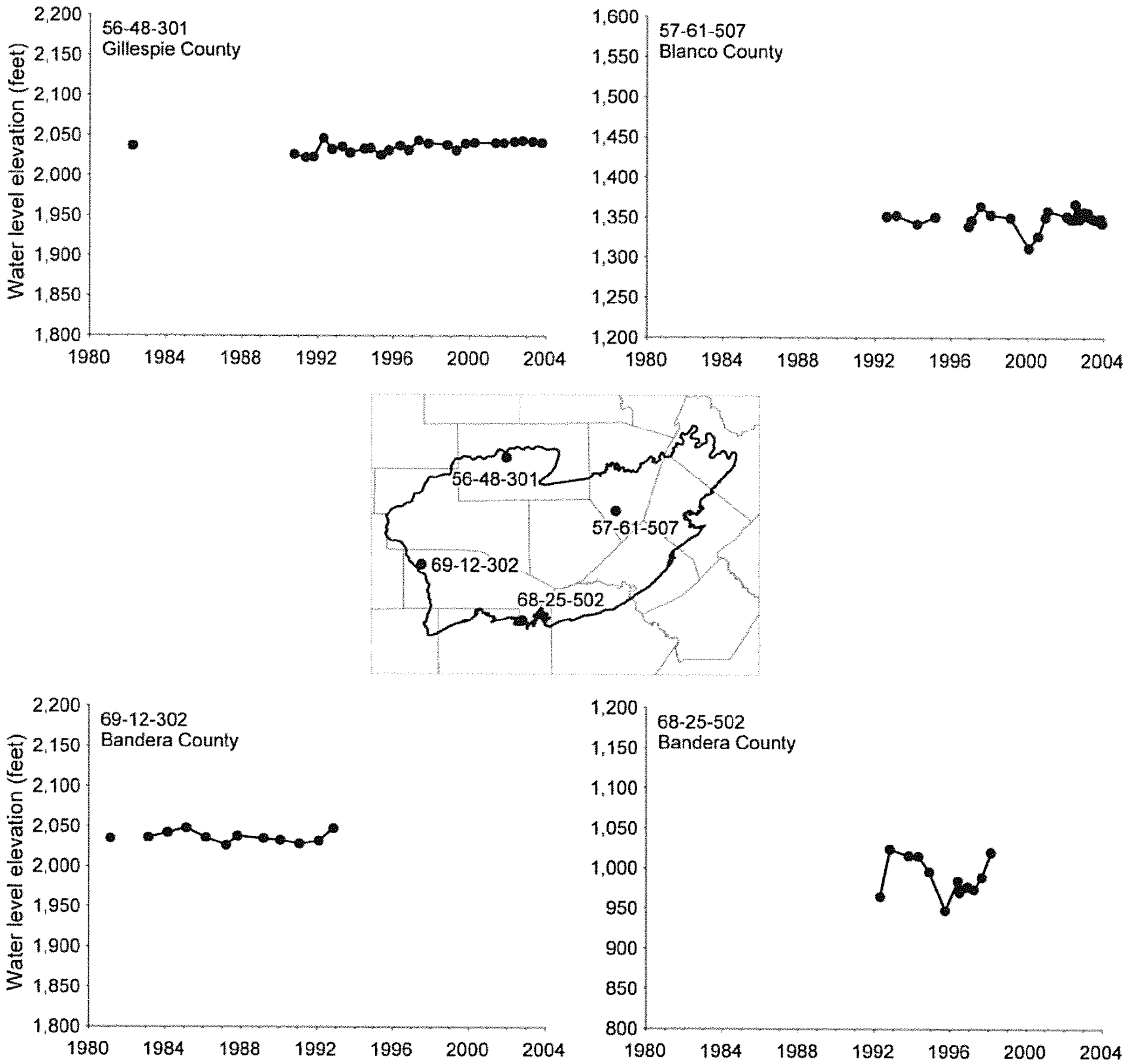


Figure 5-14. **Hydrographs from selected Upper Trinity Aquifer wells in the study area.**

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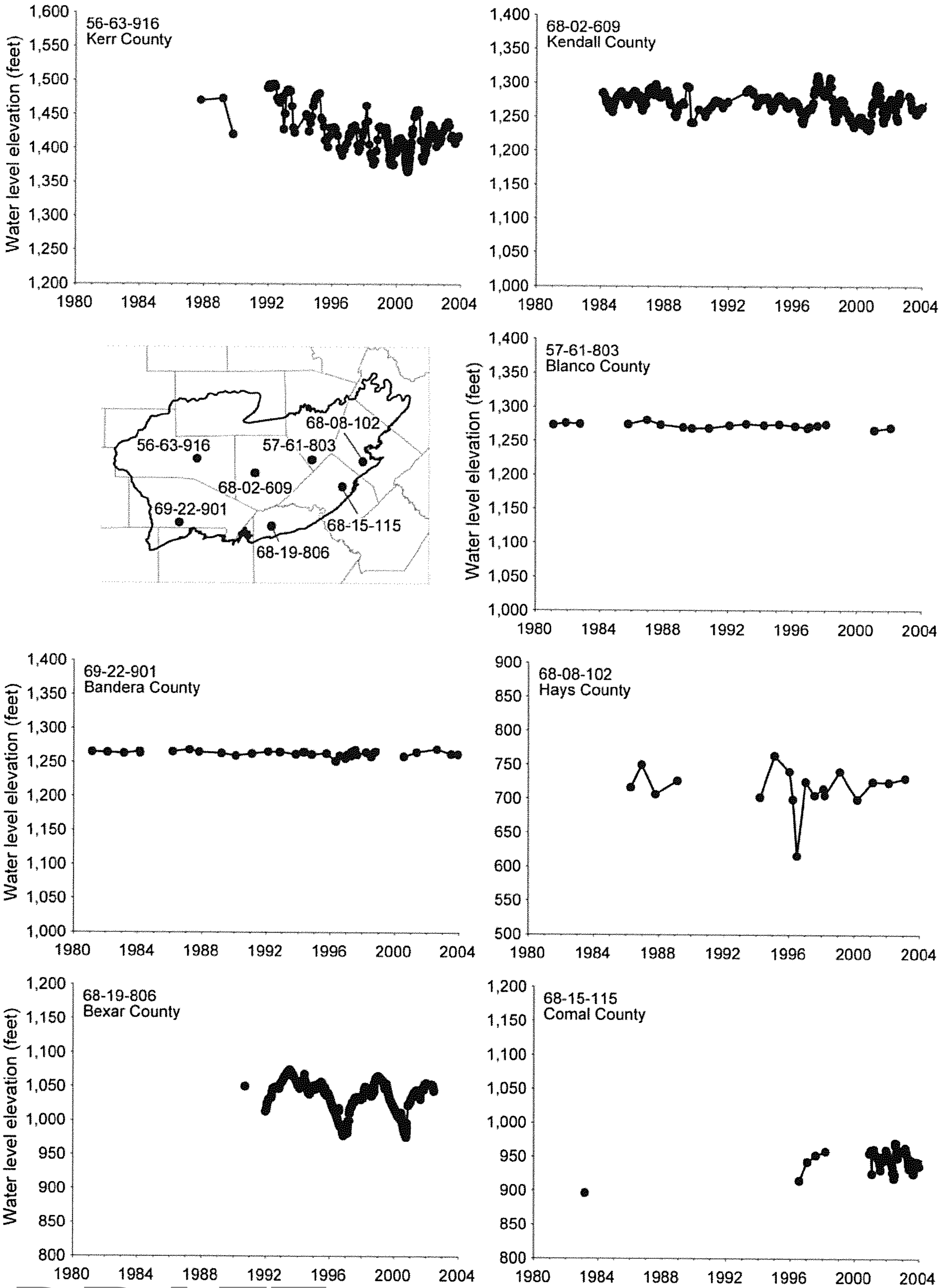


Figure 5-15. Hydrographs from selected Middle Trinity Aquifer wells in the study area.

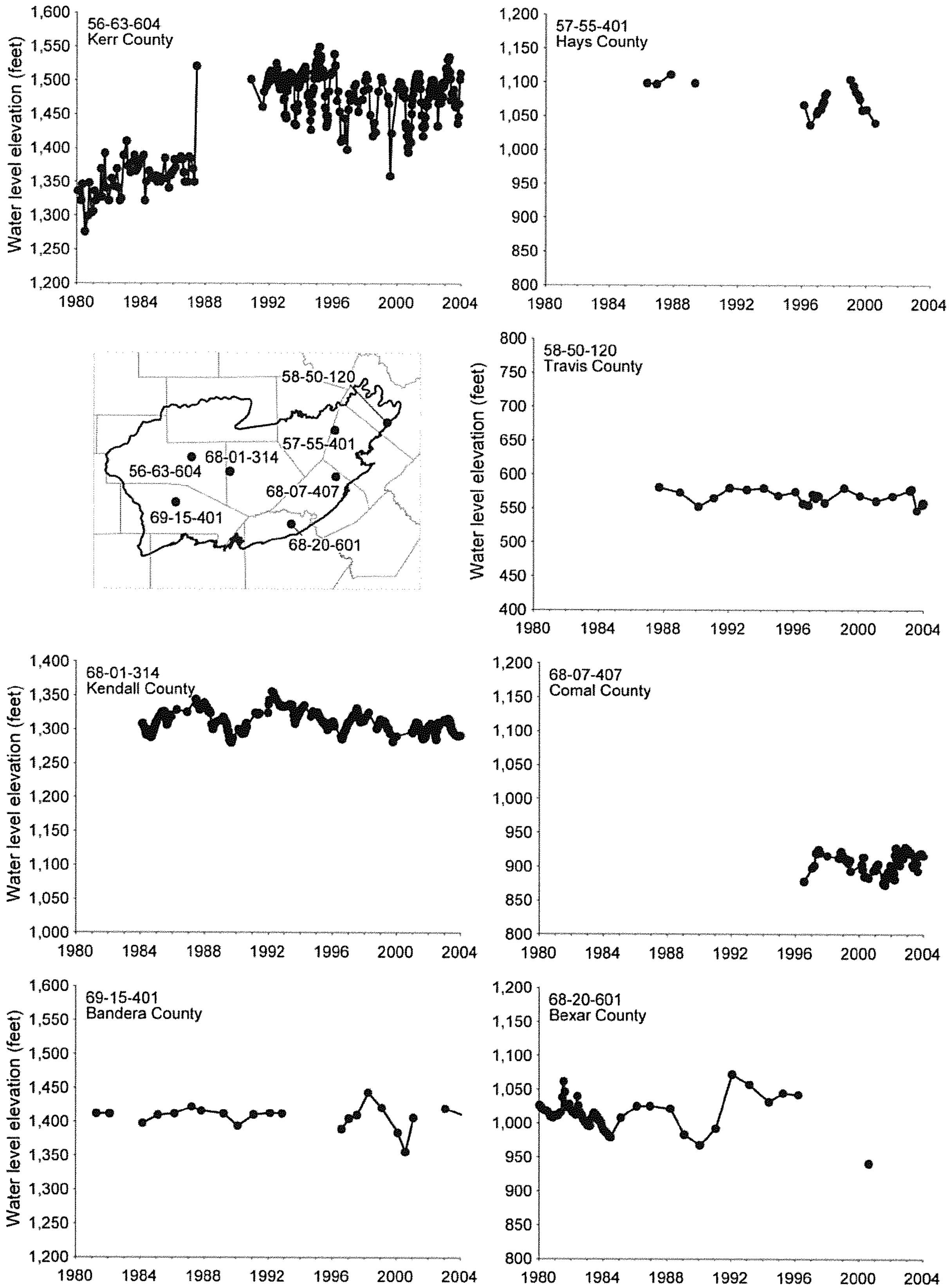


Figure 5-[illegible]6. Hydrographs from selected Lower Trinity Aquifer wells in the study area.

From 1980 to 1997, water levels generally rose in the Upper Trinity Aquifer of Bexar County (Figure 5-17). Over the same period, water levels generally declined in the Middle and Lower Trinity aquifers in Bandera, Blanco, Kendall, and Kerr counties and rose, at least locally, in Bexar and Comal counties (Figure 5-18). In other parts of the study area, water levels show seasonal fluctuations but have remained fairly constant since 1980. The area having the most significant water level decline is near the city of Kerrville in Kerr County. The largest water level decline is approximately 40 feet in the Middle Trinity Aquifer and 85 feet in the Lower Trinity Aquifer (Figures 5-15 and 5-16). The 128-foot water level rise in Kerr County (Well 56-63-604) can be attributed to a reduction in pumping by the City of Kerrville. Well 68-08-102, which is located near the city of Wimberley (Hays County), shows a water level decline of approximately 45 feet between 1980 and 2000 (Figure 5-15).

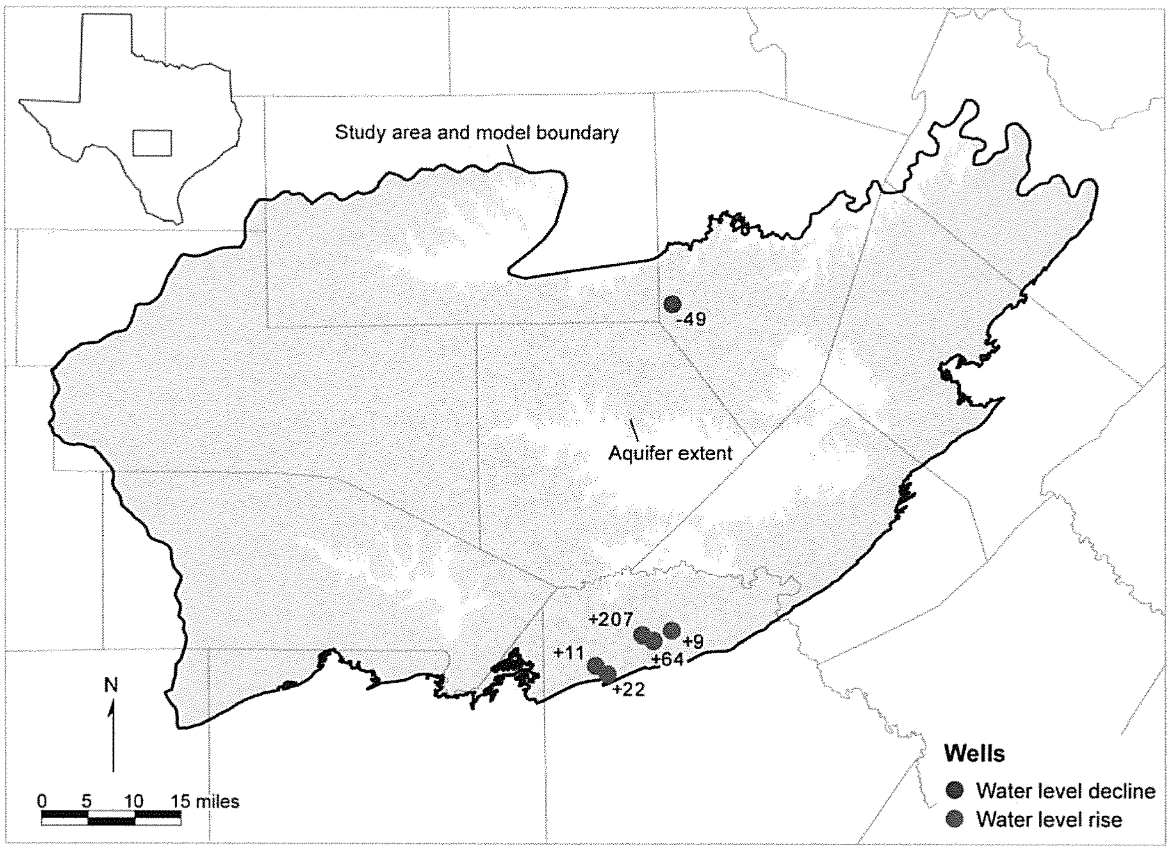


Figure 5-17. Net water level change in the Upper Trinity Aquifer between 1980 and 1997 at selected well locations.

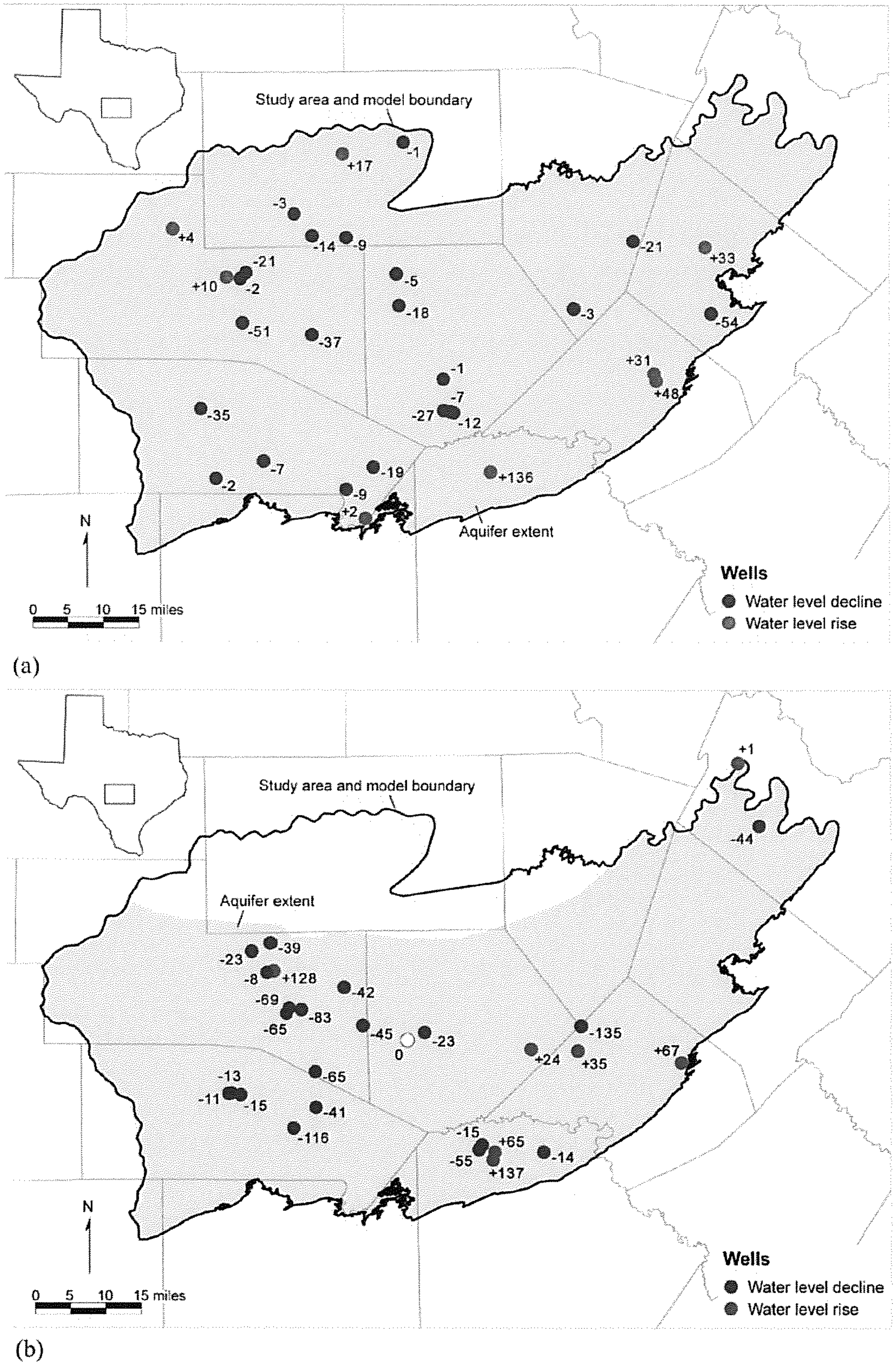


Figure 5-18. Net water level change in (a) the Middle Trinity Aquifer and (b) Lower Trinity Aquifer between 1980 and 1997 at selected well locations. Positive values (blue points) indicate rise in water level, and negative values (red points) indicate decline in water levels.

5.4 Recharge

The primary sources of inflow to the Hill Country portion of the Trinity Aquifer System are rainfall on the outcrop, seepage losses through headwater creeks, and lakes during high stage levels. The outcrops in the study area are composed of the upper and lower members of the Glen Rose Limestone, Hensell Sand, and Edwards Group and receive all of the direct recharge from rainfall. The Cow Creek Limestone and Lower Trinity Aquifer sediments are not exposed at land surface in the study area and receive water by vertical leakage from overlying strata (Ashworth, 1983). Beds containing relatively low permeability sediments within the upper member of the Glen Rose Limestone impede downward percolation of interstream recharge and facilitate horizontal groundwater flow, resulting in base flow and spring flow to the mostly gaining perennial streams that drain the Hill Country (Ashworth, 1983; Barker and Ardis, 1996). Recharge in the Edwards Group limestones of the northwestern portion of the study area occurs as infiltration of rainfall and losing streams. Much of this water later emerges as springs and seeps along the geologic contact between the Edwards Group and the upper member of the Glen Rose Limestone.

Sinkholes and caverns in the Glen Rose Limestone of southern Kendall, northern Bexar, and western Comal counties may transmit large quantities of water to the Hill Country portion of the Trinity Aquifer System. Karst-enhanced recharge is especially significant along Cibolo Creek between Boerne and Bulverde (Ashworth, 1983; Veni, 1994). However, because much of this recharge is quickly transmitted to the Edwards (Balcones Fault Zone) Aquifer, it has minimal effect on the Hill Country portion of the Trinity Aquifer System (Veni, 1994; Barker and Ardis, 1996).

Several investigators have estimated recharge rates for the Hill Country portion of the Trinity Aquifer System (Table 5-1).

Table 5-1. **Estimates of recharge rates to the Hill Country portion of the Trinity Aquifer System as a percentage of average annual precipitation.**

Literature source	Recharge rate (inches per year)	Percent value
Muller and Price (1979)	0.5	1.5
Ashworth (1983)	1.3	4.0
Kuniansky (1989)	3.6	11.0
Bluntzer (1992, calculated)	2.2	6.7
Bluntzer (1992, estimated)	1.7	5.0
Kuniansky and Holligan (1994)	2.3	7.0
Mace and others (2000)	1.3	4.0
Mace (2001)	2.2	6.6
Wet Rock Groundwater Services (2008)	3.1	9.5
Anaya and Jones (2009)	1.4	4.7

Most of them used stream base flow to estimate recharge. Muller and Price (1979) assumed a recharge rate of 1.5 percent of average annual precipitation for their rough approximation of groundwater availability. This estimate of recharge was intended to minimize impacts of groundwater production on base flow and groundwater flow to the Edwards (Balcones Fault Zone) Aquifer. On the basis of a study of base-flow gains in the Guadalupe River between the Comfort and Spring Branch gaging stations during a 20-year period between 1940 and 1960, Ashworth (1983) estimated an average annual effective recharge rate of 4 percent of average annual precipitation for the Hill Country. Kuniansky (1989) estimated base flow for 11 drainage basins in our study area for a 28-month period between December 1974 and March 1977 and estimated an annual recharge rate of about 11 percent of average annual rainfall. However, Kuniansky and Holligan (1994) reduced this recharge rate to 7 percent of average annual precipitation to calibrate a groundwater model that included the Hill Country portion of the Trinity Aquifer System. They suggested that the numerical model did not include all the local streams accepting discharge from the aquifer. Bluntzer (1992) calculated long-term average annual base flow from the Blanco, Guadalupe, Medina, Pedernales, and Sabinal rivers and Cibolo and Seco creeks to be 369,100 acre-feet per year. Using a long-term average annual precipitation of 30 inches per year, the recharge estimate by Bluntzer (1992) is equivalent to a recharge rate of 6.7 percent of average annual precipitation (Riggio and others, 1987). However, Bluntzer (1992) suggested that a recharge rate of 5 percent is more appropriate to account for human impacts on base flow such as nearby groundwater pumping, streamflow diversions, municipal and irrigation return flows, and retention structures. Bluntzer (1992) also noted that base flow was highly variable over time. Mace and others (2000) suggested that differences in recharge rates reflect biases in the record of analysis due to variation of precipitation. The higher recharge rate estimated by Kuniansky (1989) is most likely due to the higher-than-normal precipitation between December 1974 and March 1977, her record of analysis. Ashworth's (1983) recharge rate is probably biased toward a lower value because his record of analysis includes the 1950s' drought of record.

Mace and others (2000) developed an automated digital hydrograph-separation technique to estimate base flow for the drainage basin defined by the Guadalupe River gaging stations between Comfort and Spring Branch. Mace and others (2000) based this technique on methods used by Nathan and McMahon (1990) and Arnold and others (1995). Mace and others (2000) used the program to estimate base flow from 1940 to 1990 and adjusted parameters to attain the best fit with Ashworth's (1983) and Kuniansky's (1989) base-flow values for the same stream reach. Using this technique, Mace and others (2000) estimated a recharge rate of 6.6 percent of average annual precipitation. Note that the calibrated recharge rate by Mace and others (2000) is about 4 percent of average annual precipitation. All base-flow-based estimates of recharge underestimate recharge because they do not consider the component of recharge that follows the regional flow paths and bypasses the local streams. Additional error in this methodology is associated with the implied assumption that each watershed is a closed system and thus all water that recharges the aquifer discharges to the adjacent river. Regional groundwater flow between watersheds, however, results in underestimation of recharge in up-gradient watersheds and overestimation in down-gradient watersheds.

In the updated model, we spatially distributed recharge using the Parameter-elevation Regressions on Independent Slopes Model (PRISM) data (Daly and Taylor, 1998; Spatial Climate Analysis Service, 2004). The Parameter-elevation Regressions on Independent Slopes Model is an analytical model that spatially distributes monthly, seasonal, and annual precipitation. We assumed that recharge is a fraction of annual precipitation. This fraction, or recharge coefficient, is determined during model calibration. In addition to precipitation, we assumed that the aquifer receives recharge from streamflow losses in Cibolo Creek. This recharge is estimated on the basis of watershed modeling of the Cibolo Creek watershed by the U.S. Geological Survey (Ockerman, 2007). This watershed modeling indicates average annual recharge of approximately 72,000 acre-feet to the Trinity Aquifer System within the study area. The methodology used in the updated model is an improvement over the recharge estimation method used by Mace and others (2000) that was based on base-flow coefficients and precipitation distribution. In addition to overcoming the weaknesses in base-flow-based recharge estimation methods stated above, the updated model was further improved by using data from a study of the Cibolo Creek watershed (Ockerman, 2007) that was not available for use by Mace and others (2000).

5.5 Rivers, Streams, Springs, and Lakes

Most of the rivers in the study area arise along the eastern margin of the Edwards Plateau and descend with a steep gradient into the Hill Country (Figure 3-6). Many of these streams have upper reaches contained within narrow canyons and broaden into flat-bottomed valleys farther downstream (Barker and Ardis, 1996). Three major drainage basins—the San Antonio, Guadalupe, and Colorado rivers—traverse the study area and funnel flow toward the southeast.

Most of the rivers in the study area gain water from the Hill Country portion of the Trinity Aquifer System (Ashworth, 1983; Slade and others, 2002) (Figure 5-19) and are hydraulically connected to the regional flow system (Kuniansky, 1990). These streams receive groundwater that discharges through seeps and springs that occur along the tops of impermeable units where they appear at land surface (Barker and Ardis, 1996). Much of the groundwater in local flow systems within the Hill Country portion of the Trinity Aquifer System discharges to adjacent deeply entrenched, perennial streams instead of flowing to deeper portions of the aquifer (Ashworth, 1983). Many springs issue from the Edwards Group along the margin of the Edwards Plateau in the western part of the study area (Ashworth, 1983).

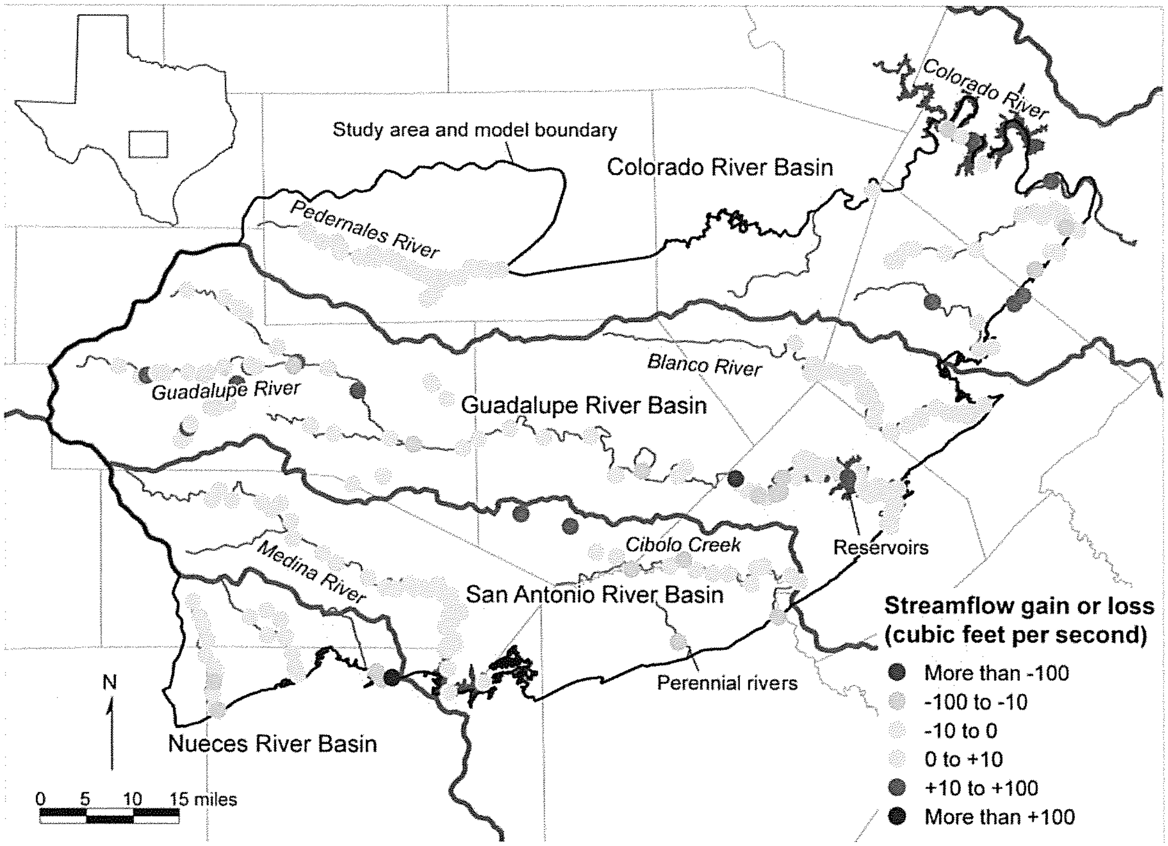


Figure 5-19. Streamflow gain (positive values) and loss (negative values) from Slade and others (2002).

Most of the rivers in the study area are perennial (Figures 5-20 through 5-26). Lower reaches of Cibolo Creek lose flow between Boerne and Bulverde where the creek flows over the lower member of the Glen Rose Limestone (Ashworth, 1983) (Figure 5-26). Upstream of Boerne, Cibolo Creek gains water where it flows over the upper member of the Glen Rose Limestone (Guyton and Associates, 1958, 1970; Espey, Huston and Associates, 1982; LBG-Guyton Associates, 1995; Mace and others, 2000). Lower reaches of most of the streams in the study area lose significant quantities of flow where they cross the recharge zone of the Edwards (Balcones Fault Zone) Aquifer (Barker and others, 1994). Most perennial rivers in the study area have extremely low flow for brief periods during droughts (Figures 5-21 through 5-23).

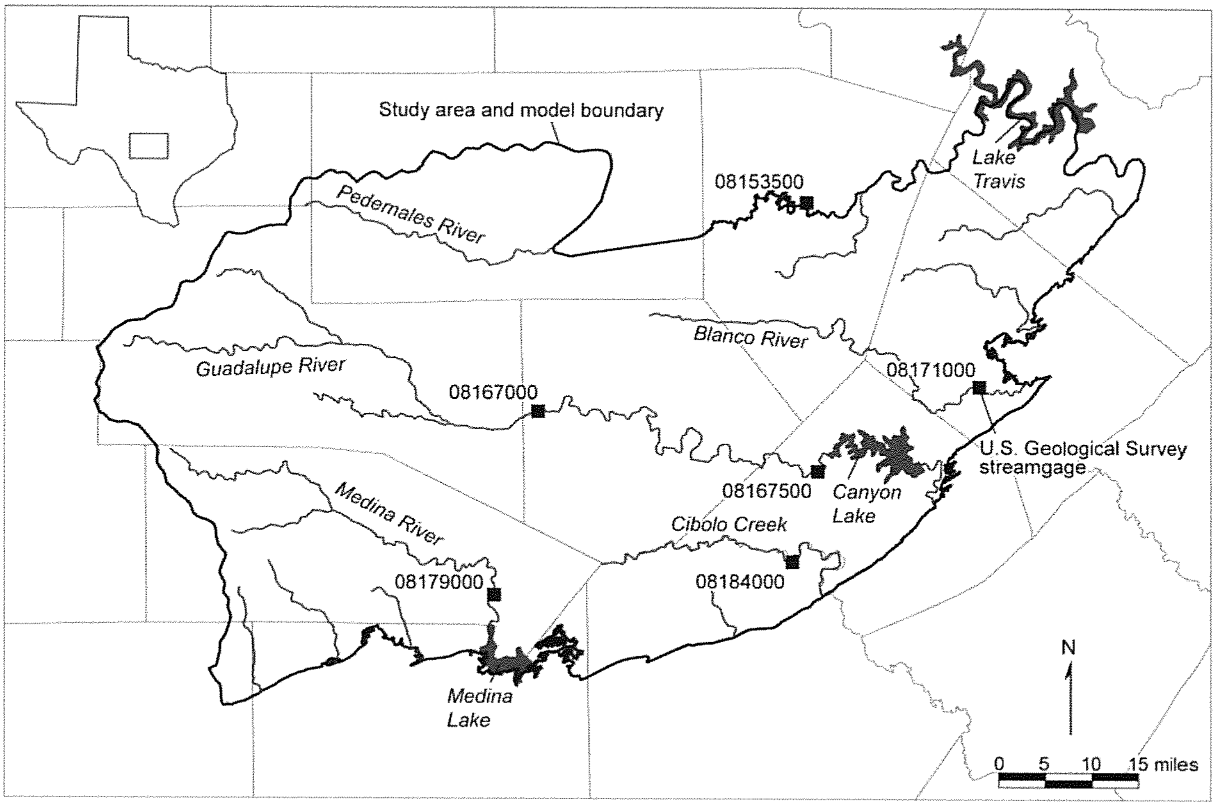


Figure 5-20. Location of streamgages for the streamflow hydrographs shown in Figures 5-21 through 5-26 (from Mace and others, 2000).

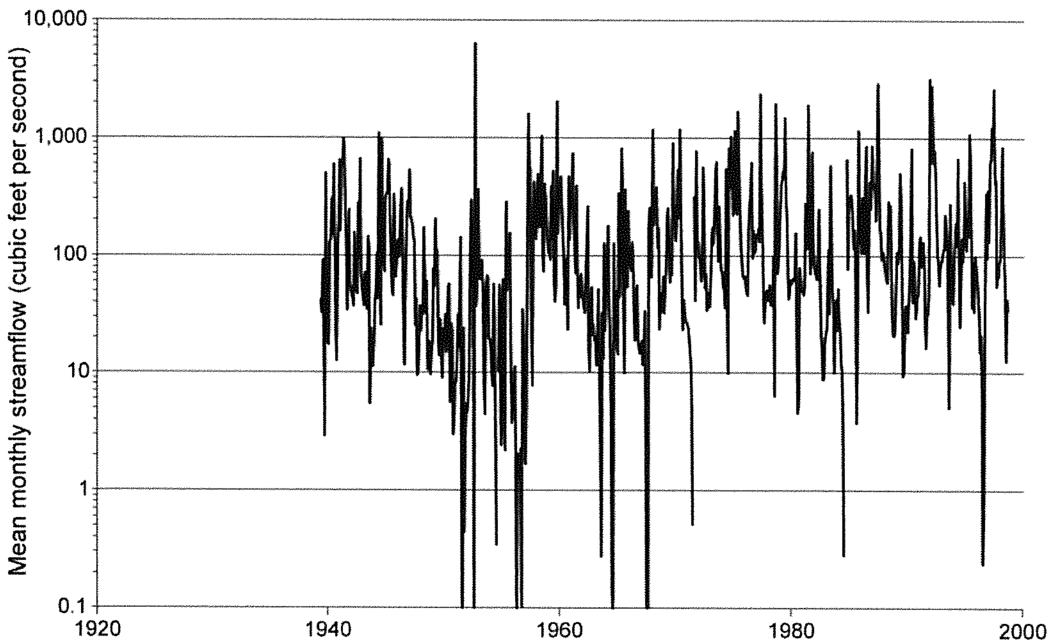


Figure 5-21. Mean monthly streamflow for the U.S. Geological Survey gaging 08153500 on the Pedernales River near Johnson City. The station location can be found in Figure 5-20 (from Mace and others, 2000).

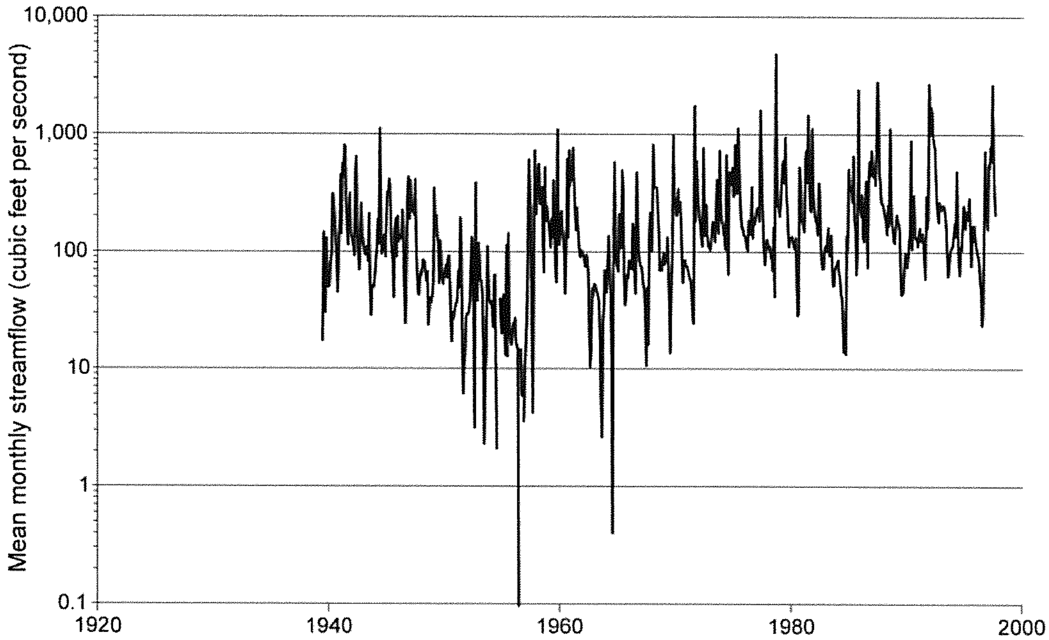


Figure 5-22. Mean monthly streamflow for the U.S. Geological Survey gaging 08167000 on the Guadalupe River at Comfort. The station location can be found in Figure 5-20 (from Mace and others, 2000).

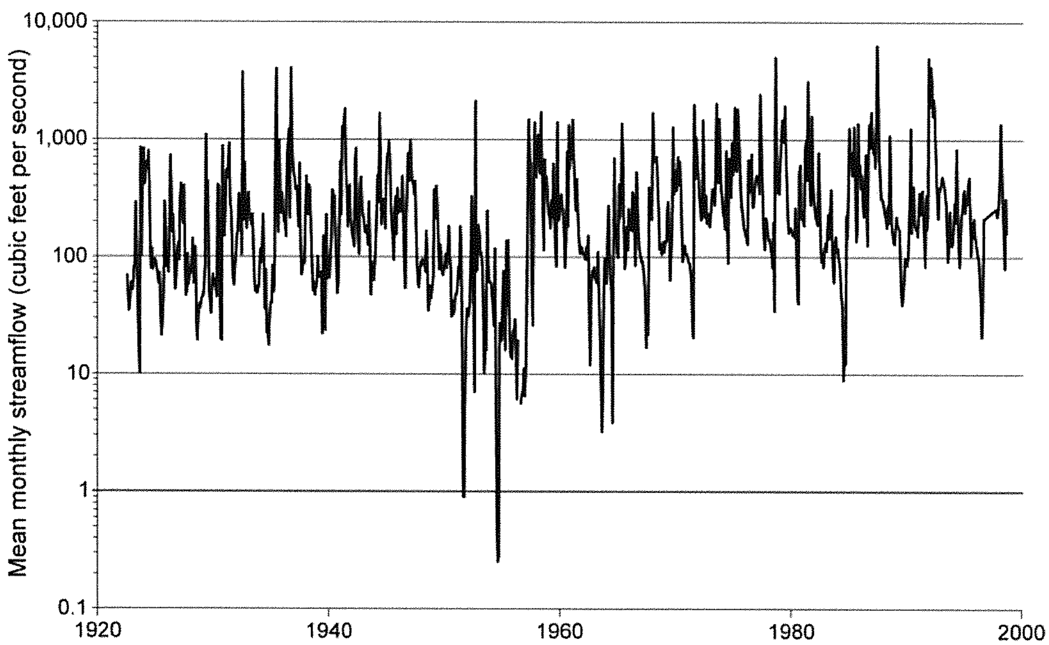


Figure 5-23. Mean monthly streamflow for the U.S. Geological Survey gaging 08167500 on the Guadalupe River near Spring Branch. The station location can be found in Figure 5-20 (from Mace and others, 2000).

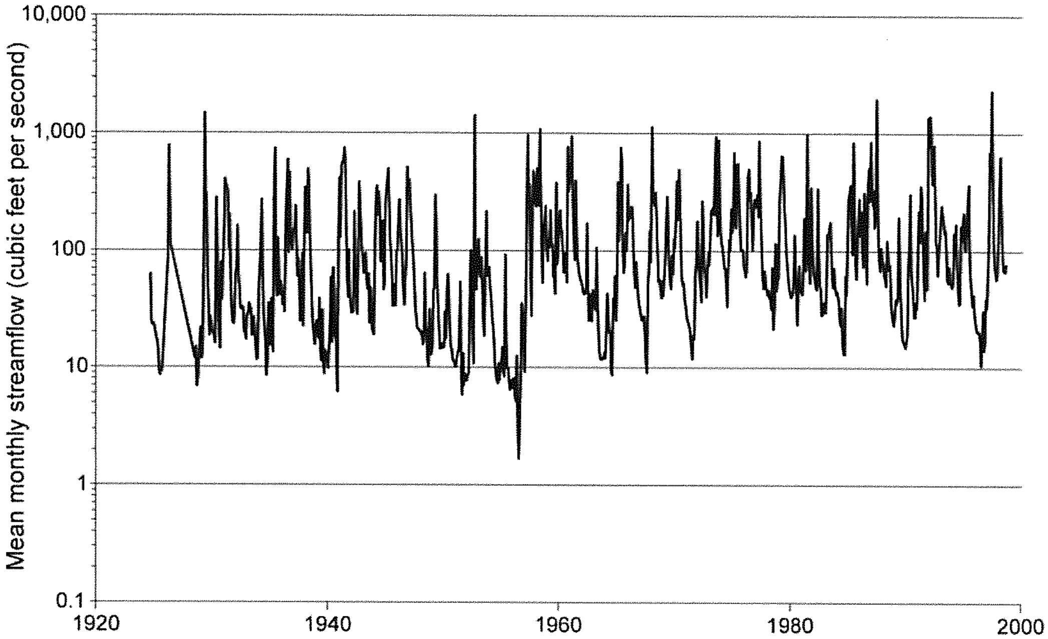


Figure 5-24. **Mean monthly streamflow for the U.S. Geological Survey gaging 08171000 on the Blanco River at Wimberley. The station location can be found in Figure 5-20 (from Mace and others, 2000).**

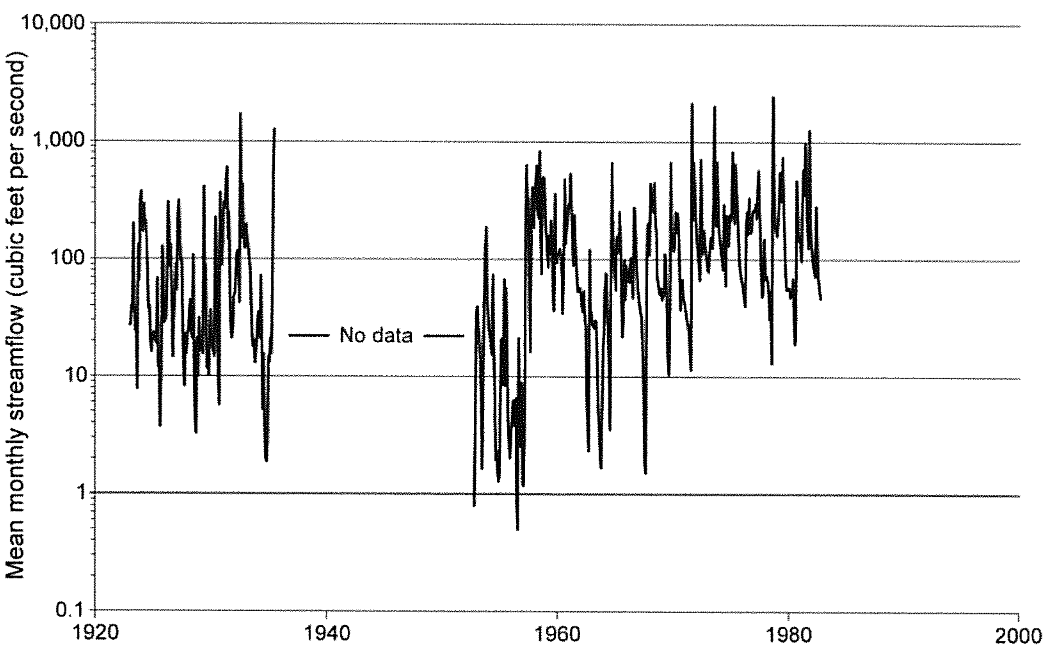


Figure 5-25. **Mean monthly streamflow for the U.S. Geological Survey gaging 08179000 on the Medina River near Pipe Creek. The station location can be found in Figure 5-20 (from Mace and others, 2000).**

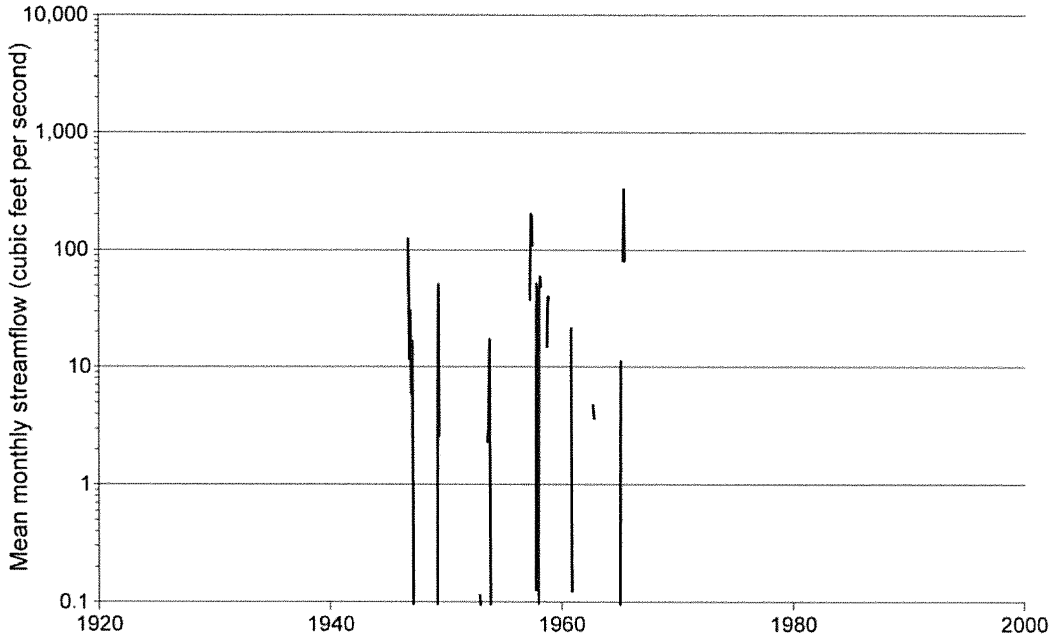


Figure 5-26. Mean monthly streamflow for the U.S. Geological Survey gaging 08184000 on Cibolo Creek near Bulverde. The station location can be found in Figure 5-20 (from Mace and others, 2000).

The study area includes four major lakes: Lake Travis, Lake Austin, Canyon Lake, and Medina Lake (Figure 3-1). Canyon Lake and Lake Travis have maintained approximately constant lake levels (± 20 feet), although Lake Travis had large declines during droughts in the 1950s and mid-1960s (Figure 5-27). Lake Medina has much more variation in water levels and was nearly dry on a few occasions during the drought of the 1950s (Espey, Huston and Associates, 1989) (Figure 5-27).

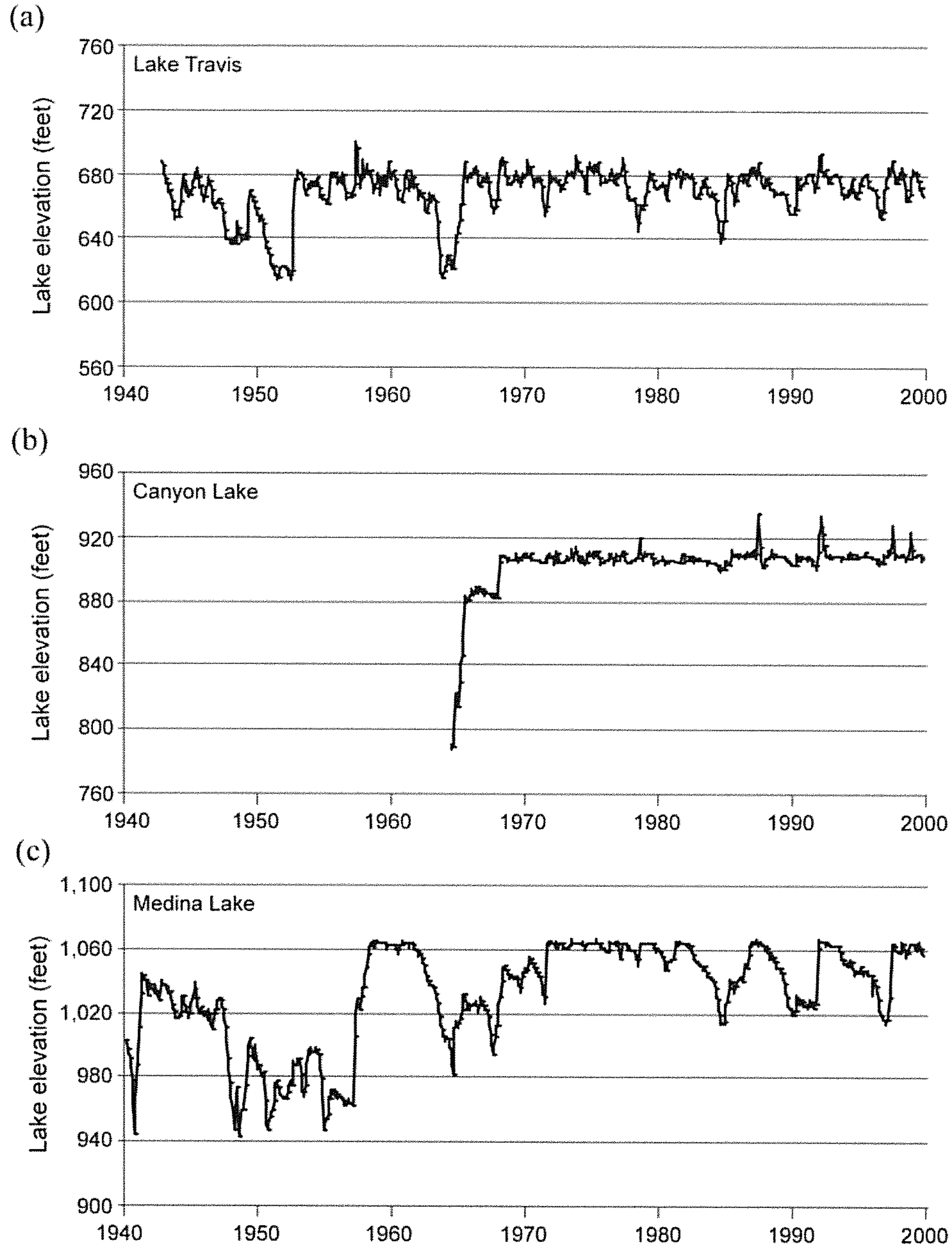


Figure 5-27. **Lake-level elevations in (a) Lake Travis, (b) Canyon Lake, and (c) Medina Lake. Lake Travis water levels are from the Lower Colorado River Authority. Canyon Lake water levels are from the U.S. Army Corps of Engineers. Medina Lake water levels for the period 1940 through 1986 are from Espey, Huston and Associates (1989). Water levels for the periods January 1987 through September 1994 and October 1997 through September 1999 are from the U.S. Geological Survey. Mace and others (2000) calculated lake levels for the period October 1994 through September 1997 by relating lake volumes from a TWDB database to lake level using the rate curve by Espey, Huston and Associates (1989).**

Numerous springs occur in the study area (Figure 5-28). Most of these springs issue from low-lying areas below the base of bluffs along rivers and streams, discharging groundwater that flows laterally along the tops of harder, more resistant Glen Rose Limestone beds. Other springs discharge along the margin of the Edwards Plateau and contribute significant flow to the headwaters of the major rivers in the study area. Many of the spring discharge zones are characterized by phreatic vegetation, such as marsh purslane, cattails, ferns, and cypress trees, indicative of a constant supply of water (Brune, 1981). Springs that occur in the Edwards Group generally have higher discharge rates than those occurring in the lower and upper members of the Glen Rose Limestone and the Cow Creek Limestone (Table 5-2), presumably because of the cavernous nature of the Edwards Group.

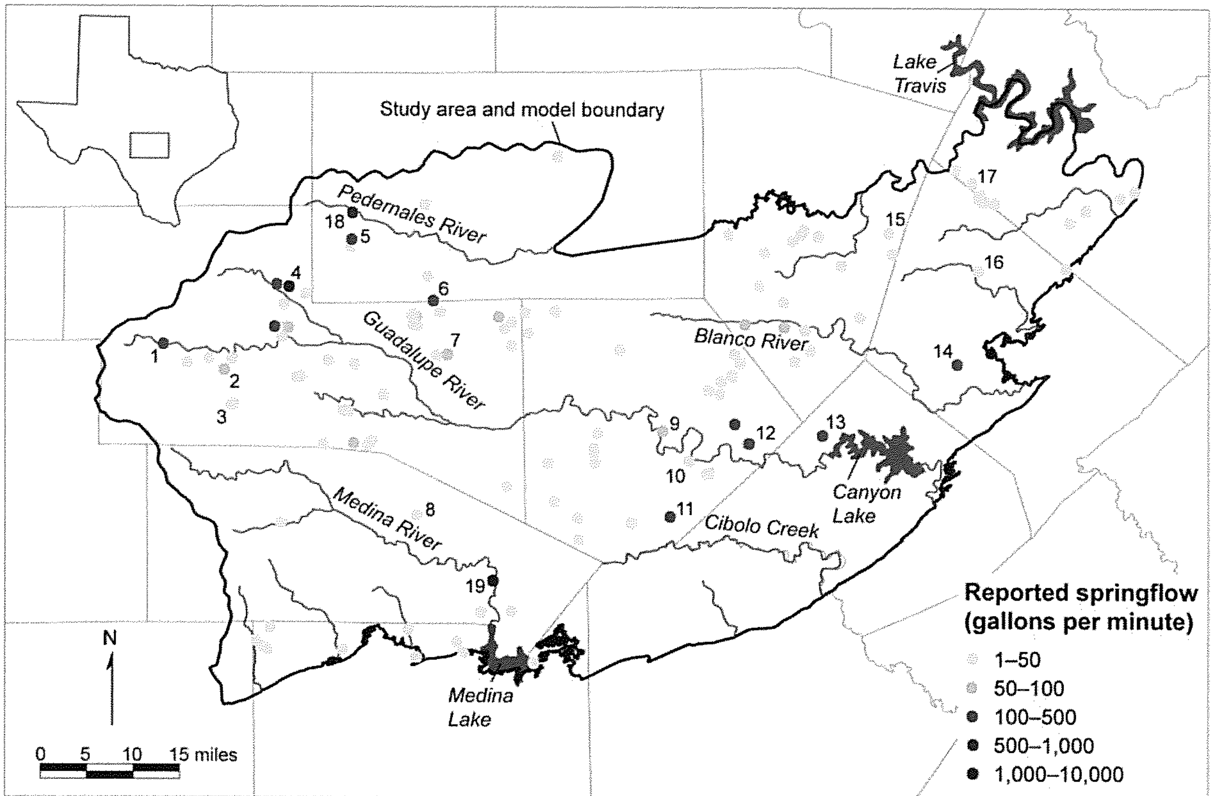


Figure 5-28. **Location and estimated spring discharge in the study area. Springflow and geological formations where the numbered springs occur are included in Table 5-2 (from Mace and others, 2000).**

Table 5-2. Estimated flow for selected springs in the study area (see Figure 5-28) (from Mace and others, 2000).

Spring	Estimated flow (gallons per minute)	Formation	Remarks
1	150	Edwards Group and associated limestone	Measured on 4/13/67
2	100	Edwards Group and associated limestone	Measured on 4/12/67, reported flow never ceased
3	100	Edwards Group and associated limestone	
4	2,500	Edwards Group and associated limestone	Measured on 3/31/66, reported flow never ceased
5	310	Edwards Group and associated limestone	Measured on 3/11/70
6	480	Edwards Group and associated limestone	Measured on 3/11/70, owner's trough spring
7	100	Edwards Group and associated limestone	Measured on 6/15/66, reported flow never ceased
8	20	Upper member of the Glen Rose Limestone	Measured on 7/13/76
9	75	Lower member of the Glen Rose Limestone	Measured on 7/10/75, ceased flowing in 1956
10	50	Lower member of the Glen Rose Limestone	Measured on 1/17/40
11	150	Lower member of the Glen Rose Limestone	Measured on 7/17/75, owner's well 9
12	300	Lower member of the Glen Rose Limestone	
13	300	Cow Creek Limestone	Measured on 7/11/75
14	500	Cow Creek Limestone	Measured on 8/31/76, estimated flow 1,070 gallons per minute, January 1955
15	25	Lower member of the Glen Rose Limestone	Measured on 1/1/66
16	50	Upper member of the Glen Rose Limestone	Measured on 12/30/88, Bassett Springs
17	50	Upper member of the Glen Rose Limestone	Measured on 5/25/73
18	9,000	Edwards Group and associated limestone	Measured on 12/20/60
19	5,000	Lower member of the Glen Rose Limestone	Measured on 8/20/91, springs discharge into Medina River

5.6 Hydraulic Properties

Variations in well yields are generally a result of variation in hydraulic properties of aquifers. Well yields in the Hill Country portion of the Trinity Aquifer System are commonly controlled by the location of fractures and dissolution features and, consequently, may vary considerably over short distances. Although the Hill Country portion of the Trinity Aquifer System as a whole is recognized by the TWDB as a major aquifer (Ashworth and Hopkins, 1995), well yields can be low compared with those of other major aquifers.

Hydraulic conductivity is defined as the rate of movement of water through a porous medium under a unit gradient. For example, very porous limestone may have hydraulic conductivities greater than 1,000 feet per day, and sandy limestone may range from 100 to 1,000 feet per day, whereas aquifers having moderate hydraulic conductivity values may range from 10 to 100 feet per day, and aquifers having low hydraulic conductivity may range from 0.1 to 10 feet per day. Transmissivity is defined as the hydraulic conductivity times the thickness of the aquifer and is thus a measure of the rate of movement through a defined thickness of aquifer under a unit gradient.

Pumping tests in wells are conducted to develop estimates of hydraulic conductivity and transmissivity. On the basis of 15 aquifer tests, Hammond (1984) determined that hydraulic conductivity ranges from 0.1 to 10 feet per day in the lower member of the Glen Rose Limestone. Barker and Ardis (1996) thought that hydraulic conductivity probably averages about 10 feet per day in the Hill Country portion of the Trinity Aquifer System. No one has investigated vertical hydraulic conductivities, although vertical hydraulic conductivities are likely to be much lower than horizontal hydraulic conductivities, especially in the upper member of the Glen Rose Limestone. Barker and Ardis (1996) noted that recharging water moves laterally more easily atop low-permeability beds than vertically through them. Guyton and Associates (1993) estimated that the vertical hydraulic conductivity of the Hammett Shale, the Bexar Shale, and the marls of the upper member of the Glen Rose Limestone was about 0.0001 to 0.003 feet per day. In their model that included the Hill Country portion of the Trinity Aquifer System, Kuniansky and Holligan (1994) considered part of the Hill Country portion of the Trinity Aquifer System along the Edwards (Balcones Fault Zone) Aquifer to have anisotropic properties, with greater hydraulic conductivity in the direction of faulting.

Ashworth (1983) reported average transmissivities of about 230 square feet per day and 1,300 square feet per day for the Middle and Lower Trinity aquifers, respectively, and suggested that substantially lower transmissivities are expected for the Upper Trinity Aquifer. Kuniansky and Holligan (1994) determined that transmissivity for the Hill Country portion of the Trinity Aquifer System ranged from 100 to 58,000 square feet per day. LBG-Guyton Associates (1995) summarized 53 aquifer tests in the Glen Rose Limestone along the Edwards (Balcones Fault Zone) Aquifer and found a median transmissivity of about 220 square feet per day. The Glen Rose Limestone can be unusually permeable in outcrop and shallow subcrop in northern Bexar County and southwestern Comal County near Cibolo Creek (Kastning, 1986; Veni, 1994). Barker and Ardis (1996) developed a map of transmissivity for the Hill Country portion of the Trinity Aquifer System on the basis of aquifer tests, geologic observation, and computer modeling. They determined that transmissivity is generally less than 5,000 square feet per day but increases from 5,000 to 50,000 square feet per day along the boundary between Comal and Bexar counties and through Kendall County and eastern Kerr County. The quartzose clastic facies of [illegible] Hensell Sand include some of the most permeable sediments in the Hill

Country portion of the Trinity Aquifer System (Barker and Ardis, 1996). Ardis and Barker (1993) and Barker and Ardis (1996) surmised that the variations in transmissivity in the Hill Country are probably due more to variations in aquifer thickness than to tectonism or diagenesis. However, Barker and Ardis (1996) noted that diagenesis of stable minerals has diminished permeability in most down-gradient, subcropping strata and that the leaching of carbonate constituents has enhanced permeability in some of the outcrop.

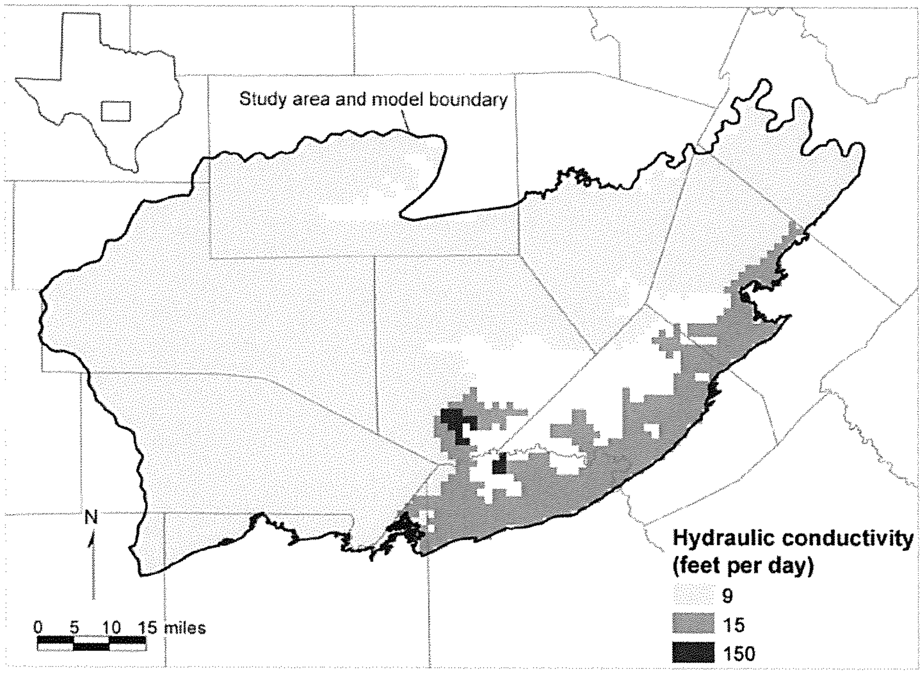
Storativity is the volume of water released from storage per decline of hydraulic head (water pressure) and is typically less than 0.01 for a confined aquifer. Specific storage is defined as the storativity divided by the aquifer thickness. Ashworth (1983) estimated that in the Trinity Group, the confined storativity ranges between 10^{-5} and 10^{-3} (a specific storage of about 10^{-6} per foot) and that the unconfined storativity (specific yield) ranges between 0.1 and 0.3. On the basis of two aquifer tests, Hammond (1984) determined a storativity of 3×10^{-5} for the lower member of the Glen Rose Limestone. Although we could not locate values for the Edwards Group in the plateau area, the specific yield for the Edwards Group in the Edwards (Balcones Fault Zone) Aquifer is 0.03 (Maclay and Small, 1986, p. 68–69). Specific yield is a ratio that describes the fraction of aquifer volume that will "yield," or be released, when the water is allowed to drain out of the aquifer under gravity.

To estimate hydraulic properties for the study area and expand upon previous studies, Mace and others (2000) (1) compiled available information on aquifer properties or tests from published reports and well records, (2) conducted and analyzed detailed aquifer tests in the study area, (3) used specific-capacity information to estimate transmissivity, and (4) summarized the results using statistics. Mace and others (2000) compiled aquifer property data from (1) available literature (Meyers, 1969; Hammond, 1984; Simpson Company Limited and Guyton and Associates, 1993; LBG-Guyton Associates, 1995; Bradley and others, 1997), (2) aquifer tests that they conducted in the study area, analyzing the results using the methodologies of Theis (1935), Cooper and Jacob (1946), and Kruseman and de Ridder (1994), and (3) specific-capacity (well-performance) tests from the TWDB water-well database. To estimate transmissivity, Mace and others (2000) used an analytical technique (Theis, 1963).

