Robert J. Huston, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Jeffrey A. Saitas, *Executive Director*

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DOC# 9906004195

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

February 9, 1999

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberly, TX 78676

Re: EDWARDS AQUIFER, Comal County
PROJECT: River Chase Subdivision, Project number 1124, Located on west side of FM 306, approximately 2.5 miles south of Purgatory Road, Comal County, Texas
TYPE: Request for Approval of Water Pollution Abatement Plan (WPAP); 30 Texas Administrative Code (TAC) §213.5(b); Edwards Aquifer Protection Program

Dear Mr. Patterson:

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the WPAP application for the referenced project that was submitted by Pro-Tech Engineering Group, Inc. on behalf of Summerlin Properties, Inc. to the San Antonio Regional Office on November 16, 1998. Final review of the WPAP submittal was completed after additional material was received on December 8, 1998, and January 28, 1999. The WPAP proposed in the application is in general compliance with 30 TAC § 213.5(b); therefore, approval of the plan is hereby granted subject to applicable state rules and the conditions in this approval letter. *This approval expires two (2) years from the date of this approval unless, prior to the expiration date, construction has commenced on the project or an extension of time has been requested.*

PROJECT DESCRIPTION

The proposed residential project will have an area of 1,494.67 acres and will consist of 338 single family residential lots of three to five acres each. Project wastewater for each residence will be treated by a private on-site Class 1 aerobic system. A letter signed by Thomas H. Hornseth, P.E., Comal County Engineer, on October 16, 1998, states,

> We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the proposed subdivision to be approved with the condition that individual septic systems permits shall be required for the lots within this subdivision.
>
> Please be advised that these individual permits will be required to meet 30 TAC 285.40, SubChapter E.... Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

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Please note that separation distances must be maintained from any existing well(s) or the well(s) must be plugged by a well driller.

The proposed impervious cover for the development is approximately 61.34 acres (4%). The site is located within the Comal County, and must conform with applicable codes and requirements of Comal County.

GEOLOGY ON SITE

According to the geologic assessment included with the submittal, there are 118 geologic or manmade features located on the project site. Five features were evaluated as sensitive, 65 were assessed as possibly sensitive, and 48 were assessed as not sensitive.

Feature S-1 covers an area 5500' by 1500' (approximately 189 acres). The geologic assessment reports the relative infiltration rate to be high, and the feature to be sensitive. It is described as:

> Discontinuous fractured vuggy rock zone. Density, aperture, and infilling varies across feature but generally zone is high density, large aperture with fine-grained infilling. Areas near cliffs lacked any infilling. Vugs generally appear to be interconnected but vary with density. The contact of this zone was estimated in some areas on the north end due to inaccessibility of the area.

Feature S-117 covers an area 8000' by 2000' (approximately 367 acres) and is similar to Feature S-1. The geologic assessment reports the relative infiltration rate to be moderate, and the feature to be possibly sensitive. It is described as:

> Discontinuous vuggy rock zone. Density, aperture, and infilling varies across feature but generally zone is high density, with large aperture with fine-grained infilling. Vugs generally appear to be interconnected but vary with density.

The San Antonio Regional Office site inspection of December 22, 1998, and January 14, 1999, revealed no other sensitive features. It was observed that Feature S-1 (megafeature) is underlain by a shallow vuggy rock zone. All incised drainages contain most of the possibly sensitive macrofeatures.

GEOLOGY DOWNGRADIENT OF SITE

According to the geologic assessment included with the submittal, there are 29 geologic or manmade features downgradient of the project site. Two features were evaluated as sensitive, seven were assessed as possible sensitive, and 20 were assessed as not sensitive.

PERMANENT POLLUTION ABATEMENT MEASURES

Seventy geologic features on the project site were assessed as being sensitive or possibly sensitive. The permanent pollution abatement measures that will be provided to protect these features are:

1. Require Class 1 aerobic systems for wastewater treatment and disposal for all lots within the subdivision.

DOC# 9906004195

2. No wastewater treatment systems will be located within the "sanitary control easements" noted on the revised site plan dated January 22, 1999.

SPECIAL CONDITIONS

1. Related to on-site sewage facilities on the Edwards Aquifer Recharge Zone, Paragraph 30 TAC 285.40(c)(2) states:

> Minimum separation distances from recharge features. The following separation distances shall be maintained from recharge features found during a site evaluation or in accordance with a geologic assessment performed in accordance with Chapter 213 of this title (relating to Edwards Aquifer). No sewage treatment tank or holding tank may be located within 50 feet of a recharge feature. No soil absorption system may be located within 150 feet of a recharge feature.

Therefore, the following minimum separation distances in feet must be provided between OSSF units and recharge features (including Feature S-1) or possible recharge features (including S-54, S-76, S-62, S-67, S-76, S-80, S-82, S-83, and S-117):

Sewage Treatment Tanks or Holding Tanks	50
Soil Absorption Systems, & Unlined Evapotranspiration Beds	150
Lined Evapotranspiration Beds	50
Sewer Pipe with Watertight Joints	50
Surface Irrigation Fields	150
Drip Irrigation Fields	100 when $R_a \leq 0.1$ 150 when $R_a > 0.1$

2. If any potential sensitive features are encountered during construction, a geologist shall evaluate the significance of the features. The evaluation shall include representative photographs and a description of the feature forwarded to the San Antonio office. Construction in the vicinity of the features may only continue with written approval from the TNRCC.

3. The proposed on-site sewage facility (OSSF) must be permitted by a local or the state permitting authority prior to commencement of construction.

4. All planning and design materials for the proposed OSSF shall be submitted by a professional engineer or a sanitarian registered in Texas.

5. A site evaluation shall be conducted by a certified site evaluator possessing a valid certificate beginning August 1, 1998. The evaluator shall submit an evaluation report of the site [30 TAC 285.4(c)] to the San Antonio Regional Office no later than two weeks prior to the onset of construction at the subdivision.

6. The proposed OSSF must meet all other requirements found in 30 TAC § 285--On-Site Sewage Facilities.

DOC# 9906004195

7. The applicant must notify all purchasers that OSSFs on all lots with possibly sensitive and sensitive features must have the required separation distances. The notification must include a copy of this letter.

8. No part of an on-site sewage treatment facility may be located within any "sanitary control easement."

STANDARD CONDITIONS

1. During the course of regulated activities related to this project, the applicant or his agent shall comply with all applicable provisions of 30 TAC Chapter 213, Edwards Aquifer. The applicant shall remain responsible for the provisions and conditions of this approval until such responsibility is legally transferred to another person or entity, upon which that person or entity shall assume responsibility for all provisions and conditions of this approval.

2. Any modification to the activities described in the referenced WPAP application following the date of approval may require the submittal of a WPAP to amend this approval, including the payment of appropriate fees and all information necessary for its review and approval.

3. Prior to commencing any regulated activity, the applicant or his agent must notify the San Antonio Regional Office in writing of the date on which the regulated activity will begin.

4. The applicant or his agent shall record this WPAP approval in the county deed records within 30 days of receiving this notice of approval. Proof of deed recordation shall be submitted to the San Antonio Regional Office prior to commencing construction. A suggested format that you may use to deed record the approved WPAP is enclosed.

5. All contractors conducting regulated activities at the project location shall be provided a copy of this notice of approval. At least one complete copy of the approved WPAP and this notice of approval shall be maintained at the project location until all regulated activities are completed.

6. Temporary erosion and sedimentation (E&S) controls, i.e., silt fences, rock berms, stabilized construction entrances, or other controls described in the approved WPAP, must be installed prior to construction and maintained during construction. Temporary E&S controls may be removed when vegetation is established and the construction area is stabilized. If a water quality pond is proposed, it shall be used as a sedimentation basin during construction. The TNRCC may monitor stormwater discharges from the site to evaluate the adequacy of temporary E&S control measures. Additional controls may be necessary if excessive solids are being discharged from the site.

7. If any significant recharge feature [sensitive feature] is discovered during construction, all regulated activities near the feature must be suspended immediately. The applicant or his agent must immediately notify the San Antonio Regional Office of the discovery of the feature. Regulated activities near the feature may not proceed until the executive director has reviewed and approved the methods proposed to protect the feature and the aquifer from potential adverse impacts to water quality.

DOC# 9906004195

8. At project locations where construction is initiated and abandoned, or not completed, the site shall be returned to a condition such that the aquifer is protected from potential contamination.

9. Approval of the design of the sewage collection system for this proposed project shall be obtained from the TNRCC prior to commencement of construction of any sewage collection system.

10. Four wells exist on the site. Any abandoned wells shall be plugged in accordance with 30 TAC § 338 or an equivalent method, as approved by the Executive Director.

    Any drill holes resulting from core sampling on-site or down-gradient of the site shall be plugged with native soil, from the bottom of the hole to the top of the hole, so as to not allow water or contaminants to enter the subsurface environment.

11. Pursuant to §26.136 of the Texas Water Code, any violations of the requirements in 30 TAC §213 may result in administrative penalties.

If you have any questions or require additional information, please contact John Mauser of the Edwards Aquifer Protection Program at 210/403-4024. Please reference project number 1124.

Sincerely,

Richard Garcia

Jeffrey A. Saitas, P.E.
Executive Director
Texas Natural Resource Conservation Commission

STATE OF TEXAS
COUNTY OF COMAL
This is to certify that this document was FILED and RECORDED in the Official Public Records of Comal County, Texas on the date and time stamped thereon.

Joy Streater
COUNTY CLERK
COMAL COUNTY, TEXAS

JAS/JKM /eg

Enclosure: Deed Recordation Affidavit

cc: Richard McDaniel, Pro-Tech Engineering Group, Inc.
Tom Hornseth, Comal County
Greg Ellis, Edwards Aquifer Authority
Harry Bennett, City of New Braunfels
John Bohuslav, TxDot San Antonio District
TNRCC Field Operations, Austin

Doc# 9906004195
Pages: 6
Date : 02-18-1999
Time : 08:47:57 A.M.
Filed & Recorded in
Official Records
of COMAL County, TX.
JOY STREATER
COUNTY CLERK
Rec. $ 19.00

DOC# 9906004195



WPAP

Comal County

OFFICE OF COMAL COUNTY ENGINEER

September 1, 1999

James McCaine
Texas Natural Resource Conservation Commission
P.O. Box 13087
Austin, Texas 78711-3087

Re: Water Pollution Abatement Plan for River Chase Subdivision, Comal County, Texas

Dear Mr. McCaine,

Please review items 10 and 11 on page 3 of the attached Water Pollution Abatement Plan, requiring that only class 1 aerobic systems for wastewater treatment and disposal be used within the subdivision, and that the Texas Natural Resource Conservation Commission, San Antonio Region Office, is to be notified 24 hours prior to commencement of construction of each on-site sewage facility.

Please advise this department if, based on the above referenced requirements, we would be required to reject all other submittals for permits proposing the use of systems other than class 1 aerobics, even if designed according to the on-site sewage facility rules, and if this department would still be in authority over all permitting and installation requirements.

Thank you for your attention in this matter.

Sincerely,

Brenda J. Ritzen
Environmental Health Coordinator

Enclosure: Water Pollution Abatement Plan, River Chase Subdivision

cc: Bobby D. Caldwell,
San Antonio Region Office

195 David Jonas Drive • New Braunfels, Texas 78132-3760 • (830) 608-2090 FAX: (830) 608-2009

\, Chairman
vez, Commissioner
nissioner
, Executive Director

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

August 25, 1999

RECEIVED
AUG 2 6 1999
COUNTY ENGINEER

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberly, TX 78676

Re: EDWARDS AQUIFER, Comal County
PROJECT: **River Chase Subdivision, Project number 1124.01, Located on west side of FM 306, approximately 2.5 miles south of Purgatory Road, Comal County, Texas**
TYPE: **Request for Reconsideration of Water Pollution Abatement Plan (WPAP); 30 Texas Administrative Code (TAC) §213.5(b); Edwards Aquifer Protection** Program

Dear Mr. Patterson:

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the request for reconsideration of Special Condition #1 of the WPAP application for the referenced project that was submitted by Mr. Kelly Kilber, P.E. of Pro-Tech Engineering Group, Inc. on behalf of Summerlin Properties, Inc. and received by the San Antonio Regional Office on March 23, 1999. Additional information was received on May 25, 1999, June 1, 1999, and August 19, 1999.

By letter dated February 9, 1999, the TNRCC approved the 1,497 acres single-family residential subdivision with 338 lots. Special Condition #1 of the February 9, 1999, letter stated, in part:

> Related to on-site sewage facilities on the Edwards Aquifer Recharge Zone, Paragraph 30 TAC 285.40(c)(2) states:
>
> > Minimum separation distances from recharge features. The following separation distances shall be maintained from recharge features found during a site evaluation or in accordance with a geologic assessment performed in accordance with Chapter 213 of this title (relating to Edwards Aquifer). No sewage treatment tank or holding tank may be located within 50 feet of a recharge feature. No soil absorption system may be located within 150 feet of a recharge feature.

> Therefore, the following minimum separation distances in feet must be provided between OSSF units and recharge features (including Feature S-1) or possible recharge features (including S-54, S-76, S-62, S-67, S-76, S-80, S-82, S-83, and S-117). . . .

As understood, your request for reconsideration is to place OSSF units within the areas originally presented as sensitive or possibly sensitive features, and is based on reassessment of the above listed features. As presented in Mr. Ed Miller's, letter dated February 19, 1999 (attached), "the term zone should not apply to the large areas mapped as features S-1, S-54, and S-117 and the sensitivity rating of Sensitive should not have been applied to extremely large areas consisting of several hundred acres." As presented in the original geologic assessment for the WPAP, feature S-1 was reported to be approximately 189 acres, feature S-54 was approximately 31 acres, and feature S-117 was approximately 367 acres.

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the request for reconsideration of the WPAP approval for the referenced project. Based on the reassessment of the geologic features, approval of the plan is hereby granted subject to applicable state rules and the conditions in this approval letter. *This approval expires two (2) years from the date of this approval unless, prior to the expiration date, construction has commenced on the project or an extension of time has been requested.*

SPECIAL CONDITIONS

1. All OSSF setbacks from geologic and manmade features shown on the site plan (dated November 1998, revised on August 17, 1999, and signed and sealed by Kelly Kilber, P.E. 41187 on August 17, 1999) shall be recorded on the plat for each affected subdivision lot.

2. The following minimum separation distances in feet must be provided between OSSF units and recharge features or possible recharge features:

Sewage Treatment Tanks or Holding Tanks	50
Soil Absorption Systems, & Unlined Evapo- transpiration Beds	150
Lined Evapotranspiration Beds	50
Sewer Pipe with Watertight Joints	50
Surface Irrigation Fields	150
Drip Irrigation Fields	100 when $R_a \leq 0.1$ 150 when $R_a > 0.1$

3. If any potential sensitive features are encountered during construction, a geologist shall evaluate the significance of the features. The evaluation shall include representative

photographs and a description of the feature forwarded to the San Antonio office. Construction in the vicinity of the features may only continue with written approval from the TNRCC.

4. The proposed on-site sewage facility (OSSF) must be permitted by a local or the state permitting authority prior to commencement of construction.

5. All planning and design materials for the proposed OSSF shall be submitted by a professional engineer or a sanitarian registered in Texas.

6. A site evaluation shall be conducted by a certified site evaluator possessing a valid certificate beginning August 1, 1998. The evaluator shall submit an evaluation report of the site [30 TAC 285.4(c)] to the San Antonio Regional Office no later than two weeks prior to the onset of construction at the subdivision.

7. The proposed OSSF must meet all other requirements found in 30 TAC § 285–On-Site Sewage Facilities.

8. The applicant must notify all purchasers that OSSF's on all lots with possibly sensitive and sensitive features, must have the required separation distances. The notification must include a copy of this letter.

9. No part of an on-site sewage treatment facility may be located within any "sanitary control easement."

10. The permanent pollution abatement measures that will be provided to protect the sensitive or possibly sensitive geologic features are:

    A. Class 1 aerobic systems for wastewater treatment and disposal for all lots within the subdivision.

    B. No wastewater treatment systems will be located within the "sanitary control easements" noted on the revised site plan dated January 22, 1999.

11. Prior to commencing installation of each on-site sewage collection system, the TNRCC must be notified 24 hours prior to commencement of construction in order to allow for installation inspections of the proposed systems.

12. This modification is subject to all Standard Conditions listed in the WPAP approval letter of February 9, 1999.

If you have any questions or require additional information, please contact John Mauser of the Edwards Aquifer Protection Program at 210/403-4024. Please reference project number 1124.01.

Sincerely,

Bobby D. Caldwell
Water Section Manager
San Antonio Region Office
Texas Natural Resource Conservation Commission

BDC/JKM/eg

Enclosures: Letter dated February 19, 1999, from Mr. Ed Miller of Pape-Dawson Engineers, Inc. to Mr. Mark Spencer of Summerlin Properties, Inc.
Deed Recordation Affidavit

cc/with letter: Richard McDaniel, Pro-Tech Engineering Group, Inc.
Ed Miller, Pape-Dawson Engineers, Inc.
Tom Hornseth, Comal County
Greg Ellis, Edwards Aquifer Authority
Harry Bennett, City of New Braunfels
John Bohuslav, TXDOT San Antonio District
TNRCC Field Operations, Austin

Robert J. Huston, *Chairman*
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John M. Baker, *Commissioner*
Jeffrey A. Saitas, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

August 25, 1999

RECEIVED
AUG 2 6 1999
COUNTY ENGINEER

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberly, TX 78676

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photographs and a description of the feature forwarded to the San Antonio office. Construction in the vicinity of the features may only continue with written approval from the TNRCC.

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7. The proposed OSSF must meet all other requirements found in 30 TAC § 285–On-Site Sewage Facilities.

8. The applicant must notify all purchasers that OSSF's on all lots with possibly sensitive and sensitive features, must have the required separation distances. The notification must include a copy of this letter.

9. No part of an on-site sewage treatment facility may be located within any "sanitary control easement."

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    A. Class i aerobic systems for wastewater treatment and disposal for all lots within the subdivision.

    B. No wastewater treatment systems will be located within the "sanitary control easements" noted on the revised site plan dated January 22, 1999.

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12. This modification is subject to all Standard Conditions listed in the WPAP approval letter of February 9, 1999.

If you have any questions or require additional information, please contact John Mauser of the Edwards Aquifer Protection Program at 210/403-4024. Please reference project number 1124.01.

Sincerely,

Bobby D. Caldwell
Water Section Manager
San Antonio Region Office
Texas Natural Resource Conservation Commission

BDC/JKM/eg

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Harry Bennett, City of New Braunfels
John Bohuslav, TXDOT San Antonio District
TNRCC Field Operations, Austin

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February 19, 1999

Mr. Mark Spencer
Vice President
Summerlin Properties, Inc.
P.O. Box 1629
Wimberley, TX 78676

Re: River Chase Subdivision
Geologic Assessment

Dear Mr. Spencer:

At the request of Summerlin Properties, Inc. and Pro-Tech Engineering Group, Inc., Pape-Dawson Engineers, Inc. (PD) has conducted a site visit to review a Geologic Assessment prepared by Raba-Kistner-Brytest Consultants, Inc. for the referenced project and to further evaluate zones specifically mapped as S-1 and S-117. In addition to Zones S-1 and S-117, Zone S-54 was also evaluated.

As an active participant in the development and preparation of both the Geologic Assessment Table and the Instructions to Geologists for Geologic Assessments, our initial reaction to seeing extremely large areas mapped as a zone was that the zone designation would not apply to this situation. The term Zone, was created to be used where there were discontinuous mappable outcrops of the same feature type that "extend over several hundred feet," and not over extremely large areas that extend over hundreds of acres. After conducting a site visit and walking over portions of the zones mapped as S-1, S-54 and S-117, our initial reaction was confirmed. In our opinion, the term Zone should not apply to the large areas mapped as features S-1, S-54 and S-117 at this site. Based on the evaluation applied to features S-1, S-54, and S-117, the zone designation may also be inappropriate for Features S-82 and S-83.

The term zone is applied mostly where numerous outcrops of fractured rock, vuggy rock or solution cavities are exposed in streambeds. The term zone is also often applied to vuggy rock outcrops that occur where a stratigraphic unit crops out on a hillside as a ledge and generally follows the topography. The use of zone as a feature type appears appropriate for Features S-3, S-26, S-34 and several others noted on the geologic map.

Vuggy rock appears to be one of the harder feature types to deal with when conducting a geologic assessment because it must be in-place, continuous for at least 10 feet in one direction, and confined to a stratigraphic layer. Most of these features occur along ledges of rock that form a step on a hillside or gentle slope. Others are commonly found in streambeds where they form a break in the gradient of the stream. On hillsides and gentle slopes, their width is normally less than ten feet, but their length may be several hundred feet where their outcrop follows the topography around a hillside.

PAPE-DAWSON ENGINEERS, INC.

555 East Ramsey | San Antonio, Texas 78216 | Phone: 210.375.9000 | Fax: 210.375.9010 | info@pape-dawson.com

Where the top of the vuggy rock unit is exposed for approximately ten or more feet away from the face of the ledge, into the hillside, the number of vugs typically declines with distance from the face and they usually disappear altogether. This suggests that the unit containing the vugs must be exposed to weathering at the surface to weather out the material that originally filled the vug. Since most vuggy rock units are less than three feet in thickness and less than five to ten feet wide, they do not provide a conduit for rapid infiltration deep into the subsurface but only through the vuggy rock unit, where the vugs are interconnected, to the underlying stratigraphic unit. Therefore, most infiltration into a vuggy rock feature or zone, would pass through the vuggy unit until encountering the underlying unit, and then migrate laterally and re-emerge at the contact between the two units. Thus, the assessment subtotal for most vuggy rock units is normally less than 60 with a Not or Possible sensitivity rating.

Many fractured rock outcrops found on hillsides and slopes fit the exposure, weathering and infiltration description discussed above for vuggy rock outcrops. It is not uncommon to find a zone on a hillside or gentle slope that contains both vugs and fractures. Fractured rock features are also found in conjunction with faults and in fracture zones whereas vuggy rock features normally are not associated with either faults or fracture zones.

In addition to reviewing the geologic assessment, PD also reviewed State of Texas WELL REPORT forms for several on-site and area water wells. The well reports show the static water level to be at an elevation of approximately 720 feet msl. The contact of the Edwards with the underlying Glen Rose is also at about 720 feet msl. This indicates that Edwards rocks are not saturated at this site and that the Trinity Aquifer system is the only aquifer underlying the site. This is further supported by flowing surface water on Glen Rose rocks exposed in Deep Creek. This indicates that springs emanating from the Glen Rose at about 720 feet msl flow over Glen Rose rocks to the Guadalupe River which is at about 680 feet msl at the confluence of the Guadalupe River and Deep Creek.

In summary, it is our opinion the term zone should not apply to the large areas mapped as features S-1, S-54, and S-117 and the sensitivity rating of Sensitive should not have been applied to extremely large areas consisting of several hundred acres.

We appreciate the opportunity to be of service to you on this project. Should you have any questions concerning this matter, please do not hesitate to contact our office.

Pape-Dawson Engineers, Inc.

Edward G. Miller

Edward G. Miller, P.G.
Senior Geologist

4602\01\word\letters\990218a1

PRO-TECH
ENGINEERING
GROUP
INCORPORATED

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

512 / 353-3335
FAX 512 / 396-0224

August 17, 1999

RECEIVED
AUG 20 1999
COUNTY ENGINEER

Texas Natural Resource Conservation Commission
140 Heimer Rd., Suite 360
San Antonio, Texas 78711-3087

Attn: John Mauser

Re: River Chase Subdivision
WPAP Project No. 1124
Comal County, Texas

Mr. Mauser:

We hereby make a request for a Motion for Reconsideration for the above referenced WPAP. The Geological Assessment has been reevaluated and modified. The modifications deal with the re-evaluation and proper classification of the components of features S-1, S-117, S-54, S-57, S-82 and S-83 that have been independently isolated and identified as approximately 200 individual features. The geologic assessment table has likewise been modified to evaluate these additional features. Four (4) copies are enclosed.

The four water wells identified as sensitive features will be plugged to prevent entry of pollution. ALL features classified as possibly sensitive have been provided with sanitary control easements which will not allow OSSF disposal facilities within 150 feet of the feature or will be filled to eliminate ponding and possible infiltration. The OSSF setback requirements will be recorded on the final plat of each section of the development. S-118 will be restored and revegetate as the subdivision lots are developed.

An OSSF site evaluation shall be conducted by a certified site evaluator for each lot prior to the installation of septic system..

The site plan has been revised to show the modified geology, four (4) copies enclosed .

Thank you for your assistance and if you have any questions, call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC

Kelly Kilber, P.E., R.P.L.S.
President

Enclosures
EO 14625

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

PRO-TECH ENGINEERING GROUP INCORPORATED

512/353-3335
FAX 512/396-0224

RECEIVED-TNRCC
1999 MAR 23 AM 8:51
SAN ANTONIO REGION

RECEIVED
MAR 26 1999
COUNTY ENGINEER

March 22, 1999

Texas Natural Resource Conservation Commission
140 Heimer Rd., Suite 360
San Antonio, Texas 78711-3087

Attn: John Mauser

Re: River Chase Subdivision
WPAP Project No. 1124
Comal County, Texas

Mr. Mauser:

We hereby make a request for a Motion for Reconsideration for the above referenced WPAP. The Geological Assessment has been reevaluated and modified. The modifications deal with the re-mapping of features S-1, S-117, and S-54. Modifications to the geologic assessment table for features S-1, S-117, S-54, S-57, S-82 and S-83 are also part of this report. Four (4) copies are enclosed along with letters from the inspecting geologist Michael Ashby and from a second geologist, Ed Miller justifying these modifications.

A site evaluation (OSSF) shall be conducted by a certified site evaluator prior to the installation of septic system on each lot.

The site plan has been revised to show the modified geology, four (4) copies enclosed .

Thank you for your assistance and if you have any questions, call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC

Kelly Kilber, P.E., R.P.L.S.
President

Enclosures
EO 14625

RECEIVED-TNRCC

1999 MAR 23 AM 9:51

February 19, 1999

Mr. Mark Spencer
Vice President
Summerlin Properties, Inc.
P.O. Box 1629
Wimberley, TX 78676

Re: River Chase Subdivision
Geologic Assessment

Dear Mr. Spencer:

At the request of Summerlin Properties, Inc. and Pro-Tech Engineering Group, Inc., Pape-Dawson Engineers, Inc. (PD) has conducted a site visit to review a Geologic Assessment prepared by Raba-Kistner-Brytest Consultants, Inc. for the referenced project and to further evaluate zones specifically mapped as S-1 and S-117. In addition to Zones S-1 and S-117, Zone S-54 was also evaluated.

As an active participant in the development and preparation of both the Geologic Assessment Table and the Instructions to Geologists for Geologic Assessments, our initial reaction to seeing extremely large areas mapped as a zone was that the zone designation would not apply to this situation. The term Zone, was created to be used where there were discontinuous mappable outcrops of the same feature type that "extend over several hundred feet," and not over extremely large areas that extend over hundreds of acres. After conducting a site visit and walking over portions of the zones mapped as S-1, S-54 and S-117, our initial reaction was confirmed. In our opinion, the term Zone should not apply to the large areas mapped as features S-1, S-54 and S-117 at this site. Based on the evaluation applied to features S-1, S-54, and S-117, the zone designation may also be inappropriate for Features S-82 and S-83.

The term zone is applied mostly where numerous outcrops of fractured rock, vuggy rock or solution cavities are exposed in streambeds. The term zone is also often applied to vuggy rock outcrops that occur where a stratigraphic unit crops out on a hillside as a ledge and generally follows the topography. The use of zone as a feature type appears appropriate for Features S-3, S-26, S-34 and several others noted on the geologic map.

Vuggy rock appears to be one of the harder feature types to deal with when conducting a geologic assessment because it must be in-place, continuous for at least 10 feet in one direction, and confined to a stratigraphic layer. Most of these features occur along ledges of rock that form a step on a hillside or gentle slope. Others are commonly found in streambeds where they form a break in the gradient of the stream. On hillsides and gentle slopes, their width is normally less than ten feet, but their length may be several hundred feet where their outcrop follows the topography around a hillside.

Where the top of the vuggy rock unit is exposed for approximately ten or more feet away from the face of the ledge, into the hillside, the number of vugs typically declines with distance from the face and they usually disappear altogether. This suggests that the unit containing the vugs must be exposed to weathering at the surface to weather out the material that originally filled the vug. Since most vuggy rock units are less than three feet in thickness and less than five to ten feet wide, they do not provide a conduit for rapid infiltration deep into the subsurface but only through the vuggy rock unit, where the vugs are interconnected, to the underlying stratigraphic unit. Therefore, most infiltration into a vuggy rock feature or zone, would pass through the vuggy unit until encountering the underlying unit, and then migrate laterally and re-emerge at the contact between the two units. Thus, the assessment subtotal for most vuggy rock units is normally less than 60 with a Not or Possible sensitivity rating.

Many fractured rock outcrops found on hillsides and slopes fit the exposure, weathering and infiltration description discussed above for vuggy rock outcrops. It is not uncommon to find a zone on a hillside or gentle slope that contains both vugs and fractures. Fractured rock features are also found in conjunction with faults and in fracture zones whereas vuggy rock features normally are not associated with either faults or fracture zones.

In addition to reviewing the geologic assessment, PD also reviewed State of Texas WELL REPORT forms for several on-site and area water wells. The well reports show the static water level to be at an elevation of approximately 720 feet msl. The contact of the Edwards with the underlying Glen Rose is also at about 720 feet msl. This indicates that Edwards rocks are not saturated at this site and that the Trinity Aquifer system is the only aquifer underlying the site. This is further supported by flowing surface water on Glen Rose rocks exposed in Deep Creek. This indicates that springs emanating from the Glen Rose at about 720 feet msl flow over Glen Rose rocks to the Guadalupe River which is at about 680 feet msl at the confluence of the Guadalupe River and Deep Creek.

In summary, it is our opinion the term zone should not apply to the large areas mapped as features S-1, S-54, and S-117 and the sensitivity rating of Sensitive should not have been applied to extremely large areas consisting of several hundred acres.

We appreciate the opportunity to be of service to you on this project. Should you have any questions concerning this matter, please do not hesitate to contact our office.

Pape-Dawson Engineers, Inc.

Edward G. Miller

Edward G. Miller, P.G.
Senior Geologist

Engineers, Geologists, [redacted]ists and Environmental Scientists

Raba Kistner

Raba-Kistner-Brytest Consultants, Inc.
8200 Cameron Rd., Suite C-164
Austin, Texas 78754
(512) 339-1745 • FAX (512) 339-6174

February 8, 1999
AAB98-003-00

Mr. John Mauser
Texas Natural Resource Conservation Commission
1040 Helmer, Suite 360
San Antonio, Texas 78232-5042

Re: River Bend Development
1500 Acre Geologic Assessment
New Braunfels, Texas

Dear Mr. Mauser:

This letter is being submitted to clarify the September 11, 1998 geologic assessment performed by Raba-Kistner Consultants, Inc. In the report, two vuggy rock zones, S-1 and S-117, were identified and classified as sensitive and possibly sensitive with high to moderate recharge potential, based on the TNRCC-0629 form. In our opinion, the classification of the features, based on the TNRCC-0629 form, is uncharacteristic of the true sensitivity and recharge potential with respect to the Edwards Aquifer at this site. Typically, these features form in burrowed sparse biomicrite beds (Abbott, 1973) generally within the Person Formation. The higher porosity and permeability within the burrows results in greater amounts of ground-water transmittance and hence larger quantities of dissolution which results in the honeycombed porosity as seen in S-1 and S-117.

Usually, the honeycombed texture is formed in the phreatic zone, however, the texture may form at the surface if sufficient runoff is present. Therefore, the degree of runoff generally controls the thickness of the honeycombed or vuggy zone. The vugs of these features tended to be interconnected only on a small scale. The depth of water in the well, located near the abandoned farmhouse, is in excess of five-hundred feet. It is our opinion that the vuggy zone is relatively shallow and the chance of extensive lateral and vertical migration of fluids is minimal.

If you have any questions or require additional information, please feel free to call.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.

Michael Ashby
Environmental Geologist

Gary W. Raba, D. Eng., P. E.
President

WPAP

Robert J. Huston, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
John M. Baker, *Commissioner*
Jeffrey A. Saitas, *Executive Director*

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

Protecting Texas by Reducing and Preventing Pollution

February 9, 1999

RECEIVED

FEB 1 0 1999

COUNTY ROAD DEPT.

Mr. Charles D. Patterson
Summerlin Properties, Inc.
P.O. Box 1629
Wimberly, TX 78676

Re: EDWARDS AQUIFER, Comal County
PROJECT: **River Chase Subdivision, Project number 1124, Located on west side of FM 306,** approximately 2.5 miles south of Purgatory Road, Comal County, Texas
TYPE: Request for Approval of Water Pollution Abatement Plan (WPAP); 30 Texas Administrative Code (TAC) §213.5(b); Edwards Aquifer Protection Program

Dear Mr. Patterson:

The Texas Natural Resource Conservation Commission (TNRCC) has completed its review of the WPAP application for the referenced project that was submitted by Pro-Tech Engineering Group, Inc. on behalf of Summerlin Properties, Inc. to the San Antonio Regional Office on November 16, 1998. Final review of the WPAP submittal was completed after additional material was received on December 8, 1998, and January 28, 1999. The WPAP proposed in the application is in general compliance with 30 TAC § 213.5(b); therefore, approval of the plan is hereby granted subject to applicable state rules and the conditions in this approval letter. ***This approval expires two (2) years from the date of this approval unless, prior to the*** *expiration date, construction has commenced on the project or an extension of time has been requested.*

PROJECT DESCRIPTION

The proposed residential project will have an area of 1,494.67 acres and will consist of 338 single family residential lots of three to five acres each. Project wastewater for each residence will be treated by a private on-site Class 1 aerobic system. A letter signed by Thomas H. Hornseth, P.E., Comal County Engineer, on October 16, 1998, states,

> We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the proposed subdivision to be approved with the condition that individual septic systems permits shall be required for the lots within this subdivision.
>
> Please be advised that these individual permits will be required to meet 30 TAC 285.40, SubChapter E.... Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Please note that separation distances must be maintained from any existing well(s) or the well(s) must be plugged by a well driller.

The proposed impervious cover for the development is approximately 61.34 acres (4%). The site is located within the Comal County, and must conform with applicable codes and requirements of Comal County.

