

Geologic Assessment

Texas Commission on Environmental Quality

For Regulated Activities on The Edwards Aquifer Recharge/transition Zones and Relating to 30 TAC §213.5(b)(3), Effective June 1, 1999

To ensure that the application is administratively complete, confirm that all fields in the form are complete, verify that all requested information is provided, consistently reference the same site and contact person in all forms in the application, and ensure forms are signed by the appropriate party.

Note: Including all the information requested in the form and attachments contributes to more streamlined technical reviews.

Signature

To the best of my knowledge, the responses to this form accurately reflect all information requested concerning the proposed regulated activities and methods to protect the Edwards Aquifer. My signature certifies that I am qualified as a geologist as defined by 30 TAC Chapter 213.

Print Name of Geologist: Richard V. Klar, P.G.

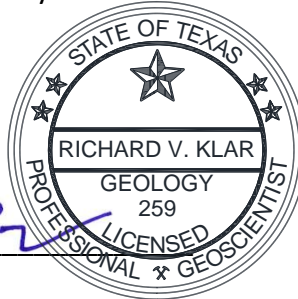

Telephone: 210-699-9090

Date: October 15, 2019 (Revised March 5, 2020)

Fax: 210-699-6426

Representing: Raba Kistner, Inc., TBPG Firm #50220 / TBPE Firm #3257 for HMT Engineering & Surveying (Name of Company and TBPG or TBPE registration number)

Signature of Geologist:



Regulated Entity Name: Village at Gruene Condominiums

Project Information

1. Date(s) of Geologic Assessment was performed: October 10, 2019, January 31, 2020, and February 18, 2020

2. Type of Project:

☒ WPAP

☐ AST

☒ SCS

☐ UST

3. Location of Project:

☒ Recharge Zone

☐ Transition Zone

☐ Contributing Zone within the Transition Zone

4. ☒ **Attachment A – Geologic Assessment Table.** Completed Geologic Assessment Table (Form TCEQ-0585-Table) is attached.

5. ☒ Soil cover on the project site is summarized in the table below and uses the SCS Hydrologic Soil Groups* (Urban Hydrology for Small Watersheds, Technical Release No. 55, Appendix A, Soil Conservation Service, 1986). If there is more than one soil type on the project site, show each soil type on the site Geologic Map or a separate soils map.

Table 1 - Soil Units, Infiltration Characteristics and Thickness

| Soil Name | Group* | Thickness (feet) |
|------------------------------------------------|--------|-------------------|
| Comfort Rock Outcrop Complex, Undulating (CrD) | D | Veneer to 1.5 ft. |
| Rumple-Comfort Association, undulating (RUD) | C | 1-2 ft. |

**Soil Group Definitions (Abbreviated)*

A. Soils having a high infiltration rate when thoroughly wetted.

B. Soils having a moderate infiltration rate when thoroughly wetted.

C. Soils having a slow infiltration rate when thoroughly wetted.

D. Soils having a very slow infiltration rate when thoroughly wetted

Note: Rumple-Comfort Series soils are not explicitly classified by the NRCS (1986). RUD soil unit is classified as Group C based on information presented in The Soil Survey of Comal and Hays Counties, Texas prepared by the U.S.D.A. (June 1984).

6. ☒ **Attachment B – Stratigraphic Column.** A stratigraphic column showing formations, members, and thickness is attached. The outcropping unit, if present, should be at the top of the stratigraphic column. Otherwise, the uppermost unit should be at the top of the stratigraphic column.

7. ☒ **Attachment C – Site Geology.** A narrative description of the site specific geology including any features identified in the Geologic Assessment Table, a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure(s), and karst characteristics is attached.

8. ☒ **Attachment D – Site Geologic Map(s).** The Site Geologic Map must be the same scale as the applicant's Site Plan. The minimum scale is 1":400'.

Applicant's Site Plan Scale: 1" = 60'

Site Geologic Map Scale: 1" = 60'

Site Soils Map Scale (if more than 1 soil type): 1" = 150'

9. Method of collecting positional data:

☒ Global Positioning System (GPS) technology.

☐ Other method(s). Please describe method of data collection: _____

10. ☒ The project site boundaries are clearly shown and labeled on the Site Geologic Map.

11. ☒ Surface geologic units are shown and labeled on the Site Geologic Map.

12. ☒ Geologic or manmade features were discovered on the project site during the field investigation. They are shown and labeled on the Site Geologic Map and are described in the attached Geologic Assessment Table.

☐ Geologic or manmade features were not discovered on the project site during the field investigation.

13. ☒ The Recharge Zone boundary is shown and labeled, if appropriate.

14. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.): If applicable, the information must agree with Item No. 20 of the WPAP Application Section.

☒ There is 1 (#) well present on the project site and the location is shown and labeled. (Check all of the following that apply.)

☒ The well is not in use and has been properly abandoned.

☐ The well is not in use and will be properly abandoned.

☐ The wells are in use and comply with 16 TAC Chapter 76.

☐ There are no wells or test holes of any kind known to exist on the project site.

Administrative Information

- ☒ Submit one (1) original and one (1) copy of the application, plus additional copies as needed for each affected incorporated city, groundwater conservation district, and county in which the project will be located. The TCEQ will distribute the additional copies to these jurisdictions. The copies must be submitted to the appropriate regional office.

ATTACHMENTS

ATTACHMENT A

**GEOLOGIC ASSESSMENT TABLE
(TCEQ-0585-TABLE)**

**COMMENTS TO GEOLOGIC
ASSESSMENT TABLE**

SOLUTION CAVITY PLAN AND PROFILE (FIGURE 1)

ADDITIONAL FEATURE PHOTOGRAPHS (S-7 AND S-8)

SOIL PROFILE

SITE SOILS MAP

| GEOLOGIC ASSESSMENT TABLE | | | | | | PROJECT NAME: Village at Gruene Condominiums - New Braunfels, Comal County, Texas (RKI Project No. ASF19-124-00) | | | | | | | | | | | | | | |
|---------------------------|-------------|-------------|-------------------------|--------|-----------|---------------------------------------------------------------------------------------------------------------------|------|------|--------------------|-----|--------------------|--------------------|------------|----------------------------------|-------|------------------|-----|---------------------------|------------|---------|
| LOCATION | | | FEATURE CHARACTERISTICS | | | | | | | | | | EVALUATION | | | PHYSICAL SETTING | | | | |
| 1A | 1B * | 1C* | 2A | 2B | 3 | 4 | | | 5 | 5A | 6 | 7 | 8A | 8B | 9 | 10 | | 11 | | 12 |
| FEATURE ID | LATITUDE | LONGITUDE | FEATURE TYPE | POINTS | FORMATION | DIMENSIONS (FEET) | | | TREND (DEGREES) | DOM | DENSITY (NO/FT) | APERTURE (FEET) | INFILL | RELATIVE INFILTRATION RATE | TOTAL | SENSITIVITY | | CATCHMENT AREA (ACRES) | TOPOGRAPHY | |
| | | | | | | | | | | | | | | | | <40 | >40 | | | <1.6 |
| | | | | | | X | Y | Z | | 10 | | | | | | | | | | |
| ON-SITE FEATURES | | | | | | | | | | | | | | | | | | | | |
| S-1 | N29 44 02.4 | W98 06 50.0 | SF | 20 | Kep | 15.0 | 10.0 | 0.1 | N-S | 0 | 1.5/FT | 0.1 | F | 6 | 26 | ✓ | | ✓ | | Hilltop |
| S-2 | N29 44 04.6 | W98 06 52.3 | SC | 20 | Kep | 6.0 | 4.0 | 1.5 | NW-SE | 0 | | | F / N | 6 | 26 | ✓ | | ✓ | | Hilltop |
| S-3 | N29 44 03.6 | W98 06 48.8 | MB (Septic) | 30 | Kep | 10.0 | 5.0 | ~5.0 | | 0 | | | F / X | 7 | 37 | ✓ | | ✓ | | Hilltop |
| S-4 | N29 44 04.0 | W98 06 49.9 | MB (PWW) | 30 | Kep | 0.6 | 0.6 | 98.0 | | 0 | | | X | 8 | 38 | ✓ | | ✓ | | Hilltop |
| S-7 | N29 44 05.3 | W98 06 51.0 | SC | 20 | Kep | 1.0 | 0.8 | 4.0 | NW-SE | 0 | | | C / F / N | 8 | 28 | ✓ | | ✓ | | Hilltop |
| S-8 | N29 44 05.2 | W98 06 51.0 | SC | 20 | Kep | 7.0 | 1.75 | 1.2 | NE-SW | 10 | | | C / F / N | 8 | 38 | ✓ | | ✓ | | Hilltop |
| OFF-SITE FEATURES | | | | | | | | | | | | | | | | | | | | |
| S-5 | N29 44 00.7 | W98 06 49.7 | MB (W) | 30 | Kep | 411.0 | 2.0 | ~4-6 | | 0 | | | F / X | 6 | 36 | ✓ | | ✓ | | Hilltop |
| S-6 | N29 43 58.9 | W98 06 52.3 | MB (WWTR) | 30 | Kep | 50.0 | 3.0 | ~4-6 | | 0 | | | F / X | 6 | 36 | ✓ | | ✓ | | Hilltop |

* DATUM: NAD 83

Features: Septic = derelict septic system, PWW = plugged water well, W = water line, WWTR = wastewater line