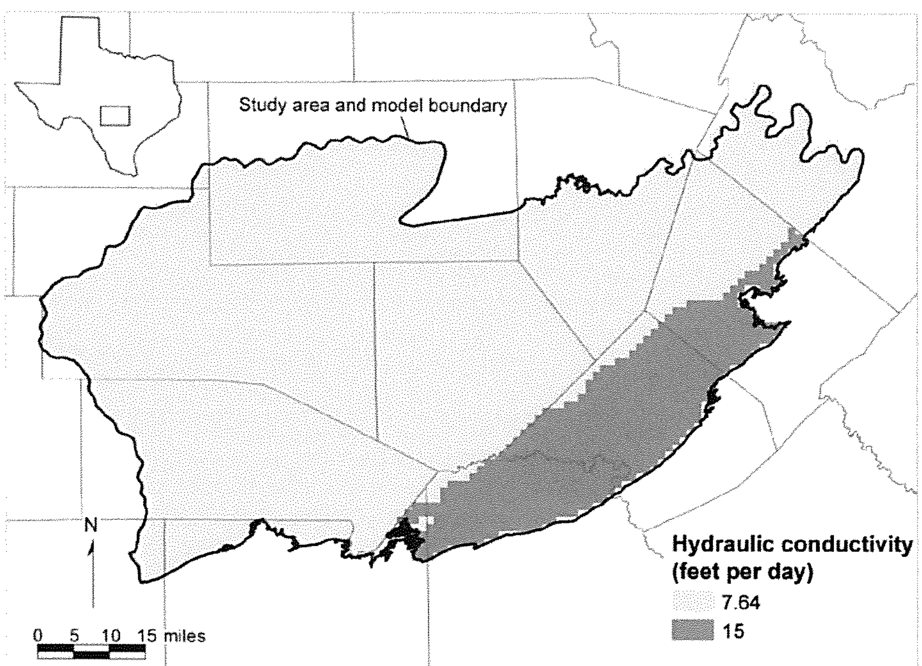
Mace and others (2000) developed a map of hydraulic conductivity for the Middle Trinity Aquifer, using the spatial distribution of hydraulic conductivity in each unit of the Middle Trinity Aquifer (Cow Creek Limestone, Hensell Sand, and lower member of the Glen Rose Limestone) and the relative thickness of each unit. To estimate the hydraulic conductivity of the Middle Trinity Aquifer at any given point, Mace and others (2000) weighted the hydraulic conductivity of each layer by the relative thickness of each respective layer at that point. As a result of the paucity of data from the Edwards Group and Upper Trinity Aquifer, Mace and others (2000) distributed hydraulic conductivity uniformly through the study area. The hydraulic conductivity values used in the Edwards Group and Upper Trinity Aquifer, 7 feet per day and 5 feet per day, respectively, are derived from calibration of the model by Mace and others (2000).

In the updated model, we simplified the distribution of hydraulic conductivity in the model and adjusted it during model calibration. As a result, hydraulic conductivity in the Edwards Group is the uniformly distributed value of 11 feet per day, whereas hydraulic conductivity in the underlying Upper, Middle, and Lower Trinity aquifers is divided into two zones. One zone represents higher hydraulic conductivity values in the Balcones Fault Zone and along Cibolo Creek, and the other zone represents the rest of the aquifer (Figure 5-29). Hydraulic conductivity values for the Lower Trinity Aquifer obtained from the TWDB groundwater database and Hays

Trinity Groundwater Conservation District lie within the range of 0.01 to 4.41 feet per day with a geometric mean of 0.52 feet per day. We calculated the hydraulic conductivity from specific-capacity data from the TWDB well database using methods outlined in Mace (2001).

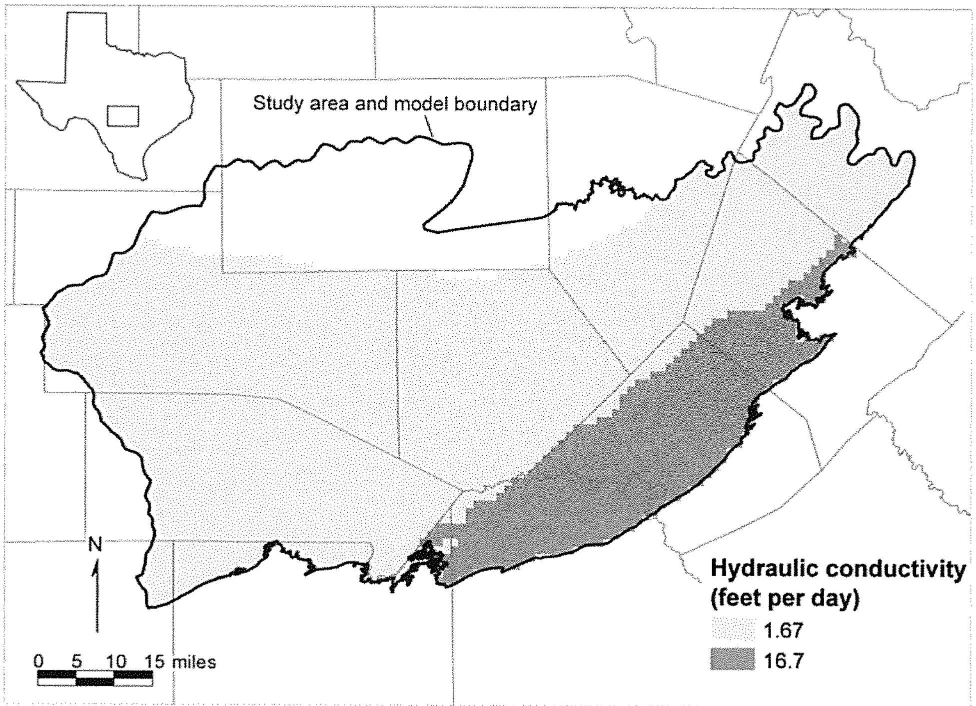


(a) Upper Trinity Aquifer



(b) Middle Trinity Aquifer

Figure 5-9. Distribution of hydraulic conductivity in the (a) Upper, (b) Middle, and (c) Lower Trinity aquifers



(c) Lower Trinity Aquifer

Figure 5-29. (continued).

5.7 Discharge

Discharge from the Upper and Middle Trinity aquifers in the Hill Country portion of the Trinity Aquifer System is, from greatest to lowest, through (1) discharge to streams and springs (Ashworth, 1983), (2) lateral subsurface flow and diffuse upward leakage to the Edwards (Balcones Fault Zone) Aquifer (Veni, 1994), (3) pumping from the aquifer, and (4) vertical leakage to the Lower Trinity Aquifer. Discharge from the Lower Trinity Aquifer takes the form of pumping and vertical leakage to the overlying Middle Trinity Aquifer. The model by Kuniansky and Holligan (1994) indicates net discharge to streams from the Hill Country portion of the Trinity Aquifer System of 155,000 acre-feet per year. The volume of base flow varies from year to year depending on precipitation.

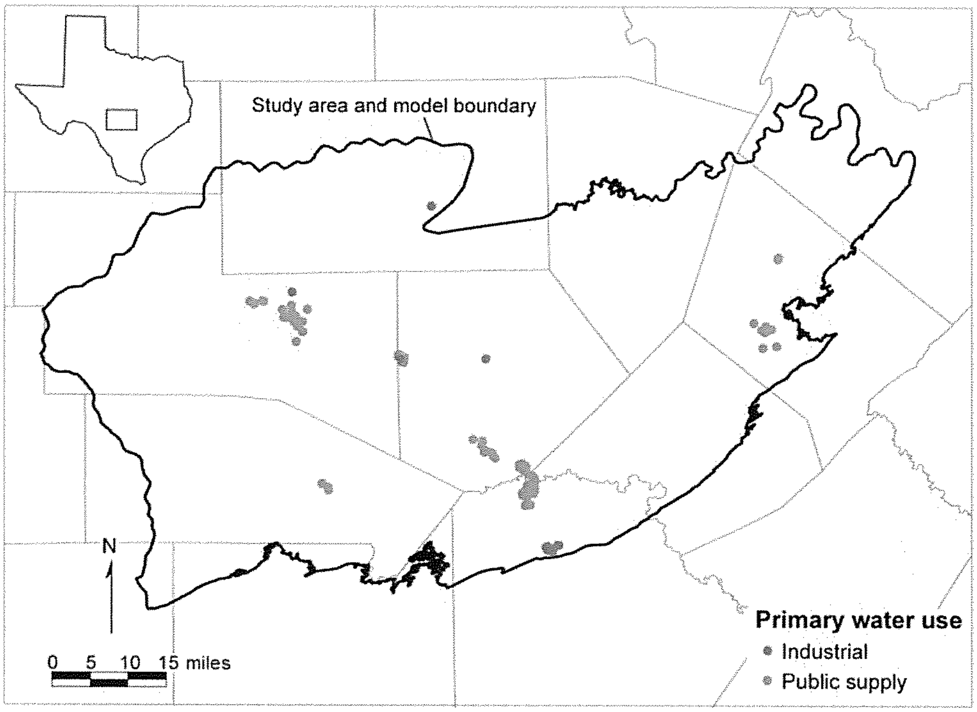
The volume of water that moves laterally from the Hill Country portion of the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer is not known, partly because of the difficulty in estimating the amount of flow. A number of studies have indicated, either through hydraulic or chemical analysis, that groundwater most likely flows from the Hill Country portion of the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer (Long, 1962; Klemt and others, 1979; Walker, 1979; Senger and Kreitler, 1984; Slade and others, 1985; Maclay and Land, 1988; Waterreus, 1992; Veni, 1994, 1995). Most of these studies focused on the movement of groundwater from the Glen Rose Limestone into the Edwards (Balcones Fault Zone) Aquifer; however, water levels (Figures 5-10 through 5-12) suggest that groundwater from the entire Hill Country portion of the Trinity Aquifer System discharges to the south and east in the direction of the Edwards (Balcones Fault Zone) Aquifer. Some of this groundwater flows directly into the Edwards (Balcones Fault Zone) Aquifer along faults, whereas the rest continues to flow in the Hill Country portion of the Trinity Aquifer System beneath the Edwards (Balcones

Fault Zone) Aquifer. It is possible that groundwater that continues to flow in the Hill Country portion of the Trinity Aquifer System eventually discharges upward into the Edwards (Balcones Fault Zone) Aquifer. However, work by Hovorka and others (1996) suggests that this vertical cross-formational flow is limited. The Glen Rose Limestone in the Cibolo Creek area has been argued to be a part of the Edwards (Balcones Fault Zone) Aquifer owing to the hydraulic response and continuity of the formations (George, 1947; Pearson and others, 1975; Veni 1994, 1995).

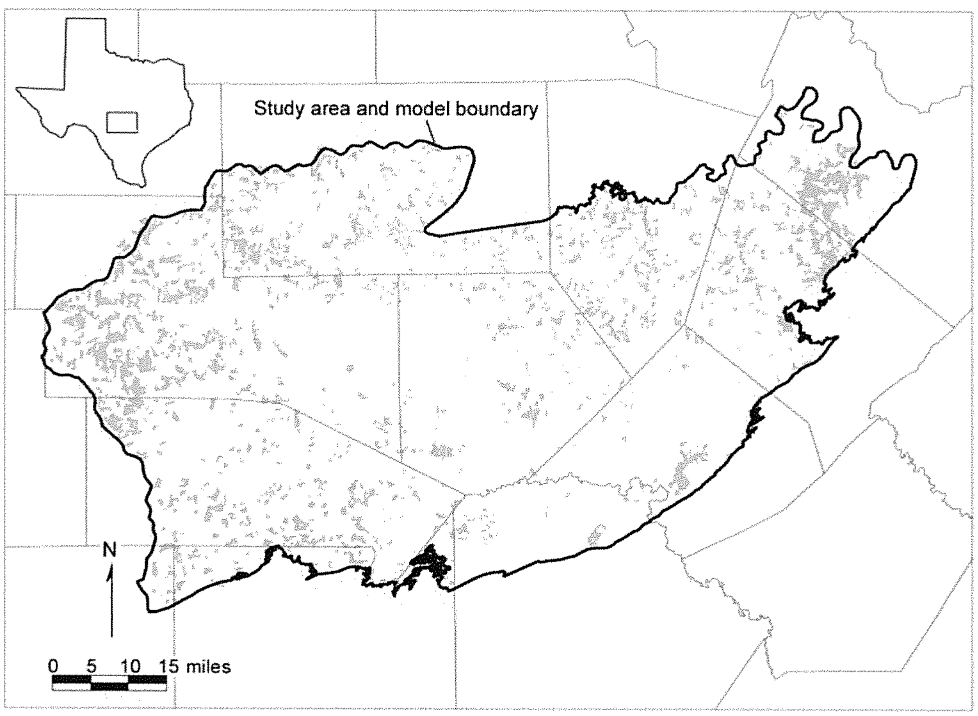
A few studies have estimated the volume of flow from the Hill Country portion of the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer. Lowry (1955) attributed a 5 percent error between measured inflows and outflows in the Edwards (Balcones Fault Zone) Aquifer to cross-formational flow from the Glen Rose Limestone. Woodruff and Abbott (1986), citing a personal communication with Bill Klemt, reported that recharge from cross-formational flow accounts for 6 percent of total recharge, or about 41,000 acre-feet per year on average, to the Edwards (Balcones Fault Zone) Aquifer. Kuniansky and Holligan (1994) suggested predevelopment groundwater discharge of 360,000 acre-feet per year from the Hill Country portion of the Trinity Aquifer System to the Edwards (Balcones Fault Zone) Aquifer. This estimate is about 53 percent of average annual recharge to the Edwards (Balcones Fault Zone) Aquifer and is probably too high (Mace and others, 2000). LBG-Guyton Associates (1995) estimated cross-formational flow from the Glen Rose Limestone to the Edwards (Balcones Fault Zone) Aquifer in the San Antonio area, excluding recharge from Cibolo Creek, to be about 2 percent of total recharge to the aquifer. Mace and others (2000) estimated net discharge from the Hill Country portion of the Trinity Aquifer System to the Edwards (Balcones Fault Zone) Aquifer of 64,000 acre-feet per year. Of the numerical groundwater flow models of the Edwards (Balcones Fault Zone) Aquifer by Klemt and others (1979), Slade and others (1985), Maclay and Land (1988), Wanakule and Anaya (1993), Barrett and Charbeneau (1996), and Lindgren and others (2004), only that of Lindgren and others (2004) includes cross-formational flow from the Hill Country portion of the Trinity Aquifer System. Maclay and Land (1988) recognized the occurrence of cross-formational flow between the Hill Country portion of the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer, but only as a topic for future study. Kuniansky and Holligan (1994) estimated 1974 to 1975 cross-formational flow from the Hill Country portion of the Trinity Aquifer System to be about 480,000 acre-feet per year, an order of magnitude larger than calculated cross-formational flow by Lindgren and others (2004) of about 40,000 acre-feet per year.

Groundwater also discharges from the aquifer through pumping of water wells. Lurry and Pavlicek (1991), Barker and Ardis (1996), and Kuniansky and Holligan (1994) estimated pumping from the Hill Country portion of the Trinity Aquifer System to be between 10,000 and 15,000 acre-feet per year in the 1970s. On the basis of information in Bluntzer (1992), we estimated that about 14,000 acre-feet per year was produced from the Hill Country portion of the Trinity and Edwards-Trinity (Plateau) aquifer systems in the study area. Guyton and Associates (1993) estimated that about 6,350 acre-feet was pumped from the Hill Country portion of the Trinity Aquifer System in northern Bexar County in 1990, with 85 percent of production coming from the Middle Trinity Aquifer. TWDB pumping data indicate that for the period 1980 through 1997 pumping from the Hill Country portion of the Trinity Aquifer System ranged from 14,000 to 24,000 acre-feet per year.

The primary categories of water use in the Hill Country portion of the Trinity Aquifer System are (1) municipal, (2) manufacturing, (3) livestock, (4) rural domestic, and (5) irrigation. Municipal and manufacturing water uses are based on reported values from the users. We associated these values with known well locations and aquifers by cross-referencing the water use to the municipal and manufacturing wells through the Texas Commission on Environmental Quality municipal water-well database, through the TWDB water-well database, and through telephone interviews with water users (Figure 5-30a). We distributed livestock, rural domestic, and irrigation pumping on the basis of the spatial distribution of range land, nonurban population, and irrigated farm land, respectively (Figures 5-30a through 5-30d). Pumping from the Hill Country portion of the Trinity Aquifer System has been rising over time, from about 15,000 acre-feet per year in 1981 to more than 20,000 acre-feet per year by 1997 (Figure 5-31). About two-thirds of this pumping is for rural domestic and municipal uses, and the rest is used for manufacturing, livestock, and irrigation. The increasing pumping from the aquifer is mostly due to increasing rural domestic pumping that rose from 6,000 acre-feet per year in 1980 to more than 10,000 acre-feet per year by 1997 (Figure 5-32). Municipal pumping rose gradually from 2,500 acre-feet per year in 1981 to about 5,000 acre-feet per year in 1997. Pumping for livestock and irrigation has remained relatively constant over the period 1980 through 1997. Manufacturing pumping rose from about 2,500 acre-feet per year to about 4,400 acre-feet per year in the late 1980s and remained relatively constant after 1988. Pumping from the Hill Country portion of the Trinity Aquifer System has been progressively increasing in most counties within the study area (Figure 5-33; Tables 5-3 to 5-8). However, pumping has remained relatively constant in Comal, Kimble, Travis, and Uvalde counties. Over the period 1980 through 1997, pumping doubled in Blanco, Gillespie, Hays, and Kendall counties.

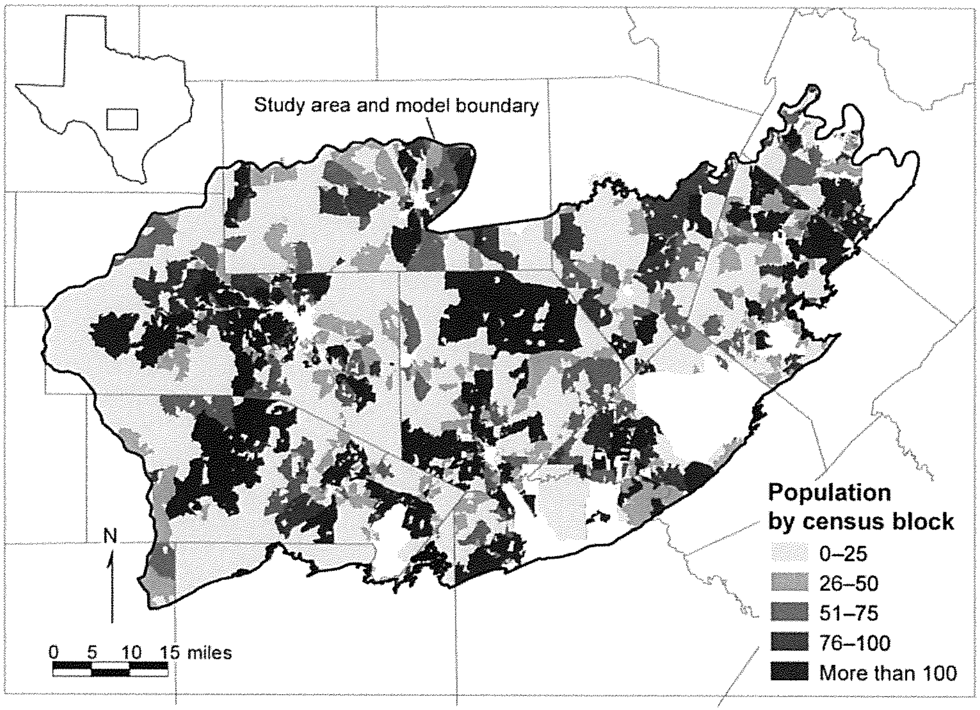


(a) Industrial and public supply wells

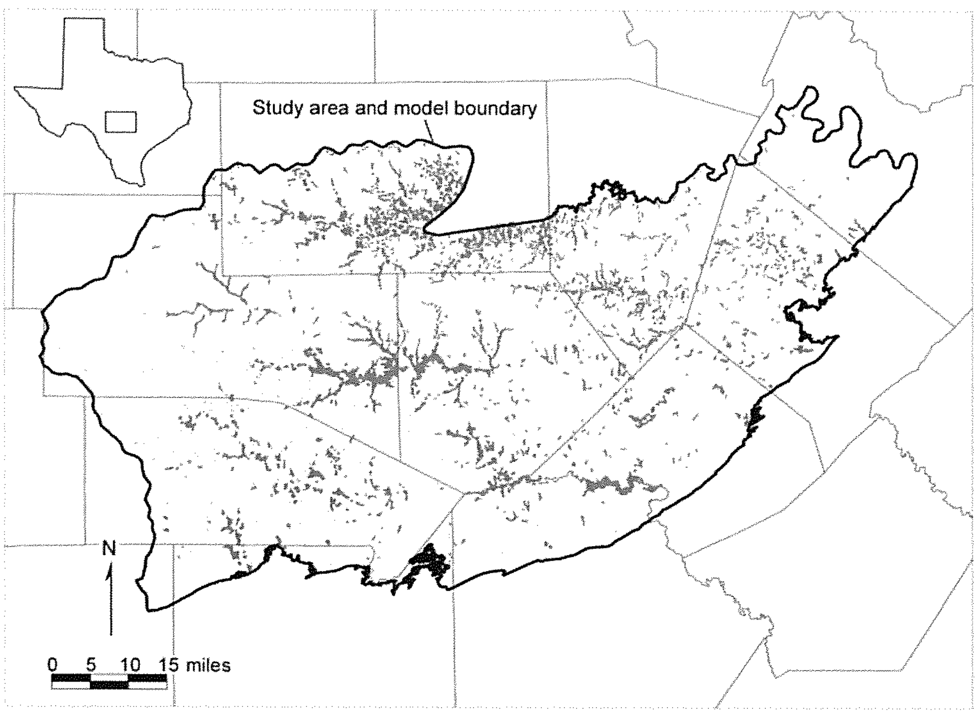


(b) Range land

Figure 5-30. Spatial distribution of pumping throughout the 1980 through 1997 model period for manufacturing, municipal, livestock, rural domestic, and irrigation uses based on the spatial distribution of (a) industrial and public supply wells, (b) range land, (c) rural population, and (d) irrigated farm land, respectively.



(c) Rural population



(d) Irrigated farm land

Figure 5-30. (continued).

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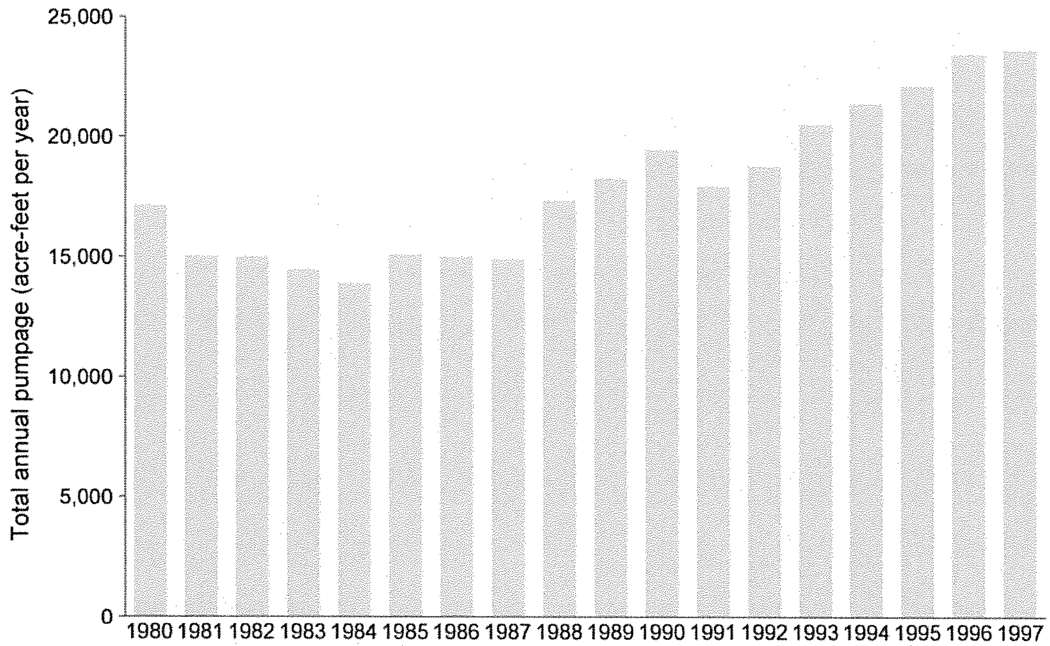

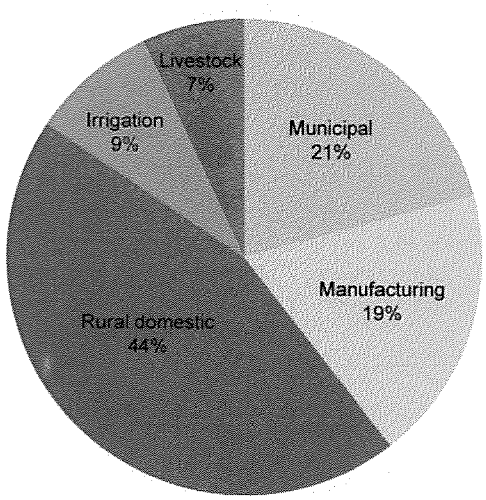

Figure 5-31. Total annual groundwater pumpage from the Hill Country portion of the Trinity Aquifer System, 1980 through 1997.

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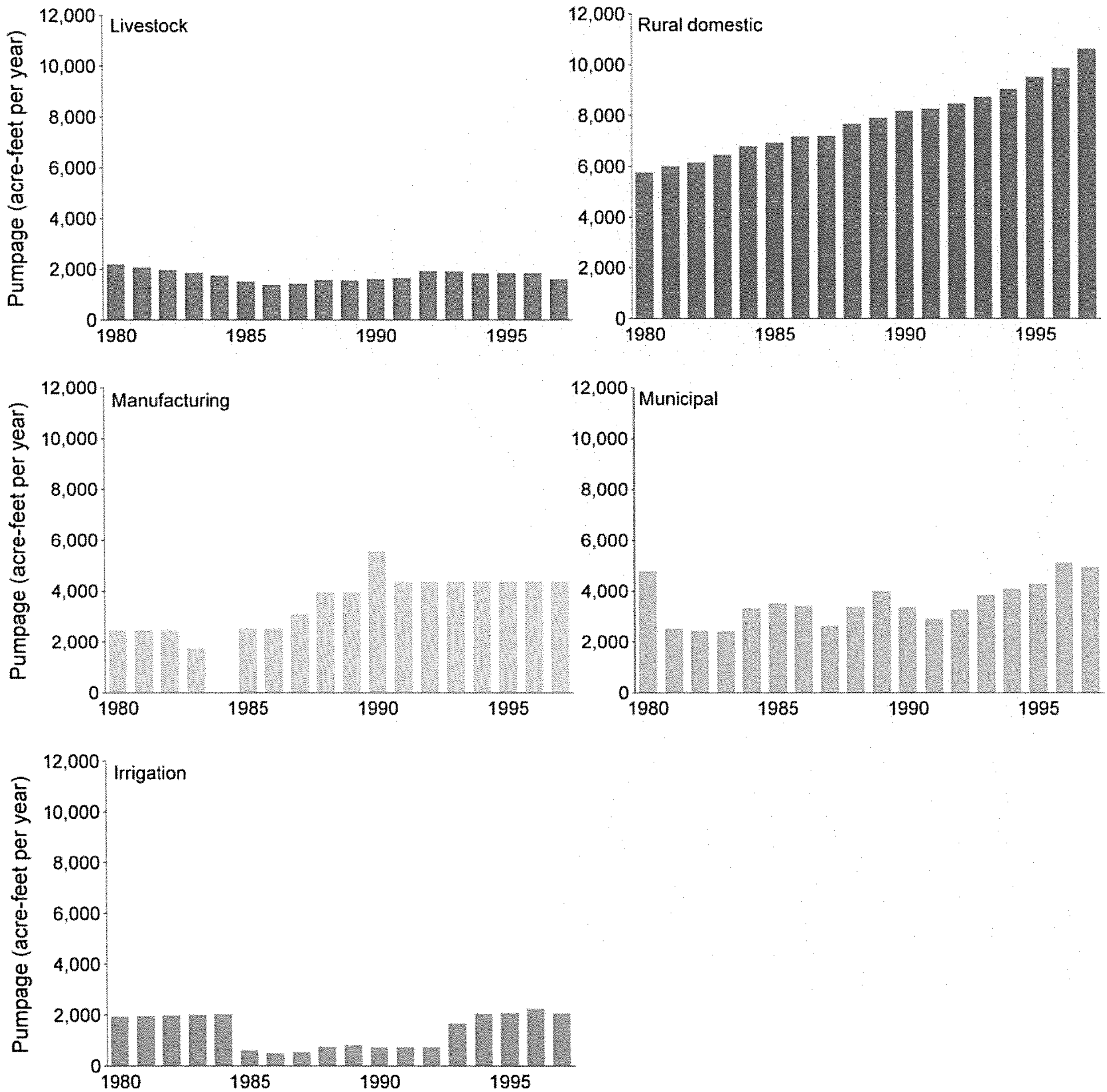


Figure 5-32. Annual groundwater pumping from the Hill Country portion of the Trinity Aquifer System for livestock, rural domestic, manufacturing, municipal, and irrigation uses, 1980 through 1997.

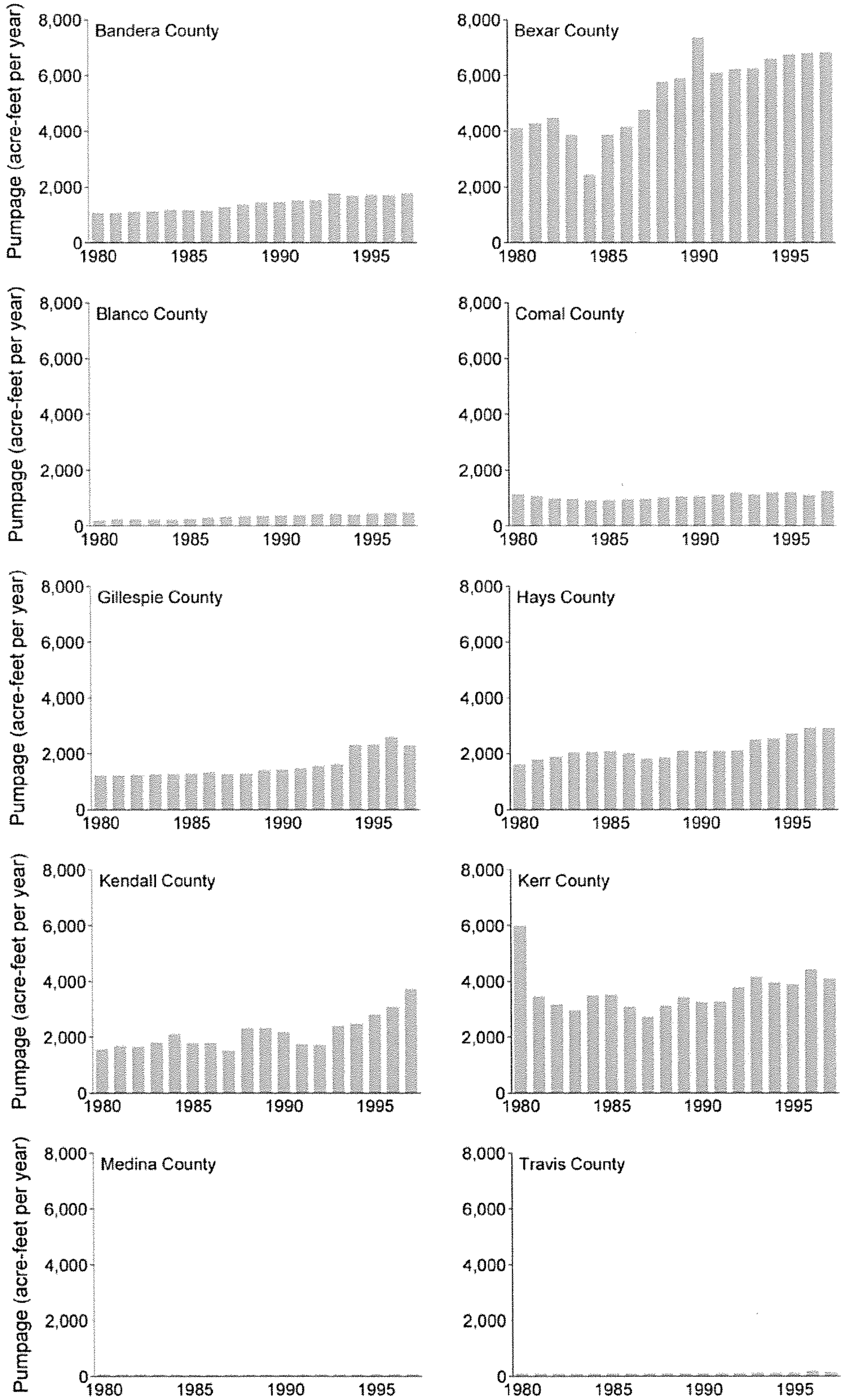


Figure 5.33. Total annual pumpage from the Hill Country portion of the Trinity Aquifer System for each county in the study area.

Table 5-3. Total pumping from the Hill Country portion of the Trinity Aquifer System for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall
1980	1,084	4,120	195	1,135	1,223	1,621	1,585
1981	1,077	4,280	234	1,076	1,235	1,788	1,690
1982	1,120	4,486	230	998	1,248	1,903	1,663
1983	1,129	3,875	224	978	1,260	2,046	1,829
1984	1,182	4,359	217	916	1,273	2,059	2,115
1985	1,175	3,892	261	918	1,289	2,087	1,781
1986	1,154	4,165	312	949	1,332	2,018	1,793
1987	1,290	4,775	333	987	1,273	1,817	1,518
1988	1,374	5,774	350	1,035	1,289	1,865	2,337
1989	1,441	5,900	367	1,058	1,421	2,116	2,343
1990	1,462	7,372	386	1,080	1,440	2,093	2,185
1991	1,529	6,098	388	1,128	1,484	2,096	1,751
1992	1,528	6,227	422	1,200	1,558	2,125	1,728
1993	1,784	6,249	432	1,125	1,633	2,506	2,414
1994	1,684	6,609	413	1,199	2,308	2,539	2,482
1995	1,723	6,767	453	1,214	2,329	2,719	2,823
1996	1,709	6,814	465	1,112	2,615	2,935	3,092
1997	1,785	6,832	472	1,268	2,297	2,923	3,738

Year	Kerr	Kimble	Medina	Travis	Uvalde	Total
1980	5,994	7	63	111	11	17,148
1981	3,463	7	60	108	11	15,027
1982	3,176	6	57	101	11	15,000
1983	2,954	6	53	100	11	14,466
1984	3,517	5	50	96	11	15,799
1985	3,529	5	45	100	11	15,093
1986	3,104	7	45	110	10	14,999
1987	2,727	6	49	111	10	14,896
1988	3,135	6	49	116	10	17,342
1989	3,433	5	49	116	10	18,259
1990	3,263	5	50	117	10	19,461
1991	3,282	5	51	125	10	17,945
1992	3,787	5	57	127	11	18,775
1993	4,161	5	66	139	11	20,525
1994	3,962	5	60	134	11	21,406
1995	3,886	6	64	138	11	22,133
1996	4,439	6	62	200	12	23,460
1997	4,095	5	59	146	11	23,631

Table 5-4. Total pumping from the Hill Country portion of the Trinity Aquifer System by use category for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Municipal													
1980	190	157	0	0	0	573	380	3,491	0	0	0	0	4,791
1981	168	177	0	0	0	732	404	1,042	0	0	0	0	2,523
1982	198	245	0	0	0	834	424	735	0	0	0	0	2,436
1983	193	220	0	0	0	965	500	538	0	0	0	0	2,416
1984	232	380	0	0	0	964	700	1,036	0	0	0	0	3,312
1985	199	360	0	0	0	1,150	553	1,248	0	0	0	0	3,510
1986	222	612	0	0	0	1,062	582	925	0	0	0	0	3,403
1987	204	645	0	0	0	825	449	506	0	0	0	0	2,629
1988	227	761	0	0	0	834	712	830	0	0	0	0	3,364
1989	297	869	0	0	0	1,076	737	1,023	0	0	0	0	4,002
1990	269	719	0	0	0	1,019	632	720	0	0	0	0	3,359
1991	275	612	0	0	0	979	378	658	0	0	0	0	2,902
1992	219	719	0	0	0	962	322	1,035	0	0	0	0	3,257
1993	298	719	0	0	0	1,220	412	1,178	0	0	0	0	3,827
1994	340	1,071	0	0	0	1,281	474	924	0	0	0	0	4,090
1995	322	1,213	0	0	0	1,317	566	867	0	0	0	0	4,285
1996	299	1,213	0	0	0	1,485	746	1,363	0	0	0	0	5,106
1997	331	1,213	0	0	0	1,432	999	965	0	0	0	0	4,940
Manufacturing													
1980	0	2,449	0	0	0	0	0	0	0	0	0	0	2,449
1981	0	2,449	0	0	0	0	0	0	0	0	0	0	2,449
1982	0	2,449	0	0	0	0	0	0	0	0	0	0	2,449
1983	0	1,727	0	0	0	0	0	0	0	0	0	0	1,727
1984	0	1,912	0	0	0	0	0	0	0	0	0	0	1,912
1985	0	2,516	0	0	0	0	0	0	0	0	0	0	2,516
1986	0	2,516	0	0	0	0	0	0	0	0	0	0	2,516
1987	0	3,085	0	0	0	0	0	0	0	0	0	0	3,085
1988	0	3,949	0	0	1	0	0	0	0	0	0	0	3,950
1989	0	3,949	0	0	0	0	0	0	0	0	0	0	3,949
1990	0	5,549	0	0	0	0	0	0	0	0	0	0	5,549
1991	0	4,363	0	0	0	0	0	0	0	0	0	0	4,363
1992	0	4,363	0	0	0	0	0	4	0	0	0	0	4,367
1993	0	4,363	0	0	0	0	0	7	0	0	0	0	4,370
1994	0	4,370	0	0	0	0	0	7	0	0	0	0	4,377
1995	0	4,370	0	0	0	0	0	7	0	0	0	0	4,377
1996	0	4,370	0	0	0	0	0	6	0	0	0	0	4,376
1997	0	4,370	0	0	0	0	0	7	0	0	0	0	4,377

Table 5-4. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Rural domestic													
1980	570	878	39	557	832	624	564	1,654	0	21	34	7	5,780
1981	598	897	85	581	854	663	652	1,619	0	21	36	7	6,013
1982	626	915	88	587	877	705	613	1,687	0	22	35	7	6,162
1983	654	930	87	650	899	747	710	1,709	0	22	39	7	6,454
1984	683	948	87	672	922	791	803	1,820	0	22	40	7	6,795
1985	710	966	138	697	945	832	770	1,813	0	23	41	7	6,942
1986	739	984	177	728	967	874	808	1,844	0	23	48	7	7,199
1987	766	1,001	198	755	989	916	643	1,865	0	23	54	7	7,217
1988	794	1,019	210	778	1,012	959	909	1,916	0	24	54	8	7,683
1989	822	1,036	213	803	1,035	997	963	1,969	0	24	55	8	7,925
1990	850	1,054	215	828	1,057	1,031	968	2,108	0	25	54	8	8,198
1991	908	1,073	214	870	1,080	1,073	779	2,179	0	26	61	8	8,271
1992	964	1,091	225	916	1,102	1,132	722	2,222	0	27	67	8	8,476
1993	1,022	1,110	235	843	1,124	1,249	787	2,266	0	28	70	8	8,742
1994	1,078	1,128	245	905	1,146	1,217	904	2,309	0	29	77	8	9,046
1995	1,135	1,147	268	909	1,168	1,361	1,075	2,352	0	30	81	8	9,534
1996	1,193	1,165	304	859	1,190	1,418	1,234	2,396	0	31	82	8	9,880
1997	1,249	1,184	307	1,016	1,213	1,462	1,632	2,439	0	32	91	8	10,633
Irrigation													
1980	62	611	47	368	52	102	200	500	4	0	0	0	1,946
1981	58	734	45	279	70	89	221	469	4	0	0	0	1,969
1982	54	857	43	190	88	76	241	437	4	0	0	0	1,990
1983	50	979	40	101	105	63	262	406	4	0	0	0	2,010
1984	47	1,102	38	12	123	50	282	374	3	0	0	0	2,031
1985	68	0	28	0	111	64	132	204	4	0	0	0	611
1986	10	0	28	0	93	44	176	136	5	0	0	0	492
1987	124	0	28	0	30	35	176	136	5	0	0	0	534
1988	124	0	28	0	8	29	440	136	4	0	0	0	769
1989	95	0	41	0	127	0	369	191	3	0	0	0	826
1990	115	0	47	0	113	0	274	187	3	0	0	0	739
1991	115	0	47	0	127	0	274	187	3	0	0	0	753
1992	115	0	47	0	127	0	274	187	3	0	0	0	753
1993	248	0	51	0	170	0	808	396	3	0	0	0	1,676
1994	15	0	51	10	845	0	718	406	3	0	0	0	2,048
1995	14	0	54	9	841	0	808	355	4	0	0	0	2,085
1996	15	0	54	10	957	0	808	396	4	0	0	0	2,244
1997	15	0	54	9	782	0	808	396	3	0	0	0	2,067

Table 5-4. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Livestock													
1980	262	25	109	210	339	322	441	349	3	42	78	4	2,184
1981	252	23	104	216	311	305	413	333	3	39	72	4	2,075
1982	241	21	100	221	283	288	386	318	3	35	66	4	1,966
1983	231	18	96	227	256	271	358	302	2	32	61	3	1,857
1984	221	16	92	232	228	254	330	286	2	28	55	3	1,747
1985	198	50	96	221	232	41	326	264	2	22	59	3	1,514
1986	184	53	108	221	272	38	228	199	2	22	62	2	1,391
1987	197	44	106	232	254	40	249	219	2	26	58	2	1,429
1988	229	46	112	257	268	43	276	253	2	25	62	2	1,575
1989	227	46	113	255	259	43	274	250	2	25	61	2	1,557
1990	228	50	124	252	269	42	312	248	2	25	62	2	1,616
1991	231	50	126	258	278	44	319	258	2	25	64	2	1,657
1992	231	54	150	284	330	31	410	338	2	30	60	3	1,923
1993	216	57	146	282	339	37	407	314	2	38	69	3	1,910
1994	251	40	118	284	317	41	386	317	2	31	57	3	1,847
1995	251	37	131	296	321	41	374	305	2	34	57	3	1,852
1996	203	66	107	243	468	32	303	278	2	31	118	4	1,855
1997	190	65	111	243	302	28	298	288	2	27	55	3	1,612

Table 5-5. Total pumping from the Edwards Group by use category for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Municipal													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0
Manufacturing													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-5. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Rural domestic													
1980	47	0	0	0	262	0	77	448	0	0	0	0	834
1981	49	0	0	0	269	0	89	439	0	0	0	0	846
1982	52	0	0	0	276	0	83	457	0	0	0	0	868
1983	54	0	0	0	283	0	96	463	0	0	0	0	896
1984	56	0	0	0	290	0	109	493	0	0	0	0	948
1985	59	0	0	0	297	0	104	492	0	0	0	0	952
1986	61	0	0	0	304	0	110	500	0	0	0	0	975
1987	63	0	0	0	311	0	87	506	0	0	0	0	967
1988	66	0	0	0	318	0	123	519	0	0	0	0	1,026
1989	68	0	0	0	326	0	131	534	0	0	0	0	1,059
1990	70	0	0	0	333	0	131	572	0	0	0	0	1,106
1991	75	0	0	0	340	0	106	591	0	0	0	0	1,112
1992	80	0	0	0	347	0	98	603	0	0	0	0	1,128
1993	84	0	0	0	354	0	107	614	0	0	0	0	1,159
1994	89	0	0	0	361	0	123	626	0	0	0	0	1,199
1995	94	0	0	0	368	0	146	638	0	0	0	0	1,246
1996	99	0	0	0	375	0	167	650	0	0	0	0	1,291
1997	103	0	0	0	382	0	221	661	0	0	0	0	1,367
Irrigation													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-5. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Livestock													
1980	16	0	0	0	0	0	0	157	3	0	0	0	176
1981	16	0	0	0	0	0	0	150	3	0	0	0	169
1982	15	0	0	0	0	0	0	143	3	0	0	0	161
1983	15	0	0	0	0	0	0	136	2	0	0	0	153
1984	14	0	0	0	0	0	0	129	2	0	0	0	145
1985	12	0	0	0	0	0	0	119	2	0	0	0	133
1986	11	0	0	0	0	0	0	89	2	0	0	0	102
1987	12	0	0	0	0	0	0	98	2	0	0	0	112
1988	14	0	0	0	0	0	0	113	2	0	0	0	129
1989	14	0	0	0	0	0	0	112	2	0	0	0	128
1990	14	0	0	0	0	0	0	112	2	0	0	0	128
1991	15	0	0	0	0	0	0	116	2	0	0	0	133
1992	15	0	0	0	0	0	0	152	2	0	0	0	169
1993	14	0	0	0	0	0	0	141	2	0	0	0	157
1994	17	0	0	0	0	0	0	143	2	0	0	0	162
1995	17	0	0	0	0	0	0	137	2	0	0	0	156
1996	13	0	0	0	0	0	0	125	2	0	0	0	140
1997	12	0	0	0	0	0	0	130	2	0	0	0	144

Table 5-6. Total pumping from the Upper Trinity Aquifer by use category for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Municipal													
1980	0	0	0	0	0	0	33	0	0	0	0	0	33
1981	0	0	0	0	0	0	38	0	0	0	0	0	38
1982	0	0	0	0	0	0	38	0	0	0	0	0	38
1983	0	0	0	0	0	0	43	0	0	0	0	0	43
1984	0	0	0	0	0	0	67	0	0	0	0	0	67
1985	0	0	0	0	0	0	48	0	0	0	0	0	48
1986	0	0	0	0	0	0	46	0	0	0	0	0	46
1987	0	0	0	0	0	0	32	0	0	0	0	0	32
1988	0	0	0	0	0	0	67	0	0	0	0	0	67
1989	0	0	0	0	0	0	69	0	0	0	0	0	69
1990	0	0	0	0	0	0	57	0	0	0	0	0	57
1991	0	0	0	0	0	0	22	0	0	0	0	0	22
1992	0	0	0	0	0	0	10	0	0	0	0	0	10
1993	0	0	0	0	0	0	22	0	0	0	0	0	22
1994	0	0	0	0	0	0	31	0	0	0	0	0	31
1995	0	0	0	0	0	0	38	0	0	0	0	0	38
1996	0	0	0	0	0	0	65	0	0	0	0	0	65
1997	0	0	0	0	0	0	103	0	0	0	0	0	103
Manufacturing													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-6. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Rural domestic													
1980	409	865	25	345	79	559	375	1,205	0	21	32	7	3,922
1981	429	884	54	360	81	593	434	1,180	0	21	34	7	4,077
1982	449	902	56	363	84	632	407	1,229	0	22	33	7	4,184
1983	469	917	56	402	86	669	472	1,246	0	22	38	7	4,384
1984	490	934	55	416	88	708	534	1,327	0	22	39	7	4,620
1985	509	952	88	431	90	745	512	1,322	0	23	39	7	4,718
1986	530	969	113	450	92	782	537	1,344	0	23	46	7	4,893
1987	549	987	126	467	94	821	428	1,360	0	23	51	7	4,913
1988	570	1,004	134	482	96	859	604	1,396	0	24	52	8	5,229
1989	590	1,021	136	497	99	892	640	1,435	0	24	53	8	5,395
1990	610	1,038	137	512	101	923	643	1,536	0	25	52	8	5,585
1991	651	1,058	136	539	103	961	518	1,588	0	26	58	8	5,646
1992	692	1,075	143	567	105	1,013	480	1,620	0	27	64	8	5,794
1993	733	1,094	149	521	107	1,118	523	1,651	0	28	67	8	5,999
1994	773	1,112	156	560	109	1,089	601	1,683	0	29	73	8	6,193
1995	814	1,130	170	563	111	1,218	714	1,715	0	30	77	8	6,550
1996	855	1,148	193	532	113	1,269	821	1,746	0	31	78	8	6,794
1997	896	1,166	195	629	115	1,309	1,085	1,778	0	32	87	8	7,300
Irrigation													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 5-6. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Livestock													
1980	227	25	95	155	257	298	299	192	0	42	74	4	1,668
1981	218	23	91	158	236	281	280	183	0	39	69	4	1,582
1982	209	21	88	161	215	264	261	175	0	35	63	4	1,496
1983	200	18	84	165	194	247	242	166	0	32	58	3	1,409
1984	192	16	80	168	173	230	223	157	0	28	53	3	1,323
1985	172	50	83	155	176	37	221	145	0	22	56	3	1,120
1986	160	53	94	155	206	35	154	109	0	22	60	2	1,050
1987	171	44	93	163	192	36	168	121	0	26	55	2	1,071
1988	199	46	98	181	203	39	187	140	0	25	59	2	1,179
1989	197	46	99	179	196	39	185	138	0	25	58	2	1,164
1990	197	50	108	177	204	38	211	136	0	25	59	2	1,207
1991	200	50	110	181	210	40	216	142	0	25	61	2	1,237
1992	200	54	131	200	250	28	277	186	0	30	57	3	1,416
1993	187	57	128	198	257	34	276	173	0	38	66	3	1,417
1994	217	40	103	200	240	37	261	174	0	31	54	3	1,360
1995	217	37	114	208	243	37	253	168	0	34	54	3	1,368
1996	175	66	94	171	354	29	205	153	0	31	113	4	1,395
1997	164	65	97	171	229	26	202	158	0	27	53	3	1,195

Table 5-7. Total pumping from the Middle Trinity Aquifer by use category for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Municipal													
1980	0	157	0	0	0	510	346	293	0	0	0	0	1,306
1981	0	177	0	0	0	666	366	200	0	0	0	0	1,409
1982	0	245	0	0	0	756	386	250	0	0	0	0	1,637
1983	0	220	0	0	0	869	457	262	0	0	0	0	1,808
1984	0	355	0	0	0	827	595	372	0	0	0	0	2,149
1985	0	341	0	0	0	1,003	469	355	0	0	0	0	2,168
1986	0	581	0	0	0	988	492	373	0	0	0	0	2,434
1987	0	613	0	0	0	724	353	318	0	0	0	0	2,008
1988	0	723	0	0	0	745	576	370	0	0	0	0	2,414
1989	0	830	0	0	0	981	596	409	0	0	0	0	2,816
1990	0	689	0	0	0	928	508	349	0	0	0	0	2,474
1991	0	587	0	0	0	882	293	347	0	0	0	0	2,109
1992	0	689	0	0	0	875	240	384	0	0	0	0	2,188
1993	0	691	0	0	0	1,098	316	441	0	0	0	0	2,546
1994	0	1,030	0	0	0	1,149	370	400	0	0	0	0	2,949
1995	0	1,166	0	0	0	1,218	442	349	0	0	0	0	3,175
1996	0	1,168	0	0	0	1,368	597	435	0	0	0	0	3,568
1997	0	1,169	0	0	0	1,313	817	356	0	0	0	0	3,655
Manufacturing													
1980	490	0	0	0	0	0	0	0	0	0	0	0	490
1981	490	0	0	0	0	0	0	0	0	0	0	0	490
1982	490	0	0	0	0	0	0	0	0	0	0	0	490
1983	345	0	0	0	0	0	0	0	0	0	0	0	345
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	419	0	0	0	0	0	0	0	0	0	0	0	419
1986	359	0	0	0	0	0	0	0	0	0	0	0	359
1987	441	0	0	0	0	0	0	0	0	0	0	0	441
1988	564	0	0	0	1	0	0	0	0	0	0	0	565
1989	564	0	0	0	0	0	0	0	0	0	0	0	564
1990	793	0	0	0	0	0	0	0	0	0	0	0	793
1991	623	0	0	0	0	0	0	0	0	0	0	0	623
1992	623	0	0	0	0	0	0	4	0	0	0	0	627
1993	623	0	0	0	0	0	0	7	0	0	0	0	630
1994	624	0	0	0	0	0	0	7	0	0	0	0	631
1995	624	0	0	0	0	0	0	7	0	0	0	0	631
1996	624	0	0	0	0	0	0	6	0	0	0	0	630
1997	624	0	0	0	0	0	0	7	0	0	0	0	631

Table 5-7. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Rural domestic													
1980	114	13	14	212	491	65	113	0	0	0	1	0	1,023
1981	120	13	31	222	504	69	130	0	0	0	1	0	1,090
1982	125	13	32	224	517	74	122	0	0	0	1	0	1,108
1983	131	14	32	248	531	78	142	0	0	0	1	0	1,177
1984	137	14	32	256	544	83	160	0	0	0	1	0	1,227
1985	142	14	50	266	557	87	154	0	0	0	1	0	1,271
1986	148	14	64	277	571	91	161	0	0	0	1	0	1,327
1987	153	15	72	288	584	96	128	0	0	0	1	0	1,337
1988	159	15	76	297	597	100	181	0	0	0	1	0	1,426
1989	165	15	77	306	611	104	192	0	0	0	1	0	1,471
1990	170	15	78	316	624	108	193	0	0	0	1	0	1,505
1991	182	16	78	332	637	112	155	0	0	0	2	0	1,514
1992	193	16	82	349	650	119	144	0	0	0	2	0	1,555
1993	204	16	85	321	663	131	157	0	0	0	2	0	1,579
1994	216	17	89	345	676	127	180	0	0	0	2	0	1,652
1995	227	17	97	347	689	142	214	0	0	0	2	0	1,735
1996	239	17	111	328	702	148	246	0	0	0	2	0	1,793
1997	250	17	112	387	715	153	325	0	0	0	2	0	1,961
Irrigation													
1980	16	385	47	257	52	102	200	335	4	0	0	0	1,398
1981	15	462	45	196	70	89	221	314	4	0	0	0	1,416
1982	15	540	43	135	88	76	241	293	4	0	0	0	1,435
1983	14	617	40	73	105	63	262	272	4	0	0	0	1,450
1984	14	694	38	12	123	50	282	251	3	0	0	0	1,467
1985	20	0	28	0	111	64	132	137	4	0	0	0	496
1986	0	0	28	0	93	44	176	91	5	0	0	0	437
1987	36	0	28	0	30	35	176	91	5	0	0	0	401
1988	36	0	28	0	8	29	440	91	4	0	0	0	636
1989	26	0	41	0	127	0	369	128	3	0	0	0	694
1990	33	0	47	0	113	0	274	125	3	0	0	0	595
1991	33	0	47	0	127	0	274	125	3	0	0	0	609
1992	33	0	47	0	127	0	274	125	3	0	0	0	609
1993	77	0	51	0	170	0	808	265	3	0	0	0	1,374
1994	0	0	51	7	845	0	718	272	3	0	0	0	1,896
1995	0	0	54	7	841	0	808	238	4	0	0	0	1,952
1996	0	0	54	8	957	0	808	265	4	0	0	0	2,096
1997	0	0	54	7	782	0	808	265	3	0	0	0	1,919

Table 5-7. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Livestock													
1980	18	0	14	55	82	24	142	0	0	0	3	0	338
1981	18	0	13	58	76	24	133	0	0	0	3	0	325
1982	17	0	13	60	69	24	125	0	0	0	3	0	311
1983	16	0	12	62	62	24	116	0	0	0	3	0	295
1984	15	0	12	64	55	24	107	0	0	0	2	0	279
1985	14	0	12	66	56	4	105	0	0	0	3	0	260
1986	13	0	14	66	66	3	74	0	0	0	3	0	239
1987	14	0	13	69	62	4	81	0	0	0	3	0	246
1988	16	0	14	76	65	4	89	0	0	0	3	0	267
1989	16	0	14	76	63	4	89	0	0	0	3	0	265
1990	16	0	16	75	65	4	101	0	0	0	3	0	280
1991	16	0	16	77	67	4	103	0	0	0	3	0	286
1992	16	0	19	84	80	3	133	0	0	0	3	0	338
1993	15	0	18	84	82	3	131	0	0	0	3	0	336
1994	17	0	15	84	77	4	125	0	0	0	3	0	325
1995	17	0	16	88	78	4	121	0	0	0	3	0	327
1996	14	0	13	72	113	3	98	0	0	0	5	0	318
1997	13	0	14	72	73	2	96	0	0	0	2	0	272

Table 5-8. Total pumping from the Lower Trinity Aquifer by use category for each county for the period 1980 through 1997 (all values in acre-feet per year).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Municipal													
1980	190	0	0	0	0	63	0	3,198	0	0	0	0	3,451
1981	168	0	0	0	0	66	0	841	0	0	0	0	1,075
1982	198	0	0	0	0	77	0	485	0	0	0	0	760
1983	193	0	0	0	0	97	0	276	0	0	0	0	566
1984	232	25	0	0	0	137	39	665	0	0	0	0	1,098
1985	199	19	0	0	0	147	36	893	0	0	0	0	1,294
1986	222	31	0	0	0	74	43	551	0	0	0	0	921
1987	204	32	0	0	0	101	64	188	0	0	0	0	589
1988	227	38	0	0	0	89	69	460	0	0	0	0	883
1989	297	40	0	0	0	95	73	614	0	0	0	0	1,119
1990	269	30	0	0	0	91	67	371	0	0	0	0	828
1991	275	26	0	0	0	98	63	311	0	0	0	0	773
1992	219	30	0	0	0	87	71	651	0	0	0	0	1,058
1993	298	28	0	0	0	122	75	737	0	0	0	0	1,260
1994	340	41	0	0	0	132	73	524	0	0	0	0	1,110
1995	322	47	0	0	0	99	87	518	0	0	0	0	1,073
1996	299	45	0	0	0	117	84	927	0	0	0	0	1,472
1997	331	43	0	0	0	119	79	609	0	0	0	0	1,181
Manufacturing													
1980	0	1,959	0	0	0	0	0	0	0	0	0	0	1,959
1981	0	1,959	0	0	0	0	0	0	0	0	0	0	1,959
1982	0	1,959	0	0	0	0	0	0	0	0	0	0	1,959
1983	0	1,382	0	0	0	0	0	0	0	0	0	0	1,382
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	2,097	0	0	0	0	0	0	0	0	0	0	2,097
1986	0	2,157	0	0	0	0	0	0	0	0	0	0	2,157
1987	0	2,644	0	0	0	0	0	0	0	0	0	0	2,644
1988	0	3,385	0	0	0	0	0	0	0	0	0	0	3,385
1989	0	3,385	0	0	0	0	0	0	0	0	0	0	3,385
1990	0	4,756	0	0	0	0	0	0	0	0	0	0	4,756
1991	0	3,739	0	0	0	0	0	0	0	0	0	0	3,739
1992	0	3,739	0	0	0	0	0	0	0	0	0	0	3,739
1993	0	3,739	0	0	0	0	0	0	0	0	0	0	3,739
1994	0	3,746	0	0	0	0	0	0	0	0	0	0	3,746
1995	0	3,746	0	0	0	0	0	0	0	0	0	0	3,746
1996	0	3,746	0	0	0	0	0	0	0	0	0	0	3,746
1997	0	3,746	0	0	0	0	0	0	0	0	0	0	3,746

Table 5-8. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Rural domestic													
1980	0	0	0	0	0	0	0	0	0	0	1	0	1
1981	0	0	0	0	0	0	0	0	0	0	1	0	1
1982	0	0	0	0	0	0	0	0	0	0	1	0	1
1983	0	0	0	0	0	0	0	0	0	0	1	0	1
1984	0	0	0	0	0	0	0	0	0	0	1	0	1
1985	0	0	0	0	0	0	0	0	0	0	1	0	1
1986	0	0	0	0	0	0	0	0	0	0	1	0	1
1987	0	0	0	0	0	0	0	0	0	0	1	0	1
1988	0	0	0	0	0	0	0	0	0	0	1	0	1
1989	0	0	0	0	0	0	0	0	0	0	1	0	1
1990	0	0	0	0	0	0	0	0	0	0	1	0	1
1991	0	0	0	0	0	0	0	0	0	0	1	0	1
1992	0	0	0	0	0	0	0	0	0	0	1	0	1
1993	0	0	0	0	0	0	0	0	0	0	1	0	1
1994	0	0	0	0	0	0	0	0	0	0	2	0	2
1995	0	0	0	0	0	0	0	0	0	0	2	0	2
1996	0	0	0	0	0	0	0	0	0	0	2	0	2
1997	0	0	0	0	0	0	0	0	0	0	2	0	2
Irrigation													
1980	46	226	0	111	0	0	0	165	0	0	0	0	548
1981	43	271	0	83	0	0	0	155	0	0	0	0	552
1982	40	317	0	55	0	0	0	144	0	0	0	0	556
1983	36	362	0	28	0	0	0	134	0	0	0	0	560
1984	33	408	0	0	0	0	0	123	0	0	0	0	564
1985	48	0	0	0	0	0	0	67	0	0	0	0	115
1986	10	0	0	0	0	0	0	45	0	0	0	0	55
1987	88	0	0	0	0	0	0	45	0	0	0	0	133
1988	88	0	0	0	0	0	0	45	0	0	0	0	133
1989	68	0	0	0	0	0	0	63	0	0	0	0	131
1990	81	0	0	0	0	0	0	62	0	0	0	0	143
1991	81	0	0	0	0	0	0	62	0	0	0	0	143
1992	81	0	0	0	0	0	0	62	0	0	0	0	143
1993	171	0	0	0	0	0	0	131	0	0	0	0	302
1994	15	0	0	3	0	0	0	134	0	0	0	0	152
1995	14	0	0	2	0	0	0	117	0	0	0	0	133
1996	15	0	0	2	0	0	0	131	0	0	0	0	148
1997	15	0	0	2	0	0	0	131	0	0	0	0	148

Table 5-8. (continued).

Year	Bandera	Bexar	Blanco	Comal	Gillespie	Hays	Kendall	Kerr	Kimble	Medina	Travis	Uvalde	Total pumpage
Livestock													
1980	0	0	0	0	0	0	0	0	0	0	0	0	0
1981	0	0	0	0	0	0	0	0	0	0	0	0	0
1982	0	0	0	0	0	0	0	0	0	0	0	0	0
1983	0	0	0	0	0	0	0	0	0	0	0	0	0
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	0	0	0	0	0	0	0	0	0	0	0	0	0
1987	0	0	0	0	0	0	0	0	0	0	0	0	0
1988	0	0	0	0	0	0	0	0	0	0	0	0	0
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	0	0	0	0	0	0
1997	0	0	0	0	0	0	0	0	0	0	0	0	0

5.8 Water Quality

Total dissolved solids in groundwater are a measure of water salinity. Fresh, slightly saline, moderately saline, and very saline water have total dissolved solids of less than 1,000, 1,000 to 3,000, 3,000 to 10,000, and 10,000 to 35,000 milligrams per liter, respectively. Most groundwater in the study area is fresh to slightly saline, but in some parts of the Hill Country portion of the Trinity Aquifer System groundwater is moderately saline (Figure 5-34). Although the groundwater in the Edwards Group generally has lower salinity than groundwater in the Upper, Middle, and Lower Trinity aquifers, the median value of total dissolved solids in groundwater is similar in the Edwards Group and Upper and Middle Trinity aquifers (Figure 5-34). The median total dissolved solids are 450, 470, and 410 milligrams per liter in the Edwards Group and Upper and Middle Trinity aquifers, respectively. In the Lower Trinity Aquifer, the median value of total dissolved solids is higher than that of the other aquifers at 760 milligrams per liter. Fresh groundwater occurs throughout the Edwards Group in the study area (Figure 5-35). In the Upper, Middle, and Lower Trinity aquifers, slightly to moderately saline groundwater typically occurs in eastern, downdip parts of the aquifers, especially in Blanco, Comal, Hays, Kendall, and Travis counties (Figures 5-36 through 5-38).

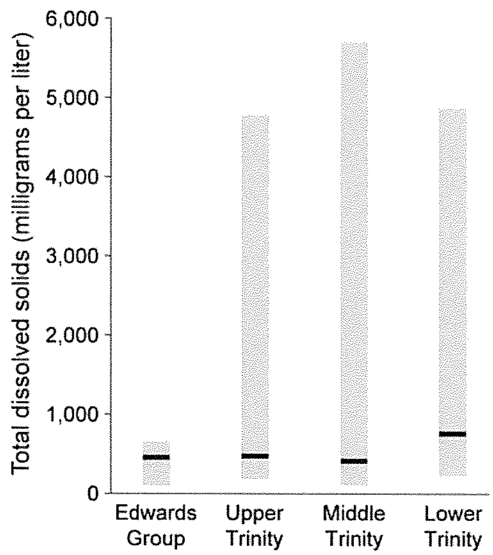


Figure 5-34. Ranges of total dissolved solids found in groundwater in the Edwards Group and the Upper, Middle, and Lower Trinity aquifers. The black line indicates the median value for each aquifer.

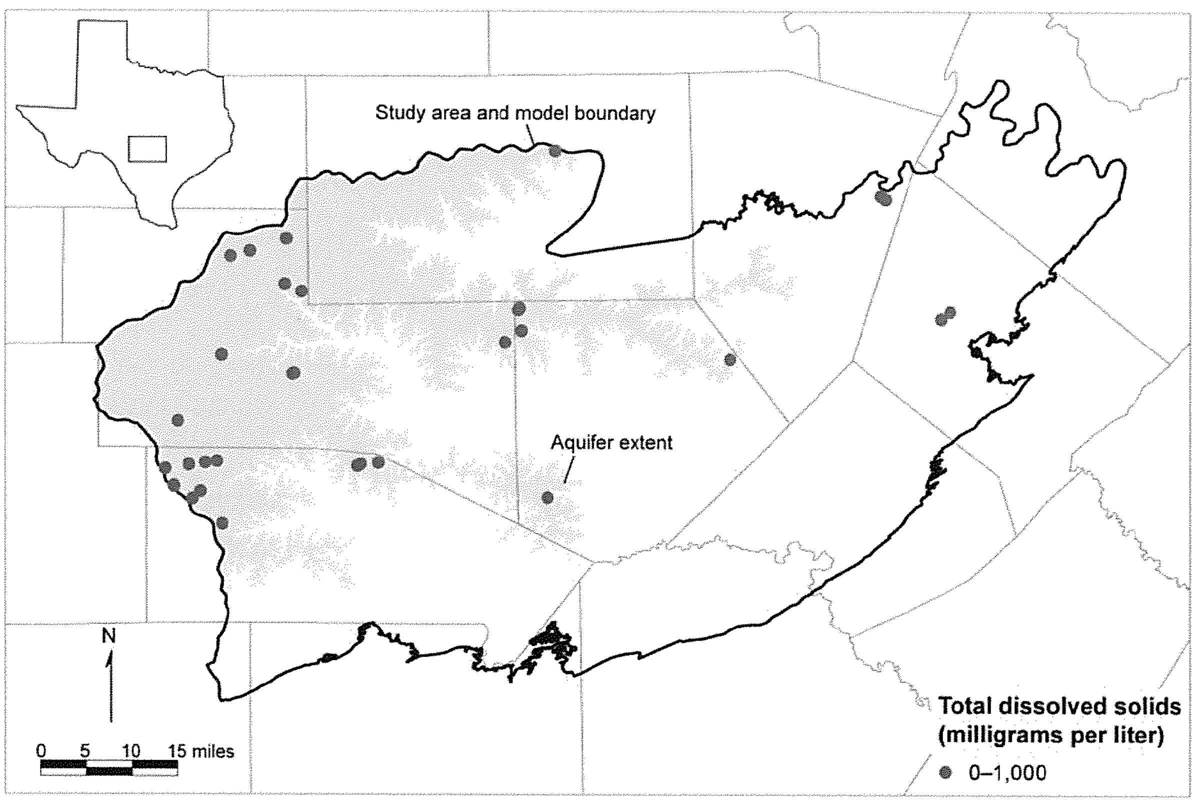


Figure 5-35. Map of total dissolved solids in the Edwards Group.