GEOLOGY ON SITE

According to the geologic assessment included with the submittal, there are 118 geologic or manmade features located on the project site. Five features were evaluated as sensitive, 65 were assessed as possibly sensitive, and 48 were assessed as not sensitive.

Feature S-1 covers an area 5500' by 1500' (approximately 189 acres). The geologic assessment reports the relative infiltration rate to be high, and the feature to be sensitive. It is described as:

> Discontinuous fractured vuggy rock zone. Density, aperture, and infilling varies across feature but generally zone is high density, large aperture with fine-grained infilling. Areas near cliffs lacked any infilling. Vugs generally appear to be interconnected but vary with density. The contact of this zone was estimated in some areas on the north end due to inaccessibility of the area.

Feature S-117 covers an area 8000' by 2000' (approximately 367 acres) and is similar to Feature S-1. The geologic assessment reports the relative infiltration rate to be moderate, and the feature to be possibly sensitive. It is described as:

> Discontinuous vuggy rock zone. Density, aperture, and infilling varies across feature but generally zone is high density, with large aperture with fine-grained infilling. Vugs generally appear to be interconnected but vary with density.

The San Antonio Regional Office site inspection of December 22, 1998, and January 14, 1999, revealed no other sensitive features. It was observed that Feature S-1 (megafeature) is underlain by a shallow vuggy rock zone. All incised drainages contain most of the possibly sensitive macrofeatures.

GEOLOGY DOWNGRADIENT OF SITE

According to the geologic assessment included with the submittal, there are 29 geologic or manmade features downgradient of the project site. Two features were evaluated as sensitive, seven were assessed as possible sensitive, and 20 were assessed as not sensitive.

PERMANENT POLLUTION ABATEMENT MEASURES

Seventy geologic features on the project site were assessed as being sensitive or possibly sensitive. The permanent pollution abatement measures that will be provided to protect these features are:

1. Require Class 1 aerobic systems for wastewater treatment and disposal for all lots within the subdivision.

2. No wastewater treatment systems will be located within the "sanitary control easements" noted on the revised site plan dated January 22, 1999.

SPECIAL CONDITIONS

1. Related to on-site sewage facilities on the Edwards Aquifer Recharge Zone, Paragraph 30 TAC 285.40(c)(2) states:

> Minimum separation distances from recharge features. The following separation distances shall be maintained from recharge features found during a site evaluation or in accordance with a geologic assessment performed in accordance with Chapter 213 of this title (relating to Edwards Aquifer). No sewage treatment tank or holding tank may be located within 50 feet of a recharge feature. No soil absorption system may be located within 150 feet of a recharge feature.

Therefore, the following minimum separation distances in feet must be provided between OSSF units and recharge features (including Feature S-1) or possible recharge features (including S-54, S-76, S-62, S-67, S-76, S-80, S-82, S-83, and S-117):

Sewage Treatment Tanks or Holding Tanks	50
Soil Absorption Systems, & Unlined Evapotranspiration Beds	150
Lined Evapotranspiration Beds	50
Sewer Pipe with Watertight Joints	50
Surface Irrigation Fields	150
Drip Irrigation Fields	100 when $R_a \leq 0.1$ 150 when $R_a > 0.1$

2. If any potential sensitive features are encountered during construction, a geologist shall evaluate the significance of the features. The evaluation shall include representative photographs and a description of the feature forwarded to the San Antonio office. Construction in the vicinity of the features may only continue with written approval from the TNRCC.

3. The proposed on-site sewage facility (OSSF) must be permitted by a local or the state permitting authority prior to commencement of construction.

4. All planning and design materials for the proposed OSSF shall be submitted by a professional engineer or a sanitarian registered in Texas.

5. A site evaluation shall be conducted by a certified site evaluator possessing a valid certificate beginning August 1, 1998. The evaluator shall submit an evaluation report of the site [30 TAC 285.4(c)] to the San Antonio Regional Office no later than two weeks prior to the onset of construction at the subdivision.

6. The proposed OSSF must meet all other requirements found in 30 TAC § 285--On-Site Sewage Facilities.

7. The applicant must notify all purchasers that OSSFs on all lots with possibly sensitive and sensitive features must have the required separation distances. The notification must include a copy of this letter.

8. No part of an on-site sewage treatment facility may be located within any "sanitary control easement."

STANDARD CONDITIONS

1. During the course of regulated activities related to this project, the applicant or his agent shall comply with all applicable provisions of 30 TAC Chapter 213, Edwards Aquifer. The applicant shall remain responsible for the provisions and conditions of this approval until such responsibility is legally transferred to another person or entity, upon which that person or entity shall assume responsibility for all provisions and conditions of this approval.

2. Any modification to the activities described in the referenced WPAP application following the date of approval may require the submittal of a WPAP to amend this approval, including the payment of appropriate fees and all information necessary for its review and approval.

3. Prior to commencing any regulated activity, the applicant or his agent must notify the San Antonio Regional Office in writing of the date on which the regulated activity will begin.

4. The applicant or his agent shall record this WPAP approval in the county deed records within 30 days of receiving this notice of approval. Proof of deed recordation shall be submitted to the San Antonio Regional Office prior to commencing construction. A suggested format that you may use to deed record the approved WPAP is enclosed.

5. All contractors conducting regulated activities at the project location shall be provided a copy of this notice of approval. At least one complete copy of the approved WPAP and this notice of approval shall be maintained at the project location until all regulated activities are completed.

6. Temporary erosion and sedimentation (E&S) controls, i.e., silt fences, rock berms, stabilized construction entrances, or other controls described in the approved WPAP, must be installed prior to construction and maintained during construction. Temporary E&S controls may be removed when vegetation is established and the construction area is stabilized. If a water quality pond is proposed, it shall be used as a sedimentation basin during construction. The TNRCC may monitor stormwater discharges from the site to evaluate the adequacy of temporary E&S control measures. Additional controls may be necessary if excessive solids are being discharged from the site.

7. If any significant recharge feature [sensitive feature] is discovered during construction, all regulated activities near the feature must be suspended immediately. The applicant or his agent must immediately notify the San Antonio Regional Office of the discovery of the feature. Regulated activities near the feature may not proceed until the executive director has reviewed and approved the methods proposed to protect the feature and the aquifer from potential adverse impacts to water quality.

8. At project locations where construction is initiated and abandoned, or not completed, the site shall be returned to a condition such that the aquifer is protected from potential contamination.

9. Approval of the design of the sewage collection system for this proposed project shall be obtained from the TNRCC prior to commencement of construction of any sewage collection system.

10. Four wells exist on the site. Any abandoned wells shall be plugged in accordance with 30 TAC § 338 or an equivalent method, as approved by the Executive Director.

    Any drill holes resulting from core sampling on-site or down-gradient of the site shall be plugged with native soil, from the bottom of the hole to the top of the hole, so as to not allow water or contaminants to enter the subsurface environment.

11. Pursuant to §26.136 of the Texas Water Code, any violations of the requirements in 30 TAC §213 may result in administrative penalties.

If you have any questions or require additional information, please contact John Mauser of the Edwards Aquifer Protection Program at 210/403-4024. Please reference project number 1124.

Sincerely,

Richard Garcia for

Jeffrey A. Saitas, P.E.
Executive Director
Texas Natural Resource Conservation Commission

JAS/JKM /eg

Enclosure: Deed Recordation Affidavit

cc: Richard McDaniel, Pro-Tech Engineering Group, Inc.
Tom Hornseth, Comal County
Greg Ellis, Edwards Aquifer Authority
Harry Bennett, City of New Braunfels
John Bohuslav, TxDot San Antonio District
TNRCC Field Operations, Austin

GENERAL INFORMATION FORM
FOR
REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §§213.4 & 213.5, EFFECTIVE DECEMBER 27, 1996

RECEIVED
FEB 1 0 1999
COUNTY ROAD DEPT.

PROJECT NAME: RIVER POINT

COUNTY: COMAL County STREAM BASIN: GUADALUPE RIVER

TYPE: X WPAP ____ AST ____ EXCEPTION
____ SCS ____ UST ____ MODIFICATION

Do not write in this box. TNRCC use only.	
Received by Region	
Fee Due:	$
Payment Verified:	
Inspection Date:	
Judged Administratively ____ complete ____ incomplete	
Written Comments Received From City/County: UWCD within 30 Days:	__ Yes __ No __ Yes __ No
____ Approved ____ Incomplete and Returned	

APPLICANT INFORMATION

1. Applicant:

Contact Person: CHARLES D. PATTERSON
Entity: SUMMERLIN PROPERTIES, INC.
Mailing Address: P.O. BOX 1629
City, State: WIMBERLEY, TX Zip: 78676
Telephone: 512-847-5263 FAX: 512-847-3690

2. Agent/Representative (If any):

Contact Person: KELLY KILBER, P.E., R.P.L.S.
Entity: PRO-TECH ENGINEERING GROUP, INC.
Mailing Address: 100 E. SAN ANTONIO ST., SUITE 100
City, State: SAN MARCOS, TX Zip: 78666
Telephone: 512-353-3335 FAX: 512-396-0224

PROJECT LOCATION

3. Site Address: N/A
Street:
City: Zip:

4. ____ This project is inside the city limits of the City of _____.

____ This project is outside the city limits but inside the ETJ (extra-territorial jurisdiction) of the City of _____.

__X__ This project is not located within any city's limits or ETJ, but is located within COMAL County.

5. The location of the project site is described below. Provide sufficient detail and clarity so that the TNRCC's Regional staff can easily locate the project for a field investigation.

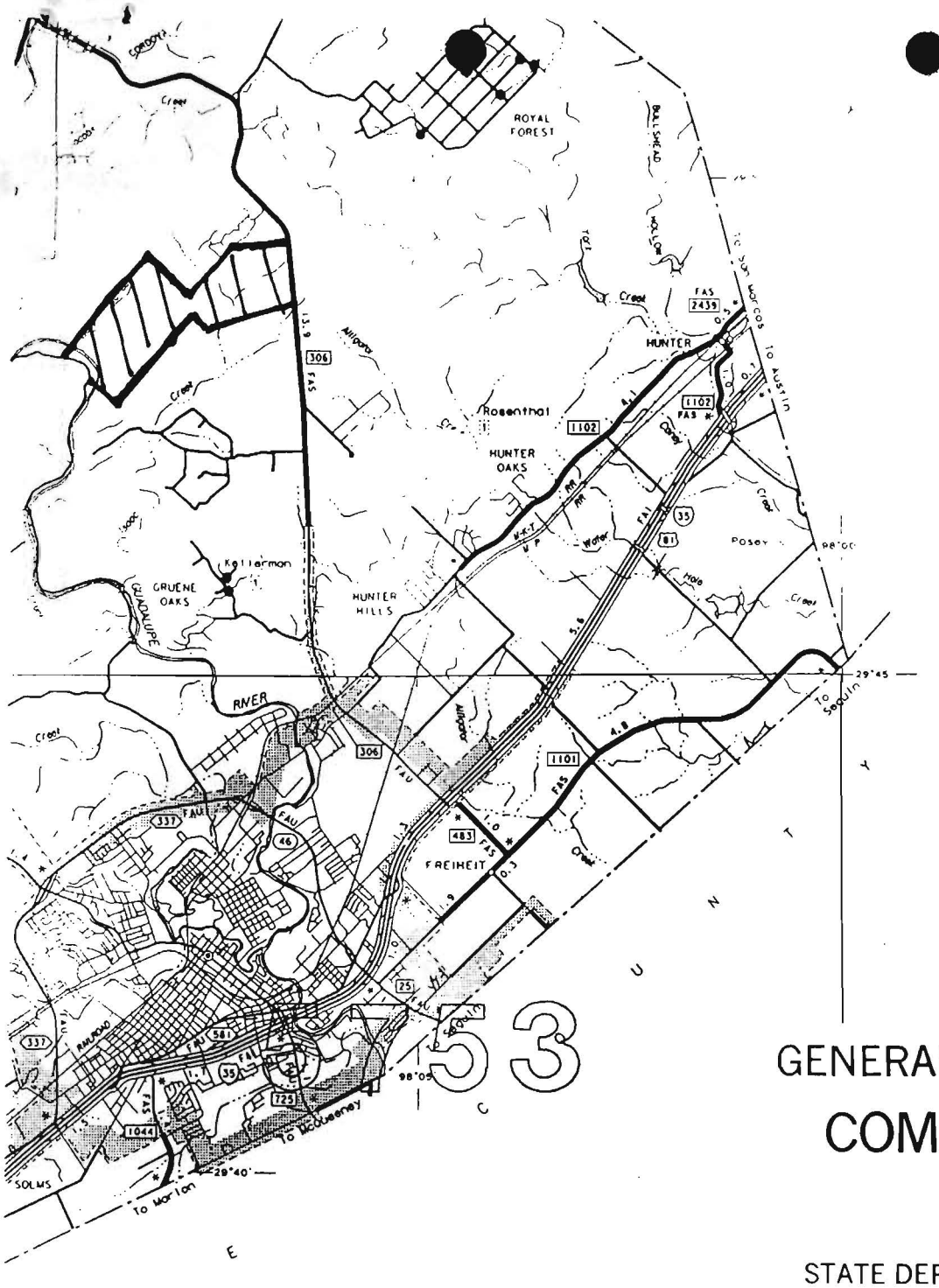
2.5 MILES SOUTH OF PURGATORY ROAD ON FM 306.

ROAD AND RECHARGE ZONE MAPS

6. XX A **Road Map** is attached behind this sheet showing directions to and location of project site.

7. XX A copy of the official 7 1/2 minute USGS Quadrangle Map (Scale: 1" = 2000') of the Edwards Recharge Zone is attached behind this sheet. The map(s) should clearly show:

__X__ **Project site.**
__X__ **USGS Quadrangle Name(s).**
__X__ **Boundaries of the Recharge Zone (and Transition Zone, if applicable).**
____ **Drainage path from the project to the boundary of the Recharge Zone.**



GENERAL HIGHWAY MAP

COMAL COUNTY

TEXAS

PREPARED BY THE

STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION

TRANSPORTATION PLANNING DIVISION

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION

SCALE IN MILES

0 1 2 3 4

1988

1980 CENSUS FIGURES

HIGHWAYS REVISED TO MAY 1, 1989

Copies of this map are available to the public at no charge from the State Department of Highways and Public Transportation P. O. Box 5051 Austin, Texas 78763

Recharge/Transition Zone Maps are available from:
Accugraphics 512/459-4929
Barton Springs/Edwards Aquifer Con. District 512/282-8441
Edwards Aquifer Authority 210/222-2204
Ferguson Map Company 210/829-7629

8. ____ Sufficient survey staking is provided on the project to allow TNRCC regional staff to locate the boundaries and alignment of the regulated activities and the geologic or manmade features noted in the Geologic Assessment. **The TNRCC must be able to inspect the project site or the application will be returned.**

PROJECT DESCRIPTION

9. _X_ A detailed narrative description of the proposed project is provided directly behind this page.

10. Existing project site conditions are noted below:
____ Existing commercial site
____ Existing industrial site
____ Existing residential site
____ Existing paved and/or unpaved roads
____ Undeveloped (Cleared)
_X_ Undeveloped (Undisturbed/Uncleared)
____ Other: _____

SOLID AND HAZARDOUS WASTES

11. Solid wastes and/or hazardous wastes:

____ There are areas of trash, debris or other solid waste and hazardous waste on this property which will be disposed of properly at an authorized facility prior to commencing construction.
_X_ There are no areas of trash, debris or other solid waste or hazardous waste existing on this property.
____ Other. A narrative description is provided directly behind this page.

12. Will there be any on-site land disposal of Municipal Solid Waste as defined in 30 TAC §330?
____ Yes
_X_ No

PROHIBITED ACTIVITIES

13. _X_ I am aware that the following activities are prohibited on the **Recharge Zone** and are not proposed for this project:

Project Description:

River Point is a 1494.67 acre single family residential subdivision located in Southeast Comal County, 2 miles Northeast of the City of New Braunfels, 2.5 miles South of Purgatory Road on FM 306.

The development is within the Edwards Aquifer Recharge Zone as determined by the TNRCC. This property is currently open, unused land. Past use has been for ranching and grazing purposes.

The development will consist of approximately 338 single family residential lots 3 to 5 acres and larger. Approximately 68,000 feet of asphalt roadways will be constructed. Water for the development will be supplied by individual water wells. Wastewater will be treated and disposed of by private septic systems constructed in accordance with the TNRCC and Comal County Health Departments rules and regulations:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed down slope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching all areas disturbed after construction.

EO#14625
projdes.doc

(1) waste disposal wells regulated under 30 TAC §331 of this title (relating to Underground Injection Control);

(2) new feedlot/concentrated animal feeding operations, as defined in 30 TAC §213.3;

(3) land disposal of Class I wastes, as defined in 30 TAC §335.1;

(4) the use of sewage holding tanks as parts of organized collection systems; and

(5) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41(b), (c), and (d) of this title (relating to Types of Municipal Solid Waste Facilities).

14. X I am aware that the following activities are prohibited on the **Transition Zone** and are not proposed for this project:

(1) waste disposal wells regulated under 30 TAC §331 (relating to Underground Injection Control);

(2) land disposal of Class I wastes, as defined in 30 TAC §335.1; and

(3) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41 (b), (c), and (d) of this title.

ADMINISTRATIVE INFORMATION

15. Under 30 TAC §213.14, application fees are due and payable at the time the application is filed. I understand that if the correct fee is not submitted, the TNRCC is not required to consider the application until the correct fee is submitted. Both the fee and the Edwards Aquifer Fee Form have been sent to the Commission's:

____ Austin central office

____ Austin regional office (for projects in Hays, Travis, and Williamson Counties)

X San Antonio regional office (for projects in Bexar, Comal, Kinney, Medina, and Uvalde Counties)

16. X One (1) original and three (3) copies of the completed application shall be submitted to the appropriate Regional Office for distribution by the TNRCC to the local municipality or county, groundwater conservation districts, and the TNRCC's Central Office.

17. X All items required for this development, as listed in the **APPLICATION GUIDELINES**, are attached.

18. As applicant for the proposed project I am aware that:

X **It is the applicant's responsibility to use the current TNRCC Edwards Aquifer application forms.**

The executive director must declare that the application is administratively complete or deficient within 30 days of receipt by the appropriate regional office and must complete the review of an application within 90 days after determining that it is administratively complete. Grounds for a deficient application include, but are not limited to, failure to pay all applicable application fees.

X No person shall commence any regulated activity until a Water Pollution Abatement Plan for such activity has been filed with and approved by the TNRCC.

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. This **GENERAL INFORMATION FORM** is hereby submitted for TNRCC review. The application was prepared by:

KELLY KILBER, AGENT
Print Name of Applicant/Owner/Agent

Signature of ~~Applicant/Owner~~/Agent

11-11-98
Date

WATER POLLUTION ABATEMENT PLAN APPLICATION
FOR
CONSTRUCTION OF REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT INFORMATION

1. The type of project is:
   - X Residential: # of Lots: 338
   - ____ Residential: # of Living Unit Equivalents: ____
   - ____ Commercial
   - ____ Industrial
   - ____ Other: ____

2. Total Acreage (Size of project): 1494.67

3. Projected population: 939

4. The amount and type of impervious cover is shown below:

Impervious Cover of Proposed Project	Sq. Ft.	Sq. Ft./Acre	Acres
Structures/Rooftops	1,183,000	÷ 43,560 =	27.16
Parking/Paved Surfaces	1,489,000	÷ 43,560 =	34.18
Other:		÷ 43,560 =	
Total Impervious Cover	2,672,000	÷ 43,560 =	61.34
Total Impervious Cover ÷ Total Acreage x 100 =			4 %

STORMWATER TO BE GENERATED BY THE PROPOSED PROJECT

5. A description of the character and volume of the stormwater runoff which is expected to occur from the proposed project is attached directly behind this page.

5. This site is divided into forty (40) distinct drainage basins. The approximate stormwater runoff for ten (10) year storm is 2250 cfs. The character of the water will be similar to other low density single family residential developments.

WASTEWATER TO BE GENERATED BY THE PROPOSED PROJECT

6. The character and volume of wastewater is shown below:

100 % Domestic	118,300	gallons/day
____ % Industrial	_____	gallons/day
____ % Commingled	_____	gallons/day

TOTAL 118,300 gallons/day

7. Wastewater will be treated by:

__X__ **On-Site** Sewage Facility (OSSF/Septic Tank):

An on-site sewage facility will be used to treat and dispose of the wastewater. The **appropriate licensing authority's written approval is attached directly behind this page.** It states that the land is suitable for the use of an on-site sewage facility or identifies areas that are not suitable.

__X__ I verify that each lot in this project/development is at least one (1) acre (43,560 square feet) in size. The system will be designed by a registered engineer or sanitarian and installed by a licensed installer in compliance with 30 TAC §285.

____ Sewage Collection System (Sewer Lines):

____ Private service laterals from the wastewater generating facilities will be connected to an existing SCS.

____ Private service laterals from the wastewater generating facilities will be connected to a proposed SCS.

____ The SCS was previously submitted on _____.

____ The SCS was submitted with this application.

____ The SCS will be submitted at a later date. The owner is aware that the SCS may not be installed prior to executive director approval.

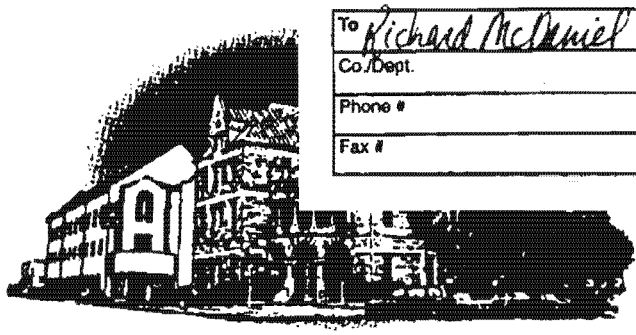
The sewage collection system will convey the wastewater to the _____ (name) Treatment Plant. A letter from the owner of the Treatment Plant indicating that the plant has sufficient capacity and accepting the wastewater is attached directly behind this page.

8. ____ All private service laterals will be inspected as required in 30 TAC 213.5(c)(3)(I).

SITE PLAN

Items 9 through 16 must be included on the Site Plan.

Post-it® Fax Note 7671	Date 10-20-98	# of pages ▶ 3
To Richard McDaniel	From Betty Liea	
Co./Dept.	Co.	
Phone #	Phone # 830-608-2090	
Fax #	Fax #	



Comal County

OFFICE OF COMAL COUNTY ENGINEER

October 16, 1998

Mr. Charles D. Patterson, President
Summerlin Properties, Inc., Managing Partner
Texas Summerlin Venture
9200 Ranch Road 12
San Marcos, TX 78666

Re: Proposed subdivision of River Bend, within Comal County, Texas

Dear Property Owner(s):

We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the proposed subdivision to be approved with the condition that individual septic systems permits shall be required for the lots within this subdivision.

Please be advised that these individual permits will be required to meet 30 TAC 285.40, SubChapter E. (copy attached) Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Please note that separation distances must be maintained from any existing well(s) or the well(s) must be plugged by a well driller.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

All OSSF will be designed by a professional engineer or Registered Sanitarian familiar with the design requirements of the EAR Zone. In sensitive areas where conventional disposal system are not applicable all OSSF's will be designed utilizing methods which will insure the protection of these areas. Aerobic systems using soil replacement or mound disposal treatment or other designs acceptable to the licensing authority will be used.

Site Plan Scale: 1" = 300'

10. _X_ **Layout of the development** (Location of lots, recreation centers, buildings, roads, etc.) is shown and labeled.

11. _N/A_ A narrative description of any on-site chemical storage is provided directly behind this page.

12. **Geologic or manmade features** which are associated with this project:

_X_ All **geologic or manmade** features identified in the Geologic Assessment are shown and labeled. Features associated with this project are those located on-site and those located either one-half mile downgradient or to the Recharge Zone boundary, whichever is shorter, and within the 100-year floodplain.

____ **No geologic or manmade features** were identified in the Geologic Assessment.

____ A Geologic Assessment is not required; however, **geologic or manmade** features were found and are shown and labeled.

____ A Geologic Assessment is not required and no **geologic or manmade** features were found.

13. _X_ Existing topographic contours are shown and labeled. The contour interval is 2 feet. (Contour interval must not be greater than 5 feet).

14. ____ **Finished topographic contours** are shown and labeled. The contour interval is 2 feet. (Contour interval must not be greater than 5 feet).

_X_ Finished topographic contours will not differ from the existing topographic configuration and are not shown.

15. **100-year floodplain boundaries**

_X_ **Some part**(s) of the project site is located within the 100-year floodplain and is shown and labeled.

____ **No part** of the project site is located within the 100-year floodplain.

The 100-year floodplain boundaries are based on the following **specific** (including date of material) sources(s):

FEDERAL EMERGENCY MANAGEMENT FLOOD INSURANCE RATE MAPS, COMAL COUNTY MAP NO. 485463 0110C, SEPTEMBER 29,1986.

16. **All known wells** (oil, water, unplugged, capped and/or abandoned, test holes, etc.):

X There are 1 (#) wells present on the project site and the locations are **shown and labeled.** (Check all of the following that apply)

___ The wells are not in use and have been properly abandoned.

X The wells are not in use and will be properly abandoned.

___ The wells are in use and comply with 30 TAC §238.

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

ADMINISTRATIVE INFORMATION

17. X One (1) original and three (3) copies of the following forms, in the **order listed below,** have been provided.

* **GENERAL INFORMATION FORM**
* **GEOLOGIC ASSESSMENT**
* **THIS FORM**
* **TEMPORARY STORMWATER SECTION**
* **PERMANENT STORMWATER SECTION**
* **All THE ADDITIONAL REQUIREMENTS LISTED ON THE APPLICATION GUIDELINES**
* **AGENT AUTHORIZATION FORM, if submitted by agent**
* **FEE FORM**

18. **Any modification of this WPAP will require TNRCC approval, prior to construction, and may require submission of a revised application, with appropriate fees.**

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. This **WATER POLLUTION ABATEMENT PLAN APPLICATION** is hereby submitted for TNRCC review. The application was prepared by:

KELLY KILBER, AGENT

Print Name of Applicant/Owner/Agent

Signature of ~~Applicant/Owner~~/Agent

11-11-98

Date

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-1	FRVRZ	HIGH	Sensitive	See Note 1
S-2	SH	HIGH	Possible	Rock Berm Upgradient
S-3	SCFRZ	Moderate	"	"
S-4	CD	"	"	Silt Fence Upgradient
S-5	SCFRZ	"	"	"
S-6	CD	"	"	"
S-7	CD	"	"	"
S-8	SCFRZ	"	"	"
S-9	CD	"	"	"
S-10	CD	Low	NOT	"
S-11	CD	Low	NOT	"
S-12	FRVRZ	Moderate	Possible	Rock Berm
S-13	FSCZ	Low	"	None
S-14	CD	Low	NOT	"
S-15	CD	"	"	"
S-16	CD	Moderate	Possible	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-17	CD	LOW	NOT	None
S-18	CD	"	"	"
S-19	CD	"	"	"
S-20	MM	HIGH	Sensitive	See Note 2
S-21	MM	"	"	Well to be Plugged
S-22	SC	Moderate	Possible	None
S-23	SC	"	"	"
S-24	SC	"	"	"
S-25	CD	LOW	NOT	None
S-26	FRZ	"	"	"
S-27	SC	Moderate	Possible	Rock Berm Upgradient
S-28	SC	LOW	"	"
S-29	CD	Moderate	"	None
S-30	CD	LOW	NOT	Rock Berm Upgradien
S-31	FRSCZ	Moderate	Possible	"
S-32	FRZ	LOW	NOT	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-33	CD	Low	NOT	Rock Berm Upgradient
S-34	CD	Moderate	Possible	"
S-35	CD	"	"	"
S-36	FRZ	Low	NOT	None
S-37	SC	"	"	"
S-38	SC	Low	NOT	"
S-39	SC	Low	Possible	"
S-40	CD	Moderate	"	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-41	CD	Moderate	Possible	None
S-42	CD	"	"	"
S-43	FRZ	"	"	"
S-44	SC	"	"	"
S-45	SC	Low	"	"
S-46	SC	"	"	"
S-47	SC	Moderate	"	"
S-48	CD	Low	"	"
S-49	CD	Low	NOT	"
S-50	CD	"	"	"
S-51	MM	HIGH	Sensitive	See Note 2
S-52	MM	"	"	"
S-53	VR	Low	NOT	None
S-54	VRSCZ	Moderate	Possible	See Note 1
S-55	VRZ	Low	NOT	None
S-56	SCZ	"	Possible	Rock Berm Upgradient

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-58	CD	Moderate	Possible	Filled in with Clay
S-59	FRVRZ	"	"	Rock Berm Upgradient
S-60	CD	"	"	Filled in with Clay
S-61	FRZ	Low	"	Rock Berm Upgradient
S-62	CD	Low	NOT	"
S-63	VRZ	Low	Possible	None
S-64	VR	"	"	Rock Berm Upgradient
S-65	CD	"	"	None
S-66	MM	"	"	"
S-67	VRCDZ	"	"	Rock Berm Upgradient
S-68	CD	Low	NOT	"
S-69	CD	Low	"	None
S-70	FR	Moderate	Possible	"
S-71	CD	Low	NOT	"
S-72	FR	Moderate	Possible	"
S-73	VR	Low	NOT	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-74	VR	Low	NOT	None
S-75	FR	"	"	"
S-76	SC	Moderate	Possible	"
S-77	FR	Low	NOT	"
S-78	VRZ	Moderate	Possible	"
S-79	SC	"	"	"
S-80	VR	Low	"	"
S-81	VRZ	"	"	"
S-82	VRZ	Moderate	"	"
S-83	VRZ	"	"	"
S-84	CD	Low	NOT	"
S-85	SC	Moderate	Possible	"
S-86	VR	Low	"	"
S-87	VR	"	"	"
S-88	VR	"	"	"
S-89	SC	Low	NOT	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-90	CD	LOW	Possible	None
S-91	FRVRZ	LOW	"	"
S-92	VRCDZ	"	"	"
S-93	CD	"	NOT	"
S-94	VR	"	Possible	"
S-95	FR	LOW	NOT	"
S-96	CD	"	"	"
S-97	FRCDZ	"	Possible	"
S-98	SH	Moderate	Possible	"
S-99	CDFRZ	LOW	"	"
S-100	VRZ	"	NOT	"
S-101	VR	"	"	"
S-102	VR	"	"	"
S-103	SC	"	"	"
S-104	SC	"	"	"
S-105	CD	"	"	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

TEMPORARY STORMWATER SECTION
FOR
REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: _____

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Temporary Pollution Abatement Measures (Design attached at the end of this form)
S-106	SC	LOW	NOT	NONE
S-107	CD	"	"	"
S-108	VR	"	"	"
S-109	VR	"	"	"
S-110	CD	"	"	"
S-111	CD	"	"	"
S-112	SC	"	"	"
S-113	CD	"	"	"
S-114	VR	"	"	"
S-115	SC	"	"	"
S-116	CD	"	"	"
S-117	VRZ	Moderate	Possible	"
S-118	MMZ	"	"	"

1 If there are no features present, enter NONE in this column.

POTENTIAL SOURCES OF CONTAMINATION

NOTE:

1. Before start of construction a visual inspection of the area of feature S-1 and S-S9 will be made to determine where additional silt fences and or Rock Berms will be installed and maintained during construction. A final plan will be submitted to the TNRCC.

2. 8 inch diameter borehole is a new water well that will be encased and brought up to TNRCC standards for a water well. Final well log will be submitted. (Features S-20, S-51 and S-52)

2. If asphalt is to be used for paving, roofing, etc. describe measures that will be taken during construction to prevent seal coat, emulsion, or other asphaltic products from washing off the project site.

____ No asphalt products will be used on this project.

__X__ Asphalt products will be used on this project. After placement of asphalt, emulsion or coatings, the applicant will be responsible for immediate clean-up should an unexpected rain occur. For the duration of the asphalt product curing time, the applicant should maintain standby personnel and equipment to contain any asphalt wash-off should an unexpected rain occur.

____ Other Measures. A narrative description is provided directly behind this page.

3. Fuels for construction equipment and hazardous substances which will be used during construction:

____ Aboveground storage tanks with a cumulative storage capacity of less that 250 gallons will be stored on the site for less than one (1) year. A lined earthen berm providing 150% containment is recommended for the temporary aboveground fuel storage tank.

__X__ Aboveground storage tanks with a cumulative storage capacity between 250 gallons and 499 gallons will be stored on the site for less than one (1) year. A lined earthen berm providing 150% containment will be provided for temporary aboveground fuel storage.

____ Aboveground storage tanks with a cumulative storage capacity of 500 gallons or more will be stored on the site. An **Aboveground Hydrocarbon and Hazardous Substance Application** must be submitted to the appropriate Regional Office of the TNRCC prior to moving the tanks onto the project.

____ Fuels and hazardous substances will be provided by an off-site facilities.

4. __X__ A description of the measures that will be taken to contain any spill of hydrocarbons or hazardous substances is provided directly behind this page.

5. __X__ **No temporary aboveground hydrocarbon and hazardous substance storage tank system is installed within 150 feet of a domestic, industrial, irrigation, or public water supply well, or other sensitive feature.**

6. __X__ Construction equipment/vehicles will be limited, where possible, to traveling within the limits of the project site. Any soil, mud, etc. carried from the project onto public roads will be cleaned up within 24 hours.

4. An earthen berm will be built immediately downgradient of any spill. Then all material will be removed from the site and disposed of in approved manner.

EO# 14625
Earthen berm

7. __X__ All soil, sand, gravel and excavated materials stockpiled on-site will have appropriately sized erosion and sedimentation controls placed downgradient.

8. __X__ Intentional release of vehicle or equipment fluids onto the ground is prohibited. Contaminated soil resulting from accidental spills will be removed and disposed of properly.

9. __X__ All waste construction material and debris will be disposed of properly at an authorized facility.

10. ____ Other potential sources of contamination. A narrative description is provided directly behind this page.
__X__ The are no other potential sources of contamination.

SITE PLAN

Items 11 through 15 must be included on the Site Plan.

11. __X__ Layout of development (Location of lots, buildings, roads, etc.) is shown and labeled.

12. Temporary pollution abatement measures for Sensitive Features:

__X__ Geologic or manmade features and temporary pollution abatement measures are shown and labeled.
____ There are no geologic or manmade features associated with this project.
____ No geologic assessment is required.

13. __X__ Stabilized Construction Exits are shown and labeled.