Kep = Person Formation

| 2A TYPE | TYPE | 2B POINTS |
|---------|-------------------------------------|-----------|
| C | Cave | 30 |
| SC | Solution cavity | 20 |
| SF | Solution-enlarged fracture(s) | 20 |
| F | Fault | 20 |
| O | Other natural bedrock features | 5 |
| MB | Manmade feature in bedrock | 30 |
| SW | Swallow hole | 30 |
| SH | Sinkhole | 20 |
| CD | Non-karst closed depression | 5 |
| Z | Zone, clustered or aligned features | 30 |

| 8A INFILLING | |
|-----------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| N | None, exposed bedrock |
| C | Coarse - cobbles, breakdown, sand, gravel |
| O | Loose or soft mud or soil, organics, leaves, sticks, dark colors |
| F | Fines, compacted clay-rich sediment, soil profile, gray or red colors |
| V | Vegetation. Give details in narrative description |
| FS | Flowstone, cements, cave deposits |
| X | Other materials: Granular bedding materials for septic system (Feature S-3) and utility lines (Features S-5 and S-6). Cement and gravel (Feature S-4). |
| 12 TOPOGRAPHY | |
| Cliff, Hilltop, Hillside, Drainage, Floodplain, Streambed | |

I have read, I understood, and I have followed the Texas Natural Resource Conservation Commission's Instructions to Geologists. The information presented here complies with that document and is a true representation of the conditions observed in the field.
My signature certifies that I am qualified as a geologist as defined by 30 TAC 213




Date: 10/15/2019 (Revised 3/5/2020)

Sheet 1 of 1

COMMENTS TO GEOLOGIC ASSESSMENT TABLE
Village at Gruene Condominiums
New Braunfels, Comal County, Texas

The locations of the following features are indicated on the *Site Geologic Map* provided as *Attachment D* of this report.

ON-SITE FEATURES

Karst Features

Feature S-1 (SF):



Feature S-1 consists of solution-enlarged fractures in a limestone outcrop measuring approximately 15 x 10 feet in plan view. The photograph depicts the outcrop and fractures. This feature is located in the southwest portion of the property on a slight break-in-slope formed by erosion. The limestone exposure is generally consistent along the 665 foot elevation contour interval. The orientation of the fractures shown are approximately 340° (N-S). Fracture density and apertures are approximately 1.5 feet and 0.1 feet, respectively.

Feature S-2 (SC):



Feature S-2 consists of a solution cavity formed by dissolution of limestone bedrock likely associated with tree root growth. The dimensions of this feature are approximately 6 x 4 x 1.5 feet in length, width and depth, respectively. Orientation of the long axis of this feature is approximately 310° (NW-SE). There was no apparent development of drainage towards this feature that would indicate potential recharge at this location.

Feature S-7 (SC):



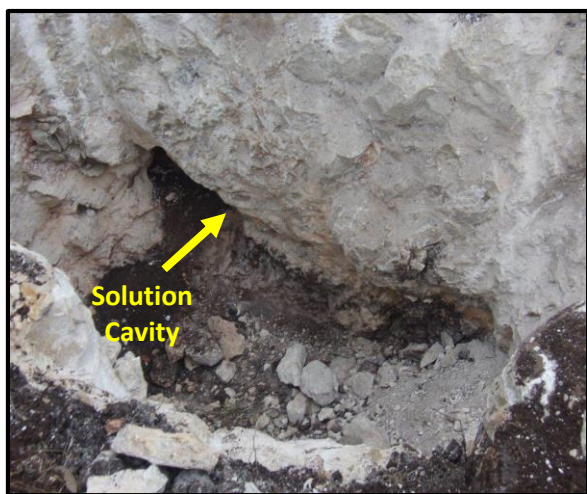
Feature S-7. As discussed in the previous geologic assessment (GA) report that was submitted for the project on February 5, 2020, a vertical solution cavity was recently identified at the SITE in close proximity to the proposed sanitary sewer utility. At the time the feature was initially assessed, its dimensions were measured at approximately 1 x 0.8 x 4 feet in length, width and depth, respectively. Although the feature was essentially vertical, the orientation of its long axis was approximately 347° (NW-SE). Based on limited hand excavation and probing, the feature was observed to taper with depth, but it was not possible to determine its complete vertical extent. Surface soil with grass was present at the base of the feature, which confirmed recent collapse. No air flow from the feature or defined surface drainage toward the feature was observed.

Pursuant to our subsequent discussions with TCEQ following their review of the previous GA report and in accordance with Edwards Aquifer Protection Program (EAPP) requirements and conditions set forth in the approved work plan submitted electronically to the agency on February 12, 2020, feature excavation activities were conducted on February 18, 2020 using heavy equipment. Excavation activities were conducted to evaluate whether a significant hydrologic connection to the subsurface existed at this location (i.e., feature serves to transmit recharge directly to the subsurface). Subsurface exploration activities were conducted to further assess the sensitivity of the feature and potential for connection to a larger subsurface void space.

A **Solution Cavity Plan and Profile** sheet (**Figure 1**) and annotated photographs that document the results of the excavation activities are provided herein as attachments immediately following this **Comments** section. As indicated on **Figure 1**, the final excavation dimensions were on the order of 6 x 3 feet in plan view and 6 feet in total depth. The vertical solution cavity was confirmed to extend through an uppermost (very resistant) bedding unit within the Cyclic and Marine Member of the Person Formation and terminate at a depth of approximately 4 feet at its lower bedding contact. As the feature was confirmed to taper with depth the solution cavity appears to have been formed in association with surficial erosional processes and tree root activity. Tree roots were encountered during the excavation process.

The original vertical solution cavity was fully removed as the result of excavation activities. The bedding contact at its termination point was observed to be highly weathered, with iron-staining and evidence of dissolution along the upper surface of the underlying (less resistant) limestone unit. The majority of the dissolution openings throughout this zone of weathering were partially to completely infilled with red “terra rossa” clay soil with scattered tree roots. The feature was found to terminate at the bedding contact and did not exhibit direct connection to any larger karst openings or void space.

Feature S-8 (SC):



Feature S-8. In conjunction with vertical excavation efforts that extended slightly (i.e., 1-2 feet) below the termination point for Feature S-7 through the weathered bedding-unit contact zone, a separate horizontal void space (solution cavity) was observed at the northwest corner of the excavation. As depicted on **Figure 1** and annotated photographs provided immediately following this **Comments** section, the aperture was measured at approximately 21 x 14 inches and confirmed to extend approximately 7 feet along the contact zone at an orientation of 29° (NE-SW). No direct connection to Feature S-7 was observed. The horizontal solution opening was not observed to connect to the south or west excavation walls and appears to represent void space along the bedding contact zone (i.e., area not completely infilled by clay terra rossa soils). The floor of the horizontal solution cavity area was observed to be comprised of clay soils. The thickness of the soils along the bedding contact is estimated to be about 1.5 to 2 feet based on excavation activities within the exploration trench.

The solution cavity opening was directly observable with the aid of a flashlight and found to taper with distance away from the excavation site (trench). The lateral boundaries of the solution cavity area are irregular and comprised of weathered (in-place) limestone and terra rossa clay. The feature was found to terminate at a distance of 7 feet. No air flow from the feature was observed and interior conditions were observed to be dry to moist. As tree roots were present within the solution cavity void space and surrounding walls, it appears that the feature (and the larger bedding unit contact zone) has been exploited historically by tree root activity.

Manmade Features in Bedrock

Feature S-3 (MB):



Feature S-3 is a derelict septic system measuring approximately 10 x 5 feet in plan view. The apparent concrete tank is installed to at least 5 feet into the Person Formation. This manmade feature is located in the southeast portion of the property, approximately 50 feet southeast of the former residential structure. No septic discharge features (i.e., sprinkler heads) or apparent subsurface leach field were observed. No surface expression of preferential flow towards this feature was observed during SITE reconnaissance activities.

Feature S-4 (MB)



Feature S-4 is a plugged domestic water-supply well. The wellhead is located in the south central portion of the property approximately 100 feet west of a former residential structure. Research in the Texas Water Development Board (TWDB) Well Registration Database confirms that the well (State Well No. 6824106) was drilled in 1936 to a total depth of 65 feet and is completed in the upper part of the Edwards Aquifer. Based on the State of Texas Plugging Report No. 176093, approximately 40 feet of well casing was removed and cemented from 68 feet to ground surface to plug the well on March 15, 2018. As reported on the well plugging report, a void was discovered at approximately 68 feet below ground

surface (bgs). The void was reportedly infilled with gravel from 68 to 98 feet bgs to facilitate plugging.