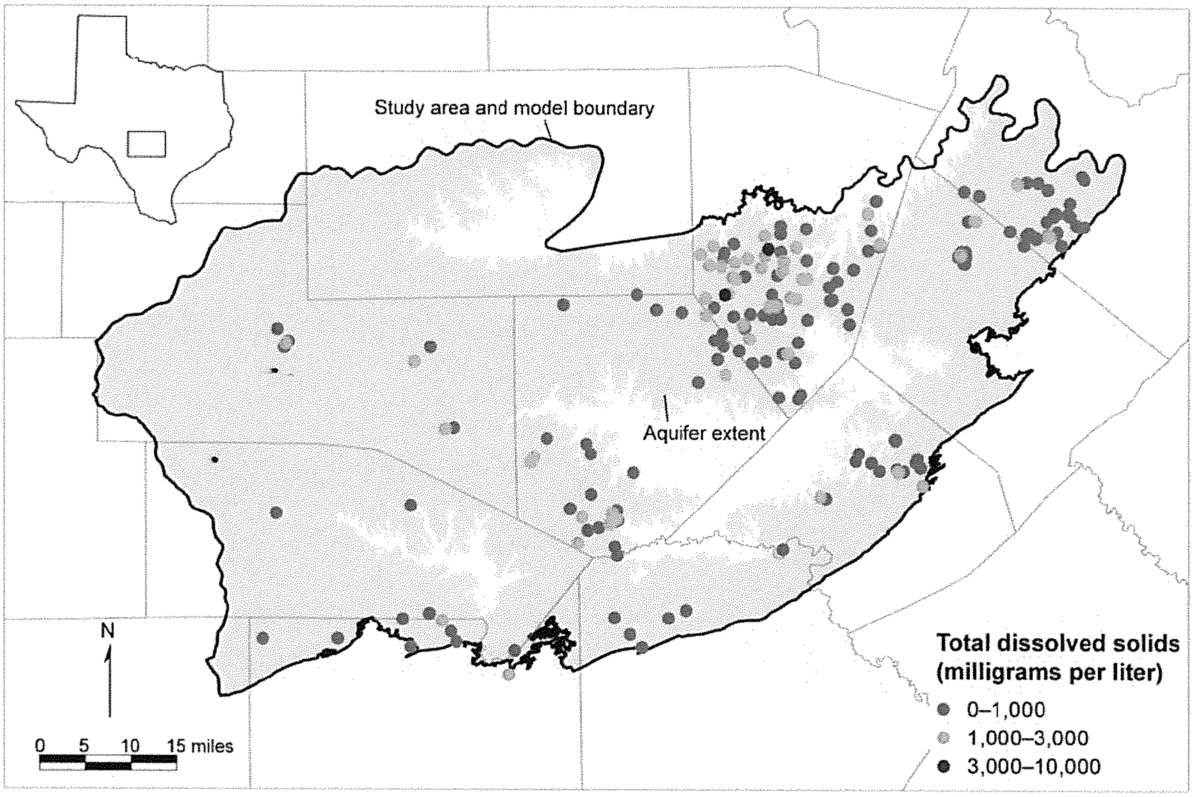


Figure 5-36. Map of total dissolved solids in the Upper Trinity Aquifer.

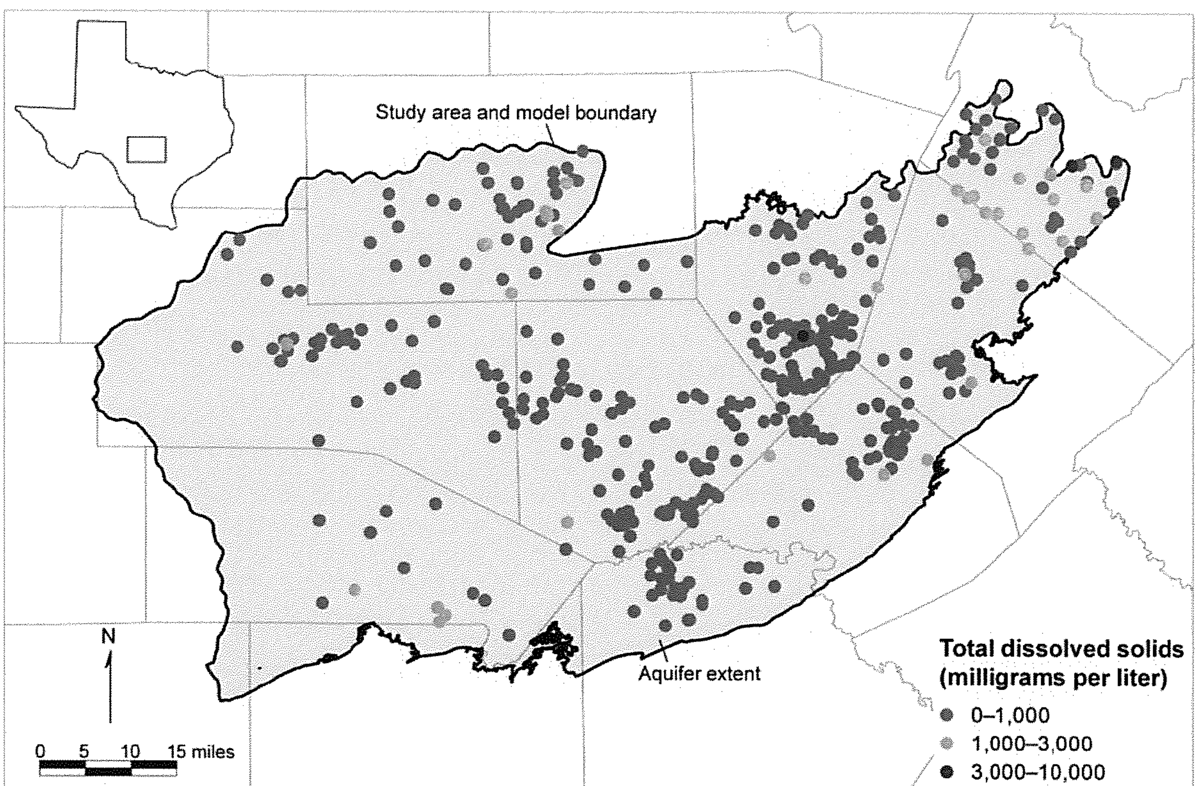


Figure 5-37. Map of total dissolved solids in the Middle Trinity Aquifer.

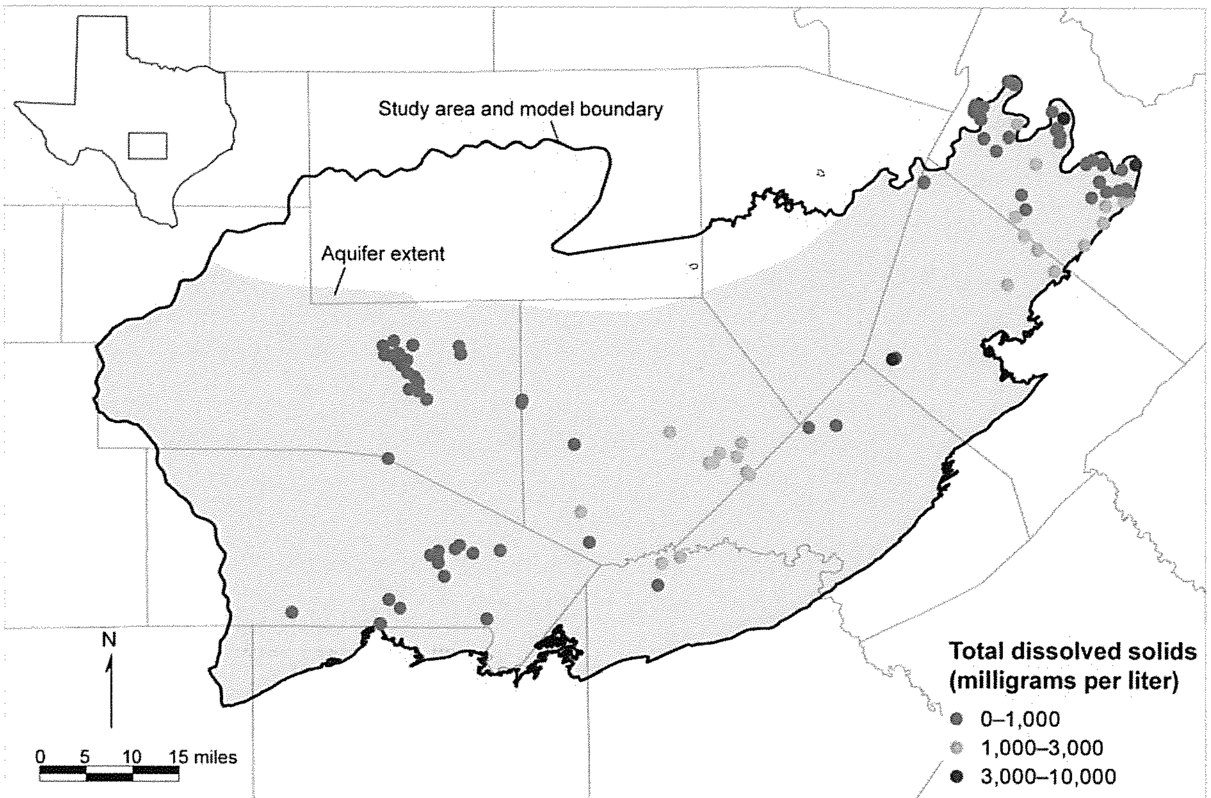


Figure 5-38. Map of total dissolved solids in the Lower Trinity Aquifer.

Groundwater in the Edwards Group is mainly calcium-magnesium-bicarbonate type (Figure 5-39). Groundwater in the Upper Trinity Aquifer is also mainly calcium-magnesium-bicarbonate type but progressively becomes calcium-magnesium-sulfate type in downdip parts of the aquifer (Figure 5-40). Groundwater in the Middle and Lower Trinity aquifers displays similar ranges of geochemical compositions, the former displaying more sulfate-dominated compositions and the latter displaying greater sodium and chloride (Figures 5-41 and 5-42). With increasing depth in the Hill Country portion of the Trinity Aquifer System, groundwater compositions can be categorized into three groups: (1) calcium-magnesium-bicarbonate-type compositions, (2) groundwater compositions characterized by increasing magnesium and sulfate, and (3) groundwater compositions characterized by increasing sodium and chloride (Figure 5-43). Groundwater compositions in the Edwards Group are characteristic of Group 1, groundwater in the Upper Trinity Aquifer displays Groups 1 and 2, and groundwater in the Middle and Lower Trinity aquifers displays compositions reflective of all three groups. These compositional trends can be explained by the following processes: (1) groundwater interaction with the limestone of the Edwards Group and the upper member of the Glen Rose Limestone, producing the calcium-magnesium-bicarbonate-type composition; (2) groundwater interaction with the dolostone and evaporites that occur within the Glen Rose Limestone, resulting in increased magnesium and sulfate in the groundwater; and (3) mixing with sodium-chloride brine migrating from depth.

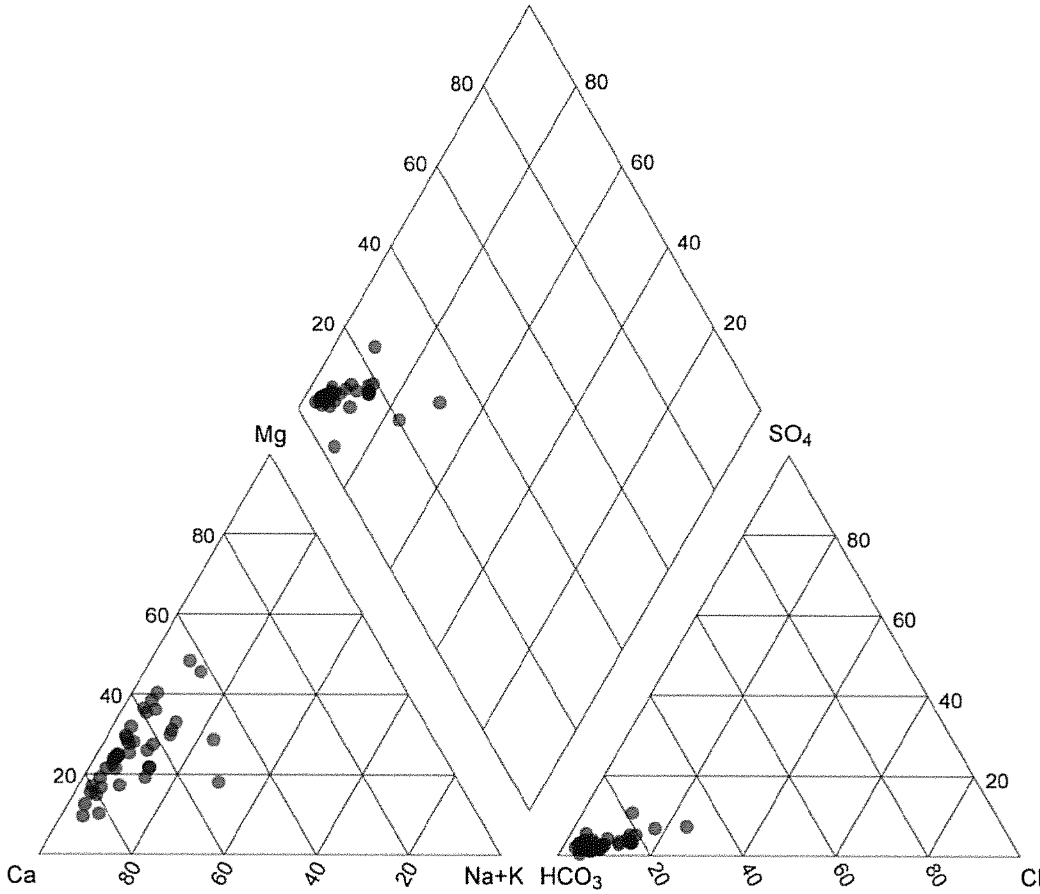


Figure 5-39. Piper diagram of groundwater from the Edwards Group showing the relative concentrations of the major ions present in the groundwater. Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, HCO_3 = bicarbonate, SO_4 = sulfate, Cl = chloride.

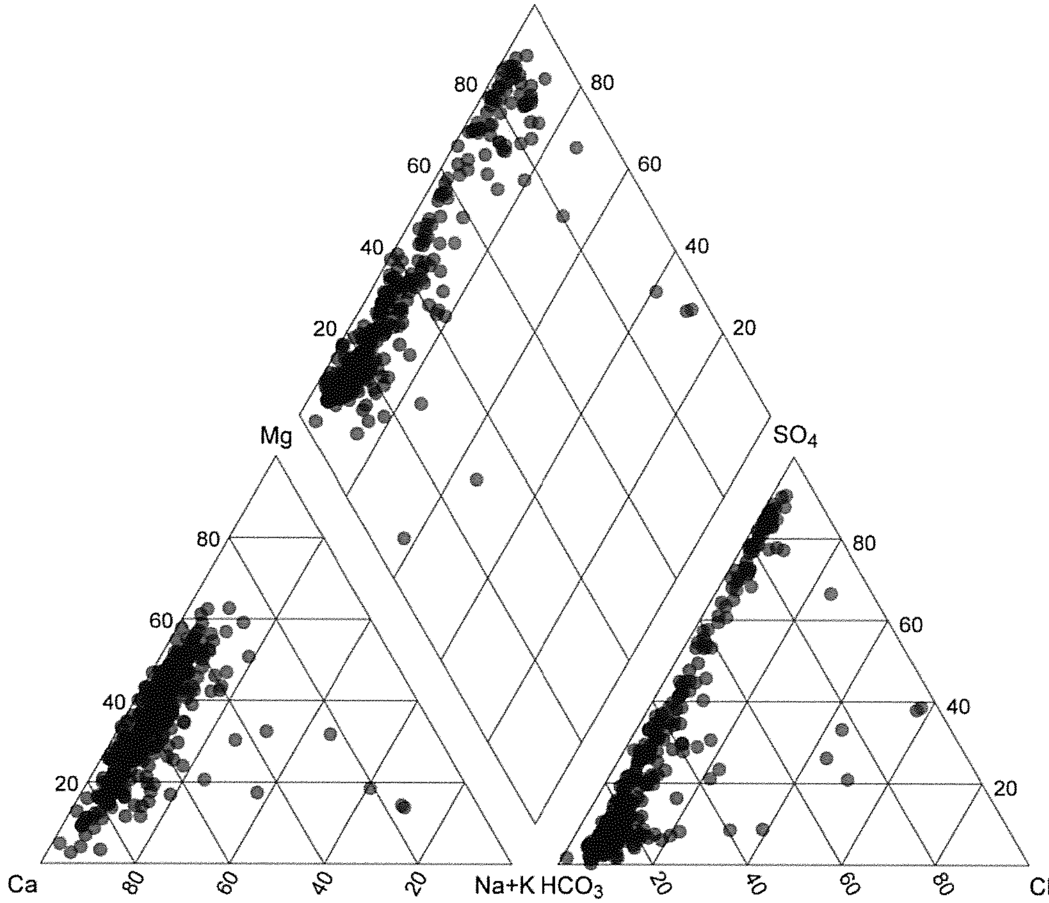


Figure 5-40. **Piper diagram of groundwater from the Upper Trinity Aquifer showing the relative concentrations of the major ions present in the groundwater. Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, HCO_3 = bicarbonate, SO_4 = sulfate, Cl = chloride.**

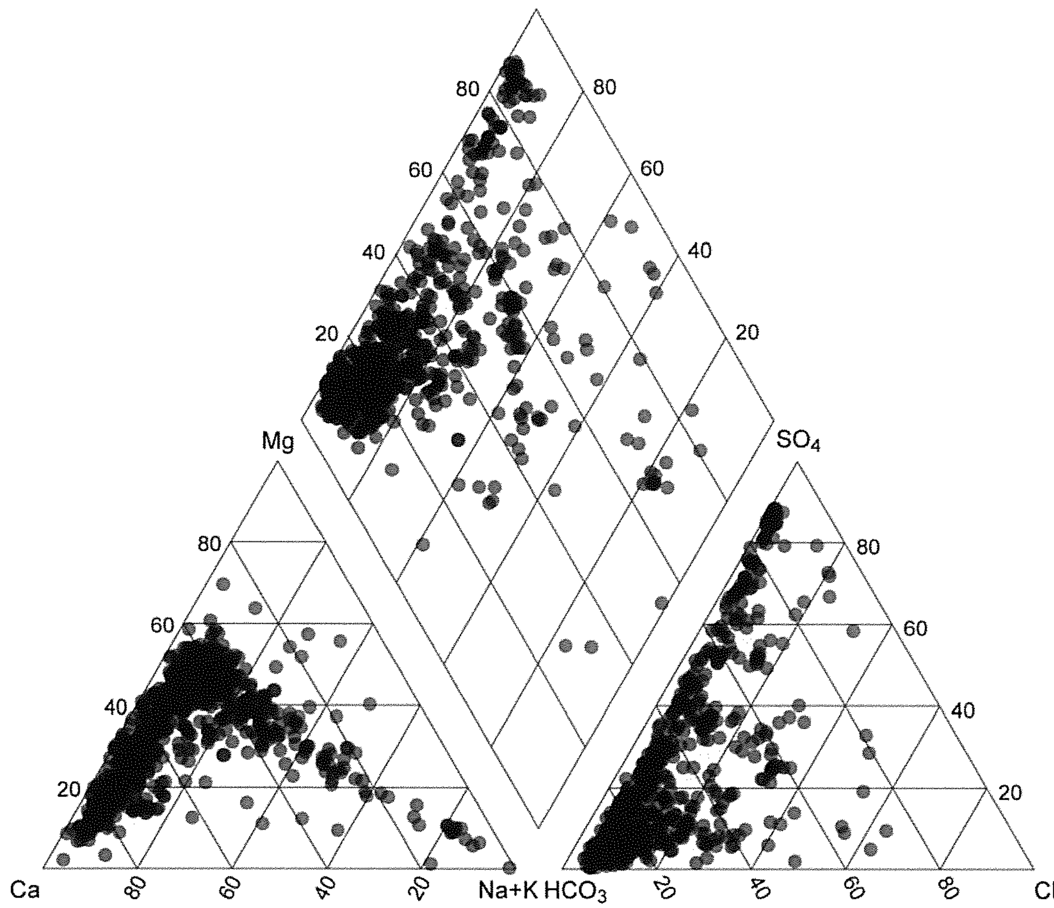


Figure 5-41. **Piper diagram of groundwater from the Middle Trinity Aquifer showing the relative concentrations of the major ions present in the groundwater. Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, HCO_3 = bicarbonate, SO_4 = sulfate, Cl = chloride.**

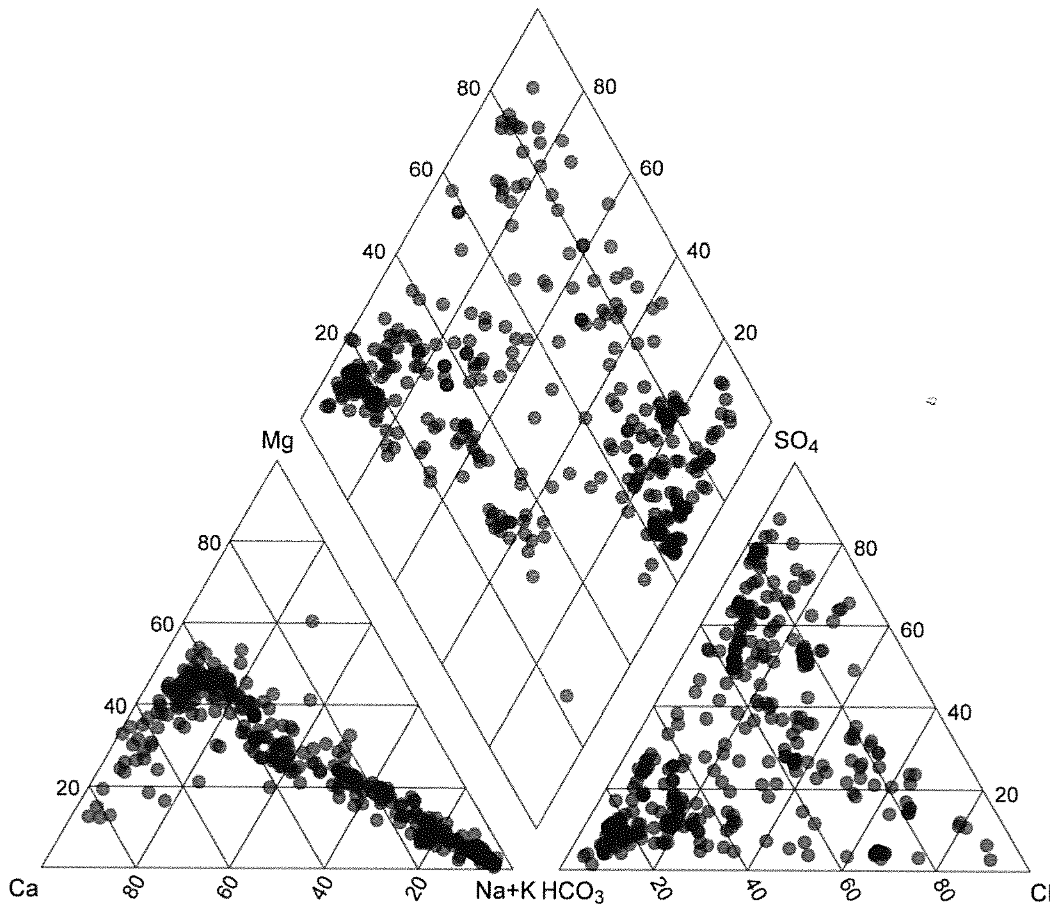


Figure 5-42. Piper diagram of groundwater from the Lower Trinity Aquifer showing the relative concentrations of the major ions present in the groundwater. Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, HCO_3 = bicarbonate, SO_4 = sulfate, Cl = chloride.

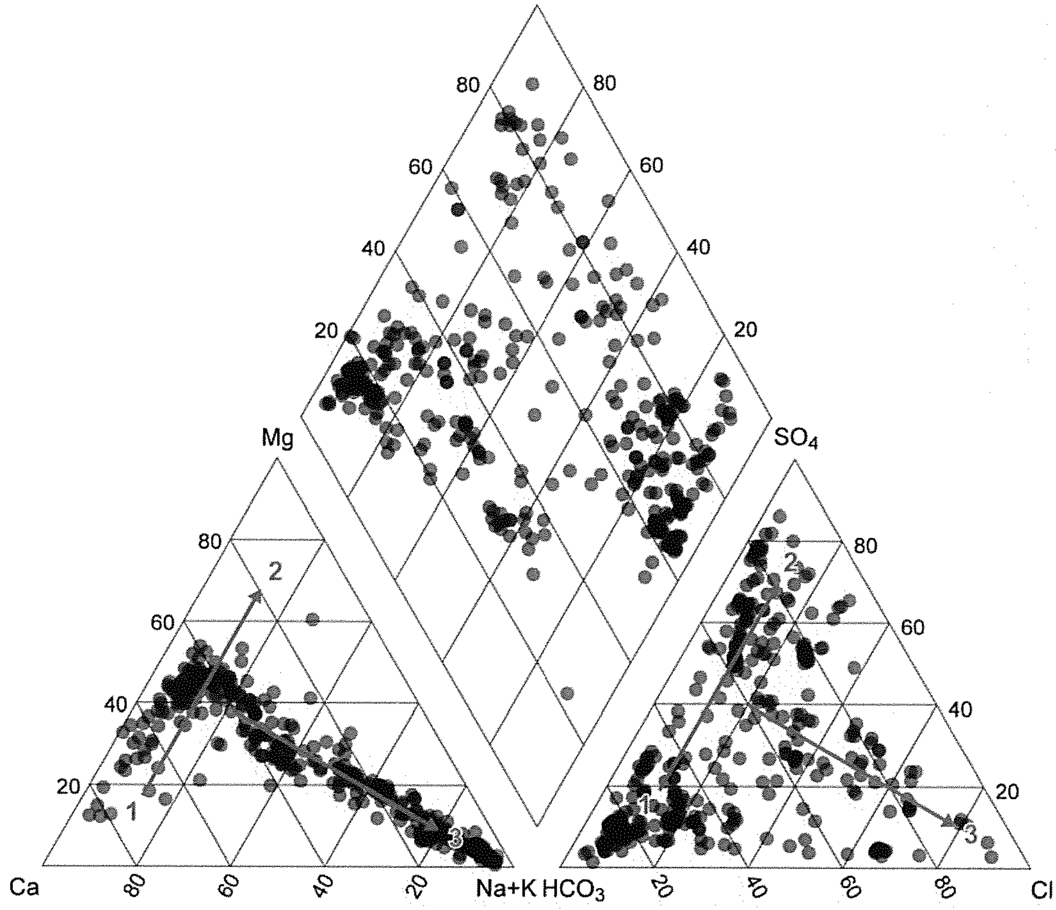


Figure 5-43. Groundwater geochemical trends that are apparent in the Hill Country portion of the Trinity Aquifer System. Ca = calcium, Mg = magnesium, Na = sodium, K = potassium, HCO_3 = bicarbonate, SO_4 = sulfate, Cl = chloride.

Distribution of total dissolved solids, chloride, and sulfate shows no specific trend with increasing well depth. Most of the samples from the Edwards Group show no significant changes in total dissolved solids, chloride, sulfate, and nitrate from the ground surface to well depths of about 3,500 feet. In the Lower Trinity Aquifer, highest groundwater salinity occurs at depths greater than 500 feet. Nitrate concentrations progressively decrease with increasing well depth in the Edwards Group and Upper, Middle, and Lower Trinity aquifers. Groundwater in the Edwards Group has the least nitrate, and the highest nitrate concentrations occur in the Upper and Middle Trinity aquifers.

6.0 Conceptual Model of Regional Groundwater Flow in the Aquifer

The conceptual model (Figure 6-1) is our best understanding of regional groundwater flow in the Hill Country portion of the Trinity Aquifer System.

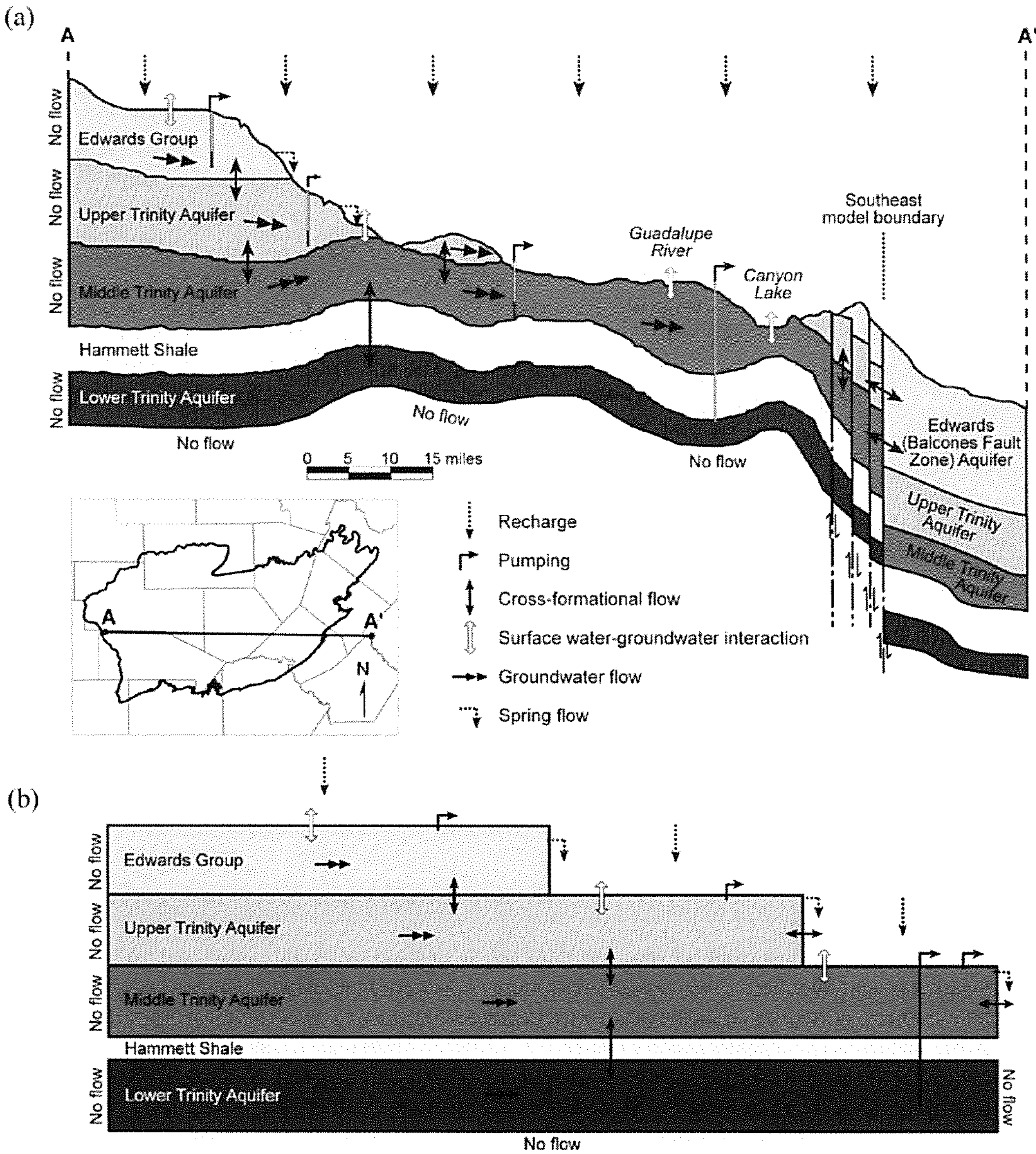


Figure 6-1. **Conceptual model of the Hill Country portion of the Trinity Aquifer System. (a) Schematic cross section through the aquifer system. (b) Diagram showing the boundary conditions at the outer edge of the model, flows between the layers, and translation of the conceptual model into the numerical model (modified from Mace and others, 2000).**

The conceptual model does not treat the Hammett Shale confining unit that separates the Middle and Lower Trinity aquifers as a distinct layer of flow. Rather, this confining unit is simulated as a zone of restricted vertical leakance between the two aquifers. When precipitation falls on the outcrop of the aquifer, much of the water evaporates, is taken up and transpired by vegetation, or runs off into local streams and eventually discharges through major streams outside of the study area. About 4 to 6 percent of the precipitation infiltrates into and recharges the underlying aquifers over most of the study area. This percentage is higher in the eastern portion of the study area where the fractures of the Balcones Fault Zone facilitate higher recharge rates.

Losing streams contribute recharge to the Edwards Group in the headwater areas of the streams along the western margin of the study area (Figure 3-6a) because the Edwards Group in the plateau area has high permeability. Most of the recharge to the Edwards Group in the study area discharges along the edge of the plateau through springs, seeps, and evapotranspiration. A small amount of the flow from the Edwards Group percolates downward into the underlying Upper, Middle, and Lower Trinity aquifers.

Most of the precipitation that recharges the Upper and Middle Trinity aquifers discharges to local and major streams through base flow to these surface-water features. An exception is Cibolo Creek, where karstification of the lower member of the Glen Rose Limestone changes the creek from a gaining stream to a losing stream between Boerne and Bulverde (Figure 3-1). Most of the remaining recharge in the aquifer either discharges through wells pumping from the aquifer or flows laterally into the Edwards (Balcones Fault Zone) Aquifer.

Several short flow paths probably lie along streams where the water table is shallow. In these areas recharged precipitation most likely flows a short distance and is discharged through evapotranspiration. Because of the localized nature of the flow paths and the limitations of the model grid, this evapotranspiration discharge would most likely be included in discharge to streams.

Groundwater can perch on low-permeability beds within the Upper Trinity Aquifer and flow laterally to springs; however, some water percolates through the Upper Trinity Aquifer into the Middle Trinity Aquifer. The Lower Trinity Aquifer is not exposed at land surface. Consequently, groundwater flow enters the Lower Trinity Aquifer through downward cross-formational flow from the Middle Trinity Aquifer and discharges by cross-formation back to the Middle Trinity Aquifer in downdip portions of the aquifers. In general, groundwater in the Hill Country portion of the Trinity Aquifer System flows from areas of higher topography to areas of lower topography, from the west to the east.

In general, lithology and local fracturing control permeability development and distributions in the Edwards Group and the Upper, Middle, and Lower Trinity aquifers. We think that hydraulic conductivity is higher in the eastern portion of the study area, where the higher hydraulic conductivity coincides with the Balcones Fault Zone, than in the rest of the aquifer system. The Edwards Group in the plateau area has high vertical and horizontal permeability due to karstification. The Upper Trinity Aquifer generally has lower permeability but can locally be very permeable, especially in the outcrop. Owing to the occurrence of shaly beds, the Upper Trinity Aquifer has a much lower ratio of vertical to horizontal permeability than does the overlying Edwards Group. The Middle Trinity Aquifer has moderate permeability and greater ability to transmit water vertically than the Upper Trinity Aquifer. The Middle Trinity Aquifer is most permeable in the sandy outcrop area of Gillespie County. Specific yield in the limestone is primarily controlled by fractures. The Lower Trinity Aquifer is on average less permeable than the overlying aquifers, the highest values occurring in the Kerrville area.

Pumping from the Hill Country portion of the Trinity Aquifer System has been progressively rising over the period 1980 through 1997. This increasing pumping is most apparent in counties adjacent to San Antonio and Austin—the two largest cities in the region—which are Bexar, Hays, Kendall, and Kerr counties. Pumping in some of these counties has doubled over the period of time covered by this study.

7.0 Model Design

Model design includes (1) choice of code and processor, (2) discretization of the aquifer into model layers and cells, and (3) assignment of model parameters into the various model layers. The model design must agree as much as possible with the conceptual model of groundwater flow in the aquifer.

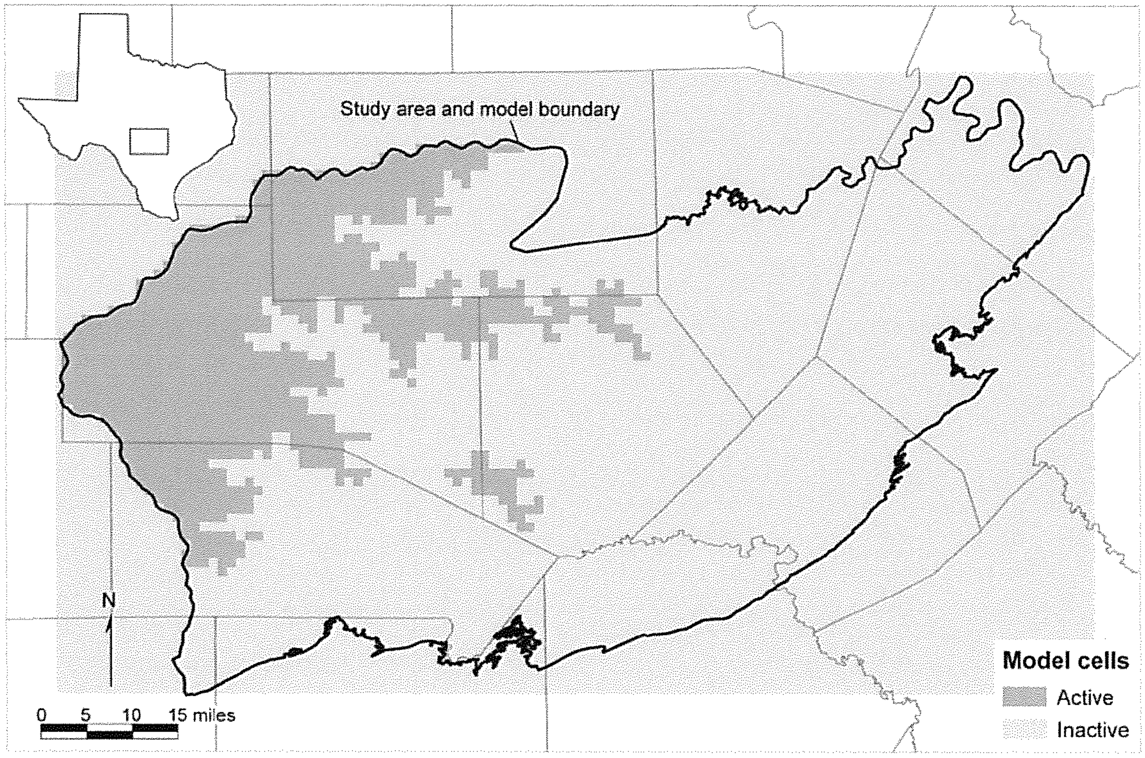
7.1 Code and Processor

Groundwater flow through the Hill Country portion of the Trinity Aquifer System was simulated using MODFLOW-96, a widely used modular finite-difference groundwater flow code written by the U.S. Geological Survey (Harbaugh and McDonald, 1996). This code was selected because of (1) its capabilities of simulating regional-scale groundwater processes in the Hill Country portion of the Trinity Aquifer System, (2) its documentation and wide use (McDonald and Harbaugh, 1988; Anderson and Woessner, 2002), (3) the availability of a number of third-party pre- and post-processors facilitating easy use of the modeling software, and (4) its ready availability as public domain software. Processing MODFLOW Pro version 7.0.18 was used to load input data into the model and view model outputs (Chiang, 2005). Other pre- and post-processors can read source files for MODFLOW-96. This model was developed and run on a Dell Precision™ 490 Workstation with a 3.0 GHz Dual-Core Xeon processor and 2 GB RAM running Microsoft Windows® XP Professional (v. 5).

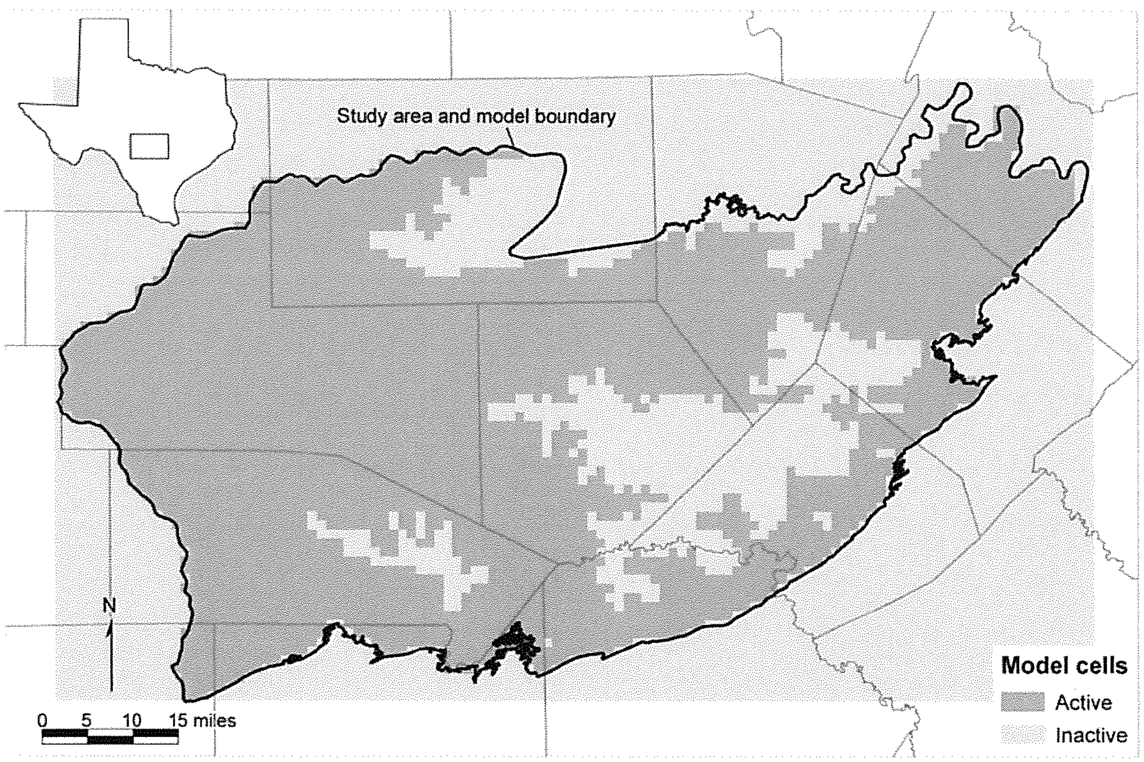
7.2 Layers and Grid

The lateral extent of the model corresponds to natural hydrologic boundaries, such as erosional limits of the aquifers, rivers, and the structural boundary with the Edwards (Balcones Fault Zone) Aquifer, and hydraulic boundaries to the west that coincide with groundwater divides. According to the hydrostratigraphy and conceptual model, we designed the model to have four layers: layer 1—the Edwards Group of the Edwards-Trinity (Plateau) Aquifer System, layer 2—the Upper Trinity Aquifer, layer 3—the Middle Trinity Aquifer, and layer 4—the Lower Trinity Aquifer.

We defined the active and inactive cells by first establishing the lateral extent of the formations in each layer using the geologic map (Figure 3-16). We assigned a cell as active if the formation covered more than 50 percent of the cell area. Please note that the spatial extents of the respective aquifers were revised slightly during model calibration to address dry cell and numerical stability issues. We did not include the thin slivers of the Edwards Group in the eastern part of the study area, for example, in Blanco County, because (1) our structure maps do not accurately represent the complexity of faulting in the area, (2) flow in some of these rocks is associated with the Edwards (Balcones Fault Zone) aquifer, and (3) in many areas these rocks are discontinuous and thus groundwater flow, if any, would be difficult to simulate at the regional scale. It should be noted that we did include a part of the Edwards Group that is not recognized by the TWDB as part of the Edwards-Trinity (Plateau) Aquifer in eastern Kerr County and western Kendall County. Each layer has 69 rows and 115 columns, for a total of 31,740 cells in the model. All the cells have uniform lateral dimensions of 1 mile by 1 mile. We selected this cell size to be small enough to reflect the density of input data and the desired output detail and large enough for the model to be manageable. Cell thickness depended on differences in top and bottom elevations of the model layers. After we made cells outside of the model area and outside the lateral extent of each layer inactive, the model had a total of 12,976 active cells: 1,107 in layer 1; 3,562 in layer 2; 4,517 in layer 3; and 3,790 in layer 4 (Figure 7-1).

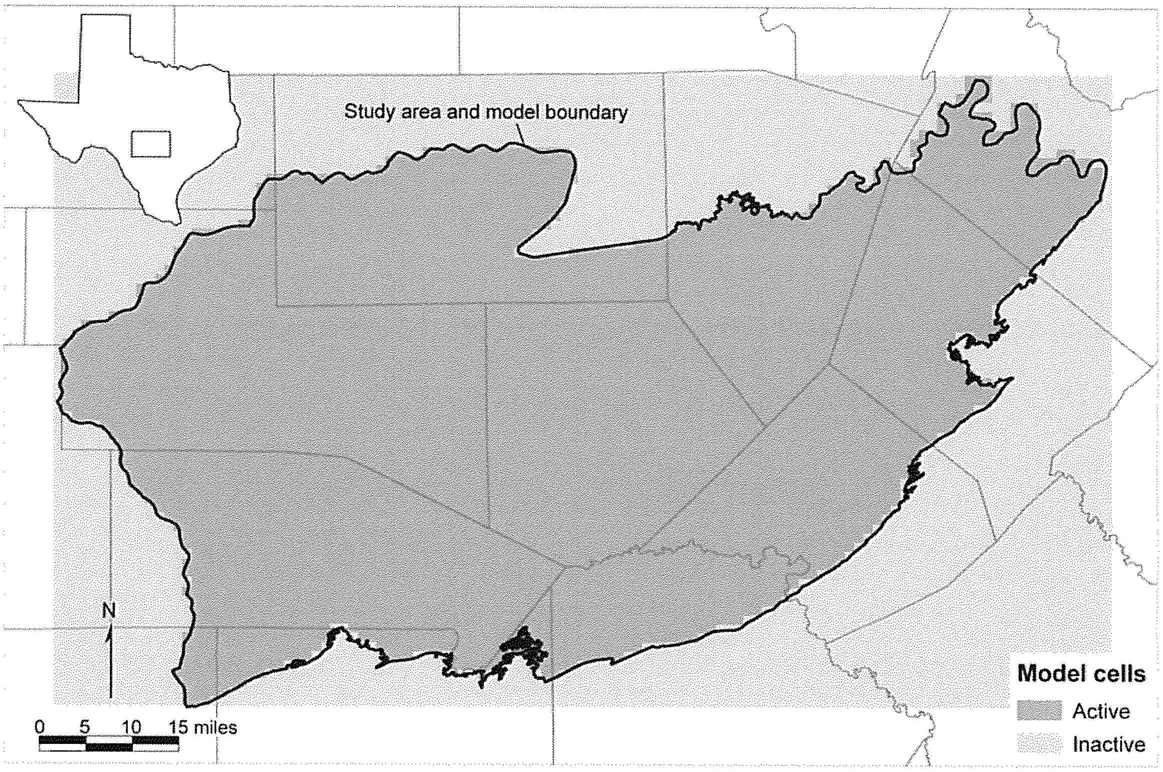


(a)



(b)

Figure 7-1 Active and inactive cells in model grid for (a) layer 1 (Edwards Group), (b) layer 2 (Upper Trinity Aquifer), (c) layer 3 (Middle Trinity Aquifer), and (d) layer 4 (Lower Trinity Aquifer).



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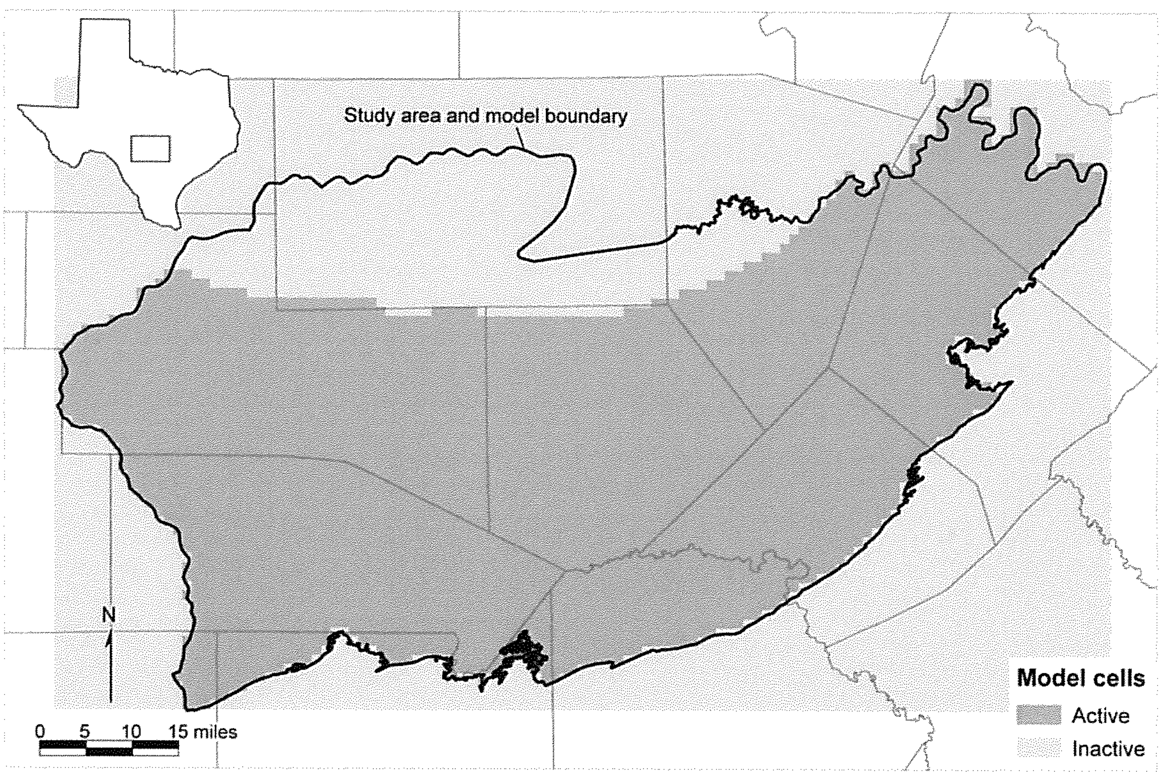


(d)

Figure 7-[illegible] (continued).

7.3 Model Parameters

We distributed model parameters, including (1) elevations of the top and bottom of each layer, (2) horizontal and vertical hydraulic conductivity, (3) specific storage, and (4) specific yield, using ArcGIS® 9.1. We defined top and bottom elevations for each layer from the structure maps and land surface elevations from digital elevation models downloaded from the U.S. Geological Survey. We used ArcGIS® 9.1 to assign top and bottom elevations. For layer 1 (Edwards Group), we assigned the top as the land surface elevation and the bottom according to the structure map of the base of the Edwards Group (Figure 5-1). The top and base of layer 2 (Upper Trinity Aquifer) were assigned according to the structure map of the Upper Trinity Aquifer (Figure 5-2). Where covered by active cells in layer 1, the top of layer 2 coincides with the base of layer 1; otherwise, it is defined by the land surface elevation. The bottom of layer 2 was defined by the base of the Upper Trinity Aquifer (Figure 5-2). Similarly, the top of layer 3 (Middle Trinity Aquifer) was defined as the bottom of layer 2 and the land surface elevation where exposed (Figure 5-3). The bottom of layer 3 was assigned using the elevation of the base of the Middle Trinity Aquifer (Figure 5-3). The top of layer 4 (Lower Trinity Aquifer) is defined as the base of the Hammett Shale, the confining unit separating the Middle and Lower Trinity aquifers (Figure 5-4). Groundwater flow through the Hammett Shale is not explicitly simulated in the model.

We initially assigned hydraulic conductivity values for layers 1, 2, and 3 previously used in Mace and others (2000) and adjusted these values during calibration. These values were uniform values of 7 and 5 feet per day in layers 1 and 2 based on geometric mean of hydraulic conductivity data, respectively, and a distributed range of values of 0.7 to 64 feet per day in layer 3. The initial hydraulic conductivity value we assigned to layer 4 was 0.6 feet per day, the geometric mean of the hydraulic conductivity data for the Lower Trinity Aquifer. We initially assigned vertical hydraulic conductivity to be one-tenth the horizontal hydraulic conductivity. We simulated groundwater flow between layers 3 and 4, through the Hammett Shale, using vertical leakance values. These vertical leakance values were initially set to be proportional to the relative thickness of the Hammett Shale in each cell. The purpose for using vertical leakance is to simulate vertical flow through the Hammett Shale confining unit without the need to simulate horizontal flow through the unit, which is assumed to be small. The range of vertical leakance values is 10^{-6} to 0.8 per day (Figure 7-2). We assigned uniform values of specific storage and specific yield in each layer. Initially assigned specific-storage values are 10^{-6}, 10^{-7}, 10^{-8}, and 10^{-8} per foot in layers 1, 2, 3, and 4, respectively. Initially assigned specific-yield values are 8×10^{-4}, 5×10^{-5}, 8×10^{-5}, and 8×10^{-5} in layers 1, 2, 3, and 4, respectively.

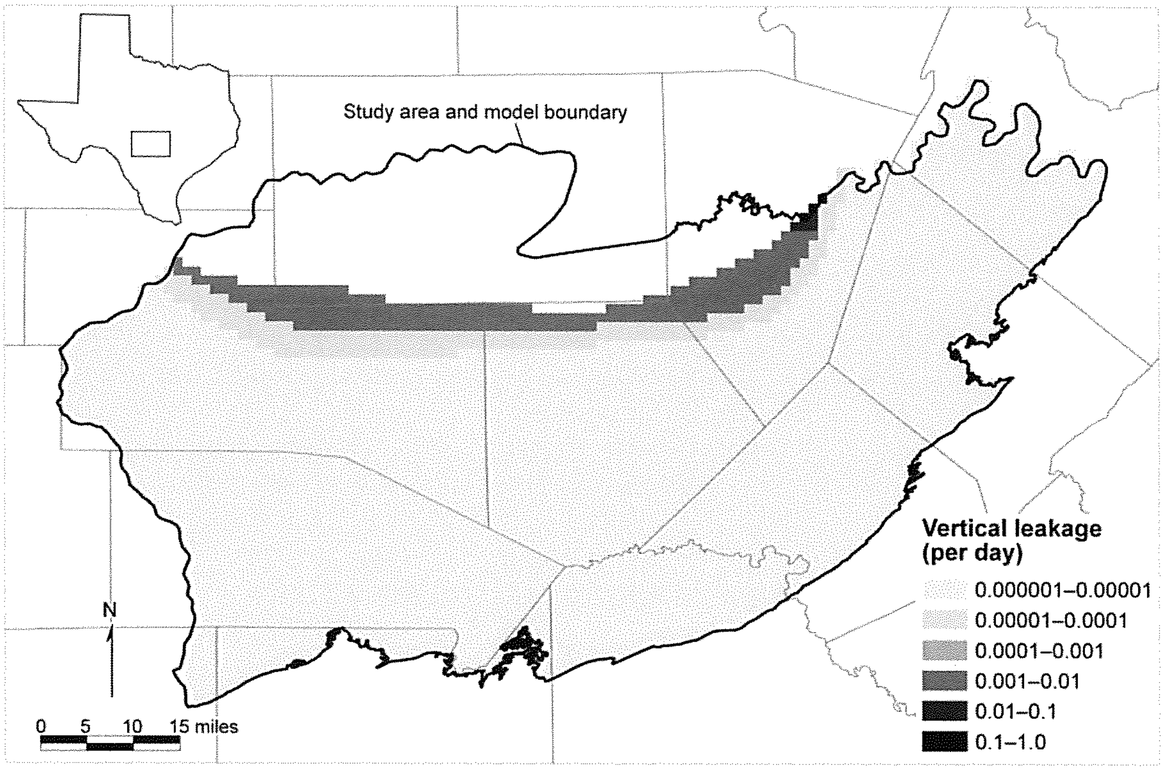


Figure 7-2. **Vertical leakance between the Middle and Lower Trinity aquifers.**

We assigned layer 1 as unconfined and layers 2 through 4 as confined/unconfined. We allowed the model to calculate transmissivity and storativity according to saturated thickness. We used units of feet for length and days for time for all input data to the model. To solve the groundwater flow equation, we used the Slice Successive Over-Relaxation solver with a convergence criterion of 0.0001 feet.

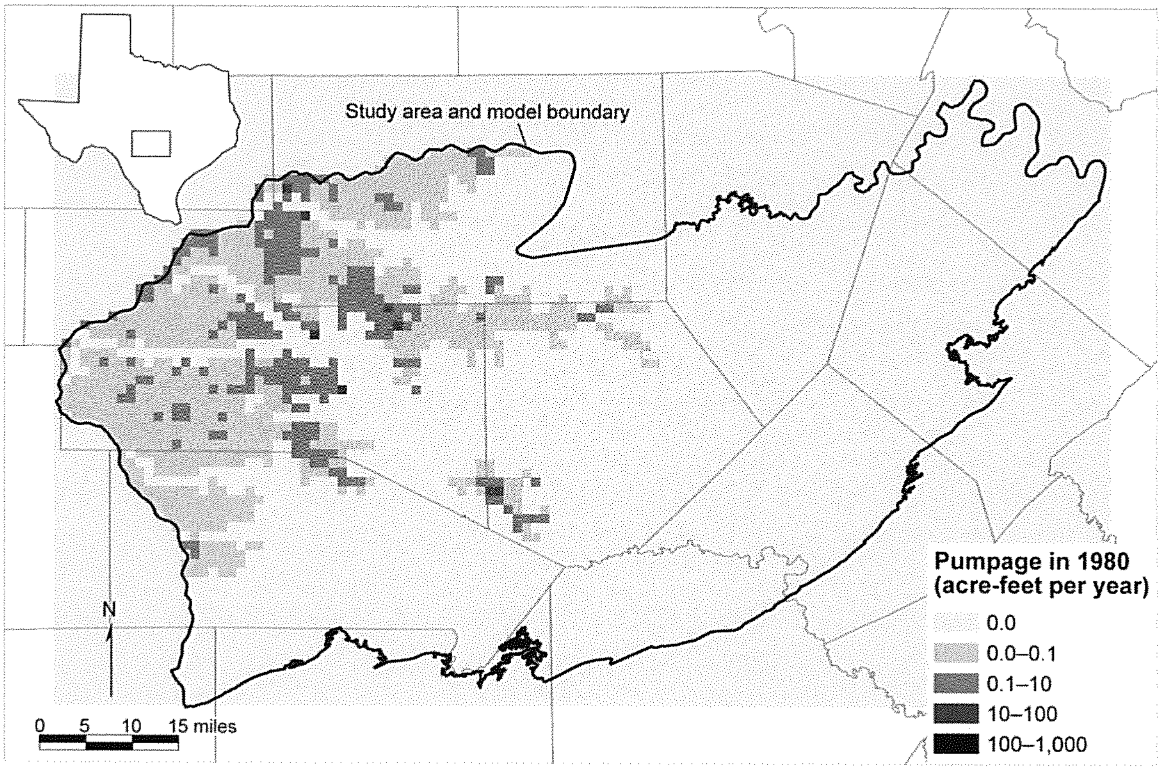
7.4 Model Boundary Conditions

Model boundary conditions are factors that control the inflow and outflow of groundwater in a numerical model. We assigned model boundary conditions for (1) recharge, (2) pumping, (3) rivers and streams, (4) reservoirs, (5) outer model boundaries, and (6) initial head conditions. We used ArcGIS® 9.1 to distribute values for model boundary conditions spatially, such as drains, general-head boundaries, recharge, and pumping.

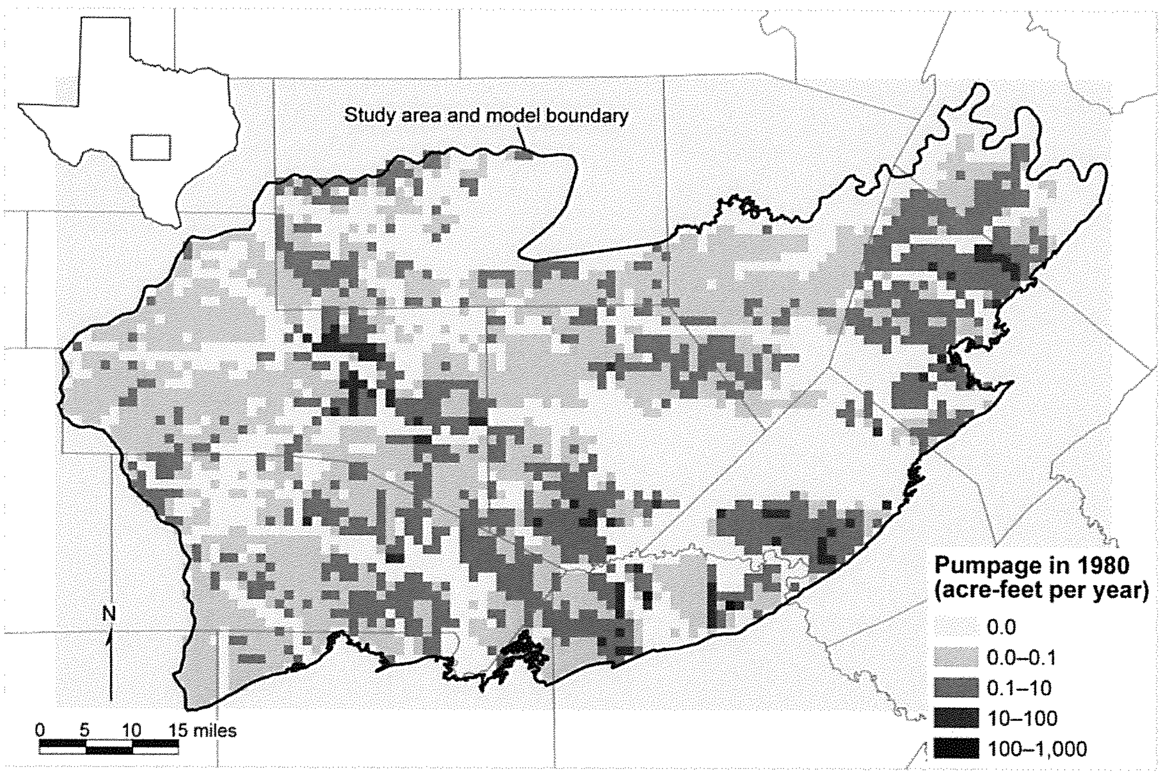
We assigned recharge primarily on the basis of the spatial distribution of annual precipitation over the study area (Figure 3-9). The initial recharge assigned to the model was 4.7 percent of annual precipitation. This value coincides with the value used in the groundwater availability model for the Edwards-Trinity (Plateau) Aquifer (Anaya and Jones, 2009). We also included in the recharge distribution, recharge from streamflow losses in Cibolo Creek.

We assigned pumping values in the model according to our analysis of pumping as discussed in Section 5.7 (Discharge) of this report (Figure 5-30). This model simulates the regional effects of pumping on water levels for rural domestic, municipal, irrigation, industrial, and livestock uses

(Tables 5-3 through 5-8). Municipal and manufacturing pumping was distributed on the basis of known well locations and pumping data from the TWDB Water Use Survey. The other uses (domestic, irrigation, and livestock) were distributed throughout the model grid, reflecting the spatial distribution of associated land use. Rural domestic pumping was distributed on the basis of the spatial distribution of population outside major urban areas that lie within the model grid. Irrigation pumping was distributed on the basis of 1:250,000-scale land use and land cover data from the U.S. Geological Survey. Irrigation was assumed to occur on all land classified as orchards, row crops, or small grains. Livestock pumping was also distributed on the basis of 1:250,000-scale land use and land cover data from the U.S. Geological Survey. Livestock pumping was assumed on all range land. Figure 7-3 shows the spatial distribution of total pumping for the year 1980.

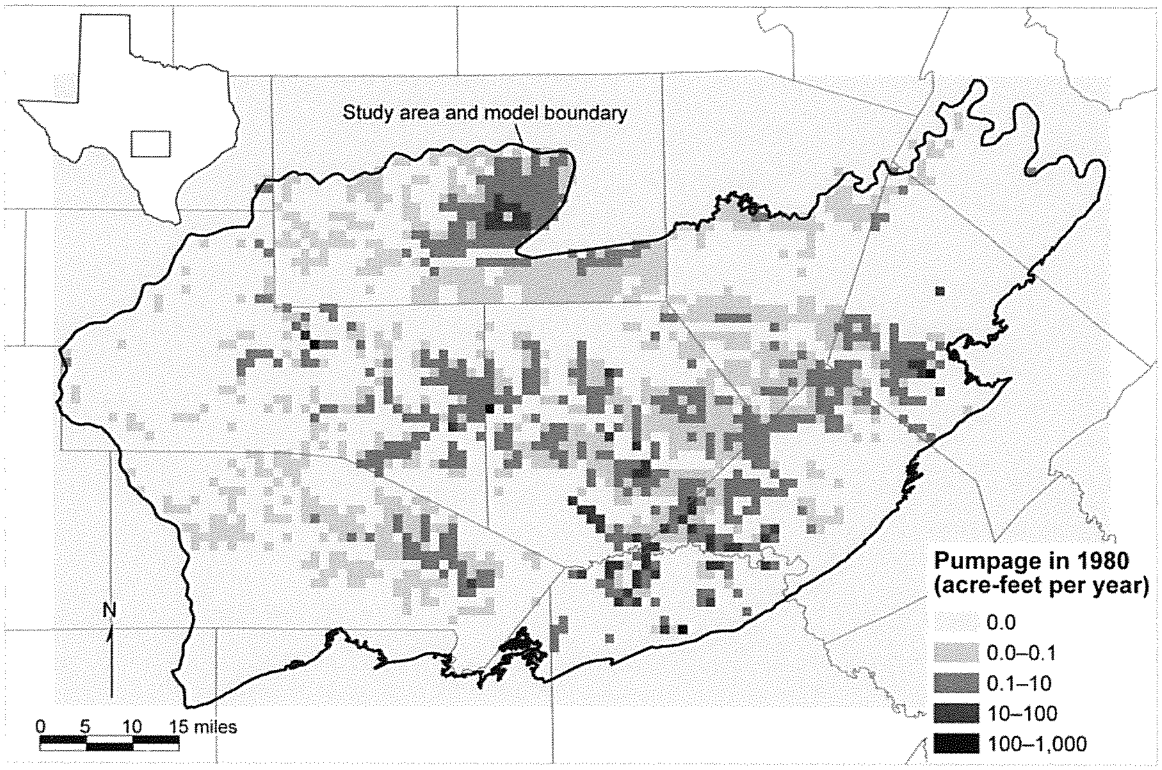


(a)



(b)

Figure 7-[illegible]. The spatial distribution of total pumping for 1980 for (a) layer 1, (b) layer 2, (c) layer 3, and ([illegible]) layer [illegible].