14. Appropriate temporary erosion and sedimentation controls are shown and labeled:

__X__ Silt fences (for drainage areas <2 acres)
__X__ Rock berms (for drainage areas <5 acres)
____ Sedimentation basins (drainage <100 acres)

____ Other measures. A narrative description is provided directly behind this page.

15. Measures to be taken to prevent pollution of stormwaters **originating on-site or upgradient** of the site.

____ Stormwater will be directed around the project site with diversion berms/channels/swales labeled on the TEMPORARY WPAP Site

Plan. Approval has been obtained from the appropriate regulating authority.

__X__ Stormwater flow from upgradient will **flow across** the project site. A narrative description is provided directly behind this page.

____ Other measures are shown and labeled on the TEMPORARY WPAP Site Plan. A narrative description is provided directly behind this page.

ADMINISTRATIVE INFORMATION

16. __X__ All structural controls will be maintained according to the submitted and approved operation and maintenance plan for the project.

17. __X__ If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TNRCC Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TNRCC has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.

18. __X__ Contractor will construct and maintain silt fences, diversion berms, and other temporary erosion and sediment controls as appropriate to prevent pollutants from entering sensitive features discovered during construction.

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. This **TEMPORARY STORMWATER SECTION** is hereby submitted for TNRCC review. The application was prepared by:

Kelly Kilber, Agent
Print Name of Applicant/Owner/Agent

_____ _____
Signature of Applicant/Owner/Agent Date

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be not installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all area disturbed during construction.

OTHER CONTROLS

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site, will be used as the main delivery route. These paved roads can be easily cleaned by a front end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the roads. The pavement surface should be cleaned as necessary but not less then once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at both entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-1	FRVRZ	HIGH	Sensitive	See Septic Note
S-2	SH	HIGH	Possible	Sanitary Control Easement
S-3	SCFRZ	Moderate	"	"
S-4	CD	"	"	"
S-5	SCFRZ	"	"	"
S-6	CD	"	"	"
S-7	CD	"	"	"
S-8	SCFRZ	"	"	"
S-9	CD	"	"	None
S-10	CD	LOW	NOT	None
S-11	CD	Low	NOT	None
S-12	FRVRZ	Moderate	Possible	None
S-13	FSCZ	LOW	"	None
S-14	CD	Low	NOT	None
S-15	CD	"	"	"
S-16	CD	Moderate	Possible	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-17	CD	Low	NOT	None
S-18	CD	"	"	"
S-19	CD	"	"	"
S-20	MM	HIGH	Sensitive	well to be Completed
S-21	MM	"	"	well to be Plugged
S-22	SC	Moderate	Possible	None
S-23	SC	"	"	Filled in by Road
S-24	SC	"	"	None
S-25	CD	Low	NOT	None
S-26	FRZ	"	"	Sanitary Control Easement
S-27	SC	Low	Possible	Sanitary Control Easeme
S-28	SC	"	"	"
S-29	CD	Moderate	Possible	None
S-30	CD	Low	NOT	"
S-31	FRSCZ	Moderate	Possible	"
S-32	FRZ	Low	NOT	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-33	CD	Low	NOT	None
S-34	CD	Moderate	Possible	"
S-35	CD	"	"	"
S-36	FRZ	Low	NOT	"
S-37	SC	"	"	"
S-38	SC	"	"	"
S-39	SC	"	Possible	"
S-40	CD	Moderate	"	"
S-41	CD	"	"	"
S-42	CD	"	"	"
S-43	FRZ	"	"	"
S-44	SC	"	"	"
S-45	SC	Low	"	"
S-46	SC	"	"	"
S-47	SC	Moderate	"	"
S-48	CD	Low	NOT	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-49	CD	Low	NOT	None
S-50	CD	"	"	"
S-51	MM	High	Sensitive	Water well to be Complete
S-52	MM	"	"	"
S-53	VR	Low	NOT	None
S-54	VRSCZ	Moderate	Possible	See Septic Note
S-55	VRZ	Low	NOT	None
S-56	SCZ	"	Possible	None
S-57	VRZ	"	"	"
S-58	CD	Moderate	Possible	Filled in By ROAD
S-59	FRVRZ	"	"	Sanitary Control Easement
S-60	CD	"	"	Filled in By ROAD
S-61	FRZ	Low	"	None
S-62	CD	"	Not	None
S-63	VRZ	Low	Possible	"
S-64	VR	"	"	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION
FOR
REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-65	CD	Low	Possible	None
S-66	MM	"	"	Fill in with Clay
S-67	VRCDZ	"	"	None
S-68	CD	Low	NOT	"
S-69	CD	"	"	"
S-70	FR	Moderate	Possible	"
S-71	CD	Low	Not	"
S-72	FR	Moderate	Possible	"
S-73	VR	Low	NOT	"
S-74	VR	"	"	"
S-75	FR	"	"	"
S-76	SC	Moderate	Possible	"
S-77	FR	Low	NOT	"
S-78	VRZ	Moderate	Possible	Filled in by Road
S-79	SC	"	"	None
S-80	VR	Low	"	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-81	VRZ	Low	Possible	None
S-82	VRZ	Moderate	"	"
S-83	VRZ	"	"	"
S-84	CD	Low	NOT	"
S-85	SC	Moderate	Possible	Sanitary Control Easeme
S-86	VR	Low	"	" " "
S-87	VR	"	"	None
S-88	VR	"	"	Sanitary Control Easement
S-89	SC	"	Not	None
S-90	CD	"	Possible	Sanitary Control Easement
S-91	FRVRZ	"	"	" " "
S-92	VRCDZ	"	"	" " "
S-93	CD	"	NOT	" " "
S-94	VR	"	Possible	" " "
S-95	FR	"	NOT	" " "
S-96	CD	"	"	" " "

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION
FOR
REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-97	FRCDZ	Low	POSSIBLE	Sanitary Control Easement
S-98	SH	Moderate	"	" " "
S-99	CDFRZ	Low	"	" " "
S-100	VRZ	"	Not	None
S-101	VR	"	"	"
S-102	VR	"	"	"
S-103	SC	"	"	"
S-104	SC	"	"	"
S-105	CD	"	"	"
S-106	SC	"	"	"
S-107	CD	"	"	"
S-108	VR	"	"	"
S-109	VR	"	"	"
S-110	CD	"	"	"
S-111	CD	"	"	"
S-112	SC	"	"	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

PERMANENT STORMWATER SECTION

FOR

REGULATED ACTIVITIES

ON THE EDWARDS AQUIFER RECHARGE ZONE

AND RELATING TO 30 TAC §213.5(b)(4), EFFECTIVE DECEMBER 27, 1996

PROJECT NAME: RIVER POINT

PROJECT DESCRIPTION

1. Geologic or manmade features identified on the project site in the geologic assessment are shown below:

#[1]	Feature Type	Relative Infiltration Rate (refer to Geologic Assessment)	Sensitivity of Feature	Permanent Pollution Abatement Measure[2] (Design attached at the end of this form)
S-113	CD	Low	NOT	NONE
S-114	VR	"	"	"
S-115	SC	"	"	"
S-116	CD	"	"	"
S-117	VRZ	Moderate	Possible	"
S-118	MMZ	"	"	"

1 If there are no features present, enter NONE in this column.
2 If the sensitivity value for a feature is indicated as "NOT", no permanent measures are required.

2. The sealing of naturally occurring sensitive features as a pollution control measure will be avoided where reasonable and

practicable alternatives exist and will be evaluated by the executive director on a case-by-case basis.

____ No naturally occurring geologic features were found on the project.

POTENTIAL SOURCES OF CONTAMINATION

3. List any potential sources of contamination associated with this project after construction is complete:

1. Storm Water Runoff from Paved Roads
2. _____
3. _____
4. _____
5. _____

FOR MULTI-FAMILY, COMMERCIAL, INDUSTRIAL DEVELOPMENTS ANSWER ITEMS 4 THROUGH 6; OTHERWISE GO TO ITEM 7.

4. Measures to be taken to prevent pollution of stormwaters **originating on-site or upgradient** of the site.

____ Stormwater will be directed around the project site with diversion berms/channels/swales labeled on the Permanent WPAP Site Plan. Approval has been obtained.

__X__ Stormwater flow from upgradient will flow across the project site and will be included in sizing calculations for any pollution abatement measures. A narrative description is provided directly behind this page.

____ Other measures are shown and labeled on the Permanent WPAP Site Plan. A narrative description is provided directly behind this page.

5. For multi-family residential, commercial, or industrial projects permanent stormwater pollution controls will be:

__N/A__ **Sedimentation/Filtration basins** designed to capture the first one-half (1/2) inch of stormwater runoff. The criteria used for design of the permanent stormwater controls is from:

____ City of Austin Environmental Criteria Manual
____ **Full** sedimentation/filtration basin system
____ **Partial** sedimentation/filtration basin system
____ Lower Colorado River Authority Lake Travis Nonpoint Source Pollution Control Ordinance Technical Manual
Full sedimentation/filtration basin system
Partial sedimentation/filtration basin system

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be not installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all area disturbed during construction.

OTHER CONTROLS

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site, will be used as the main delivery route. These paved roads can be easily cleaned by a front end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the roads. The pavement surface should be cleaned as necessary but not less then once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at both entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

THE MAJORITY OF THE SUBDIVISION WILL BE LEFT IN ITS NATURAL STATE AND AS HOMES ARE BUILT YARDS WILL BE LANDSCAPE AND GRASS PLANTED.

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize the tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains Ranch Road 12 adjacent to the site, will be used as the main delivery route. These paved roads can be easily cleaned by a front end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the roads. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at both entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

____ Other. A detailed explanation of the design criteria is provided directly behind this page.

____ **Vegetated filter strips** (Buffer Zone) designed to treat stormwater runoff. The criteria used for design of the vegetated filter strips is from:

____ City of Austin Environmental Criteria Manual

____ Lower Colorado River Authority Lake Travis Nonpoint Source Pollution Control Ordinance Technical Manual

____ Other. A detailed explanation of the design criteria is provided directly behind this page.

____ **Alternative method.** A detailed explanation of the design criteria, including calculations showing pollutant removal rates, is provided directly behind this page. All submittals shall be signed and sealed by a registered professional engineer.

__X__ This is a single-family residential subdivision.

6. __N/A__ Scaled plans, profiles, and details are included which illustrate that the proposed treatment system is sized appropriately. Supporting calculations are shown on the plan sheet, including:

____ Volume of stormwater to be treated

____ Sizing of permanent pollution abatement measures.

OPERATION AND MAINTENANCE PROCEDURES

7. __N/A__ The maintenance plan and schedule for each permanent pollution abatement structure or measure is provided directly behind this page.

STREAM CONTAMINATION AND/OR EROSION

8. If construction of the project will increase flashing, create stronger flow and stream velocity, or otherwise increase instream erosion and the degradation of water quality, measures to avoid or minimize the surface stream contamination or changes in the way that stormwater enters the stream must be taken.

__X__ The project will not increase the peak of the downgradient instream stormwater hydrograph or the downgradient velocity of the stream.

____ The project will increase the peak of the downgradient instream stormwater hydrograph and/or the downgradient velocity of the stream. A description of the measures to avoid or minimize the effects of the regulated activity on the downgradient stream is provided directly behind this page.

SITE PLAN

Items 9 through 15 must be included on the Site Plan.

9. X Layout of development (Location of lots, buildings, roads, etc.) is shown and labeled.

10. X Geologic or manmade features are shown and labeled.
____ There are no geologic or manmade features associated with this project.

11. ____ Vegetated filter areas are shown and labeled.
X There are no vegetated filter areas associated with this project.

12. ____ Sedimentation/filtration basins are shown and labeled.
X There are no sedimentation/filtration basins associated with this project.

13. ____ Berms, channels, etc. showing velocity controls are shown and labeled.
X There are no berms, channels, etc. associated with this project.

14. ____ Areas of concentrated runoff with appropriately sized energy dissipators at each outfall are shown and labeled.
X There are no areas of concentrated runoff (channels, culverts, drainage pipe discharges, etc.) associated with this project.

15. X Other pollution abatement measures are shown and labeled. A narrative description is provided directly behind this page.

ADMINISTRATIVE INFORMATION

16. X All structural controls will be maintained according to the submitted and approved operation and maintenance plan for the project.

17. X If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TNRCC Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TNRCC has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.

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. This **PERMANENT**

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be not installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all area disturbed during construction.

OTHER CONTROLS

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site, will be used as the main delivery route. These paved roads can be easily cleaned by a front end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the roads. The pavement surface should be cleaned as necessary but not less then once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at both entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

STORMWATER SECTION is hereby submitted for TNRCC review. The application was prepared by:

_____
Print Name of Applicant/Owner/Agent

_____ 11-11-98
Signature of ~~Applicant/Owner~~/Agent Date

AGENT AUTHORIZATION FORM
FOR SUBMITTAL OF
EDWARDS AQUIFER PROTECTION PLANS
FOR REGULATED ACTIVITIES ON THE
EDWARDS AQUIFER
RECHARGE/TRANSITION ZONES
AND RELATING TO 30 TAC §213.4(d), EFFECTIVE DECEMBER 27, 1996

I CHARLES D. PATTERSON,
Print Name

PRESIDENT
Title - Owner/President/Other

of SUMMERLIN PROPERTIES, INC.
Corporation/Partnership/Entity Name

have authorized KELLY KILBER
Print Name of Agent/Engineer

of PRO-TECH ENGINEERING GROUP, INC.
Print Name of Firm

to represent and act on the behalf of the above named **Corporation, Partnership, or Entity** for the purpose of preparing and submitting this Edwards Aquifer Protection Plan application to the Texas Natural Resource Conservation Commission (TNRCC) for the review and approval consideration for construction of regulated activities on the Edwards Aquifer Recharge Zone or Transition Zone (30 TAC §213.4(d)).

I also understand that:

1. No regulated activity is allowed to commence prior to the executive director's approval of the Edwards Aquifer protection plan. If unauthorized construction begins before the approval is granted or if any aspect of the project does not conform to 30 Texas Administrative Code §213 and any condition of the TNRCC's approval letter, the TNRCC is authorized to assess administrative penalties of up to $10,000 per day per violation.

2. Before beginning any construction related to the approved regulated activity, the appropriate TNRCC regional office must be given 24 to 48 hour written notice of the date when the regulated activity will commence.

3. **A notorized copy of the Agent Authorization Form must be provided for the person preparing the application, and the forms must accompany the completed submittal.**

4. Application fees accompanied by an Edwards Aquifer Application Fee Form are due and payable at the time the application is submitted. The application fee must be sent to the Revenues Section of the TNRCC or to the appropriate regional office. **The application will not be considered until the correct fee is received by the commission.**

Applicant's Signature

11/11/98
Date

THE STATE OF TEXAS §

County of Hays §

BEFORE ME, the undersigned authority, on this day personally appeared Charles Patterson known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that (s)he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office on this 11 day of November, 1998.

Carolyn J. Duncan
NOTARY PUBLIC

CAROLYN J. DUNCAN
NOTARY PUBLIC
State of Texas
Comm. Exp. 08-01-2000

Carolyn J. Duncan
Typed or Printed Name of Notary

MY COMMISSION EXPIRES: 08-01-2000

Signatories to Applications 30 TAC §213.4(d)

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION

EDWARDS AQUIFER PROTECTION PROGRAM

APPLICATION FEE FORM

NAME OF PROPOSED PROJECT: RIVER POINT

PROJECT LOCATION: FM HIGHWAY 306 - COMAL COUNTY

NAME OF OWNER/DEVELOPER: SUMMERLIN PROPERTIES

OWNER'S ADDRESS: P O BOX 1629 WIMBERLEY TX 78676

CONTACT PERSON: CHARLES D. PATTERSON PHONE: (512) 847-5263
Please Print

AUSTIN REGIONAL OFFICE

- ☐ Hays
- ☐ Travis
- ☐ Williamson

SAN ANTONIO REGIONAL OFFICE

- ☐ Bexar
- ☒ Comal
- ☐ Kinney
- ☐ Medina
- ☐ Uvalde

APPLICATION FEES MUST BE PAID BY CHECK, CERTIFIED CHECK, OR MONEY ORDER, PAYABLE TO THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION. YOUR CANCELED CHECK WILL SERVE AS YOUR RECEIPT. **TO ENSURE CREDIT TO THE PROPER ACCOUNT PLEASE RETURN THIS FORM WITH YOUR FEE PAYMENT. THIS PAYMENT IS BEING SUBMITTED TO (CHECK ONE):**

☒ **SAN ANTONIO REGIONAL OFFICE** ☐ **AUSTIN REGIONAL OFFICE**

☐ **Mailed to TNRCC:**
TNRCC - Cashier
Revenues Section
Mail Code 214
P.O. Box 13088
Austin, TX 78711-3088

☐ **Overnight Delivery to TNRCC:**
TNRCC - Cashier
12100 Park 35 Circle
Building A, 3rd Floor
Austin, TX 78753
512/239-0347

Type of Application	Size	Fee Due		
		New (3373)	Modification (3374)	
WPAP	1500 Acres	$ 5,000	$	PAP
SCS	L.F.	$	$	SCS
Lift Stations without sewer lines	Acres	$	$	
UST/AST	Tanks	$	$	HHS
Piping System(s)		$	$	

(Installed without tanks)	Each			PSM
Extension of Time	Each	$	$	EXT

Signature

11/11/98
Date



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN
GENERAL CONSTRUCTION NOTES

1. The construction activities associated with this project must meet all applicable criteria of the Texas Natural Resource Conservation Commission set forth in 30 Texas Administrative Code (TAC) §213.5(b) – Water Pollution Abatement Plan for Regulated Activities undertaken on the recharge zone of the Edwards Aquifer.

2. Temporary erosion and sedimentation controls are required during construction. The controls must remain in place until disturbed areas are revegetated and the areas have become permanently stabilized. The temporary erosion and sedimentation controls must be inspected periodically for damage caused by construction activities and following every rainfall. Damaged or obstructed controls must be repaired or replaced as necessary to maintain proper operation.

3. If any sensitive feature is discovered during construction, regulated activities near the sensitive feature must be suspended immediately. The owner must immediately notify the appropriate regional office of the Texas Natural Resource Conservation Commission of the sensitive feature discovered. The regulated activities near the sensitive feature may not proceed until the executive director has review and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentialy adverse impacts to water quality while maintaining the structural integrity of the line.

4. Any modification to the approved Water Pollution Abatement Plan must be submitted to the appropriate regional office for approval by the executive director of the Texas Natural Resource Conservation Commission before construction of the proposed modification may commence.

5. All contractors conducting regulated activities associated with this project must be provided with copies of the approved Water Pollution Abatement Plan and the TNRCC letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractors are required to keep on-site copies of the approved plan and approval letter.

RECEIVED-TNRCC
1999 JAN 28 AM 8:55
SAN ANTONIO REGION

LEGEND

— DRAINAGE STRUCTURE

●●●●● ROCK BERM

~~~~~ SILT FENCE

NOTE:
NO ASPHALT PRODUCTS WILL BE USED DURING PERIODS OF WET WEATHER. ONLY DURING PERIODS OF DRY WEATHER AND WITH PERMISSION OF THE ENGINEER.

The contractor shall hydromulch or sod all exposed cuts and fills upon completion of grading and installation of all utilities. The seeding or erosion control shall be applied at the specified rate over areas disturbed by construction as follows:

From September 15 to March 1, seeding shall be with a combination of (1) one pound per (1000) thousand square feet of unhulled bermuda and (3) three pounds per (1000) thousand square feet of winter rye with a purity of 95% with 85% germination.

From March 1 to September 15, seeding shall be with hulled bermuda grass (Cynoden Dactolyn) at a rate of (1) one pound per (1000) thousand square feet with a purity of 95% with 85% germination.

Fertilizer shall have an analysis of 15–10–5 and shall be applied at the rate of 600 pounds per acre. Mulch type to be Conwed, applied at a rate of 2100 pounds per acre. Restoration shall be acceptable when the grass has reached a height of at least 1–1/2" (95%) coverage and no bare spots larger than 16 square feet exist.

The seeded or planted area is to be irrigated or sprinkled in a manner which will not erode the topsoil but will sufficiently soak the soil to a depth of 6 inches. The irrigation shall occur at seven day intervals for the first two months. Rainfall occurrences of at least 1 inch shall postpone the watering operation for one week.

REVISED JANUARY 22, 1999

RIVER CHASE

WPAP

COMAL COUNTY, TEXAS

PRO·TECH ENGINEERING GROUP INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

NOVEMBER 1998

E.O. 14625 | SCALE: 1"=500' | SHEET 1 OF 2
~~~~~

PRO-TECH
ENGINEERING
GROUP
INCORPORATED

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

512 / 353-3335
FAX 512 / 396-0224

RECEIVED
FEB 10 1999
COUNTY ROAD DEPT.

RECEIVED-TNRCC
99 FEB 26 AM 8:55
SAN ANTONIO REGION

January 25, 1999

Texas Natural Resource Conservation Commission
140 Heimer Road, Suite 360
San Antonio, Tx 78232-5042

Attn: John Mauser

Re: River Chase (River Point) WPAP
Comal Co., Tx.

John;

Enclosed please find four (4) copies of the revised layouts for the above referenced project. Please note the name change of the subdivision to River Chase. Comal County already has a River Point.

→ Also the owner of the project will make a part of the deed restrictions that all septic systems shall be a Class 1 aerobic system.

If you have any questions, please call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC.

Richard McDaniel

RMD/cl

Enclousers

xc: Charles D. Patterson

EO# 14625
TNRCC – Name Change

ROBERT MORRISS, INC.

P.O. Box 1688 Cedar Park, Texas 78630 Voice & Fax (512)267-0688

"Using the most appropriate technology to provide practical efficient engineering designs of small flow sewage treatment and disposal facilities."

RECEIVED

DEC 0 7 1998

Ans'd.....

December 4, 1998

Kelly Kilber, P.E.
President
Pro Tech Engineering Group, Inc.
100 E. San Antonio Street, Suite 100
San Marcos, Texas 78666

RECEIVED-TNRCC
1998 DEC -8 AM 10:
SAN ANTONIO REGIO

RE: On-site sewage disposal systems for use over the Edwards Aquifer recharge zone
River Point Development

Dear Mr. Kilber,

In preparing a response to your recent request for information on the design of on-site sewage facilities (OSSF) suitable for use over the Edwards Aquifer recharge zone, I have reviewed Subchapter E of Chapter 285 as published by T.N.R.C.C. in February, 1997. Subchapter E imposes some additional requirements for OSSF constructed over the recharge zone, but the basic construction standards are the same as for an OSSF constructed elsewhere. Therefore, the following information on the selection of a particular design would apply to any other site with similar surface geologic conditions.

Although the required setbacks from wells, streams, sharp slopes and man-made structures, as stated in Chapter 285, Table X, are sometimes the controlling factors, the more common limitations on the use of conventional OSSF design is the surface soil and sub-soil material characteristics. In the Edwards Aquifer recharge zone, the most common limitation is the depth of suitable soils. For a conventional OSSF, the requirement is for at least 24 inches of suitable soil below the bottom of the excavation of the disposal field.

Where the surface soils are non-existent or too shallow for conventional disposal systems, there are options. For sites that have essentially no soil over vuggy rock, an evapotranspiration (ET) bed can be used. This is a shallow watertight container, usually constructed in a berm or a structural wall, which receives the septic tank effluent. The "disposal" is by evaporation from the moist surface of the soil in the watertight container and by transpiration from the plants growing in the soils. While ET beds can be constructed in locations not approved for any other type of disposal system, they are large and expensive.

A second "no soil" option over vuggy rock would be a Wisconsin mound system. This consists of a mound of sand and selected topsoil placed on top of the vuggy rock. Septic tank effluent is pumped into the mound and only reaches the vuggy rock after passing through the sand in the mound. The Wisconsin mound is also large and careful design and layout is critical for success.

If the vuggy rock is broken and can be excavated to a depth of 2 feet or so, a soil substitution bed may be used. In this option, a pit is excavated 2 feet to 3 feet deep and a 24" deep topsoil fill is placed. On this is installed a gravel fill and a pressure distribution system. A final topsoil covering completes the bed. This option usually requires a smaller area than the previous two mentioned as well as less imported material. Being mostly below original grade, the finished appearance is usually more acceptable.

If some soil, say at least 6", is present over the vuggy rock , a surface application disposal system may be an option. For surface application, usually done by spray nozzles, a very high quality effluent is required. This is usually obtained by use of an aerobic home sized treatment plant, although there are "low tech" options. The high quality effluent is stored, disinfected and then sprayed on a vegetated area late at night. While this

option may offer savings in the disposal system, the treatment component cost will be much higher and the on-going maintenance costs can be significant. In addition, the disposal area requirements are greater because of the very low application rates allowed.

With a little deeper soil cover, say 12" to 18". A drip irrigation disposal system could be permitted. While some treatment beyond that obtained with a septic tank is desirable, disinfection is not usually required. The disposal is done with drip emitter tubing located with at least 12" of soil below the tubing and with ±8" of covering soil. The covering soil may be mostly imported material. The area requirements will be less than for a surface application disposal system, although the drip emitter system will cost more to install. The maintenance costs would be about the same for the two.

As the soil depth increases above 20", the low pressure dosed drainfield can be used. This option requires 12" of soil below the trench bottom, and trenches as shallow as ±8" can be used. Sufficient treatment can be obtained by a standard septic tank with an outlet filter, and a simple gravel filter can be added if the Regulating Agency insists on a better effluent. This is usually the least expensive of the options discussed to this point.

Finally, the State Standards (Chapter 285) do not state a minimum soil depth above rock if the wastewater receives a high level of treatment and is disinfected. High level here means a final effluent BOD_5 level of 30 mg/l or better and a high level of nitrogen removal. I would suggest theat this approach may be harder to get approved at the County level and could be more expensive to maintain.

The treatment processes mentioned in the above options include:

Aerobic home sized treatment plants: These units are specifically reviewed and approved at the State level and can be specified by brand and model.

Sand Filters: The design and sizing criteria are established in Chapter 285.

Recirculating sand filters or gravel filters, anaerobic processes, artificial wetlands, etc. are usually reviewed and approved for a specific project. These "low-tech" treatment methods can be more reliable and easier to maintain, but are often harder to "sell" to the Regulatory Agency.

As an aid to understanding the basics of the above described options, I am enclosing copies of plans for the types of systems that I have designed recently. I am not granting permission to copy these plans. If you have a reason to need additional copies, contact me.

Respectfully submitted,

Robert L. Morriss, P.E.
President

RLM:cm

Project # 981101



PRO-TECH
ENGINEERING
GROUP
INCORPORATED

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

512 / 353-3335
FAX 512 / 396-0224

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1998 DEC -8 AM 10: 42
SAN ANTONIO REGION

December 7, 1998

Texas Natural Resource Conservation Commission
140 Heimer Road, Ste. 360
San Antonio, Tx 78232-5042

RECEIVED
DEC 17 1998
COUNTY ROAD DEPT.

Attn: John Mauser

Re: River Point – WPAP
Comal County, Texas

John:

As requested, enclosed are the following;

1. Four copies of the WPAP Plan at a scale of 1" = 500'.

2. Four copies of six different types of OSSF designs that are suitable for use on this project.

Also during road construction silt fences will be installed and maintained in road side ditches at intervals of 1000 feet and 500 feet when grades exceed 8%. These erosion controls will be left in place until permanent controls (vegetation) has been established.

Thank you for your assistance and if you need any additional; information, please call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC.

Richard McDaniel

KK/cl

xc: Charles D. Patterson

EO# 14625
John Mauser - TNRCC - WPAP



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN
GENERAL CONSTRUCTION NOTES

1. The construction activities associated with this project must meet all applicable criteria of the Texas Natural Resource Conservation Commission set forth in 30 Texas Administrative Code (TAC) §213.5(b) – Water Pollution Abatement Plan for Regulated Activities undertaken on the recharge zone of the Edwards Aquifer.

2. Temporary erosion and sedimentation controls are required during construction. The controls must remain in place until disturbed areas are revegetated and the areas have become permanently stabilized. The temporary erosion and sedimentation controls must be inspected periodically for damage caused by construction activities and following every rainfall. Damaged or obstructed controls must be repaired or replaced as necessary to maintain proper operation.

3. If any sensitive feature is discovered during construction, regulated activities near the sensitive feature must be suspended immediately. The owner must immediately notify the appropriate regional office of the Texas Natural Resource Conservation Commission of the sensitive feature discovered. The regulated activities near the sensitive feature may not proceed until the executive director has review and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentialy adverse impacts to water quality while maintaining the structural integrity of the line.

4. Any modification to the approved Water Pollution Abatement Plan must be submitted to the appropriate regional office for approval by the executive director of the Texas Natural Resource Conservation Commission before construction of the proposed modification may commence.

5. All contractors conducting regulated activities associated with this project must be provided with copies of the approved Water Pollution Abatement Plan and the TNRCC letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractors are required to keep on-site copies of the approved plan and approval letter.

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1999 JAN 28 AM 8:55
SAN ANTONIO REGION

LEGEND

— DRAINAGE STRUCTURE

●●●●● ROCK BERM

~~~~~ SILT FENCE

NOTE:
NO ASPHALT PRODUCTS WILL BE USED DURING PERIODS OF WET WEATHER. ONLY DURING PERIODS OF DRY WEATHER AND WITH PERMISSION OF THE ENGINEER.

The contractor shall hydromulch or sod all exposed cuts and fills upon completion of grading and installation of all utilities. The seeding or erosion control shall be applied at the specified rate over areas disturbed by construction as follows:

From September 15 to March 1, seeding shall be with a combination of (1) one pound per (1000) thousand square feet of unhulled bermuda and (3) three pounds per (1000) thousand square feet of winter rye with a purity of 95% with 85% germination.

From March 1 to September 15, seeding shall be with hulled bermuda grass (Cynoden Dactolyn) at a rate of (1) one pound per (1000) thousand square feet with a purity of 95% with 85% germination.

Fertilizer shall have an analysis of 15–10–5 and shall be applied at the rate of 600 pounds per acre. Mulch type to be Conwed, applied at a rate of 2100 pounds per acre. Restoration shall be acceptable when the grass has reached a height of at least 1–1/2" (95%) coverage and no bare spots larger than 16 square feet exist.

The seeded or planted area is to be irrigated or sprinkled in a manner which will not erode the topsoil but will sufficiently soak the soil to a depth of 6 inches. The irrigation shall occur at seven day intervals for the first two months. Rainfall occurrences of at least 1 inch shall postpone the watering operation for one week.

REVISED JANUARY 22, 1999

RIVER CHASE

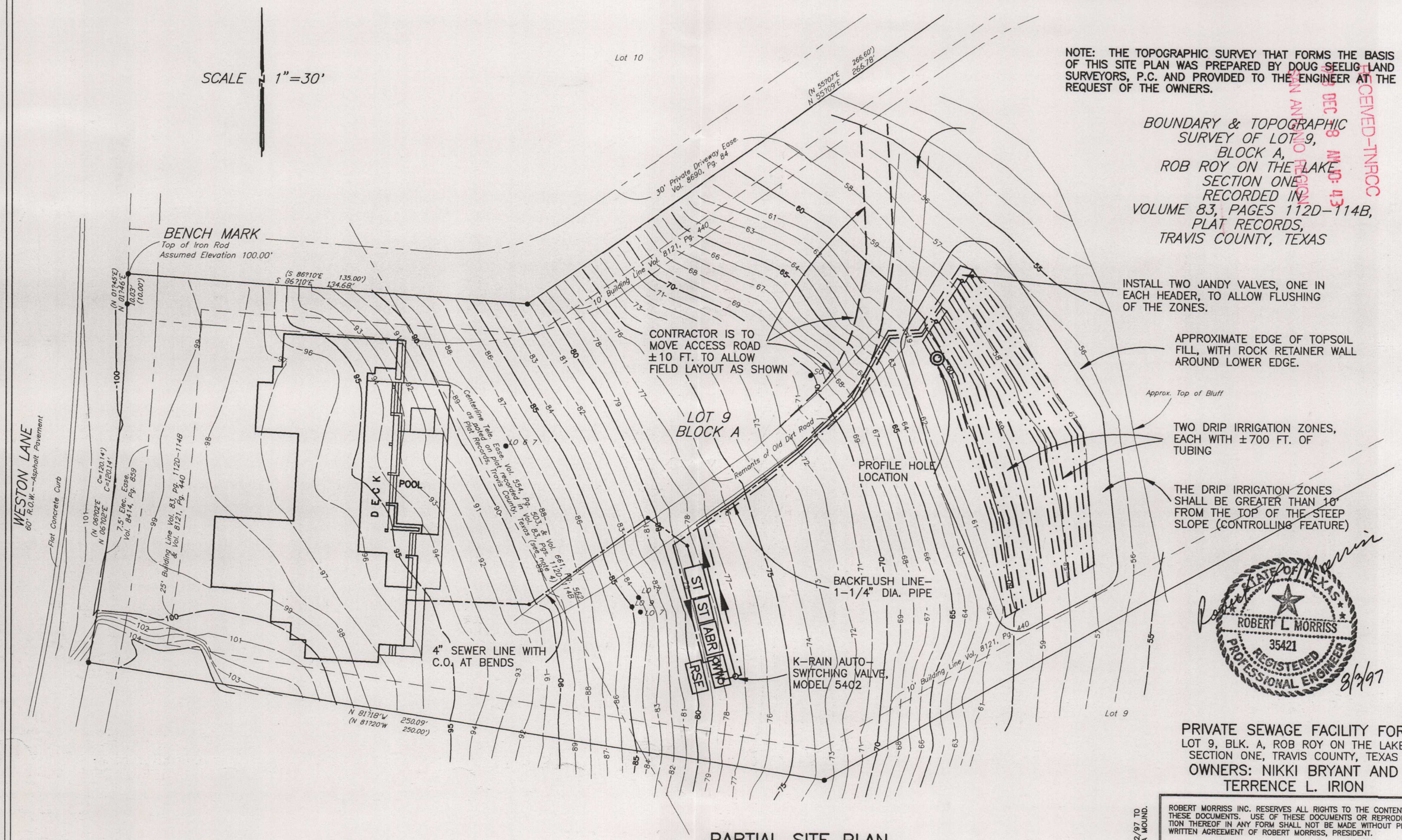
WPAP

COMAL COUNTY, TEXAS

PRO·TECH ENGINEERING GROUP INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

NOVEMBER 1998

E.O. 14625 | SCALE: 1"=500' | SHEET 1 OF 2
~~~~~



NOTE: THE TOPOGRAPHIC SURVEY THAT FORMS THE BASIS OF THIS SITE PLAN WAS PREPARED BY DOUG SEELIG LAND SURVEYORS, P.C. AND PROVIDED TO THE ENGINEER AT THE REQUEST OF THE OWNERS.