OFF-SITE FEATURES

Feature S-5 (MB)

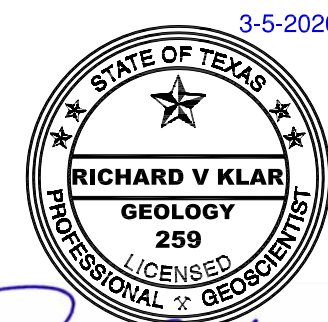
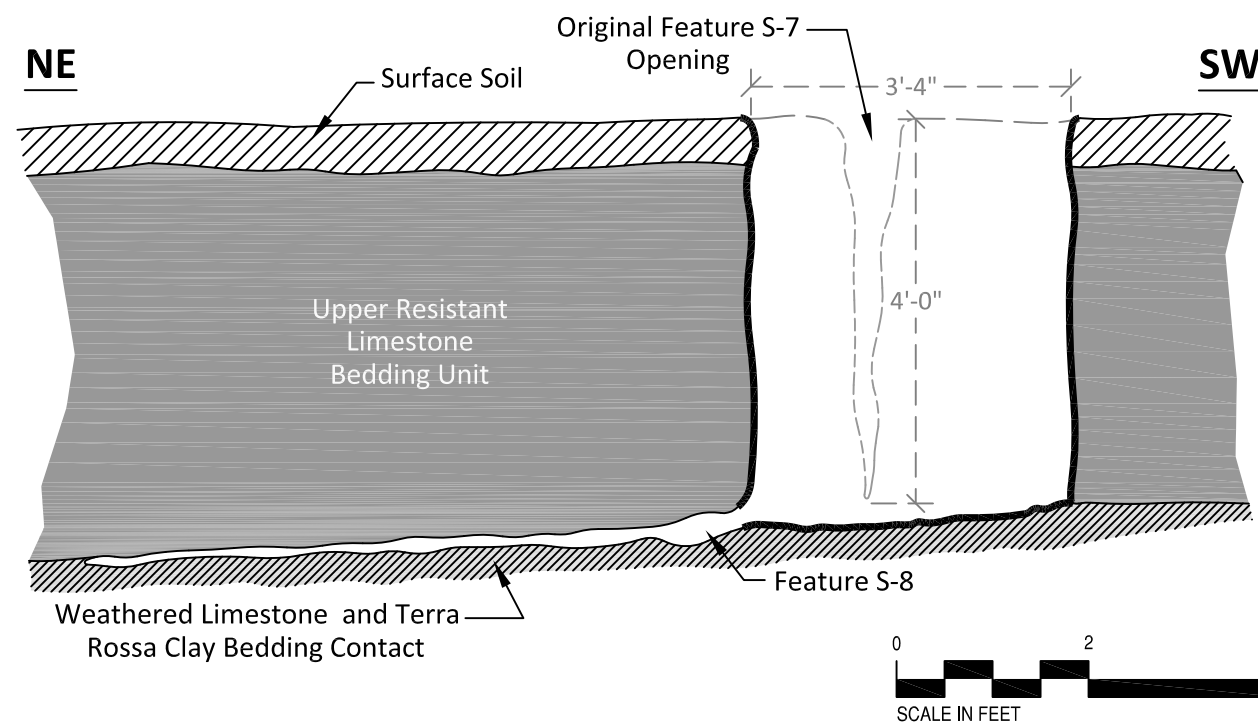
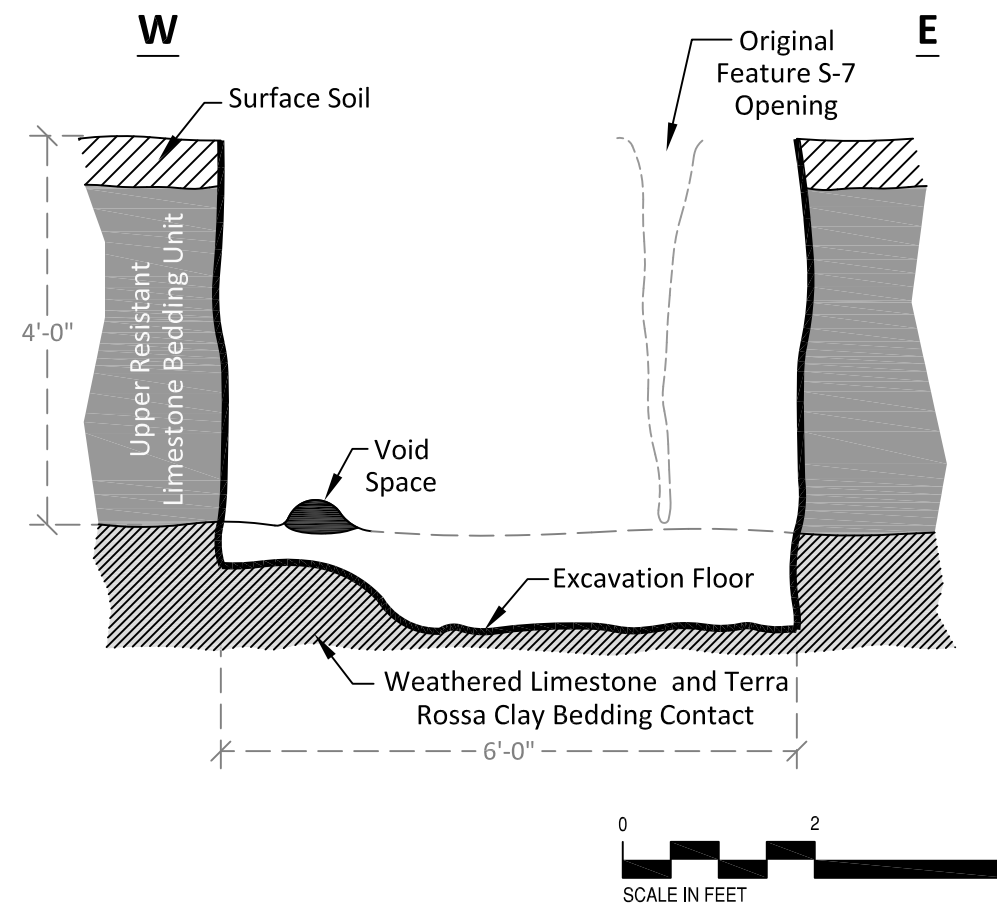
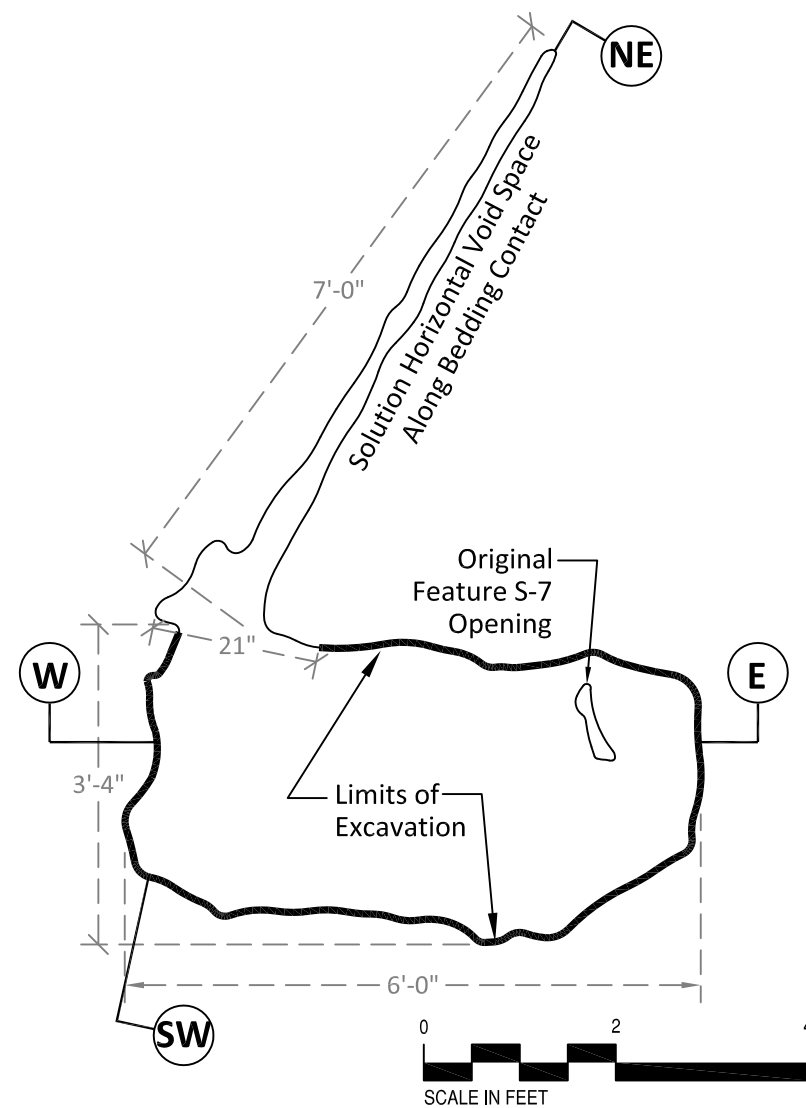
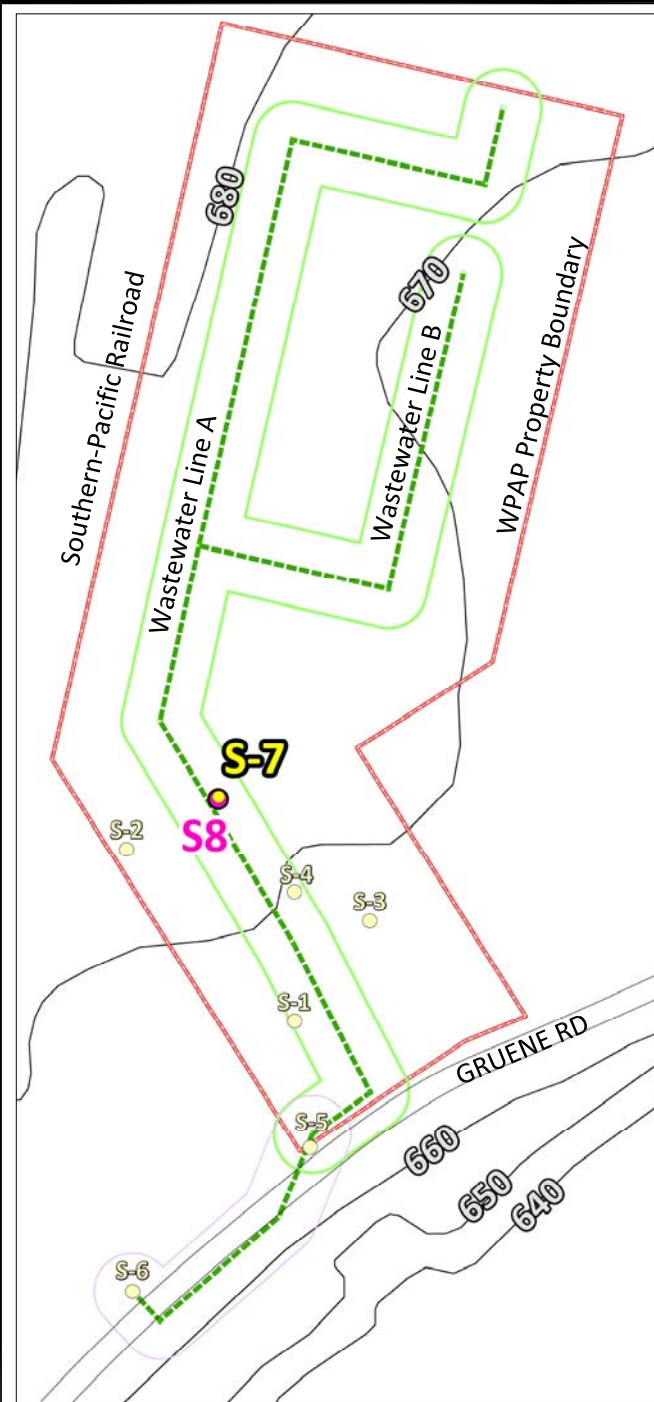