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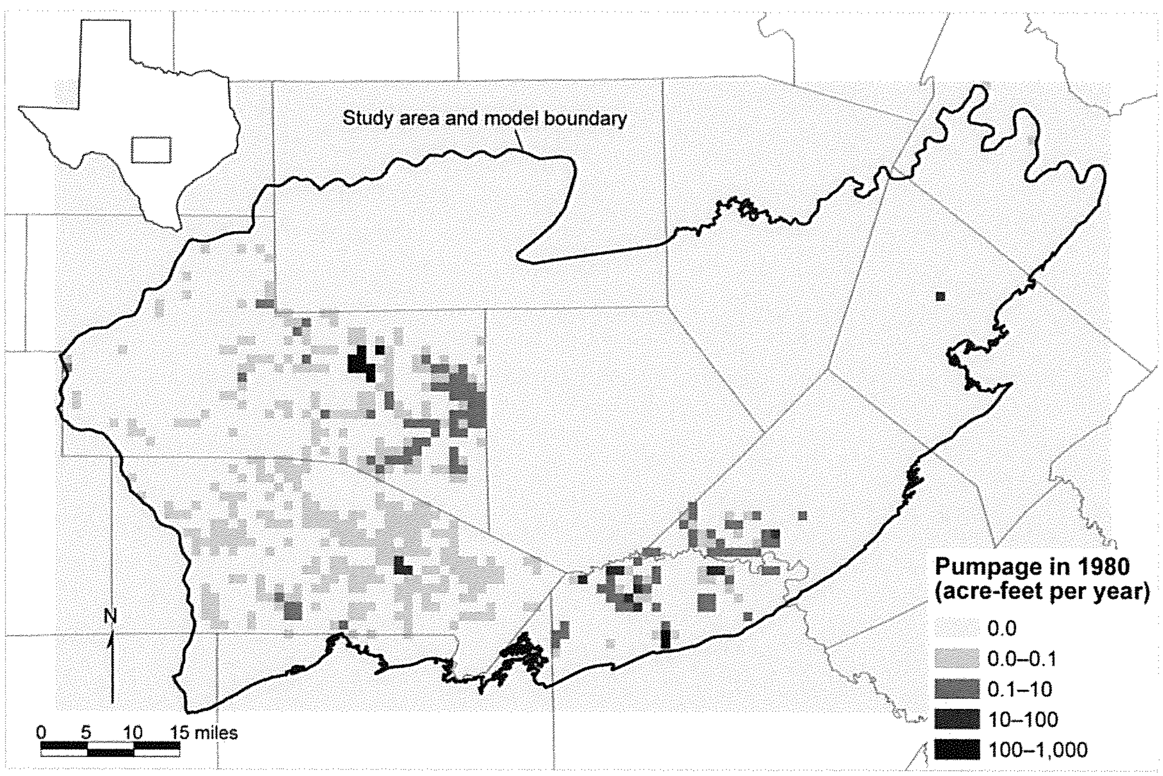
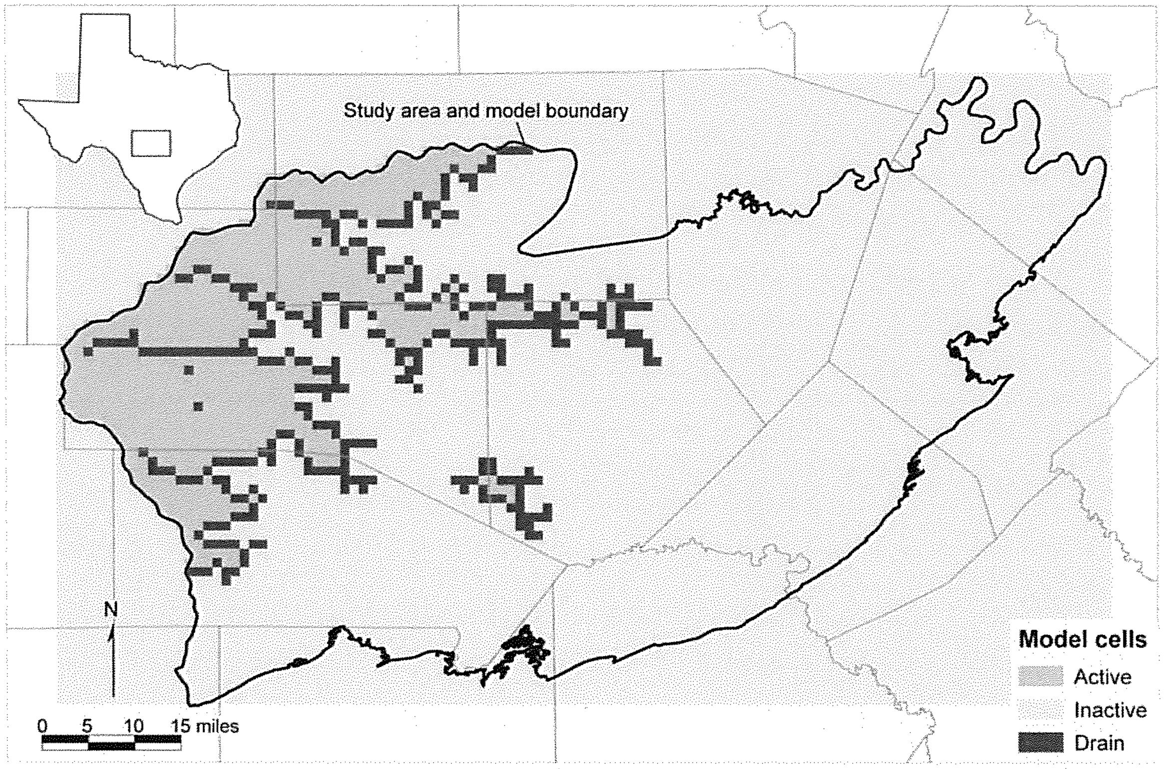


(d)

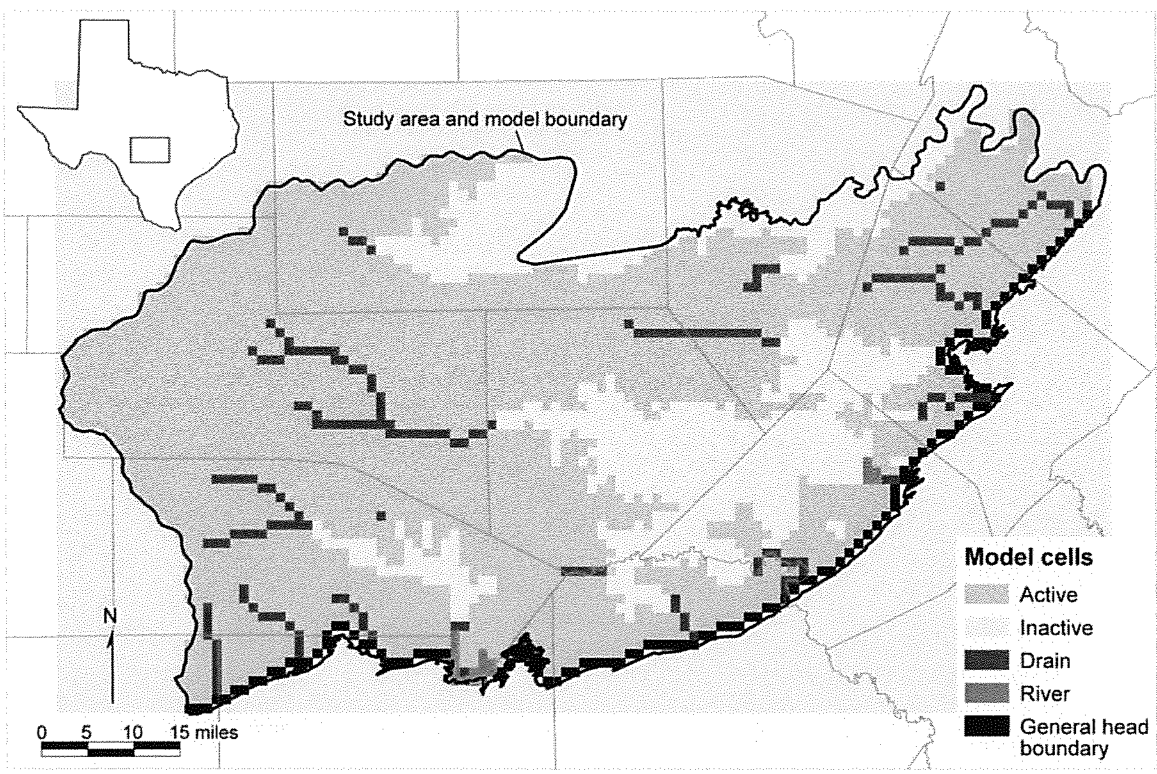
Figure 7- (continued).

We used the Drain Package of MODFLOW to represent rivers and streams in the model (Figure 7-4). This package only allows the streams to gain water from the aquifer. The River Package, which is another possible approach for simulating rivers and streams, allows streams to gain and lose water. Mace and others (2000) found that the River Package could allow unrealistic amounts of water to move from the rivers and streams into the aquifer and thus underestimate potential water level declines due to pumping or drought. Observed streamflow losses in Cibolo Creek along the boundary between Bexar and Comal counties are simulated as recharge. The Drain Package requires a drain elevation and conductance. When the head in the aquifer is above the drain elevation, water flows out of the model through the drain. If the head in the aquifer is equal to or below the drain elevation, no flow occurs from the drain to the aquifer. Drain conductance is a measure of hydraulic resistance to flow out of the drain. We defined the drain elevation by intersecting stream-bed location with the digital elevation model in ArcGIS® 9.1. We assigned the drain conductance on the basis of estimated width of the stream, a stream length of 1 mile (equivalent to the model cell size), an assumed riverbed thickness of 1 foot, and an assumed vertical hydraulic conductivity of 0.1 feet per day. After Mace and others (2000) calibrated the model, they investigated the sensitivity of simulated water levels to different values of drain conductance. Except for very low values, the drain conductance generally has little effect on water levels in the model (Mace and others, 2000). We also used drains to represent discharge to major springs, seepage from the erosional edge of the Edwards Group in the plateau area, and flow out of the Middle Trinity Aquifer in Gillespie County (Figure 7-4). For the springs, we assigned the drain elevation as the land surface elevation at the spring location and an initial conductance based on an assumed 1-foot thickness and the geometric mean hydraulic conductivity of the layer. For the erosional edge of the Edwards Group and flow out of the Middle Trinity Aquifer in Gillespie County, we assigned a drain elevation 10 feet above the base of layer 1 and a drain conductance based on a 1-foot thickness and the geometric mean hydraulic conductivity of the layer.

We simulated the influence of Medina Lake, Canyon Lake, Lake Travis, and Lake Austin on the aquifer using MODFLOW's River Package (Figure 7-4). The River Package requires hydraulic conductance of riverbed, river stage, and bottom elevation of the river. We assigned the riverbed conductance according to estimated width of the stream, a stream length of 1 mile (equivalent to the model cell size), riverbed thickness of 1 foot, and vertical hydraulic conductivity of 0.1 feet per day. We assigned the head in the river as the average lake-level elevation for the respective lakes. We defined the elevation of the riverbed by intersecting stream-bed location with the digital elevation model in ArcGIS® 9.1.

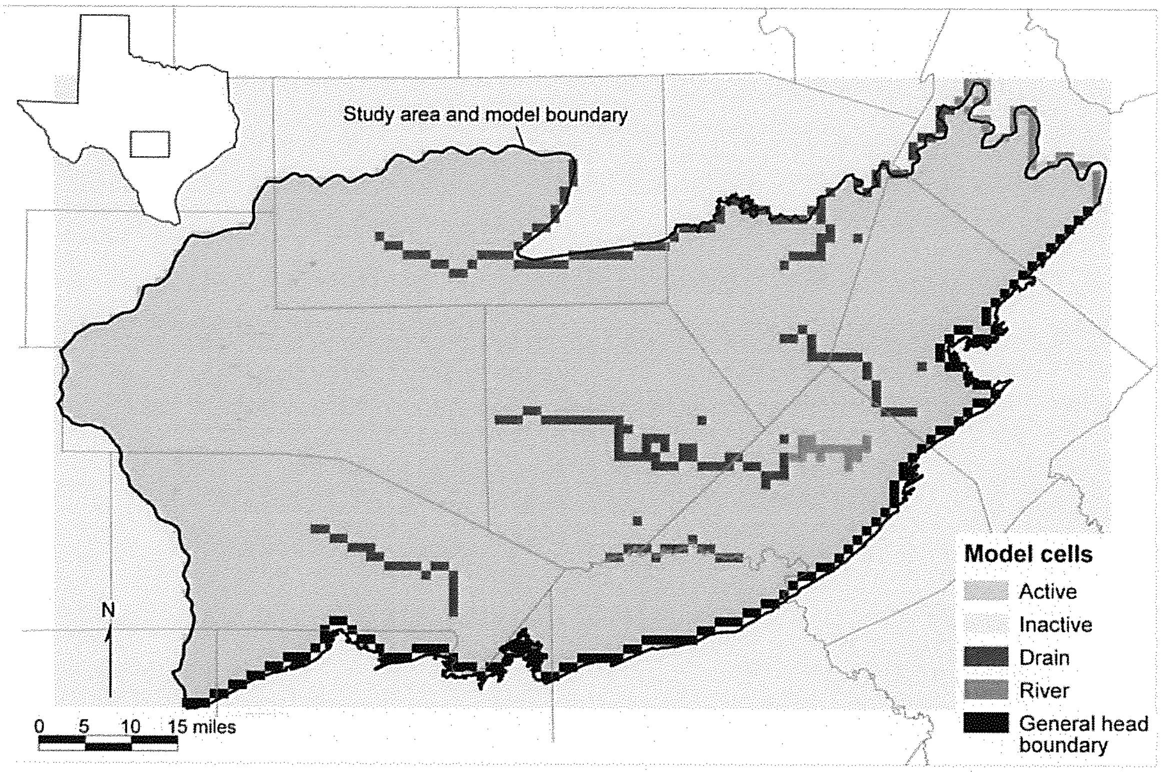


(a)



(b)

Figure 7-[illegible]. Boundary cells in model grid for (a) layer 1, (b) layer 2, (c) layer 3, and (d) layer 4.



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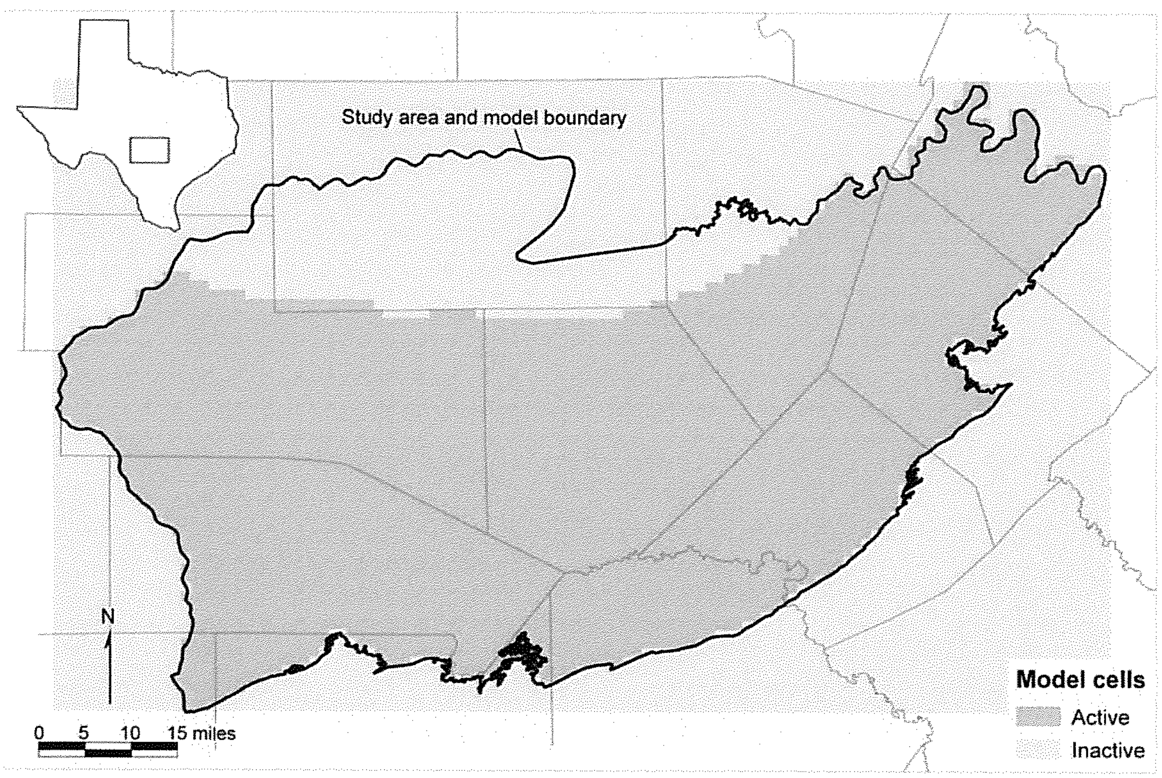


(d)

F ure 7- (co nu l).

Outer model boundary conditions define the spatial extent of active flow within the respective layers in the model. In this model, the outer boundary conditions are defined by the use of no-flow and general-head boundaries. The model boundaries are generally simulated by no-flow boundaries to the north and west and general-head boundaries in the south and east, where the Hill Country portion of the Trinity Aquifer System bounds the Edwards (Balcones Fault Zone) Aquifer. The no-flow boundary in the north coincides with surface-water divides in the Pedernales and Colorado River basins. The no-flow boundary in the west follows a flow path in the Edwards-Trinity (Plateau) Aquifer. We inferred that layer 4 is also bound by no-flow boundaries in the south and east on the basis of the assumption, in response to work by Hovorka and others (1996), that there is very little groundwater flow between the Hill Country portion of the Trinity Aquifer System and Trinity Group rocks underlying the Edwards (Balcones Fault Zone) Aquifer. A no-flow boundary also exists at the base of the Lower Trinity Aquifer, a conclusion based on the assumption that there is no cross-formational flow between the Lower Trinity Aquifer and underlying Pre-Cretaceous rocks. To model the flow of groundwater between the Hill Country portion of the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer, we used the General-Head Boundary Package of MODFLOW. We placed general-head boundary cells along the contact with the Edwards (Balcones Fault Zone) Aquifer in layers 2 and 3 (Figure 7-4). The General-Head Boundary Package requires values for hydraulic head and conductance. We assigned the hydraulic head according to the interpreted water level map (Figure 5-3) in the area of the general-head boundary cells. We assigned the general-head boundary conductance according to the hydraulic conductivity and geometry of the cell and an assumed 1-foot thickness. Conceptually, the general-head boundary conductance represents the resistance to flow between a cell in the model and a constant-head source or sink. In this case, we have used the general-head boundary to represent flow out of the study area either into the Edwards (Balcones Fault Zone) Aquifer across faults or continuing into the downdip parts of the Trinity Aquifer System. For simplicity, we used an arbitrary thickness of unity (1 foot) to define conductance.

The updating of this model included changes to the boundary conditions. Besides adding the Lower Trinity Aquifer as another layer, the model comprised these changes: (1) the constant-head cells that were used by Mace and others (2000) to simulate reservoirs were replaced by river cells, (2) river cells simulating Lake Travis were removed from layer 2 and now only appear in layer 3, (3) the spatial extent of Medina Lake was revised, and (4) the spatial distribution of recharge was revised to account for the effects of the Balcones Fault Zone and recharge from Cibolo Creek. The constant-head cells were converted to river cells because constant head provides an unlimited, unrestricted source of water when impacted by nearby pumping and therefore could produce unrealistically high water levels adjacent to the constant-head cells. On the other hand, the River Package in MODFLOW includes a conductance parameter that can be used to restrict flow and would therefore allow water levels to fall to more realistic values in response to pumping. Although the potential exists to produce unrealistically high flows from the River Package (similar to the use of constant heads), amounts of water to the groundwater flow system under periods of high pumping and proper attention to boundary elevation and conductance can mitigate this effect. During model calibration, we made minor adjustments to the outer model boundary conditions to address dry cell and numerical stability issues.

8.0 Modeling Approach

Model calibration involves the adjustment of parameters until the model results of groundwater elevations and base-flow discharge reasonably match measured field data. Our approach for calibrating the model comprised two major steps: (1) calibrating a steady-state model and (2) calibrating a transient model.

The steady-state model was developed first to facilitate easier calibration because some parameters, such as aquifer storage and water level variations over time, do not need to be taken into consideration. In the steady-state model, calibration only requires consideration of spatial variations of all input parameters within the aquifer. We calibrated the steady-state model to reproduce water levels for 1980, reproducing the 1977 through 1985 water level measurements (Figure 5-9 through 5-12). We used the steady-state model to investigate (1) recharge rates, (2) hydraulic properties, (3) boundary conditions, (4) discharge from the Hill Country portion of the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer, (5) groundwater flow budget, and (6) sensitivity of model results to different parameters.

Our approach for calibrating the model was to match water levels and groundwater discharge to rivers (for steady-state conditions) and water level and groundwater discharge fluctuations (for transient conditions) using our conceptual understanding of the flow system. We quantified the calibration, or goodness of fit between the simulated and measured water level values, using the mean absolute error (MAE):

$$MAE = \frac{1}{n}\sum_{i=1}^{n}\left|(h_m - h_s)_i\right|, \qquad (1)$$

where MAE is the mean absolute error, n is the number of calibration points, h_m is the measured hydraulic head at point i, and h_s is the simulated hydraulic head at point i. The mean absolute error is the mean of the absolute value of the differences in measured and simulated hydraulic head (Anderson and Woessner, 2002). Our standards for calibration were (1) the mean absolute error must be less than 10 percent of the measured hydraulic-head drop across the model area, and (2) the error shall not be biased by areas having considerably more control points than other areas. Once we completed the steady-state model, we used the framework of the model to develop a transient model for the years 1980 through 1997 using annual stress periods. Please note that the first stress period in the transient model is 1,000,000 days long and represents the 1980 steady-state model. The transient model allowed us to test how well the model could reproduce water level fluctuations in the aquifer. We calibrated the transient model by adjusting aquifer storage values to minimize the difference between simulated and measured water level variations.

9.0 Steady-State Model

Once we assembled the input data sets and constructed the framework of the model, we calibrated the steady-state model and assessed the sensitivity of the model to different hydrologic parameters.

9.1 Calibration

We calibrated the model to measured water levels for 1977 through 1985 used to represent 1980 water levels. We chose the year 1980 for our steady-state model because it fell within a period of relatively stable water levels in the Hill Country portion of the Trinity Aquifer System. We adjusted recharge and spatial distribution of hydraulic conductivity and general-head boundary conductance to calibrate the steady-state model.

We assigned recharge into three zones on the basis of varying aquifer characteristics and recharge pathways: (1) Balcones Fault Zone, (2) areas outside the fault zone, and (3) Cibolo Creek. We varied recharge during the calibration process, resulting in a final recharge rate of 5 percent of average annual precipitation in the Balcones Fault Zone along the eastern margin of the study area and 3.5 percent of average annual precipitation throughout the rest of the model area. Along Cibolo Creek, we set recharge equivalent to measured streamflow loss of about 70,300 acre-feet per year (Figure 9-1).

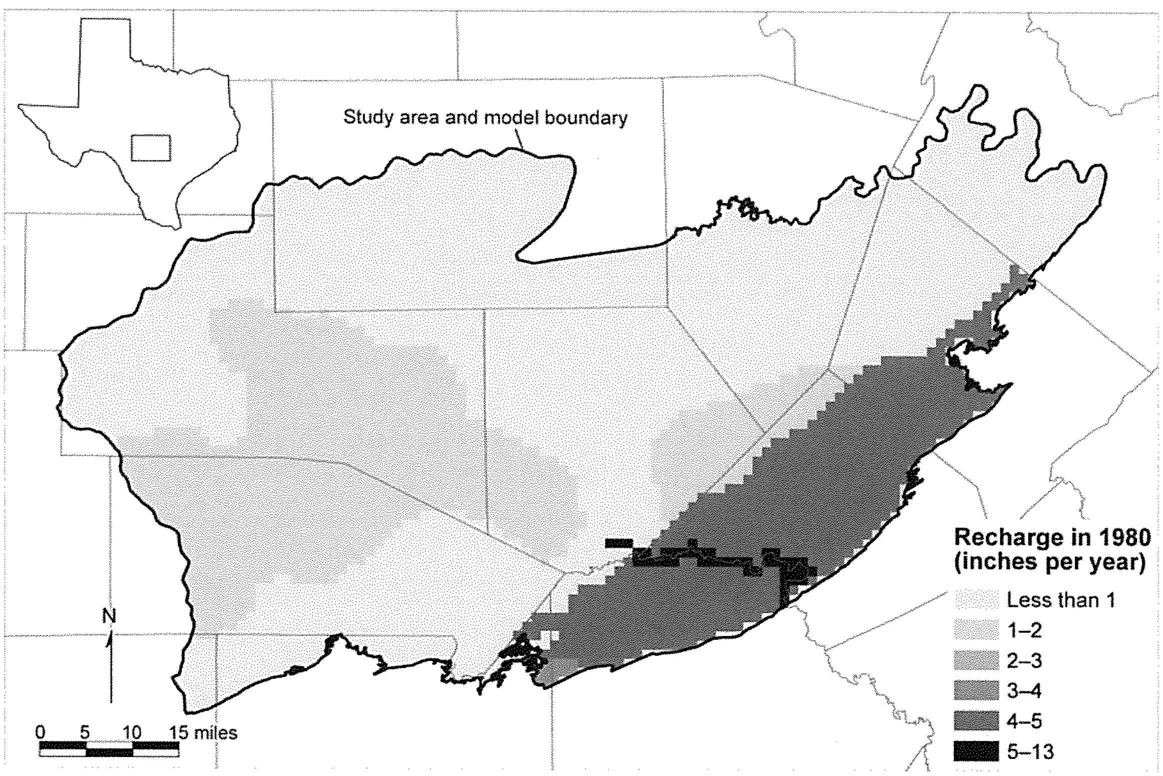


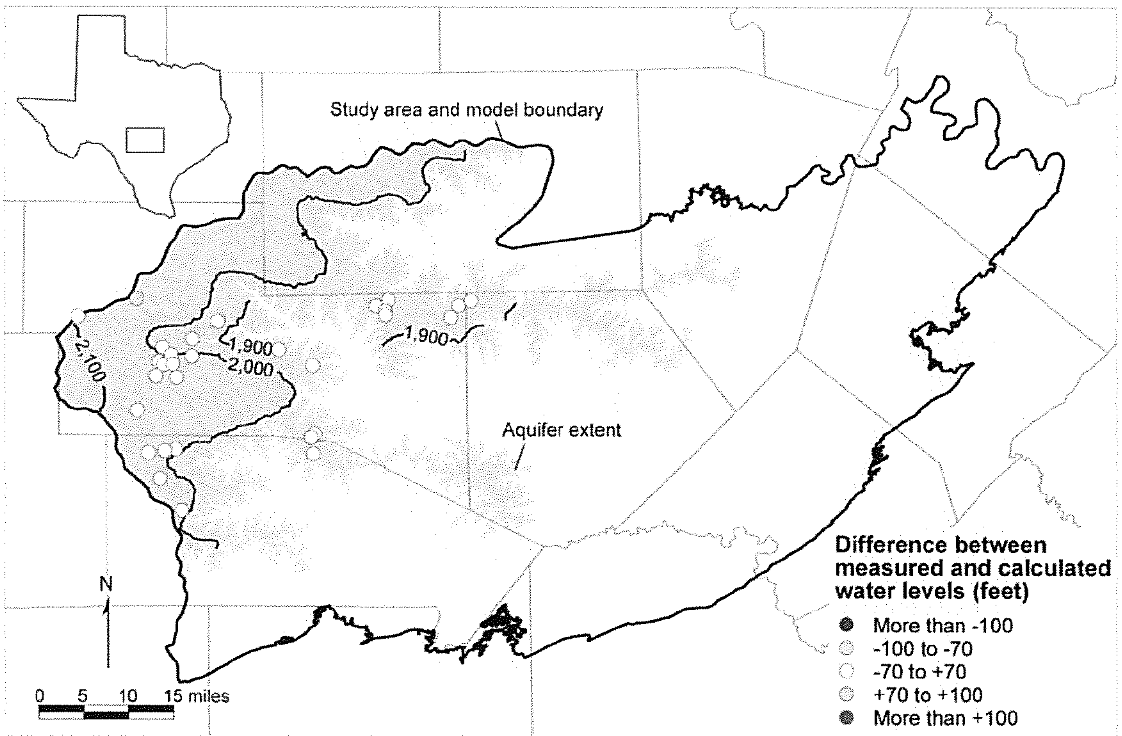
Figure 9-1. Estimated spatial distribution of recharge for 1980 based on precipitation data for the study area and Cibolo Creek streamflow loss studies.

We also adjusted hydraulic conductivity during model calibration. In the calibrated model, we assigned a uniform hydraulic conductivity value of 11 feet per day to the Edwards Group. Assigned hydraulic conductivity values in the Upper Trinity Aquifer are 150 feet per day along Cibolo Creek, 15 feet per day within the Balcones Fault Zone, and 9 feet per day in the rest of the aquifer. The two lower hydraulic conductivities, within and outside the Balcones Fault Zone, fall within the range of measured hydraulic conductivity in the Upper Trinity Aquifer. The highest hydraulic conductivities in the Upper Trinity Aquifer, which lie along part of Cibolo Creek, can be justified on the basis of work done by Kastning (1986) and Veni (1994) that indicates very high hydraulic conductivity near the creek. In the Middle Trinity Aquifer, we assigned a uniform hydraulic conductivity of 7.64 feet per day, the geometric mean of the hydraulic conductivity values used by Mace and others (2000), for the portion of the aquifer outside the Balcones Fault Zone. In the Balcones Fault Zone portion of the Middle Trinity Aquifer, we assigned a uniform hydraulic conductivity of 15 feet per day. In the Lower Trinity Aquifer, we assigned hydraulic conductivity values of 16.7 and 1.67 feet per day to the Balcones Fault Zone and the rest of the aquifer, respectively.

The calibration process resulted in only minor changes to drain conductance values in individual cells. We increased general-head boundary conductance values by factors of 5 and 2.5 in layers 2 and 3, respectively, to facilitate increased interaquifer flow between the Hill Country portion of the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer owing to the large amounts of recharge flowing from the Cibolo Creek.

Interaquifer flow between the Middle and Lower Trinity aquifers through the Hammett Shale is simulated using vertical leakance. We varied vertical leakance spatially on the basis of the Hammett Shale thickness. Vertical leakance values decrease with increasing Hammett Shale thickness, reaching a maximum value where the Hammett Shale is absent. Vertical leakance values lie in the range of 10^{-6} to 0.8 per day.

Simulated water levels from the calibrated steady-state model are fairly close to measured water levels and display no apparent spatial biases (Figure 9-2). The mean absolute error of the calibrated model is 54 feet, which is approximately 4 percent of the 1,700-foot range of measured water levels (Figure 9-3). This value indicates that the average difference between measured and simulated water levels in the model is 54 feet—acceptable because the result lies within the 10 percent target for model calibration. Water-balance discrepancies are also acceptable, approaching 0 percent.



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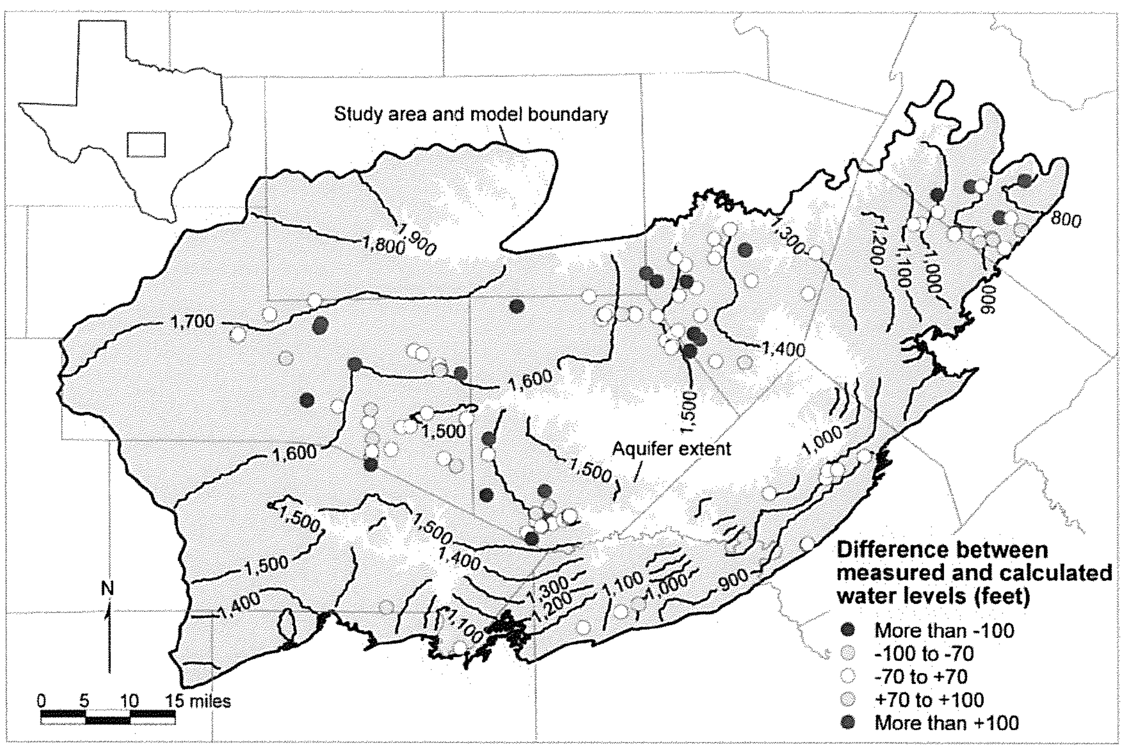
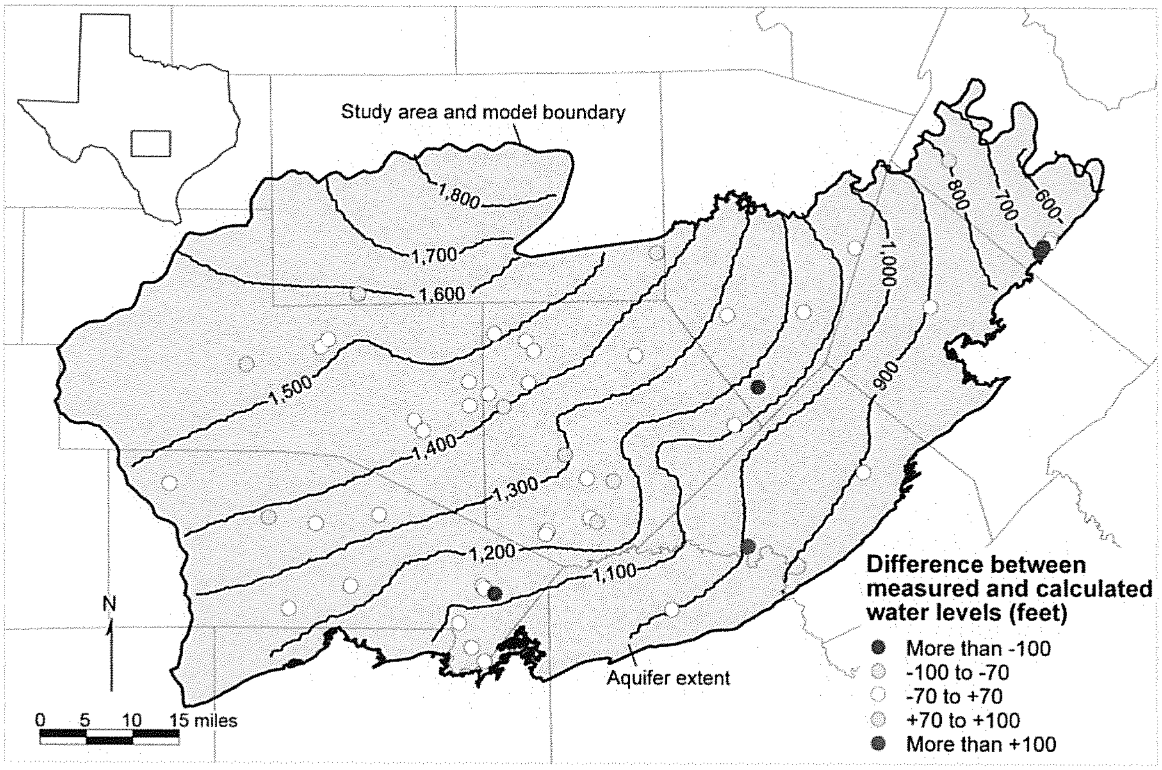


(b)

Figure 9-2. Comparison of measured and calculated water levels from the steady-state model for (a) layer 1, (b) layer 2, (c) layer 3, and (d) layer 4. The contours represent calculated water levels expressed in feet above sea level, whereas the points indicate the difference between measured and simulated water levels relative to the measured water levels.



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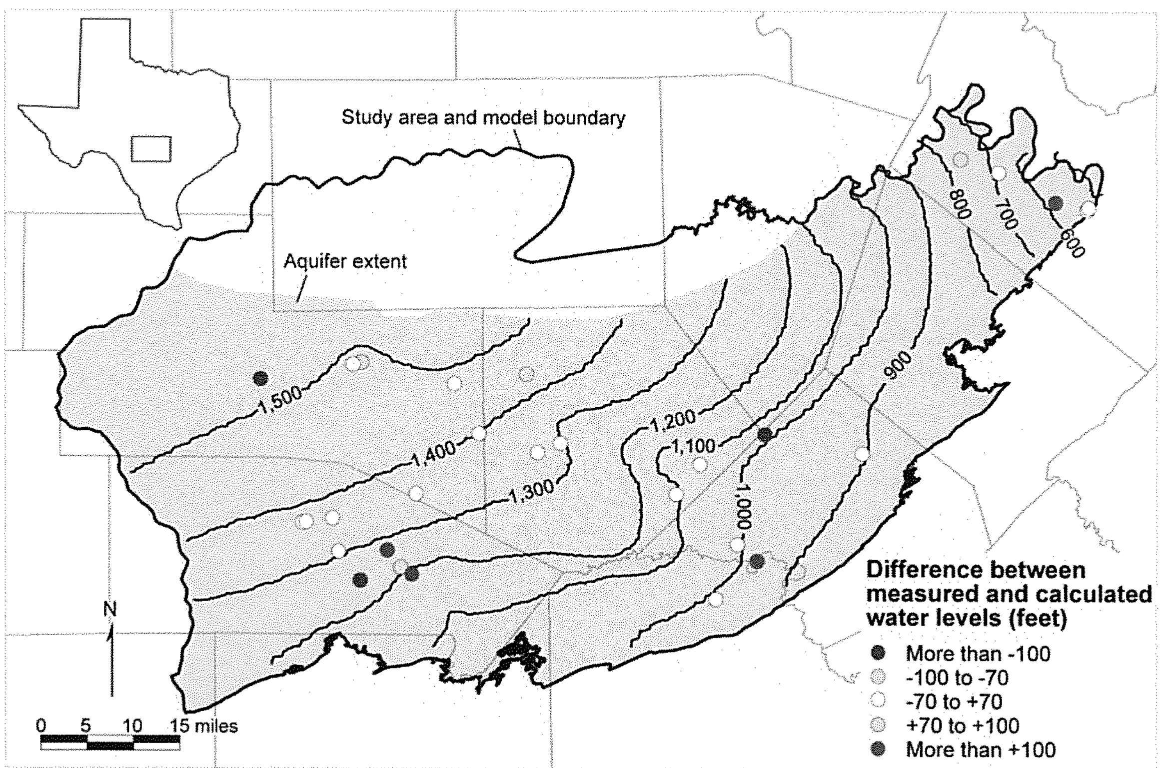

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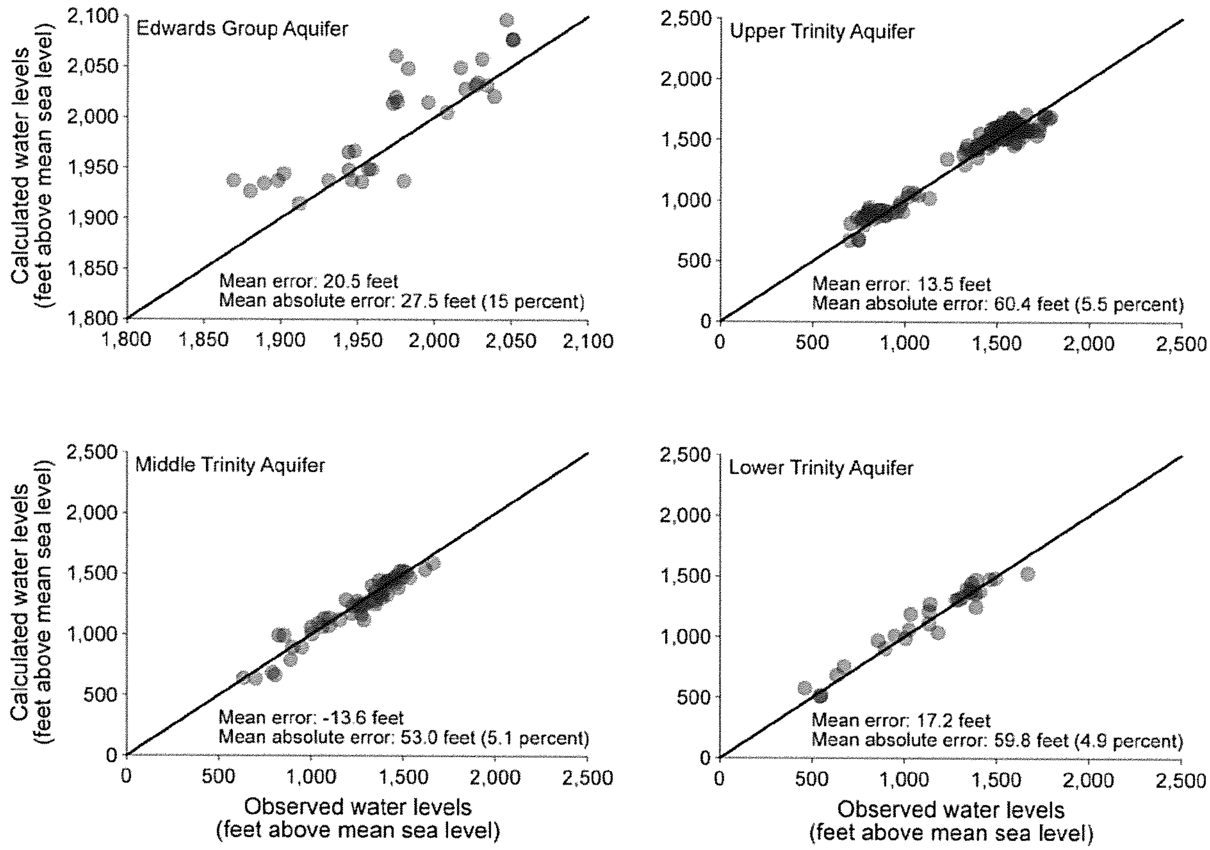


Figure 9-3. Comparison of measured and calculated water levels from the steady-state model.

In addition to comparing measured and simulated water levels, we compared measured streamflow and simulated drain discharge to determine how well the model reproduces groundwater discharge to major streams in the study area (Figures 9-4 and 9-5). General agreement between measured stream discharge of Barton Creek, Blanco River, Guadalupe River, Hondo Creek, Medina River, Onion Creek, and Pedernales River indicates that the steady-state model does a reasonable job of reproducing base flow to streams.

The water budget of the steady-state model indicates that total groundwater flow through the model is approximately 321,000 acre-feet per year (Table 9-1). Of this flow, about 60 percent discharges to streams, springs, and reservoirs, and 35 percent discharges through cross-formational flow to the Edwards (Balcones Fault Zone) Aquifer. About 5 percent of groundwater discharge is due to well pumping, mostly for municipal and rural domestic uses.

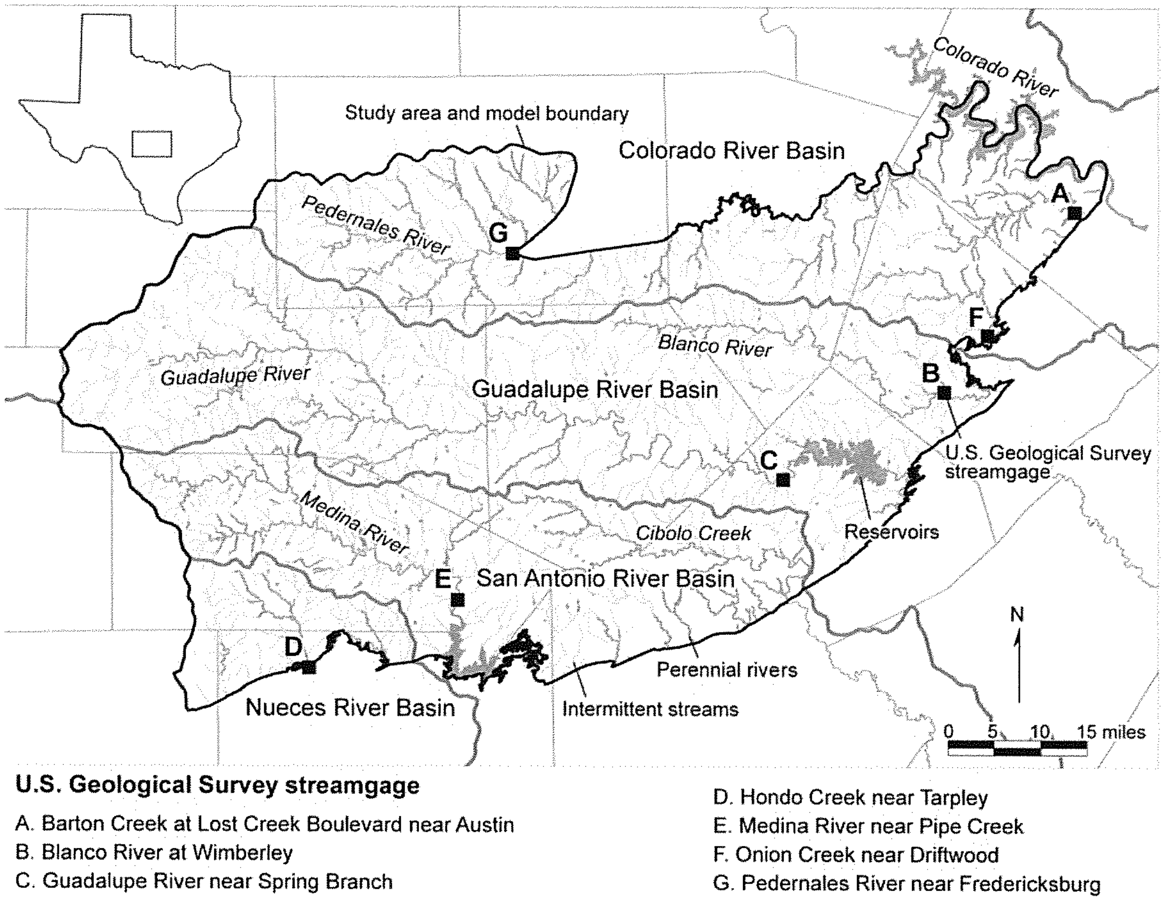
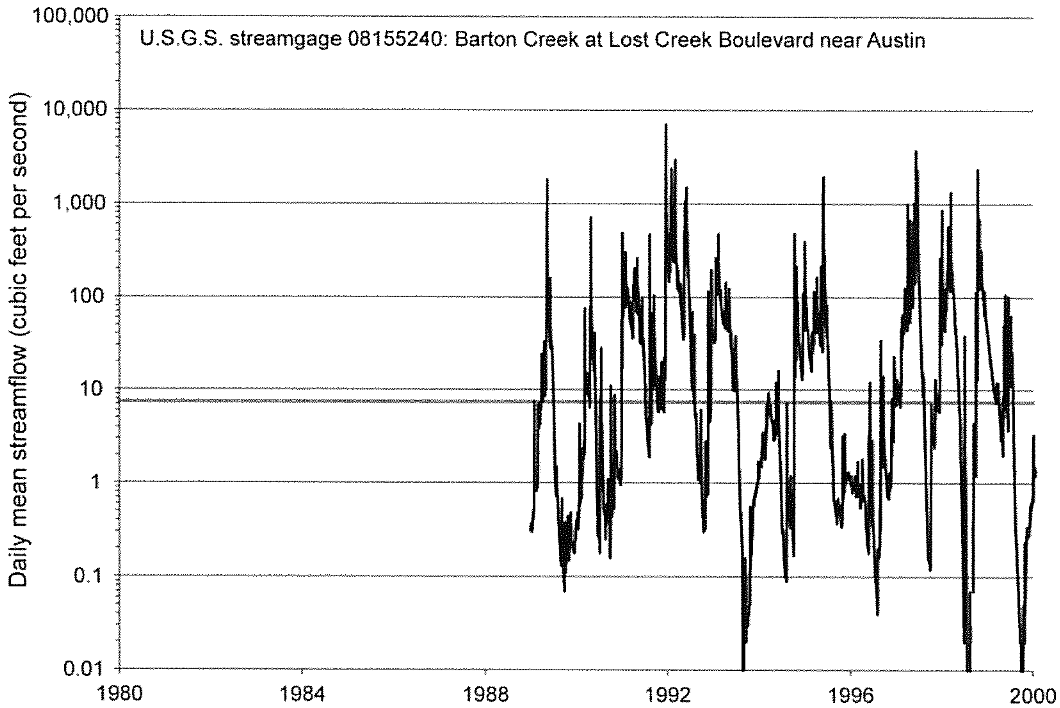


Figure 9-4. Location of streamgages used to compare measured streamflow and calculated discharge to streams from the model.



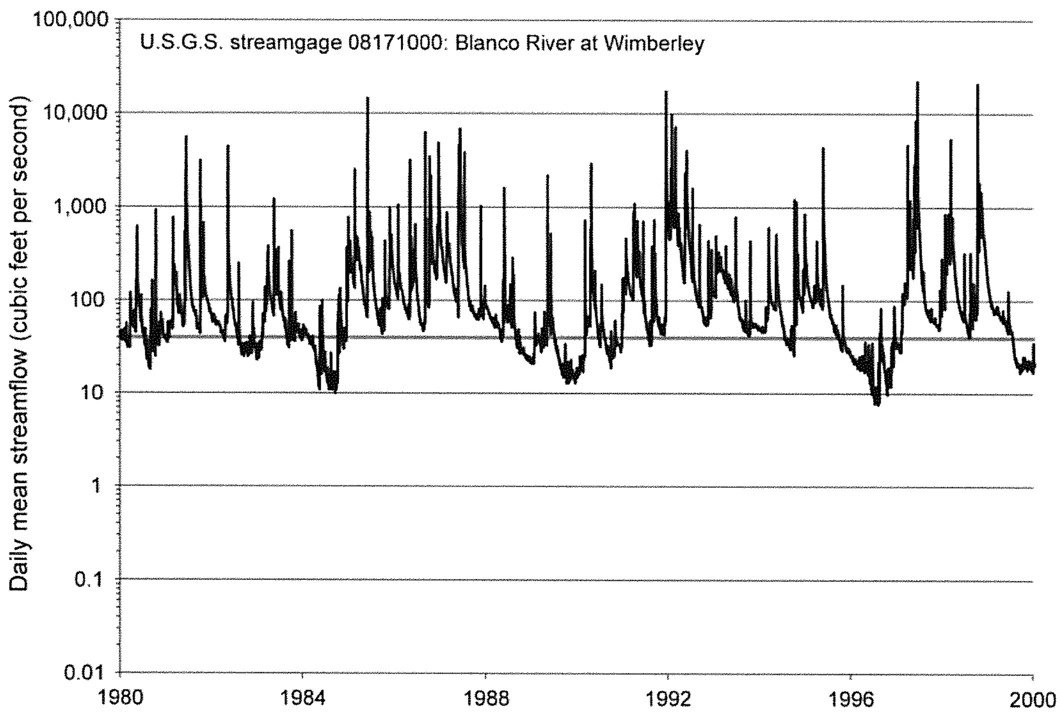


Figure 9-5. **Comparison of the calculated groundwater discharge rate to perennial streams from the 1980 steady-state model (gray line) and measured streamflow data. Streamgage locations are shown in Figure 9-4. U.S.G.S. = U.S. Geological Survey**

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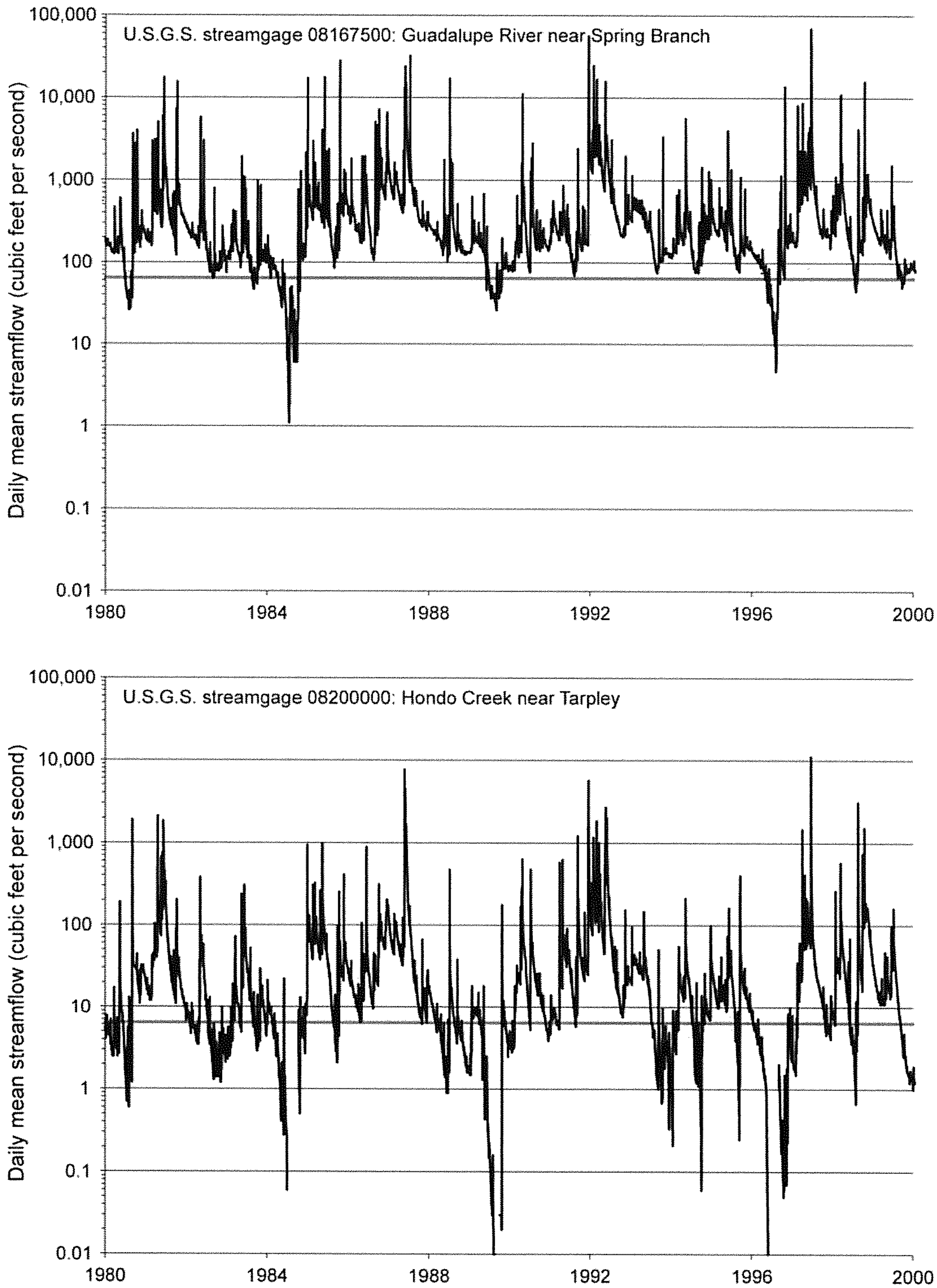

Figure 9-5. (continued).

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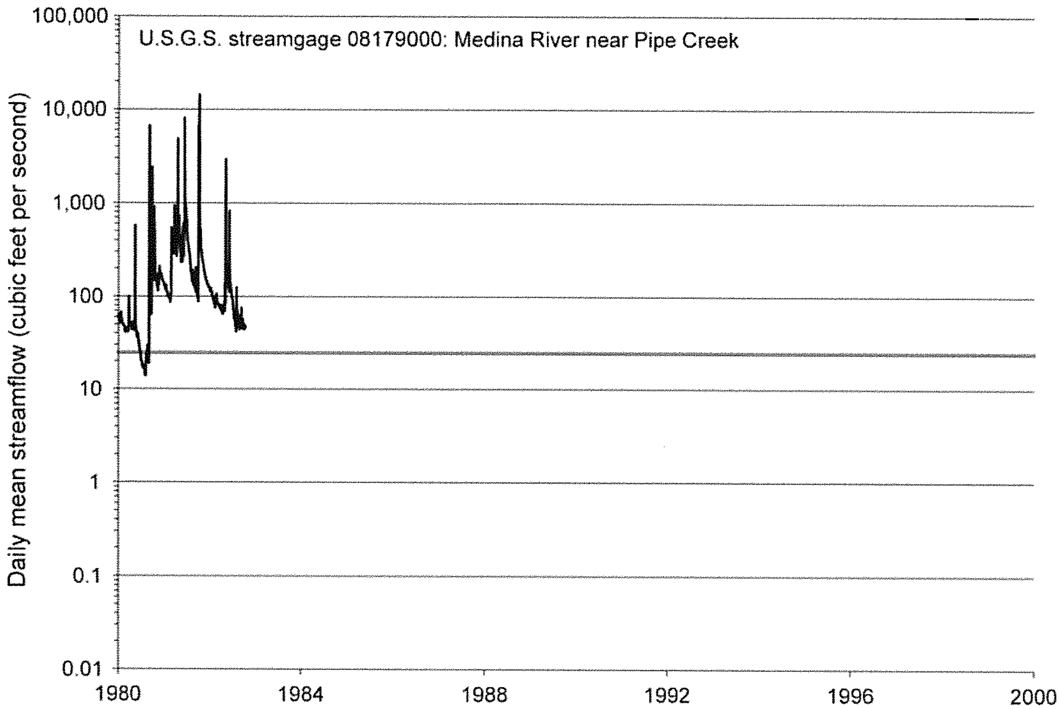

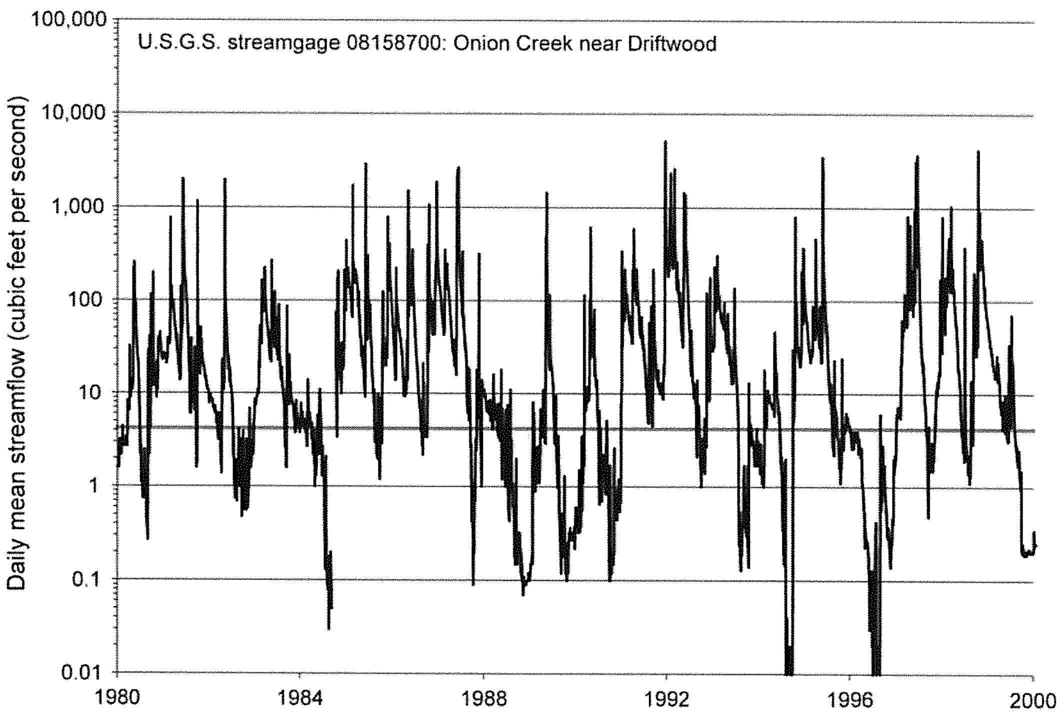

Figure 9-5. (continued).

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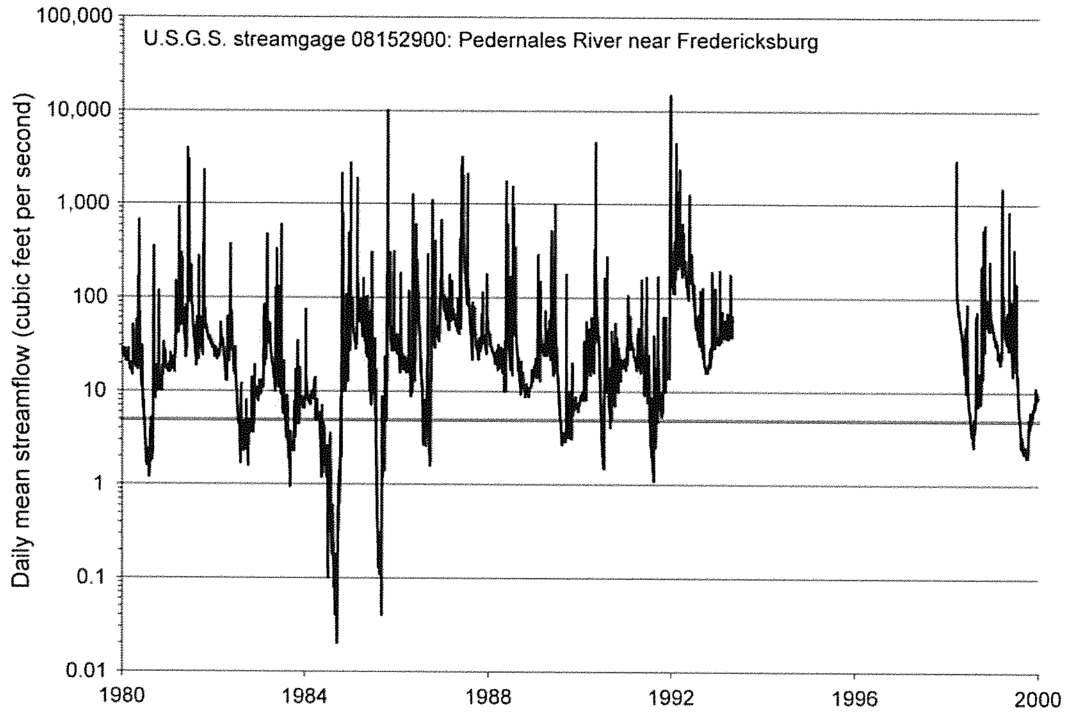


Figure 9-5. (continued).

Table 9-1. Water budget for the calibrated steady-state model for 1980 (all values in acre-feet per year, rounded to hundreds of acre-feet; negative values indicate net discharge from the aquifer).

	In	Out	Net
Wells	0	16,700	-16,700
Streams and springs	0	164,500	-164,500
Reservoirs	9,000	28,800	-19,800
Edwards (Balcones Fault Zone) Aquifer	8,100	110,600	-102,500
Recharge	303,500	0	303,500
Total	**320,600**	**320,600**	**0**

We used the calibrated model to investigate the volume of recharge to and groundwater moving between the different aquifers (Table 9-2). The total volume of recharge to the aquifer due to precipitation falling on the land surface and streamflow loss from Cibolo Creek is about 304,000 acre-feet per year. About 50 percent of the recharge in the study area occurs in the Upper Trinity Aquifer, whereas 20 and 30 percent of recharge occurs in the Edwards Group and Middle Trinity Aquifer, respectively. Recharge to the Lower Trinity Aquifer is insignificant. In the model, very small amounts of recharge to the Lower Trinity Aquifer occur along the Pedernales River where the overlying Middle Trinity Aquifer is thin and may not be saturated. About 20 percent of the water that recharges the Edwards Group flows into the Upper Trinity Aquifer. The total inflow of water to the Upper Trinity Aquifer, including infiltration of precipitation and cross-formational flow, is about 166,000 acre-feet per year. About 40 percent of the total inflow into the Upper Trinity Aquifer flows into the Middle Trinity Aquifer. Total inflow into the Middle Trinity

Aquifer is about 153,000 acre-feet per year. According to the model, slightly less water enters the Middle Trinity Aquifer through cross-formational flow than through direct infiltration on the outcrop. Our conceptual model indicates total groundwater circulation in the Lower Trinity Aquifer is a relatively minor component of the total groundwater budget of the Hill Country portion of the Trinity Aquifer System. In this steady-state model, net cross-formational flow from the Middle Trinity Aquifer to the Lower Trinity Aquifer is approximately equal to total pumping from the Lower Trinity Aquifer.

Table 9-2. Water budget for the respective layers in the calibrated steady-state model for 1980 (all values in acre-feet per year, rounded to hundreds of acre-feet; negative values indicate net discharge from the aquifer).

	Edwards Group	Upper Trinity Aquifer	Middle Trinity Aquifer	Lower Trinity Aquifer	Total
Interaquifer flow (above)	0	9,800	64,100	5,800	79,700
Interaquifer flow (below)	-9,800	-64,100	-5,800	0	79,700
Wells	-1,000	-5,100	-4,600	-6,000	-16,700
Streams and springs	-47,700	-60,900	-55,900	0	-164,500
Reservoirs	0	-2,500	-17,300	0	-19,800
Edwards (Balcones Fault Zone) Aquifer	0	-33,300	-69,200	0	-102,500
Recharge	58,500	156,200	88,700	100	303,500

The model shows that more than 100,000 acre-feet per year of groundwater flows out through the general-head boundary along the eastern and southern margins of the model. This groundwater flows from the Upper and Middle Trinity aquifers into the Edwards (Balcones Fault Zone) Aquifer. Some of this groundwater flows directly from the Trinity Aquifer System into the Edwards (Balcones Fault Zone) Aquifer, and some continues to flow in the portion of the Trinity Aquifer System that underlies the Edwards (Balcones Fault Zone) Aquifer (Ashworth and Hopkins, 1995). Presumably, groundwater moves downdip in the Trinity Aquifer System and eventually discharges upward into the Edwards (Balcones Fault Zone) Aquifer.

The model results show that the flow of groundwater across the general-head boundary is much less in the northeastern part of the boundary than in the central and southwestern parts (Table 9-3). The groundwater flow across the general-head boundary is 260 acre-feet per year per mile for the boundary within Travis and Hays counties, reaches a maximum of 1,700 acre-feet per year per mile in Comal and Bexar counties, and is 490 acre-feet per year per mile within Medina, Bandera, and Uvalde counties. This numerical result is qualitatively supported by the measured potentiometric surface, which shows groundwater generally flowing perpendicular to the boundary in Comal, Bexar, and Medina counties and subparallel to the boundary in Travis and Hays counties (Figure 9-2). The spatial distribution of groundwater flow between the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer is most likely influenced by the large amounts of recharge occurring along Cibolo Creek in Bexar and Comal counties. Faults also have greater displacements to the east and may therefore act as more effective barriers to flow.

Table 9-3. Water budget for the respective counties in the calibrated steady-state model for 1980 (all values in acre-feet per year, rounded to hundreds of acre-feet; negative values indicate net discharge from the aquifer).