BOUNDARY & TOPOGRAPHIC SURVEY OF LOT 9, BLOCK A, ROB ROY ON THE LAKE SECTION ONE RECORDED IN VOLUME 83, PAGES 112D-114B, PLAT RECORDS, TRAVIS COUNTY, TEXAS

RECEIVED-TNRCC
98 DEC 18 AM 10:43
SAN ANTONIO REGION

PRIVATE SEWAGE FACILITY FOR
LOT 9, BLK. A, ROB ROY ON THE LAKE
SECTION ONE, TRAVIS COUNTY, TEXAS
OWNERS: NIKKI BRYANT AND TERRENCE L. IRION

PARTIAL SITE PLAN

SCALE: 1" = 30'

REVISED 7/12/97 TO CHANGE TO A MOUND. BY R.L.M.

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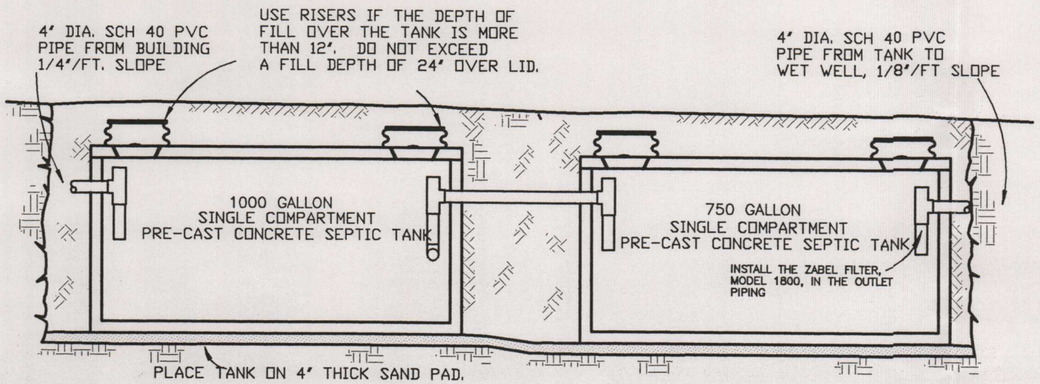
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

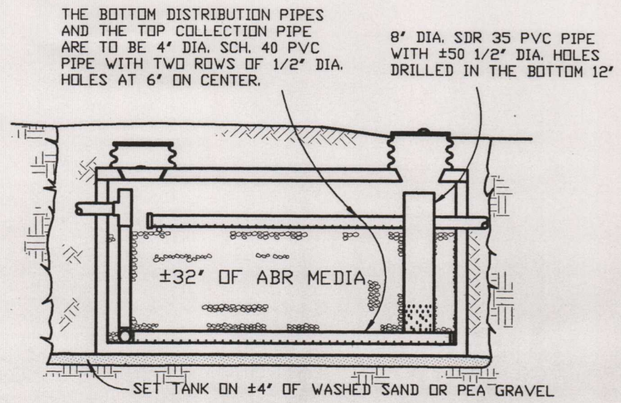
DESIGNED BY RLM
PROJECT # 96-09-05
DATE 2/4/97
SHEET 1 OF 4

960905



DUAL SEPTIC TANK DETAIL

TANKS ARE TO BE FROM HILL COUNTRY CONCRETE PRODUCTS, KYLE, TEXAS OR AN APPROVED EQUAL



ANAEROBIC BIOLOGICAL REACTOR (ABR)

ABR MEDIA TO BE 1-1/2" TO 2" CLEAN WASHED RIVER GRAVEL

MATERIAL AND EQUIPMENT SPECIFICATIONS:

WET WELL #1 — COVERT SUBMERSIBLE PUMP MODEL SSB-31, CONTROLLED BY AN INTERMATIC CYCLE TIMER, MODEL C8845 (W. W. GRAINGER STOCK NO. 2E131) AND A LOW LEVEL CUTOFF FLOAT SWITCH.

WET WELL #2 — GRUNDFOS JETSUB PUMP, MODEL JS-07-03 1/3 HP, 120V. MOTOR, CONTROLLED BY THE S. J. ELECTRO SYSTEMS TWO FLOAT FLOAT SWITCH MODEL 15DFD120VWP, WITH THE "ON" FLOAT IN WET WELL #1 AND THE "OFF" FLOAT IN WET WELL #2. SEE THE WET WELL DETAIL FOR THE FLOAT SETTINGS.

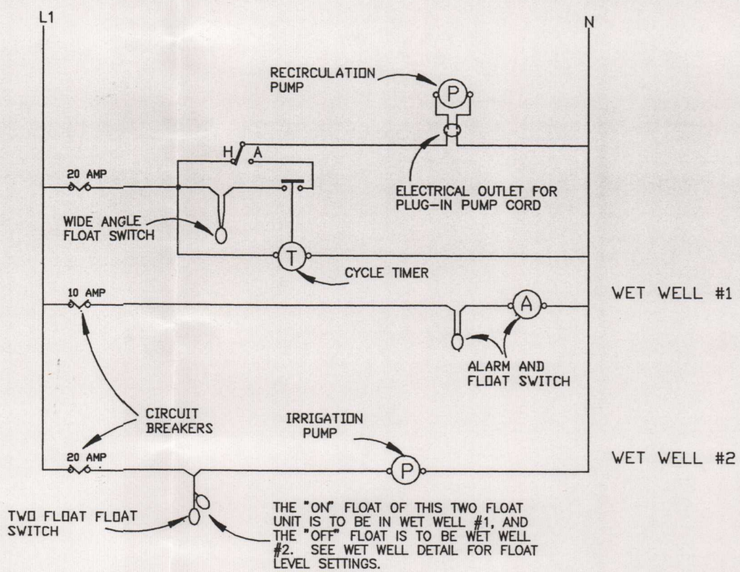
ALARM — A PEABODY BARNES NO. 61487 HIGH WATER ALARM UNIT SHALL BE INSTALLED IN THE HOME AT A LOCATION SELECTED BY THE OWNER. THE FLOAT SWITCH THAT OPERATES THE ALARM SHALL BE MOUNTED IN WET WELL #1 AND SET AS SHOWN IN THE WET WELL DETAIL.

AUTOMATIC SWITCHING VALVE.... K-RAIN MODEL 5402.
SPIN CLEAN FILTER...AGRICULTURAL PRODUCTS INC. MODEL 4E-1" WITH BALL FLUSH VALVE

IRRIGATION SYSTEM COMPONENTS....TO BE 'GEOFLOW' PRODUCTS:

PRESSURE REGULATOR	PART NO. SEN-PMR-25MF
AIR VENT/VACUUM BREAKER VALVE	PART NO. WAVP-1
COMPRESSION ADAPTORS	PART NO. CA600
DRIPLINE TUBING	WASTEFLOW 1/2" TUBING WITH 1 GPH EMITTERS SPACED AT 24".

PIPING....THE VARIOUS SIZE PVC PLASTIC PIPE SHALL BE CLASS 200 MEETING THE ASTM STANDARD D-2241 OR SCH. 40 MEETING THE ASTM STANDARD D-1785. SEE DETAILS FOR PIPE SIZE AND WEIGHT FOR EACH APPLICATION.
FILTER FABRIC...REMAY TYPAR, STYLE 3201.



ELECTRICAL SCHEMATIC FOR PUMPS AND CONTROLS

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER
8/3/97

PRIVATE SEWAGE FACILITY FOR

LOT 9, BLK. A, ROB ROY ON THE LAKE SECTION ONE, TRAVIS COUNTY, TEXAS

OWNERS: NIKKI BRYANT AND TERRENCE L. IRION

REVISED 7/12/97 TO CHANGE TO A MOUND. BY R.L.M.

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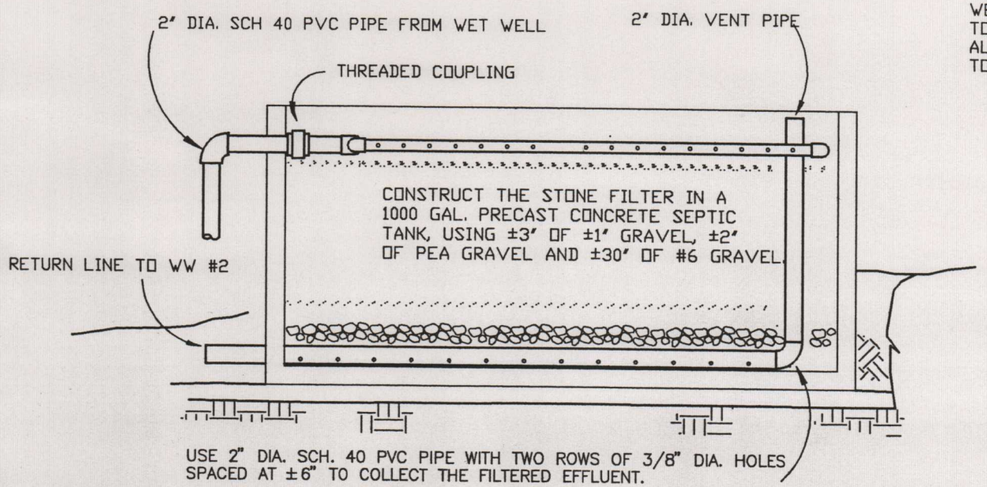
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

DESIGNED BY RLM
PROJECT # 96-09-05
DATE 2/4/97
SHEET 2 OF 4

960905



RECIRCULATING STONE FILTER

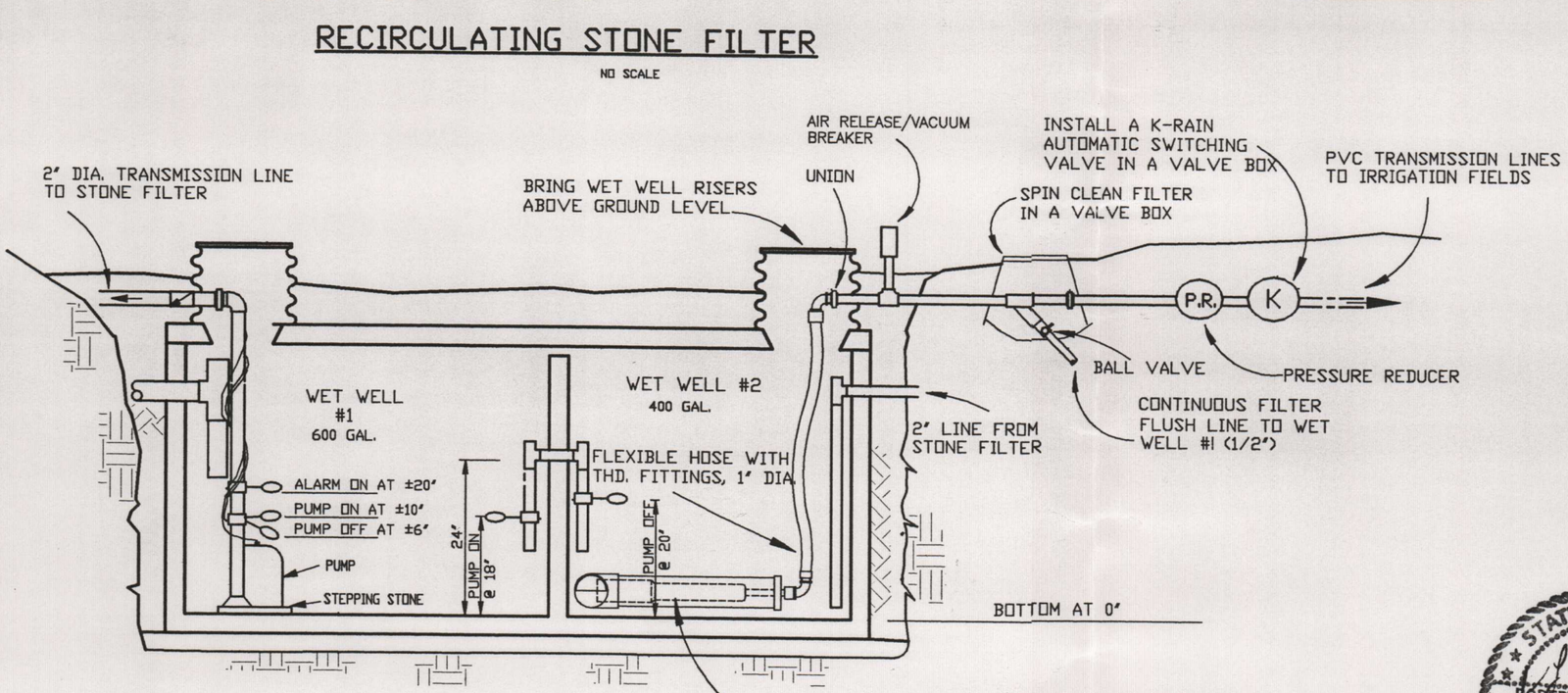
NO SCALE

THE FOUR DISTRIBUTION PIPES ARE 1" DIA. SCH.40 PVC PIPES CONNECTED AS SHOWN TO THE 2" TRANSMISSION PIPE FROM THE WET WELL #1. EACH DISTRIBUTION PIPE IS TO HAVE 5/32" DIA. HOLES SPACED AT ±12" ALONG BOTH SIDES OF THE PIPE, ARRANGED TO PRODUCE A HORIZONAL SPRAY PATTERN.



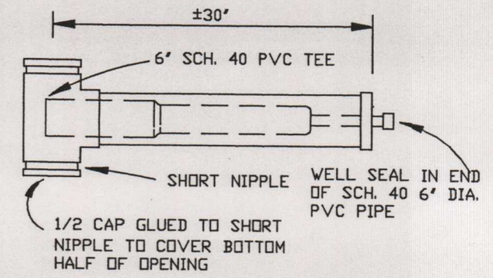
TOP VIEW

NOTE: AFTER PLACEMENT OF THE DISTRIBUTION PIPING AND AFTER RUNNING A PRESSURE TEST ON THE PIPE INSTALLATION, COVER THE PIPING WITH ADDITIONAL FILTER MEDIA TO THE TOP OF THE TANK AND MOUND THE MEDIA ±2" TO THE CENTER OF THE TANK.

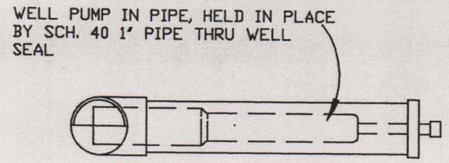


WET WELL DETAIL

CONSTRUCT IN A 1000 GALLON PRECAST CONCRETE SEPTIC TANK



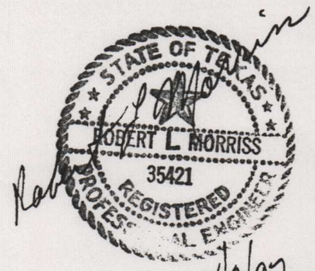
TOP VIEW



SIDE VIEW

WELL PUMP DETAIL

NO SCALE



PRIVATE SEWAGE FACILITY FOR
LOT 9, BLK. A, ROB ROY ON THE LAKE SECTION ONE, TRAVIS COUNTY, TEXAS
OWNERS: NIKKI BRYANT AND TERRENCE L. IRION

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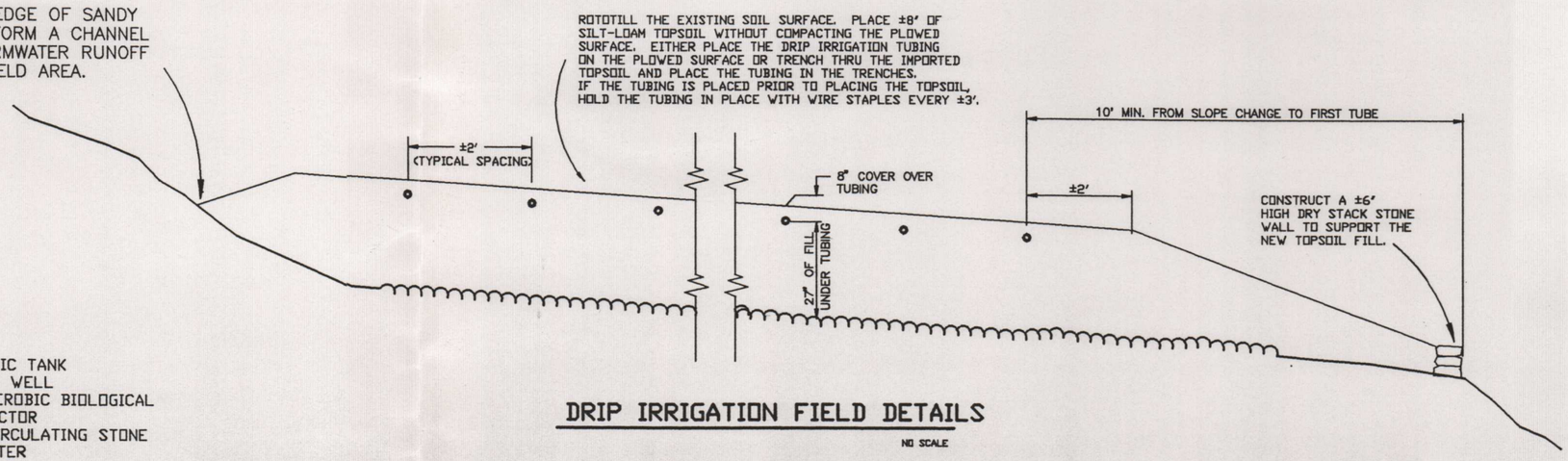
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

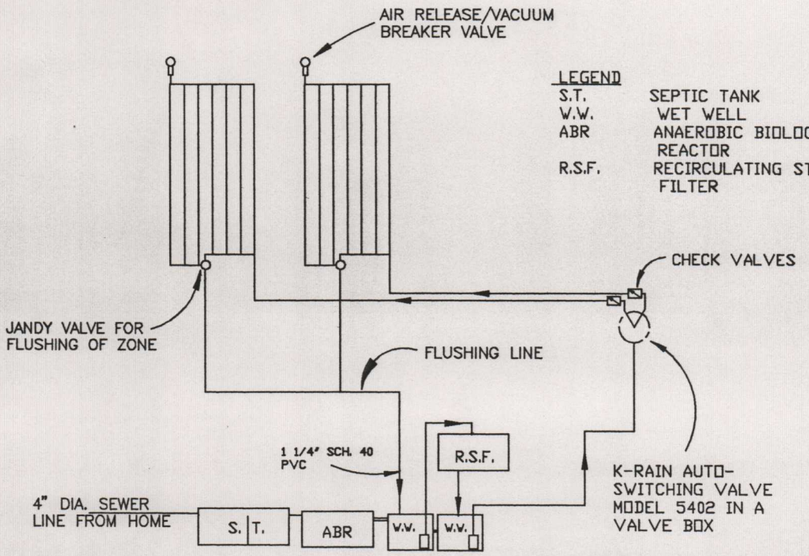
DESIGNED BY RLM
PROJECT # 96-09-05
DATE 2/4/97
SHEET 3 OF 4

960905

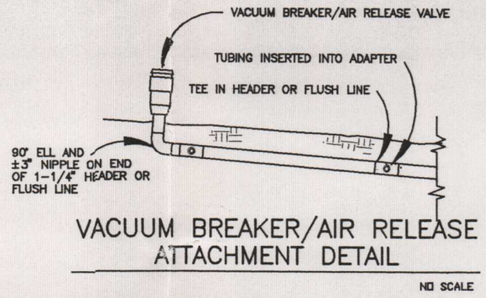


DRIP IRRIGATION FIELD DETAILS

NO SCALE

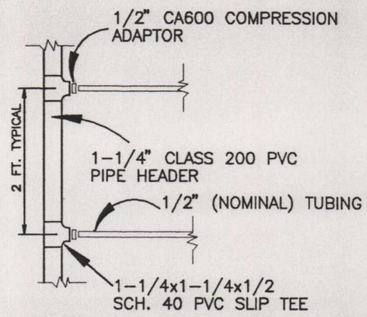


FLOW SCHEMATIC



VACUUM BREAKER/AIR RELEASE ATTACHMENT DETAIL

NO SCALE



DRIP IRRIGATION TUBING TO HEADER CONNECTION DETAIL

NO SCALE

NOTE: THE CA600 ADAPTOR GLUES INTO THE 1/2" LEG OF THE TEE AND THE 1/2" EMITTER TUBING "STABS" INTO THE ADAPTOR ±1/2".

IRRIGATION FIELD CONSTRUCTION NOTES

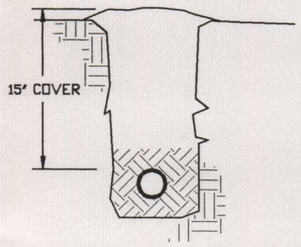
TUBING LOCATION, ARRANGEMENT AND SPACING IS APPROXIMATE, AND MAY BE ADJUSTED ON SITE BY THE ENGINEER TO BETTER FIT THE TERRAIN AND TO REDUCE SITE DAMAGE. A TOTAL TUBING LENGTH OF AT LEAST 1400 FEET WILL BE INSTALLED, WITH APPROXIMATELY 1/2 IN EACH OF THE TWO FIELDS.

THE SITE IS TO BE CLEARED OF BRUSH, DEBRIS AND TRASH, AND THEN ROTO-TILLED TO A DEPTH OF ±4" TO THE EXTENTS SHOWN IN THE DETAIL ABOVE.

THE SANDY LOAM OR LOAMY SAND FILL SHALL BE PLACED OVER THE TILLED SURFACE IN A MANNER THAT AVOIDS COMPACTION OF THE TILLED SURFACE, AND SHAPED TO CONFORM WITH THE CROSS-SECTION SHOWN. THE TUBING IS TO BE INSTALLED IN TRENCHES CUT INTO THE IMPORTED SOIL MASS, WITH A FINAL COVER DEPTH OF AT LEAST 8".

THE TUBING IS TO BE LAID OUT AS SHOWN ON THE PLAN, THE HEADER AND FLUSHING PIPES ARE TO BE PLACED, AND THE CONNECTIONS OF TUBING TO PIPING MADE. THIS ASSEMBLEY SHALL BE INSPECTED AND APPROVED BEFORE PROCEEDING.

AFTER TUBING INSTALLATION IS COMPLETE, THE ENTIRE TOPSOIL BLANKET IS TO BE RAKED SMOOTH AND ALL LARGE CLODS REMOVED. THE SURFACE IS TO BE SEEDED WITH BERMUDA GRASS SEED AT THE RATE OF 100 LBS. PER ACRE AND WITH RYE GRASS SEED AT THE RATE OF 200 LBS. PER ACRE.



EMBED TRANSMISSION PIPE ON 2" OF SAND AND COVER WITH 2" OF THE SAME MATERIAL. THE REMAINDER OF THE TRENCH BACKFILL MAY BE EXCAVATED MATERIAL IF FREE OF ROCK OVER ±2" AND FREE OF ROOTS, STICKS, OR OTHER ORGANIC MATERIAL. IMPORTED BACKFILL, IF REQUIRED, SHOULD BE SANDY LOAM OR A CLAY LOAM FREE OF LARGE CLODS AND ORGANIC MATERIAL. WHERE CROSSING UNDER DRIVEWAYS - ENCLOSE TRANSMISSION PIPE IN SCH 40 PVC CASING PIPE WHICH IS TO BE 2" LARGER THAN THE TRANSMISSION PIPE DIA.

TRANSMISSION LINE EMBEDMENT DETAIL

NO SCALE

STATE OF TEXAS
ROBERT L. MORRISS IV
35421
REGISTERED PROFESSIONAL ENGINEER
8/3/97

PRIVATE SEWAGE FACILITY FOR
LOT 9, BLK. A, ROB ROY ON THE LAKE
SECTION ONE, TRAVIS COUNTY, TEXAS
OWNERS: NIKKI BRYANT AND TERRENCE L. IRION

REVISED 7/12/97 TO CHANGE TO A MOUND. BY R.L.M.

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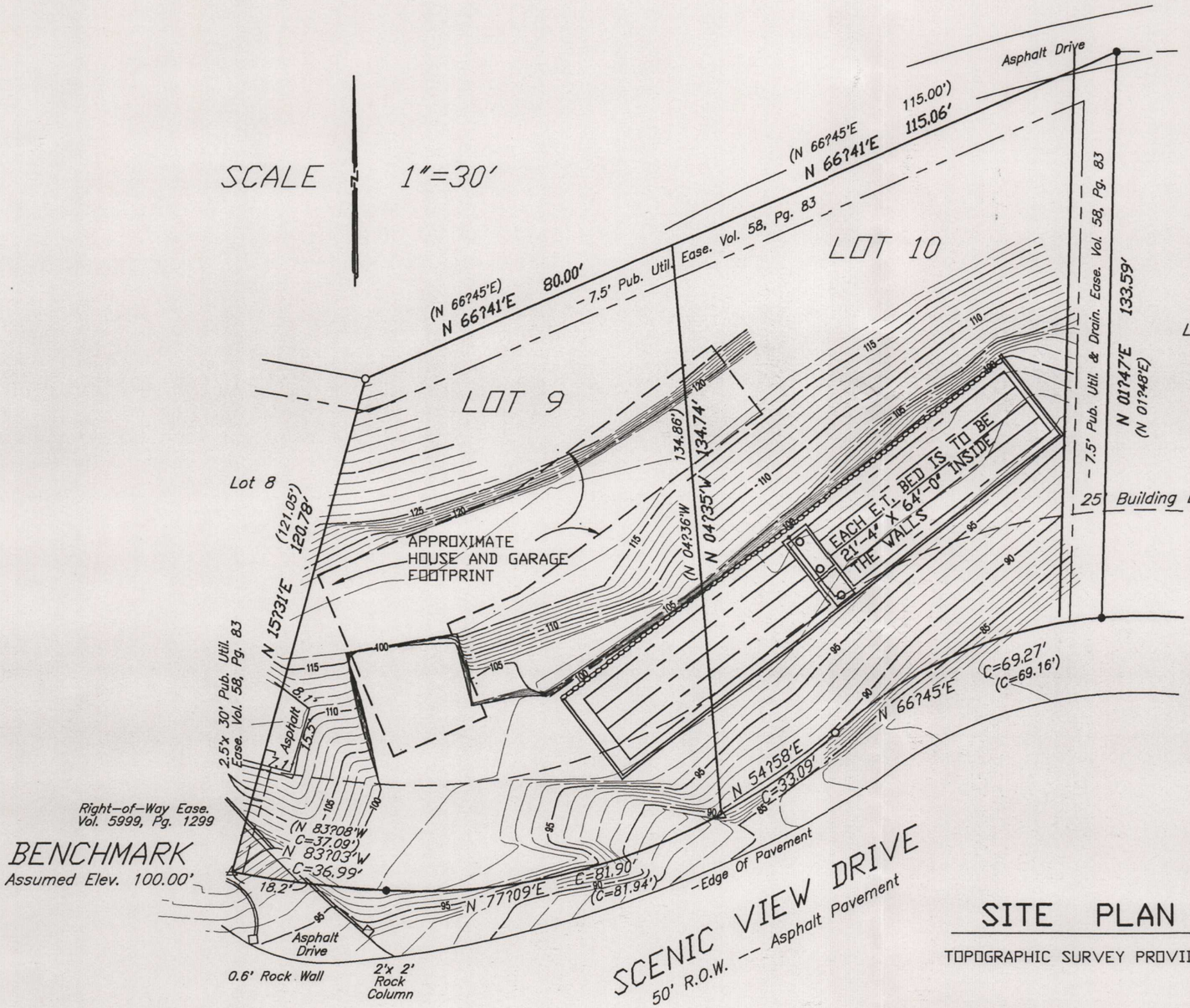
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

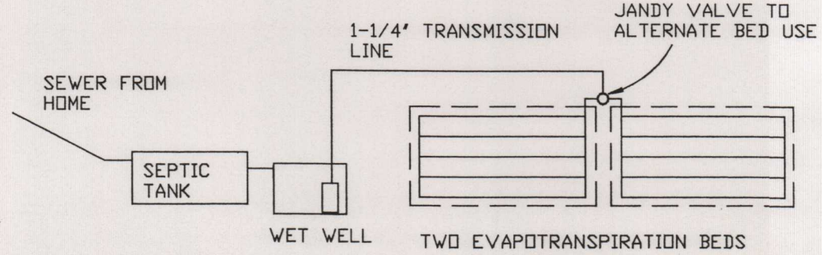
DESIGNED BY RLM DATE 2/4/97
PROJECT # 96-09-05 SHEET 4 OF 4

960905



SITE PLAN

TOPOGRAPHIC SURVEY PROVIDED BY OWNER



FLOW SCHEMATIC FOR FACILITY

NO SCALE

NOTE ON FACILITY DESIGN:
THIS PRIVATE SEWAGE FACILITY HAS BEEN DESIGNED TO SERVE A FOUR BEDROOM HOME WITH UP TO 2699 SQ. FT.
E.T. BED SIZE = 31,000(1+4)X0.90/53.75 = 2595 SQ. FT.
THE ACTUAL BED AREA TO BE PROVIDED IS 2730 SQ. FT.
SEPTIC TANK CAPACITY = 1250 GALLONS
WET WELL CAPACITY = 750 GALLONS

AS-BUILT NOTES:
THE TANKS WERE INSTALLED BETWEEN THE TWO E. T. BEDS AND THE VINYL LINERS WERE SUPPORTED BY SANDBAGS ALONG THE HIGH SIDE OF THE BEDS.

RECEIVED-TNRCC
98 DEC -8 AM 10:43
SAN ANTONIO REGION

TOPOGRAPHIC SURVEY
OF LOTS 9 AND 10,
SCENIC VIEW WEST
RECORDED IN
PLAT BOOK 58, PAGE 83,
PLAT RECORDS,
TRAVIS COUNTY, TEXAS

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER
Feb 10, 1998

PRIVATE SEWAGE FACILITY FOR
5204 SCENIC VIEW DRIVE
AUSTIN, TEXAS
OWNER: GARY MORSE

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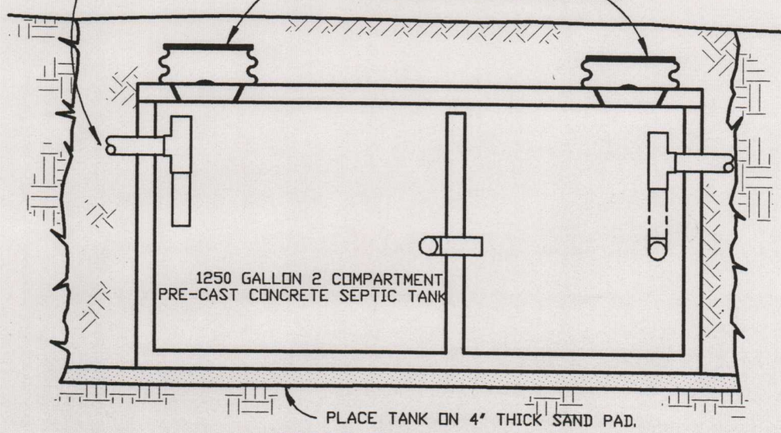
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)250-1318

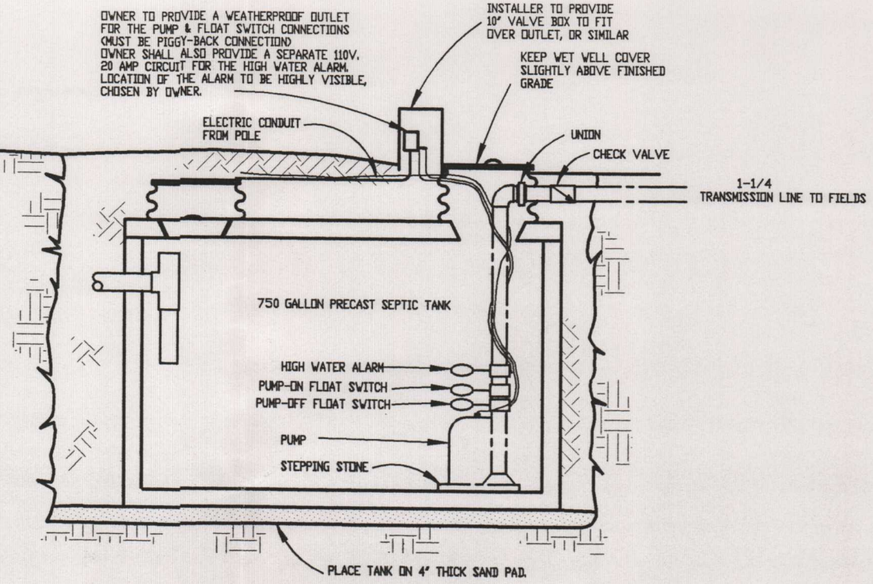
DESIGNED BY RLM DATE 10/24/96
PROJECT # 95-12-01 SHEET 1 OF 3

951201



SEPTIC TANK DETAIL

TANKS ARE TO BE FROM HILL COUNTRY CONCRETE PRODUCTS, KYLE, TEXAS OR AN APPROVED EQUAL



WET WELL DETAIL

PUMP NOTES:

WET WELL — COVERT SUBMERSIBLE PUMP MODEL SSB-31 WITH THE S. J. ELECTRO SYSTEMS MODEL 15DFD120VWP FLOAT SWITCH UNIT, ASSEMBLED TO PROVIDE A PUMP DOWN RANGE OF 4". PUMP TO STOP AT A WATER DEPTH OF ±6" TO AVOID RUNNING DRY.

ALARM — A PEABODY BARNES NO. 61487 HIGH WATER ALARM, MERCURY LEVEL FLOAT SWITCH SHALL BE MOUNTED TO OPERATE AT ±3" ABOVE THE "PUMP ON" LEVEL IN THE WET WELL. THE ALARM UNIT SHALL BE MOUNTED IN THE HOME IN A VISIBLE LOCATION SELECTED BY THE OWNER.

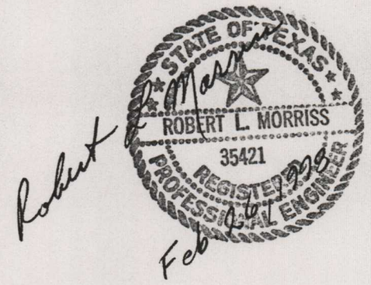
TESTING NOTES — WHEN TESTING THE PUMP ON-OFF AND ALARM FUNCTIONS, OBSERVE THE FOLLOWING LIMITATIONS:

1. WET WELL - DO NOT OPERATE PUMP LONGER THAN ±4 MINUTES WITHOUT SWITCHING BEDS.

ELECTRICAL — OWNER TO PROVIDE A WEATHERPROOF OUTLET FOR THE PUMP & FLOAT SWITCH CONNECTIONS (MUST BE PIGGY-BACK CONNECTION). OWNER SHALL ALSO PROVIDE A SEPARATE 110V. CIRCUIT FOR THE HIGH WATER ALARM. LOCATION OF THE ALARM TO BE HIGHLY VISIBLE, CHOSEN BY OWNER. CIRCUITS ARE TO BE 20 AMP CIRCUITS.