Feature S-5 consists of an existing potable water line. On the basis of our observations, it is inferred that the trench hosting the utility line is installed 4-6 feet or more into the Person Formation. Based on field reconnaissance and review of the Overall Wastewater Plan, dated October 2019 provided by HMT Engineering & Surveying, this trench hosts an existing 12- to 8-inch water line that runs parallel to Gruene Road. The water line has a tie-in connection near an existing fire hydrant just off the property boundary with a length within the off-site SCS project area estimated on the order of 411 linear feet.

Feature S-6 (MB)



Feature S-6 consists of an existing 8-inch polyvinyl chloride (PVC) wastewater line. Based on field reconnaissance and review of the Overall Wastewater Plan, Sheet C8.5 (HMT, 2019) the trench hosting the utility line is installed 4-6 feet or more into the Person Formation. The wastewater line was identified by an existing manhole located approximately 284 feet southwest of the on-site property boundary corner. The wastewater line within the off-site SCS project area is estimated on the order of 50 linear feet.



RABA
KISTNER
12821 West Golden Lane
San Antonio, Texas 78249
P 210.699.9090
F 210.699.6426
www.rkci.com

TBPE Firm F-3257 / TBPG Firm 50220

**SOLUTION CAVITY
PLAN AND PROFILE**

VILLAGE AT GRUENE CONDOMINIUMS
NEW BRAUNFELS, COMAL COUNTY, TEXAS

[illegible]

| | |
|------------------------------|------------|
| PROJECT No.: ASF19-124-00 | |
| ISSUE DATE: | 03-05-2020 |
| DRAWN BY: | LAW |
| CHECKED BY: | RAS |
| REVIEWED BY: | RVK |

ATTACHMENT A

FIGURE 1



Photo 1. View of Feature S-7 prior to excavation. Feature size is approximately 1 x 0.8 x 4 feet in length, width, and depth, respectively.



Photo 2. Top of limestone bedding unit at Feature S-7 following removal of soil and vegetation.

Photographs taken on 2/18/2020.



Photo 3. Excavation at Feature S-7 in progress through the resistant upper bedding unit of the Person Formation (Cyclic and Marine member).

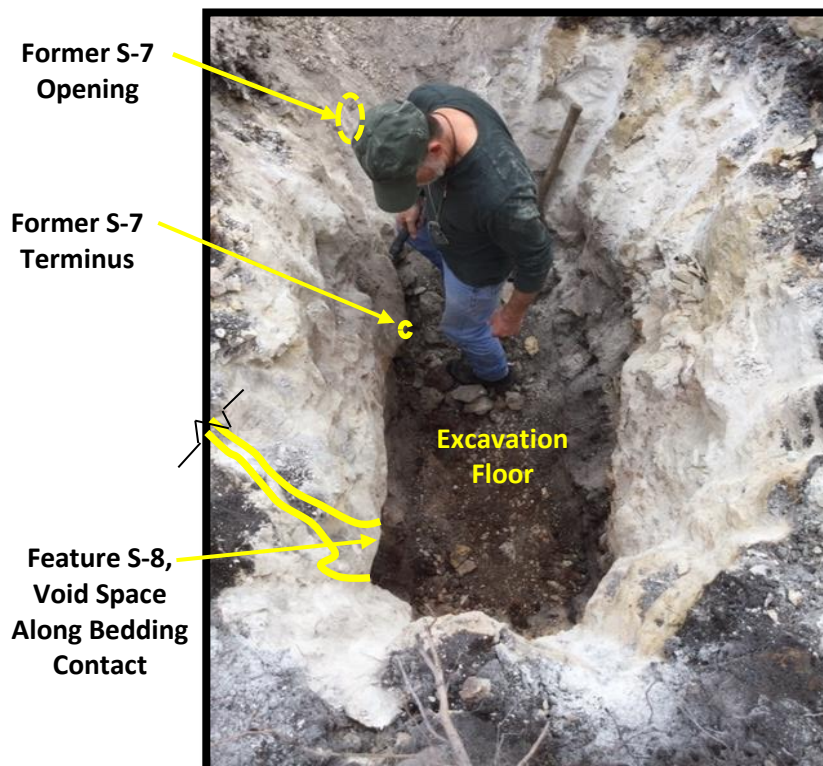


Photo 4. Final excavation extent. Feature S-7 is completely removed and was determined to be terminated at the weathered limestone contact zone (excavation floor).

Photographs taken on 2/18/2020.

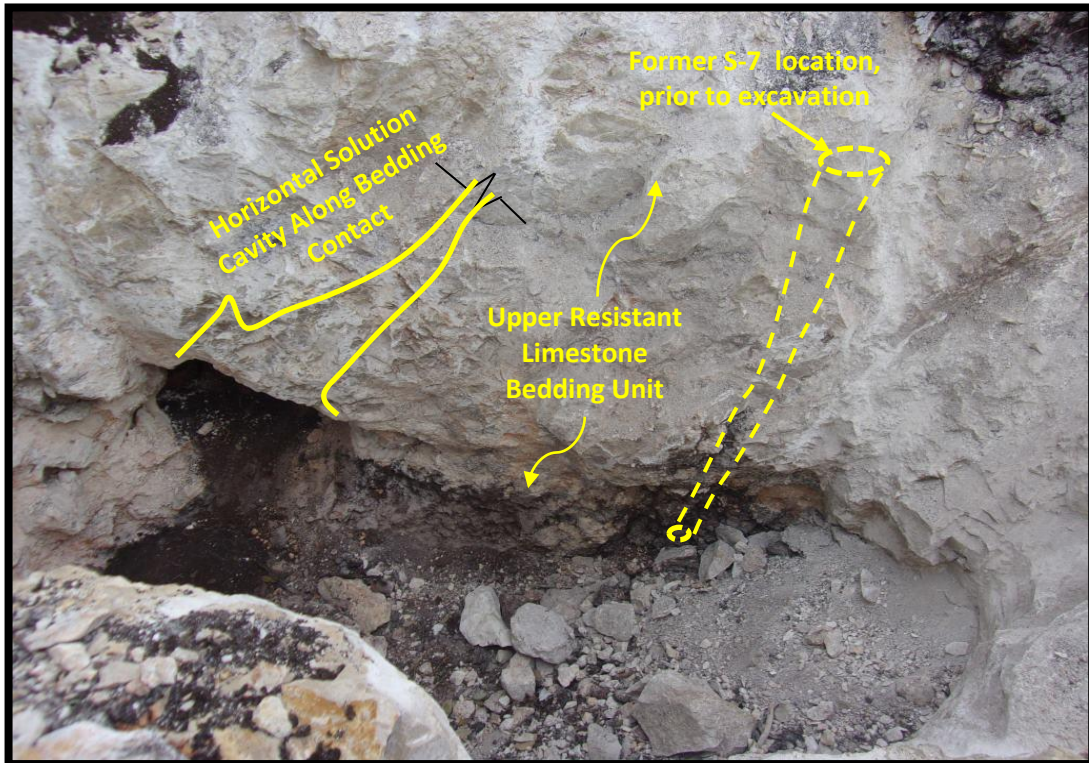


Photo 5. Overview of Feature S-8 opening at base of the bedding contact. Floor of the excavation consists of the weathered contact zone with abundant terra rossa clay infilling.



Photo 6. Feature S-8 opening at base of the excavation along the bedding contact. The feature is partially infilled with terra rossa clay.