County	Wells	Streams and springs	Recharge	Reservoirs	Edwards (Balcones Fault Zone) Aquifer	Lateral inflow	Lateral outflow
Bandera	-1,100	-34,300	36,900	-1,000	-1,800	25,500	-24,200
Bexar	-3,900	-9,900	39,000	0	-37,200	36,200	-24,300
Blanco	-200	-14,200	19,000	0	0	6,900	-11,500
Comal	-1,000	-3,700	40,300	-5,900	-37,900	37,600	-29,500
Gillespie	-1,200	-14,300	28,300	0	0	900	-13,700
Hays	-1,600	-18,800	21,800	0	-6,700	14,200	-9,000
Kendall	-1,600	-28,500	51,000	0	0	9,600	-30,500
Kerr	-6,000	-32,600	47,100	0	0	10,500	-19,000
Kimble	0	0	400	0	0	200	-500
Medina	0	-2,400	5,800	-2,600	-14,300	20,400	-6,900
Travis	-100	-5,200	11,900	-10,300	-2,100	6,100	-400
Uvalde	0	-500	1,800	0	-2,500	2,000	-800
Total	**-16,700**	**-164,500**	**303,500**	**-19,800**	**-102,500**	**170,200**	**-170,200**

9.2 Sensitivity Analysis

After we completed calibration of the steady-state model, we analyzed the input parameters to assess the sensitivity of model results to respective input parameters: vertical and horizontal hydraulic conductivity, general-head boundary conductance, drain conductance, river conductance, pumping, and recharge. Sensitivity analysis is a method of quantifying uncertainty of the calibrated model related to uncertainty in the estimates of respective aquifer parameters, stresses, and boundary conditions (Anderson and Woessner, 2002). Determining the sensitivity of the model to specific parameters offers insights into the uniqueness of the calibrated model. Sensitivity analysis identifies which parameters have the greatest influence on water levels and groundwater discharge to springs and streams. A model is sensitive to a specified input parameter if relatively small changes in that parameter result in relatively large changes in simulated water levels. In other words, calibration is possible only over a narrow range of values and, consequently, model uncertainties are relatively low. A model is insensitive if relatively large changes of a specific input parameter produce small water level changes. Insensitivity results in higher uncertainties because the model will remain calibrated over a large range of input parameter values. Sensitivity is analyzed by systematically varying parameter values and noting changes in water levels over the calibrated model. The water level changes are quantified by calculating the mean difference (MD) as follows:

$$MD = \frac{1}{n}\sum_{i=1}^{n}\left(h_{sen} - h_{cal}\right), \qquad (2)$$

where n is the number of points, h_{sen} is the simulated water level for the sensitivity analysis, and h_{cal} is the calibrated water level. The mean difference is positive if water levels are higher than calibrated values and negative if they are lower than calibrated values.

Water levels in the model are most sensitive to recharge and horizontal hydraulic conductivity and, to a lesser extent, to vertical hydraulic conductivity (Figure 9-6). The model is insensitive to pumping and to general-head boundary, drain, and river conductance. The insensitivity to pumping can be attributed to the fact that pumping is a relatively minor component of the overall aquifer water budget. Insensitivity to drain and general-head boundary conductance can be attributed to high conductance values of as much as 10^9 square feet per day. Consequently, in order to have much of an effect on water levels, drain and general-head boundary conductance would probably have to be lowered by several orders of magnitude. Additionally, the effects of drain and general-head boundary conductance are local. As a result, varying drain and general-head boundary conductance only produces water level changes close to the boundaries and does not have widespread effects throughout the model.

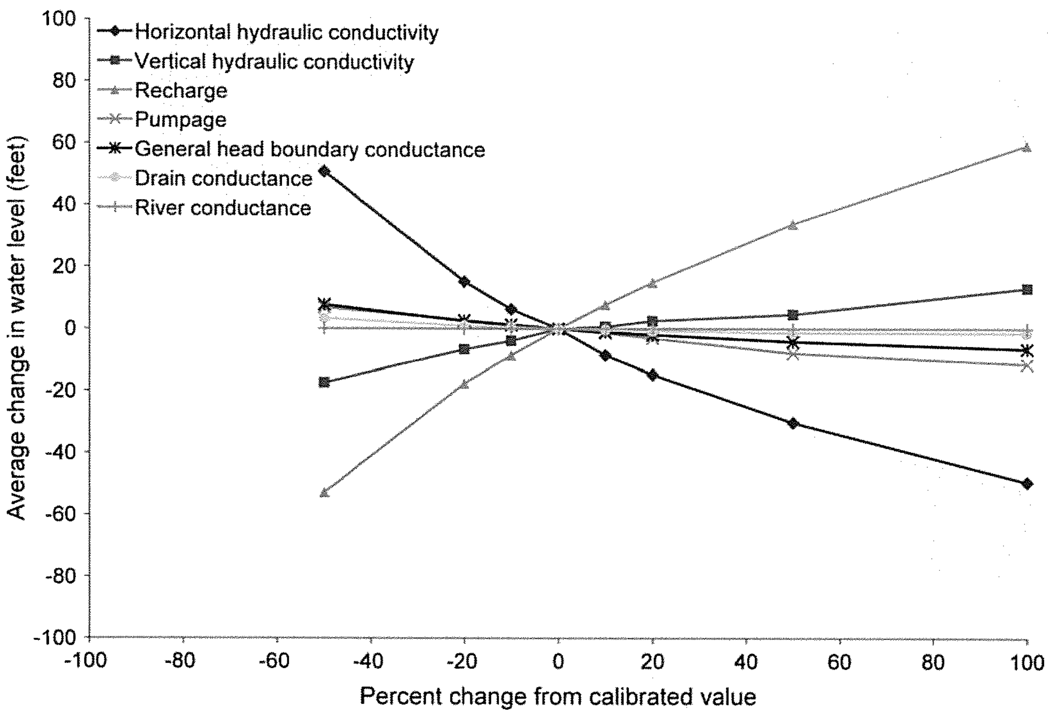


Figure 9-6. Sensitivity of calculated water levels in the steady-state model to changes in model parameters.

10.0 Transient Model

Once we calibrated the steady-state model to 1980 conditions, we proceeded to calibrate the model for transient conditions for the period 1980 through 1997 (Table 10-1).

Table 10-1. Stress periods of the transient model.

Stress period	Year	Length (days)
1	Steady-state (1980)	100,000
2	1981	365
3	1982	365
4	1983	365
5	1984	365
6	1985	365
7	1986	365
8	1987	365
9	1988	365
10	1989	365
11	1990	365
12	1991	365
13	1992	365
14	1993	365
15	1994	365
16	1995	365
17	1996	365
18	1997	365

10.1 Calibration

We simulated water level fluctuations during the period 1980 through 1997 using annual stress periods for 1981 through 1997. Calibration was achieved by adjusting storage parameter values, specific storage, and specific yield until the model responses approximated water level fluctuations observed in wells in the model area. Specific yield is applicable to the unconfined parts of the aquifer and is defined as the volume of water that an unconfined aquifer releases from storage per unit surface area of aquifer per unit decline in the water level (Domenico and Schwartz, 1990). Specific storage is applicable to the confined parts of the aquifer and is defined as a measure of the volume of water per unit volume of aquifer rock that enters or leaves storage per unit change in water level (Domenico and Schwartz, 1990). Specific storage and specific yield are important factors in transient calibration because they influence water level responses to changes in recharge and discharge. Low specific-storage or specific-yield values result in water level fluctuations that are larger and more rapid than those associated with higher specific-storage or specific-yield values. This difference occurs because less water is required to produce a given water level change.

Using annual stress periods, we simulated water level fluctuations due to recharge and pumping variations during the period 1980 through 1997. We found that specific-storage values of 10^{-5}, 10^{-6}, 10^{-7}, and 10^{-7} per foot for the Edwards Group and the Upper, Middle, and Lower Trinity aquifers, respectively, and specific-yield values of 0.008, 0.0005, 0.0008, and 0.0008 for the Edwards Group and the Upper, Middle, and Lower Trinity aquifers, respectively, worked best for reproducing observed water level fluctuations (Table 10-2).

Table 10-2. Calibrated specific-yield, specific-storage, and hydraulic conductivity data for the respective model layers.

Model layer	Aquifer	Specific yield	Specific storage (per foot)	Hydraulic conductivity (feet per day)	
				Range	Mean
1	Edwards Group	0.008	1.0E-05	11	11.0
2	Upper Trinity Aquifer	0.0005	1.0E-06	9 to 150	10.4
3	Middle Trinity Aquifer	0.0008	1.0E-07	7.6 to 15	8.8
4	Lower Trinity Aquifer	0.0008	1.0E-07	1.67 to 16.7	4.4

The model does a good job of reproducing observed water level fluctuations in some areas but not as well in other areas (Figures 10-1 through 10-5). Note that baseline shifts in water levels in Figure 10-2 are commonly due to the influence of local-scale conditions not represented in the regional model or errors in our parameterization of the aquifer data. Although it has limitations, the model does a good job of reproducing year-to-year water level variations in most wells. Comparison of measured and simulated 1990 and 1997 water levels indicates mean absolute errors of 52 and 57 feet, respectively, or approximately 3.5 and 5.3 percent of the range of measured water levels (Table 10-3; Figure 10-4).

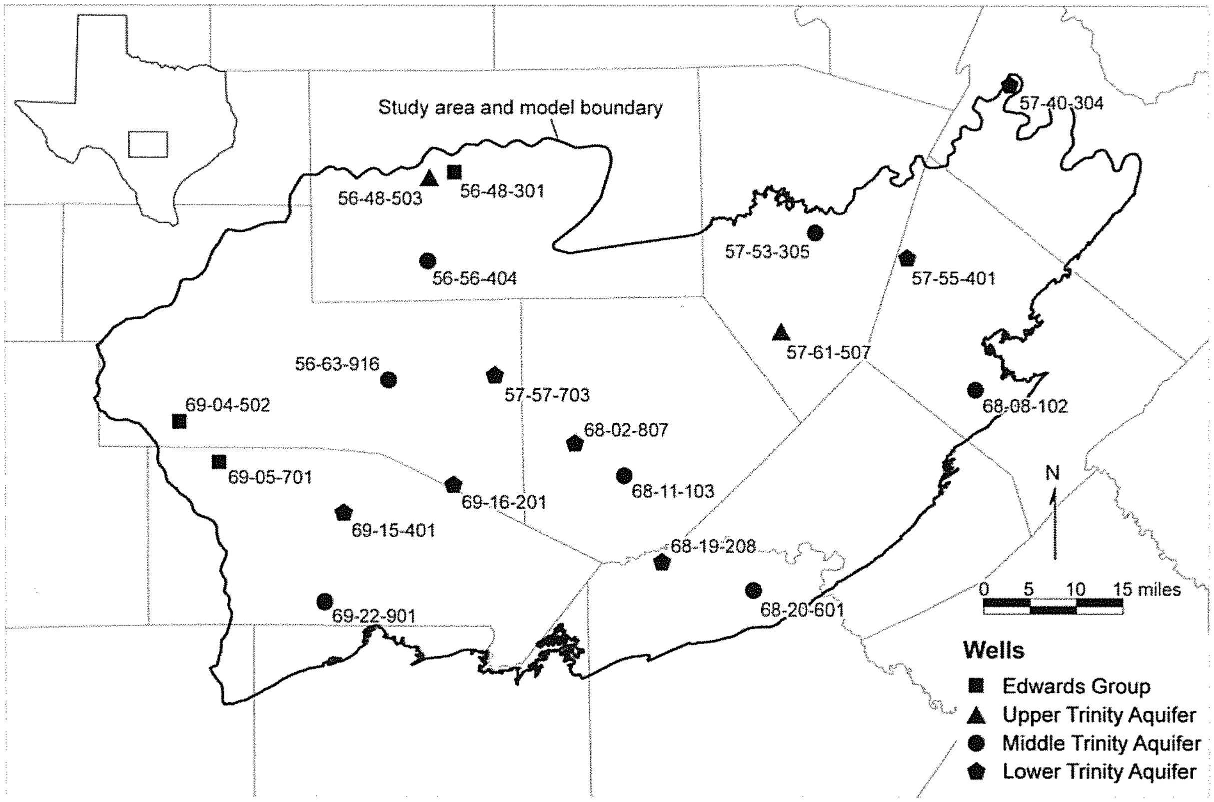


Figure 10-1. Locations of wells used to compare measured water levels over the transient period (1980 through 1997) and calculated water levels.

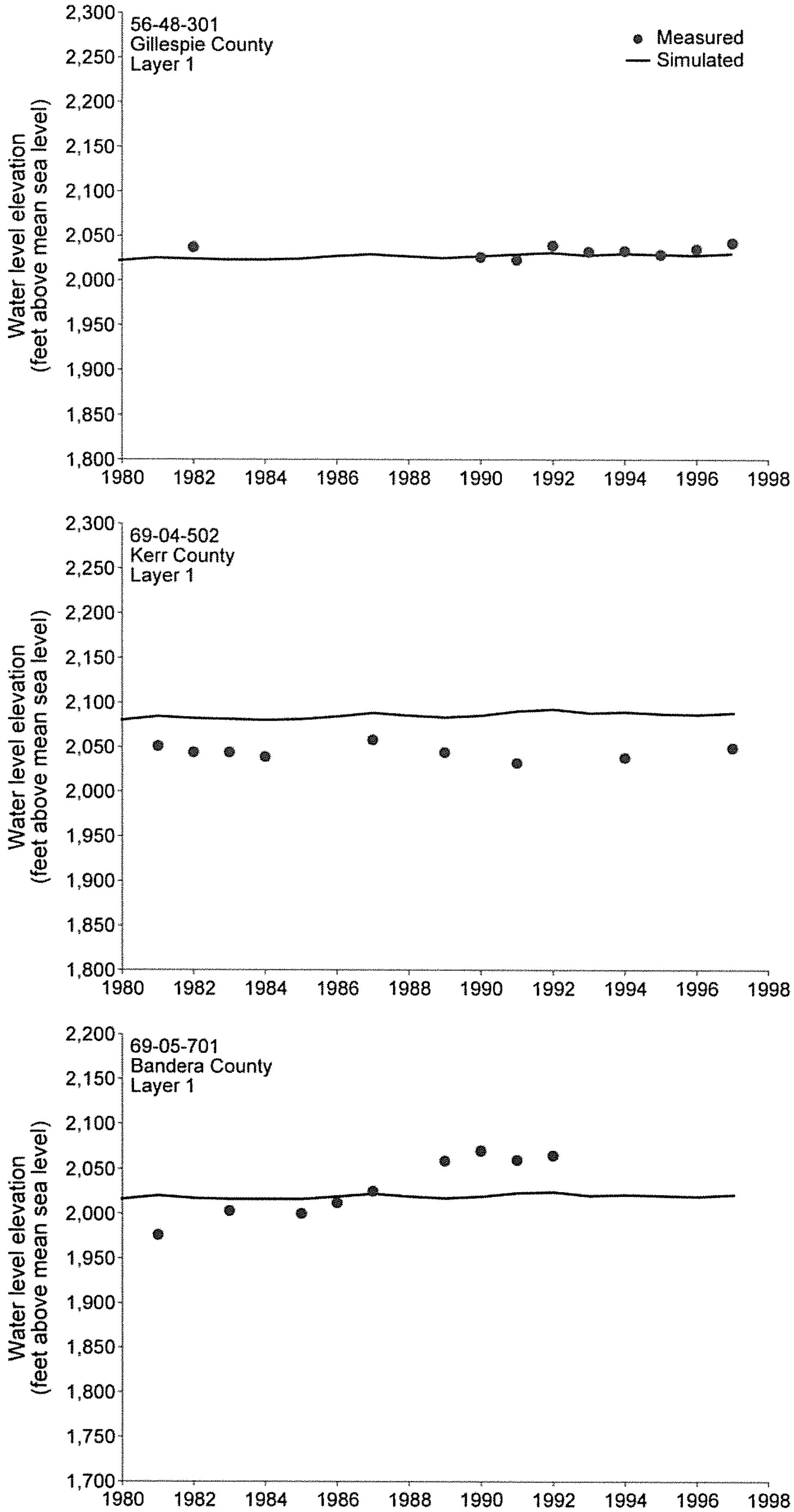


Figure 10-2. Comparison of simulated water level fluctuations to measured water levels. Well locations are shown in Figure 10-1.

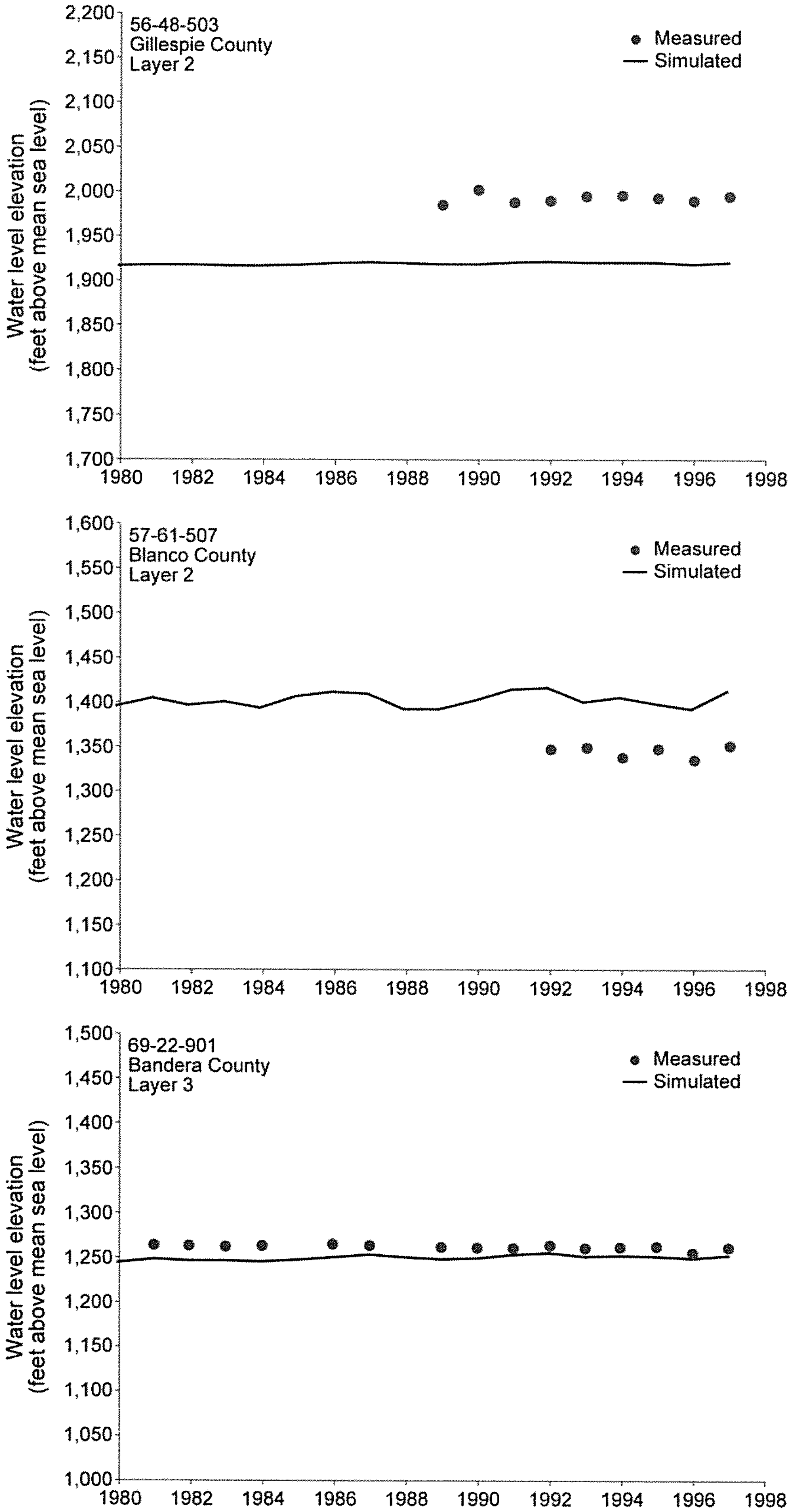


Figure 10.2. (continued).

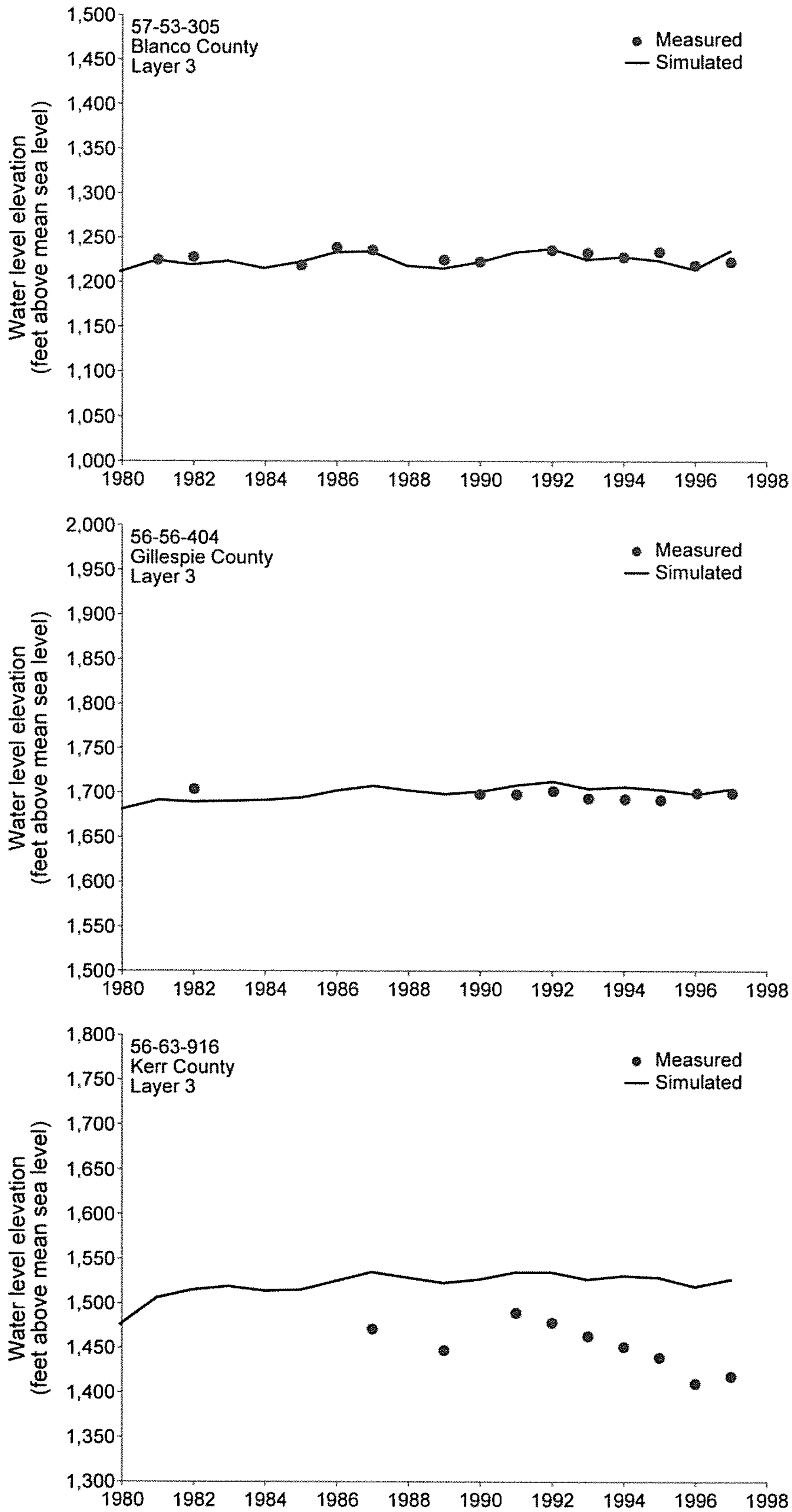
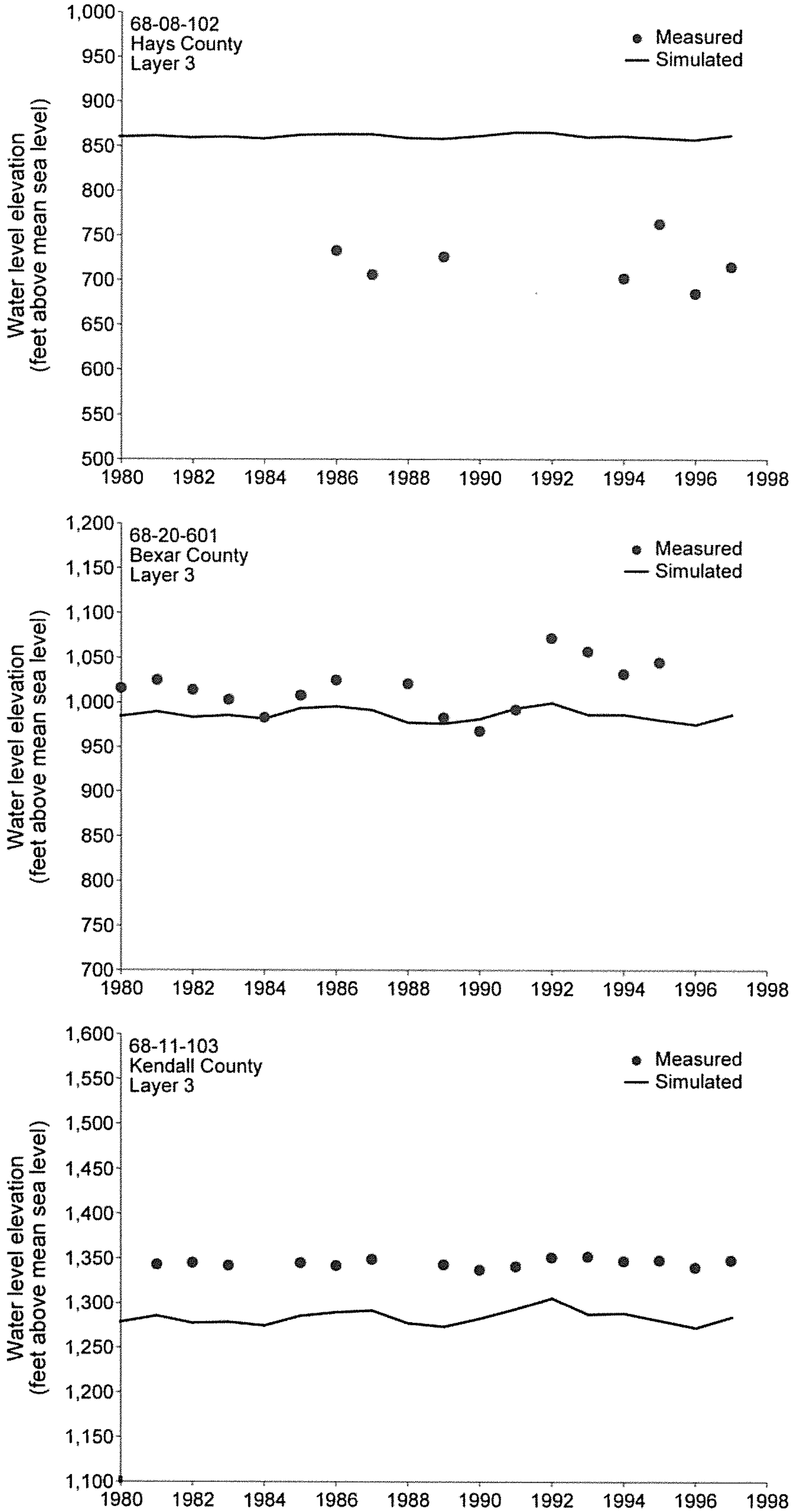


Figure 10.2. (continued).



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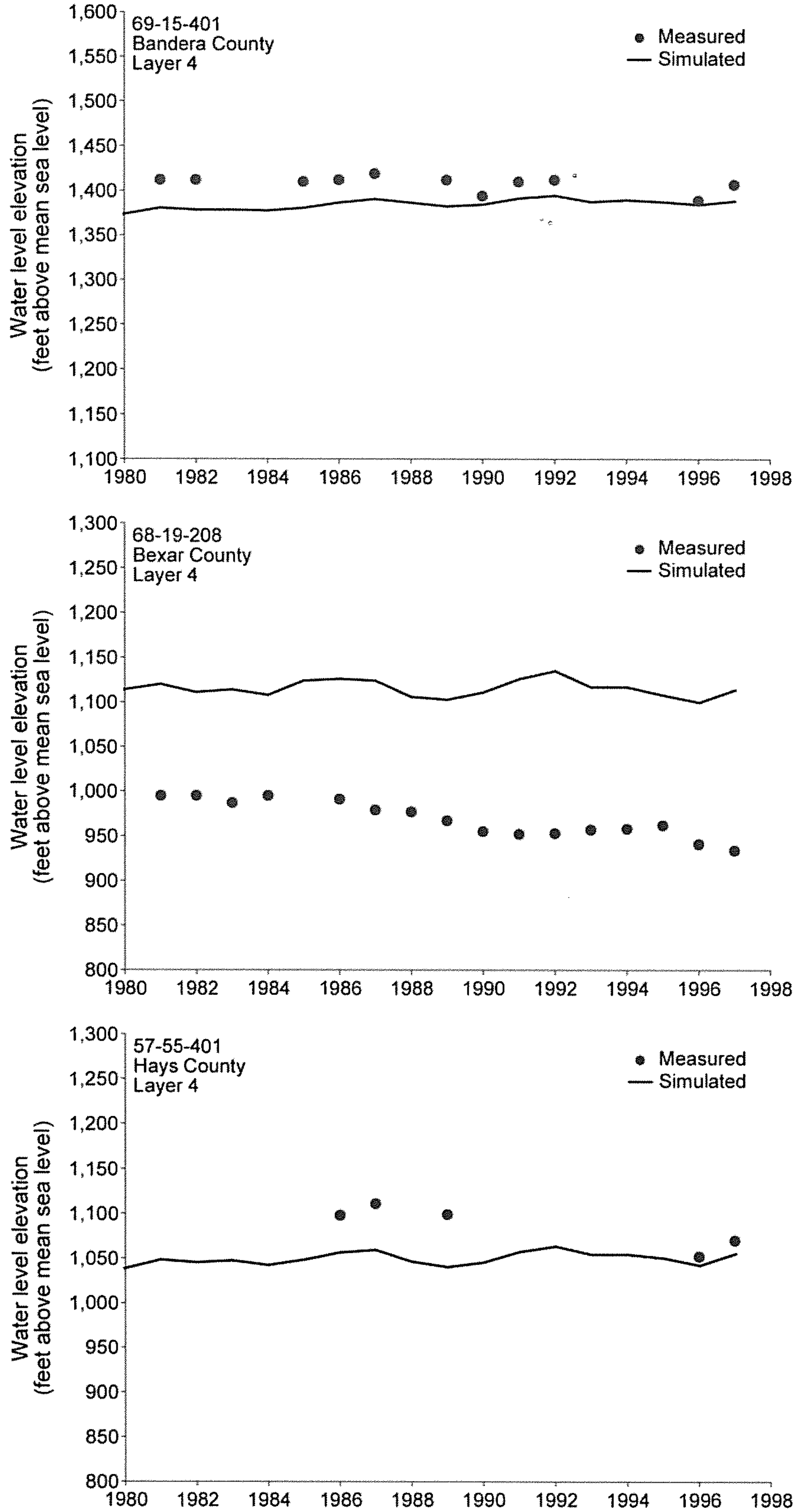

Figure 10.2. (continued).

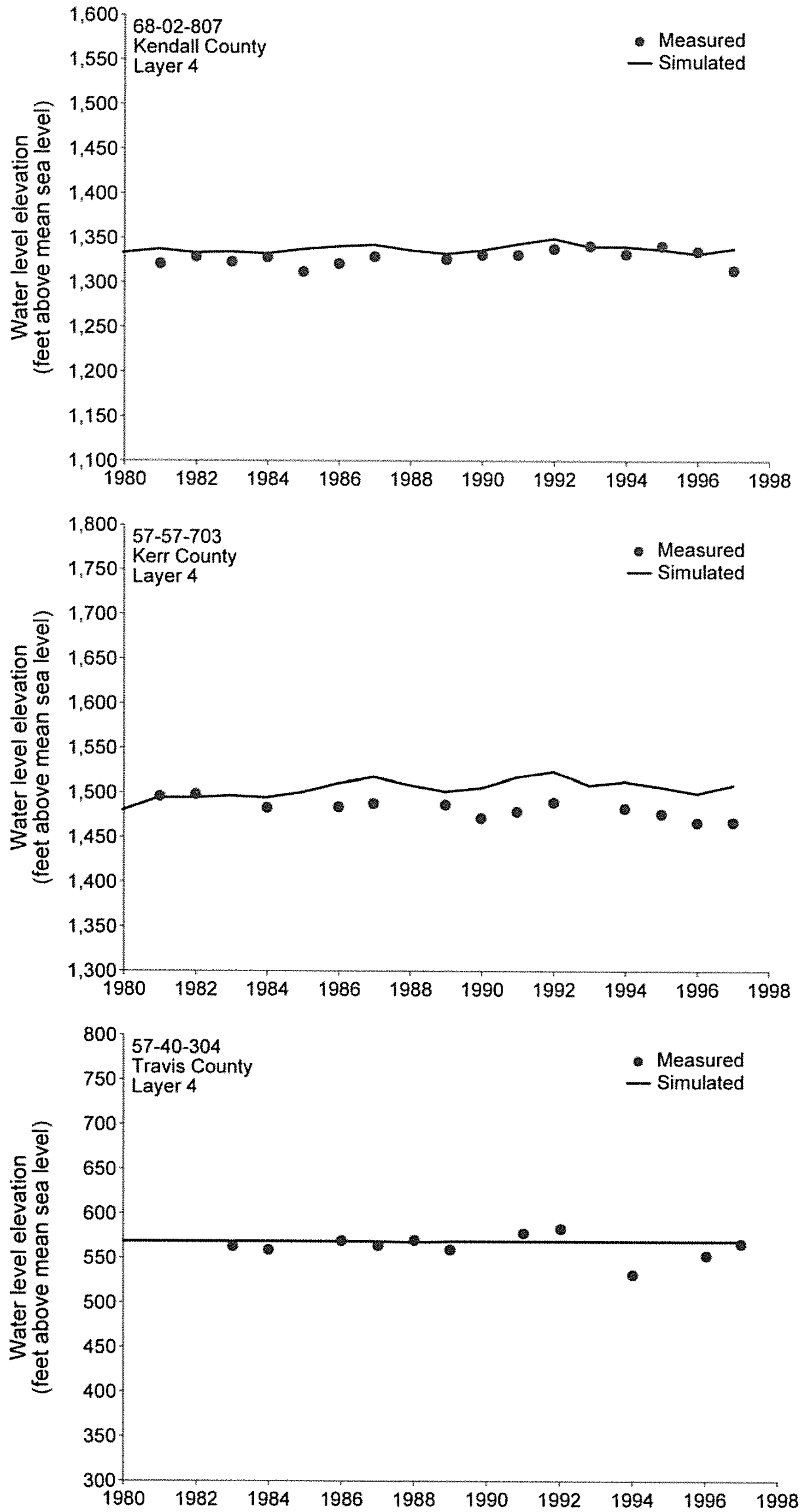

Figure 10.2. (continued).

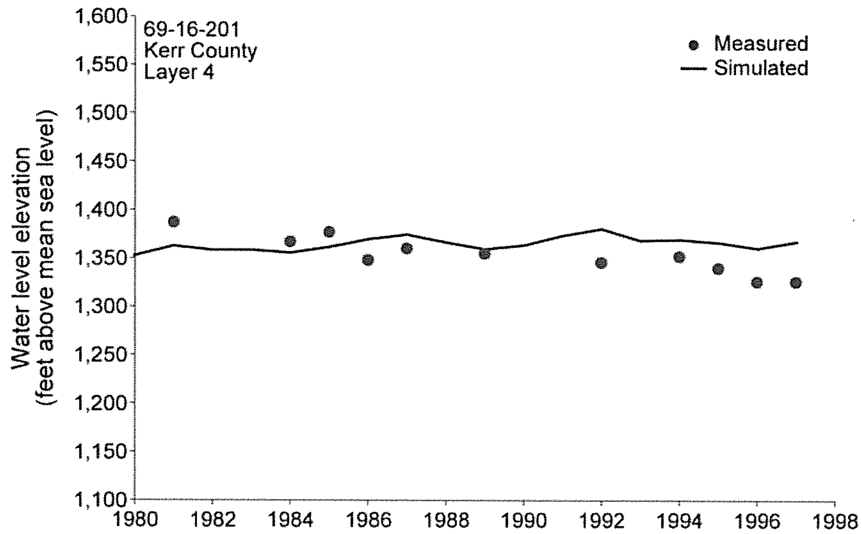

Figure 10-2. (continued).

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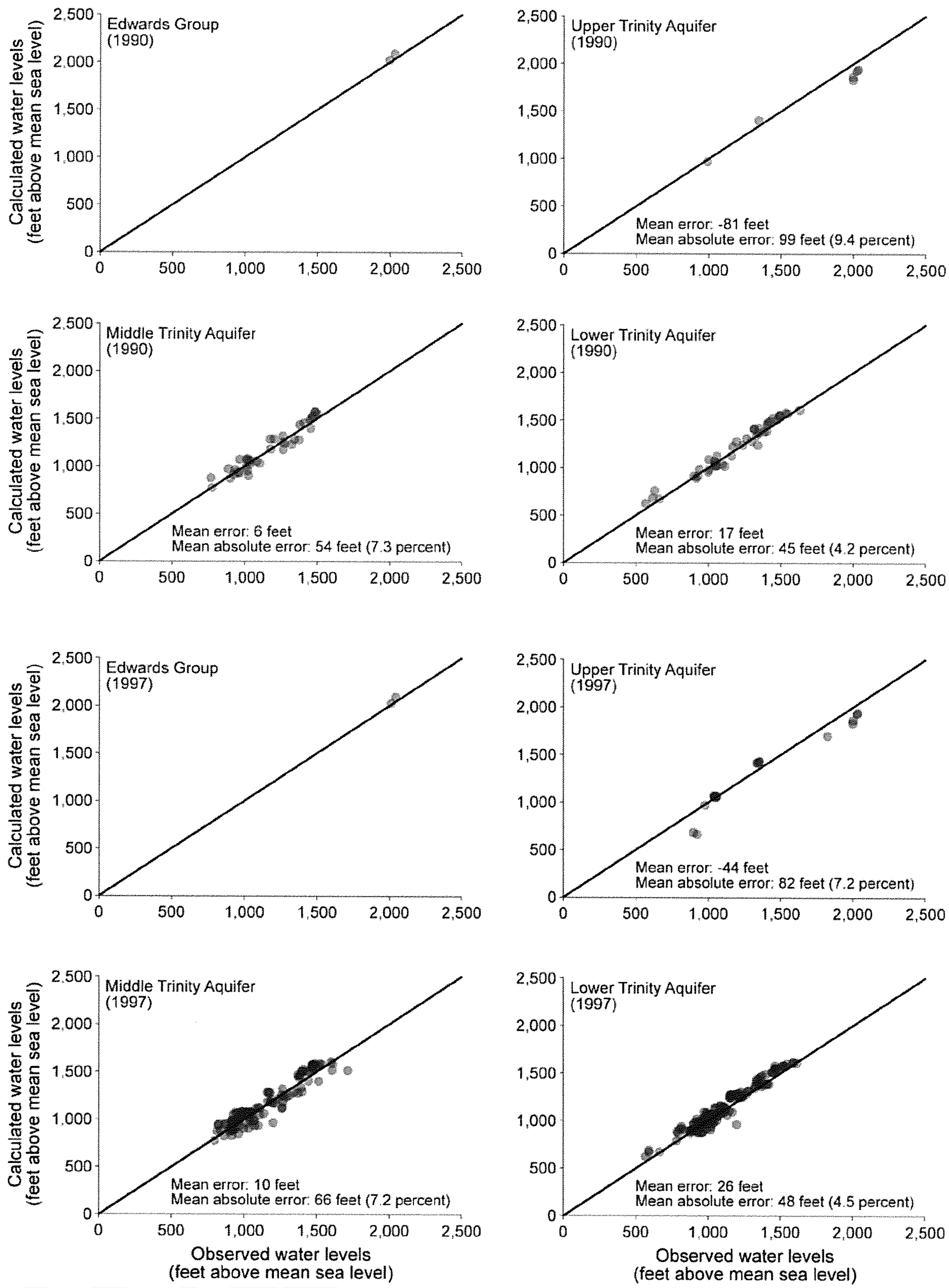
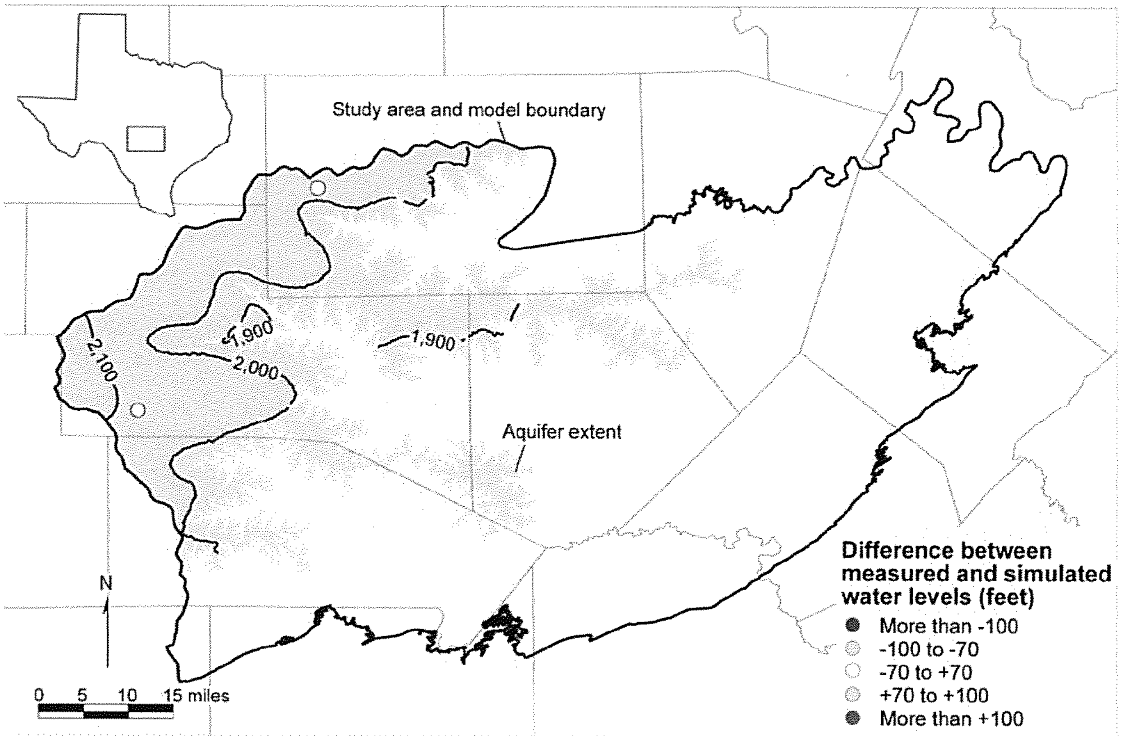
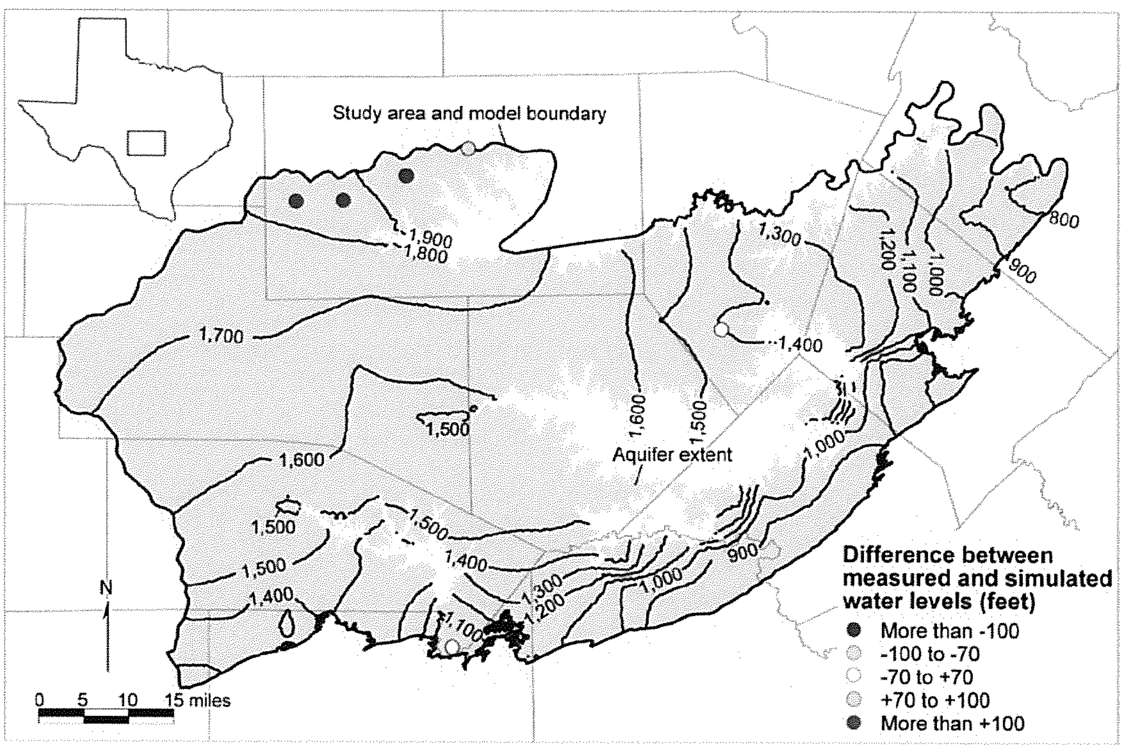


Figure 10.3. Comparison of measured and calculated water levels for 1990 and 1997 from the transient model.

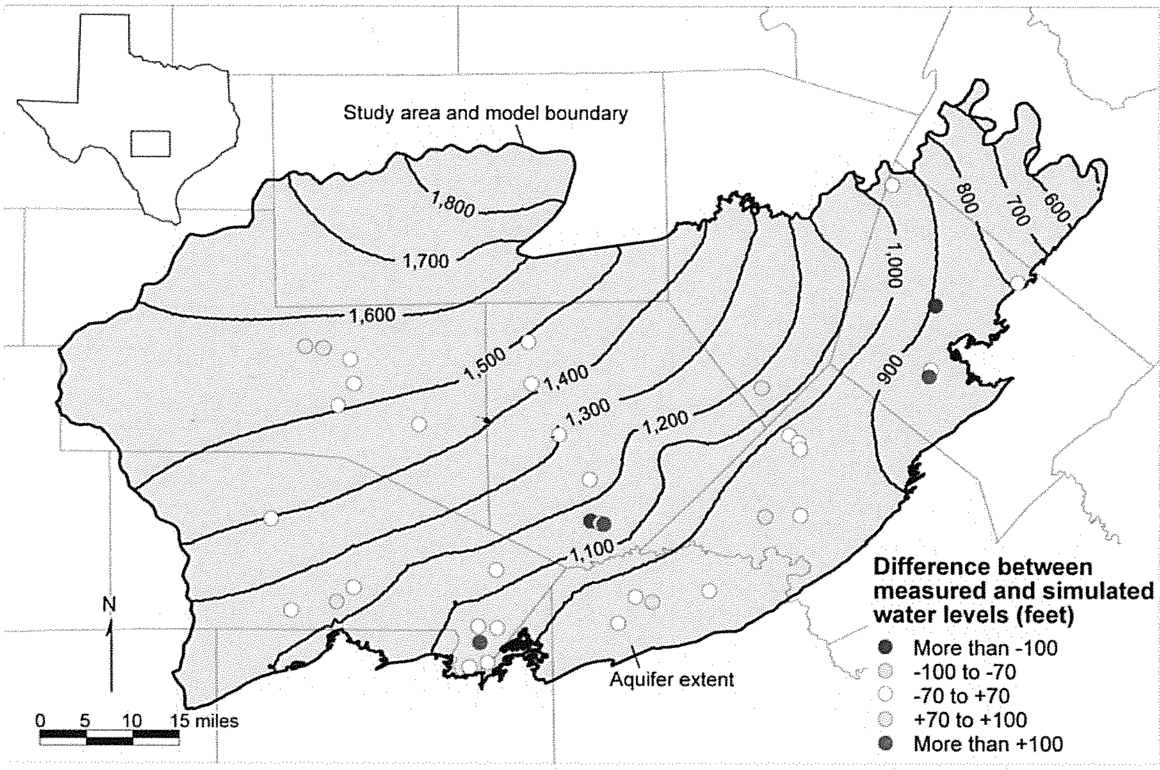


(a)

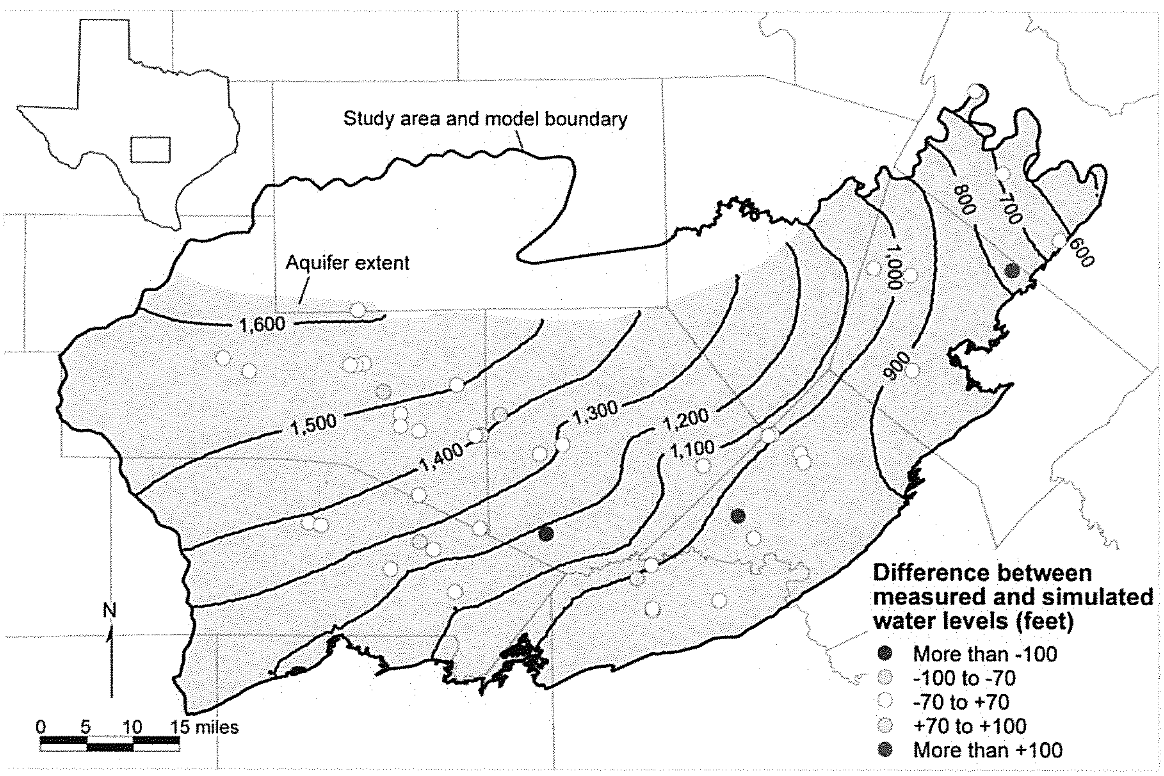


(b)

Figure 10-4. Comparison of 1990 measured and calculated water levels from the transient model for (a) layer 1, (b) layer 2, (c) layer 3, and (d) layer 4. The contours represent calculated water levels, expressed in feet above sea level, whereas the points indicate the difference between measured and simulated water levels relative to the measured water levels.

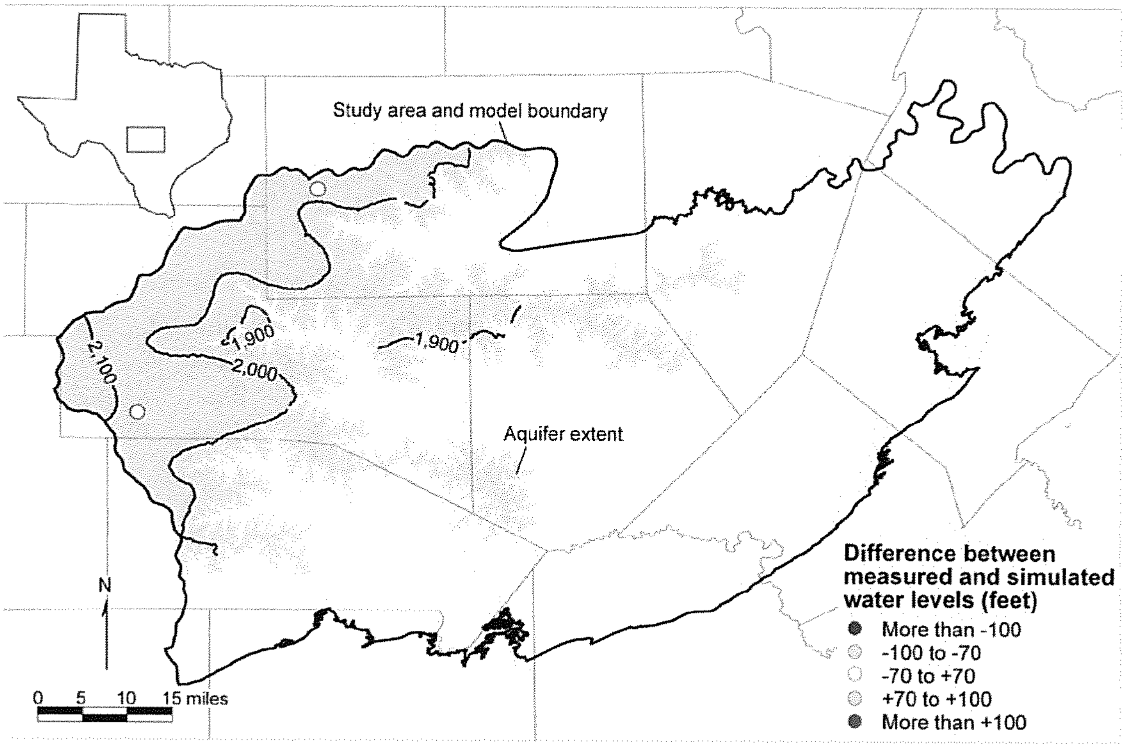


(c)

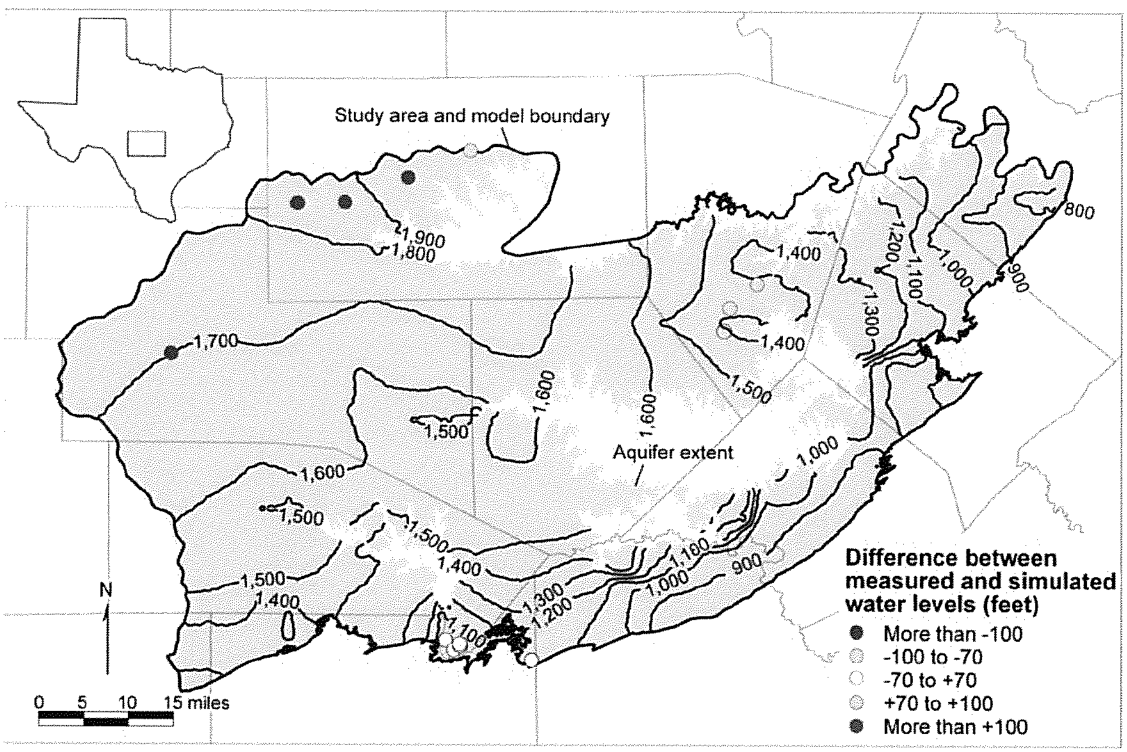


(d)

Figure 10-4. (continued).

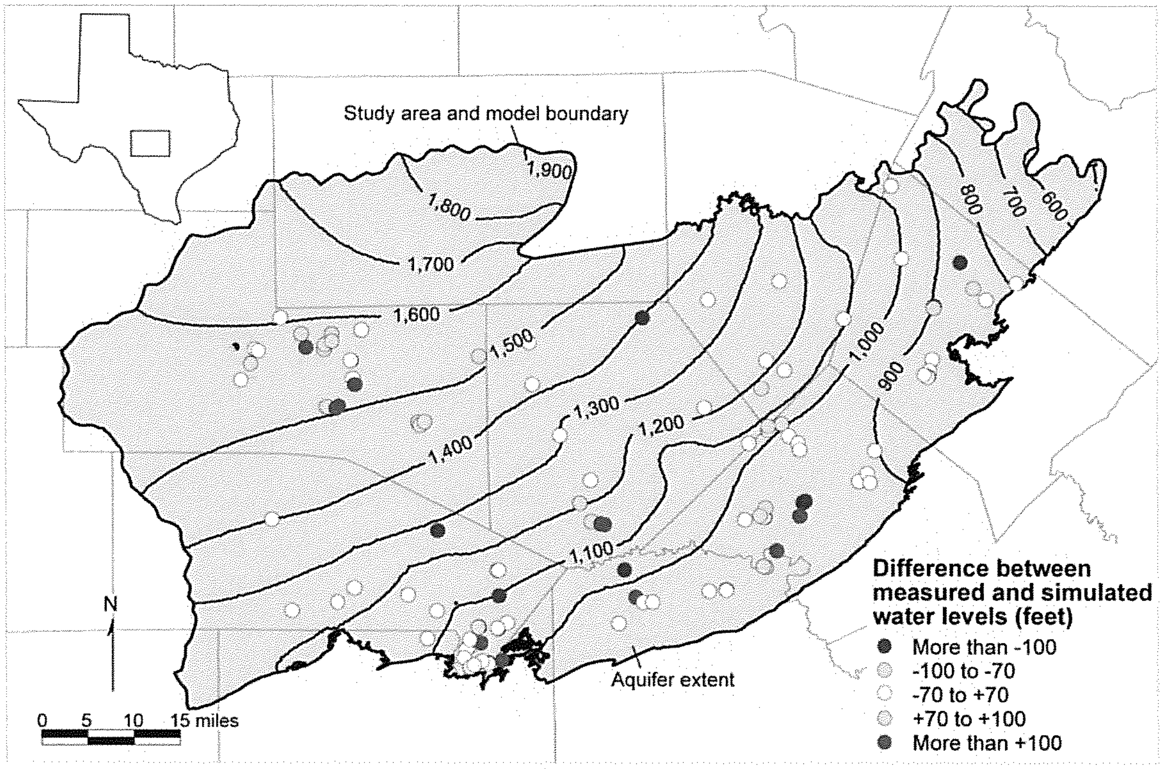


(a)

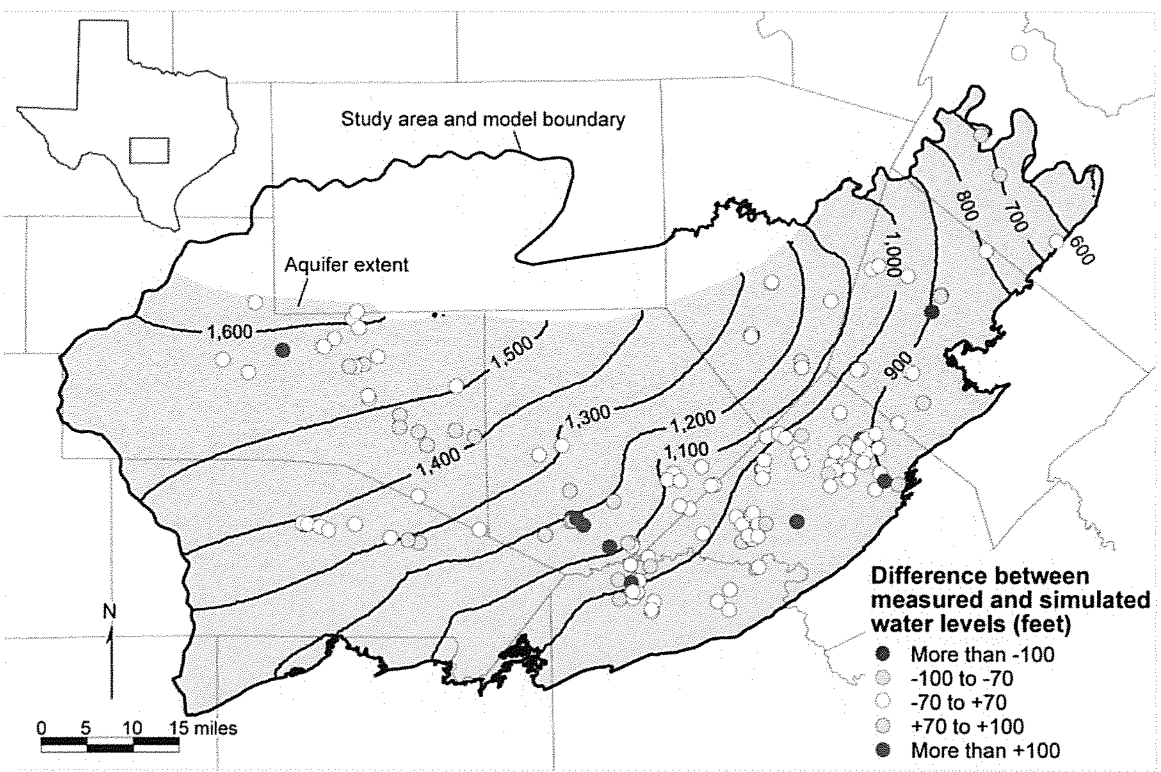


(b)

Figure 10-5. Comparison of 1997 measured and calculated water levels from the transient model for (a) layer 1, (b) layer 2, (c) layer 3, and (d) layer 4. The contours represent calculated water levels expressed in feet above sea level, whereas the points indicate the difference between measured and simulated water levels relative to the measured water levels.



(c)



(d)

Figure 10.5. (continued).

Table 10-3. Calibration statistics for the transient model for the years 1980, 1990, and 1997. The percentage represents the mean absolute error relative to the range of measured water levels.

1980	Mean error	Mean absolute error	Mean absolute error (percent)
Overall	14	59	4
Edwards Group	23	31	17
Upper Trinity Aquifer	23	68	6
Middle Trinity Aquifer	-14	53	5
Lower Trinity Aquifer	17	58	5

1990	Mean error	Mean absolute error	Mean absolute error (percent)
Overall	6	52	4
Edwards Group	34	34	—
Upper Trinity Aquifer	-81	99	9
Middle Trinity Aquifer	6	54	7
Lower Trinity Aquifer	17	45	4

1997	Mean error	Mean absolute error	Mean absolute error (percent)
Overall	15	57	4
Edwards Group	26	26	—
Upper Trinity Aquifer	-44	82	7
Middle Trinity Aquifer	10	66	7
Lower Trinity Aquifer	26	48	5

— = too few water-level measurements to calculate percent mean absolute error.

Table 10-4 shows the water budgets for the respective model layers in 1980, 1990, and 1997. Simulating discharge to springs using a regional-scale model is commonly difficult because of spatial and temporal scale issues. Table 10-5 shows simulated and measured discharge for selected springs in the study area. It should be noted that the measured discharge values represent single snapshots in time that (1) in most cases did not fall within the 1980 through 1997 transient model period and (2) may not be representative of average discharge from the spring during the transient modeling period because spring discharge varies widely over time. Simulated discharge values represent discharge averaged over each annual stress period. Additionally, springs are commonly discharge sites for highly localized flow systems that cannot be simulated in regional models. The result is that the apparent ability of the model to simulate spring discharge varies widely. Of 17 springs, 6 display a good comparison between measured and simulated discharge values. Simulated spring discharge from springs having the highest measured discharge values differs from measured values by about an order of magnitude. Most springs in the study area represent discharge from highly localized flow systems within the aquifer system that are characterized by short flow paths. The localized nature of these flow paths and the limitations of the regional model grid result in much of the spring discharge being included in base-flow discharge to streams. Overall, the model also does a good job of mimicking base-flow fluctuations (Figure 10-6).

Table 10-4. Water budget for the respective layers in the calibrated transient model for 1980, 1990, and 1997 (all values in acre-feet per year; negative values indicate net discharge from the aquifer).

1980	Edwards Group	Upper Trinity Aquifer	Middle Trinity Aquifer	Lower Trinity Aquifer
Interaquifer flow (above)	0	9,773	64,138	5,825
Interaquifer flow (below)	-9,773	-64,138	-5,825	0
Wells	-1,007	-5,157	-4,556	-5,961
Streams and springs	-47,735	-60,879	-56,013	0
Reservoirs	0	-2,519	-17,329	0
Edwards (Balcones Fault Zone) Aquifer	0	-33,224	-69,293	0
Recharge	58,516	156,135	88,910	155

1990	Edwards Group	Upper Trinity Aquifer	Middle Trinity Aquifer	Lower Trinity Aquifer
Storage	-7,960	-9,839	-5,788	-232
Interaquifer flow (above)	0	10,087	68,750	5,793
Interaquifer flow (below)	-10,087	-68,750	-5,793	0
Wells	-1,229	-6,253	-5,650	-5,732
Streams and springs	-51,290	-70,642	-64,676	0
Reservoirs	0	-3,097	-18,990	0
Edwards (Balcones Fault Zone) Aquifer	0	-37,821	-68,783	0
Recharge	70,567	186,292	100,916	180

1997	Edwards Group	Upper Trinity Aquifer	Middle Trinity Aquifer	Lower Trinity Aquifer
Storage	-12,380	-16,923	-11,8528	-447
Interaquifer flow (above)	0	10,329	77,150	5,297
Interaquifer flow (below)	-10,329	-77,150	-5,297	0
Wells	-1,504	-7,901	-8,448	-5,079
Streams and springs	-54,343	-85,266	-75,397	0
Reservoirs	0	-4,408	-23,563	0
Edwards (Balcones Fault Zone) Aquifer	0	-45,1623	-70,962	0
Recharge	78,557	226,464	118,348	240

Table 10-5. Estimated spring discharge and simulated average spring discharge rates from the calibrated transient model expressed in gallons per minute. The location of these springs can be found in Figure 5-28 (all values in gallons per minute). Please note that (1) the spring discharge measurements are single measurements collected over a wide range of conditions and time periods, (2) only two of the spring discharge measurements coincide with the calibration period, and (3) owing to scale issues, the model results may not reflect the more localized flow systems that influence discharge at specific springs.