AS-BUILT NOTE

THE TANKS INSTALLED WERE MOULDED PLASTIC TANKS DUE TO THE DIFFICULTY OF PLACING THE CONCRETE TANKS IN THE SELECTED LOCATION.



PRIVATE SEWAGE FACILITY FOR
5204 SCENIC VIEW DRIVE
AUSTIN, TEXAS
OWNER: GARY MORSE

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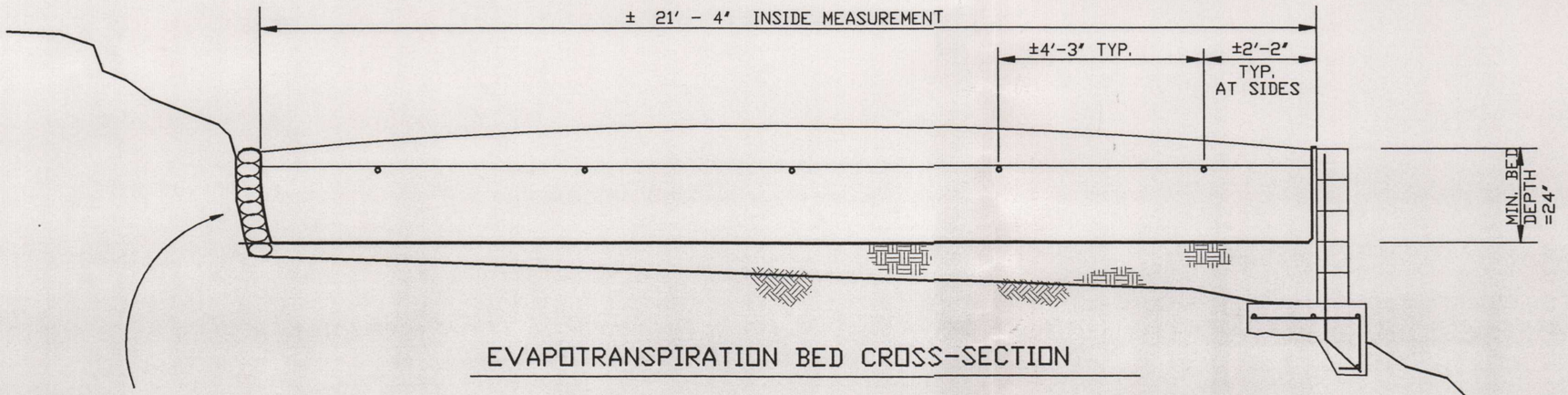
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)250-1318

DESIGNED BY RLM DATE 10/24/96
PROJECT # 95-12-01 SHEET 2 OF 3

951201



EVAPOTRANSPIRATION BED CROSS-SECTION

AS-BUILT NOTES:

THE VINYL LINER WAS SUPPORTED ALONG THE HIGH SIDE OF THE BEDS BY A SANDBAG WALL PLACED AGAINST THE FACE OF THE EXCAVATION, AND THE LINER WAS DRAPED OVER THE TOP OF THE BAG WALL.

NOTES ON EVAPOTRANSPIRATION BED DETAILS

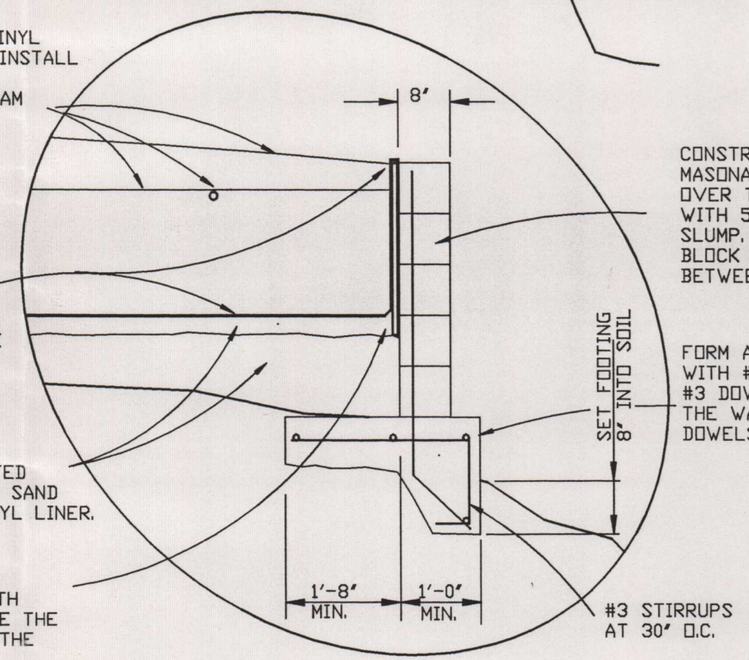
THE 1" DISTRIBUTION PIPING IN EACH BED CONSISTS OF FIVE RUNS OF ±62 FT. LONG EACH, WITH A 1-1/4" HEADER AT THE INLET END AND WITH A 1" HEADER AT THE OPPOSITE END. EACH DISTRIBUTION PIPE SHALL HAVE 19 HOLES, SPACED AT 41" ALONG THE PIPE. ALL DISCHARGE HOLES ARE TO BE 5/32" DIA. HOLES ARE TO BE LOCATED ALONG THE BOTTOM OF THE PIPE.

PLACE ±20" OF WASHED SAND ON THE VINYL LINER AND LEVEL THE SAND SURFACE. INSTALL THE DISTRIBUTION PIPING ±2" INTO THE SAND AND COVER ALL WITH A SANDY LOAM OR SILT LOAM TOPSOIL, ±4" DEEP AT THE EDGE AND ±8" DEEP AT THE BED MIDDLE.

INSTALL A 30 MIL THICK VINYL LINER ON THE SAND PAD AND AGAINST THE FOAM SIDING. FOLD THE CORNERS TO CREATE A WATERTIGHT CONTAINER. FOLD THE TOP EDGE OF THE LINER OVER THE TOP OF THE FOAM SIDING AND DOWN BEHIND THE SIDING.

LEVEL THE BOTTOM OF THE BED ENCLOSURE WITH COMPACTED SOIL OR SAND, AND ADD A ±4" SAND PAD DIRECTLY UNDER THE VINYL LINER.

PAD THE INSIDE OF THE CONTAINMENT WALLS WITH 3/4" FOAM SIDING WHERE THE LINER IS ADJACENT TO THE WALLS.



CONSTRUCT WALLS BY STACKING CONCRETE MASONARY UNITS WITH STAGGERED JOINTS OVER THE #3 REBAR DOWELS, THEN FILL WITH 5 SACK CONCRETE WITH A 6" MAX. SLUMP. VIBRATE CONCRETE INTO THE BLOCK VOIDS UNTIL MORTAR APPEARS BETWEEN THE BLOCKS.

FORM AND PLACE THE CONCRETE FOOTING WITH #4 REBAR AS SHOWN. PLACE THE #3 DOWELS AT 16" ON CENTER TO ALLOW THE WALL BLOCK UNITS TO SIT OVER THE DOWELS. USE A 5 SACK LOW SLUMP CONCRETE.

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER

PRIVATE SEWAGE FACILITY FOR
5204 SCENIC VIEW DRIVE
AUSTIN, TEXAS
OWNER: GARY MORSE

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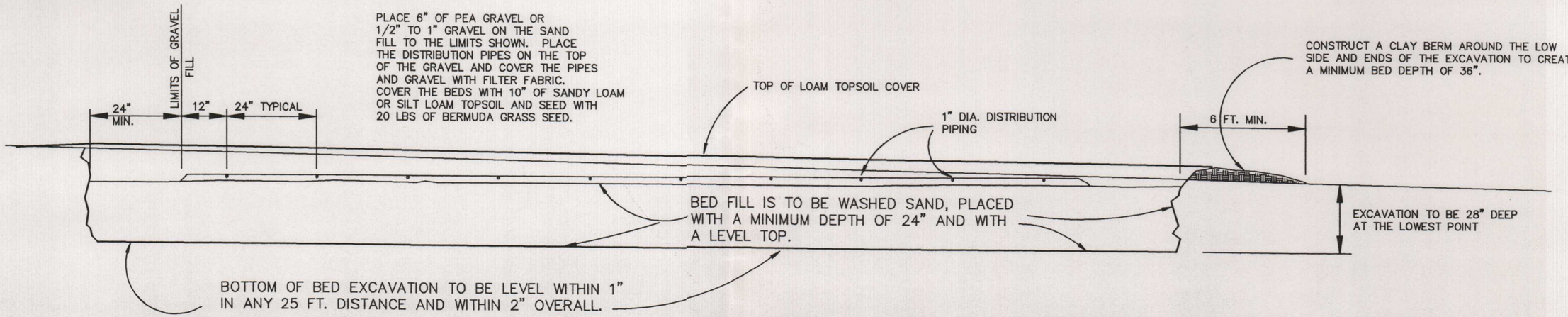
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)250-1318

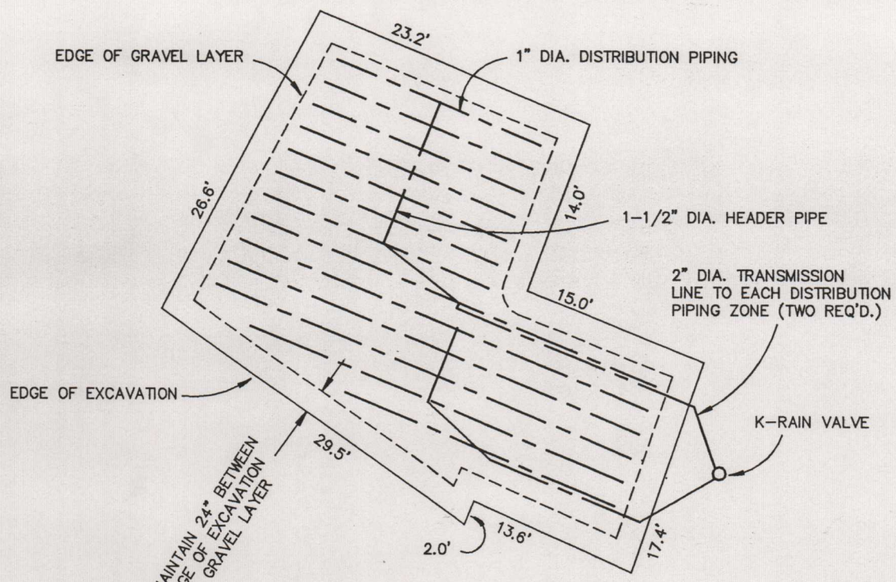
DESIGNED BY RLM DATE 10/24/96
PROJECT # 95-12-01 SHEET 3 OF 3

951201



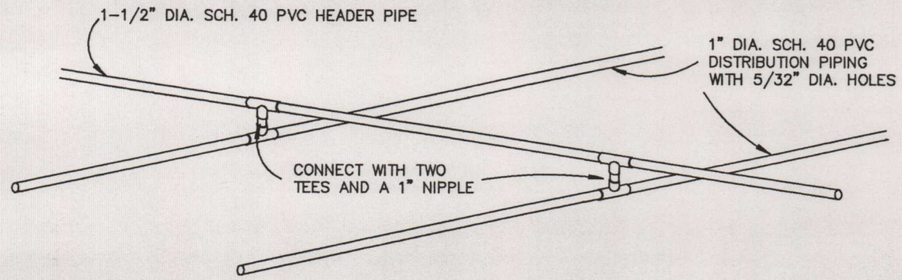
SOIL SUBSTITUTION BED SECTION

NO SCALE



SOIL SUBSTITUTION BED DETAIL

NO SCALE



TYPICAL PIPING CONNECTION IN BEDS

NO SCALE

THE REQUIRED BED AREA, AS DEFINED BY THE AREA COVERED BY THE GRAVEL LAYER, SHALL BE AT LEAST 800 SQ. FT.

THE ENGINEER RESERVES THE RIGHT TO ALTER THE BED DIMENSIONS TO BETTER FIT THE TERRAIN OR TO REDUCE TREE LOSS.

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER
12/4/98

EXPANSION OF AN EXISTING
PRIVATE SEWAGE FACILITY ON
LOT 3, BLOCK "B", LONG CANYON,
PHASE 1-B IN TRAVIS COUNTY, TEXAS
8511 HORSESHOE LEDGE, AUSTIN, TEXAS
OWNER: THE ROY G. SHULTS REVOCABLE TRUST,
JOHN F. RODGERS, TRUSTEE,
GRETCHEN S. RICHARDS, ATTORNEY IN FACT

REVISED 11/01/98 TO SHOW AS-BUILT BED DIMENSIONS. BY R.L.M.

REVISED 8/10/98 IN RESPONSE TO ATCHD LETTER OF 8/3/98 BY R.L.M.

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DESIGNED BY RLM DATE 5/30/98
PROJECT # 98-03-03 SHEET 3 OF 3

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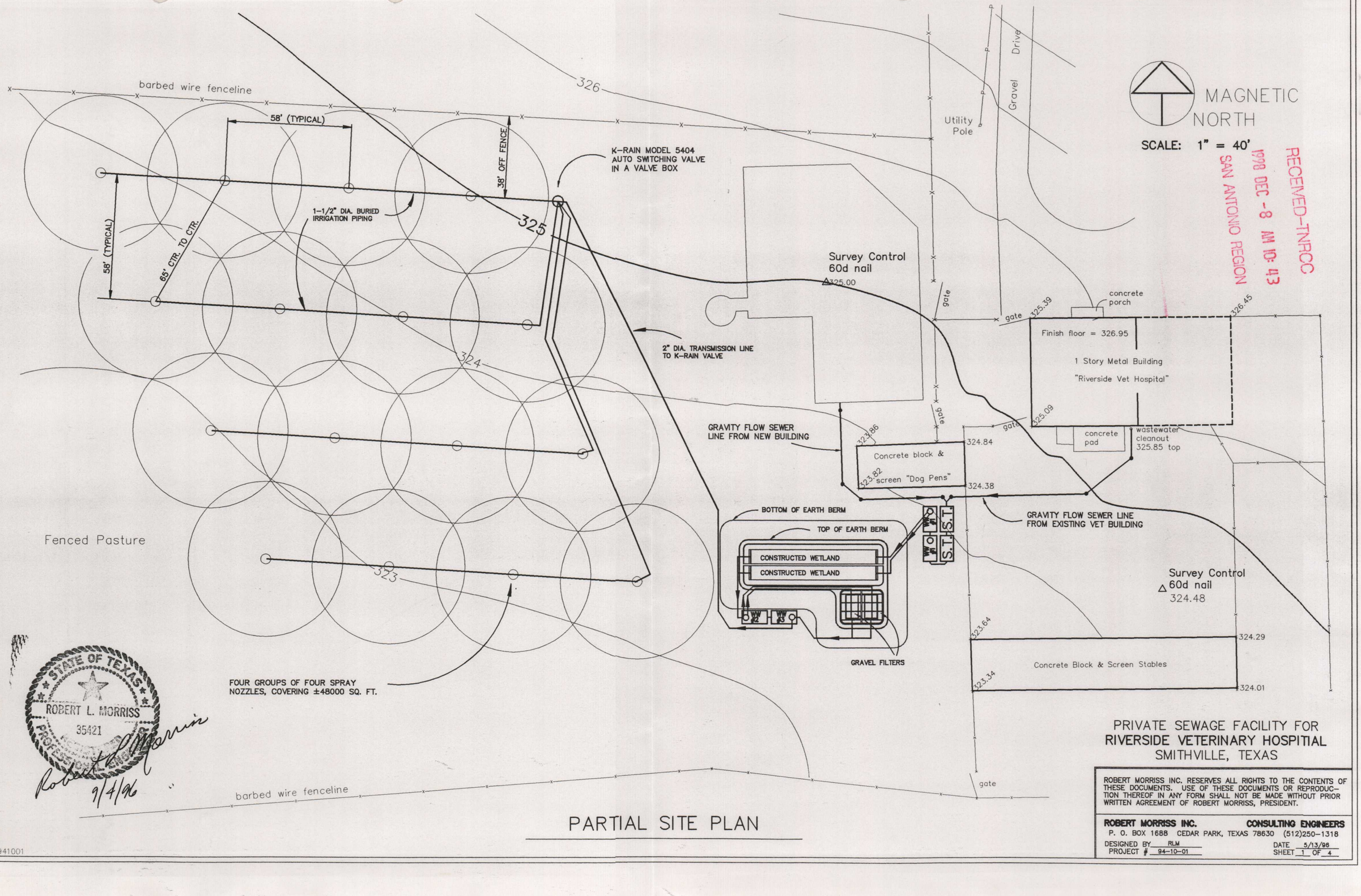

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STATE OF TEXAS
ROBERT L. MORRISS
35421
PROFESSIONAL ENGINEER

Robert L. Morriss
9/4/96

PARTIAL SITE PLAN

PRIVATE SEWAGE FACILITY FOR
RIVERSIDE VETERINARY HOSPITIAL
SMITHVILLE, TEXAS

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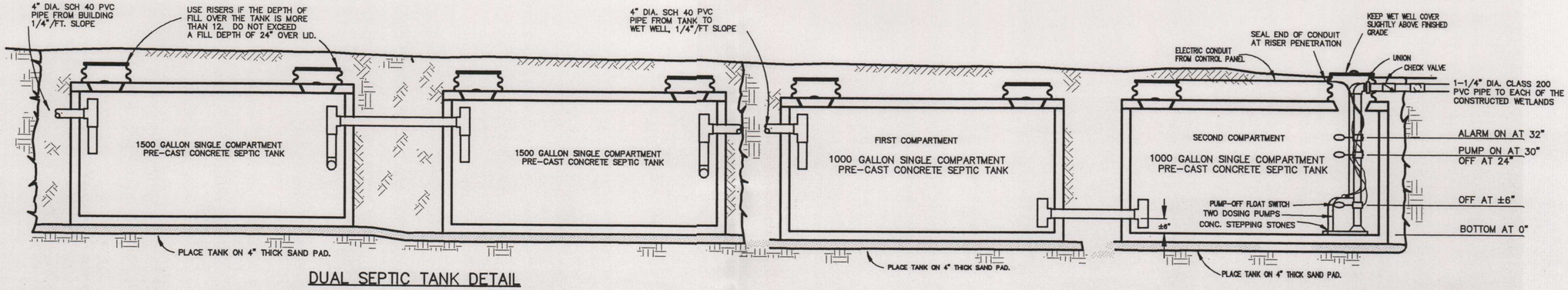
DESIGNED BY RLM DATE 5/13/96
PROJECT # 94-10-01 SHEET 1 OF 4

941001

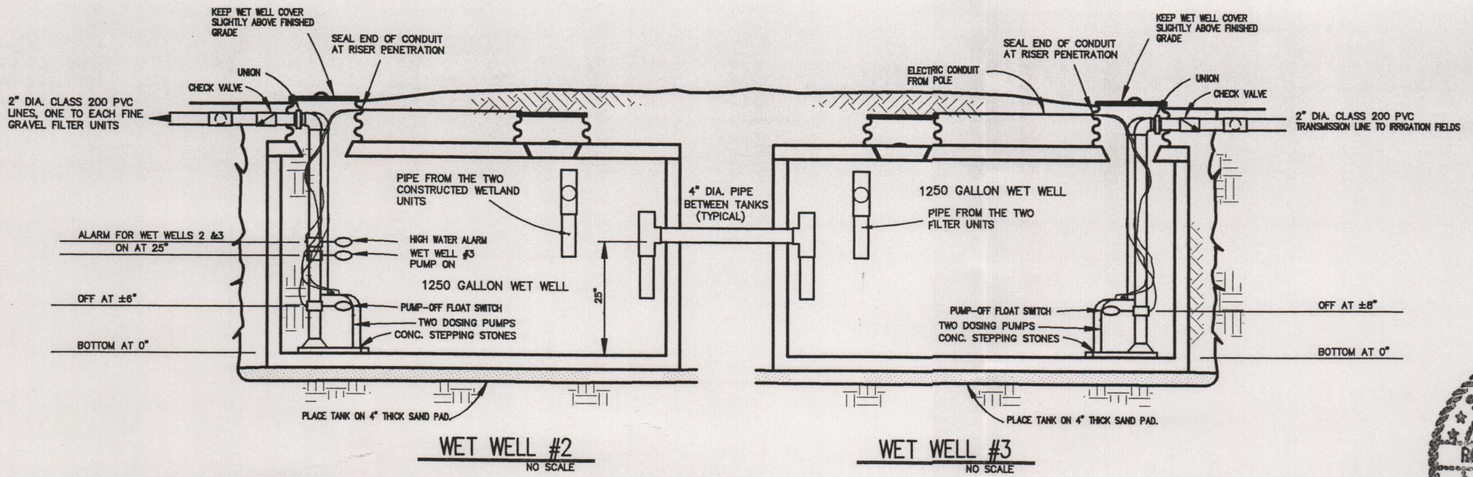


DUAL SEPTIC TANK DETAIL

TANKS ARE TO BE FROM HILL COUNTRY CONCRETE PRODUCTS, KYLE, TEXAS OR AN APPROVED EQUAL

WET WELL #1

NO SCALE



WET WELL #2

NO SCALE

WET WELL #3

NO SCALE

PUMP AND CONTROL NOTES:

ALL PUMPS AND CONTROLS ARE TO BE FURNISHED BY ONE SUPPLIER TO INSURE COMPONENT COMPATIBILITY.
WET WELL #1 PUMPS ARE TO BE THE COVERT MODEL SSP-26 PUMPS WITH A TIMER CONTROL AND AN ALTERNATOR. THE TIMER SHALL ALLOW A VARIABLE PUMP RUN TIME AND A PUMP START INTERVAL OF 30 MINUTES.
WET WELL #2 PUMPS ARE TO BE THE PEABODY BARNES MODEL SE411 PUMPS WITH A TIMER CONTROL AND AN ALTERNATOR. THE TIMER SHALL ALLOW A VARIABLE PUMP RUN TIME AND A PUMP INTERVAL OF30 MINUTES.
WET WELL #3 PUMPS ARE TO BE THE BARNES PUMPS, INC. MODEL STEP 1022L, CONTROLLED BY A PAIR OF FLOAT SWITCHES AND AN ALTERNATOR.

THE CHEMICAL FEED PUMP AND SOLUTION TANK UNIT SHALL BE THE W. W. GRAINGERS SOLUTION PUMP SYSTEM NO. 7P076, WITH THE NO. 2P300 METERING PUMP.

THERE SHALL BE AN ALARM SYSTEM THAT WILL OPERATE AN AUDIO AND VISUAL ALARM IN THE EVENT OF ANY PUMP FAILURE OR IN THE EVENT OF A HIGH WATER CONDITION IN WET WELL #1 OR WET WELL #2. THE ALARM UNIT SHALL BE MOUNTED IN THE NEW BUILDING IN A LOCATION THAT IS VISIBLE AND FREQUENTLY OCCUPIED.

STATE OF TEXAS
ROBERT L. MORRISS
PROFESSIONAL ENGINEER
Robert L. Morriss 9/17/96

REVISED TO ADD ALARM FEATURE TO WET WELL #1 AND #2 PER TCEQ REQUEST DATED 7/17/96 BY E.A.K.

PRIVATE SEWAGE FACILITY FOR RIVERSIDE VETERINARY HOSPITIAL SMITHVILLE, TEXAS

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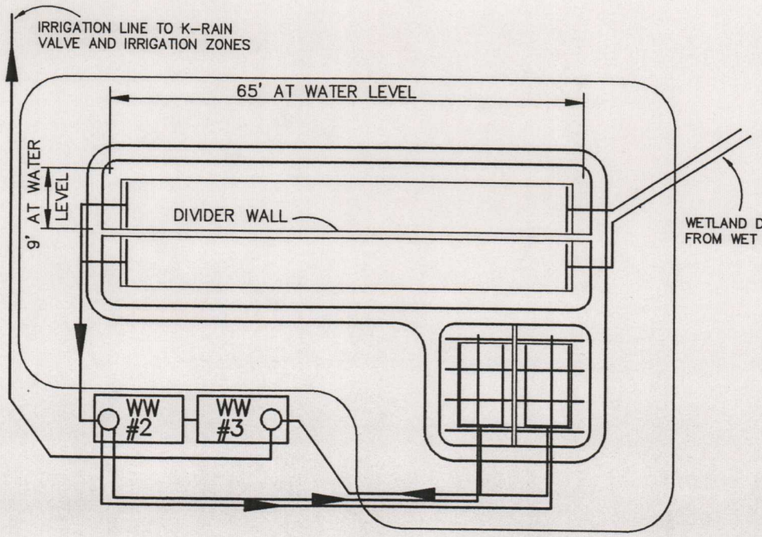
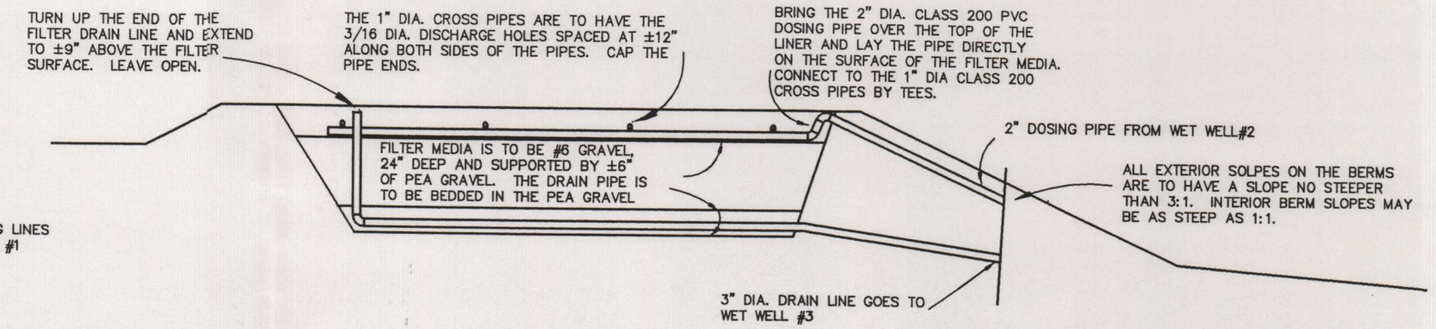
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)250-1318

DESIGNED BY RLM DATE 5/13/96
PROJECT # 94-10-01 SHEET 2 OF 4

941001



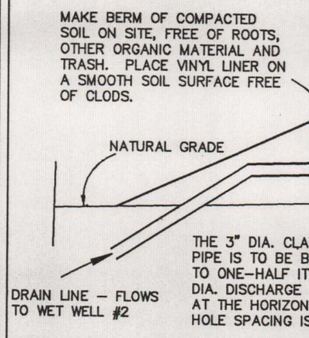


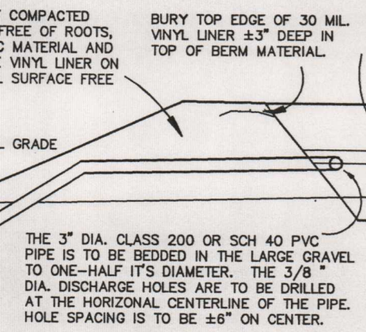
LONGITUDINAL SECTION OF RECIRCULATING GRAVEL FILTER

NO SCALE

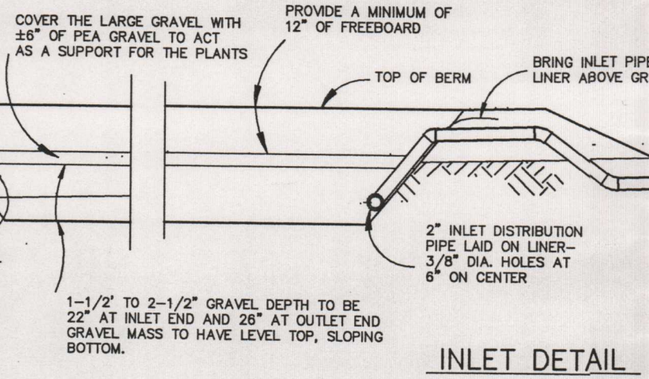
THE FILTERS ARE TO BUILT WITHIN A 30 MIL VINYL MEMBRANE SUPPORTED BY A COMPACTED EARTH BERM. THE BERM IS TO BE HIGH ENOUGH TO ALLOW THE FILTER TO DRAIN FROM THE BOTTOM BACK INTO WET WELL #3, WITH WET WELL #3 BEING NO DEEPER THAN 12" TO THE TANK TOP. THE DOSING PIPE SHALL ENTER THE FILTER OVER THE TOP OF THE LINER. THE DRAIN LINE PENETRATION OF THE LINER SHALL BE REINFORCED WITH A VINYL "BOOT" FABRICATED BY THE LINER SUPPLIER AND INSTALLED BY THE CONTRACTOR.

FILTER SIZING:
EACH GRAVEL FILTER IS TO BE 8' WIDE, 14' LONG, AS MEASURED AT THE TOP OF THE MEDIA. THE CONTAINING BERM SHALL PROVIDE AT LEAST 12" OF FREEBOARD ABOVE THE LEVEL OF THE MEDIA SURFACE.





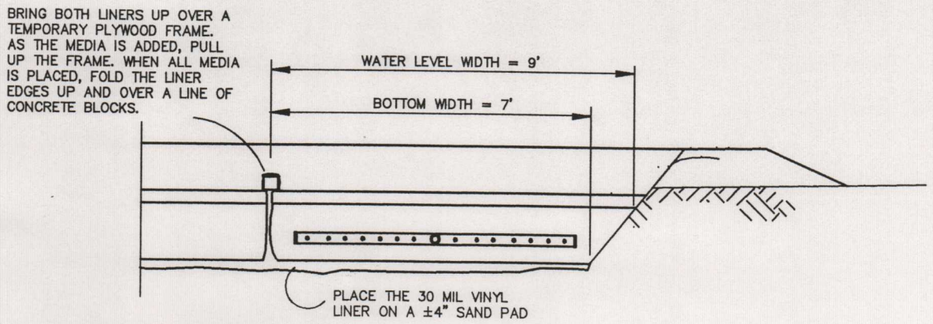
OUTLET DETAIL



INLET DETAIL

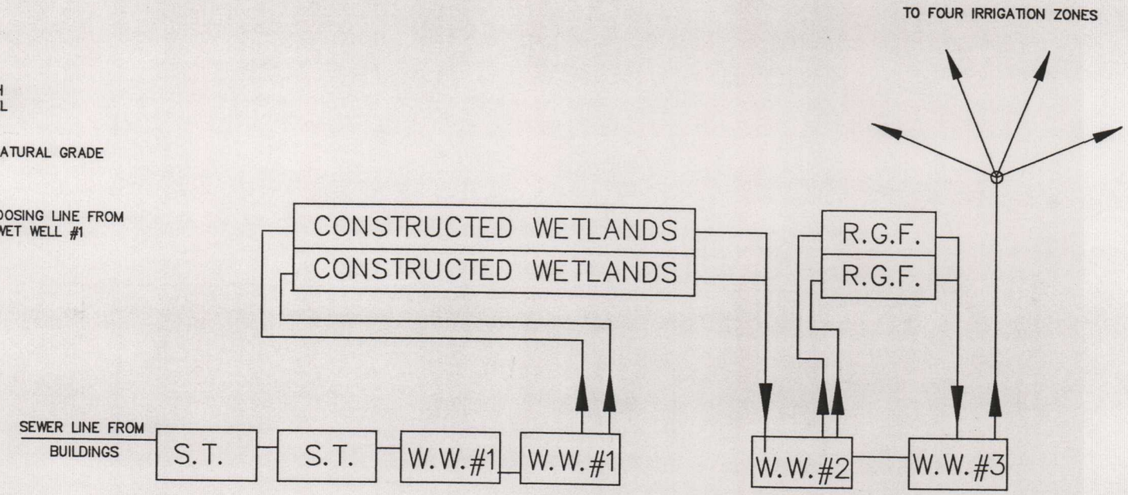
LONGITUDINAL SECTION OF CONSTRUCTED WETLANDS

NO SCALE

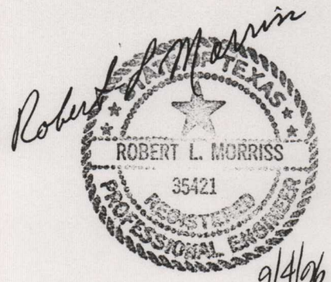


PARTIAL SECTION ACROSS CONSTRUCTED WETLANDS

NO SCALE



FLOW SCHEMATIC



PRIVATE SEWAGE FACILITY FOR
RIVERSIDE VETERINARY HOSPITIAL
SMITHVILLE, TEXAS

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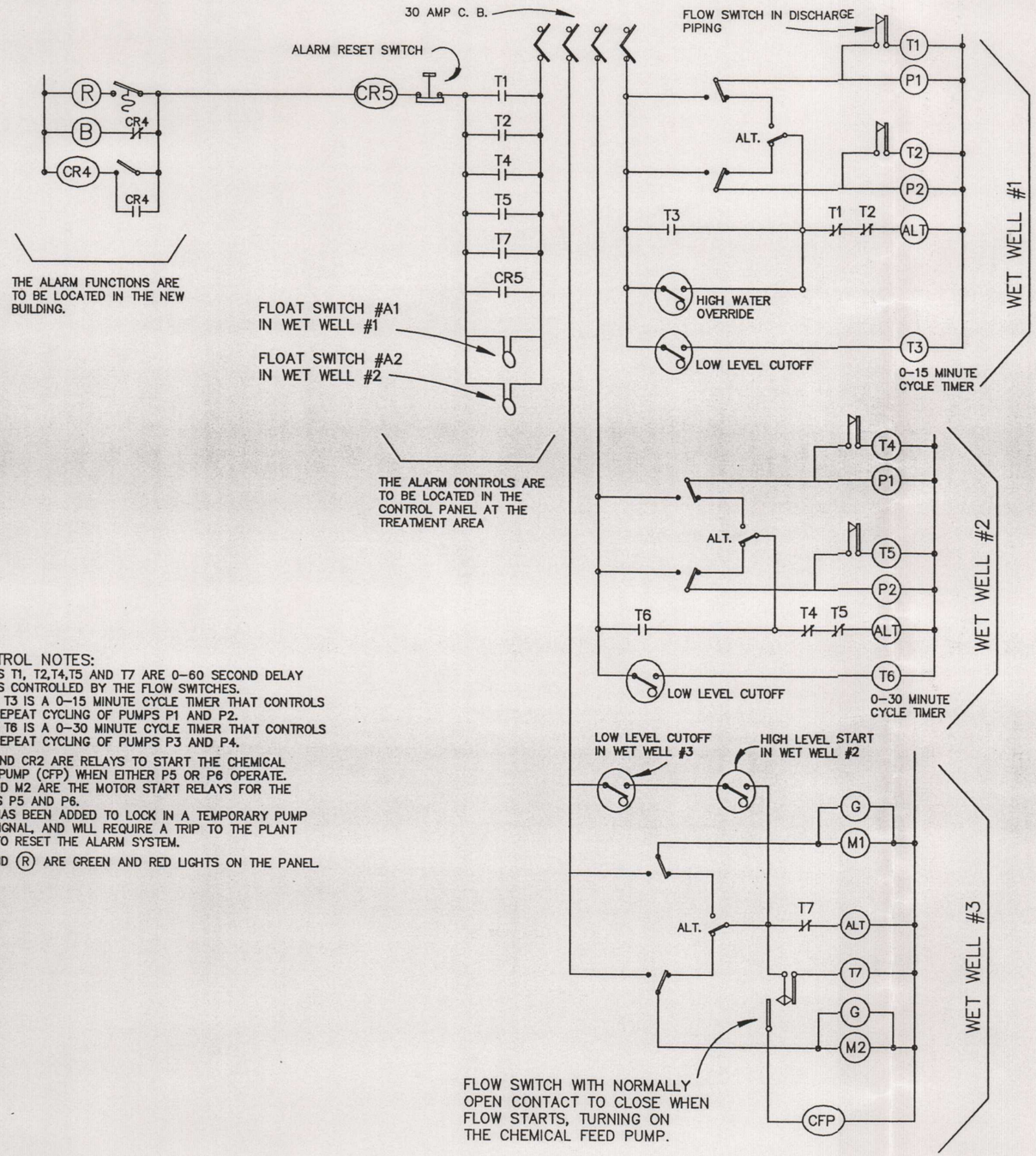
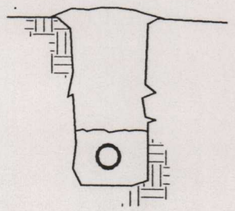
DESIGNED BY RLM
PROJECT # 94-10-01
DATE 5/13/98
SHEET 3 OF 4

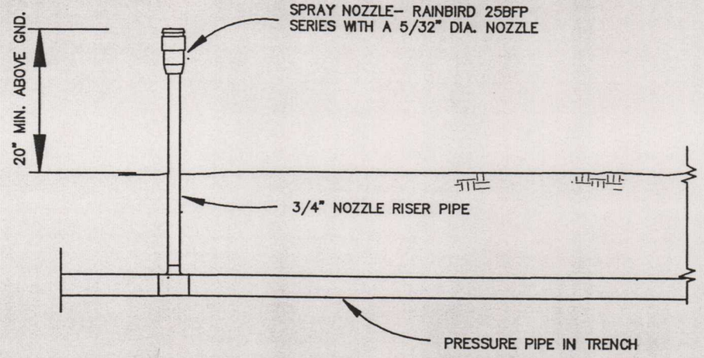
941001





EMBED PIPE ON ±3" OF SAND OR SANDY LOAM AND COVER WITH ±3" OF THE SAME MATERIAL. BACKFILL REMAINDER OF TRENCH WITH THE EXCAVATED MATERIAL, FREE OF STONES AND ORGANIC DEBRIS. COMPACT BACKFILL IN 8" LIFTS AND LEAVE A MOUND OVER TRENCH FOR SETTLING.
WHERE CROSSING DRIVES, ENCLOSE ANY PRESSURE PIPE IN A SCH. 40 PVC PIPE 2" LARGER THAN THE PRESSURE PIPE.