Photographs taken on 2/18/2020.



Photo 7. Feature S-8 vertical dimensions (14 inches) of the horizontal solution cavity in the excavation sidewall.



Photo 8. Feature S-8 horizontal dimension (21 inches) of the horizontal solution cavity in the excavation sidewall.

Photographs taken on 2/18/2020.



Photo 9. Feature S-8 maximum horizontal extent (approximately 7 feet) of the horizontal solution cavity along the long axis.

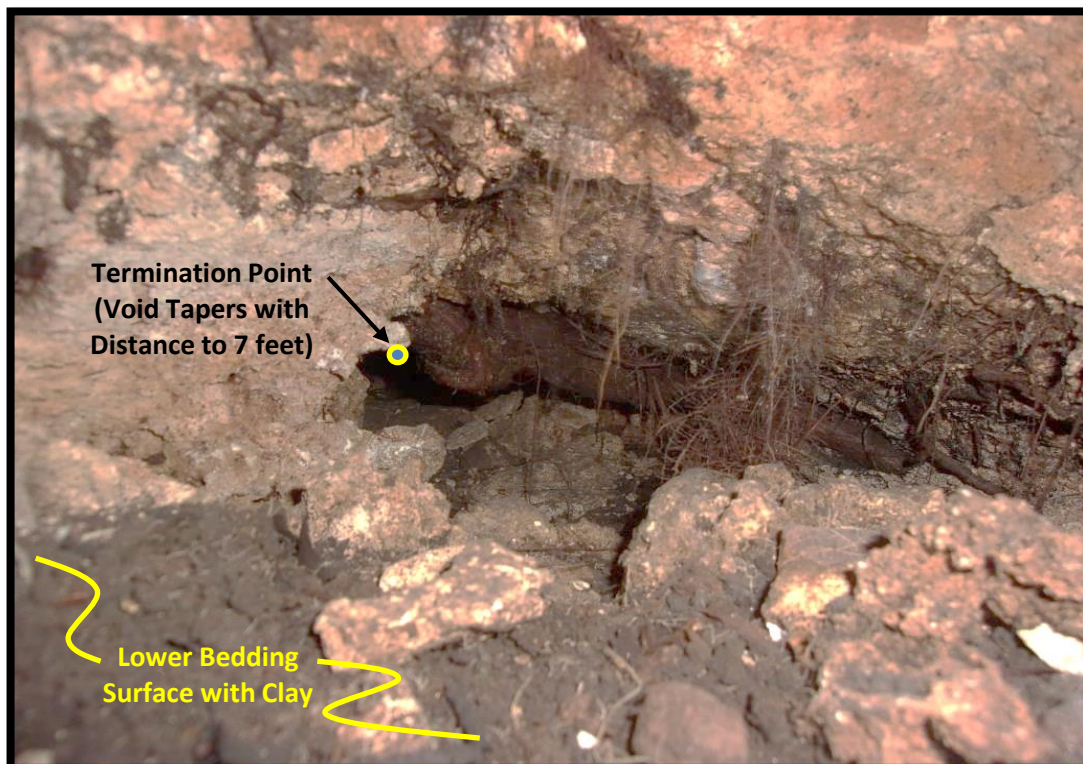


Photo 10. View of horizontal void space (Feature S-8) taken from inside the aperture.

Photographs taken on 2/18/2020.



Photo 11. Silt-fencing placed around Features S-7/S-8 excavation site.

Photographs taken on 2/18/2020.

SOIL PROFILE
Village at Gruene Condominiums
New Braunfels, Comal County, Texas

| SOIL SERIES | THICKNESS ON SITE | DESCRIPTION |
|---------------------|----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Comfort-Rock | Veneer to 1.5 ft. | Comfort-Rock outcrop complex, undulating (CrD): This complex comprises shallow clayey soils and limestone outcrop on side slopes, hilltops, and ridge tops in the Edwards Plateau. On average, Comfort soils make up 70% of the complex. Areas of limestone outcrop form narrow horizontal bands, and Comfort soils occur between the bands. The surface layer of the Comfort soil is dark brown, extremely stony clay, typically about 6 inches thick. Cobbles to 4 feet in diameter are abundant. Subsoil is dark reddish-brown clay, extremely stony and occurs to depths of about 13 inches. |
| Rumple – Comfort | 1 to 2 ft. | Rumple-Comfort association, undulating (RUD): Rumple soils comprise approximately 60% of this association and Comfort soils comprise approximately 20%. The surface layer of Rumple soils is comprised of a dark reddish brown very cherty clay loam approximately 10 inches thick. Chert and limestone cobbles cover approximately 20% of the surface. The subsoil extends to a depth on the order of 14 inches and is comprised of dark reddish brown very cherty clay. For Comfort soils, the surface layer is comprised of dark brown extremely stony clay approximately 7 inches thick. The subsoil is comprised of dark reddish brown extremely stony clay. The underlying material is indurated fractured limestone. |

The preceding table was prepared on the basis of information provided in the *Soils Survey of Comal and Hays Counties, Texas (June 1984)* in addition to field observations. As presented on the attached **Site Soils Map**, native soils mapped in the southern portion of the SITE hosting the former residence and farm structures in addition to offsite assessment area along Gruene Road are classified as Comfort-Rock outcrop complex, undulating (CrD). Soils classified as the Rumple-Comfort association, undulating (RUD) are mapped throughout the remainder of the SITE. Each of the referenced soils are weakly-developed and relatively thin, occurring over weathered limestone units of the Person Formation. While both soil units exhibit low permeability, Rumple soils have a higher permeability than Comfort soils (0.2-0.6 inches/hour versus 0.06-0.2 inches/hour, respectively), which accounts for its Soil Group classification of “C” versus “D”. Both the CrD and RUD soils are reported as having low to moderate shrink-swell potential.

Disturbed soil conditions associated with land clearing were generally observed throughout the central portion of the SITE, immediately north-northwest of the former residence and farm structures. It appears that this portion of the SITE has been used historically for temporary staging of aggregates or construction spoil.

Legend

Approximate SITE Boundary

GA Feature

Fence

Existing Manhole

Existing Water Line

Off-SITE 50-Foot SCS Buffer

Existing Wastewater Line

On-SITE 50-Foot SCS Buffer

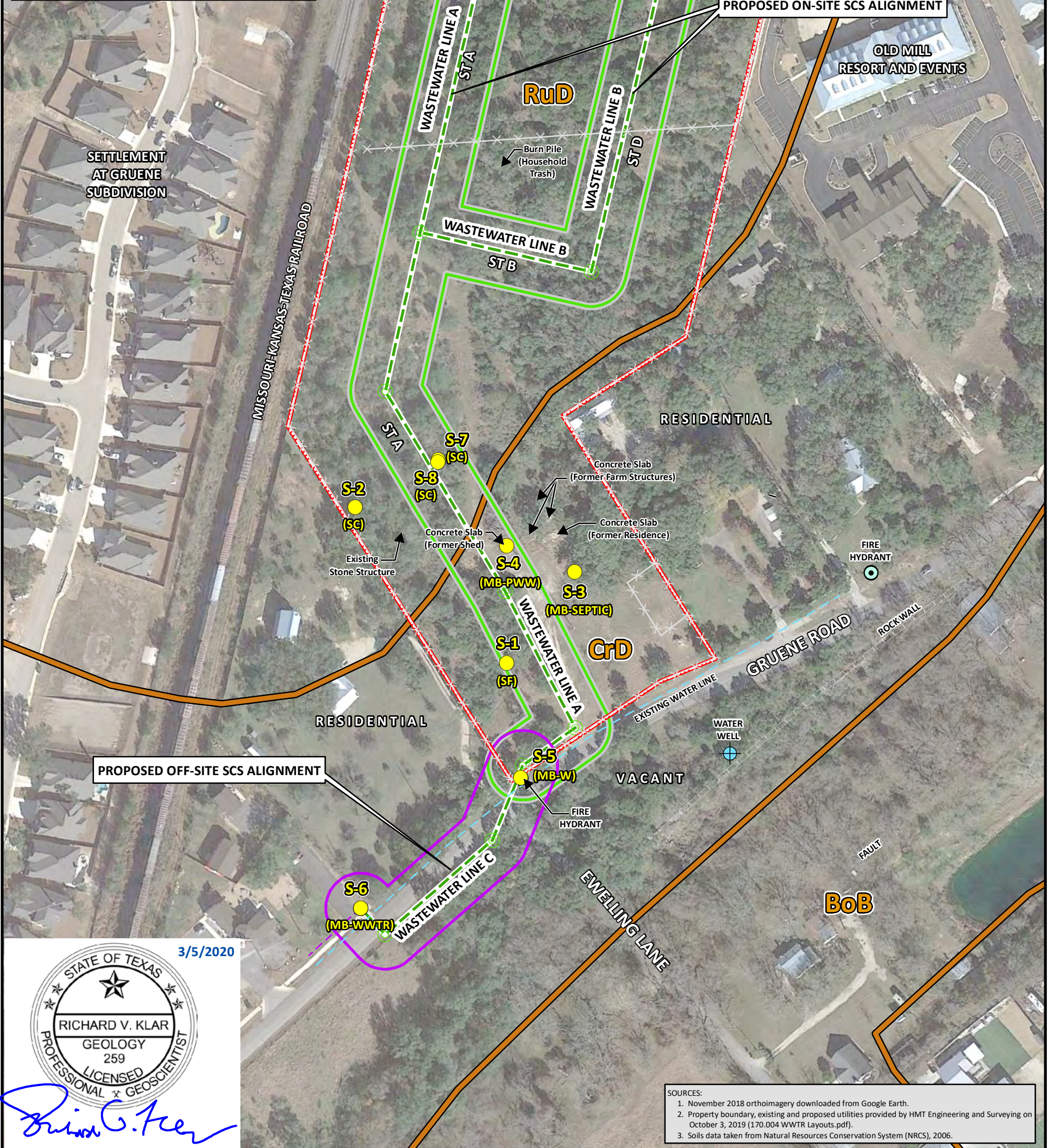
Proposed Wastewater Line

Proposed Manhole

Soil Type (NRCS, 2006)

CrD = Comfort-Rock Outcrop, undulating

RUD = Rumble-Comfort Association, undulating



STATE OF TEXAS

RICHARD V. KLAR

GEOLOGY

259

LICENSED

PROFESSIONAL GEOSCIENTIST

3/5/2020

Richard V. Klar

- SOURCES:
1. November 2018 orthoimagery downloaded from Google Earth.