	Spring	Estimated Flow	Date	1980	1981	1982	1983
1		150	4/13/1967	139	142	140	139
2	Bee Caves Spring	100	4/12/1967	75	83	78	75
3	Lynx Haven Springs	100		82	86	84	82
4	Ellebracht Springs	2,500	3/31/1966	225	238	217	213
5		310	3/11/1970	330	358	331	317
8		20	7/13/1976	366	474	350	346
9		75	7/10/1975	33	40	33	36
10	Cave Without A Name	50	1/17/1940	119	127	115	119
11	Kenmore Ranch Spring #9	150	7/17/1975	0	81	0	0
12	Edge Falls Springs	300		0	0	0	0
13	Rebecca Springs	300	7/11/1975	0	0	0	0
14	Jacob's Well Spring	500	8/31/1976	0	0	0	0
15		25	1/1/1966	6	9	8	9
16	Bassett Springs	50	12/30/1988	0	0	0	0
17		50	5/25/1973	0	0	0	0
18		9,000	12/20/1960	407	423	407	400
19	Cold Springs	5,000	8/20/1991	441	516	437	448

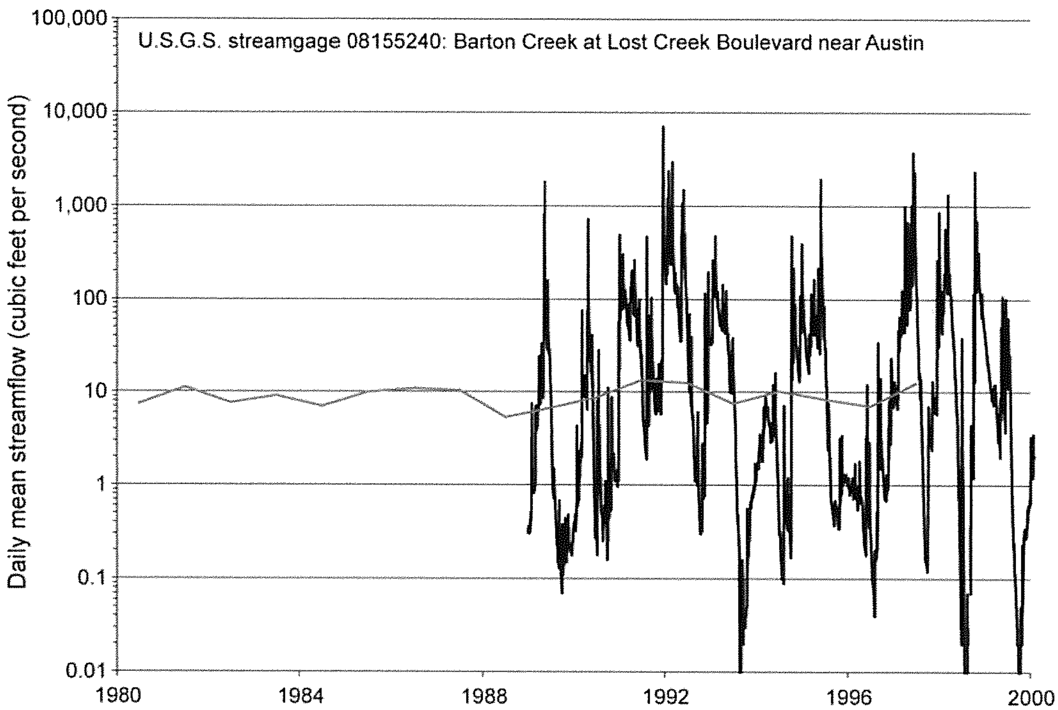
Table 10. 5 (continued).

	Spring	1984	1985	1986	1987	1988	1989
1		139	140	142	145	142	140
2	Bee Caves Spring	74	76	84	92	87	81
3	Lynx Haven Springs	82	83	86	90	88	85
4	Ellebracht Springs	218	226	241	255	228	222
5		321	332	360	393	358	338
8		322	388	466	500	368	308
9		32	42	46	46	32	32
10	Cave Without A Name	113	132	134	132	111	110
11	Kenmore Ranch Spring #9	0	113	152	140	0	0
12	Edge Falls Springs	0	0	0	0	0	0
13	Rebecca Springs	0	0	0	0	0	0
14	Jacob's Well Spring	0	0	0	0	0	0
15		7	9	11	12	7	6
16	Bassett Springs	0	0	0	0	0	0
17		0	0	0	0	0	0
18		408	413	429	446	416	410
19	Cold Springs	419	489	542	558	442	414

Table 10. 5 (continued).

	Spring	1990	1991	1992	1993	1994	1995
1		142	145	146	142	144	142
2	Bee Caves Spring	85	93	98	88	92	88
3	Lynx Haven Springs	87	91	94	89	91	89
4	Ellebracht Springs	236	244	250	219	242	227
5		359	382	404	355	378	363
8		392	508	528	359	426	386
9		40	50	56	40	44	37
10	Cave Without A Name	125	139	150	124	129	118
11	Kenmore Ranch Spring #9	1	195	351	59	70	0
12	Edge Falls Springs	0	0	83	0	0	0
13	Rebecca Springs	0	0	0	0	0	0
14	Jacob's Well Spring	0	0	0	0	0	0
15		8	12	13	10	10	9
16	Bassett Springs	0	0	0	0	0	0
17		0	0	0	0	0	0
18		428	436	447	415	432	425
19	Cold Springs	474	568	626	473	518	471

	Spring	1996	1997
1		142	144
2	Bee Caves Spring	86	90
3	Lynx Haven Springs	88	90
4	Ellebracht Springs	224	247
5		350	388
8		335	446
9		31	47
10	Cave Without A Name	110	132
11	Kenmore Ranch Spring #9	0	35
12	Edge Falls Springs	0	0
13	Rebecca Springs	0	0
14	Jacob's Well Spring	0	0
15		7	11
16	Bassett Springs	0	0
17		0	0
18		420	446
19	Cold Springs	419	522



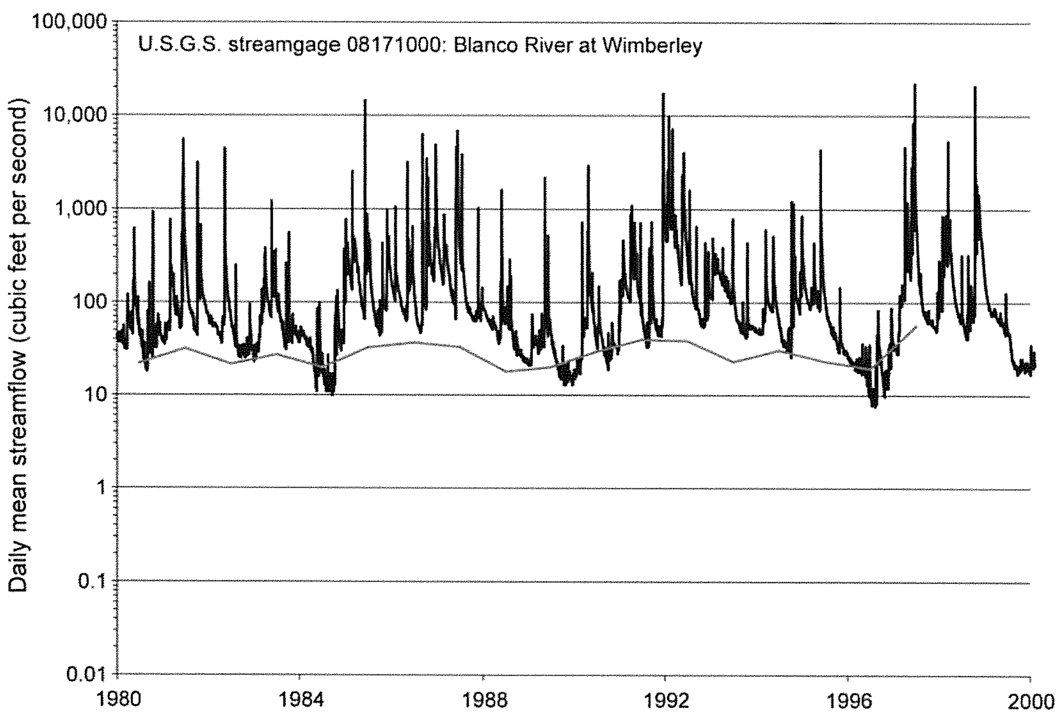
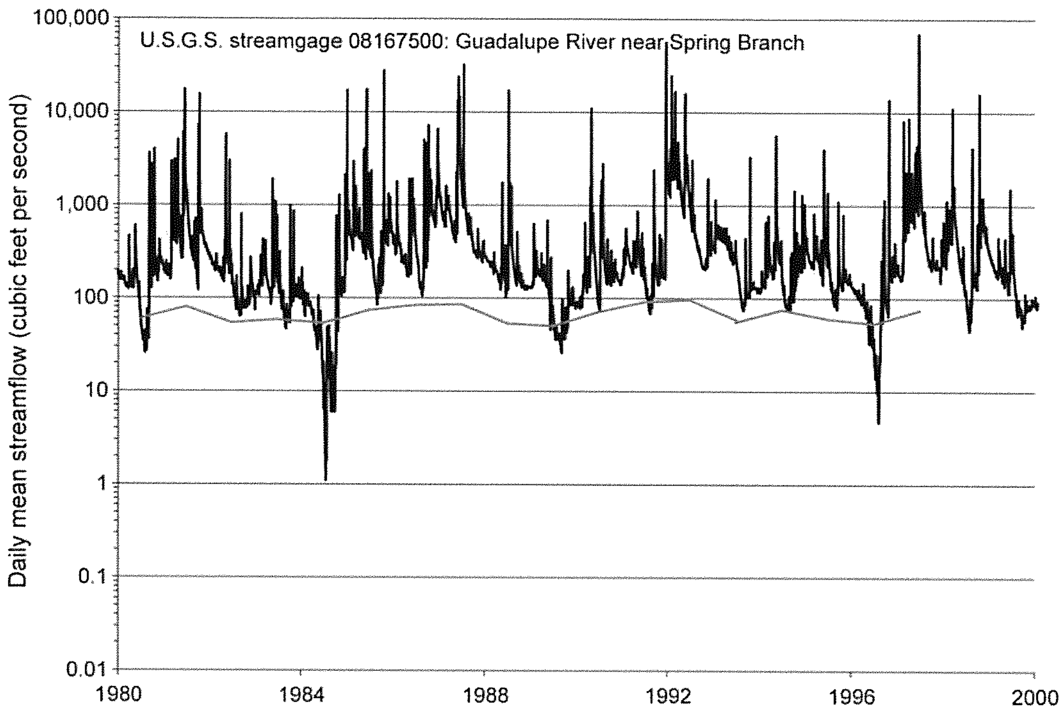


Figure 10-6. **Comparison of calculated annual groundwater discharge rates to perennial streams from the transient model (gray line) and measured streamflow data. Streamgage locations are shown in Figure 9-4.**



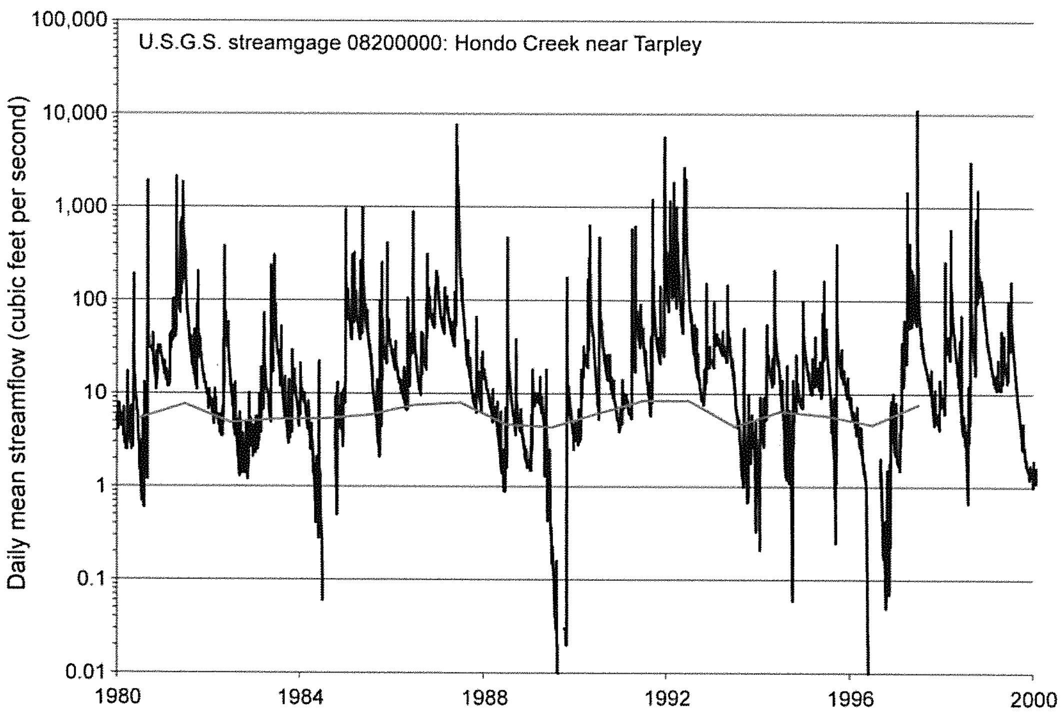


Figure 10-6. (continued).

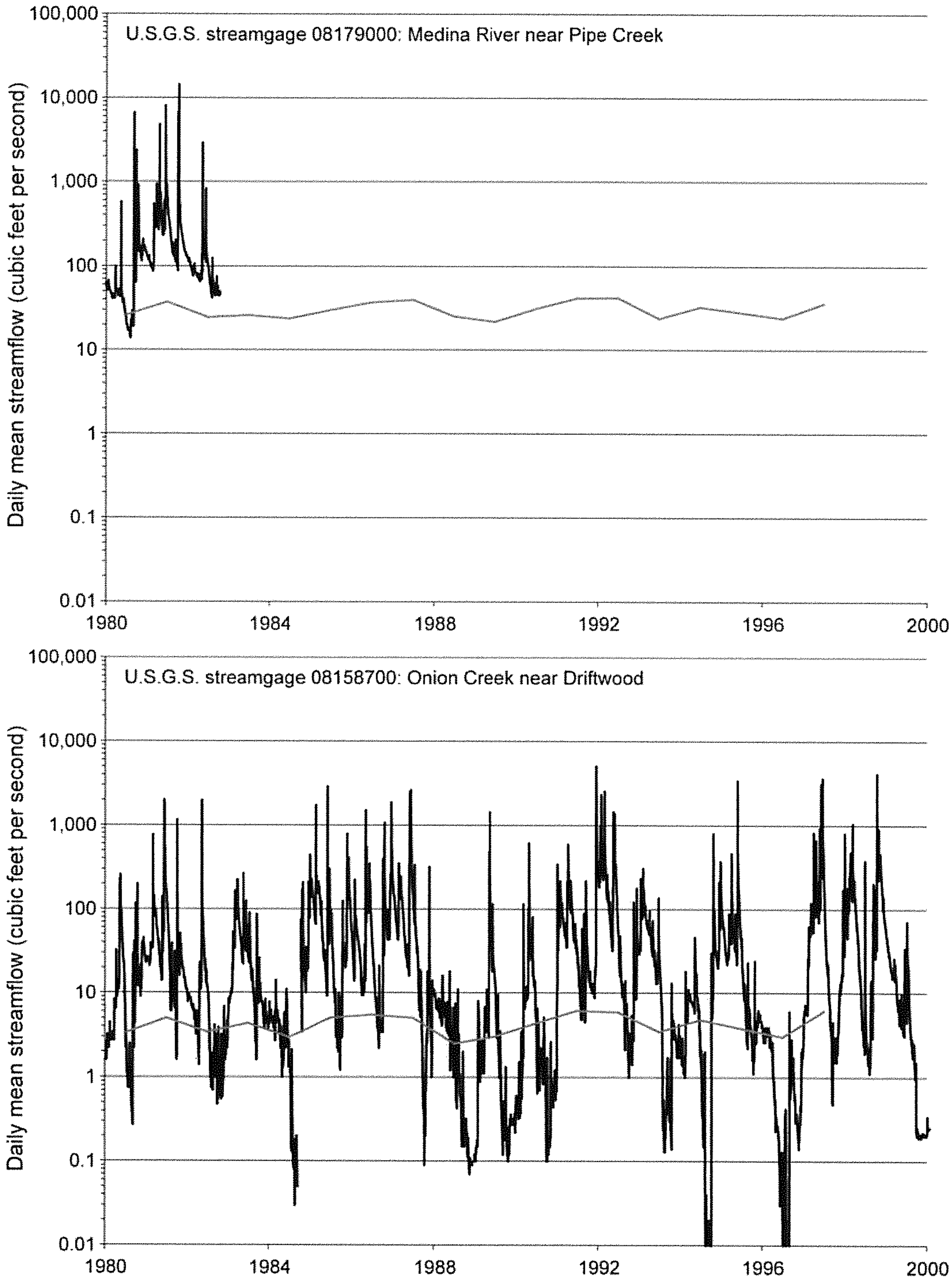


Figure 10-6. (continued).

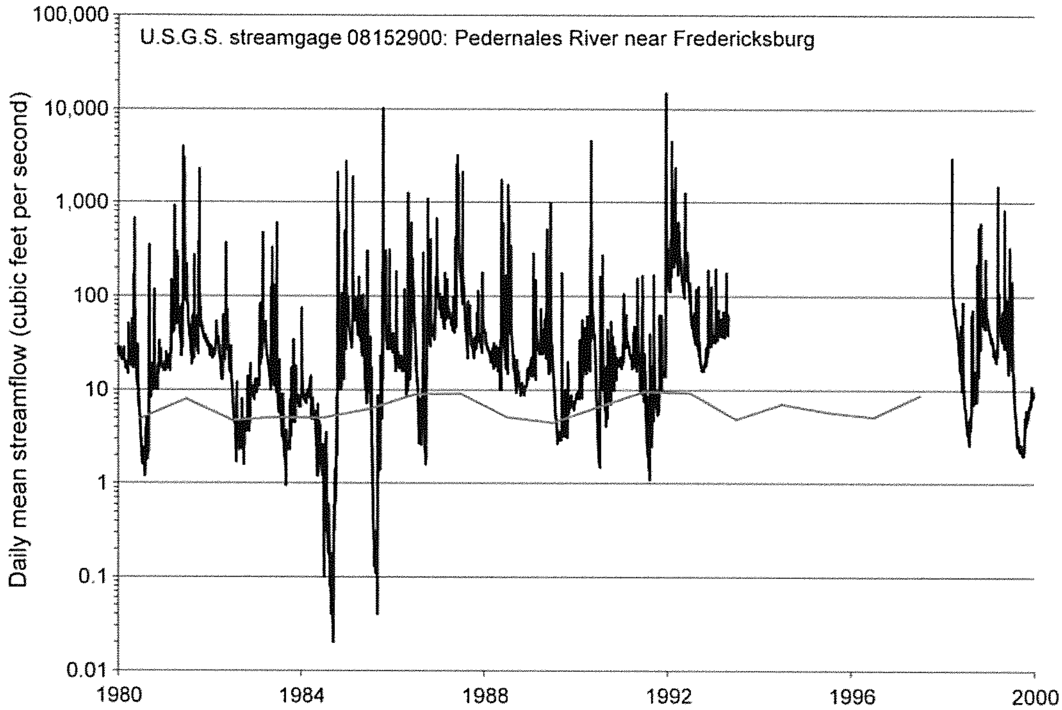


Figure 10-6. (continued).

10.2 Sensitivity Analysis

Upon completion of transient model calibration, we assessed the storage parameters to determine the sensitivity of the model to variation of specific-yield and specific-storage values. Sensitivity analysis involves systematically varying specific yield and specific storage to determine associated changes in aquifer response over the transient model run. We ran the model multiple times, lowering and then raising the calibrated specific-yield and specific-storage values by an order of magnitude.

Sensitivity analysis indicates that the unconfined Edwards Group (layer 1) is sensitive to increasing specific-yield input values and insensitive to specific-storage input values (Figures 10-7 and 10-8). This result is not surprising because MODFLOW only utilizes specific-yield input values when simulating groundwater flow through an unconfined aquifer. Overall, the model is much more sensitive to specific yield than to specific storage.

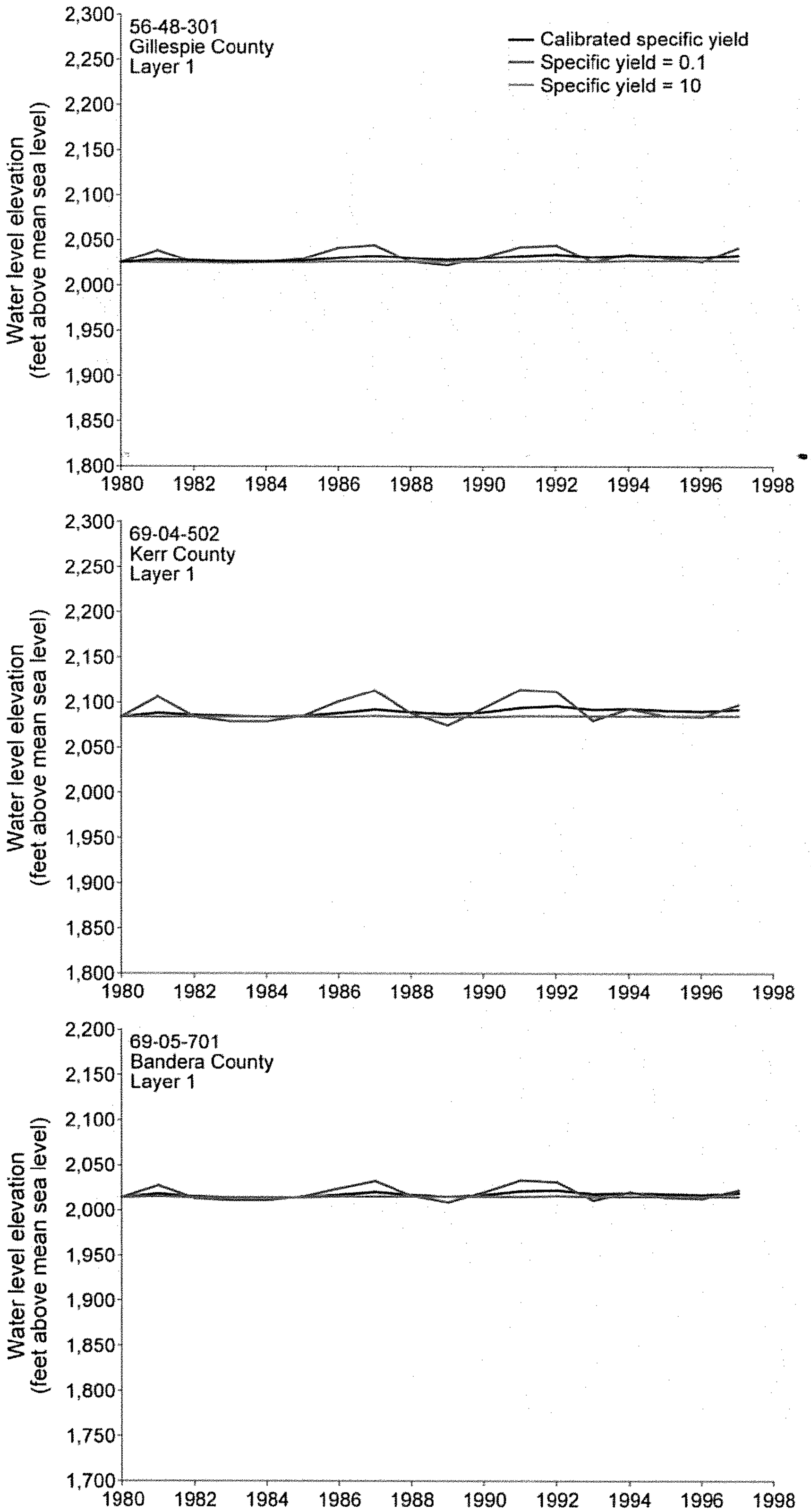
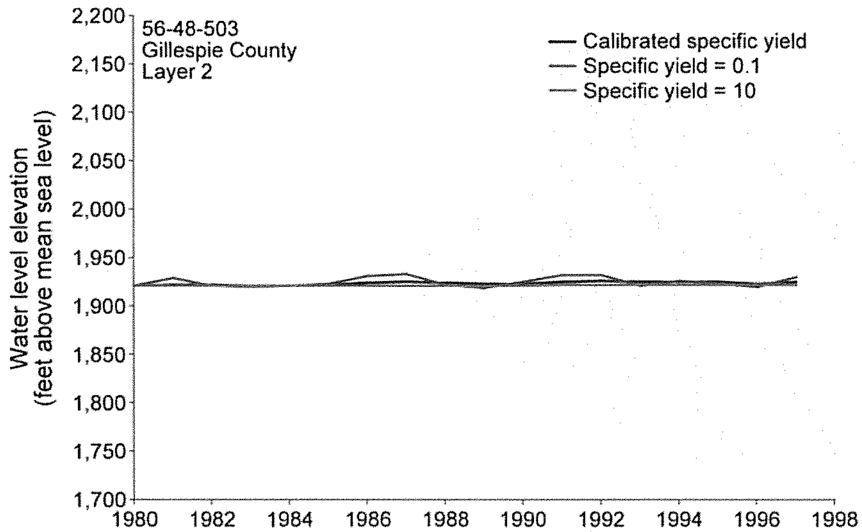
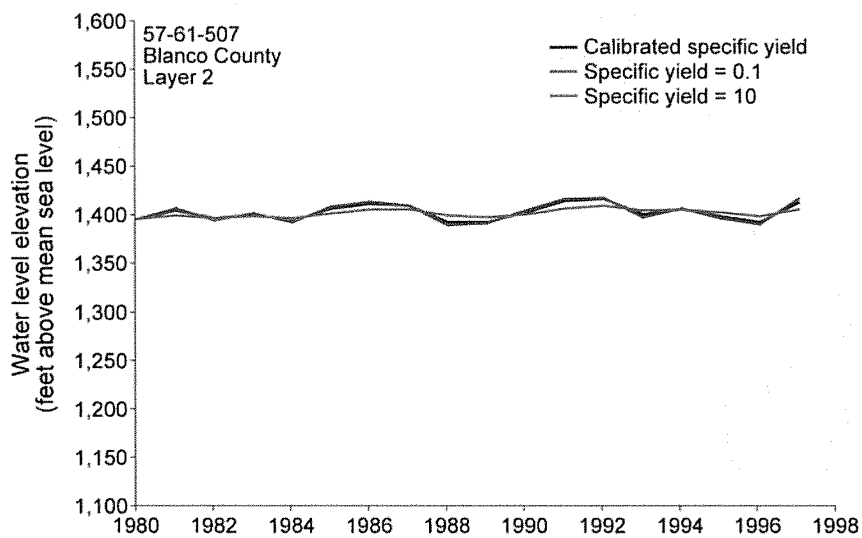


Figure 10-7. Sensitivity of the transient calibration to specific yield. The red and blue lines represent one order of magnitude lower and higher than the calibrated values, respectively, relative to calibrated specific-yield values (black line).





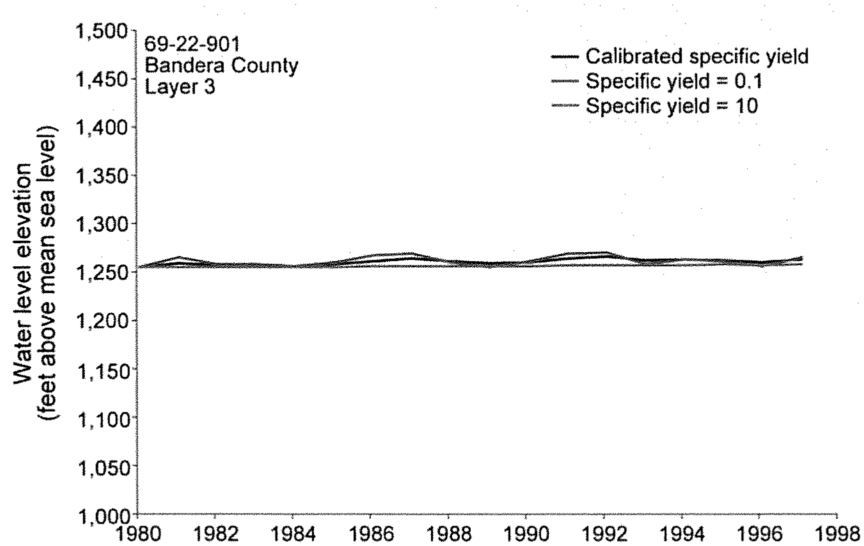


Figure 10.7. (continued).

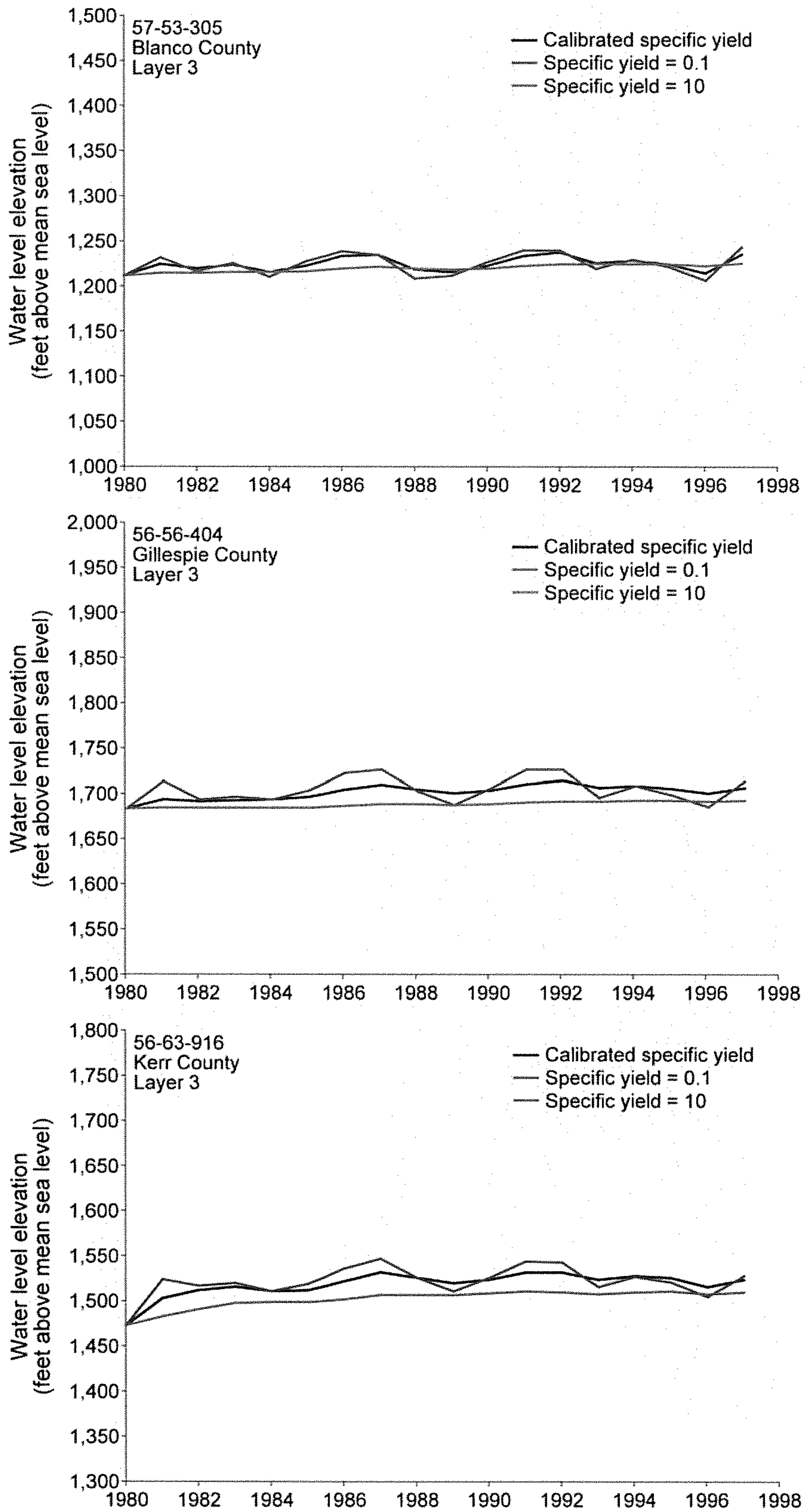


Figure 10[illegible]7. (continued).

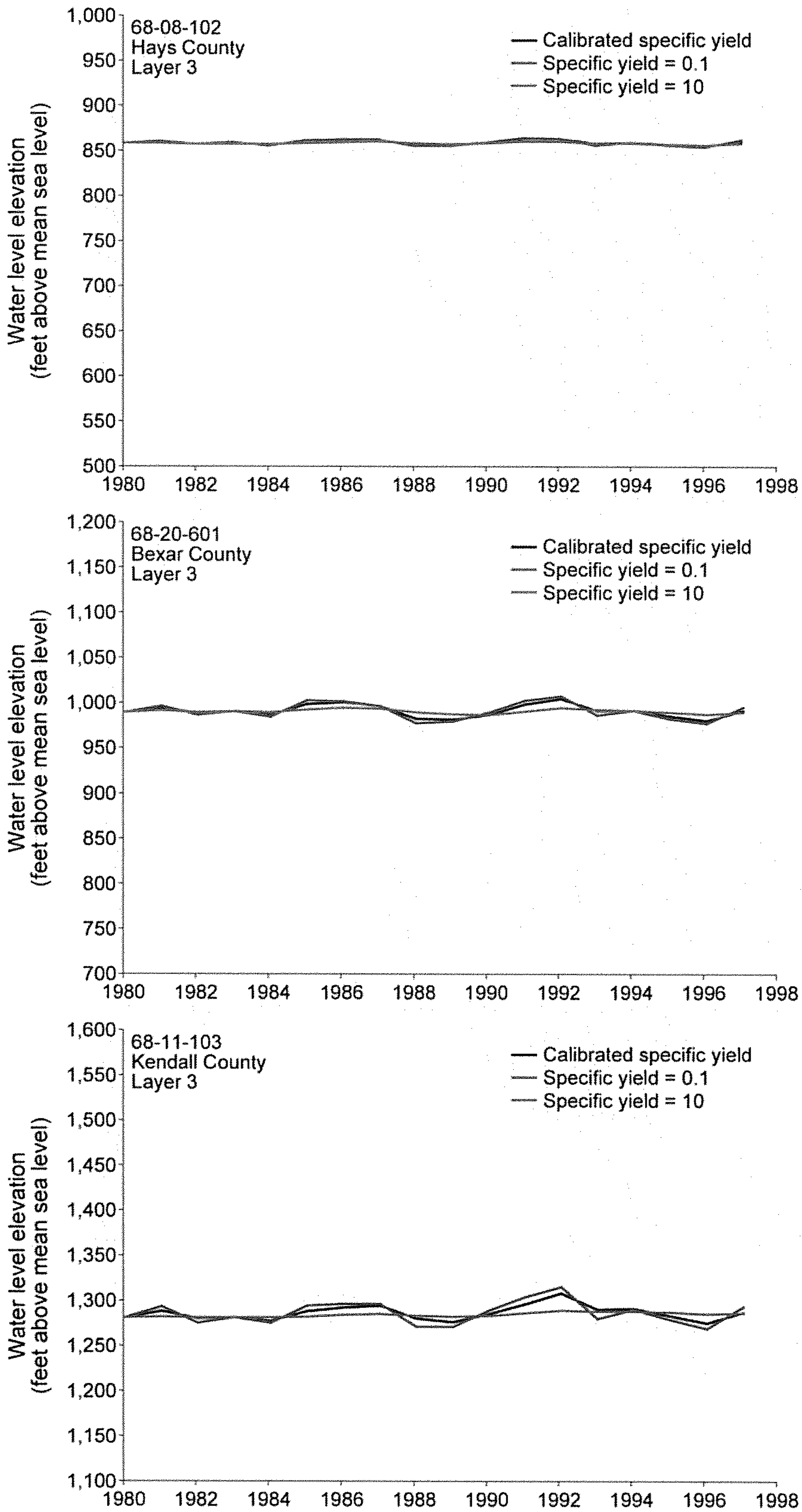


Figure 10[illegible]. (continued).

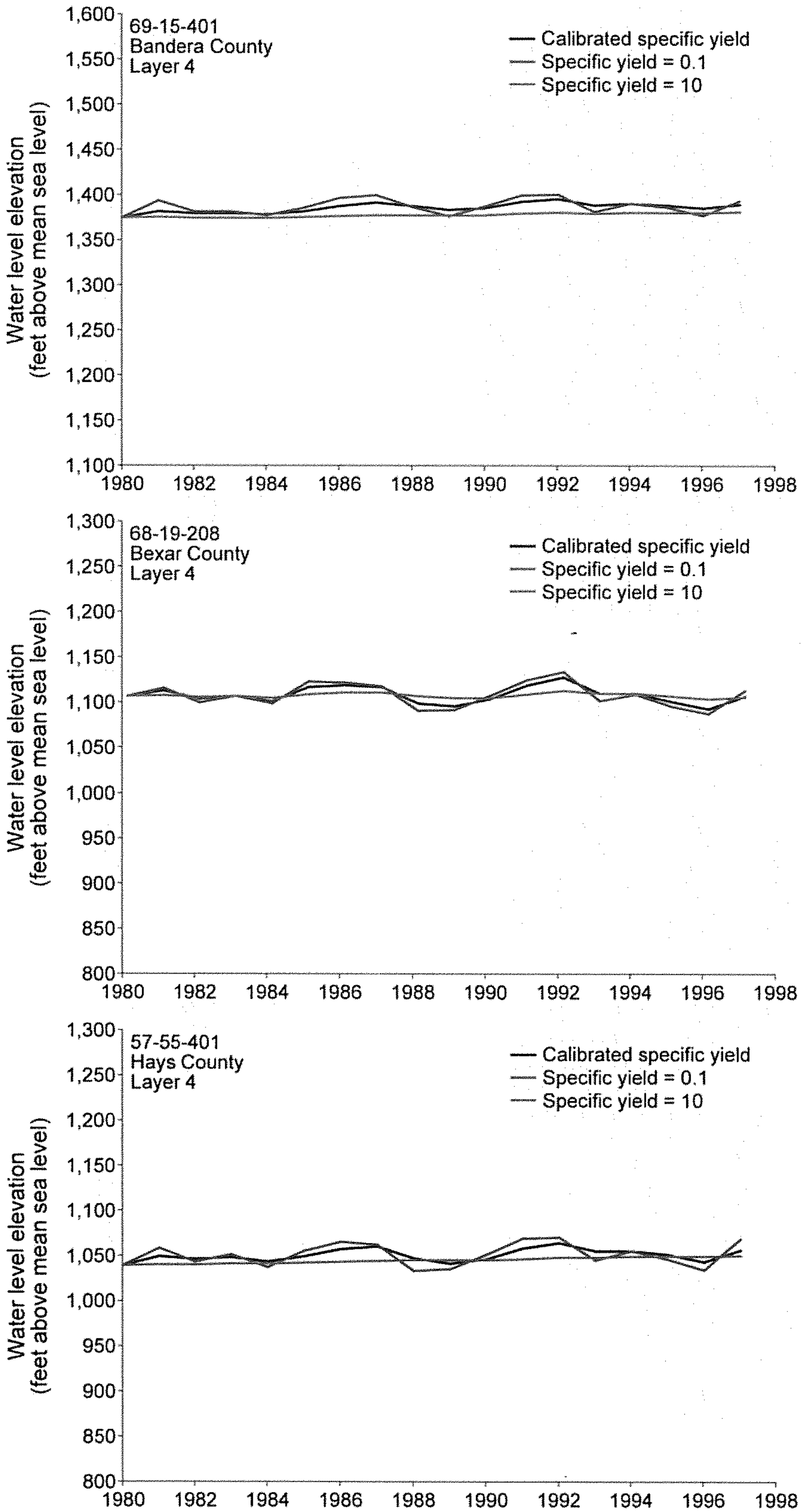


Figure 10[illegible]. (continued).

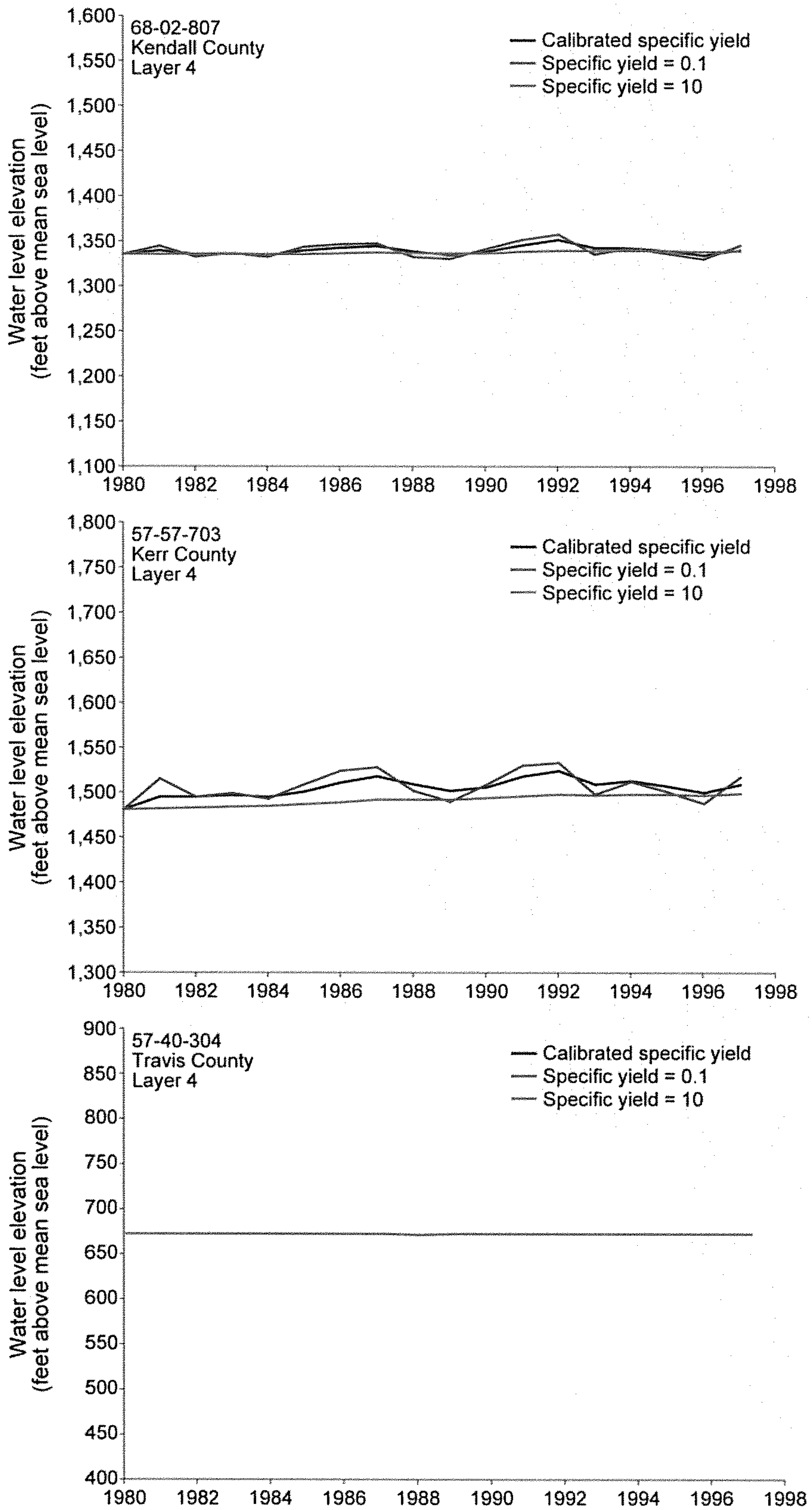


Figure 10.7. (continued).

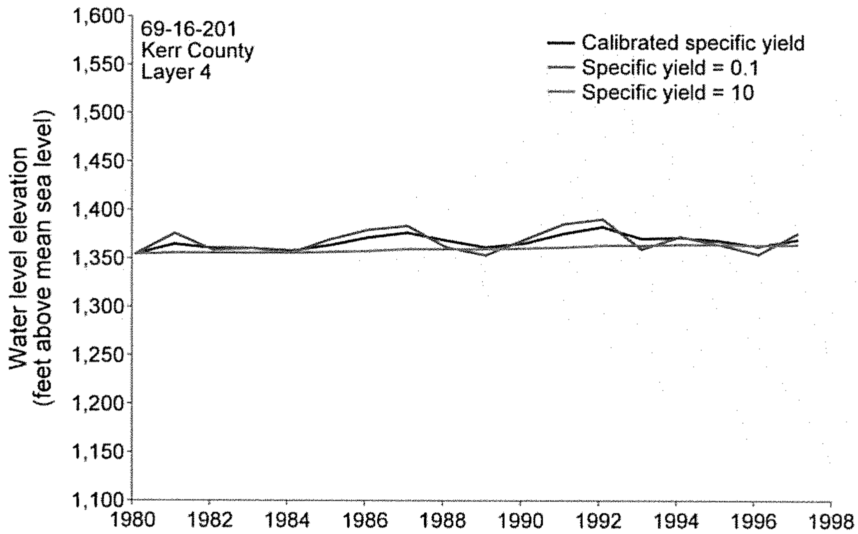


Figure 10-7. (continued).

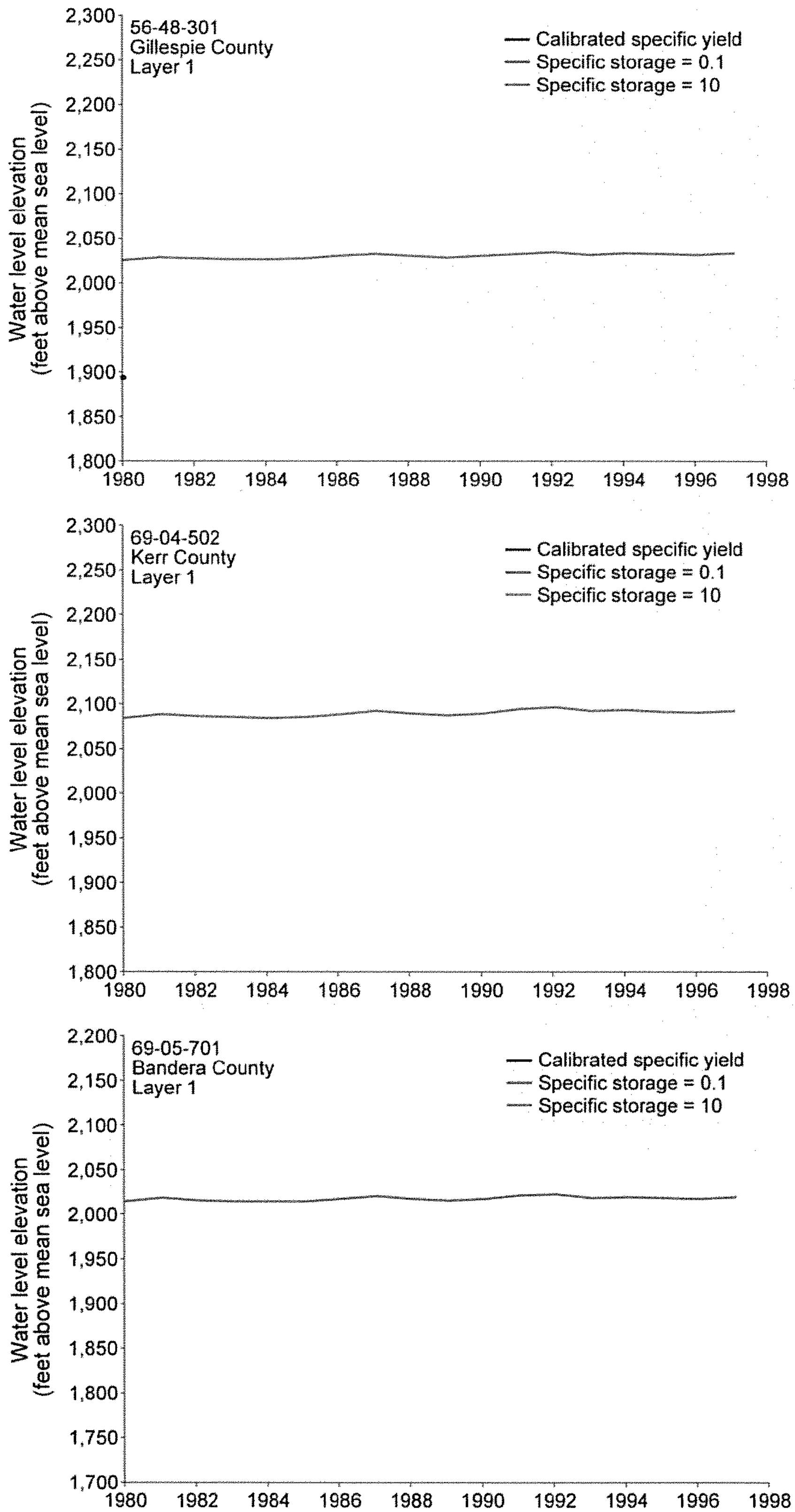


Figure 10.8 Sensitivity of the transient calibration to specific storage. The red and blue lines represent one order of magnitude lower and higher than the calibrated values, respectively, relative to calibrated specific-storage values (black line).

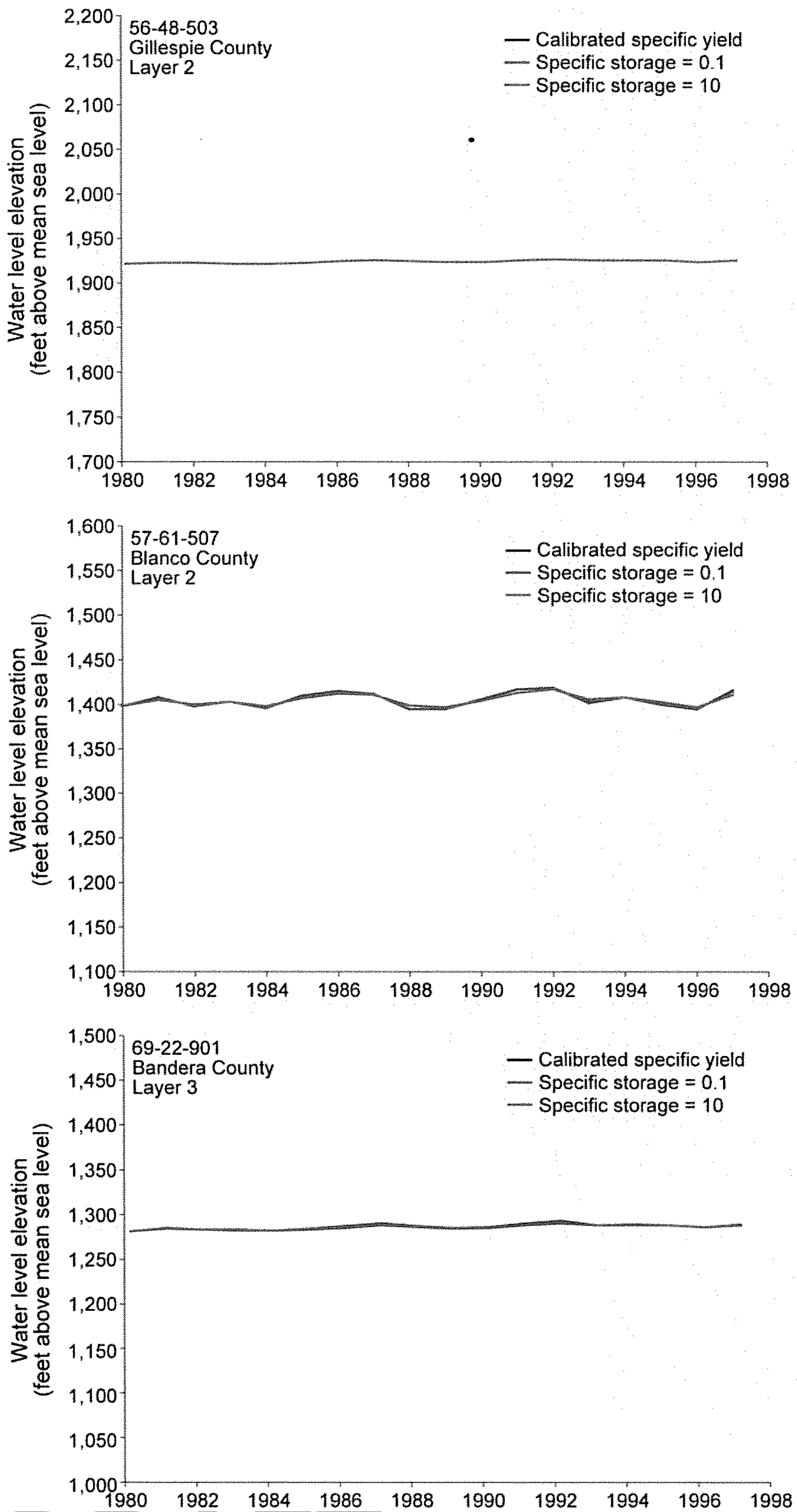


Figure 10.8. (continued).

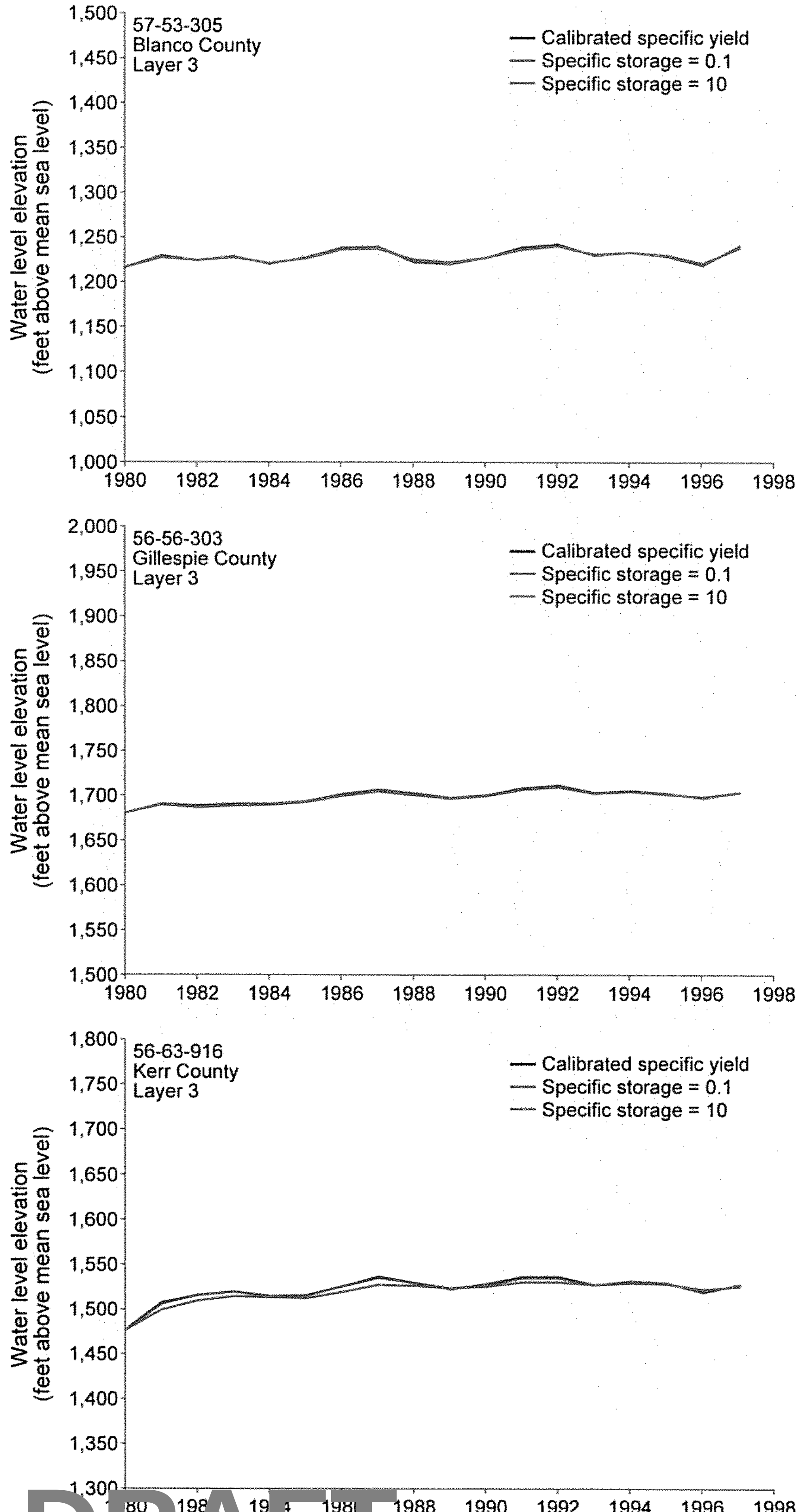


Figure 10.8. (continued).

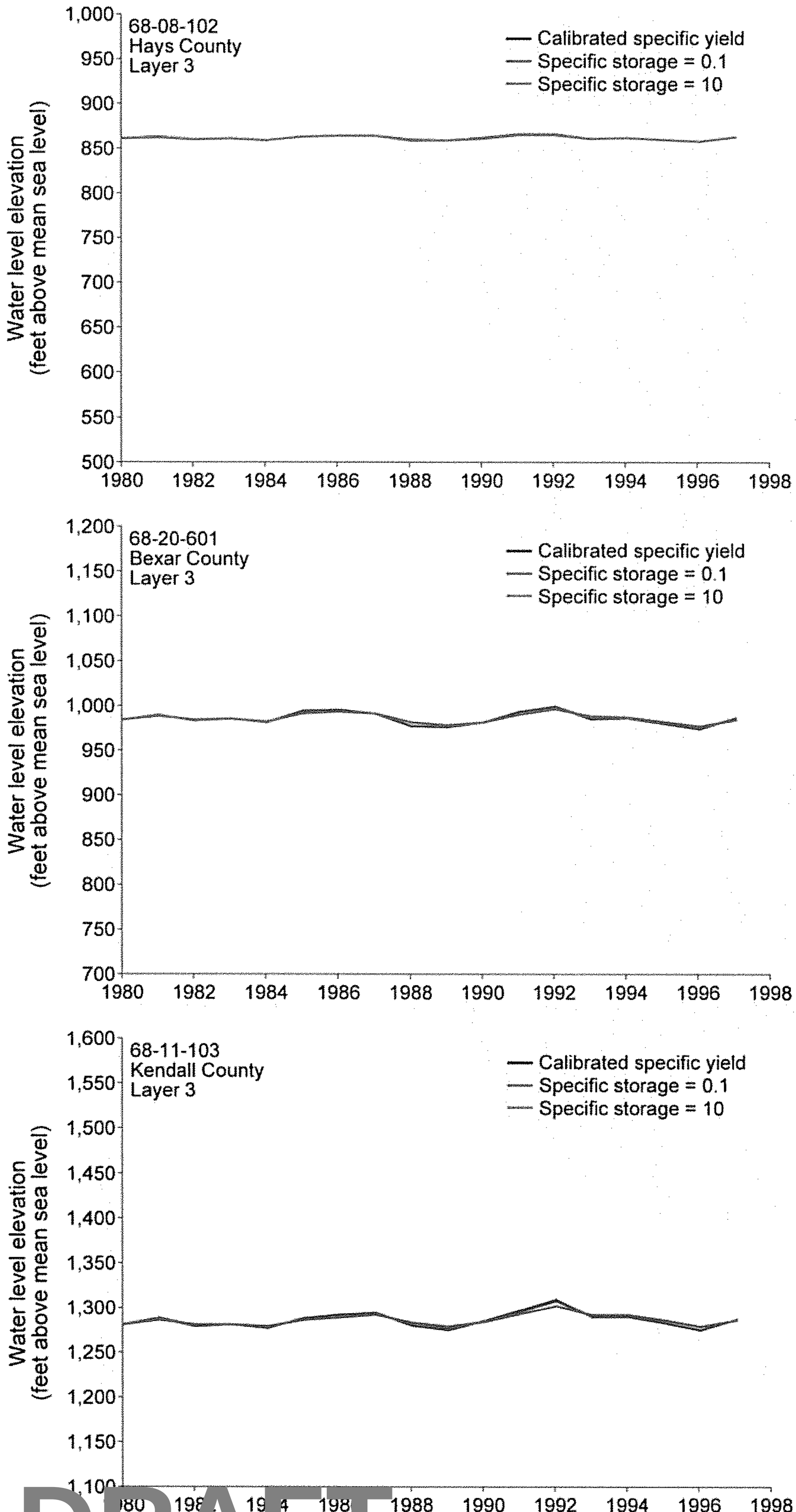


Figure 10.8. (continued).

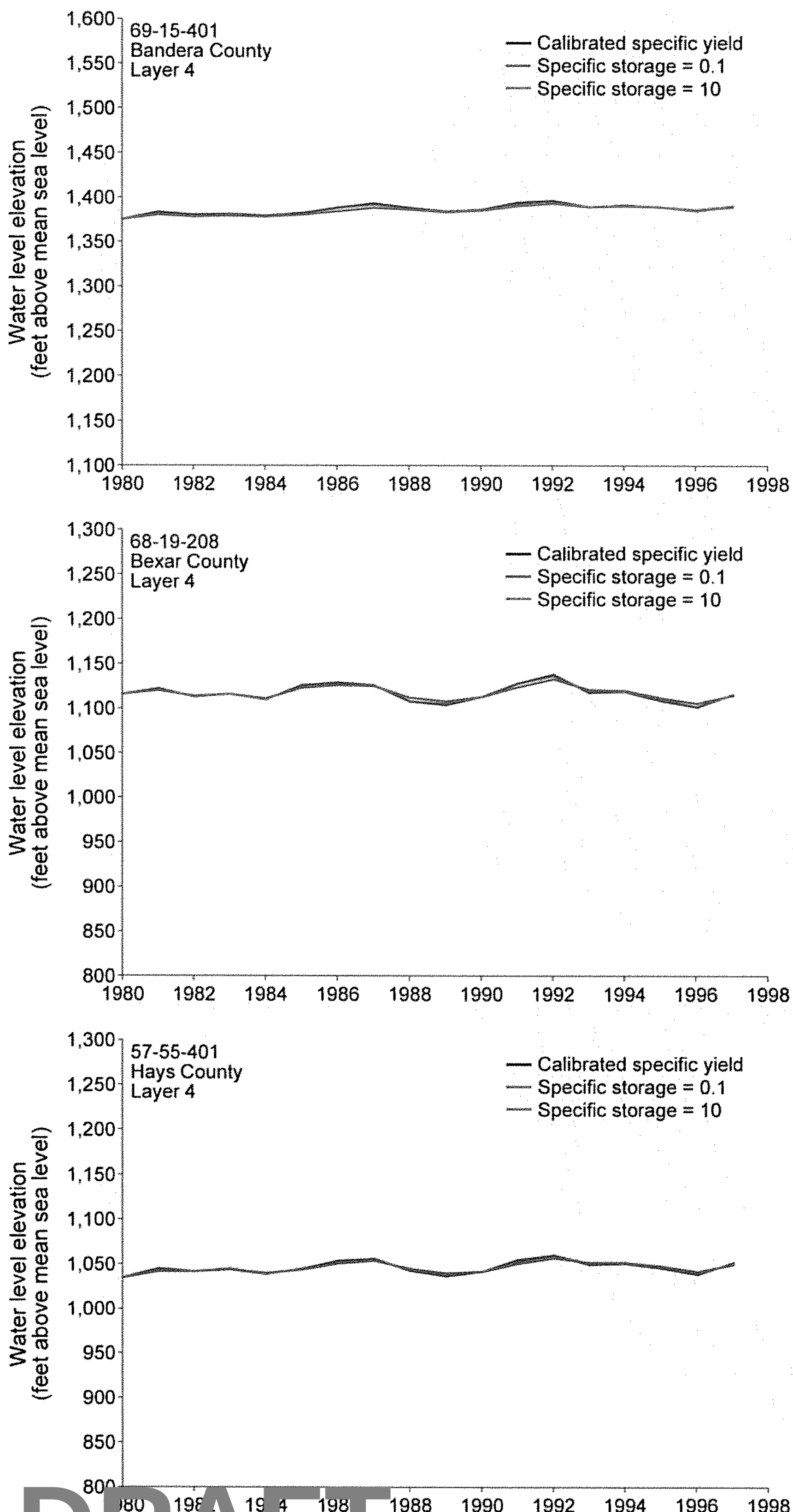


Figure 10.8. (continued).

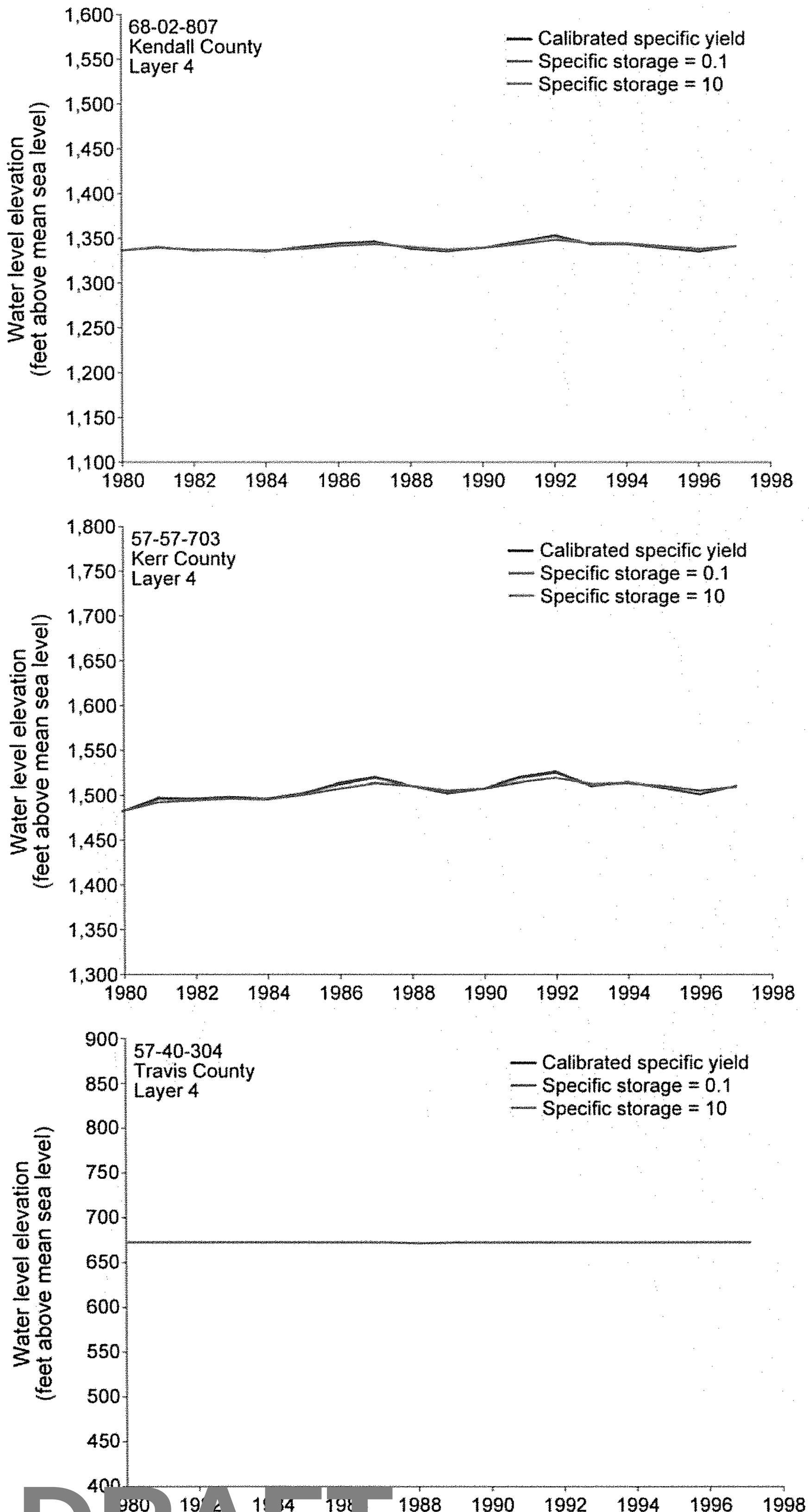


Figure 1[illegible]-8. (continued).