PIPE EMBEDMENT DETAIL
NO SCALE



CONTROL NOTES:
TIMERS T1, T2,T4,T5 AND T7 ARE 0-60 SECOND DELAY TIMERS CONTROLLED BY THE FLOW SWITCHES.
TIMER T3 IS A 0-15 MINUTE CYCLE TIMER THAT CONTROLS THE REPEAT CYCLING OF PUMPS P1 AND P2.
TIMER T6 IS A 0-30 MINUTE CYCLE TIMER THAT CONTROLS THE REPEAT CYCLING OF PUMPS P3 AND P4.

CR1 AND CR2 ARE RELAYS TO START THE CHEMICAL FEED PUMP (CFP) WHEN EITHER P5 OR P6 OPERATE.
M1 AND M2 ARE THE MOTOR START RELAYS FOR THE PUMPS P5 AND P6.
CR5 HAS BEEN ADDED TO LOCK IN A TEMPORARY PUMP OFF SIGNAL, AND WILL REQUIRE A TRIP TO THE PLANT SITE TO RESET THE ALARM SYSTEM.

(G) AND (R) ARE GREEN AND RED LIGHTS ON THE PANEL.

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER

Robert L. Morriss
9/17/96

PRIVATE SEWAGE FACILITY FOR
RIVERSIDE VETERINARY HOSPITIAL
SMITHVILLE, TEXAS

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P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)250-1318

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PROJECT # 94-10-01
DATE 5/13/96
SHEET 4 OF 4

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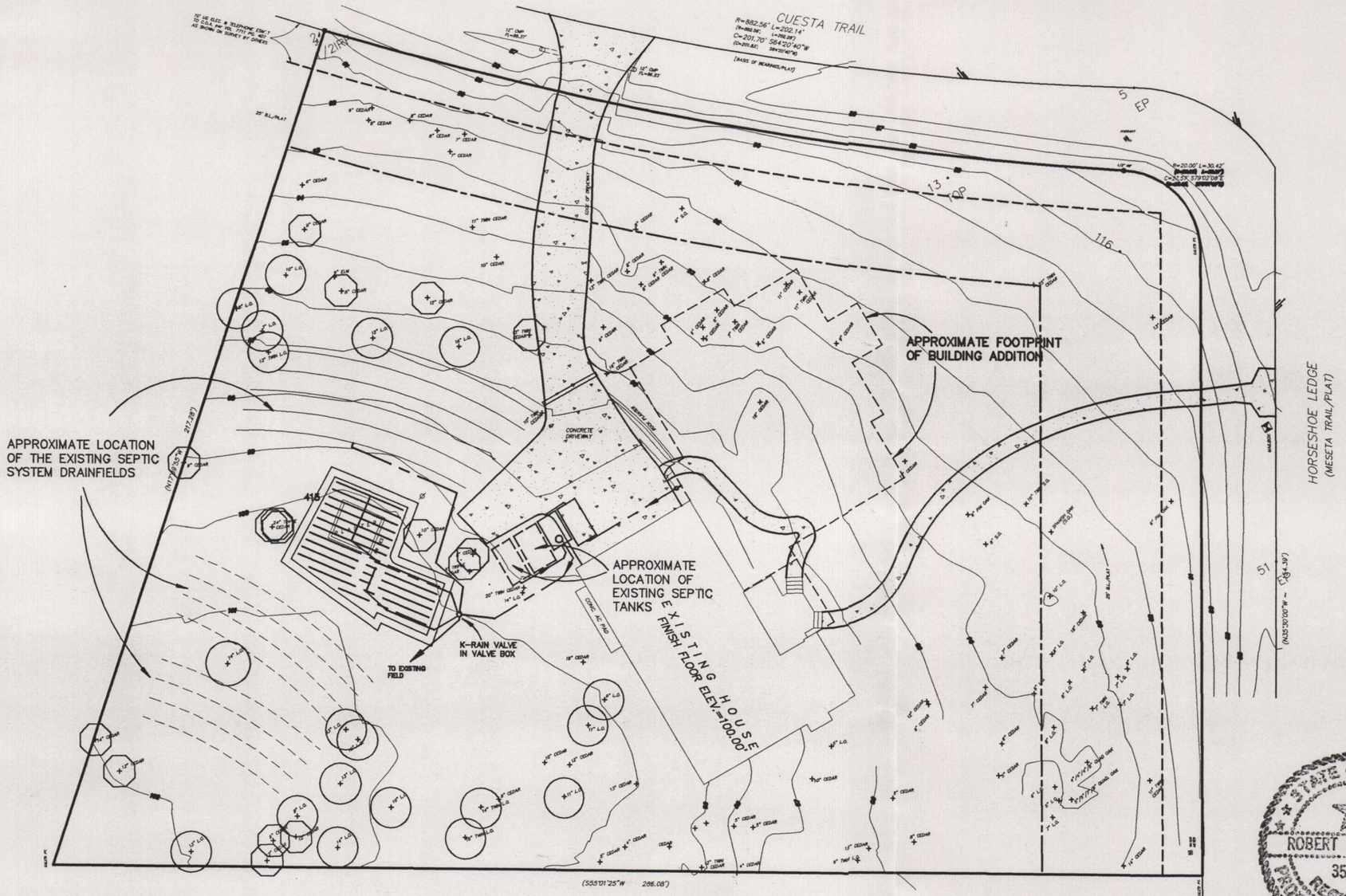
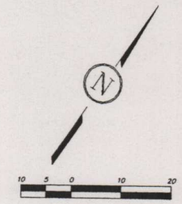
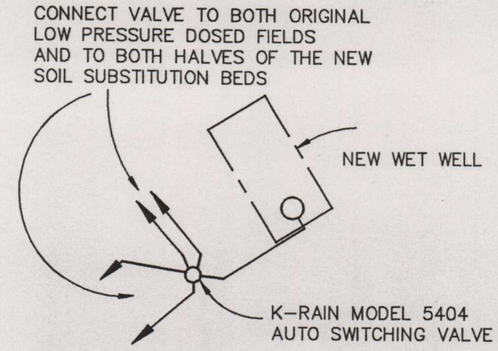




NOTE ON TOPOGRAPHIC INFORMATION

THE TOPOGRAPHIC INFORMATION, TREE LOCATION AND IMPROVEMENT LOCATIONS WAS MAPPED BY LENZ AND ASSOCIATES, SURVEYORS, FOR THE OWNER AND PROVIDED TO THE ENGINEER BY THE OWNER.



SWITCHING VALVE DETAIL

NO SCALE

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER
12/4/98

NOTE ON TANK LOCATION REVISION:
THE TANKS HAVE BEEN RELOCATED DUE TO THE SEWER LINE FROM THE HOUSE NOT BEING INSTALLED AS ORIGINALLY PLANNED. THE LOCATION UNDER THE DRIVEWAY WILL REQUIRE CAST IRON MANHOLE RINGS AND COVERS TO BE CAST INTO THE NEW CONCRETE DRIVEWAY TO PROVIDE ACCESS INTO THE TANK UNITS. THIS RELOCATION WILL ALSO ALLOW THE RETENTION OF SEVERAL TREES.

EXPANSION OF AN EXISTING
PRIVATE SEWAGE FACILITY ON
LOT 3, BLOCK "B", LONG CANYON,
PHASE 1-B IN TRAVIS COUNTY, TEXAS
8511 HORSESHOE LEDGE, AUSTIN, TEXAS
OWNER: THE ROY G. SHULTS REVOCABLE TRUST,
JOHN F. RODGERS, TRUSTEE,
GRETCHEN S. RICHARDS, ATTORNEY IN FACT

REVISED 11/20/98 TO SHOW AS-BUILT LOCATION AND EXTENT OF NEW BED. BY R.L.M.
REVISED 12/4/98 TO RELOCATE THE TANKS AND REVISE THE NEW ABSORPTION BED. BY R.L.M.

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DESIGNED BY RLM
PROJECT # 98-03-03
DATE 5/30/98
SHEET 1 OF 3

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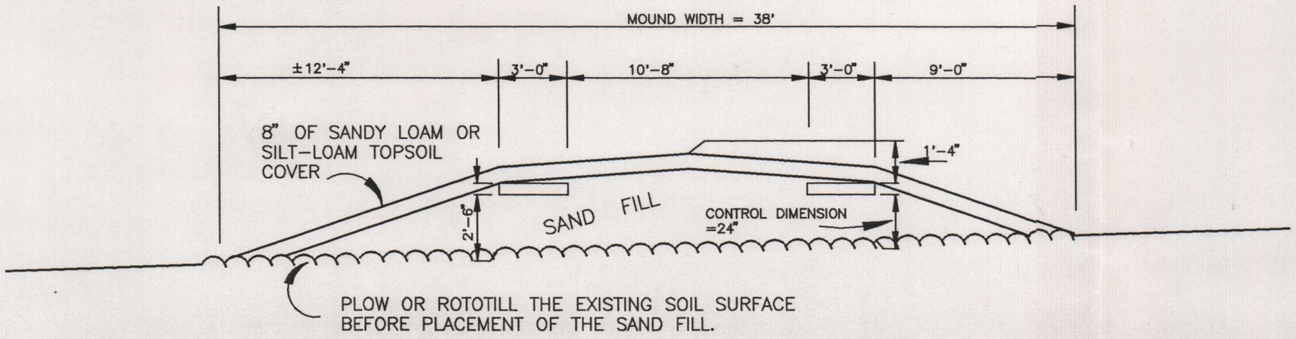
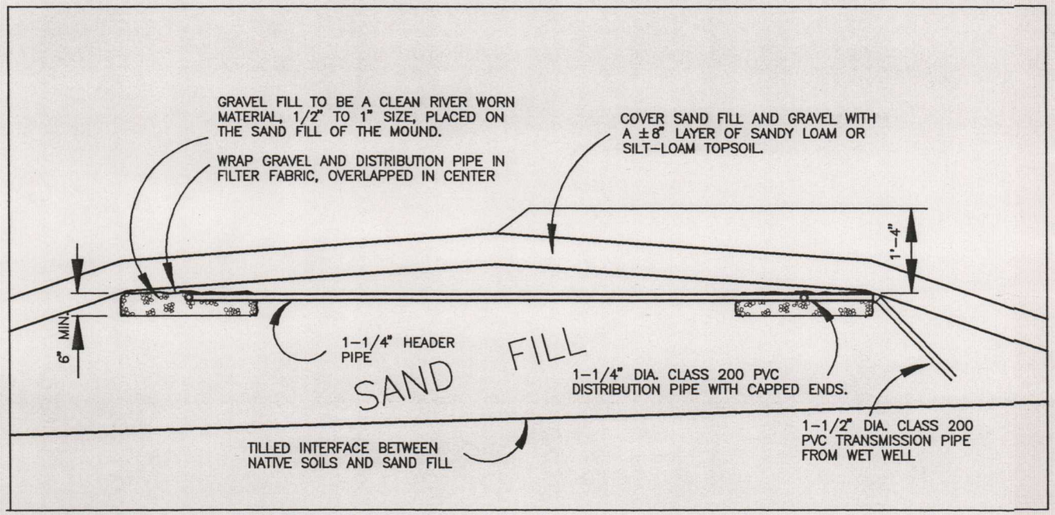


MOUND CONSTRUCTION NOTES

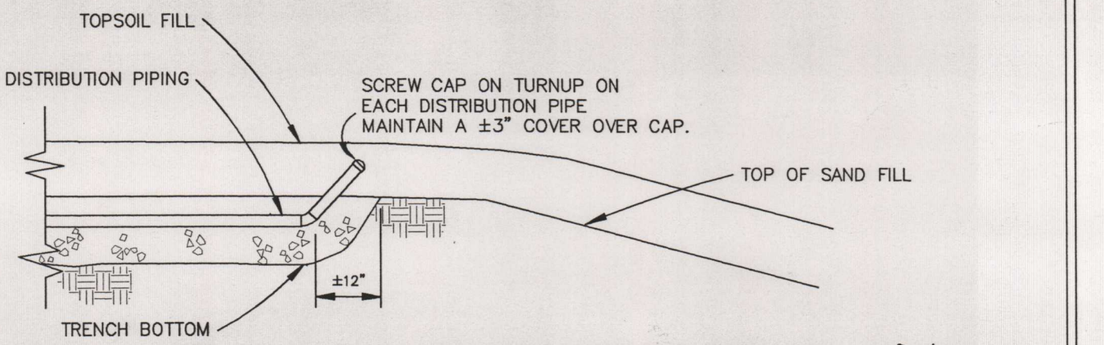
THE ENTIRE AREA TO BE COVERED BY THE MOUND IS TO BE CLEANED OF TRASH AND DEBRIS AND THEN ROTOTILLED OR PLOWED TO A DEPTH OF ±4". THIS TILLED SURFACE IS TO BE PROTECTED FROM VEHICLE TRAFFIC AND OTHER ACTIVITY THAT WOULD COMPACT THE TILLED SURFACE.
THE SAND FILL IS TO BE PLACED OVER THE TILLED SURFACE WITHOUT ANY WHEELED VEHICLES GETTING ON THE TILLED SURFACE. TRACKED EARTH MOVERS MAY BE USED IN THE MOUND AREA IF A 12" CUSHION OF SAND IS MAINTAINED UNDER THE TRACKED VEHICLES.
WITH THE SAND FILL IN PLACE, EXCAVATE THE TRENCHES, KEEPING THE TRENCH BOTTOMS LEVEL WITHIN 1" PER 25' AND 4" OVERALL.
PLACE THE FILTER FABRIC WRAP ON EACH SIDE OF THE TRENCH AND PLACE THE GRAVEL IN THE TRENCH TO PRODUCE A LEVEL TOP.
INSTALL THE DISTRIBUTION PIPING AND HEADER, COVER THE PIPE AND GRAVEL WITH THE FILTER FABRIC, AND PLACE THE TOPSOIL COVER OVER THE ENTIRE MOUND. ONLY TRACKED EQUIPMENT CAN BE USED.
SEED THE SMOOTHED SURFACE WITH BERMUDA GRASS SEED AT THE RATE OF 100 LBS. PER ACRE AND RAKE IN. IT SHALL BE THE CONTRACTORS RESPONSIBILTY TO WATER THE SEED UNTIL THE GRASS IS ±1" HIGH.



DETAIL OF GRAVEL TRENCH WITH PIPING

NO SCALE

NOTE ON DISTRIBUTION PIPING IN GRAVEL-FILLED TRENCHES:
THE TWO DISTRIBUTION PIPES ARE TO BE 1-1/4" DIA. CLASS 200 PVC PLASTIC PIPES WITH CAPPED ENDS AS SHOWN.
THE DISCHARGE HOLES ARE TO BE 5/32" DIA.,SPACED AT 27.5" ALONG THE BOTTOM OF THE PIPES. START WITH A HOLE WITHIN 3" OF THE PIPE END AND LAY OUT THE 29" SPACING UNTIL THE MIDDLE OF THE PIPE IS REACHED. REPEAT THIS PROCEDURE , STARTING AT THE OTHER END, TO LEAVE ONE ODD SPACE AT THE MIDDLE OF THE PIPE.



TRENCH END DETAIL

NO SCALE

MOUND MATERIAL SPECIFICATIONS

SAND - THE SAND FILL FOR THE MOUND SHALL BE A LOCALLY OBTAINED WASHED SAND INTENDED FOR USE IN MIXING CONCRETE. THE FINER SAND SOLD AS MORTAR SAND IS NOT ACCEPTABLE.
GRAVEL - THE GRAVEL IS TO BE A SMOOTH RIVER-WORN GRAVEL, SIZED 1/2"-1", AND FREE OF FINES AND TRASH.
TOPSOIL - THE TOPSOIL BLANKET PLACED OVER THE MOUND SHALL BE A SANDY LOAM OR SILT-LOAM MATERIAL, FREE OF CLAY CLODS, ROOTS AND TRASH.
ALL MATERIALS ARE TO BE APPROVED BY THE ENGINEER PRIOR TO PLACING IN THE MOUND. THE ENGINEER MAY APPROVE A REPRESENTATIVE SAMPLE OF A MATERIAL IF THE SOURCE CAN PROVIDE A SUFFICANT AND CONSISTANT QUANTITY.

Robert L Morriss

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER

5/29/97

PRIVATE SEWAGE FACILITY FOR
302 MEISTER LANE, PFLUGERVILLE, TEXAS
3.0 AC. OUT OF THE PETER CONRAD SURVEY NO.71
TRAVIS COUNTY, TEXAS
OWNER: ROBERT GIESEN

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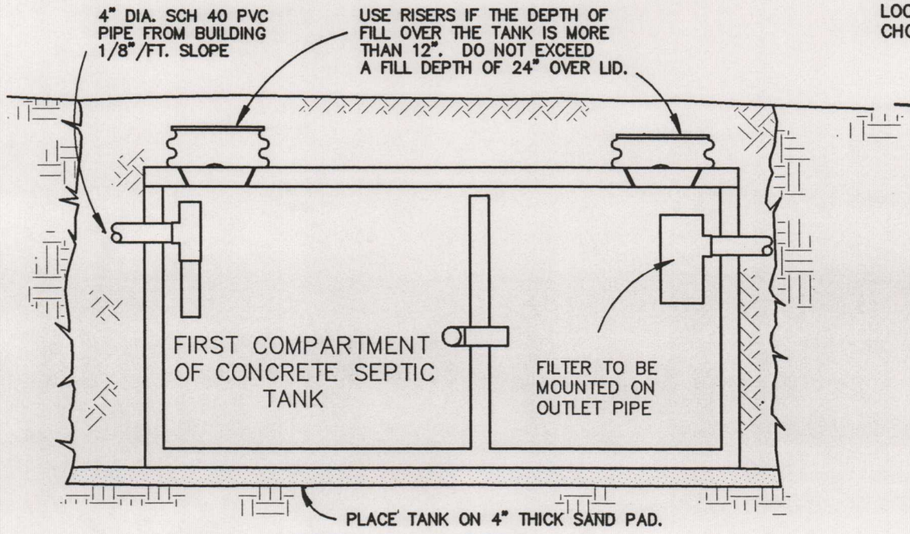
ROBERT MORRISS INC. **CONSULTING ENGINEERS**
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

DESIGNED BY RLM DATE 4/18/97
PROJECT # 97-03-02 SHEET 3 OF 3

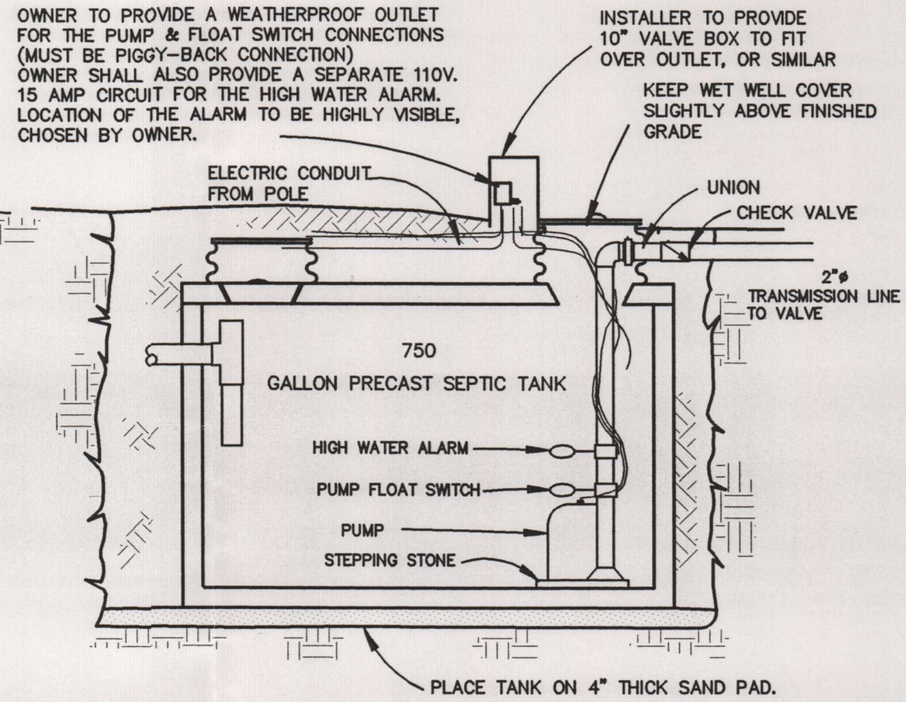
970302



SEPTIC TANK DETAIL

TANKS ARE TO BE FROM HILL COUNTRY CONCRETE PRODUCTS, KYLE, TEXAS OR AN APPROVED EQUAL

TANK TO BE A 1000 GALLON TWO COMPARTMENT UNIT
FILTER TO BE THE ZABEL MODEL A100 UNIT



WET WELL DETAIL

CONSTRUCTION NOTES:

1. THE CONTRACTOR IS TO DETERMINE, BY HAND DIGGING, THE LOCATION OF THE TWO TRENCHES CLOSEST TO THE PLANNED LOCATION OF THE SOIL SUBSTITUTION BEDS AND DO A TRIAL LAYOUT OF THE BEDS TO INSURE THAT THE BEDS CAN BE CONSTRUCTED AS PLANNED. THIS WORK IS TO BE DONE BEFORE THE TANKS ARE SET.
2. THE NEW SEPTIC TANK SHALL BE SET AT A DEPTH TO RECEIVE THE SEWER LINE FROM THE HOUSE EXPANSION, WITH THE SEWER LINE LAID AT A MINIMUM GRADE OF 1/8" PER FOOT.
3. THE WET WELL SHALL BE SET AT A DEPTH TO ALLOW GRAVITY FLOW FROM THE NEW SEPTIC TANK AND THE ORIGINAL WET WELL.
4. THE ORIGINAL WET WELL SHALL BE CONNECTED TO THE NEW WET WELL BY A 4" PIPE AT THE LEVEL OF THE ORIGINAL OUTLET OF THE ORIGINAL WET WELL TANK, AND THE OLD PUMP IS TO BE REMOVED FROM THE ORIGINAL WET WELL TO CONVERT THE WET WELL TO ANOTHER SEPTIC TANK COMPARTMENT.
5. THE INTENT OF 3 AND 4 ABOVE IS TO HAVE THE NEW WET WELL RECEIVE ALL THE WASTE WATER FLOW FROM THE ORIGINAL AND NEW SEPTIC TANKS AND DISTRIBUTE IT TO THE FOUR DISPOSAL AREAS, TWO ORIGINAL AND TWO NEW.
6. SET A NEW COVERT MODEL SSB-41 SUBMERSIBLE PUMP AND A S. J. ELECTRO SYSTEMS TWO FLOAT FLOAT SWITCH, MODEL 15DFD120VWP, SET FOR A PUMP DOWN RANGE OF 3". THE PUMP SHALL STOP WHEN THE WATER DEPTH DROPS TO 6" TO PREVENT THE PUMP RUNNING DRY.
7. INSTALL A NEW ALARM FLOAT SWITCH TO OPERATE AT A WATER LEVEL 2" HIGHER THAN THE PUMP ON LEVEL.

BED CONSTRUCTION NOTES:

1. BED EXCAVATION IS TO BE DONE WITHOUT DAMAGING THE EXISTING LOW PRESSURE DOSED DRAINFIELDS.
2. THE WASHED SAND FILL IS TO BE A WASHED CONCRETE SAND.
3. THE GRAVEL TO BE PLACED ON THE SAND IS TO BE CLEAN RIVER WORN GRAVEL, FREE OF SOIL, FINES AND TRASH.
4. THE DISTRIBUTION PIPING IS TO BE 1" DIA. SCH. 40 PVC PRESSURE PIPE WITH 5/32" DIA. HOLES SPACED AT 24" ALONG THE BOTTOM OF THE PIPE. LAY OUT THE HOLES AS FOLLOWS: DRILL A HOLE AT ±3" FROM THE ONE END OF THE PIPE, THEN LAY OUT THE 24" SPACING UNTIL THE APPROXIMATE MIDDLE OF THE PIPE LENGTH IS REACHED. GO TO THE OTHER END OF THE PIPE, DRILL A HOLE ±3" FROM THE PIPE END AND LAY OUT THE 24" SPACING FROM THIS HOLE UNTIL THE MIDDLE OF THE PIPE IS AGAIN REACHED. THIS WILL RESULT IN ONE ODD SPACE BETWEEN HOLES NEAR THE MIDDLE OF EACH PIPE. CAP ALL PIPE ENDS WITH SCREW FITTINGS.
5. THE FILTER FABRIC USED TO COVER THE PIPE AND GRAVEL CAN BE ANY AGENCY APPROVED MATERIAL. ALL EDGES ARE TO BE OVERLAPPED AT LEAST 4" AND THE MATERIAL SHALL EXTEND AT LEAST 6" BEYOND THE GRAVEL LAYER.
6. THE SANDY LOAM OR SILT LOAM TOPSOIL TO BE PLACED OVER THE BED IS TO BE CLEAN MATERIAL, FREE OF TRASH, ROOTS AND CLAY CLODS OVER 2" DIA. THE SOIL IS TO BE RAKED SMOOTH, THE SEED SPREAD ON THE SURFACE, AND THE SURFACE AGAIN RAKED TO COVER THE SEED.

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER

Robert L Morriss 8/10/98

EXPANSION OF AN EXISTING
PRIVATE SEWAGE FACILITY ON
LOT 3, BLOCK "B", LONG CANYON,
PHASE 1-B IN TRAVIS COUNTY, TEXAS
8511 HORSESHOE LEDGE, AUSTIN, TEXAS
OWNER: THE ROY G. SHULTS REVOCABLE TRUST,
JOHN F. RODGERS, TRUSTEE,
GRETCHEN S. RICHARDS, ATTORNEY IN FACT

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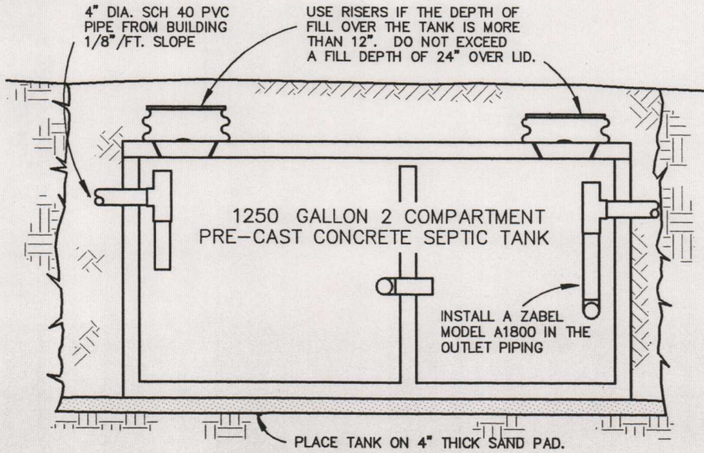
ROBERT MORRISS INC. CONSULTING ENGINEERS
P. O. BOX 1688 CEDAR PARK, TEXAS 78630 (512)267-0688

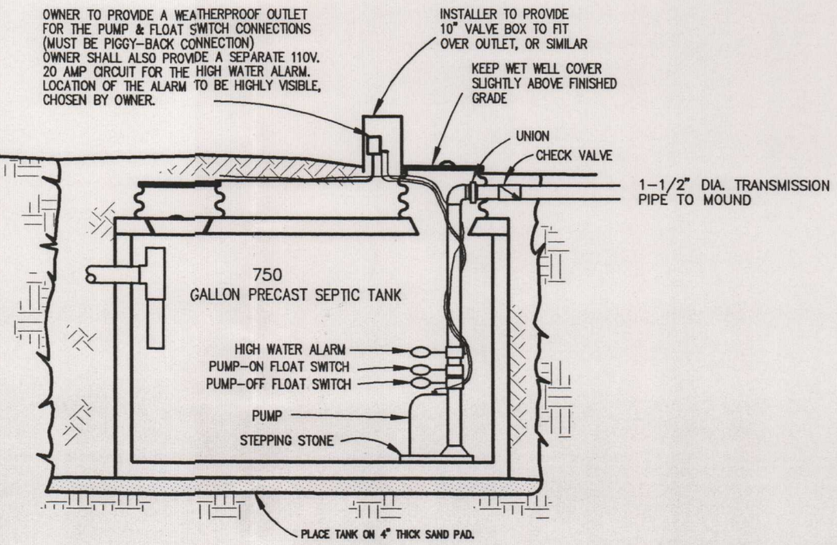
DESIGNED BY RLM DATE 5/30/98
PROJECT # 98-03-03 SHEET 2 OF 3

980303A



SEPTIC TANK DETAIL

TANKS ARE TO BE FROM HILL COUNTRY CONCRETE PRODUCTS, KYLE, TEXAS OR AN APPROVED EQUAL



WET WELL DETAIL

WET WELL PUMP — COVERT SUBMERSIBLE PUMP MODEL SSP-26 WITH THE S. J. ELECTRO SYSTEMS MODEL 15DFD120VWP FLOAT SWITCH UNIT, ASSEMBLED TO PROVIDE A PUMP DOWN RANGE OF 6". PUMP TO STOP AT A WATER DEPTH OF ±4" TO AVOID RUNNING DRY.

ALARM — A PEABODY BARNES NO. 61487 HIGH WATER ALARM, MERCURY LEVEL FLOAT SWITCH SHALL BE MOUNTED TO OPERATE AT ±2" ABOVE THE "PUMP ON" LEVEL IN THE WET WELL. THE ALARM UNIT SHALL BE MOUNTED IN THE HOME IN A VISIBLE LOCATION SELECTED BY THE OWNER.

ELECTRICAL — OWNER TO PROVIDE A WEATHERPROOF OUTLET FOR THE PUMP & FLOAT SWITCH CONNECTIONS (MUST BE PIGGY-BACK CONNECTION). OWNER SHALL ALSO PROVIDE A SEPARATE 110V. CIRCUIT FOR THE HIGH WATER ALARM. LOCATION OF THE ALARM TO BE HIGHLY VISIBLE, CHOSEN BY OWNER. CIRCUITS ARE TO BE 20 AMP CIRCUITS.