2. Property boundary, existing and proposed utilities provided by HMT Engineering and Surveying on October 3, 2019 (170.004 WWTR Layouts.pdf).

3. Soils data taken from Natural Resources Conservation System (NRCS), 2006.

RABA KISTNER

Raba Kistner, Inc.

12821 West Golden Lane

San Antonio, Texas 78249

www.rkci.com

P 210 :: 699 :: 9090

F 210 :: 699 :: 6426

TBPE Firm F-3257 / TBPG Firm #50220

REVISIONS:

| No. | DATE | DESCRIPTION |
|-----|----------|--------------------------|
| 1 | 12-17-19 | Revised project title. |
| 2 | 02-05-20 | Addition of Feature S-7. |
| 3 | 03-05-20 | Addition of Feature S-8. |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

SITE SOILS MAP

VILLAGE AT GRUENE CONDOMINIUMS

NEW BRAUNFELS, COMAL COUNTY, TEXAS

PROJECT No.:

ASF19-124-00

ISSUE DATE:

10-15-19 (Rev. 03-05-20)

CHECKED BY:

RAS

DRAWN BY:

LAW

REVIEWED BY:

RVK

N

E

S

W

0

37.5

75

150

1 INCH = 150 FEET

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes

ATTACHMENT B

STRATIGRAPHIC COLUMN

STRATIGRAPHIC COLUMN
Village at Gruene Condominiums
New Braunfels, Comal County, Texas

| STRATIGRAPHIC FORMATION | THICKNESS | DESCRIPTION |
|------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Edwards Limestone (Ked) <u>Person Formation</u> (Kep) <i>Cyclic and Marine Members, undivided</i> | 180-240 feet 80-100 feet | Unit consists of massive mudstone to packstone, <i>miliolid</i> grainstone and chert. Identified in the field by cycles of massive beds to relatively thin beds. <i>Inferred to underlie the SITE as indicated in published data.</i> |
| <i>Leached and Collapsed Member, undivided</i> | 80-100 feet | Unit consists of crystalline limestone, mudstone to grainstone and chert. Identified in the field by bioturbated iron-stained beds separated by massive limestone beds. <i>Not exposed at the SITE.</i> |
| <i>Regional Dense Member</i> | 20–24 feet | Unit consists of dense, argillaceous mudstone. Identified in the field by wispy iron-oxide stains. <i>Not exposed at the SITE.</i> |

Note: Stratigraphic Column adapted from Stein and Ozuna (1996).

ATTACHMENT C

NARRATIVE OF SITE SPECIFIC GEOLOGY

SITE GEOLOGY NARRATIVE
Village at Gruene Condominiums
New Braunfels, Comal County, Texas

Introduction

The following discussion is a site-specific assessment of existing geological conditions and potential recharge features within the referenced onsite and offsite project areas. This assessment was performed by **Raba Kistner, Inc. (RKI)** for HMT Engineering & Surveying, pursuant to applicable Edwards Aquifer Protection Program (EAPP) Rules as specified in *Title 30 of the Texas Administrative Code, Section 213 (30 TAC §213, effective April 24, 2008)*. This assessment report is in the format required by the Texas Commission on Environmental Quality (TCEQ) for the Geologic Assessment portion of the referenced Water Pollution Abatement Plan (WPAP) and Sewage Collection System (SCS) Plan submittals and was prepared in accordance with the revised *Instructions to Geologists for Geologic Assessments on the Edwards Aquifer Recharge/Transition Zones (TCEQ-0585)*, which are applicable to submittals received by the TCEQ after October 1, 2004.

This geologic assessment report documents conditions observed by **RKI** within the project boundaries in conjunction with initial survey efforts on October 10, 2019, a follow-up site visit conducted on January 31, 2020 at the request of TCEQ, and subsequent karst feature assessment/excavation conducted on February 18, 2020 using heavy equipment. The follow-up site visit was performed specifically to re-assess the south-central portion of the property and evaluate the presence of a small vertical solution cavity (**Feature S-7**) that appears to have recently developed a connection to the surface due to recent rain events. Feature excavation activities were subsequently conducted at this location using heavy equipment in accordance with applicable EAPP requirements as set forth in a TCEQ-approved work plan to further assess the sensitivity of the feature and its potential connection to a larger subsurface void space. As further discussed herein, results of feature excavation activities confirmed that **Feature S-7** terminated, but revealed the presence of a separate horizontal solution opening within the lower contact zone of the uppermost (resistant) limestone bedding unit, which has been designated herein as **Feature S-8**. Although this feature had no previous connection to the surface, it was also assessed as part of the recent GA study effort.

This GA report has been prepared to document most recent mapping and karst feature assessment activities at the subject property and should supersede the previous report submitted to the agency following initial (visual) assessment of **Feature S-7** on February 5, 2020.

Site Description

Site Location. The subject project (collectively designated as SITE) is located near the intersection of Gruene Road and Ewelling Lane, in New Braunfels, Comal County, Texas and consists of: (i) approximately 14.9 acres of land (ON-SITE); (ii) a proposed on-site SCS alignment comprising approximating 2,459 linear feet (ON-SITE); and (iii) a proposed off-site SCS alignment comprising approximately 375 linear feet (OFF-SITE) along Gruene Road. The ON-SITE property is currently vacant

but hosts concrete slabs (i.e. former residence and farm structures), plugged domestic water well, derelict septic system, and stone structure.

Based on review of official maps published by the Texas Commission on Environmental Quality (TCEQ), the SITE is fully located within the Edwards Aquifer Recharge Zone (EARZ). As such, the performance of a geologic assessment is required to facilitate planned residential development and SCS construction activities in accordance with applicable provisions set forth in the EAPP rules as specified in *Title 30 of the Texas Administrative Code, Section 213 (30 TAC 213, effective April 24, 2008)*.

Topography and Drainage. Topographic contours on the U.S. Geological Survey (USGS, 2013) 7.5-minute topographic map (i.e. New Braunfels East Quadrangle) were reviewed to evaluate the general surface conditions and drainage patterns are depicted on the **Site Geologic Map**. Both the ON-SITE and OFF-SITE areas generally consist of gently sloping land characterized by hilltop topography. The elevation at the maximum elevation for the ON-SITE subject property is approximately 682 feet above mean sea level (msl) and gently slopes downhill to the southeast to an elevation of approximately 662 feet msl. The maximum elevation for the OFF-SITE subject property is approximately 662 feet above mean sea level (msl) and gently slopes downhill to the southeast to an elevation of approximately 660 feet msl. As indicated by topographic contours presented on the **Site Geologic Map**, the surface drainage pattern for the majority of the ON-SITE and OFF-SITE assessment areas is primarily from west to east and occurs as sheet flow toward natural drainage features and manmade storm water conveyances having ultimate discharge to Comal Creek, which is located approximately one-half mile to the south/southeast. No well-defined channels or drainage features exist on the SITE. A review of Flood Insurance Rate Map (FEMA, 2009) indicates that no portions of the SITE are located within 100-year or 500-year floodplain areas as depicted on official maps.

Historical Property Use. Although research pertaining to past SITE operations and historical land use activities was beyond the scope of this Geologic Assessment, historical aerial imagery was reviewed to evaluate historical land use and the presence of any lineations (i.e., evidence of a fault). No indications of normal faulting were identified in the aerial photos within SITE boundaries, although a prominent lineation correlating to a well-documented normal fault zone is located approximately 200 feet south of the subject property, south of Gruene Road. The aerial imagery indicates that improvements on the property (i.e., house, well, and septic system) occurred in the 1930s. It appears that this property was part of a larger ranch property at one time. Reconnaissance activities conducted in conjunction with recent assessment activities indicate residential and commercial land use in the SITE vicinity. The west side of the property abuts the Missouri-Kansas-Texas (M-K-T) railroad line.

In conjunction with field reconnaissance activities, disturbed soil conditions and some promiscuous dumping was observed throughout the central portion of the SITE, which appears to have historically hosted land clearing activities. Multiple gravel and soil stockpiles and a household trash burn pile were observed in this portion of the SITE. On the basis of our field observations, it appears that this portion of the property has been used as a temporary staging site for aggregate stockpiles or construction spoil.