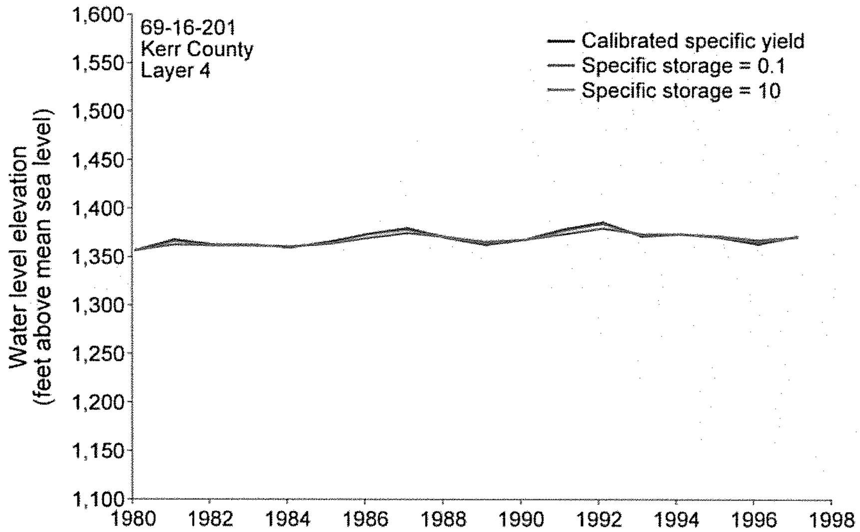


Figure 10-8. (continued).

11.0 Limitations of the Model

All numerical groundwater flow models have limitations. These limitations are usually associated with (1) the extent of current understanding of the workings of the aquifer, (2) the availability and accuracy of input data, (3) the assumptions and simplifications used in developing the conceptual and numerical models, and (4) the scale of application of the model. The limitations determine the spatial and temporal variation of uncertainties in the model because calibration uncertainty decreases with increased availability of input data. Additionally, many of the assumptions, degree of simplification, and spatial resolution of groundwater flow models are influenced by availability of input data.

11.1 Input Data

Several of the input data sets for the model are based on limited information. These include structural geology, recharge, water level data, hydraulic conductivity, specific storage, and specific yield.

Although this model's representation of aquifer hydraulic properties may be adequate for the regional model, it may not be appropriate for local-scale conditions. The same problem occurs in the assigning of specific-storage and specific-yield values in the model. The paucity of measured specific-storage and specific-yield values is partly overcome by calibrating the model on the basis of observed water level responses in the wells in the model area having the most water level measurements over the model period.

There is no published information on the spatial distribution of recharge throughout the Hill Country portion of the Trinity Aquifer System. Calibration of recharge rates is obtained by trial and error during construction of the steady-state model. Application of these recharge rates to the transient model assumes that (1) a linear relationship exists between precipitation and recharge and (2) there is no threshold that must be exceeded before recharge occurs. This assumption suggests the possibility of overestimating recharge during dry periods, when all precipitation may be taken up by evapotranspiration or absorbed by dry soils. The relatively good correlation between observed and simulated water levels and stream discharge suggests that, despite uncertainties, the model water budget reasonably represents the regional groundwater budget.

Our structural maps simplify faulting along the southeastern margin of the model and smooth out the base of the Middle Trinity Aquifer in the northern part of the model. This simplification causes the model to represent the regional structural controls and regional groundwater flow but limits the ability to simulate local groundwater flow in these areas. Greater structural control may be attained with more detailed maps and a finer model grid in this area. However, this increased complexity would come at the cost of the requirement of a finer model grid and consequently much longer run times and increased computational complexity, resulting in increased instability of the model with no guarantee of increased model accuracy.

Water level maps, and therefore the calibration of the model, are affected by limited information, especially in layer 1 where there are few measurements. Limited availability of wells having multiple water level measurements affects calibration of the transient model. Limited water level measurements bias model calibration to areas where water levels have been measured. The difference between measured and simulated water levels can be accounted for by factors such as unavoidable simplifications incorporated into the model and water level measurements not representative of the average water level for a specific period of time simulated by the model.

11.2 Assumptions

We used several assumptions to simplify construction of the model. The most important assumptions are (1) there is no flow between the Lower Trinity Aquifer and underlying Paleozoic units, (2) the Drain Package of MODFLOW can be used to simulate discharge to streams and rivers, (3) the General-Head Boundary Package of MODFLOW can be used to simulate cross-formational flow between the Hill Country portion of the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer, and (4) recharge from Cibolo Creek is constant over time.

We assumed that the vertical leakance between the Middle and Lower Trinity aquifers is a function of the thickness of the Hammett Shale. Most of the base of the Middle Trinity Aquifer is underlain by the Hammett Shale (Amsbury, 1974; Barker and Ardis, 1996), which restricts flow between the Middle and Lower Trinity aquifers (Ashworth, 1983).

We used the Drain Package of MODFLOW to simulate streams and rivers in the study area. The Drain Package only allows water to move from the aquifer to the streams and rivers, thus implying that the streams and rivers in the study area are gaining streams and will remain so in the future.

We used the General-Head Boundary Package to simulate cross-formational flow between the Hill Country portion of the Trinity Aquifer System and the Edwards (Balcones Fault Zone) Aquifer. The spatial distribution of general-head boundary cells in the model is based on the assumption that cross-formational flow occurs where the two aquifers juxtapose along the

Balcones Fault Zone. We also assumed that there is no groundwater flow from the Lower Trinity Aquifer to the Trinity rocks underlying the Edwards (Balcones Fault Zone) Aquifer.

Annual fluctuations in recharge from Cibolo Creek are small enough during the transient model period not to affect calibration, thus allowing the use of constant recharge. However, during periods of extreme drought, it is likely that recharge from Cibolo Creek will decline and eventually cease. Consequently, predictive model runs that include periods of lower precipitation and streamflow (for example, drought of record) should include reduced recharge in this area.

11.3 Scale of Application

The limitations described earlier and the nature of regional groundwater flow models affect the scale of application of the model. As calibrated, this model is most accurate in assessing regional-scale groundwater issues, such as predicting aquifer-wide water level changes and trends in the groundwater budget that may result from different proposed water management strategies, on an annual timescale. Accuracy and applicability of the model decrease when moving from addressing regional- to local-scale issues because of limitations of the information used in model construction and the model cell size that determines spatial resolution of the model. Consequently, this model is not likely to accurately predict water level declines associated with a single well or spring because (1) these water level declines depend on site-specific hydrologic properties not included in detail in regional-scale models and (2) the cell size used in the model is too large to resolve changes in water levels that occur over relatively short distances. Addressing local-scale issues requires a more detailed model, with local estimates of hydrologic properties, or an analytical model. This model is more useful in determining the impacts of groups of wells or well fields distributed over a few square miles. The model can be used to predict changes in ambient water levels rather than actual water level changes at specific locations, such as an individual well.

12.0 Future Improvements

The TWDB plans periodically to update, and thus improve, its groundwater availability models. This model may be improved by incorporating greater complexity or hydrologic information that was not available when it was updated. Model uncertainty may be reduced with additional information on streamflow, hydraulic properties, water level elevations, and recharge.

Additional hydraulic head measurements and aquifer-test data are required for the Hill Country portion of the Trinity Aquifer System. This information can be used to improve calibration of the model by increasing the number and spatial distribution of sites and the frequency of measurements for comparing measured and simulated water levels. Aquifer tests will facilitate determination of whether improving the model by more complex spatial distribution of hydraulic conductivity, specific storage, and specific yield can be justified.

Future updates of this model might include using the Stream-flow Routing Package (Prudic, 1989) to simulate streams. Using the Stream-flow Routing Package would simulate two-way interaction between the aquifer and rivers or streams. This approach is a potentially superior alternative to the Drain Package and may allow better simulation of recharge from Cibolo Creek.

13.0 Conclusions

We updated a finite-difference groundwater flow model that can be used to predict water level changes in response to specified pumping and drought scenarios. The updated model has four layers—the Edwards Group and the Upper, Middle, and Lower Trinity aquifers—and 12,976 active cells, each with a uniform grid size of 1 mile by 1 mile. We developed the conceptual model of groundwater flow and defined aquifer properties on the basis of a review of previous work and studies we conducted on water levels, structure, recharge, and hydraulic properties. The process of updating the model included (1) adding the Lower Trinity Aquifer as another layer to the model, (2) revising the structure and spatial distribution of parameters, such as recharge and pumping, and (3) calibrating to steady-state conditions for 1980 and historical transient conditions for the period 1980 through 1997.

The calibrated model does a reasonable job of matching the water level distribution and water level fluctuations in the aquifer. The steady-state model has an overall mean absolute error of 54 feet, about 3.5 percent of the hydraulic-head drop across the study area. Calibration of the steady-state model indicates an average recharge rate of about 5 percent of average annual precipitation in the Balcones Fault Zone portion of the aquifer and 3.5 percent in the rest of the aquifer. Estimated recharge from Cibolo Creek averages about 70,000 acre-feet per year. Calibrated hydraulic conductivity is 11 feet per day in the Edwards Group, 9 to 150 feet per day in the Upper Trinity Aquifer, 7.6 to 15 feet per day in the Middle Trinity Aquifer, and 1.7 to 17 feet per day in the Lower Trinity Aquifer. Water levels in the model are most sensitive to changes in (1) recharge, (2) horizontal hydraulic conductivity, and (3) vertical hydraulic conductivity. We also calibrated values of vertical hydraulic conductivity, specific storage, and specific yield for the aquifer.

We found that more than 300,000 acre-feet per year of water flows through the aquifer, mostly in the Upper and Middle Trinity aquifers. Of the total flow, almost all is derived from infiltration of precipitation, with minor amounts from inflow from reservoirs and the adjacent Edwards (Balcones Fault Zone) Aquifer. The model estimates that about 100,000 acre-feet per year of groundwater flows from the Upper and Middle Trinity aquifers to the Edwards (Balcones Fault Zone) Aquifer.

14.0 Acknowledgments

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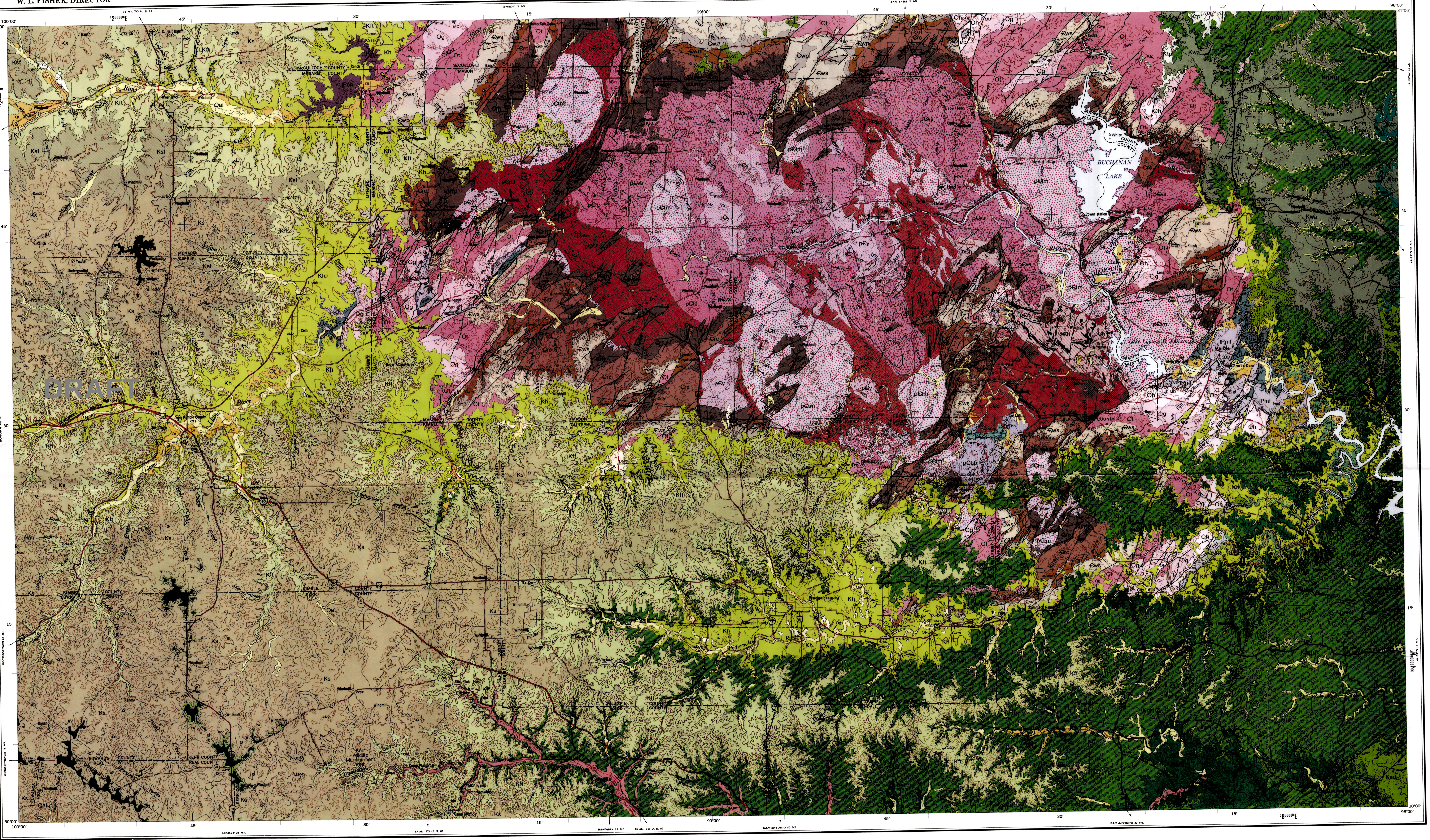
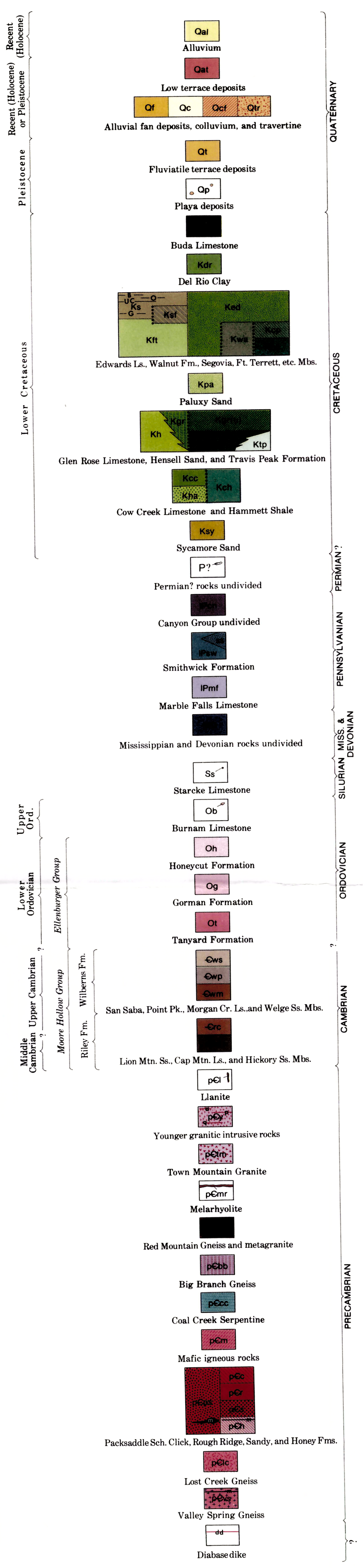
Appendix C

Llano Sheet – Geologic Atlas of Texas

THE UNIVERSITY OF TEXAS AT AUSTIN
BUREAU OF ECONOMIC GEOLOGY
W. L. FISHER, DIRECTOR



EXPLANATION

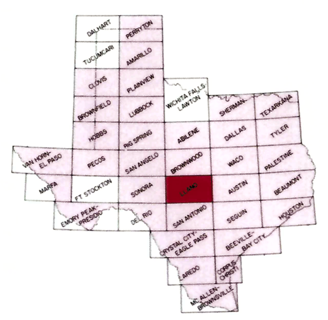


Prepared by the Army Map Service (AJSX), Corps of Engineers, U. S. Army, Washington, D. C. Compiled in 1954 by photogrammetric methods. Horizontal and vertical control by USC&GS and USGS. Aerial photography 1952-53. Photography field annotated, 1954.

10,000-meter Universal Transverse Mercator grid ticks, zone 14, shown in blue

Partially funded by Texas Department of Water Resources

LOCATION MAP



VIRGIL E. BARNES, PROJECT DIRECTOR
Geologic mapping mostly from sources shown on Index of Geologic Mapping and by V. E. Barnes with contributions gratefully acknowledged from Shell Development Company and Shell Oil Company. Map scribed by R. L. Dillon. Geological mapping reviewed by Austin Geological Society, Geologic Atlas Committee, Robert E. Boyer, Chairman, and Stephen E. Clabaugh (Department of Geological Sciences) and Ernest T. Baker, Jr., (U. S. Geological Survey).

Scale 1:250,000

5 0 5 10 15 20 Statute Miles
5 0 5 10 15 20 25 30 Kilometers
5 0 5 10 Nautical Miles

CONTOUR INTERVAL 100 FEET

TRANSVERSE MERCATOR PROJECTION

1980 MAGNETIC DECLINATION FOR CENTER OF THIS SHEET IS 8°48′E
MEAN ANNUAL CHANGE IS 5.33′ WESTWARD

INDEX OF GEOLOGIC MAPPING
Sources consulted include items in bibliography in "Index to Areal Geologic Maps in Texas, 1891-1961," by T. E. Brown (1963), Bureau of Economic Geology, The University of Texas at Austin. For references for areas A through RR and for other sources, see text.

GEOLOGIC ATLAS OF TEXAS, LLANO SHEET

VIRGIL EVERETT BARNES EDITION

REPRINTED 1986

APPENDIX R

SITE PREPARATION PLAN

SITE PREPARATION PLAN

FOR

TRAVIS COUNTY MUD NO. 22 WASTEWATER TREATMENT PLANT
DOMESTIC WASTEWATER PERMIT APPLICATION
FOR A
TEXAS LAND APPLICATION PERMIT
MAJOR AMENDMENT

JANUARY 2025

PREPARED BY

LJA ENGINEERING, INC.
7500 RIALTO BLVD. BUILDING II SUITE 100
AUSTIN, TEXAS 78735
(512) 439-4700

SITE PREPARATION PLAN

All site preparations will be made so that any potential site-specific limitations will be alleviated and suitability for the subsurface drip irrigation system will be ensured.

No restrictive horizons within the soil columns were discovered so no unusual design criteria are planned to compensate. Soil importation is not currently planned due to the results of the soil investigation, but the applicant plans to mine soil during project construction and may use that to enhance irrigation areas.

Minimal amounts of existing vegetation will be removed during installation of the subsurface drip irrigation system. Existing vegetation in open areas will be supplemented with Bermuda and winter rye grasses.

The applicant also plans to construct berms as necessary to spread and divert concentrated run-on around the irrigation areas. Refer to the site plan (Appendix I) for location of irrigation areas and demonstration that concentrated flows are routed around the proposed irrigation areas.

Leah Whallon

From: Lauren Crone <lcrone@lja.com>
Sent: Monday, March 17, 2025 11:45 AM
To: Leah Whallon
Subject: RE: Application to Amend Permit No. WQ0015201001; Travis County Municipal Utility District No. 22
Attachments: Update 1 NOD WQ0012501001_20250317.pdf; 5160 format Landowner Labels.docx; Municipal Disposal Amendment Spanish NORI.docx

Follow Up Flag: Follow up
Flag Status: Flagged

Leah,

Please see the NOD response attached. Let me know if you have any questions or need anything else.

Thank you,

Lauren Crone, P.E. I Senior Project Manager
CENTRAL TEXAS LAND DEVELOPMENT
O: 512.439.4700 I C: 512.971.7693
7500 Rialto Blvd. Building II, Suite 100 Austin, TX 78735
EMPLOYEE-OWNED. CLIENT FOCUSED.
www.lja.com

From: Leah Whallon <Leah.Whallon@Tceq.Texas.Gov>
Sent: Thursday, March 6, 2025 2:43 PM
To: Lauren Crone <lcrone@lja.com>
Cc: Daniel Ryan <dryan@lja.com>; john@carltonlawaustin.com
Subject: Application to Amend Permit No. WQ0015201001; Travis County Municipal Utility District No. 22

[EXTERNAL EMAIL]

Good Afternoon,

Please see the attached Notice of Deficiency letter dated March 6, 2025 requesting additional information needed to declare the application administratively complete. Please send the complete response by March 20, 2025.

Please let me know if you have any questions.

Thank you,

Leah Whallon
Texas Commission on Environmental Quality
Water Quality Division
512-239-0084
leah.whallon@tceq.texas.gov

How is our customer service? Fill out our online customer satisfaction survey at
www.tceq.texas.gov/customersurvey

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

March 14th, 2025

Leah Whallon
Applications Review and Processing Team
Water Quality Division – TCEQ, MC 148
12100 Park 35 Circle
Austin, Texas 78753

Re: Travis County MUD No. 22 Wastewater Treatment Plant
Proposed by Travis County Municipal Utility District No. 22 (CN605721349)
Application No. WQ0012501001
RN107010209
LJA Project No. A336-0403.501

Dear Rachel:

Please find the responses related to the permit application for Travis County MUD No. 22 WWTP received December 11th, 2024 below.

1. Administrative Report 1.0, Section 1
Please provide the check or ePay voucher number to confirm payment of the application fee.
Response: The fee was paid using the ePay system. The voucher is attached.

2. Administrative Report 1.0, Section 8.F
The plain language summaries reference wastewater is to be discharged, which is not authorized in the current permit. Please provide revised plain language summaries in English and Spanish to reflect the proposed effluent disposal method.
Response: The plain language summary has been updated to reflect the subsurface area drip dispersal system effluent disposal method.

3. Administrative Report 1.0, Section 9. Item E
The owner of the effluent disposal site is listed as Masonwood HP LTD, but no lease agreement was provided. Technical worksheet 3.3 lists the owner of the disposal site as Masonwood HP LTD and John and Sandra Hatchett. An effluent disposal lease is referenced in Appendix B, but the attachment included is a deed for the treatment facility site and a portion of the disposal site.
Please provide a revised page to list all owners of the disposal site properties in Section 9, Item E and attach lease agreements for all disposal site properties not owned by the applicant.
Response: The updated effluent lease has been attached to this response. All owners have been included and listed in Section 9.

4. Administrative Report 1.0, Section 13
The property boundaries on the USGS map must show the applicant's property boundaries to include only the areas owned or leased by the applicant.
Please provide a revised USGS map that shows and labels the applicant's property boundaries consistent with the deed or lease agreements in Section 9.
Response: A revised USGS Map has been provided that reflects the applicant's property boundaries.

512.439.4700
TBPELS F-1386
TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

5. Administrative Report 1.1, Section 1
The affected landowner map must show the applicant's property boundaries to include only the areas owned or leased by the applicant, consistent with the deed or lease agreements attached in Section 9. All properties adjacent to the applicant's property boundaries and disposal site boundaries must be shown and labeled on the landowner map and a cross-reference list of all current adjacent property owners must be included on a separate sheet.
Please provide an updated landowner map, cross-reference list, and the list formatted for mailing labels (Avery 5160) in a Microsoft Word document.
Response: An updated landowner map, property owner list, and mailing labels list has been attached to this response.

6. The following is a portion of the NORI which contains information relevant to your application. Please read it carefully and indicate if it contains any errors or omissions. The complete notice will be sent to you once the application is declared administratively complete.
APPLICATION. Travis County Municipal Utility District No. 22, 4301 Westbank Drive, Suite B-130, Austin, Texas 78746, has applied to the Texas Commission on Environmental Quality (TCEQ) to amend Texas Land Application Permit (TLAP) No. WQ0015201001 to authorize relocating the effluent disposal areas. The domestic wastewater treatment facility and disposal site are located at 16925 1/2 Lavondre Drive, approximately 3.2 miles west of the intersection of Hamilton Pool Road and State Highway 71, near the city of Bee Cave, in Travis County, Texas 78738. TCEQ received this application on February 25, 2025. The permit application will be available for viewing and copying at Bee Cave City Hall, 4000 Galleria Parkway, Bee Cave, in Travis County, Texas prior to the date this notice is published in the newspaper. The application, including any updates, and associated notices are available electronically at the following webpage: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications.
This link to an electronic map of the site or facility's general location is provided as a public courtesy and not part of the application or notice. For the exact location, refer to the application.
https://gisweb.tceq.texas.gov/LocationMapper/?marker=-98.02194,30.30833&level=18
Further information may also be obtained from Travis County Municipal Utility District No. 22 at the address stated above or by calling Ms. Lauren Crone, P.E., LJA Engineering, Inc., at 512-439-4700.
Response: The NORI is approved and considered complete.

512.439.4700
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TBPELS 10110501
www.LJA.com
7500 Rialto Boulevard, Building II, Suite 100, Austin, Texas 78735

7. The Public Involvement Plan (PIP) form item 5.e indicates more than 5 percent of the population speaks Spanish, requiring public notices in Spanish to be provided. After confirming the portion of the NORI above does not contain any errors or omissions, please use the attached template to translate the NORI into Spanish. Only the first and last paragraphs are unique to this application and require translation. Please provide the translated Spanish NORI in a Microsoft Word document.
Response: The NORI has been attached in a Microsoft word document to this notice.

Should you have any questions or need any additional information, please do not hesitate to call.

Sincerely,

Lauren Crone

Lauren Crone, P.E.

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

PLAIN LANGUAGE SUMMARY FOR TPDES OR TLAP PERMIT APPLICATIONS

ENGLISH TEMPLATE FOR TPDES or TLAP NEW/RENEWAL/AMENDMENT APPLICATIONS DOMESTIC WASTEWATER/STORMWATER

The following summary is provided for this pending water quality permit application being reviewed by the Texas Commission on Environmental Quality as required by 30 TAC Chapter 39. The information provided in this summary may change during the technical review of the application and is not a federal enforceable representation of the permit application.

Travis County Municipal Utility District No. 22 (CN605721349) proposes to operate Travis County MUD No. 22 WWTP (RN107010209), a 0.45MGD wastewater treatment plant. The facility will be located at approximately 3.2 miles West from the intersection of State Hwy 71 and Hamilton Pool Road off of Hamilton Pool Road, in Bee Cave, Travis County, Texas 78738. This is a new application to disperse 450,000 gallons per day of processed wastewater on an intermittent and flow-variable basis.

Discharges from the facility are expected to contain five-day carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), ammonia nitrogen (NH_3-N), total phosphorus (P), and Escherichia Coli. Domestic wastewater will be treated by a future WWTP consisting of a packaged single stage nitrification plant, including headworks (bar screening), aeration, clarification, chlorination, chlorine contact & aerobic digestion. Treated effluent will be stored in a holding tank for six days in the initial phase, three days in the interim phase and three days in the final phase prior to disposal using subsurface drip irrigation near the treatment plant on land owned by the applicant. Sludge will be disposed of by hauling off-site by a licensed hauler, to a permitted landfill.

LEASE AGREEMENT
(Effluent Disposal Lands)

THE STATE OF TEXAS	§	
	§	**KNOW ALL BY THESE PRESENTS:**
COUNTY OF TRAVIS	§	

THIS LEASE AGREEMENT ("*Lease*") is entered into effective March 5, 2019 (the "*Effective Date*") between **JPHD, Inc.**, a Texas corporation ("*JPHD*"); **JPH Capital, Ltd.**, a Texas limited partnership ("*JPH*"); **John Hatchett**; and **Sandra Hatchett** (collectively, "*Lessors*"); and **Travis County Municipal Utility District No. 22**, a conservation and reclamation district of the State of Texas (the "*Lessee*" or "*District*").

Recitals

WHEREAS, each of the Lessors are the owners of portions of that certain real property in Travis County, Texas more particularly described on **Exhibit "A"** attached hereto (the "*Property*");

WHEREAS, Permit No. WQ-0015301001, as issued by the Texas Commission on Environmental Quality ("*TCEQ*") and as may be transferred, amended, renewed or reissued (the "*Permit*"), authorizes the Permittee to dispose of treated wastewater effluent on the Property;

WHEREAS, Lessors and Lessee are parties to that certain "Agreement Relating to Wastewater Matters" simultaneously herewith (the "*Wastewater Agreement*") pursuant to which JPH, as permittee under the Permit, has agreed to transfer the Permit to Lessee, and pursuant to which Lessors agreed to lease the Property to Lessee for effluent disposal in accordance with the terms and conditions of the Permit; and

NOW, THEREFORE, in consideration of the foregoing premises and the mutual promises and agreements of the Parties contained in this Lease, the Parties agree as follows:

I.
LEASE

1.01 Lease. Lessors hereby lease the Property to Lessee for the authorized purposes set forth herein.

1.02 Reservation of Rights; Title; Quiet Possession. Lessors confirm that collectively they are the fee simple owners of the Property and have full power to lease the Property (or portion thereof owned by each Lessor) and any improvements thereon (collectively, the "*Leased Premises*") to Lessee. Lessors covenant that Lessee will peaceably hold and enjoy the Leased Premises during the term of this Lease, without interruption by Lessors or any person claiming by, through, or under Lessors. Lessors reserve all rights relating to the Property provided, however, Lessors shall not materially impair or interfere with: (i) Lessee's ability to comply with the terms and conditions of the Permit and any related regulatory obligations; or (ii) Lessee's rights to construct, operate, repair, maintain and repair wastewater conveyance, pumping, storage, disposal or irrigation improvements on the Leased Premises. Lessors agree that they will not, during the term of this Lease, grant any liens or easements or place any restrictions or encumbrances of any kind upon any portion of the Leased Premises that are not subordinate to Lessee's leasehold rights, including Lessee's rights to construct, operate, repair, maintain and repair wastewater conveyance, pumping, storage, disposal or irrigation improvements on the Leased Premises, unless such liens, easements, restrictions or encumbrances are approved by Lessee in writing, such approval not to be unreasonably conditioned delayed or withheld.

II.
USE

2.01 Authorized Uses. Lessors agree that Lessee may use and improve the Property for the construction, operation, replacement and maintenance of wastewater collection, treatment and disposal facilities; for the storage, transmission and surface and subsurface drip irrigation of wastewater effluent, and any other lawful use related thereto or to the Permit.

2.02 Construction Obligations. Nothing in this Lease Agreement shall obligate Lessee to construct any wastewater facilities on or within the Property.

2.03 Amendments to Property Description. Lessee agrees to cooperate with Lessors as necessary from time to time to amend the description of the Property to reflect any amendments to the authorized disposal lands under the Permit, so that the only lands subject to this Lease shall be those lands authorized for effluent disposal under the Permit that have not been conveyed in fee to Lessee. The Parties agree that the Lease shall terminate as to those portions of the Property that are conveyed to Lessee from time to time in accordance with the terms of the Wastewater Agreement.

2.04 Lessee Obligations. In connection with the exercise of its leasehold rights, Lessee agrees as follows:

(a) **Compliance with Laws**. Lessee will comply in all materials respects, at its sole cost, with all applicable federal, state and local laws, rules and regulations that are applicable to Lessee's activities under this Lease.

(b) **Property Damage and Personal Injury**. To the maximum extent authorized by Texas law, Lessee shall be responsible for any property damage and personal injury caused by Lessee, its agents or contractors arising from the exercise of Lessee's leasehold rights under this Lease.

III.
TERM/MODIFICATION/TERMINATION

3.01 Term. This Lease will begin on the Effective Date and remain in effect for ninety-nine (99) years (the "*Term*"); provided, however, that this Lease will automatically terminate as to portions of the Property upon their conveyance by any of the Lessors (or third parties) to Lessee in accordance with the terms of this Lease and the Wastewater Agreement. The parties shall amend the description of the Leased Premises from time to time upon conveyance of any portion of the Leased Premises to Lessee; however, in no event will the Leased Premises be amended to contain less (when combined with the portion(s) of the Property conveyed in fee to Lessee) than the acreage required under the Permit. Further, at such time as all of the lands to be provided with wastewater service within the District have been developed and fully built-out and all portions of the Property and facilities to be used for wastewater effluent disposal and related purposes have been conveyed to Lessee, Lessee shall upon receipt of written request from any Lessors seek to amend the Permit to reduce the permitted disposal authorization to an amount required to serve full development of the lands within the District. Upon final approval of such Permit amendment, the parties shall execute a written termination of this Lease as to any remaining Leased Premises no longer required for the wastewater effluent authorization under the amended Permit.

IV.

GENERAL PROVISIONS

4.01 Taxes. Lessors shall be responsible for all ad valorem taxes assessed against the Leased Premises according to the ownership of each Lessor. Lessee agrees to participate and cooperate in any protest of any appraised value of the Leased Premises if requested by any Lessor.

4.02 Binding on Successors\Recordation. The provisions of this Lease shall be considered covenants that run with the land and shall inure to the benefit of and be binding on the Parties and the irrespective heirs, legal representatives, successors and assigns. The Parties agree that this Lease itself may be recorded in the Official Public Documents of Travis County or a Memorandum of Lease may be prepared and recorded in the Official Public Documents of Travis County by any Party, with or without the other Parties' signature, in order to memorialize obligations of the Parties hereunder.

4.03 Severability. The provisions of this Lease are severable and, if any provision of this Lease is held to be invalid for any reason by a court or agency of competent jurisdiction, the remainder of this Lease will not be affected and this Lease will be construed as if the invalid portion had never been contained herein.

4.04 Assignment. The assignment of this Lease by any Party is prohibited without the prior written consent of the other Parties, such consent not to be unreasonably conditioned, delayed or withheld. All of the respective covenants, undertakings, and obligations of each of the Parties will bind that Party and will apply to and bind any successors or permitted assigns of that Party.

4.05 Cooperation. The Parties agree to cooperate at all times in good faith to effectuate the purposes and intent of this Lease.

4.06 Entire Agreement. This Lease contains the entire agreement of the Parties regarding the subject matter hereof and supersedes all prior or contemporaneous understandings or representations, whether oral or written, regarding the subject matter.

4.07 Amendments. Any amendment of this Lease must be in writing and will be effective if signed by the authorized representatives of the Parties.

4.08 Applicable Law; Venue. This Lease will be construed in accordance with Texas law. Venue for any action arising hereunder will be in Travis County, Texas.

4.09 Notices. Any notice given under this Lease must be in writing and may be given: (i) by depositing it with Federal Express or another delivery service guaranteeing "next day delivery", addressed to the Party to be notified and with all charges prepaid; or (ii) by personally delivering it to the Party, or any agent of the Party listed in this Lease. Notice given in any manner will be effective when received. For purposes of notice, the addresses of the Parties will, until changed as provided below, be as follows:

For Lessee:

TRAVIS COUNTY MUNICIPAL UTILITY DISTRICT NO. 22
c/o McLean & Howard, LLP
901 S. Mopac Expressway, Bldg. II, Ste. 225
Austin, Texas 78746

For Lessors:

A. Rick Hightower
Hightower & Associates
Attorneys At Law
Barton Oaks Plaza
901 South Mopac Expwy
Bldg 1 Ste 300
Austin, Texas 78746

Any Party may change its address to any other address within the United States of America by giving at least five (5) days' written notice to the other Parties. Any Party may, by giving at least five (5) days' written notice, designate additional parties to receive copies of notices under this Lease.

4.10 Exhibits. The following exhibits are attached to this Lease and incorporated herein by reference:

Exhibit A - Description of Property

4.11 Counterparts; Effect of Partial Execution. This Lease may be executed simultaneously in multiple counterparts, each of which will be deemed an original, but all of which will constitute the same instrument.

4.12 Authority. Each Party represents and warrants that it has the full right, power and authority to execute this Lease.

[The remainder of this page intentionally left blank.]

LESSORS:

JPH CAPITAL, LTD.,
a Texas limited partnership

By: JPH Enterprises, LLC,
its General Partner

By:
Name: John Hatchett
Title: President and General Manager

Date: 5/30/19

JPHD, INC.,
a Texas Corporation

By:
Name: John Hatchett
Title: President

Date: 5/30/19

JOHN HATCHETT:

John Hatchett

Date: 5/30/19

SANDRA HATCHETT:

Sandra Hatchett
Sandra Hatchett

Date: 5-30-19

<u>LESSEE</u>:

TRAVIS COUNTY MUNICIPAL UTILITY DISTRICT NO. 22:

By: ______________________

Name: Jonathan Concat

Title: President

Date: March 5, 2019

____
Secretary, Board of Directors

Exhibit "A"

Description of Property

LANDESIGN
SERVICES, INC.
1220 McNeil Road, Suite 200
Round Rock, Texas 78681
TBPLS Firm No. 10001800
512-238-7901 office

EXHIBIT " A "

METES AND BOUNDS DESCRIPTION

BEING 11.90 ACRES OF LAND, SURVEYED BY LANDESIGN SERVICES, INC., SITUATED IN THE SAMUEL WILDY SURVEY, ABSTRACT NO. 799, AND THE WILLIAM MCINTIRE SURVEY, ABSTRACT NO. 533, BOTH IN TRAVIS COUNTY, TEXAS AND BEING A PORTION OF THE REMAINDER OF A 264.377 ACRE TRACT OF LAND DESCRIBED IN A DEED TO BARRY D. JOHNSON, TRUSTEE OF MASONWOOD HP, LTD., AS RECORDED IN DOCUMENT NO. 2015164123, OF THE OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS (O.P.R.T.C.T.), AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

COMMENCING at a 1/2-inch rebar found in the North right-of-way line of Farm to Market Highway 3238 (FM 3238) (Hamilton Pool Road) (R.O.W. Varies) and also being the Southwest corner of a called 0.974 of one acre tract of land described in a deed to WTF Harrell Property Management, LLC recorded in Document No. 2014101366 of the O.P.R.T.C.T. and an external corner of said 264.377 acre tract, from which a 1/2-inch rebar found for the Southeast corner of said 0.974 of one acre tract and an external corner of a called 7.967 acre tract of land described in deed to James C. Kuykendall, Jr., recorded in Document No. 2006180878 of the O.P.R.T.C.T., bears South 76°31'01" East a distance of 114.36 feet and from said Southwest corner of the 0.974 of one acre tract a 1/4-inch pipe found in the said North right-of-way line of FM 3238 and the South line of said 264.377 acre tract, bears North 75°13'03" West a distance of 160.45 feet;

THENCE North 27°52'14" East with the common line of said 264.377 acre tract and said 0.974 of one acre tract, a distance of 10.25 feet to a Calculated Point for the **POINT OF BEGINNING** of the herein described tract;

THENCE over and across said 264.377 acre tract, the following thirteen (13) courses and distances:

1. **North 75°56'18" West** a distance of **308.72** feet to a Calculated Point;

2. **South 82°36'58" West** a distance of **29.34** feet to a Calculated Point;

3. **North 30°08'51" West** a distance of **108.74** feet to a Calculated Point;

4. **North 04°56'35" West** a distance of **39.52** feet to a Calculated Point;

5. **North 06°13'28" East** a distance of **76.77** feet to a Calculated Point;
6. **North 11°59'26" East** a distance of **60.62** feet to a Calculated Point;
7. **North 15°22'34" East** a distance of **157.85** feet to a Calculated Point;
8. **North 15°53'50" East** a distance of **213.85** feet to a Calculated Point;
9. **North 07°16'41" East** a distance of **105.94** feet to a Calculated Point;
10. **North 01°55'24" East** a distance of **92.54** feet to a Calculated Point;
11. **North 12°09'18" East** a distance of **102.95** feet to a Calculated Point;
12. **North 31°13'39" East** a distance of **131.04** feet to a Calculated Point; and
13. **South 59°09'29" East** a distance of **191.87** feet to a Calculated Point for an interior corner of said 264.377 acre tract and an exterior corner of a remainder of a called 318.405 acre tract of land described in deed to Masonwood HP, LTD., recorded in Document No. 2017038374 of the O.P.R.T.C.T.;

THENCE **South 59°09'29" East** with the common line of said 264.377 acre tract and said 318.405 acre tract, a distance of **469.74** feet to a Calculated Point in the common line of said 264.377 acre tract and said 7.967 acre tract, from which a 1/4-inch pipe found for the Northwest corner of said 7.967 acre tract and interior corner of said 318.405 acre tract bears, North 28°05'35" East a distance of 83.13 feet;

THENCE **South 28°05'35" West** with the common line of said 264.377 acre tract and said 7.967 acre tract, a distance of **500.39** feet to a 1/2-inch rebar found for the Northwest corner of said 0.974 of one acre tract;

THENCE **South 27°52'14" West** with the common line of said 264.377 acre tract and said 0.974 of one acre tract, a distance of **370.78** feet to the **POINT OF BEGINNING** and containing 11.90 acres of land, more or less.

This project is referenced for all and coordinate basis to the Texas Coordinate System, North American Datum of 1983 (NAD83 - 2011 adjustment), Central Zone (4203).

Distances and areas shown hereon are surface values represented in U.S. survey feet based on a grid-to-surface combined adjustment factor of 1.0000925.

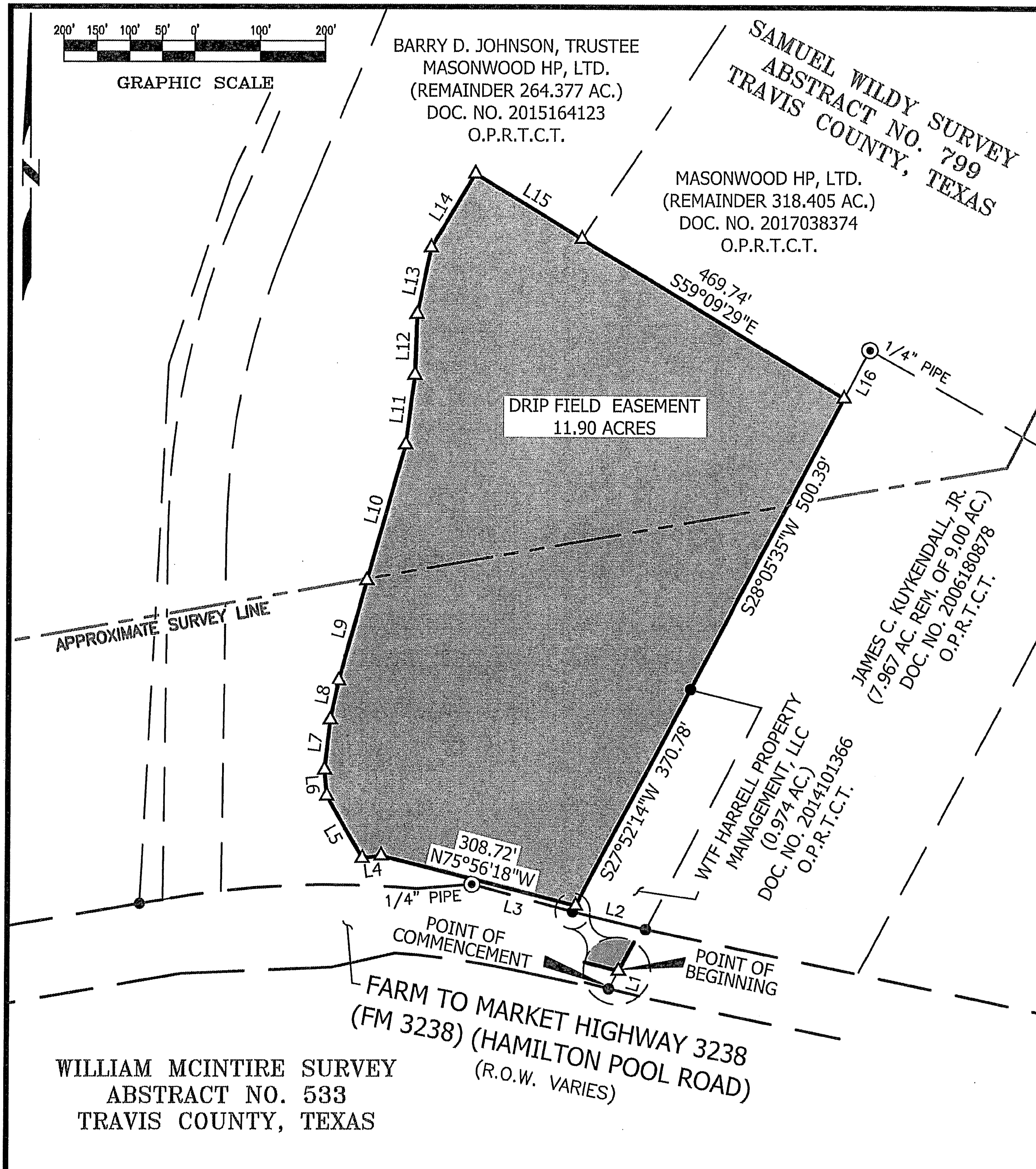
This property description was prepared from an on-the-ground survey performed under my supervision and is accompanied by a separate plat of even date. The field work was completed in August 2016.

04/16/2019

Travis S. Tabor
Registered Professional Land Surveyor
State of Texas No. 6428

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

Job Number: 321-15-2
Attachments: CAD Drawing: L:\Hatchett 923\DWGS\Provence Esmts\Provence DF 5 Esmt.dwg



JOB NUMBER: 321-15-2		DATE: 04/15/2019	
PROJECT NAME: HATCHETT 923			
DRAWING NAME: PROVENCE DF 5 ESMT.DWG			
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS			
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 5 ESMT.DOC			
RPLS: TST	TECH: HAS	PARTY CHIEF: N/A	CHK BY: TST
SHEET 04 of 05	FIELDBOOKS N/A		SCALE:1"= 200'

LANDESIGN
SERVICES, INC.
LSI

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

Line Table		
Line #	Direction	Length
L1	N27° 52' 14"E	10.25'
L2	S76° 31' 01"E	114.36'
L3	N75° 13' 03"W	160.45'
L4	S82° 36' 58"W	29.34'
L5	N30° 08' 51"W	108.74'
L6	N04° 56' 35"W	39.52'
L7	N06° 13' 28"E	76.77'
L8	N11° 59' 26"E	60.62'
L9	N15° 22' 34"E	157.85'
L10	N15° 53' 50"E	213.85'
L11	N07° 16' 41"E	105.94'
L12	N01° 55' 24"E	92.54'
L13	N12° 09' 18"E	102.95'
L14	N31° 13' 39"E	131.04'
L15	S59° 09' 29"E	191.87'
L16	N28° 05' 35"E	83.13'

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

04/16/2019

THIS PROJECT IS REFERENCED FOR ALL BEARING AND COORDINATE BASIS TO THE TEXAS STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83 – 2011 ADJUSTMENT), CENTRAL ZONE (4203).

SURFACE DISTANCES AND SCALE FACTOR:
DISTANCES AND AREAS SHOWN HEREON ARE SURFACE VALUES REPRESENTED IN U.S. SURVEY FEET BASED ON A GRID-TO-SURFACE COMBINED ADJUSTMENT FACTOR OF 1.0000925

LEGEND

●	1/2" REBAR FOUND (OR AS NOTED)
◉	1/4" PIPE FOUND (OR AS NOTED)
△	CALCULATED POINT NOT SET
O.P.R.T.C.T.	OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS
R.P.R.T.C.T.	REAL PROPERTY RECORDS OF TRAVIS COUNTY, TEXAS

JOB NUMBER: 321-15-2 | DATE: 04/15/2019
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METES AND BOUNDS FILE PATH:
L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 5 ESMT.DOC
RPLS: TST | TECH: HAS | PARTY CHIEF: N/A | CHK BY: TST
SHEET 05 of 05 | FIELDBOOKS N/A | SCALE:1"= 200'

LSI
LANDESIGN
SERVICES, INC.
1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

LANDESIGN
SERVICES, INC.
1220 McNeil Road, Suite 200
Round Rock, Texas 78681
TBPLS Firm No. 10001800
512-238-7901 office

EXHIBIT "A "

METES AND BOUNDS DESCRIPTION

BEING 23.31 ACRES OF LAND, SURVEYED BY LANDESIGN SERVICES, INC., SITUATED IN THE E. HALLMAN SURVEY, ABSTRACT NO. 2245 AND THE J. MOAT SURVEY, ABSTRACT NO. 559, BOTH IN TRAVIS COUNTY, TEXAS AND BEING A PORTION OF THE REMAINDER OF A 129.55 ACRE TRACT OF LAND DESCRIBED IN A DEED TO JPH CAPITAL, LTD., AS RECORDED IN DOCUMENT NO. 2004153385, DOCUMENT NO. 2004153386, DOC. NO. 2004153387, DOCUMENT NO. 2004153388 AND DOCUMENT NO. 2004153389 ALL OF THE OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS (O.P.R.T.C.T.), AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING at a 1/2-inch rebar found for the Southeast corner of said 129.55 acre tract, the Southwest corner of a called 147.29 acre tract of land described as Tract 20 in a deed to Nash Sweetwater, LLC, as recorded in Document No. 2015050284 of the O.P.R.T.C.T. and in the North line of Lot 26, Block A, DESTINY HILLS SECTION TWO, a subdivision of record in Document No. 201400230 of the O.P.R.T.C.T;

THENCE **South 40°41'53" West** with the South line of said 129.55 acre tract and said North line of Lot 26, at a distance of 254.81 feet passing a 1/2-inch rebar found for the Northwest corner of said Lot 26 and the Northeast corner of Lot 25, said Block A and continuing for a total distance of **283.79** feet to a 1/2-inch rebar with cap marked "LANDESIGN" found for the Southeast corner of Lot 2, Block J, PROVENCE PHASE 1, SECTION 1, a subdivision of record in Document No. 201900014 of the O.P.R.T.C.T. and also being in the North line of said Lot 25, from which a 1/2-inch rebar found for the Northwest corner of said Lot 25 and the Northeast corner of Lot 24, said Block A, bears South 40°41'53" West a distance of 418.41 feet;

THENCE **North 49°18'07" West** over and across said 129.55 acre tract and with the East line of said Lot 2, a distance of **50.65** feet to a 1/2-inch rebar with cap marked "LANDESIGN" found for an external corner of said Lot 2, from which a 1/2-inch rebar with cap marked "LANDESIGN" found for an external corner of said Lot 2, bears South 44°16'56" West a distance of 80.03 feet;

THENCE continuing over and across said 129.55 acre tract, the following twenty (20) courses and distances:

1. **North 19°57'59" East** a distance of **80.03** feet to a Calculated Point;

2. **North 04°20'58" West** a distance of **80.03** feet to a Calculated Point;

3. **North 73°29'34" East** a distance of **51.15** feet to a Calculated Point;

4. **North 28°39'54" West** a distance of **96.32** feet to a Calculated Point;

5. **North 41°15'31" West** a distance of **126.32** feet to a Calculated Point;

6. **South 48°44'29" West** a distance of **34.99** feet to a Calculated Point;

7. **North 41°15'31" West** a distance of **147.75** feet to a Calculated Point;

8. Along a curve to the **Left** having a radius of **505.00** feet, an arc length of **252.65** feet, a delta angle of **28°39'52"**, and a chord which bears **North 55°35'27" West** a distance of **250.02** feet to a Calculated Point;

9. **North 69°55'21" West** a distance of **321.11** feet to a Calculated Point;

10. **North 55°54'00" West** a distance of **53.33** feet to a Calculated Point;

11. **North 35°08'45" West** a distance of **56.74** feet to a Calculated Point;

12. **North 33°48'13" West** a distance of **649.40** feet to a Calculated Point;

13. Along a curve to the **Right** having a radius of **95.00** feet, an arc length of **20.40** feet, a delta angle of **12°18'03"**, and a chord which bears **North 27°39'11" West** a distance of **20.36** feet to a Calculated Point;

14. **North 21°30'10" West** a distance of **596.23** feet to a Calculated Point;

15. **North 27°47'41" West** a distance of **112.14** feet to a Calculated Point;

16. **North 40°05'37" West** a distance of **99.34** feet to a Calculated Point;

17. **North 46°53'27" West** a distance of **147.40** feet to a Calculated Point;

18. **North 53°16'44" West** a distance of **43.45** feet to a Calculated Point;

19. **North 22°39'59" West** a distance of **205.38** feet to a Calculated Point; and

20. **North 38°13'26" East** a distance of **163.33** feet to a Calculated Point in the common line of said 129.55 acre tract and said 147.29 acre tract, from which a rock mound found for the Northeast corner of said 129.55 acre tract and an external corner of said 147.29 acre tract, bears North 51°46'34" West a distance of 441.66 feet, from said rock mound a 1/2-inch rebar found bears South 56°07'21" East a distance of 6.83 feet;

THENCE with the common line of said 129.55 acre tract and said 147.29 acre tract, the following twenty (20) courses and distances:

1. **South 51°46'34" East** a distance of **899.90** feet to a rock mound found;
2. **South 38°19'44" West** a distance of **108.09** feet to a cotton spindle found;
3. **South 35°24'51" East** a distance of **401.75** feet to a 1/2-inch rebar found;
4. **South 35°55'42" East** a distance of **264.42** feet to a 1/2-inch rebar found;
5. **South 35°50'34" East** a distance of **417.75** feet to a 60d nail found;
6. **South 41°56'11" East** a distance of **63.62** feet to a live oak tree;
7. **South 49°40'00" East** a distance of **58.47** feet to a 1/2-inch rebar found;
8. **South 43°45'46" East** a distance of **53.48** feet to a 1/2-inch rebar found;
9. **South 35°56'53" East** a distance of **117.99** feet to a 1/2-inch rebar found;
10. **South 32°49'25" East** a distance of **20.35** feet to a 1/2-inch rebar found;
11. **South 29°37'25" East** a distance of **45.51** feet to a fence corner post found;
12. **South 27°28'25" East** a distance of **47.30** feet to a 1/2-inch rebar found;
13. **South 23°17'30" East** a distance of **91.30** feet to a 17" live oak tree;
14. **South 25°42'37" East** a distance of **20.43** feet to a 1/2-inch rebar found;
15. **South 28°28'37" East** a distance of **61.27** feet to a 60d nail found in a cedar tree;
16. **South 25°00'37" East** a distance of **51.27** feet to a 1/2-inch rebar found;
17. **South 29°47'37" East** a distance of **59.98** feet to a 1/2-inch rebar found;
18. **South 28°16'37" East** a distance of **67.88** feet to a 60d nail found in the side of a live oak tree;
19. **South 32°15'37" East** a distance of **78.09** feet to a 1/2-inch rebar found; and

20. **South 45°32’37” East** a distance of **135.17** feet to the **POINT OF BEGINNING** and containing 23.31 acres of land, more or less.

This project is referenced for all bearing and coordinate basis to the Texas State Plane Coordinate System, North American Datum of 1983 (NAD83 - 2011 adjustment), Central Zone (4203).

Distances and areas shown hereon are surface values represented in U.S. survey feet based on a grid-to-surface combined adjustment factor of 1.0000925.

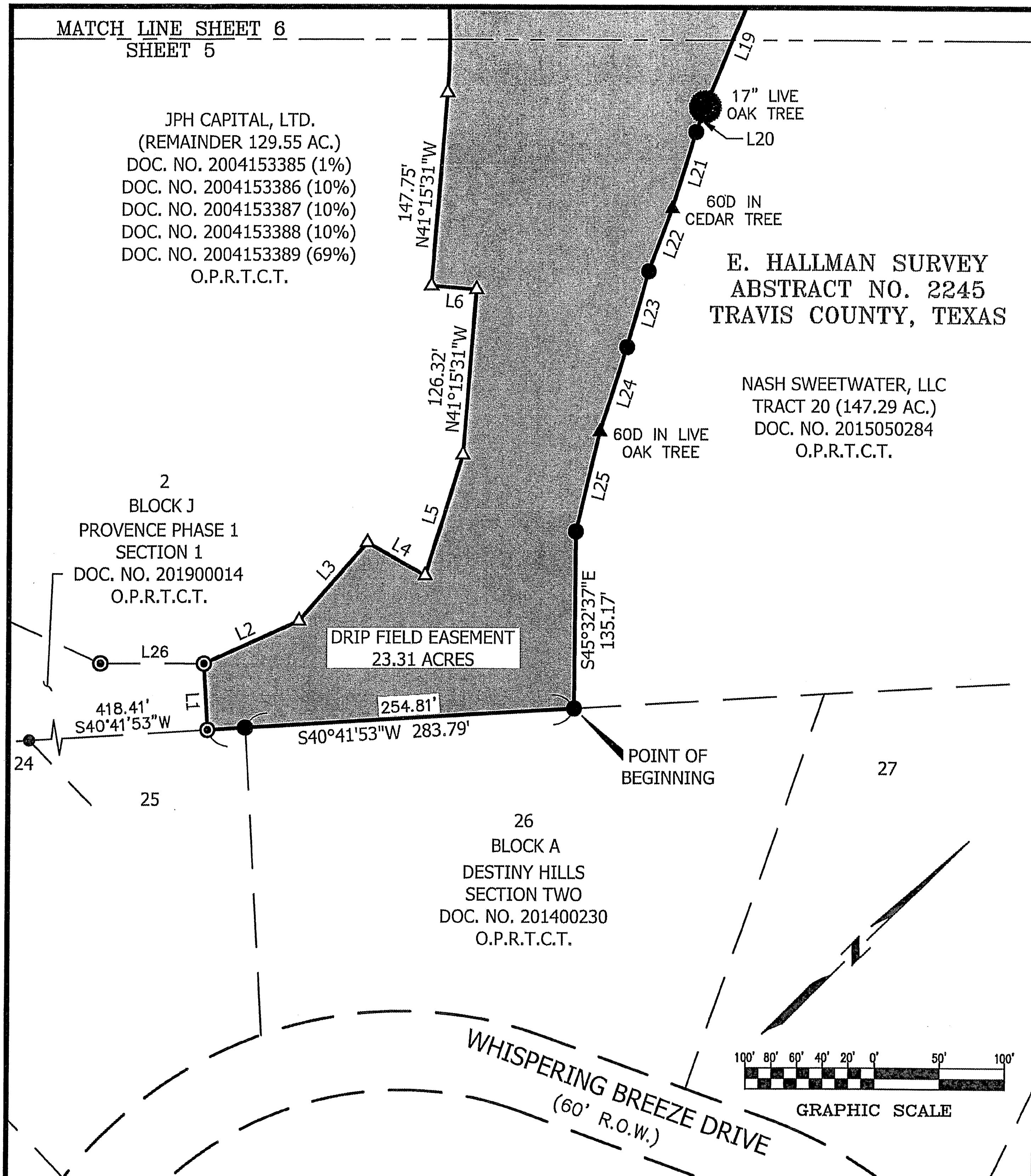
This property description was prepared from an on-the-ground survey performed under my supervision and is accompanied by a separate plat of even date. The field work was completed in August 2016.

04/16/2019

Travis S. Tabor
Registered Professional Land Surveyor
State of Texas No. 6428

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

Job Number: 321-15-2
Attachments: CAD Drawing: L:\Hatchett 923\DWGS\Provence Esmts\Provence DF 6.dwg

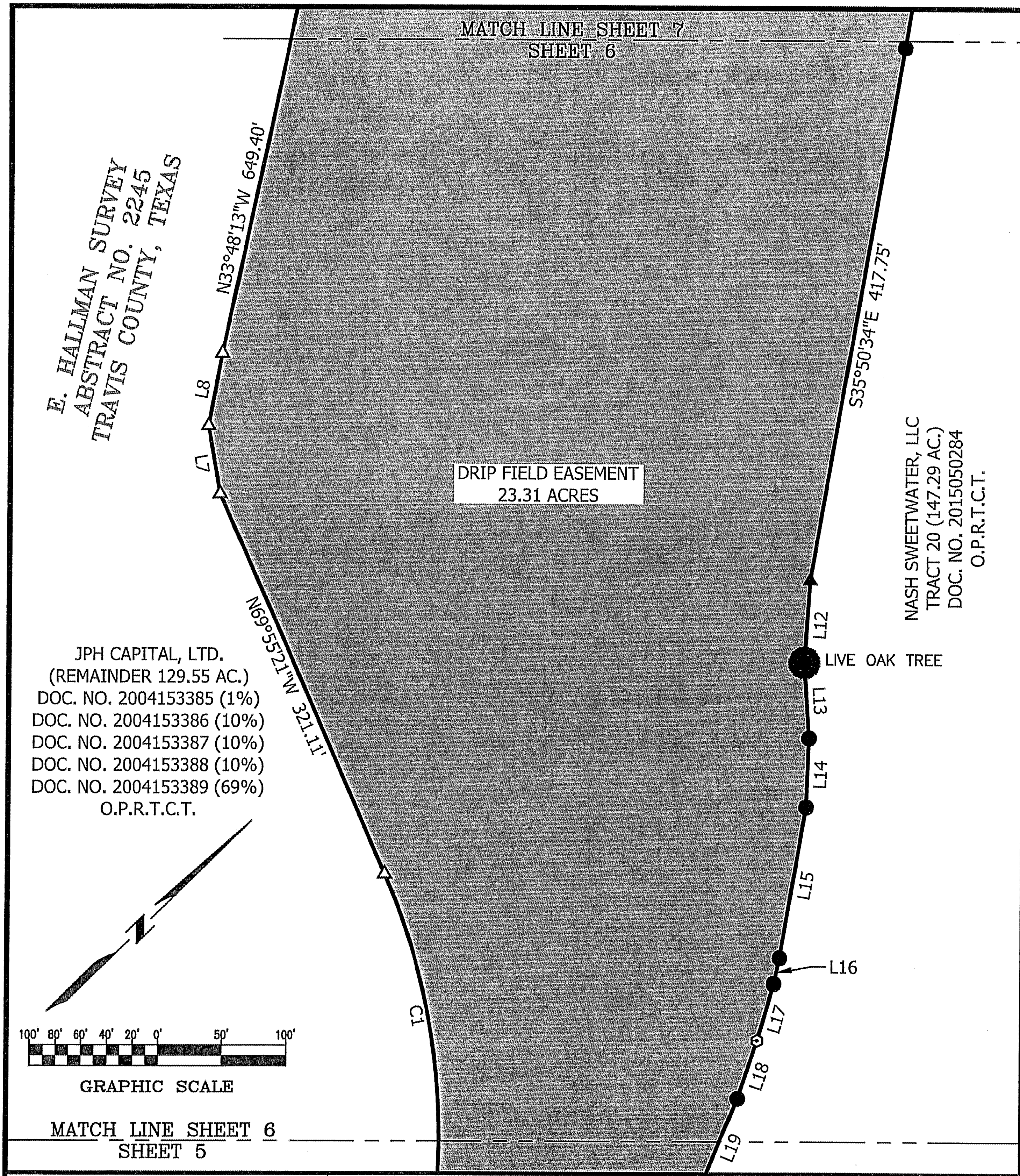


JOB NUMBER: 321-15-2		DATE: 04/11/2019	
PROJECT NAME: HATCHETT 923			
DRAWING NAME: PROVENCE DF 6.DWG			
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS			
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 6.DOC			
RPLS: TST	TECH: HAS	PARTY CHIEF: N/A	CHK BY: TST
SHEET 05 of 09	FIELDBOOKS N/A	SCALE:1"= 100'	

LANDESIGN SERVICES, INC.