Robert L Morriss

STATE OF TEXAS
ROBERT L. MORRISS
35421
REGISTERED PROFESSIONAL ENGINEER

5/29/97

PRIVATE SEWAGE FACILITY FOR
302 MEISTER LANE, PFLUGERVILLE, TEXAS
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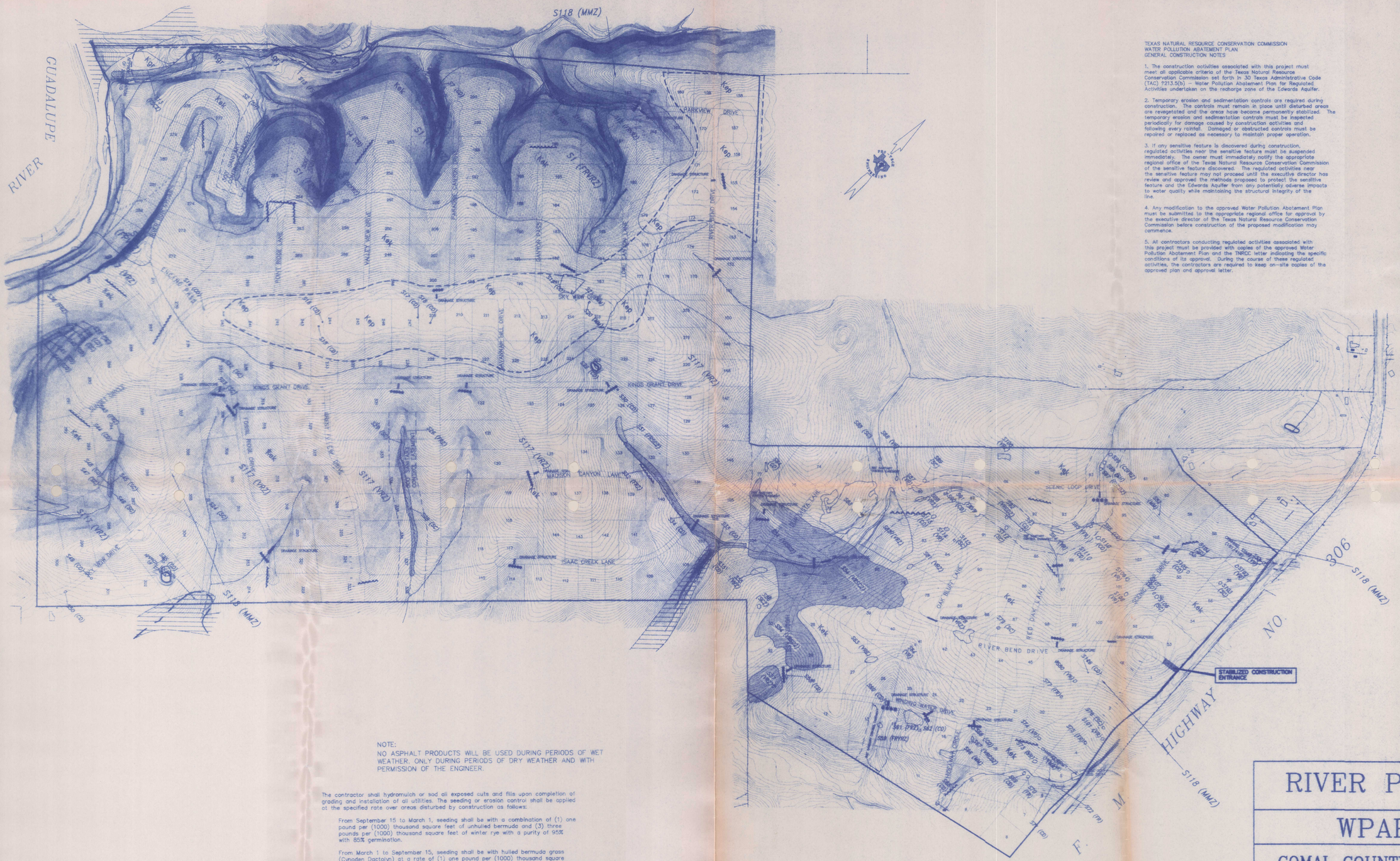
DESIGNED BY RLM DATE 4/18/97
PROJECT # 97-03-02 SHEET 2 OF 3

970302



TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN
GENERAL CONSTRUCTION NOTES

1. The construction activities associated with this project must meet all applicable criteria of the Texas Natural Resource Conservation Commission set forth in 30 Texas Administrative Code (TAC) ?213.5(b) – Water Pollution Abatement Plan for Regulated Activities undertaken on the recharge zone of the Edwards Aquifer.

2. Temporary erosion and sedimentation controls are required during construction. The controls must remain in place until disturbed areas are revegetated and the areas have become permanently stabilized. The temporary erosion and sedimentation controls must be inspected periodically for damage caused by construction activities and following every rainfall. Damaged or obstructed controls must be repaired or replaced as necessary to maintain proper operation.

3. If any sensitive feature is discovered during construction, regulated activities near the sensitive feature must be suspended immediately. The owner must immediately notify the appropriate regional office of the Texas Natural Resource Conservation Commission of the sensitive feature discovered. The regulated activities near the sensitive feature may not proceed until the executive director has review and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentially adverse impacts to water quality while maintaining the structural integrity of the line.

4. Any modification to the approved Water Pollution Abatement Plan must be submitted to the appropriate regional office for approval by the executive director of the Texas Natural Resource Conservation Commission before construction of the proposed modification may commence.

5. All contractors conducting regulated activities associated with this project must be provided with copies of the approved Water Pollution Abatement Plan and the TNRCC letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractors are required to keep on-site copies of the approved plan and approval letter.

NOTE:
NO ASPHALT PRODUCTS WILL BE USED DURING PERIODS OF WET WEATHER, ONLY DURING PERIODS OF DRY WEATHER AND WITH PERMISSION OF THE ENGINEER.

The contractor shall hydromulch or sod all exposed cuts and fills upon completion of grading and installation of all utilities. The seeding or erosion control shall be applied at the specified rate over areas disturbed by construction as follows:

From September 15 to March 1, seeding shall be with a combination of (1) one pound per (1000) thousand square feet of unhulled bermuda and (3) three pounds per (1000) thousand square feet of winter rye with a purity of 95% with 85% germination.

From March 1 to September 15, seeding shall be with hulled bermuda grass (Cynoden Dactolyn) at a rate of (1) one pound per (1000) thousand square feet with a purity of 95% with 85% germination.

Fertilizer shall have an analysis of 15–10–5 and shall be applied at the rate of 600 pounds per acre. Mulch type to be Conwed, applied at a rate of 2100 pounds per acre. Restoration shall be acceptable when the grass has reached a height of at least 1–1/2" (95%) coverage and no bare spots larger than 16 square feet exist.

The seeded or planted area is to be irrigated or sprinkled in a manner which will not erode the topsoil but will sufficiently soak the soil to a depth of 6 inches. The irrigation shall occur at seven day intervals for the first two months. Rainfall occurrences of at least 1 inch shall postpone the watering operation for one week.

LEGEND

— DRAINAGE STRUCTURE

●●●●● ROCK BERM

^^^^^ SILT FENCE

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1998 DEC -8 AM 10:42
SAN ANTONIO REGION

RIVER POINT

WPAP

COMAL COUNTY, TEXAS

PRO-TECH
ENGINEERING GROUP
INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

STATE OF TEXAS
KELLY KELLY
PROFESSIONAL ENGINEER
11-17-98

E.O. 14625	SCALE 1"=500'	DATE NOVEMBER 1998
		SHEET 1 OF 2

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

512 / 353-3335
FAX 512 / 396-0224

PRO-TECH
ENGINEERING
GROUP
INCORPORATED

March 23, 2006

Texas Commission on Environmental Quality
Region 13 – San Antonio
14250 Judson Road
San Antonio, TX 78233-4480

Attn: John Mauser

Re: River Chase, Units 5, 6, 7 & 8
Comal County, Texas
Edwards Aquifer Protection Plan File No. 1777.00

Mr. Mauser:

For your information and records Unit Nine and Unit Ten of River Chase, are part of the original Unit Eight as permitted. We made the units smaller than originally planned.

Thank you for your assistance and if you have any questions, please call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC.

Richard McDaniel

EO#14677
XC Chris McMonagle
TCEQ 032306.doc

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ATTACHMENT D

400 Acres

S4	150' RADIUS OSSF SETBACK EASEMENT
S8	150' RADIUS OSSF SETBCK EASEMENT, FEATURE TO BE FILLED WITH COBBLES AND SEALED WITH CONCRETE
S13	150' RADIUS OSSF SETBACK EASEMENT
S17	150' RADIUS OSSF SETBACK EASEMENT, FEATURE TO BE FILLED WITH COBBLES
S18	150' RADIUS OSSF SETBACK EASEMENT
S21	150' RADIUS OSSF SETBACK EASEMENT
S22	150' RADIUS OSSF SETBACK EASEMENT
S23	150' RADIUS OSSF SETBACK EASEMENT
S24	150' RADIUS OSSF SETBACK EASEMENT
S25	150' RADIUS OSSF SETBACK EASEMENT
S26	150' RADIUS OSSF SETBACK EASEMENT
S27	150' RADIUS OSSF SETBACK EASEMENT
S29	150' RADIUS OSSF SETBACK EASEMENT
S30	150' RADIUS OSSF SETBACK EASEMENT
S31	150' RADIUS OSSF SETBACK EASEMENT
S32	150' RADIUS OSSF SETBACK EASEMENT
S34	150' RADIUS OSSF SETBACK EASEMENT
S37	150' RADIUS OSSF SETBACK EASEMENT
S38	150' RADIUS OSSF SETBACK EASEMENT

S14, S15, S19, S33, S35 AND S36, THESE FEATURES TO HAVE OSSF SETBACK EASEMENTS IN DRAINAGE INTERSECT.

1855 ACRES

S2	150' RADIUS OSSF SETBACK EASEMENT
S3	150' RADIUS OSSF SETBACK EASEMENT
S4	150' RADIUS OSSF SETBACK EASEMENT
S5	150' RADIUS OSSF SETBACK EASEMENT
S13	150' RADIUS OSSF SETBACK EASEMENT
S14	150' RADIUS OSSF SETBACK EASEMENT
S15	150' RADIUS OSSF SETBACK EASEMENT
S21	WATER WELL TO BE SEALED TO TNRCC SPECIFICATIONS.
S22	WATER WELL TO COMPLY WITH 30 TAC 238
S24	WATER WELL TO COMPLY WITH 30 TAC 238

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S27	150' RADIUS OSSF SETBACK EASEMENT
S28	150' WIDE OSSF SETBACK EASEMENT
S32	150' RADIUS OSSF SETBACK EASEMENT
S49	150' RADIUS OSSF SETBACK EASEMENT
S50	150' RADIUS OSSF SETBACK EASEMENT
S69	WATER WELL TO BE SEALED TO TNRCC SPECIFICATIONS
S91	WATER WELL IS NOT LOCATED ON THIS PROJECT
S99	WATER WELL IS NOT LOCATED ON THIS PROJECT
S105	150' RADIUS OSSF SETBACK EASEMENT
S108	150' RADIUS OSSF SETBACK EASEMENT
S109	150' RADIUS OSSF SETBACK EASEMENT
S110	150' RADIUS OSSF SETBACK EASEMENT
S111	150' RADIUS OSSF SETBACK EASEMENT
S113	150' RADIUS OSSF SETBACK EASEMENT
S116	150' RADIUS OSSF SETBACK EASEMENT
S117	150' RADIUS OSSF SETBACK EASEMENT
S118	150' RADIUS OSSF SETBACK EASEMENT
S121	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S122	150' RADIUS OSSF SETBACK EASEMENT
S123	150' RADIUS OSSF SETBACK EASEMENT
S124	150' RADIUS OSSF SETBACK EASEMENT
S125	150' RADIUS OSSF SETBACK EASEMENT
S128	150' RADIUS OSSF SETBACK EASEMENT
S131	150' RADIUS OSSF SETBACK EASEMENT
S132	150' RADIUS OSSF SETBACK EASEMENT
S133	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S134	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S136	150' RADIUS OSSF SETBACK EASEMENT

S6, S18, S19, S26, S29, S30, S33, S42, S43, S44, S48, S54, S86, S87, S104, S107 THESE FEATURES TO HAVE OSSF SETBACK EASEMENTS IN DRAINAGE INTERSECTS.

ALL OSSF EASEMENTS TO BE SHOWN ON PLAT

Horizon

Corporate Headquarters: Austin, TX

Offices: Beaumont, TX Houston, TX Karnes City, TX Pittsburg, TX San Antonio, TX Shreveport, LA Ann Arbor, MI Canton, MI

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FEB 21 2002
COUNTY ENGINEER

12 February 2002

Richard McDaniel
Pro-Tech Engineering Group
100 East San Antonio Street
San Marcos, Texas 78666
Via Fax: (512) 396-0224

RE: 1855- and 400-acre Pfeuffer Tracts (River Chase), Travis County, Texas
HJN 020014 GA

Dear Mr. McDaniel:

This report is meant to address features visited during January 2002 meetings with the Texas Natural Resource Conservation Commission (TNRCC) for the above-referenced subject site. Attached are the revised pages of the TNRCC Geologic Assessment Table. The "Relative Infiltration Rate" columns of Feature S-8 of the 400-acre tract and S-17 of the 1855-acre tract were revised based on the latest field evaluation. Each of the following features was reviewed in cooperation with the TNRCC.

The Edwards Aquifer Protection Plan (EAPP) and its associated documents, including the Water Pollution Abatement Plan, address best management practices (BMPs) and describe planned water pollution abatement strategies. Temporary and permanent BMPs should be used to control any runoff during and after the proposed activities and should be based on the TNRCC Guidelines for BMPs (TNRCC, 1999).

The results of this survey do not preclude the possibility of finding subsurface voids or abandoned test or water wells during the clearing or construction phases of the proposed project. If a subsurface void is encountered during any phase of the project, construction near the feature should be halted until the TNRCC (or appropriate agency) is contacted and a geologist can investigate the feature. The geologist will submit a Solution Feature Notification Form to the TNRCC. Edwards Rules also require that a geologist inspect completed excavation trenches for a sewage lift station or underground storage tank (UST) tankhold to determine if sensitive features are present.

Per 30 TAC § 285, each lot or tract of land on the Recharge Zone on which on-site sewage facilities (OSSFs) are to be located must have an area of at least 1 acre (43,560 square feet) per single-family dwelling. Additionally, the minimum separation distances should be maintained from significant recharge features found during the geologic assessment. No sewage treatment tank or holding tank should be located within 50 feet of a significant recharge feature. No soil absorption system should be located within 150 feet of a recharge feature.

HORIZON ENVIRONMENTAL SERVICES, INC.
P.O. Box 162017 • Austin, Texas 78716 • 2600 Dellana Lane, Suite 200 • Austin, Texas 78746
(512) 328-2430 • FAX (512) 328-1804 • http://www.horizon-esi.com

002/008 02/12/2002 TUE 15:17 FAX

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1855-acre Pfeuffer tract

S-3 Solution cavity (sinkhole). This feature has a closed depression diameter of ~10 feet, extends vertically a minimum of 4 feet, and is filled with loose cobbles and organic debris. The feature appears to extend vertically into the subsurface an unknown distance. This feature is located 30 feet to the northwest of Feature S-4 and may be connected in the subsurface.

PLANNED ABATEMENT: A 50-foot building setback is planned for this feature. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur. This feature will be filled with cobbles, grading upward to gravel.

S-4 Cave. This feature consists of a 2-foot-in-diameter cavity in solid limestone that extends vertically 4 feet into a small room about 30 feet in diameter. Many harvestman arachnids and cave crickets were observed within this feature.

PLANNED ABATEMENT: A 50-foot building setback is planned for this feature. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur.

S-5 Solution cavity. This feature is an enlarged bedding plane cavity within the margins of a creek bed. The entrance to this feature measures approximately 2 feet in diameter and extends 2 feet horizontally into the hillside. No airflow or cave fauna were observed for this feature.

PLANNED ABATEMENT: No building setback is planned for this feature. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur. This feature will be filled with cobbles, grading upward to gravel.

S-13 Sinkhole (potential cave). This feature is approximately 3.5 feet in diameter and rimmed with limestone and extends 3 feet to loose cobbles. This feature was observed to have cool air flowing during hand excavation. This feature is coincident with the Bat Cave Fault zone (S-18).

PLANNED ABATEMENT: No building setback is planned for this feature. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur. This feature will be filled with cobbles, grading upward to gravel.

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S-28 Fractured rock zone. A rock outcrop measuring up to 20 feet wide and up to 1000 feet long located within a creek bed. Fracture spacing is variable, with densities up to 1 every 0.25 feet, apertures up to 3 inches, and trends of 35°, 85° and 120°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Exposure of the outcrop is discontinuous as it is partially covered with coarse alluvial deposits within the streambed. This feature is coincident with 2 fault zones (S-29 and S-30).

PLANNED ABATEMENT: A 150-foot setback is planned from the center line of the creek. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur.

S-113 Fractured rock and possible collapsed sinkhole. This feature consists of a rock outcrop measuring up to 100 feet in diameter, containing fractures and limestone beds that dip toward one another. The dipping beds may be the result of minor folding, undocumented faulting, or perhaps solutioning and collapse.

PLANNED ABATEMENT: A 150-foot setback is planned from the centerline of the creek. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur.

400-acre tract

S-8 Solution cavities (Sinkhole). This feature consists of 2 solution cavities within an elongated closed depression about 25 feet long and up to 10 feet wide. The 2 portals are about 12 feet apart and trend ~60° parallel to the elongated closed depression. The most significant cavity measures about 1 foot in diameter and extends up to 5 feet vertically to limestone cobbles.

PLANNED ABATEMENT: No building setback is planned for this feature. This feature will be filled with cobbles, grading upward to gravel, and sealed with concrete. Any runoff from roads or parking lots should be diverted away from this feature. Any septic systems should be located away from this area because infiltration of pollutants may occur.

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1 MILE

000 5000 6000 7000 FEET

1 KILOMETRE

FEET

ATUM OF 1929

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

TEXAS

QUADRANGLE LOCATION

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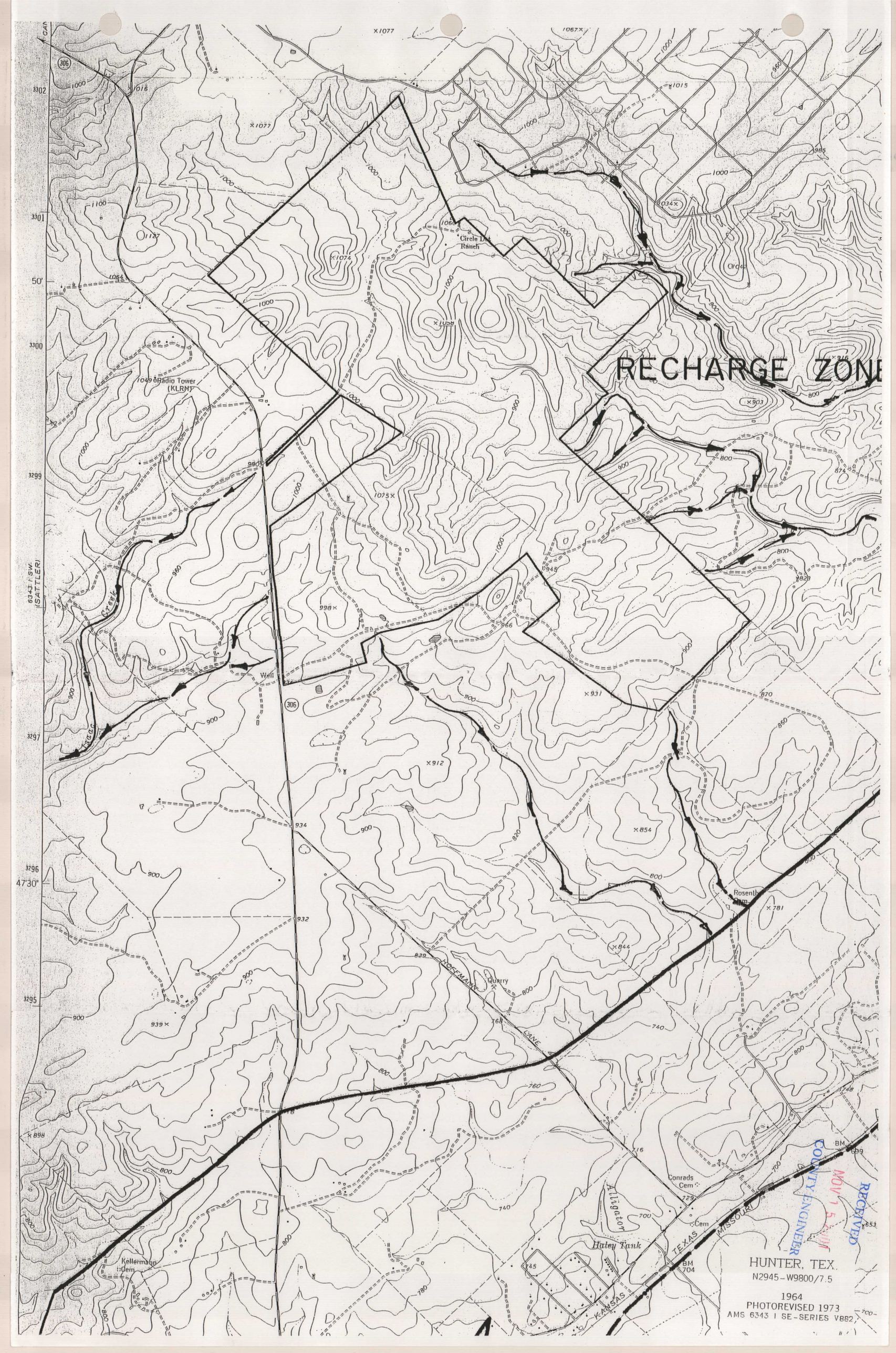
SATTLER, TEX. 35

N2945–W9807.5/7.5

1963
PHOTOREVISED 1973

NDARDS
RESTON, VIRGINIA 22092
ILABLE ON REQUEST


RECHARGE ZONE
Circle Lot Ranch
Radio Tower (KLRN)
Well
Creek
Quarry
HOFFMANN LANE
Rosenthal Cem
Conrads Cem
Alligator
Haley Tank
TEXAS
MISSOURI
KANSAS
Kellermann Cem
6343 I SW (SATTLER)
50'
47'30"
HUNTER, TEX.
N2945-W9800/7.5
1964
PHOTOREVISED 1973
AMS 6343 I SE-SERIES V882
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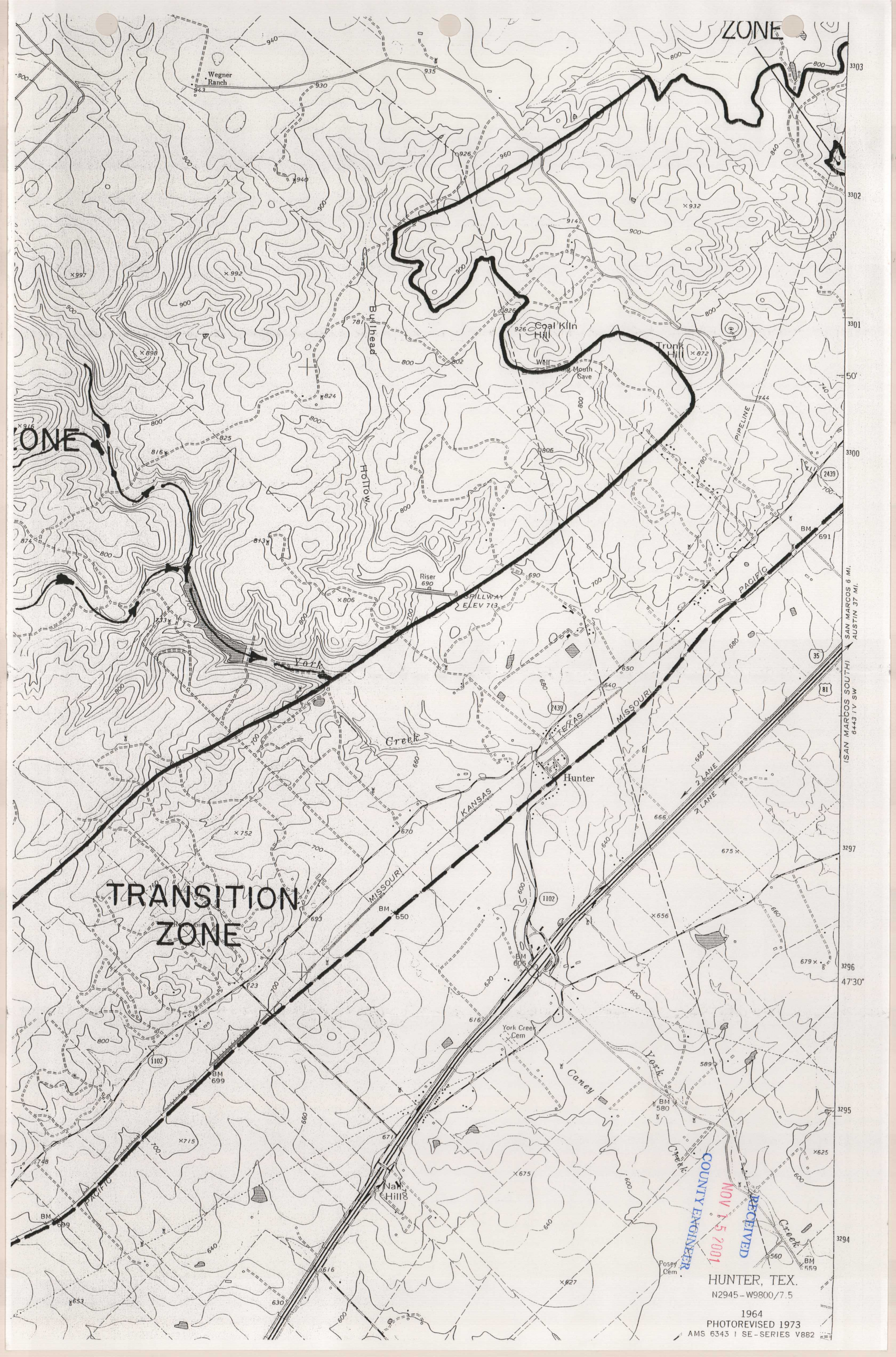
ZONE
ONE
TRANSITION ZONE
Wegner Ranch
Bullhead Hollow
Coal Kiln Hill
Trunk Hill
Well
Big Mouth Cave
PIPELINE
Riser 690
SPILLWAY ELEV 713
York Creek
Hunter
KANSAS
TEXAS
MISSOURI
PACIFIC
2 LANE
(SAN MARCOS SOUTH)
6443 I V SW
SAN MARCOS 6 MI.
AUSTIN 37 MI.
York Creek Cem
Caney Creek
Nail Hill
Posey Cem
BM 699
BM 691
BM 650
BM 605
BM 580
BM 559
3303
3302
3301
3300
3297
3296
3295
3294
50'
47'30"
HUNTER, TEX.
N2945-W9800/7.5
1964
PHOTOREVISED 1973
AMS 6343 I SE-SERIES V882
RECEIVED
NOV 15 2001
COUNTY ENGINEER



NEW BRAUNFELS EAST, TEX

N2937.5—W9800/7.5

1958
PHOTOREVISED 1973
AMS 6343 II NE SERIES V882

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PROJECT DESCRIPTION:

River Chase Unit Five, Six, Seven and Eight is an 1130 Lot single family residential subdivision located approximately 7 miles north of the city of New Braunfels off of FM 306. The project consists of 1963 acres of land located in Comal County, Texas and is not located within any Extra Territorial Jurisdiction of any local city.

River Chase is located on the eastern edge of the Edwards Plateau. York Creek runs through the northeastern side of this property, Alligator Creek to the south and Issac Creek to the west. The development is located within the Edwards Aquifer Zone as determined by the TNRCC. This property is currently open/unused land, past uses have been for ranching and grazing purposes.

The development will consist of approximately 1130 single-family residential lots, , with a minimum lot size of one 1.01 acre. 96,200 feet of asphalt roadway will be constructed. New Braunfels Utility will supply water for the development. Water distribution lines will be constructed in accordance with New Braunfels Utility specifications. Wastewater will be treated and disposed of by private septic systems constructed in accordance with the TNRCC and Comal County Health Department's rules and regulations. Drainage will be by sheet flow and open ditches.

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Horizon

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Austin, TX

Offices:
Beaumont, TX
Houston, TX
Karnes City, TX
Pittsburg, TX
San Antonio, TX
Shreveport, LA
Ann Arbor, MI

GEOLOGIC ASSESSMENT
FOR 1855-ACRE PFUEFFER RANCH
AT FM 306
COMAL COUNTY, TEXAS
HJN 010083 GA

PREPARED FOR:

SOUTHERLAND PROPERTIES
WIMBERLY, TEXAS

PREPARED BY:

HORIZON ENVIRONMENTAL SERVICES, INC.

MARCH 2000

HORIZON ENVIRONMENTAL SERVICES, INC.
P.O. Box 162017 • Austin, Texas 78716 • 2600 Dellana Lane, Suite 200 • Austin, Texas 78746
(512) 328-2430 • FAX (512) 328-1804 • http://www.horizon-esi.com

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A GEOLOGIC ASSESSMENT TABLE
B STRATIGRAPHIC COLUMN
C SITE GEOLOGIC MAP
D RESUMES OF PARTICIPANTS

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ENVIRONMENTAL SERVICES, INC.

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TNRCC GEOLOGIC ASSESSMENT FORM

FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE/TRANSITION ZONES
AND RELATING TO 30 TAC §213.5(b)(3), EFFECTIVE JUNE 1, 1999

PROJECT NAME: 1855-ACRE PROPERTY, PFEUFFER RANCH AT FM 306, COMAL COUNTY, TEXAS.

TYPE OF PROJECT: X WPAP __ AST __ SCS __ UST

LOCATION OF PROJECT: X Recharge Zone __ Transition Zone __ Contributing Zone

PROJECT INFORMATION

1. X Geologic or manmade features are described and evaluated using the attached **GEOLOGIC ASSESSMENT TABLE (Appendix A)**.

2. Soil cover on the project site is up to 6.7 feet thick. In general, the soil present appears to have the ability to:

__ transmit fluid flow to the subsurface.
X impede fluid flow to the subsurface.

3. X **SOILS ATTACHMENT**. A narrative description of soil units and a soil profile, including thickness and hydrologic characteristics are provided in Section 5.0 of the Additional Comments section at the end of this form.

4. X A **STRATIGRAPHIC COLUMN** is attached at the end of this form that shows formations, members, and thicknesses. The outcropping unit should be at the top of the stratigraphic column (Appendix B).

5. X A **NARRATIVE DESCRIPTION OF SITE SPECIFIC GEOLOGY** is attached at the end of this form in the Additional Comments section. The description must include a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure, and karst characteristics of the site.

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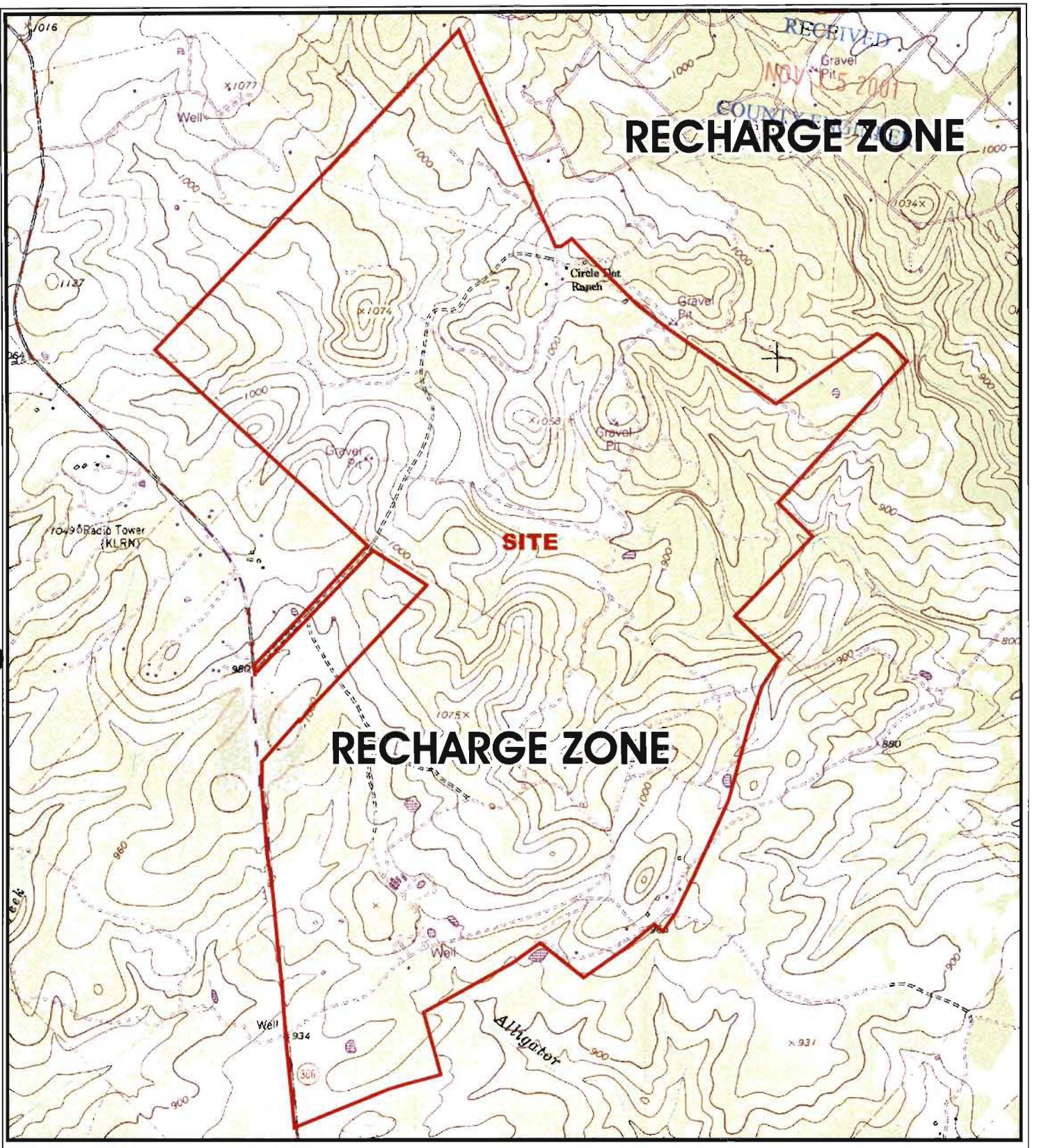

BASE MAP SOURCE: U.S. GEOLOGICAL SURVEY, 7.5' SERIES, HUNTER QUADRANGLE, 1994.

0 1000 2000
SCALE IN FEET

N



SITE LOCATION MAP

1855-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 010083 GA
November 2000

Horizon
ENVIRONMENTAL SERVICES, INC.