Classification of Recharge Features: As further described herein, 4 naturally occurring recharge features attributed to karstification of limestone terrain and/or surface erosional processes were identified within

SITE boundaries. Features identified and discussed below include a solution-enlarged fracture outcrop, 3 solution cavities, in addition to 4 manmade features: (i) plugged domestic water-supply well (ii) derelict septic system, (iii) potable water utility, and (iv) wastewater utility. The significance of these features was assessed using definitions and guidance provided in *Instructions to Geologists (TCEQ-0585-Instructions, revised October 1, 2004)*. All features within the SITE that met the criteria presented in this reference were mapped. The characteristics of all mapped features and the assessments of these features, as defined by the TCEQ, are presented in the attached **Geologic Assessment Table (TCEQ-0585-Table)**.

As further discussed herein, additional excavation and assessment activities were conducted to specifically evaluate solution cavity **Features S-7 and S-8** following submittal of the previous GA report

Stratigraphy

As presented in the attached **Stratigraphic Column**, information pertaining to the lithologies and thickness of geologic units underlying the SITE was primarily taken from Stein and Ozuna (1996). More recent geologic mapping data by Collins (2000) indicates that the SITE is underlain by limestone of the Person Formation (Kep), which comprises the uppermost part of the Edwards Limestone and consists of 180 to 224 feet of limestone, subdivided into 3 discrete members (i.e., Cyclic and Marine member, leached and collapsed member and the regional dense member. As presented on the **Site Geologic Map**, field observations indicate that the entire SITE is underlain by the Cyclic and Marine layer (Kpcm) of the Person Formation, which consists of alternating massive and thin beds of mudstone, packstone, and *miliolid* grainstone.

Where exposed at the SITE, the Cyclic and Marine member contains open fractures, but possesses low matrix permeability with total porosity on the order of 5 to 10%. The underlying Leached and Collapsed member is reported with zones of honeycombed porosity that are laterally extensive with a total porosity less than 20%. This member is generally considered the most porous and permeable part of the Person Formation. Based on review of published sources and field observations, this unit is not exposed at the SITE, but it is inferred that the former ON-SITE water well (**Feature S-4**) was completed within it below a depth of approximately 40 feet relative to existing ground surface.

Structure

This SITE is located along the southern edge of the Balcones Fault Zone and, as such, exhibits a similar structural trend. The Balcones Fault Zone generally consists of a northeast-southwest trending, *en echelon* normal fault system, which juxtaposes Upper Cretaceous lithologies in the southeast with Lower Cretaceous lithologies in the northwest. As a result of this larger-scale, regional faulting, minor internal fault sequences and fractures exist within this zone which generally follow the same structural trend and accommodate localized displacement. No indications of faulting were identified within the ON-SITE or OFF-SITE assessment areas in conjunction with field mapping efforts.

Based on review of published geological maps, a large normal fault is identified by Collins (2000) approximately 200 feet southeast of the SITE, juxtaposing older (Kpcm) rocks on the northwest side of the fault with younger fluvial (river) deposits southeast of the fault.

Karst Features

A total of 4 recharge features were identified within the SITE boundaries that are attributed to karstification of the limestone terrain. The sensitivity of the features was assessed based upon application of point assignment criteria presented in the ***Geologic Assessment Table (TCEQ-0585)*** and professional judgment. A brief description of karst features is provided in the following paragraphs. Please see ***Comments to Geologic Assessment Table*** provided in ***Attachment A*** for complete descriptions of karst features and discussion of additional excavation activities conducted to further evaluate ***Features S-7 and S-8***.

Solution-Enhanced Fracture

ON-SITE Feature S-1 consists of a weathered limestone exposure exhibiting dissolution-enlarged fractures. Fractures, which trend roughly north-south, are apparently limited to the upper limestone bedding unit and were found to extend about 1 foot vertically into the subsurface, terminating in a lower limestone bedding unit. The feature is partially filled with fine-grained soils and vegetative materials. Exposed bedrock in the area containing the subject feature generally meets the definition of “karren”. This is supported by the fact that dissolution features generally terminate in soil or the uppermost limestone bedding unit with no connection to the subsurface that would provide rapid infiltration.

This feature is classified as not sensitive owing to its erosional origin, stratigraphic location, and estimated low relative infiltration rate (i.e., no evidence of capacity for rapid infiltration).

Solution Cavities

ON-SITE Feature S-2 consists of a solution cavity that appears to have formed as the result of tree root activity. The feature consists of small vertical solution cavities associated with surface scour and erosion within the weathered upper surface of the Person Formation. The feature is primarily limited to the soil zone, but were found to extend about 1.5 feet vertically into the subsurface based on probing through loose soil infilling. The feature appears to have been enhanced by tree root activity and surface runoff. Collective field observations indicate that the feature is limited to the uppermost weathered limestone/soil horizon (epikarst zone) and does not connect to a larger subsurface karst features or open void.

This feature is classified as not sensitive owing to its inferred erosional origin, position within the epikarst zone with no connection to underlying limestone, and estimated low relative infiltration rates (i.e., no evidence of capacity for rapid infiltration).

ON-SITE Feature S-7 consisted of a small-diameter vertical solution cavity that extended approximately 4 feet into the underlying Person Formation. No surface expression was evident during the initial October 2019 assessment, but this feature appears to have developed a surface connection in association with subsequent rainfall events. Results of an initial assessment conducted on January 31, 2020 indicated that the feature appeared to taper with depth, but it was

not possible to determine its complete vertical extent. Surface soil with grass was present at the base of the feature, which confirmed recent collapse of soil cover. As reported in the previous February 5, 2020 GA report, this feature was initially classified as potentially sensitive owing to its inferred karst origin, connection to underlying limestone, and inferred potential for rapid infiltration. Although classified as sensitive per point assignment criteria set forth in the Geologic Assessment Table, it was not considered to represent a significant recharge feature, however, owing to its small size, lack of established drainage, and very small upgradient catchment area.

As further discussed in the **Comments** section, the project owner subsequently elected to further assess feature sensitivity in accordance with established EAPP protocols (i.e., Phase II assessment) to determine whether a significant hydrologic connection to the subsurface existed at this location (i.e., feature serves to transmit recharge directly to the subsurface). Following TCEQ approval of a work plan request submitted on February 12, 2020, excavation activities were subsequently conducted on February 18, 2020 using heavy equipment (backhoe excavator) to further assess the sensitivity of the feature and potential for connection to a larger subsurface void space. The vertical solution cavity was confirmed to extend through an uppermost (very resistant) bedding unit and terminate at a depth of approximately 4 feet at its lower bedding contact. The original vertical solution cavity was fully removed as the result of excavation activities.

On the basis of observations during the excavation process and in consideration of applicable point assignment criteria, the feature has been reclassified as not sensitive. Information developed as the result of the assessment effort that supports this classification is as follows:

- The solution cavity appears to have been formed in association with surficial erosional processes and tree root activity. Tree roots were encountered during the excavation process.
- The feature was found to terminate at the bedding contact and did not exhibit direct connection to any larger karst openings or subsurface void space.
- Although the bedding contact was observed to be highly weathered, with iron-staining and evidence of dissolution, the majority of the dissolution openings throughout this zone of weathering were partially to completely infilled with red “terra rossa” clay soil and scattered tree roots.
- There is no well-defined drainage or channelization of surface flow to the feature. The feature did not contribute significant recharge to the subsurface.

ON-SITE Feature S-8. In conjunction with vertical excavation efforts that extended slightly (i.e., 1-2 feet) below the termination point for **Feature S-7** through the weathered bedding-unit contact zone, a separate horizontal void space (solution cavity) was observed at the northwest corner of the excavation trench. As depicted on the field sketches and annotated photographs provided in the **Comments** section, the aperture was measured at approximately 21 x 14 inches and confirmed to extend approximately 7 feet along the contact zone at an orientation of 29° (NE-SW). The feature is localized in nature and does not connect to the south or west

excavation walls. The floor of the horizontal solution cavity area was observed to be comprised of clay soils. The thickness of the soils along the bedding contact is estimated to be about 1.5 to 2 feet based on excavation activities within the exploration trench. The solution cavity opening was directly observable with the aid of a flashlight and found to taper with distance away from the excavation site (trench). The lateral boundaries of the solution cavity area are irregular and comprised of weathered (in-place) limestone and terra rossa clay.

On the basis of observations during the excavation process and in consideration of applicable point assignment criteria, the feature has been classified as not sensitive. Information developed as the result of the assessment effort that supports this classification is as follows:

- Prior to excavation, this horizontal solution opening did not have a direct connection to the surface. No direct connection to **Feature S-7** was observed.
- The solution cavity is localized and appears to have been formed by dissolution along the limestone bedding-unit contact zone. The contact zone that hosts the feature is partially to completely infilled with red terra rossa clay soils, which typically facilitate the retention of subsurface soil moisture.
- The feature was found to terminate at a maximum distance of 7 feet from its opening. No air flow from the feature was observed and interior conditions were observed to be dry to moist. The feature does not constitute a drain and is not considered to represent a major component of the subsurface flow system.
- As tree roots were present within the solution cavity void space and surrounding walls, it appears that the feature (and the larger bedding unit contact zone) has been exploited historically by tree root activity.
- There is no well-defined subsurface drainage toward or through the feature. The feature does not contribute significant recharge to the subsurface.