LSI

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

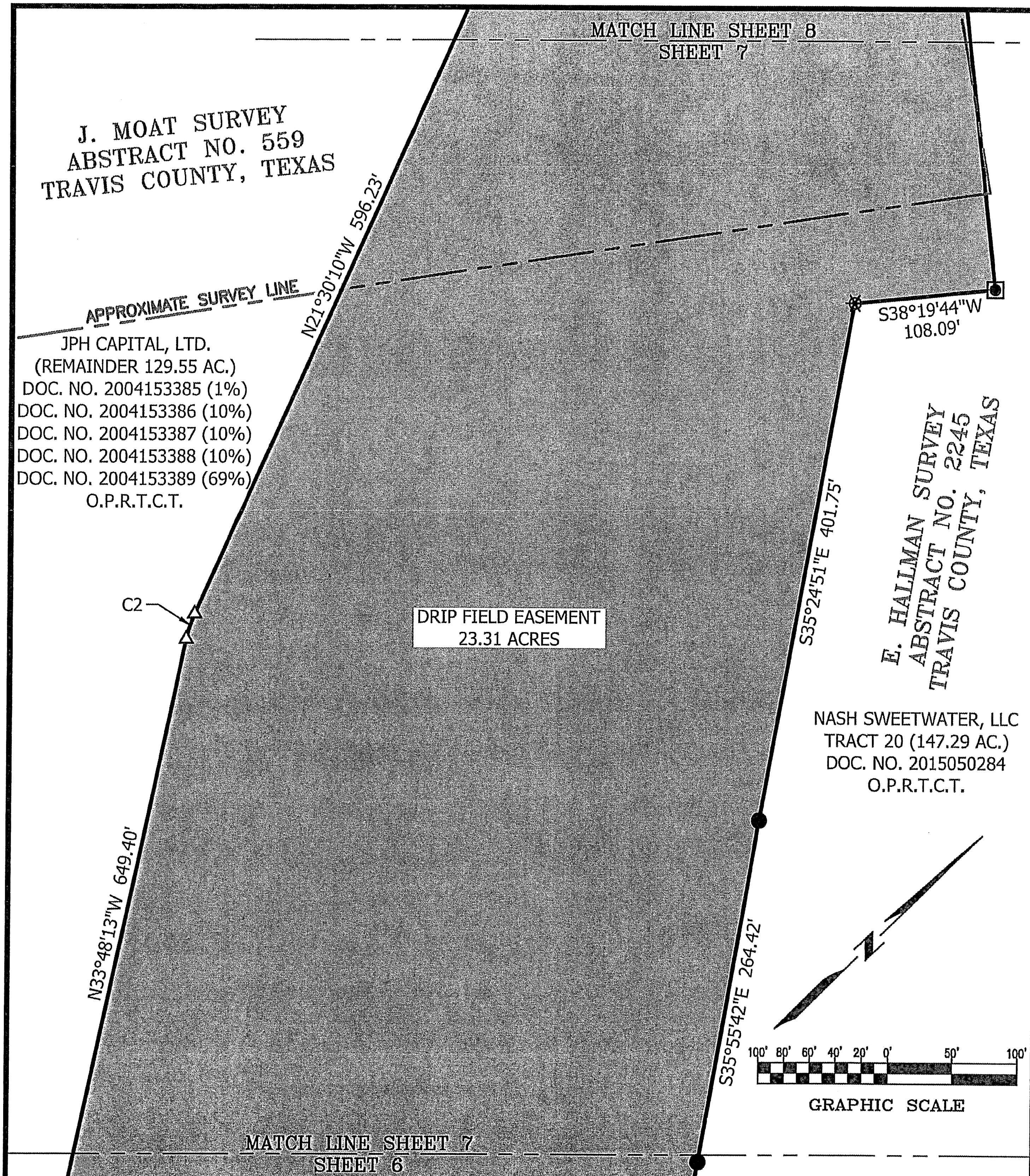


JOB NUMBER: 321-15-2	DATE: 04/11/2019
PROJECT NAME: HATCHETT 923	
DRAWING NAME: PROVENCE DF 6.DWG	
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS	
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 6.DOC	
RPLS: TST / TECH: HAS / PARTY CHIEF: N/A	CHK BY: TST
SHEET 06 of 09 / FIELDBOOKS N/A	SCALE:1"= 100'

LSI

LANDESIGN SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901



JOB NUMBER: 321–15–2 | DATE: 04/11/2019

PROJECT NAME: HATCHETT 923

DRAWING NAME: PROVENCE DF 6.DWG

DRAWING FILE PATH:
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METES AND BOUNDS FILE PATH:
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RPLS: TST | TECH: HAS | PARTY CHIEF: N/A | CHK BY: TST

SHEET 07 of 09 | FIELDBOOKS N/A | SCALE: 1"= 100'

LSI

LANDESIGN
SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
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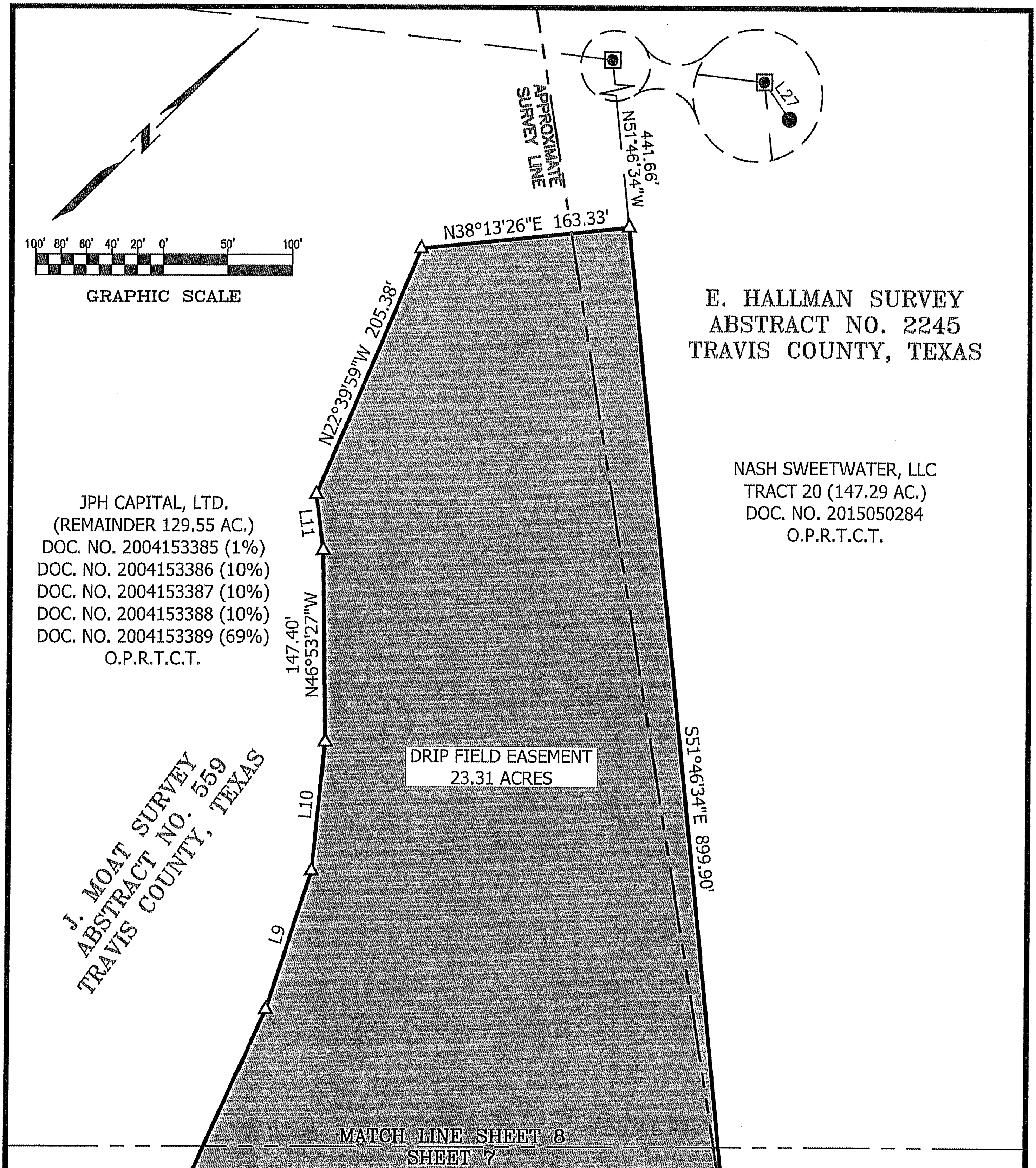

JOB NUMBER: 321-15-2 | DATE: 04/11/2019

PROJECT NAME: HATCHETT 923

DRAWING NAME: PROVENCE DF 6.DWG

DRAWING FILE PATH:
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METES AND BOUNDS FILE PATH:
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RPLS: TST | TECH: HAS | PARTY CHIEF: N/A | CHK BY: TST

SHEET 08 of 09 | FIELDBOOKS N/A | SCALE:1"= 100'

LSI

LANDESIGN
SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

Curve Table					
Curve #	Radius	Length	Delta	Chord Bearing	Chord
C1	505.00'	252.65'	28°39'52"	N55° 35' 27"W	250.02'
C2	95.00'	20.40'	12°18'03"	N27° 39' 11"W	20.36'

Line Table		
Line #	Direction	Length
L1	N49° 18' 07"W	50.65'
L2	N19° 57' 59"E	80.03'
L3	N04° 20' 58"W	80.03'
L4	N73° 29' 34"E	51.15'
L5	N28° 39' 54"W	96.32'
L6	S48° 44' 29"W	34.99'
L7	N55° 54' 00"W	53.33'
L8	N35° 08' 45"W	56.74'
L9	N27° 47' 41"W	112.14'
L10	N40° 05' 37"W	99.34'
L11	N53° 16' 44"W	43.45'
L12	S41° 56' 11"E	63.62'
L13	S49° 40' 00"E	58.47'
L14	S43° 45' 46"E	53.48'
L15	S35° 56' 53"E	117.99'
L16	S32° 49' 25"E	20.35'
L17	S29° 37' 25"E	45.51'
L18	S27° 28' 25"E	47.30'
L19	S23° 17' 30"E	91.30'
L20	S25° 42' 37"E	20.43'

Line Table		
Line #	Direction	Length
L21	S28° 28' 37"E	61.27'
L22	S25° 00' 37"E	51.27'
L23	S29° 47' 37"E	59.98'
L24	S28° 16' 37"E	67.88'
L25	S32° 15' 37"E	78.09'
L26	S44° 16' 56"W	80.03'
L27	S56° 07' 21"E	6.83'

04/16/2019

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

THIS PROJECT IS REFERENCED FOR ALL BEARING AND COORDINATE BASIS TO THE TEXAS STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83 – 2011 ADJUSTMENT), CENTRAL ZONE (4203).

SURFACE DISTANCES AND SCALE FACTOR:
DISTANCES AND AREAS SHOWN HEREON ARE SURFACE VALUES REPRESENTED IN U.S. SURVEY FEET BASED ON A GRID-TO-SURFACE COMBINED ADJUSTMENT FACTOR OF 1.0000925

LEGEND

●	1/2" REBAR FOUND (OR AS NOTED)
◎	1/2" REBAR WITH CAP MARKED "LANDESIGN" FOUND (OR AS NOTED)
▣	ROCK MOUND FOUND
▲	60D NAIL FOUND (OR AS NOTED)
	COTTON SPINDLE FOUND
	FENCE CORNER POST FOUND
△	CALCULATED POINT NOT SET
O.P.R.T.C.T.	OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS
R.P.R.T.C.T.	REAL PROPERTY RECORDS OF TRAVIS COUNTY, TEXAS

JOB NUMBER: 321-15-2 | DATE: 04/11/2019
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RPLS: TST | TECH: HAS | PARTY CHIEF: N/A | CHK BY: TST
SHEET 09 of 09 | FIELDBOOKS N/A | SCALE: 1"= 100'

LSI
LANDESIGN
SERVICES, INC.
1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

LANDESIGN
SERVICES, INC.
1220 McNeil Road, Suite 200
Round Rock, Texas 78681
TBPLS Firm No. 10001800
512-238-7901 office

EXHIBIT "A "

METES AND BOUNDS DESCRIPTION

BEING 20.03 ACRES OF LAND, SURVEYED BY LANDESIGN SERVICES, INC., SITUATED IN THE SAMUEL WILDY SURVEY, ABSTRACT NO. 799 AND THE WILLIS FAWCETT, ABSTRACT NO. 298, BOTH IN TRAVIS COUNTY, TEXAS AND BEING A PORTION OF THE REMAINDER OF A 333.609 ACRE TRACT OF LAND DESCRIBED AS TRACT 1 IN A DEED TO JPH CAPITAL, LTD., AS RECORDED IN DOCUMENT NO. 2004153390 AND A PORTION OF THE REMAINDER OF A CALLED 264.377 ACRE TRACT OF LAND DESCRIBED IN DEED TO BARRY D. JOHNSON, TRUSTEE MASONWOOD HP, LTD., AS RECORDED IN DOCUMENT NO. 2015164123 BOTH OF THE OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS (O.P.R.T.C.T.), AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

COMMENCING at a 1/2-inch rebar with cap marked "LANDESIGN" found in the South terminus of Lavonde Drive (70' R.O.W.) as shown on the PROVENCE PHASE 1, SECTION 1 plat of record in Document No. 201900014 of the O.P.R.T.C.T., from which a 1/2-inch rebar with cap marked "LANDESIGN" found for the North terminus and in the South line of Lot 1, Block J, said PROVENCE PHASE 1, SECTION 1, hereinafter called "Point A", bears North 29°49'56" East a distance of 70.00 feet;

THENCE North 77°10'17" West over and across said 333.609 acre tract, a distance of 1155.96 feet to a Calculated Point for the **POINT OF BEGINNING** of the herein described tract;

THENCE over and across said 333.609 acre tract and said 264.377 acre tract, the following thirty-five (35) courses and distances:

1. **North 83°49'57" West** a distance of **544.31** feet to a Calculated Point;
2. **North 71°31'48" West** a distance of **46.36** feet to a Calculated Point;
3. **North 53°07'45" West** a distance of **202.87** feet to a Calculated Point;
4. **North 08°01'07" East** a distance of **632.49** feet to a Calculated Point;
5. **North 24°59'25" East** a distance of **68.97** feet to a Calculated Point;

6. **North 17°25'39" West** a distance of **200.04** feet to a Calculated Point;

7. **North 45°14'44" West** a distance of **86.54** feet to a Calculated Point;

8. **North 02°03'19" West** a distance of **208.50** feet to a Calculated Point;

9. **North 88°18'49" East** a distance of **146.75** feet to a Calculated Point;

10. **South 79°43'20" East** a distance of **120.69** feet to a Calculated Point;

11. **South 79°55'38" East** a distance of **59.23** feet to a Calculated Point;

12. **South 78°22'31" East** a distance of **117.08** feet to a Calculated Point;

13. **South 87°26'43" East** a distance of **116.23** feet to a Calculated Point;

14. **North 89°13'59" East** a distance of **97.93** feet to a Calculated Point;

15. **South 88°54'52" East** a distance of **120.09** feet to a Calculated Point;

16. **South 87°15'32" East** a distance of **114.87** feet to a Calculated Point;

17. **South 85°07'38" East** a distance of **107.43** feet to a Calculated Point;

18. **South 81°35'03" East** a distance of **30.29** feet to a Calculated Point;

19. **South 71°56'35" East** a distance of **45.60** feet to a Calculated Point;

20. **South 19°27'25" West** a distance of **49.99** feet to a Calculated Point;

21. **South 69°55'35" East** a distance of **85.23** feet to a Calculated Point;

22. **South 04°50'00" West** a distance of **130.18** feet to a Calculated Point, from which said "Point A", bears South 32°47'10" East a distance of 1478.77 feet;

23. **North 90°00'00" West** a distance of **200.00** feet to a Calculated Point;

24. **North 00°00'00" East** a distance of **23.97** feet to a Calculated Point;

25. **North 90°00'00" West** a distance of **50.00** feet to a Calculated Point;

26. **South 80°46'07" West** a distance of **95.31** feet to a Calculated Point;

27. **South 50°58'28" West** a distance of **193.30** feet to a Calculated Point;

28. **South 22°05'27" West** a distance of **8.76** feet to a Calculated Point;

29. **South 00°18'59" West** a distance of **128.19** feet to a Calculated Point;

30. **North 90°00'00" East** a distance of **24.07** feet to a Calculated Point;

31. **South 00°01'16" East** a distance of **303.35** feet to a Calculated Point;

32. **South 03°13'30" East** a distance of **61.25** feet to a Calculated Point;

33. **South 07°34'00" East** a distance of **61.75** feet to a Calculated Point;

34. **South 11°54'30" East** a distance of **61.57** feet to a Calculated Point; and

35. **South 15°51'23" East** a distance of **324.31** feet to the **POINT OF BEGINNING** and containing 20.03 acres of land, more or less.

This project is referenced for all bearing and coordinate basis to the Texas State Plane Coordinate System, North American Datum of 1983 (NAD83 - 2011 adjustment), Central Zone (4203).

Distances and areas shown hereon are surface values represented in U.S. survey feet based on a grid-to-surface combined adjustment factor of 1.0000925.

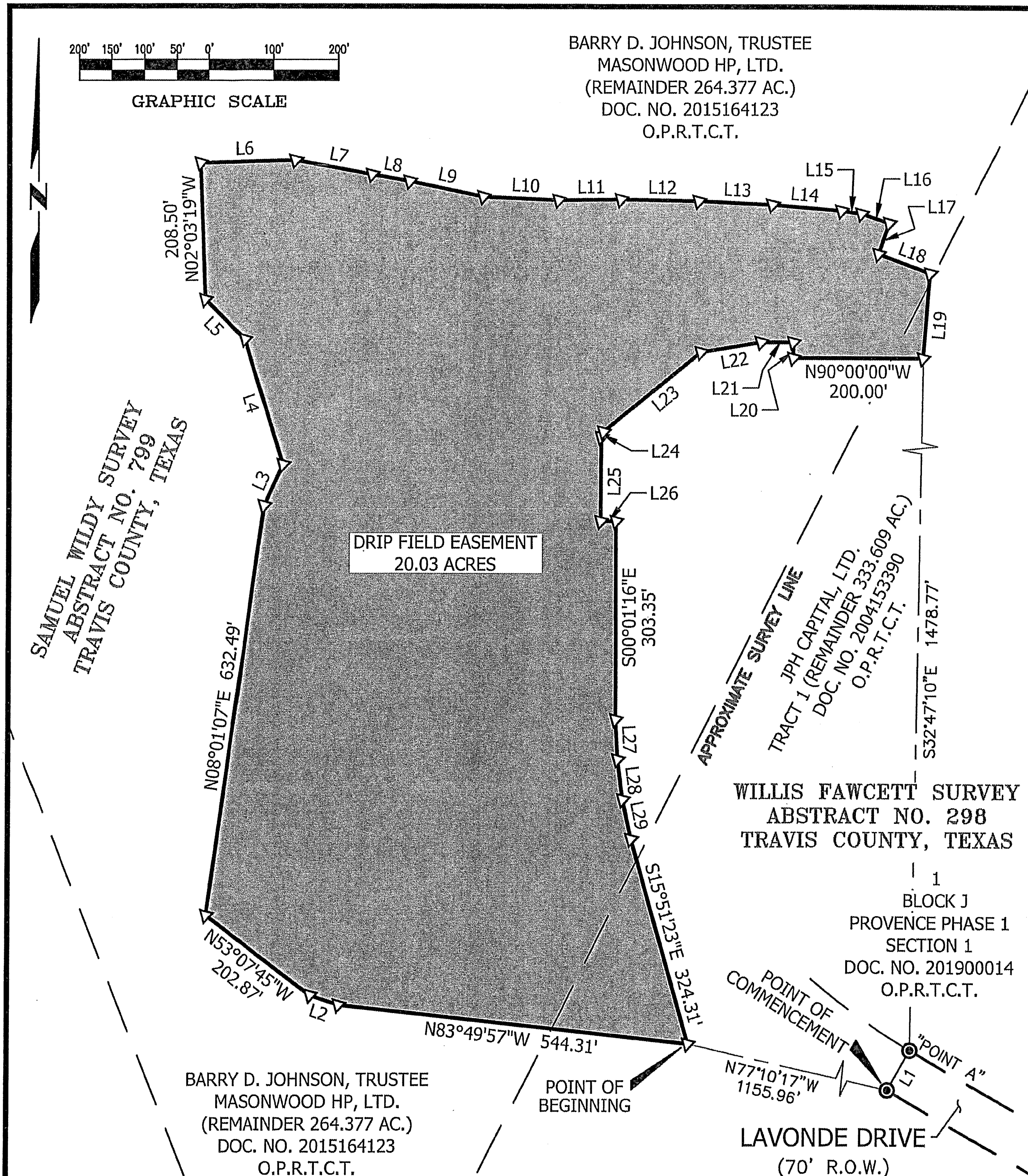
This property description was prepared from an on-the-ground survey performed under my supervision and is accompanied by a separate plat of even date. The field work was completed in August 2016.

04/16/2019

Travis S. Tabor
Registered Professional Land Surveyor
State of Texas No. 6428

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

Job Number: 321-15-2
Attachments: CAD Drawing: L:\Hatchett 923\DWGS\Provence Esmts\Provence DF 3.dwg



JOB NUMBER: 321-15-2	DATE: 04/15/2019
PROJECT NAME: HATCHETT 923	
DRAWING NAME: PROVENCE DF 3.DWG	
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS	
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 3.DOC	
RPLS: TST	TECH: HAS
PARTY CHIEF: N/A	CHK BY: TST
SHEET 04 of 05	FIELDBOOKS N/A
SCALE:1"= 200'	

LSI

LANDESIGN
SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

Line Table		
Line #	Direction	Length
L1	N29° 49' 56"E	70.00'
L2	N71° 31' 48"W	46.36'
L3	N24° 59' 25"E	68.97'
L4	N17° 25' 39"W	200.04'
L5	N45° 14' 44"W	86.54'
L6	N88° 18' 49"E	146.75'
L7	S79° 43' 20"E	120.69'
L8	S79° 55' 38"E	59.23'
L9	S78° 22' 31"E	117.08'
L10	S87° 26' 43"E	116.23'
L11	N89° 13' 59"E	97.93'
L12	S88° 54' 52"E	120.09'
L13	S87° 15' 32"E	114.87'
L14	S85° 07' 38"E	107.43'
L15	S81° 35' 03"E	30.29'
L16	S71° 56' 35"E	45.60'
L17	S19° 27' 25"W	49.99'
L18	S69° 55' 35"E	85.23'
L19	S04° 50' 00"W	130.18'
L20	N00° 00' 00"E	23.97'

Line Table		
Line #	Direction	Length
L21	N90° 00' 00"W	50.00'
L22	S80° 46' 07"W	95.31'
L23	S50° 58' 28"W	193.30'
L24	S22° 05' 27"W	8.76'
L25	S00° 18' 59"W	128.19'
L26	N90° 00' 00"E	24.07'
L27	S03° 13' 30"E	61.25'
L28	S07° 34' 00"E	61.75'
L29	S11° 54' 30"E	61.57'

N

200' 150' 100' 50' 0' 100' 200'

GRAPHIC SCALE

04/16/2019

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

THIS PROJECT IS REFERENCED FOR ALL BEARING AND COORDINATE BASIS TO THE TEXAS STATE PLANE COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83 – 2011 ADJUSTMENT), CENTRAL ZONE (4203).

SURFACE DISTANCES AND SCALE FACTOR:
DISTANCES AND AREA SHOWN HEREON ARE SURFACE VALUES REPRESENTED IN U.S. SURVEY FEET BASED ON A GRID–TO–SURFACE COMBINED ADJUSTMENT FACTOR OF 1.0000925

LEGEND

●	1/2" REBAR FOUND (OR AS NOTED)
◉	1/2" REBAR WITH CAP MARKED "LANDESIGN" FOUND (OR AS NOTED)
△	CALCULATED POINT NOT SET
O.P.R.T.C.T.	OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS
R.P.R.T.C.T.	REAL PROPERTY RECORDS OF TRAVIS COUNTY, TEXAS

JOB NUMBER: 321–15–2		DATE: 04/15/2019	
PROJECT NAME: HATCHETT 923			
DRAWING NAME: PROVENCE DF 3.DWG			
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS			
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 3.DOC			
RPLS: TST	TECH: HAS	PARTY CHIEF: N/A	CHK BY: TST
SHEET 05 of 05	FIELDBOOKS N/A	SCALE:1"= 200'	

LSI

LANDESIGN
SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

LANDESIGN
SERVICES, INC.
1220 McNeil Road, Suite 200
Round Rock, Texas 78681
TBPLS Firm No. 10001800
512-238-7901 office

EXHIBIT "A "

METES AND BOUNDS DESCRIPTION

BEING 22.42 ACRES OF LAND, SURVEYED BY LANDESIGN SERVICES, INC., SITUATED IN THE SAMUEL WILDY SURVEY, ABSTRACT NO. 799, AND THE RH GRAHAM SURVEY, ABSTRACT NO. 334, BOTH IN TRAVIS COUNTY, TEXAS AND BEING A PORTION OF THE REMAINDER OF A 264.377 ACRE TRACT OF LAND DESCRIBED IN A DEED TO BARRY D. JOHNSON, TRUSTEE OF MASONWOOD HP, LTD., AS RECORDED IN DOCUMENT NO. 2015164123, A PORTION OF THE REMAINDER OF A CALLED 333.06 ACRE TRACT OF LAND DESCRIBED AS TRACT 1 IN A DEED TO JPH CAPITAL, LTD., AS RECORDED IN DOCUMENT NO. 2004153390, AND A PORTION OF THE REMAINDER OF A CALLED 318.405 ACRE TRACT OF LAND DESCRIBED IN DEED TO MASONWOOD HP, LTD., AS RECORDED IN DOCUMENT NO. 2017038374, ALL OF THE OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS (O.P.R.T.C.T.), AND BEING MORE PARTICULARLY DESCRIBED BY METES AND BOUNDS AS FOLLOWS:

BEGINNING at a 1/2-inch rebar found for the Northwest corner of a called 12.557 acre tract of land described in deed to Phil Berdoll and Linda Berdoll, as recorded in Document No. 2009171277 of the O.P.R.T.C.T. and being an interior corner of said 264.377 acre tract;

THENCE **South 17°36'22" West** with the common line of said 264.377 acre tract and said 12.557 acre tract, a distance of **350.76** feet to a Calculated Point, from which a 1/2-inch rebar found for the Southwest corner of said 12.557 acre tract, bears South 17°36'22" West a distance of 457.16 feet;

THENCE with the common line of said 318.405 and the said remainder 264.377 acre tract, the following fifteen (15) courses and distances:

1. **South 72°51'32" West** a distance of **29.81** feet to a Calculated Point;
2. **North 27°54'09" West** a distance of **89.61** feet to a Calculated Point;
3. **South 62°05'51" West** a distance of **21.83** feet to a Calculated Point;
4. **North 27°54'09" West** a distance of **140.00** feet to a Calculated Point;
5. **North 23°43'55" West** a distance of **67.59** feet to a Calculated Point;

6. **North 22°08’02” West** a distance of **70.00** feet to a Calculated Point;

7. **North 21°12’20” West** a distance of **67.06** feet to a Calculated Point;

8. **North 03°09’45” West** a distance of **60.06** feet to a Calculated Point;

9. **North 20°46’24” East** a distance of **60.24** feet to a Calculated Point;

10. **North 32°15’23” East** a distance of **280.00** feet to a Calculated Point;

11. **North 39°40’54” East** a distance of **65.21** feet to a Calculated Point;

12. **North 43°42’16” East** a distance of **140.00** feet to a Calculated Point;

13. **North 39°04’51” East** a distance of **88.60** feet to a Calculated Point;

14. **North 27°47’59” East** a distance of **91.00** feet to a Calculated Point; and

15. **North 24°51’01” East** a distance of **55.76** feet to a Calculated Point;

THENCE **South 86°40’03” East** over across said 264.377 acre tract and with a Southern line of said 318.405 acre tract, a distance of **407.38** feet to a Calculated Point;

THENCE **South 89°55’23” East** with the common line of said remainder 264.377 acre tract and said 318.405 acre tract, a distance of **146.50** feet to a Calculated Point;

THENCE **South 83°06’25” East** with the common line of said reminder 333.06 acre tract and said 318.405 acre tract, a distance of **209.59** feet to a Calculated Point;

THENCE **South 83°05’49” East** over across said 333.06 acre tract, a distance of **70.00** feet to a Calculated Point;

THENCE with the common line of said reminder 333.06 acre tract and said 318.405 acre tract, the following two (2) courses and distances:

1. **South 83°06’16” East** a distance of **90.00** feet to a Calculated Point; and

2. **South 06°53’56” West** a distance of **450.00** feet to a Calculated Point;

THENCE over and across said 333.06 acre tract and said 318.405 acre tract, the following three (3) courses and distances:

1. **North 83°06’04” West** a distance of **28.30** feet to a Calculated Point;

2. **South 06°53’56” West** a distance of **75.00** feet to a Calculated Point; and

3. **South 02°06'46" East** a distance of **91.64** feet to a Calculated Point;

THENCE with the common line of said reminder 333.06 acre tract and said 318.405 acre tract, the following two (2) courses and distances:

1. **South 31°50'17" East** a distance of **86.54** feet to a Calculated Point; and

2. **South 59°39'22" East** a distance of **86.54** feet to a Calculated Point;

THENCE **South 76°10'28" West** over and across said 333.06 acre tract and said 264.377 acre tract, a distance of **503.72** feet to a Calculated Point, from which a 1/2-inch rebar found for the Northeast corner of said 12.557 acre tract, bears South 72°41'11" East a distance of 159.55 feet;

THENCE **North 72°41'11" West** with the common line of said 264.377 acre tract and said 12.557 acre tract, a distance of **578.19** feet to the **POINT OF BEGINNING** and containing 22.42 acres of land, more or less.

This project is referenced for all bearing and coordinate basis to the Texas Coordinate System, North American Datum of 1983 (NAD83 - 2011 adjustment), Central Zone (4203).

Distances and areas shown hereon are surface values represented in U.S. survey feet based on a grid-to-surface combined adjustment factor of 1.0000925.

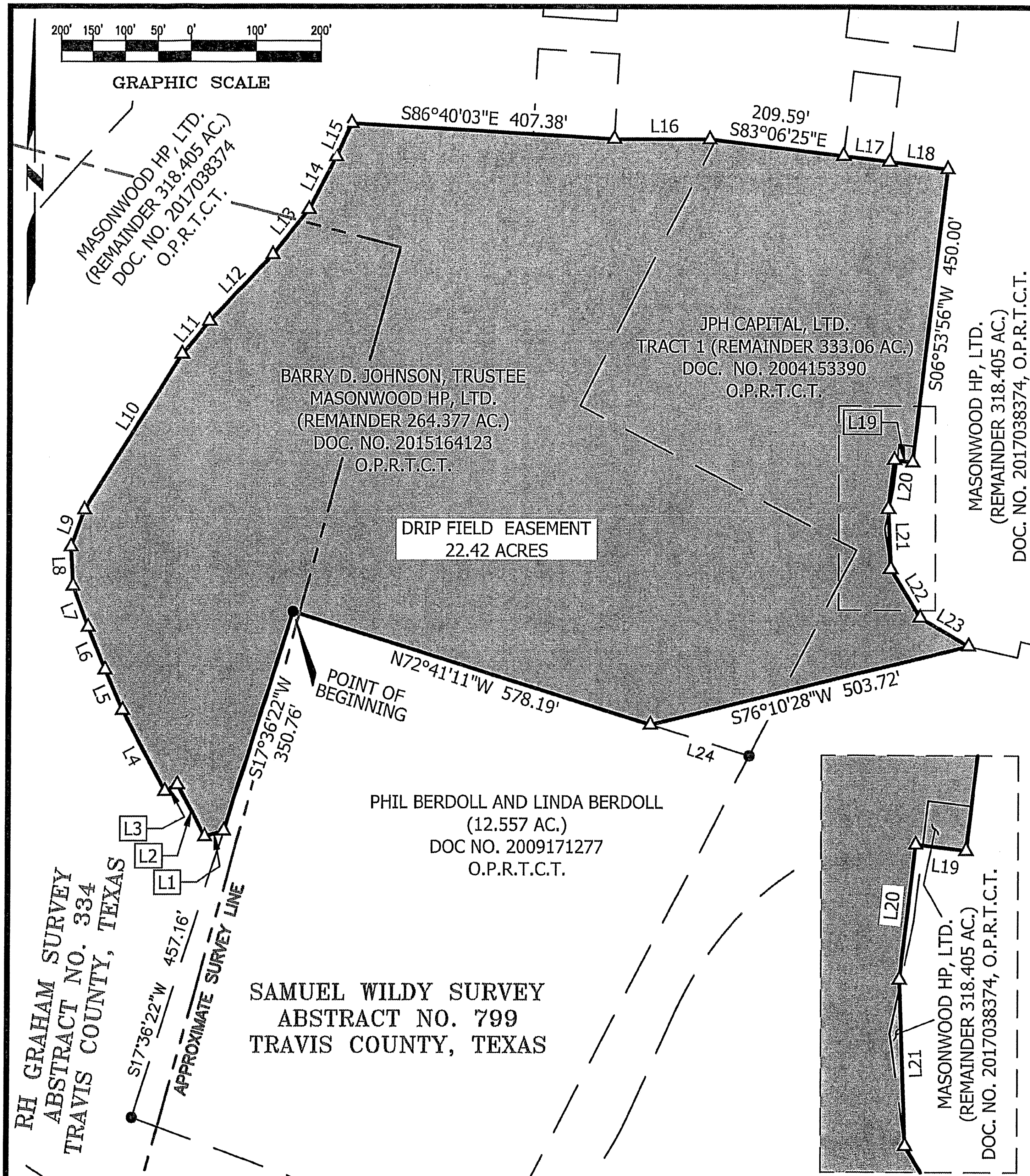
This property description was prepared from an on-the-ground survey performed under my supervision and is accompanied by a separate plat of even date. The field work was completed in August 2016.

04/16/2019

Travis S. Tabor
Registered Professional Land Surveyor
State of Texas No. 6428

STATE OF TEXAS REGISTERED TRAVIS S. TABOR 6428 PROFESSIONAL LAND SURVEYOR

Job Number: 321-15-2
Attachments: CAD Drawing: L:\Hatchett 923\DWGS\Provence Esmts\Provence DF 4 Esmt.dwg



JOB NUMBER: 321-15-2	DATE: 04/15/2019
PROJECT NAME: HATCHETT 923	
DRAWING NAME: PROVENCE DF 4 ESMT.DWG	
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS	
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 4 ESMT.DOC	
RPLS: TST / TECH: HAS / PARTY CHIEF: N/A	CHK BY: TST
SHEET 04 of 05 / FIELDBOOKS N/A	SCALE: 1"= 200'

LSI
LANDESIGN
SERVICES, INC.
1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

Line Table		
Line #	Direction	Length
L1	S72° 51' 32"W	29.81'
L2	N27° 54' 09"W	89.61'
L3	S62° 05' 51"W	21.83'
L4	N27° 54' 09"W	140.00'
L5	N23° 43' 55"W	67.59'
L6	N22° 08' 02"W	70.00'
L7	N21° 12' 20"W	67.06'
L8	N03° 09' 45"W	60.06'
L9	N20° 46' 24"E	60.24'
L10	N32° 15' 23"E	280.00'
L11	N39° 40' 54"E	65.21'
L12	N43° 42' 16"E	140.00'
L13	N39° 04' 51"E	88.60'
L14	N27° 47' 59"E	91.00'
L15	N24° 51' 01"E	55.76'
L16	S89° 55' 23"E	146.50'
L17	S83° 05' 49"E	70.00'
L18	S83° 06' 16"E	90.00'
L19	N83° 06' 04"W	28.30'
L20	S06° 53' 56"W	75.00'

Line Table		
Line #	Direction	Length
L21	S02° 06' 46"E	91.64'
L22	S31° 50' 17"E	86.54'
L23	S59° 39' 22"E	86.54'
L24	S72° 41' 11"E	159.55'

04/16/2019

STATE OF TEXAS
REGISTERED
TRAVIS S. TABOR
6428
PROFESSIONAL
LAND SURVEYOR

THIS PROJECT IS REFERENCED FOR ALL BEARING AND COORDINATE BASIS TO THE TEXAS COORDINATE SYSTEM, NORTH AMERICAN DATUM OF 1983 (NAD83 – 2011 ADJUSTMENT), CENTRAL ZONE (4203).

SURFACE DISTANCES AND SCALE FACTOR:
DISTANCES AND AREA SHOWN HEREON ARE SURFACE VALUES REPRESENTED IN U.S. SURVEY FEET BASED ON A GRID-TO-SURFACE COMBINED ADJUSTMENT FACTOR OF 1.0000925

LEGEND

●	1/2" REBAR FOUND (OR AS NOTED)
◉	1/4" PIPE FOUND (OR AS NOTED)
△	CALCULATED POINT NOT SET
O.P.R.T.C.T.	OFFICIAL PUBLIC RECORDS OF TRAVIS COUNTY, TEXAS
R.P.R.T.C.T.	REAL PROPERTY RECORDS OF TRAVIS COUNTY, TEXAS

JOB NUMBER: 321-15-2		DATE: 04/15/2019	
PROJECT NAME: HATCHETT 923			
DRAWING NAME: PROVENCE DF 4 ESMT.DWG			
DRAWING FILE PATH: L:\HATCHETT 923\DWGS\PROVENCE ESMTS			
METES AND BOUNDS FILE PATH: L:\HATCHETT 923\METES AND BOUNDS\PROVENCE DF 4 ESMT.DOC			
RPLS: TST	TECH: HAS	PARTY CHIEF: N/A	CHK BY: TST
SHEET 05 of 05	FIELDBOOKS N/A		SCALE:1"= 200'

LSI

LANDESIGN
SERVICES, INC.

1220 MCNEIL ROAD, SUITE 200
ROUND ROCK, TX 78681
TBPLS FIRM NO. 10001800
512-238-7901

3. Do the students at these schools attend a bilingual education program at another location?

   ☐ Yes ☒ No

4. Would the school be required to provide a bilingual education program but the school has waived out of this requirement under 19 TAC §89.1205(g)?

   ☐ Yes ☐ No

5. If the answer is **yes** to **question 1, 2, 3, or 4**, public notices in an alternative language are required. Which language is required by the bilingual program? Click to enter text.

F. Plain Language Summary Template

Complete the Plain Language Summary (TCEQ Form 20972) and include as an attachment.

Attachment: Appendix C

G. Public Involvement Plan Form

Complete the Public Involvement Plan Form (TCEQ Form 20960) for each application for a **new permit or major amendment to a permit** and include as an attachment.

Attachment: Appendix C

Section 9. Regulated Entity and Permitted Site Information (Instructions Page 29)

A. If the site is currently regulated by TCEQ, provide the Regulated Entity Number (RN) issued to this site. **RN 107010209**

Search the TCEQ's Central Registry at http://www15.tceq.texas.gov/crpub/ to determine if the site is currently regulated by TCEQ.

B. Name of project or site (the name known by the community where located):

Travis County MUD No. 22 Wastewater Treatment Plant

C. Owner of treatment facility: Travis County Municipal Utility District No. 22

Ownership of Facility: ☒ Public ☐ Private ☐ Both ☐ Federal

D. Owner of land where treatment facility is or will be:

Prefix: Mr. Last Name, First Name: Gilbert, Nate

Title: President Credential: Click to enter text.

Organization Name: Travis County Municipal Utility District No. 22

Mailing Address: 4301 Westbank Drive Suite B-130 City, State, Zip Code: Austin, Texas 78746

Phone No.: (512) 614-0901 E-mail Address: john@carltonlawaustin.com

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

E. Owner of effluent disposal site:

Prefix: Click to enter text. Last Name, First Name:

Title: Credential: Click to enter text.

Organization Name: JPH Capital LTD / Masonwood HP LTD / John and Sandra Hatchett

Mailing Address: PO Box 340878 / 4301 Westbank Drive Bldg A Suite 110 / PO Box 340878 City, State, Zip Code: Austin, Texas 78734 / Austin, Texas 78746 / Austin, Texas 340878

Phone No.: 512-306-8300 E-mail Address:

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

F. Owner sewage sludge disposal site (if authorization is requested for sludge disposal on property owned or controlled by the applicant)::

Prefix: N/A Last Name, First Name: Click to enter text.

Title: Click to enter text. Credential: Click to enter text.

Organization Name: Click to enter text.

Mailing Address: Click to enter text. City, State, Zip Code: Click to enter text.

Phone No.: Click to enter text. E-mail Address: Click to enter text.

If the landowner is not the same person as the facility owner or co-applicant, attach a lease agreement or deed recorded easement. See instructions.

Attachment: Click to enter text.

Section 10. TPDES Discharge Information (Instructions Page 31)

A. Is the wastewater treatment facility location in the existing permit accurate?

☒ Yes ☐ No

If **no, or a new permit application**, please give an accurate description:

N/A

B. Are the point(s) of discharge and the discharge route(s) in the existing permit correct?

☐ Yes ☐ No

If **no, or a new or amendment permit application**, provide an accurate description of the point of discharge and the discharge route to the nearest classified segment as defined in 30 TAC Chapter 307:

N/A

City nearest the outfall(s): Click to enter text.

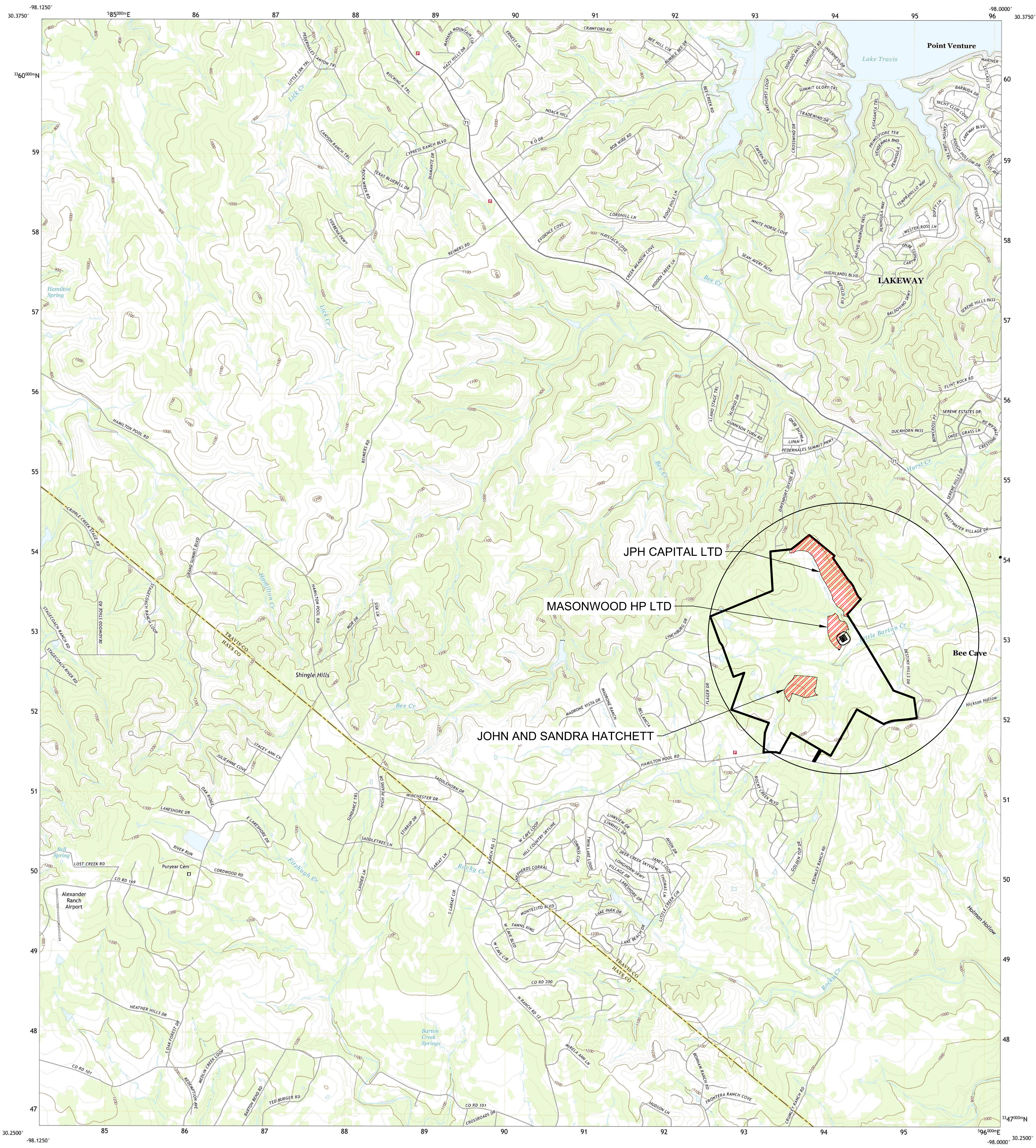
County in which the outfalls(s) is/are located: Click to enter text.

C. Is or will the treated wastewater discharge to a city, county, or state highway right-of-way, or

U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

The National Map
US Topo

SHINGLE HILLS QUADRANGLE
TEXAS
7.5-MINUTE SERIES



Produced by the United States Geological Survey
North American Datum of 1983 (NAD83)
World Geodetic System of 1984 (WGS84). Projection and 1 000-meter grid:Universal Transverse Mercator, Zone 14R
This map is not a legal document. Boundaries may be generalized for this map scale. Private lands within government reservations may not be shown. Obtain permission before entering private lands.

Imagery........NAIP, September 2016 - November 2016
Roads........U.S. Census Bureau, 2015 - 2019
Names........GNIS, 1979 - 2021
Hydrography........National Hydrography Dataset, 2002 - 2018
Contours........National Elevation Dataset, 2019
Boundaries........Multiple sources; see metadata file 2019 - 2021
Wetlands........FWS National Wetlands Inventory Not Available

MN
GN
0°28´
8 MILS
3°54´
69 MILS
UTM GRID AND 2019 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

U.S. National Grid
100,000 - m Square ID
NU
Grid Zone Designation
14R

SCALE 1:24 000
KILOMETERS
METERS
MILES
FEET

CONTOUR INTERVAL 20 FEET
NORTH AMERICAN VERTICAL DATUM OF 1988

This map was produced to conform with the National Geospatial Program US Topo Product Standard.

TEXAS
QUADRANGLE LOCATION

1 Spicewood
2 Pace Bend
3 Mansfield Dam
4 Hammetts Crossing
5 Bee Cave
6 Henly
7 Dripping Springs
8 Signal Hill
ADJOINING QUADRANGLES

ROAD CLASSIFICATION
Expressway
Secondary Hwy
Ramp
Local Connector
Local Road
4WD
Interstate Route
US Route
State Route

SHINGLE HILLS, TX
2022

NSN. 7643016398257
NGA REF NO. USGSX24K41096

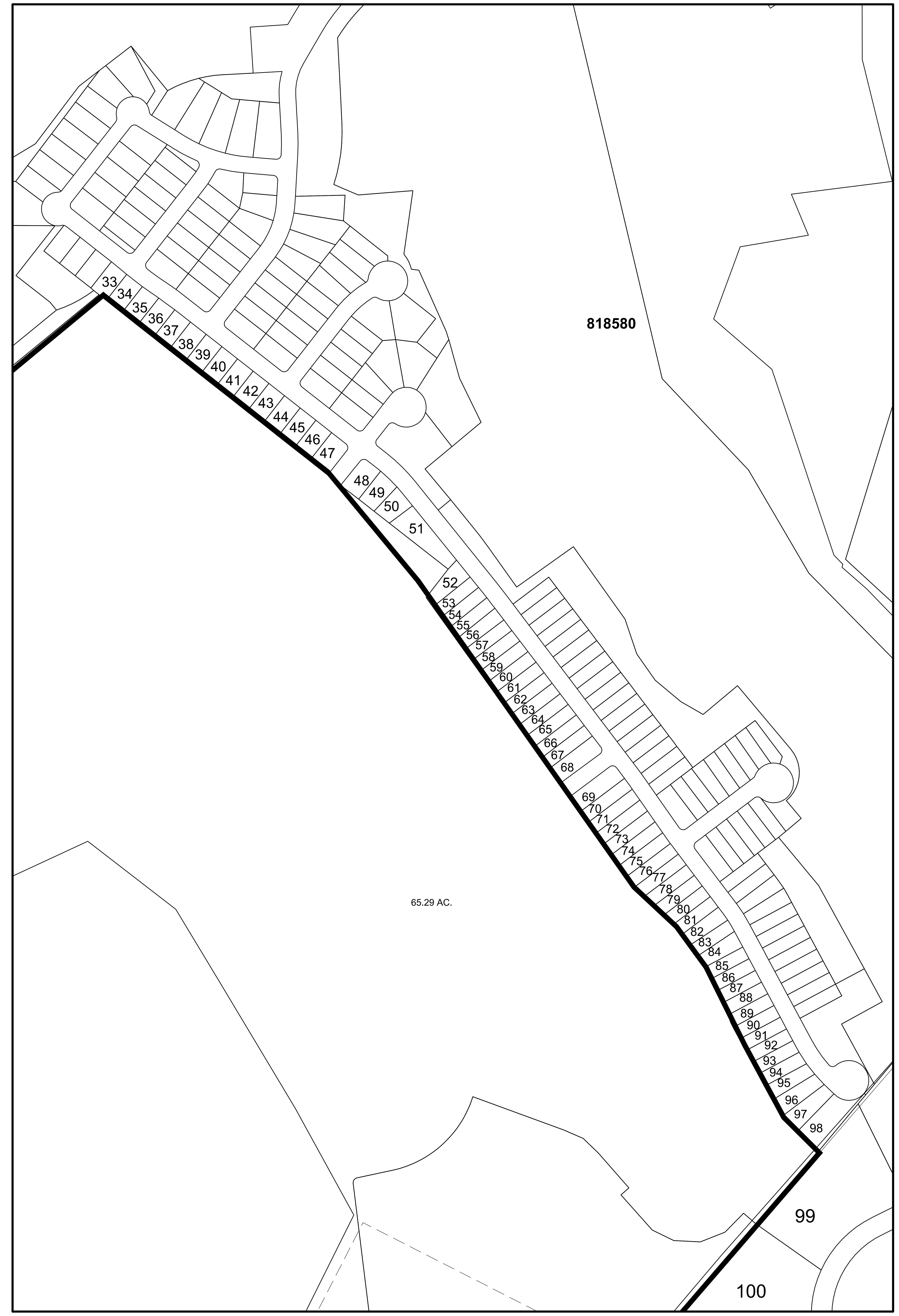
I:\A336 (tcmud 22)\TC MUD 22 Major Permit Amendment\exhibits\USGS Map.dwg

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

USGS MAP
SHINGLE HILLS, TX
OWNER INFORMATION



ADJACENT PROPERTY OWNERS MAP

TRAVIS COUNTY MUD No. 22 WWTP

TRAVIS COUNTY, TX

LJA Engineering, Inc.
7500 Rialto Boulevard
Building II, Suite 100
Austin, Texas 78735
Phone 512.439.4700
Fax 512.439.4716
FRN - F-1386

1 OF 1

MAP NUMBER	NAME	ADDRESS (1)
1	RATHBUN JASON & SHAY	16901 WHISPERING BREEZE, AUSTIN TX 78738-4123
2	HARBACH JEFF R	16837 WHISPERING BREEZE, AUSTIN TX 78738-4124
3	MEHRDAD MORABBI	12004 FORTUNA CV, AUSTIN TX 78738
4	MR AND MRS PARODI	16705 DESTINY CV, AUSTIN TX 78738
5	MR AND MRS BLUBKE	7008 DESTINY HILLS DR, AUSTIN TX 78738
6	MR AND MRS STEWART	7016 DESTINY HILLS DR, AUSTIN TX 78738
7	JORGE HERRERO	7100 DESTINY HILLS DR, AUSTIN TX 78738
8	JEANNA JAMES	7114 DESTINY HILLS DR, AUSTIN TX 78738
9	MR AND MRS NAIZER	7200 DESTINY HILLS DR, AUSTIN TX 78738
10	MARION VOUDOURIS	PO BOX 130, DRIPPING SPRINGS TX 78620
11	MR AND MRS HANSON	16400 HAMILTON POOL RD, AUSTIN TX 78738
12	CHARLES RIDER III	PO BOX 26962, AUSTIN TX 78755-0962
13	MR AND MRS NIXON	16614 HAMILTON POOL RD, AUSTIN TX 78738
14	MR AND MRS SCHEFFEL	16712 HAMILTON POOL RD, AUSTIN TX 78738
15	MR AND MRS SCHEFFEL	16713 HAMILTON POOL RD, AUSTIN TX 78738
16	MR AND MRS SCHEFFEL	16714 HAMILTON POOL RD, AUSTIN TX 78738
17	MR AND MRS KUYKENDALL	16910 HAMILTON POOL RD, AUSTIN TX 78738
18	MR AND MRS AYDAM	15100 HORNSBY HILL RD, AUSTIN TX 78734
19	MR AND MRS PRIOUR	17120 HAMILTON POOL RD, AUSTIN TX 78738
20	JAMES HARRIS	13501 RANCH ROAD 12, WIMBERLY TX 78676-5353
21	MR AND MRS BERDOLL	17008 HAMILTON POOL RD, AUSTIN TX 78738
22	MR AND MRS AYRES	707 W 10TH ST, AUSTIN TX 78701
23	MR AND MRS AYRES	708 W 10TH ST, AUSTIN TX 78701
24	VACATED DRIP DISPOSAL AREA 1	MASONWOOD HP LTD
25	VACATED DRIP DISPOSAL AREA 2	HATCHETT JOHN & SANDRA
26	WOOD KAY HARRIS	12166 CONIFER RIDGE DR, CONIFER CO 80433-6122
27	VALDEZ DAVID	7524 DAVENPORT DIVIDE RD, TX 78738
28	FARES FIDEL & ROSE	17925 DAVENPORT DIVIDE CT, TX 78738
29	BALBINOT LEANDRO F & DANIELA C	17917 DAVENPORT DIVIDE RD, TX 78738

30	RAVIRAJ TEJAS & RASHMI SHOBANA RABH	17909 DAVENPORT DIVIDE CT, TX 78738
31	TOMSON STEVEN W & TRACY T	17901 DAVENPORT DIVIDE CT, TX 78738
32	LAZY NINE MUNICIPAL UTILITY DISTRICT NO 1B	9600 N MOPAC EXWPY STE 750, AUSTIN TX 78759
33	MOORE JARED & EMILY DEEANN WILLIAMS	17800 HATTIE TRCE, AUSTIN TX 78738-5073
34	JAYAPAUL DAVID KIRUBAKARA LEO	17716 HATTIE TRCE, AUSTIN TX 78738-5065
35	KOLLURU SURYA K & SIVANI CHEKURI	17712 HATTIE TRACE, AUSTIN TX 78738-5065
36	GARY JONATHAN & CHRISTLE CLARE GARY	17708 HATTIE TRCE , AUSTIN TX 78738
37	DANDREA ADRIAN & ANNETTE	17704 HATTIE TRCE, AUSTIN TX 78738-5065
38	MANN AMARDEEP & MEHAK GILL	17700 HATTIE TRCE, AUSTIN TX 78738-5065
39	BRADY ICHING TSENG	17616 HATTIE TRCE, AUSTIN TX 78738-5064
40	HENDRICKS ROBERT & SHARON HENDRICKS	17612 HATTIE TRCE , AUSTIN TX 78738-5064
41	WALTRIP-HOWELL KAITLIN NELL	17808 HATTIE TRCE, AUSTIN TX 78738-5073
42	FLORANDER MICHELLE M	17604 HATTIE TRCE, AUSTIN TX 78738-5064
43	AHLGREN DANIEL LEE	17600 HATTIE TRCE , AUSTIN TX 78738-5064
44	SMITH BRIAN SCOTT & JANETTE EILEEN	17512 HATTIE TRCE , AUSTIN TX 78738-5063
45	DHAMANWALA SUMIT H	17508 HATTIE TRCE, AUSTIN TX 78738-5063
46	JAKATI AMIT MADHAV	17504 HATTIE TRCE , AUSTIN TX 78738-5063
47	GURUNG AMIT	17500 HATTIE TRC, AUSTIN TX 78738
48	MEDIKONDA SAI KRISHNA	17429 HATTIE TRCE, AUSTIN TX 78738-5062
49	WALKER MITCHELL	17425 HATTIE TRCE, AUSTIN TX 78738-5062
50	SWEETWATER MASTER COMMUNITY INC	11149 RESEARCH BLVD STE 100, AUSTIN TX 78759-5227
51	SWEETWATER MASTER COMMUNITY INC	11150 RESEARCH BLVD STE 100, AUSTIN TX 78759-5227
52	JAGADEESHA YASHAS BANGALOR	17411 HATTIE TRCE, AUSTIN TX 78738-5062
53	PULKRABEK LORI	17409 HATTIE TRCE, AUSTIN TX 78738-5062
54	NEWMARK HOMES AUSTIN LLC	2101 LAKEWAY BLVD STE 205, LAKEWAY TX 78734-5272
55	GILLESPIE KELSEY MARIE	17405 HATTIE TRCE, AUSTIN TX 78738-5062
56	PALAT MOHAN & NIRMALA	17403 HATTIE TRCE, AUSTIN TX 78738-5062
57	VANKINENI HARI PRIYA	17401 HATTIE TRCE, AUSTIN TX 78738
58	CALLAHAN MICHAEL	17321 HATTIE TRCE, AUSTIN TX 78738-5061
59	MUDEDE SAMMY TAFADZWA & YVONNE C	17319 HATTIE TRCE, AUSTIN TX 78738-5061
60	NEWMARK HOMES AUSTIN LLC	2101 LAKEWAY BLVD STE 205, LAKEWAY TX 78734-5272
61	NEWMARK HOMES AUSTIN LLC	2101 LAKEWAY BLVD STE 205, LAKEWAY TX 78734-5272
62	NEWMARK HOMES AUSTIN LLC	2101 LAKEWAY BLVD STE 205, LAKEWAY TX 78734-5272

63	VICTORIO CESAR EUDES BALLINAS	17311 HATTIE TRCE, AUSTIN TX 78738-5061
64	EERALLA AJAY KUMAR	17309 HATTIE TRCE, AUSTIN TX 78738-5061
65	JAKKANNAGARI VINAY KUMAR REDDY	17307 HATTIE TRCE, AUSTIN TX 78738-5061
66	BELLAM RAFAEL	17305 HATTIE TRCE, AUSTIN TX 78738-5061
67	PHILLIPS MICHAEL	17303 HATTIE TRCE,AUSTIN TX 78738-5061
68	WALSH ANDREW & TAYLOR	17301 HATTIE TRCE, AUSTIN TX 78738-5061
69	SPEARS MATTHEW CARL	17213 HATTIE TRCE, AUSTIN TX 78738-5060
70	GS FOR INVESTMENT INC	7701 SANDIA LOOP, AUSTIN TX 78735-1520
71	BOICELLI STEFANIE CHRISTINA	17209 HATTIE TRCE, AUSTIN TX 78738-5060
72	ROBBINS ANDREA & MICHAEL	17207 HATTIE TRCE ,AUSTIN TX 78738-5060
73	MOORE JASON RANDAL	17205 HATTIE TRCE, AUSTIN TX 78738-5060
74	SIMMONS ROBBIN & RODNEY	17203 HATTIE TRCE ,AUSTIN TX 78738-5060
75	SHAH RAIMI & AIGERIM TURSYNBEKOVA	17201 HATTIE TRCE ,AUSTIN TX 78738-5060
76	ZAMBITO JILL M	17119 HATTIE TRCE ,AUSTIN TX 78738-5059
77	FEORANZO DANIELLE LINDSAY	17117 HATTIE TRCE, AUSTIN TX 78738-5059
78	LIBERTO CRAIG MATTHEW & ZOE EMILY	17115 HATTIE TRCE, AUSTIN TX 78738-5059
79	SETHUMURUGAN SUBHASH	17113 HATTIE TRCE, AUSTIN TX 78738-5059
80	NELMS LEE	17111 HATTIE TRACE, AUSTIN TX 78738
81	MATHY GREGORY CHARLES	17109 HATTIE TRCE, AUSTIN TX 78738-5059
82	KIM KWANGHO & SEUNGHYUN OH	17107 HATTIE TRCE, AUSTIN TX 78738-5059
83	GUERRA DANE TOMAS	17105 HATTIE TRCE, AUSTIN TX 78738-5059
84	PULTE HOMES OF TEXAS LP	9401 AMBERGLEN BLVD, AUSTIN TX 78729-1192
85	RAPPACCIOLI HORACIO SEBASTIAN	305 AVENA TRL, LAKEWAY TX 78738-5648
86	FIEDLER JOHN JOSEPH II	17025 HATTIE TRCE, AUSTIN TX 78738-5058
87	NEWMARK HOMES AUSTIN LLC	23033 GRAND CIR BLVD #200, KATY TX 77449-2461
88	RENNER JACQUELYN M	17021 HATTIE TRCE , AUSTIN TX 78738-5058
89	LARI BRYAN & CHARLES E ALVARADO	17019 HATTIE TRCE, AUSTIN TX 78738-5058
90	NEWMARK HOMES AUSTIN LLC	23033 GRAND CIR BLVD #200, KATY TX 77449-2461
91	SMITH RANDY CURTIS & MELISSA	17015 HATTIE TRCE, AUSTIN TX 78738-5058
92	PHI BRENDAN	17013 HATTIE TRCE, AUSTIN TX 78738-5058
93	PATEL PARAG M	17011 HATTIE TRCE, AUSTIN TX 78738
94	GOLLAPUDI VISHNU KIRAN	17009 HATTIE TRCE, AUSTIN TX 78738-5058
95	WARMBROD THOMAS W & LOIS JANE	17007 HATTIE TRCE, AUSTIN TX 78738-5058

96	CUCCIA MICHAEL P & RENITA D	17005 HATTIE TRCE, AUSTIN TX 78738-5058
97	NEWMARK HOMES AUSTIN LLC	23033 GRAND CIR BLVD #200, KATY TX 77449-2461
98	KAPOOR SUPREET & REEMA	17001 HATTIE TRCE, AUSTIN TX 78738-5058
99	MACKEY JAMES S & BONNIE L	306 SANDCASTLE LN, BRYN MAWR PA 19010-2112
100	ANDERSON SCOTT	17017 WHISPERING BREEZE DR, AUSTIN TX 78738-4125
101	BIRDWELL JANA MARZANO	17001 WHISPERING BREEZE, AUSTIN TX 78738-4125
102	EPSTEIN BRAD LIVING TRUST	16925 WHISPERING BREEZE DR, AUSTIN TX 78738-4123
103	TURNQUIST COLTON & LILLIAN	16300 PADDLEFISH WAY, AUSTIN TX 78738-4134

Comisión de Calidad Ambiental del Estado de Texas

AVISO DE RECIBO DE LA SOLICITUD E
INTENCION DE OBTENER PERMISO PARA LA CALIDAD DEL AGUA
MODIFICACION

PERMISO NO. WQ00_________

SOLICITUD. El Distrito Municipal de Servicios Públicos del Condado de Travis No. 22, 4301 Westbank Drive, Suite B-130, Austin, Texas 78746, ha solicitado a la Comisión de Calidad Ambiental de Texas (TCEQ) la modificación del Permiso de Solicitud de Tierras de Texas (TLAP) No. WQ0015201001 para autorizar la reubicación de las áreas de disposición de efluentes. La planta de tratamiento de aguas residuales domésticas y el vertedero se encuentran en 16925 1/2 Lavondre Drive, aproximadamente a 3.2 millas al oeste de la intersección de Hamilton Pool Road y la Carretera Estatal 71, cerca de la ciudad de Bee Cave, en el Condado de Travis, Texas 78738. La TCEQ recibió esta solicitud el 25 de febrero de 2025. La solicitud de permiso estará disponible para su consulta y copia en el Ayuntamiento de Bee Cave, 4000 Galleria Parkway, Bee Cave, en el Condado de Travis, Texas, antes de la fecha de publicación de este aviso en el periódico. La solicitud, incluyendo cualquier actualización, y los avisos asociados están disponibles electrónicamente en la siguiente página web: https://www.tceq.texas.gov/permitting/wastewater/pending-permits/tlap-applications. Este enlace a un mapa electrónico de la ubicación general del sitio o instalación se proporciona como cortesía pública y no forma parte de la solicitud ni del aviso. Para conocer la ubicación exacta, consulte la solicitud.

https://gisweb.tceq.texas.gov/LocationMapper/?marker=-98.02194,30.30833&level=18

Include the following non-italicized sentence if the facility is located in the Coastal Management Program boundary and is an application for a major amendment which will increase the pollutant loads to coastal waters or would result in relocation of an outfall to a critical areas, or a renewal with such a major amendment. The Coastal Management Program boundary is the area along the Texas Coast of the Gulf of México as depicted on the map in 31 TAC §503.1 and includes part or all of the following counties: Cameron, Willacy, Kenedy, Kleberg, Nueces, San Patricio, Aransas, Refugio, Calhoun, Victoria, Jackson, Matagorda, Brazoria, Galveston, Harris, Chambers, Jefferson y Orange. If the application is for amendment that does not meet the above description, do not include the sentence: El Director Ejecutivo de la TCEQ ha revisado esta medida para ver si está de acuerdo con los objetivos y las regulaciones del Programa de Administración Costero de Texas (CMP) de acuerdo con las regulaciones del Consejo Coordinador de la Costa (CCC) y ha determinado que la acción es conforme con las metas y regulaciones pertinentes del CMP.

AVISO ADICIONAL. El Director Ejecutivo de la TCEQ ha determinado que la solicitud es administrativamente completa y conducirá una revisión técnica de la solicitud. Después de completar la revisión técnica, el Director Ejecutivo puede preparar un borrador del permiso y emitirá una Decisión Preliminar sobre la solicitud. **El aviso de la solicitud y la decisión preliminar serán publicados y enviado a los que están en la lista de correo de las personas a lo largo del condado que desean recibir los avisos y los que están en la lista de correo que desean recibir avisos de esta solicitud. El aviso dará la fecha límite para someter comentarios públicos.**

COMENTARIO PUBLICO / REUNION PUBLICA. Usted puede presentar comentarios públicos o pedir una reunión pública sobre esta solicitud. El propósito de una reunión pública es dar la oportunidad de presentar comentarios o hacer preguntas acerca de la solicitud. La TCEQ realiza una reunión pública si el Director Ejecutivo determina que hay un grado de interés público suficiente en la solicitud o si un legislador local lo pide. Una reunión pública no es una audiencia administrativa de lo contencioso.

OPORTUNIDAD DE UNA AUDIENCIA ADMINISTRATIVA DE LO CONTENCIOSO. Después del plazo para presentar comentarios públicos, el Director Ejecutivo considerará todos los comentarios apropiados y preparará una respuesta a todo los comentarios públicos esenciales, pertinentes, o significativos. **A menos que la solicitud haya sido referida directamente a una audiencia administrativa de lo contencioso, la respuesta a los comentarios y la decisión del Director Ejecutivo sobre la solicitud serán enviados por correo a todos los que presentaron un comentario público y a las personas que están en la lista para recibir avisos sobre esta solicitud. Si se reciben comentarios, el aviso también proveerá instrucciones para pedir una reconsideración de la decisión del Director Ejecutivo y para pedir una audiencia administrativa de lo contencioso.** Una audiencia administrativa de lo contencioso es un procedimiento legal similar a un procedimiento legal civil en un tribunal de distrito del estado.

PARA SOLICITAR UNA AUDIENCIA DE CASO IMPUGNADO, USTED DEBE INCLUIR EN SU SOLICITUD LOS SIGUIENTES DATOS: su nombre, dirección, y número de teléfono; el nombre del solicitante y número del permiso; la ubicación y distancia de su propiedad/actividad con respecto a la instalación; una descripción específica de la forma cómo usted sería afectado adversamente por el sitio de una manera no común al público en general; una lista de todas las cuestiones de hecho en disputa que usted presente durante el período de comentarios; y la declaración "[Yo/nosotros] solicito/solicitamos una audiencia de caso impugnado". Si presenta la petición para una audiencia de caso impugnado de parte de un grupo o asociación, debe identificar una persona que representa al grupo para recibir correspondencia en el futuro; identificar el nombre y la dirección de un miembro del grupo que sería afectado adversamente por la planta o la actividad propuesta; proveer la información indicada anteriormente con respecto a la ubicación del miembro afectado y su distancia de la planta o actividad propuesta; explicar cómo y porqué el miembro sería afectado; y explicar cómo los intereses que el grupo desea proteger son pertinentes al propósito del grupo.

Después del cierre de todos los períodos de comentarios y de petición que aplican, el Director Ejecutivo enviará la solicitud y cualquier petición para reconsideración o para una audiencia de caso impugnado a los Comisionados de la TCEQ para su consideración durante una reunión programada de la Comisión. La Comisión sólo

puede conceder una solicitud de una audiencia de caso impugnado sobre los temas que el solicitante haya presentado en sus comentarios oportunos que no fueron retirados posteriormente. Si se concede una audiencia, el tema de la audiencia estará limitado a cuestiones de hecho en disputa o cuestiones mixtas de hecho y de derecho relacionadas a intereses pertinentes y materiales de calidad del agua que se hayan presentado durante el período de comentarios.

LISTA DE CORREO. Si somete comentarios públicos, un pedido para una audiencia administrativa de lo contencioso o una reconsideración de la decisión del Director Ejecutivo, la Oficina del Secretario Principal enviará por correo los avisos públicos en relación con la solicitud. Ademas, puede pedir que la TCEQ ponga su nombre en una or mas de las listas correos siguientes (1) la lista de correo permanente para recibir los avisos de el solicitante indicado por nombre y número del permiso específico y/o (2) la lista de correo de todas las solicitudes en un condado especifico. Si desea que se agrega su nombre en una de las listas designe cual lista(s) y envia por correo su pedido a la Oficina del Secretario Principal de la TCEQ.

CONTACTOS E INFORMACIÓN A LA AGENCIA. Todos los comentarios públicos y solicitudes deben ser presentadas electrónicamente vía http://www14.tceq.texas.gov/epic/eComment/ o por escrito dirigidos a la Comisión de Texas de Calidad Ambiental, Oficial de la Secretaría (Office of Chief Clerk), MC-105, P.O. Box 13087, Austin, Texas 78711-3087. Tenga en cuenta que cualquier información personal que usted proporcione, incluyendo su nombre, número de teléfono, dirección de correo electrónico y dirección física pasarán a formar parte del registro público de la Agencia. Para obtener más información acerca de esta solicitud de permiso o el proceso de permisos, llame al programa de educación pública de la TCEQ, gratis, al 1-800-687-4040. Si desea información en Español, puede llamar al 1-800-687-4040.

También puede obtener más información del Distrito Municipal de Servicios Públicos No. 22 del Condado de Travis, en la dirección indicada anteriormente, o llamando a la Sra. Lauren Crone, P.E., LJA Engineering, Inc., al 512-439-4700.

Fecha de emisión ___________ *[Date notice issued]*