Manmade Features

As presented on the **Site Geologic Map**, a total of 4 manmade features were identified that may potentially serve to enhance the transmission of surface runoff to the subsurface. The features consist of a derelict septic system and plugged domestic water-supply well, in addition to potable water and wastewater utility lines which meet the criteria for assessment as manmade features in bedrock. Although some information regarding the locations of the existing water and wastewater utility trenches were gleaned from base maps provided to **RKI** by HMT on October 3, 2019, the locations of remaining utility trenches are largely inferred, based on field observations of manway access points or valves. The specific utility trench features identified are listed below:

ON-SITE

Feature S-3 consists of a derelict septic system.

Feature S-4 consists of a plugged domestic water-supply well.

OFF-SITE

Feature S-5 consists of a potable water utility line.

Feature S-6 consists of an existing wastewater utility line.

None of the manmade features were observed in conjunction with any naturally-occurring recharge features. The septic system, potable water line and wastewater line are classified as not sensitive, having a low potential of transmitting fluids into the Edwards Aquifer.

Review of the Texas Water Development Board (TWDB) Water Interactive Data (WID) website <https://www2.twdb.texas.gov/apps/WaterDataInteractive/GroundwaterDataViewer/?map=sdr> confirms that (**Feature S-4**) was a former domestic water-supply well that was plugged and abandoned with cement on March 15, 2018. The plugging report indicates that a significant void was identified at the base of the well and filled with gravel from approximately 68 feet to 98 feet below ground surface. As the water well is no longer existing, it is classified as not sensitive. These classifications are based upon the point assignment criteria presented in the **Geologic Assessment Table (TCEQ-0585)** and professional judgment.

Potential for Fluid Migration to the Edwards Aquifer

The majority of the SITE is characterized by intact limestone with overlying clay soils having slow or very slow published infiltration rates. Based on our review of SITE geology, topography and drainage conditions, in addition to the results of our detailed mapping efforts, the overall potential for fluid movement (i.e. surface-derived flow) to the Edwards Aquifer via infiltration is considered to be low to moderate. The following assessment findings support this conclusion.

- The SITE is directly underlain to depths estimated on the order of 80-110 feet by the Person Formation, the uppermost unit of the Edwards Aquifer. With the exception of a small vertical solution cavity (**Feature S-7**) identified within the south-central portion of the SITE, no potentially sensitive karst or manmade features were identified in conjunction with initial (Phase I) reconnaissance mapping efforts. Results of additional intrusive (Phase II) assessment efforts at **Feature S-7** did not reveal a direct connection to any larger karst openings or subsurface void space.
- Other naturally-occurring karst features identified as the result of this assessment were fully assessed by probing and/or hand-excavation and determined to be either: (i) limited to the epikarst zone with no evidence of rapid infiltration capacity (**Features S-1 and S-2**); or (ii) localized subsurface solution opening along bedding-unit contact zone with terra rossa clay infilling (**Feature S-8**).
- No well-defined drainage channels exist on SITE that would serve to concentrate or focus recharge into the subsurface; particularly in association with any of the mapped recharge features.
- On the basis of Phase II assessment results discussed herein, it is recommended that the WPAP include provisions for the plugging and abandonment of the exploratory trench that was installed

to assess **Feature S-7** during the initial phases of SITE development. Pending TCEQ approval, this could be accomplished by placement of limestone gravel from the base of the trench along the bedding-unit contact zone up to a depth of 2 feet, followed by a clay soil cap.

References

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- Maclay, R. W., 1995, Geology and hydrogeology of the Edwards aquifer in the San Antonio area, Texas: U.S. Geological Survey Water Resources Investigations Report 95-4186, 64 p.
- National Flood Insurance Program, 2009, Flood Insurance Rate Map, Comal County, Texas and Incorporated Areas; Federal Emergency Management Agency, Map 48091C0455F.
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- Texas Water Development Board, Water Data Interactive (WDI) Groundwater Data Viewer, <https://www2.twdb.texas.gov/apps/WaterDataInteractive/GroundwaterDataViewer/?map=sdr>, accessed October 11, 2019.
- United States Geological Survey (USGS), 2013, New Braunfels East Quadrangle; USGS, Denver, Colorado.
- United States Department of Agriculture (USDA), 1984, Soil Survey of Comal and Hays Counties, Texas; USDA / Soil Conservation Service / Texas Agricultural Experiment Station.
- United States Department of Agriculture (USDA), 1986, Urban Hydrology for Small Watersheds; USDA / Natural Resource Conservation Service, Technical Release (TR-) 55, June 1986.

ATTACHMENT D

GENERAL SITE PHOTOGRAPHS

FEATURE POSITION TABLE (GPS COORDINATES)

SITE GEOLOGIC MAP

GENERAL SITE PHOTOGRAPHS
Village at Gruene Condominiums
New Braunfels, Comal County, Texas



View to the northwest of the SITE entrance.



View to the east of an old water cistern.



View to the north of the former residence location.



View to the west of a former structure foundation.



View to the east along the proposed St A wastewater alignment (Line A).



View to the southwest of gravel/soil stockpiles near the central portion of the SITE.



View to the south of an old burn pile in the central portion of the SITE.



View to the south along the proposed St A wastewater alignment (Line A).



View to the west along the proposed St C wastewater alignment. (Line A)



View to the east along the proposed St C wastewater alignment (Line A).



View to the north along the proposed St D wastewater alignment (Line B).

FEATURE POSITION TABLE
Village at Gruene Condominiums
New Braunfels, Comal County, Texas
RKI Project No. ASF19-124-00

| Feature Designation | Feature Type | Date Collected | North Latitude | West Longitude | UTM Northing (meters) | UTM Easting (meters) |
|--------------------------|-----------------------------------------------------------------|----------------|----------------|----------------|-----------------------|----------------------|
| ON-SITE FEATURES | | | | | | |
| S-1 | Solution-Enhanced Fracture | 10/10/2019 | N29 44 02.3 | W98 06 49.9 | 3289639 | 585695 |
| S-2 | Solution Cavity | 10/10/2019 | N29 44 04.6 | W98 06 52.3 | 3289707 | 585629 |
| S-3 | Manmade Feature in Bedrock (Derelict Septic System) | 10/10/2019 | N29 44 03.6 | W98 06 48.7 | 3289678 | 585725 |
| S-4 | Manmade Feature in Bedrock (Plugged Domestic Water-Supply Well) | 10/10/2019 | N29 44 04.0 | W98 06 49.9 | 3289690 | 585695 |
| S-7 | Solution cavity | 1/31/2020 | N29 44 05.3 | W98 06 51.0 | 3289728 | 585665 |
| S-8 | Solution cavity | 2/18/2020 | N29 44 05.2 | W98 06 51.0 | 3289727 | 585665 |
| OFF-SITE FEATURES | | | | | | |
| S-5 | Manmade Feature in Bedrock (Water Line) | 10/10/2019 | N29 44 00.7 | W98 06 49.7 | 3289588 | 585701 |
| S-6 | Manmade Feature in Bedrock (Wastewater Line) | 10/10/2019 | N29 43 58.9 | W98 06 52.3 | 3289531 | 585631 |

NOTES:

- 1) Geographic coordinates are presented Degrees, Minutes, Decimal Seconds
- 2) Reference Datum is NAD 83
- 3) Data were collected utilizing a **Garmin GPS 60cx Global Positioning System**
- 4) Horizontal Accuracy: RMS Value < 3 meter ground resolution
- 5) GPS data were collected by Rick Sample (RKI Project Professional).



RABA KISTNER, Inc.
12821 West Golden Lane
San Antonio, Texas 78249
www.rkci.com
P 210 :: 699 :: 9090
F 210 :: 699 :: 6426

SOURCES:

1. November 2018 orthomage taken from Google Earth.
2. Property boundary and existing and proposed utilities provided by HMT Engineering and Surveying on October 3, 2019 (170.004 Wastewater Layouts.pdf).
3. 10-foot topographic contours provided by Texas Natural Resources Information System (TNRS), based off U.S.G.S. 7.5 minute series topographic map, New Braunfels East, 2013.
4. Geology and fault taken from Collins, Geologic Map of the New Braunfels, Texas, 30x60 Quadrangle, Bureau of Economic Geology, 2000.
5. The ON-SITE and OFF-SITE project areas are located on the Edwards Aquifer Recharge Zone (EARZ), TNRC Edwards Aquifer Protection Program, 1998, Edwards Aquifer Recharge Zone Map, New Braunfels East, September 1998.
6. Both the ON-SITE and OFF-SITE are located in Zone X (Aerial of Minimal Flood Hazard). Data reviewed from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), September 2009, panel no. 48091C045F.

REVISIONS:

| No. | DATE | DESCRIPTION |
|-----|----------|-------------------------|
| 1 | 12-17-19 | Revised project title |
| 2 | 02-05-20 | Addition of Feature S-7 |
| 3 | 03-05-20 | Addition of Feature S-8 |

SITE GEOLOGIC MAP
VILLAGE AT GRUENE CONDOMINIUMS
NEW BRAUNFELS, COMAL COUNTY, TEXAS

PROJECT NO.: ASF-19-124-00
ISSUE DATE: 10-15-19 (Rev. 03-05-20)
DRAWN BY: LAW
CHECKED BY: BAS
REVIEWED BY: JWK

0 15 30 60
1 INCH = 60 FEET

TBPE Firm F-3257 / TBPG Firm #50220

NOTE: This Drawing is Provided for Illustration Only, May Not be to Scale and is Not Suitable for Design or Construction Purposes