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6. X Appropriate **SITE GEOLOGIC MAP(S)** are attached (Appendix C).

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" = 400'
Site Geologic Map Scale	1" = 400'

7. Method of collecting positional data:
   X Global Positioning System (GPS) technology.
   X Other method(s).

8. X The project site is shown and labeled on the Site Geologic Map.

9. X Surface geologic units are shown and labeled on the Site Geologic Map.

10. X 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.

11. X The Recharge Zone boundary is shown and labeled, if appropriate.

12. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.):

    X There are 7(#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply.)
    __ The wells are not in use and have been properly abandoned.
    1 The wells are not in use and will be properly abandoned.
    6 The wells are in use and comply with 16 TAC §76.
    __ There are no wells or test holes of any kind known to exist on the project site.

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ADMINISTRATIVE INFORMATION

13. X One (1) original and three (3) copies of the completed assessment have been provided.

Date(s) Geologic Assessment was performed:

28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000
Date(s)

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 213.

Jason John
Print Name of Geologist

(512) 328-2430
Telephone

For Horizon Environmental Services, Inc.

(512) 328-1804
Fax

Signature of Geologist

16 March 2001
Date

Representing: Horizon Environmental Services, Inc., Austin, Texas

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1855-ACRE
PFEUFFER RANCH
AT FM 306
COMAL COUNTY, TEXAS

ADDITIONAL COMMENTS
HJN 010083 GA

This report provides the results of a geologic assessment conducted by Horizon Environmental Services, Inc. (Horizon) on the above-referenced site. Horizon conducted the field reconnaissance on 28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000. Horizon spent a minimum of 260 hours in the field evaluating the site and surrounding area.

1.0 KARST INVESTIGATION METHODOLOGY

This geologic assessment includes a review of the site for potential aquifer recharge and documentation of general geologic characteristics for the subject site. Horizon conducted the necessary field and literature studies to meet or exceed Texas Natural Resource Conservation Commission (TNRCC) requirements. Horizon walked transects spaced 50 feet apart and mapped the location of features, if any, using a hand-held global positioning system (GPS), topographic maps, and aerial photographs. Horizon walked concentric circles (looking for karst features) around any areas showing evidence of internal drainage, including characteristics such as soil piping, solutionally enlarged voids or fractures, slumping, soil piping, extremely disturbed areas, or collapsed sinkholes. Section 4.0 provides a description of all features found during Horizon's survey.

2.0 ENVIRONMENTAL SETTING

2.1 LAND USE

The subject property consists of unimproved pasture and woodlands used for ranch and livestock activities. Several single-family residential houses are located on the subject site. Surrounding land use consists of undeveloped ranch land with sparse, single-family residential houses.

2.2 VEGETATION

Vegetation on the site consists of open grasslands and woodlands. Woodlands are dominated by plateau live oak (*Quercus fusiformis)*, Texas oak (*Quercus buckleyi*), Ashe juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), with a few mesquite (*Prosopis glandulosa* var. *glandulosa*) interspersed. Ashe juniper removal has been practiced on the subject site, creating open grasslands.

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2.3 TOPOGRAPHY AND SURFACE WATER

Topography on the subject property contains hills and valleys with surface elevations ranging from 920 to 1070 feet above mean sea level (MSL). Surface water drains via overland sheetflow and along natural drainages and York Creek. York Creek flows to the southeast through the center of the subject site. The portion of the subject site adjacent to York Creek is within the 100-year floodplain (FEMA, 1986).

2.4 RECHARGE ZONE BOUNDARY

The above-referenced site is within the Edwards Aquifer Recharge Zone as mapped by the TNRCC (TNRCC, 1996). The Recharge Zone is known as the area where the stratigraphic units constituting the Edwards Aquifer are exposed at the surface and where water may filter in the aquifer through permeable features such as cracks, fissures, caves and other openings in these layers (TNRCC, 1999). The Recharge Zone is identified as that area designated as such on official maps located in the appropriate regional office and groundwater conservation districts.

2.5 DESCRIPTION OF ON-SITE GEOLOGY

The subject site is found within the Edwards Aquifer Recharge Zone (TNRCC, 1996). According to published geologic maps of the region and Horizon's field investigation, the subject site is underlain by the Kainer and Person Formations of the Edwards Group limestones and the Georgetown, Del Rio, and Buda limestone formations. The site geologic map (Appendix C) was created from outcrop maps and areal photographs, allowing modification of published geologic maps (UT-BEG, 1982; Baumgardner and Collins, 1991; Hanson and Small, 1994). Following is a description of the site-specific geology, stratigraphy, potential for fluid movement, karstic characteristics, and geologic structures of the subject site.

2.5.1 Kainer Formation of the Edwards Group

The Kainer Formation is subdivided into informal members by Rose (1972). The Dolomitic, Kirschberg Evaporite, and Grainstone members are exposed on the subject site. The Kainer Formation ranges in thickness from about 260 to 310 feet and includes marine sediments consisting of fossiliferous mudstones (commonly rudistids) and wackestones that grade upward into dolomitic mudstones and evaporites, terminating in a *miliolid* grainstone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Kirschberge Evaporite Member (Kek6) is reported to be the most porous and permeable of the Kainer Formation in Comal County (Hanson and Small, 1994).

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2.5.1.1 Dolomitic Member (Kek_7)

The Dolomitic Member of the Kainer Formation (Hydrogeologic Subdivision VII of the Edwards Group) is poorly exposed along the northwestern portion of the subject site north of Bat Cave Fault (Hanson and Small,1994), and inferred due to thickness constraints along the southern portion of York Creek. The Dolomitic Member is regionally described as mostly dense crystalline limestone, with occasional zones of grainstone and layers of variably burrowed mudstone. Chert nodules and thin, discontinuous beds of chert are scattered throughout this member. Commonly rudist fossils, *Toucasia* sp., are found near the top of this member (Hanson and Small, 1994. Primary field characteristics of the Dolomitic Member on the subject site include abundant chert nodules and bivalve wackestone to packstones.

The Dolomitic Member is generally porous and relatively permeable. Evaporite beds are burrowed and dissolved to the extent of being honeycombed. Many beds contain isolated molds, casts, and burrows with large secondary porosity, but low permeability because voids are often unconnected. Caves are often associated with open bedding planes (Stein and Ozuna, 1995). The upper part of the Dolomitic Member may be cavernous and highly altered with abundant, red, clay-filled cavities (Rose, 1972).

2.5.1.2 Kirschberg Evaporite Member (Kek_6)

The Kirschberg Evaporite Member of the Kainer Formation (Hydrogeologic Subdivision VI of the Edwards Group) is regionally described as crystalline and chalky limestone, with lenses and nodules of chert about 50 feet thick. Primary field characteristics of the Kirschberg Evaporite Member on the subject site include thin to thick bedded buff to greyish-white color mudstones with fenestral porosity. Fenestral porosity (arranged in long rows parallel to bedding) suggests the remains of dissolved gypsum nodules (Rose, 1972). This member is described as the most porous and permeable member of the Kainer Formation and is host to extensive cave development in Comal County (Hanson and Small, 1994).

2.5.1.3 Grainstone Member (Kek_5)

The Grainstone Member of the Kainer Formation (Hydrologic Subdivision V of the Edwards Group) is exposed throughout the subject site. Primary field characteristics of the Grainstone Member on the subject site include white, cross-bedded, *Miliolid* and bivalve grainstones, with locally bivalved wakestones and mudstones. Regionally, the Grainstone Member is described as a dense, tightly cemented *Miliolid* grainstone, with some mudstone and wackestone.

The Grainstone Member is reported to be about 50 feet thick (Hason and Small, 1994). A *Toucasia* sp. (rudist fossil) bed is reported to be located at the top of the Grainstone Member (Rose, 1972). The Grainstone Member is highly recrystallized, thereby reducing its permeability and porosity. However, interparticle and intraparticle porosity and fracture (due to faulting) porosity and permeability are locally present.

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Few caves are known to develop in this formation in Comal County; however, many caves in Bexar County have entrances in the lower part of this subdivision that provide access to the Kirschberg Evaporite Member below (Hanson and Small, 1994; Stein and Ozuna, 1995).

2.5.2 Person Formation of the Edwards Group

The Person Formation is subdivided into informal members by Rose (1972). The Regional Dense and Leached and Collapsed (Undivided) members are exposed on the subject site. The lithology of the Person Formation ranges from variably burrowed mudstone to grainstone to crystalline limestone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Leached and Collapsed Member (Kek3) is reported to be the most porous and permeable of the Person Formation in Comal County (Hanson and Small, 1994).

2.5.2.1 Regional Dense Member (Kep_4)

The Regional Dense Member of the Person Formation (Hydrologic Subdivision IV of the Edwards Group) is regionally described as a dense, argillaceous mudstone (Rose, 1972; Hanson and Small, 1994). The Regional Dense Member is about 20 to 24 feet thick in Comal County (Hanson and Small, 1994). Primary field characteristics of the Regional Dense Member on the subject site include white, nodular, chalky, bivalve mudstones. Historically, the Regional Dense Member was quarried for road base throughout the subject site and was extremely useful as a stratigraphic marker during geologic mapping. The Regional Dense Member has little permeability or porosity overall and is known as the least porous or permeable subdivision (Hanson and Small, 1994). It does not typically produce large caves near the subject site. Hanson and Small (1994) describe this member as a possible confining unit locally within the Edwards Aquifer. However, caves, faults, and fractures may greatly reduce the confining effects of this member locally.

2.5.2.2 Leached and Collapsed Member (Kep_3)

The Leached and Collapsed Member of the Person Formation (Hydrologic Subdivision III of the Edwards Group) overlies the Regional Dense Member and is reported to be about 80 to 100 feet thick in Comal County. The Leached and Collapsed Member is regionally described as a variably burrowed mudstone to grainstone with intervals of crystalline limestone. Chert is commonly found within this member (Hanson and Small, 1994). The common collapsed zones within this member were the result of a collapse of the overlying limestone into the voids created by dissolved evaporite lenses and layers (Rose, 1972). Primary field identification characteristics of the Leached and Collapsed Member on the subject site include *Toucasia* sp. (rudist) fossils, bivalve wake- to packstones, and thick red soils with abundant chert cobbles. The Leached and Collapsed Member is one of the most porous and permeable formations (Stein and Ozuna, 1995). It is known to have vuggy and burrow porosity and permeability associated with evaporites, burrowed zones, breccia, and caves. Permeability and porosity are associated with collapsed zones, where evaporites have been dissolved and in areas where faulting or fractures occur.

2.5.3 Georgetown Formation (Kgt)

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The Georgetown Limestone Formation (Hydrologic Subdivision I of the Edwards Group) is exposed in the southwestern portion of the subject site and overlies the Edwards Group (Person and Kainer Formations). The Georgetown limestone is reported to be less than 10 feet thick in Comal County (Small and Hanson, 1994). The Georgetown Formation is described as gray to light-tan, marly, fossiliferous limestone that usually contains brachiopods (*Waconella wacoensis*). The contact between the Edwards and Georgetown formations is pitted and bored and often contains iron-oxide staining with common *Toucasia* sp. fossils (Rose, 1972).

No karst features occur within this formation on the subject site and due to the thin, low porosity, and low permeability nature of the Georgetown Formation, it probably yields little water to wells in Comal County. However, where outcrop of the Georgetown Formation is extensively weathered the Georgetown Formation may be considered a part of the unsaturated zone of the Edwards Aquifer (Stein and Ozuna, 1995).

2.5.4 Del Rio Clay Formation (Kdr)

Contrary to the published map of Hanson and Small (1994), the Del Rio and Buda formations, not the Edwards Group limestones is found on the southern portion of the subject site. The Del Rio Formation underlies the lowlands in the southern portion of the subject site primarily used for cultivating hay. Del Rio Clay is about 40 to 50 feet thick in Comal County and is described as weathered, poorly compacted, friable, fossiliferous, blue-green to yellow-brown clay, with some thin lenticular, calcareous, siltstone beds (Rose, 1972; Hanson and Small, 1994). The primary marker fossil for the Del Rio Clay is the pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994).

The Del Rio Formation forms the primary upper confining unit of the Edwards Aquifer (Rose, 1972; Hanson and Small, 1994). The Del Rio Clay is described as having no porosity, low permeability, and no cavern development (Hanson and Small, 1994).

2.5.5 Buda Formation (Kbu)

The Buda Formation occupies the uplands of the southern portion of the subject site. The Buda Formation is reported to be about 40 to 50 feet thick in northeastern Comal County and consists of a buff, light gray, dense mudstone (Hanson and Small, 1994). Primary field identification includes small, calcite-filled veins, red-stained intraclasts, porcelaneous limestone character, and pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994). The Buda limestone is lithologically indistinguishable from the Georgetown limestone; however, the reported thickness of the Buda (up to 50 feet) compared to the relatively thin Georgetown Formation (less than 10 feet) and the stratigraphic position confirm that the Buda limestone is found on the subject site (Hanson and Small, 1994). The Buda Formation has low porosity and permeability with minor surface karst and no cavern development in the region (Hanson and Small, 1994).

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2.5.6 Tertiary and Quaternary Gravel Deposits (T-Qgr)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits are not associated with the present drainage systems and appear to be similar to gravel deposits equivalent to the late Tertiary or Quaternary Uvalde Gravel with thicknesses reportedly ranging from several feet to more than 10 feet (Baumgardner and Collins, 1991). This unit contains high porosity and permeability, but does not develop karst features associated with recharge of the Edwards Aquifer.

2.5.7 Quaternary Alluvium Deposits (Qal)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone deposits within creekbeds and drainages on the subject site. These deposits are associated with the modern drainage systems and occur as narrow, discontinuous deposits, with thicknesses from several feet to more than probably 10 feet locally. These deposits were generally not mapped due to their discontinuous, narrow, and relatively thin nature. These deposits contain very high porosity and permeability, but do not develop karst features associated with recharge of the Edwards Aquifer.

2.5.8 Geologic Structures

All faults were identified in the field by stratigraphic displacement (primarily the Regional Dense Member of the Person Formation), in addition to one or more of the following characteristics related to faulting: fault gouge and breccia, slickensides, steeply dipping beds due to fault-drag, fractured rock zones, and vegetation lineaments on areal photographs. All faults mapped are normal faults, and generally all contain vertical fault planes.

Some potential recharge features found on the subject site appear to be related to inferred and mapped faults on the subject site. Folding of limestone beds within fault-bound blocks and dipping limestone beds throughout the subject site accounts for greater apparent thicknesses on the geologic map.

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2.6 SOILS

Soils on the subject site are characterized as follows (Batte, 1984):

SOIL NAME	SOIL TYPE	SOIL DEPTH (FEET)	UNDERLYING MATERIAL	PERMEABILITY	AVAILABLE WATER CAPACITY	SHRINK-SWELL CAPACITY
Comfort-rock outcrop complex (CrD), undulating	stony clay	1.1	indurated fractured limestone	slow	very low	low to moderate
Rumple-comfort association, undulating (RuD)	cherty clay loam to stony clay	2.3	indurated fractured limestone	moderately slow	very low	low to moderate
Perves clay, 1 to 5% slopes (PuC)	clay	1.6	indurated fractured limestone	moderately slow	very low	high
Medlin-Eckrant association, undulating (MEC)	clay to 3.2 feet and marl to 6.7 feet	6.7	fractured limestone	very slow	very low	high
Denton silty clay, 1 to 3% slopes (DeB)	clay	3.0	fractured, indurated limestone interbedded with calcareous clayey marl	slow	medium	high
Eckrant-rock outcrop complex, steep (ErG)	very stony clay	0.8	indurated fractured limestone	moderately slow	very low	moderate

2.7 WATER WELLS

A search was made for water wells on the subject site. A review of the records of the TNRCC and the Texas Water Development Board (TWDB) revealed 2 potential water wells on the subject site (TWDB, 2000). However, Horizon found 7 water wells (S21 through S24, S69, S91, and S99) on the subject site during field investigation. These wells are located on the site geologic map (Appendix C).

The results of this survey do not preclude the possibility of finding an additional abandoned test or water well during the clearing or construction phases of the proposed project. If a water well or casing is encountered during construction, construction should be halted until the TNRCC is contacted.

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All abandoned wells must be capped or properly abandoned according to the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code (TAC), Chapter 76, effective 3 January 1999. A plugging report must be submitted (by a licensed water well driller) to the Texas Department of Licensing and Regulation, Water Well Driller's Program, Austin, Texas. If a well is intended for use, it must comply with 16 TAC §76.

3.0 SPECIAL INSTRUCTIONS TO CONTRACTORS OR DEVELOPERS

The Edwards Aquifer Protection Plan (EAPP) and its associated documents address best management practices (BMPs) and describe recommended water pollution abatement strategies specifically for the subject site and surrounding area. Temporary and permanent BMPs should be used to control any runoff during and after the proposed activities and should be based on the TNRCC Guidelines for BMPs, which typically require that all runoff from areas of impervious cover be captured and filtered before leaving a site within the recharge zone (TNRCC, 1999).

4.0 GEOLOGIC ASSESSMENT TABLE COMMENTS (DETAILED FEATURE DESCRIPTIONS) AND ABATEMENT RECOMMENDATIONS

The following features are shown and labeled on the Geologic Assessment Table in Appendix A and on the Site Geologic Map in Appendix C. Below is a description for features found on the subject site.

S1 Stock pond. This manmade cattle pond is approximately 150 feet in diameter and 15 feet deep. The tank is filled with fine-grained sediment and holds water. No openings or internal drainages were found within this feature. No setback is recommended.

S2 Fracture Rock in drainage. A fractured rock outcrop measuring approximately 30 feet wide and 200 feet long. No solution features were noted during the field investigation. Fractures are spaced 1 every 1 foot, with apertures up to 2 inches, locally filled with black soil and trend 140° to 160°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for Sewage Collection System (SCS) and/or Soil Adsorption System (SAS) may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S3 Solution cavity (sinkhole). This feature has a closed depression diameter of ~10 feet, extends vertically a minimum of 4 feet, and is filled with loose cobbles and organic debris. The feature appears to extend vertically into the subsurface an unknown distance. This feature is located 30 feet to the west of Feature S4. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that it is connected to S4. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

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S4 Cave. This feature consists of a 2-foot diameter cavity in solid limestone that extends vertically 4 feet into a small room about 30 feet in diameter. Harvestman arachnids and cave crickets were observed within this feature. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that this feature is a cave. Horizon recommends a more detailed mapping of this feature to determine its subaerial extent. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S5 Solution cavity. This feature is an enlarged bedding plane cavity within the margins of a creek bed. The entrance to this feature measures approximately 2 feet in diameter and extends 2 feet horizontally into the hillside. No airflow or cave fauna were observed for this feature. No setback is recommended.

S6 Fault and fracture zone within drainage. The fault exposed in the creek bed trends 15° and is associated with steeply dipping beds, fault gouge and breccia, and fractures. The exposed outcrop measures approximately 15 feet wide and 50 feet long within the drainage, and contains fractures spaced 1 every 2 to 3 inches, with apertures up to 2 inches and trends of 75° and 150°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S7 Fractures in drainage. An outcrop of rock measuring approximately 15 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 1 foot, with apertures up to 0.5 inches and trend 85° and 125°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S8 Fractures in drainage. An outcrop of rock measuring approximately 30 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 2 to 3 inches, with apertures up to 1 inch locally filled with black soil and trend 120°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S9 Solution cavity. This feature measures approximately 1 foot in diameter and extends 1 foot horizontally, representing a solutionally enhanced bedding plane feature. This feature is located at the top of a hill with limited potential for recharge due to its location and infilling soil. No setback is recommended.

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S10 Solution cavity. This feature is a solutionally enlarged fracture at the top of a hill. The feature measures approximately 4 feet long and 6 inches wide and extends 4 feet vertically. The base is infilled with soil. It is Horizon's opinion that this feature is a result of fracturing due to surficial weathering and the fracturing is limited in extent. No setback is recommended.

S11 Fractures within a drainage. An outcrop of fractured rock measuring approximately 15 feet wide and 30 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 2 inches trending 110° and 030°. No solution features were found. This feature is coincident with the Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S12 Fractures in drainage. An outcrop of rock measuring within a drainage containing fractures spaced 1 every 1 foot with apertures up to 0.5 inches trending 60°. No solution features were found. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S13 **Sinkhole (potential cave).** This feature is approximately 3.5 feet in diameter, rimmed with limestone, and extends 3 feet to loose cobbles. This feature was observed to have air flow during hand excavation. This feature is coincident with the Bat Cave Fault zone (S18). Horizon recommends excavation of this feature to determine the recharge potential of this feature. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S14 Fractures in drainage. An outcrop of fractured rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 1 inch, and trend 90°, 150°, and 120°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S15 Fractures in drainage. An outcrop of rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 3 inches to 1.5 feet, with apertures up to 1 inch, and trend 100°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S16 Solution cavity. This feature is a solutionally enlarged bedding plane located on a hillside. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and its recharge ability is limited. No setback is recommended.

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S17 Solution cavity. This feature is a solutionally enlarged bedding plane located on the side of drainage. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and recharge ability. No setback is recommended.

S18 Bat Cave Fault Zone. Horizon observed fault gouge, breccia, and fractures coincident with the fault zone mapped by Hanson and Small (1994). Additionally, Horizon field verified where the Bat Cave Fault intersects Country Road (CR) 306 and observed extensive fault breccia and gouge associated with this fault zone. This fault zone has fractured rock outcrops (S2, S11, S12, S14, S15) exposed within several drainages on the subject site. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages.

S19 Fault zone. Horizon observed fault gouge, fractures, and offset geologic members coincident with the fault zone mapped by Hanson and Small (1994). No solution cavities were observed along the fault. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S20 Fractures within a drainage. Fractures are spaced 1 every 1 foot, with cemented apertures and trends of 100°. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S21 Water well. This feature is located at the top of a hill and consists of an inactive windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S22 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S23 Water well. This feature is an active windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S24 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S25 Fractures in drainage. This rock outcrop measures approximately 50 feet in diameter and located between 2 converging drainages. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 115°. Fractures on the hillsides were difficult to identify.

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Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S26 Fault Zone. This fault zone is originally mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. The fault is also exposed near the eastern boundary of the site. A vegetation lineament is coincident with this feature on the aerial photograph. No solution features are found within 200 feet of this fault, which is inferred over most of the property. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects and areas. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S27 Solution cavities. An outcrop of vuggy rock, measuring 8 feet in diameter, contains several solution cavities up to 2 feet in diameter and a 2-foot vertical depth. The cavities contain loose, fine-grained soil and leaf litter. No airflow or cave fauna were observed for this feature. One cavity contains mounded dirt apparently related to animal burrowing. Setbacks for SCS and/or SAS may be appropriate.

S28 Fractured rock zone. A rock outcrop measuring up to 20 feet wide and up to 1000 feet long is located within a creek bed. Fracture spacing is variable, with densities up to 1 every 0.25 feet, apertures up to 3 inches, and trends of 35°, 85° and 120°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Exposure of the outcrop is discontinuous, as it is partially covered with coarse alluvial deposits within the streambed. This feature is coincident with 2 fault zones (S29 and S30). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S29 Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fractures (S28 and S49), a linear exposure of red soils with rock breccia, and a vegetation lineament are coincident with this feature. No solution features are found within 200 feet of the fault on the property. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S30 Fault Zone. This fault zone juxtaposes the Kirschberg Evaporite and Grainstone members of the Kainer Formation within the same drainage as S-28. Additionally, fractures and a slight vegetation lineament on an aerial photograph are coincident with this feature.

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Setbacks for SCS and/or SAS may be appropriate for portions of the drainages the fault intersects, as well as features S121 and S124 that are not within drainages, but coincide with the fault. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S31 Stock pond. This manmade cattle pond is approximately 200 feet in diameter and approximately 15 feet deep. No setbacks are recommended.

S32 Solution cavity. This feature is a solutionally enlarged fracture. It measures approximately 3 feet long, up to 3 inches wide, and extends 2.5 feet vertically to a horizontal bedding plane cavity. The feature trends to the northeast and no airflow or cave fauna were observed for this feature. Setbacks for SCS and/or SAS may be appropriate.

S33 Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and is exposed in the CR 308 road cut east of the site, where it juxtaposes the Leached and Collapsed Member and the Eagle Ford Formations. On the subject site, this fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph were coincident with this feature. No solution features are located within 200 feet of this inferred fault. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S34 Stock pond. This manmade cattle pond is approximately 75 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

S35 Stock pond. This manmade pond is approximately 200 feet long, 100 feet wide of unknown depth, and holds water. No openings or internal drainage were observed within this feature. No setback is recommended.

S36 Stock pond. This manmade cattle pond is approximately 50 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

S37 Stock pond. This manmade cattle pond is approximately 100 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

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S38 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S39 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S40 Stock ponds. Four parallel stock ponds measuring up to 200 feet long and 20 feet wide. These ponds hold water and no openings or internal drainage were observed within this feature. No setbacks are recommended.

S41 Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

S42 Fault Zone. This fault zone was originally mapped by Hanson and Small (1994). This feature juxtaposes the Regional Dense and the Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph was coincident with this feature. No solution features are located within 200 feet of this fault. Setbacks for SCS and/or SAS may be appropriate for only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S43 Inferred fault zone. This fault zone is inferred based on exposed fractured bedrock. Setbacks for SCS and/or SAS may be appropriate since it is entirely within a drainage system.

S44 Fault Zone. This fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fault gouge and a vegetation lineament on an aerial photograph were coincident with this feature. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects and for features S-64, S-62, S-75, S-81, S-116, S-117, and S-118 that coincide with it.

S45 Man-made outhouse pit. A manmade closed depression approximately 8 feet in diameter and up to 3.5 feet deep. This feature is located near a house and was apparently used as an outhouse. No openings or internal drainage were observed within this feature. No setback is recommended.

S46 Solution cavity. This feature is located along the margins of a drainage, with an entrance measuring approximately 0.5 feet in diameter extending at an angle of 30° to a depth of 3 feet. It is infilled with soil. It is Horizon's opinion that this is an enlarged bedding plane with a low relative infiltration rate. No setback is recommended.

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S47 Vuggy rock. An outcrop measuring up to 15 feet in diameter that contains unconnected and connected vugs. The vugs have a moderate density (1 per 2 to 4 inches) and apertures greater than 2 inches. It is Horizons opinion that the vugs are a result of surficial weathering. No setback is recommended.

S48 Fault and closed depression. A small fault zone, with gouge about 2 inches wide, striking 20° and dipping 79° to the east, is exposed in a quarry located within the Regional Dense Member. Additionally, dipping beds and fractures (trending 120° and 040°) within a nearby outcrop of the Grainstone Member, and a vegetation lineament on an aerial photograph are coincident with this feature. A small, closed depression, measuring about 30 feet in diameter and up to 2 feet deep, within the quarry contains mudcracks. The small fault has no associated solution cavities and the closed depression is man made. No setback is recommended for S-48.

S49 Fractured rock. A rock outcrop measuring up to 10 feet wide and 75 feet long is located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and a trend of 20°. Fractures are generally open; however, locally, apertures are cemented and filled with soil. This feature is coincident with a fault zone (S29). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S50 Vuggy rock. A outcrop of vuggy rock about 100 feet long and 50 feet wide, containing unconnected and locally connected vugs located slightly up drainage (approximately 200 feet) from S-29. This feature is within what appears to be the Kirschberg Evaporite Member and characteristically contains vugs due to dissolution of evaporite minerals. Vug densities are 1 every 0.5 feet, with apertures up to 3 inches. It is Horizon's opinion that the dissolution is due to surficial weathering. No setback is recommended.

S51 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 1 foot in diameter extends 45° to the northwest to a depth of 1.5 feet where it is infilled with soil. It is located on a hillside and has a drainage area of less than 1 acre. It is Horizon's opinion that this feature has a low potential for recharge. No setback is recommended.

S52 Quarry and closed depression. This feature is a manmade quarry within the Regional Dense Member that contains a man-made closed depression measuring about 30 feet in diameter, up to 3 feet deep, and holding water. No openings or internal drainage were observed within this feature. No setback is recommended.

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S53 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 0.5 feet in diameter, and extends to a minimum depth of 2 feet. No airflow was observed for this feature. It is partially infilled with soil and has a moderate infiltration rate. It is located near the top of a hill with no defined catchment area. No setback is recommended.

S54 Fault Zone. This fault zone is exposed in a quarry and trends 135°, juxtaposing steeply dipping beds of the Grainstone Member with the chalky, nodular beds of the Regional Dense Member. Additionally, the fault zone contains fractures and fault gouge exposed within the quarry that was used for road base. The fault has no associated solution features and is located on a hillside. No setback is recommended.

S55 Stock pond. This dry stock pond is 50 feet in diameter, 7 feet deep, and is located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S56 Stock ponds. Two stock ponds, approximately 50 feet in diameter and up to 5 feet deep, are located within a drainage and contain no water. No openings or internal drainage were observed within this feature. The ponds are located in adjacent and convergent drainages about 50 feet apart. No setback is recommended.

S57 Solution cavity. This feature is an enlarged bedding plane cavity with an entrance measuring 7 inches wide and 3 inches high, extending horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with little or no recharge ability. No setback is recommended.

S58 Solution cavities. Two solutionally enlarged bedding planes on a shallow hillside with no defined catchment area. Each measures approximately 1 foot in diameter and extends to a depth of 2 feet to soil and leaf debris. This feature appears to extend horizontally along a bedding plane that pinches out with distance. The feature is interpreted to have limited recharge ability based on the location and infilling sediments. No setback is recommended.

S59 Solution cavity. This feature is a bedding plane solution cavity with an entrance measuring 8 inches wide, 5 inches high, and extends horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with no defined catchment area. It is infilled with fine sediments. No setback is recommended.

S60 Solution cavities. Two entrances within a limestone outcrop appear solutionally enlarged, and measure approximately 0.5 feet in diameter, and extend to a depth of 1.5 feet to soil and leaf debris. This feature appears to also be partially modified by animal burrowing. No setback is recommended.

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S61 Solution cavity. This feature is located on a hillside, measures 0.5 feet in diameter, and extends vertically a minimum of 3 feet. It is infilled with fine soil and loose leaf debris. No air or cave fauna was observed for this feature. It appears to have limited recharge ability based on location and infilling sediments. No setback is recommended.

S62 Collapsed sinkhole. This feature is a closed depression about 100 feet in diameter and 15 feet deep that does not appear to hold water, though no openings were observed within this feature. The feature is completely surrounded by limestone outcrop that locally contains caliche or possibly travertine along the exposed rock. The feature contains soil, chert, and limestone cobbles, and mature oak (up to 2 feet diameter) and persimmon trees. No evidence of manmade activities, such as spoil piles and dozer tracks/scrapes, was apparent surrounding the feature, although spoil piles (soil and Del Rio Clay) were dumped into 1 side of the sinkhole. This feature is coincident with S-44 (Fault). Setbacks for SCS and/or SAS is appropriate for this feature. Any untreated runoff should be diverted away from this feature.

S63 Solution cavity. This feature is an enlarged bedding with an entrance measuring 0.5 feet in diameter extending horizontally 2 feet deep. It is located on a hillside, infilled with fine sediments, and has a low relative infiltration rate. No setback is recommended.

S64 Fractures in drainage. A rock outcrop of steeply dipping fractures (20° to SE) measuring approximately 10 feet wide and 50 feet long located within a drainage. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 55°. These fractures are coincident with S-44 (Fault). Setbacks for SCS and/or SAS may be appropriate for this drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S65 Stock pond. This stock pond is 30 feet in diameter, 5 feet deep, and located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S66 Stock pond. This stock pond is 150 feet in diameter and 8 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

S67 Stock pond. This stock pond is 50 feet long, 30 feet wide, and 5 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S68 Solution cavity. This feature is a solution cavity developed along a bedding plane with an entrance measuring 0.5 feet in diameter extending horizontally along the bedding plane 1 foot deep until it pinches out. It is partially infilled with soil. This feature is located near a hilltop with no defined catchment area. Its relative infiltration rate and ability to transmit fluids appear to be none to low. No setback is recommended.

S69 Water well. This feature is an active water well with a large water storage tank. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S70 Stock pond. This feature measures approximately 25 feet in diameter, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S71 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S72 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S73 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S74 Solution cavity. This feature consists of a solutioned limestone hole measuring 1 feet in diameter, extending 2 feet deep to loose soil and leaf litter. No soil was piping into the feature and no air was observed to flow from the feature. This feature is located on a hillside with no defined catchment area. The infiltration rate is interpreted to be none to low. No setback is recommended.

S75 Solution cavity. This feature consists of a solutioned limestone hole measuring 0.3 feet in diameter and extends 5 feet to limestone cobbles. No soil was observed piping into the feature and no air was observed to flow from the feature. This feature appears to be developed along a fracture trending 20° that is coincident with an interpreted fault (S-44). Setbacks for SCS and/or SAS may be appropriate for this feature.

S76 Stock pond. This feature measures approximately 50 feet in diameter, up to 10 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S77 Stock pond. This feature measures approximately 50 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S78 Stock pond. This feature measures approximately 30 feet in diameter and up to 6 feet deep and apparently holds water but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S79 Solution cavity. This feature is a solution cavity developed along a bedding plane, with an entrance measuring approximately 1 foot in diameter extending subhorizontally 3 feet along the bedding plane. This feature is located on a hillside near a hilltop. Soil was observed piping into this feature. It has a 10-foot diameter defined catchment area. Based on the limited catchment area, size, and infilling sediments, no setback is recommended.

S80 Solution cavities (sinkholes). This feature consists of 2 solution cavities about 5 feet apart, within a single rock outcrop about 30 feet in diameter, located on the side of a hill. The entrances measure approximately 2.5 by 0.75 feet and 1.5 diameter, and both extend about 2.5 feet vertically to loose leaves and dirt that fall into the entrances off the hillside (< 10 acres). These features are developed along fractures that trend 0° to 10°. The fractures are interpreted to be a result of weathering of the side of the hill. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S81 Solution cavities. This feature contains 2 solution cavities developed along a bedding plane with entrances measuring approximately 1 foot in diameter extending subhorizontally along the bedding plane 3 feet deep. This feature is located within a drainage and nearly coincident with the fault zone (S44). Limestone beds within the drainage are observed to dip up to 12° to the north due to fault drag. Setbacks for SCS and/or SAS may be appropriate for this feature in the drainage.

S82 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S83 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S84 Stock pond. This feature measures approximately 30 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S85 Stock pond. This feature measures approximately 30 feet in diameter, up to 6 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S86 Fault zone. This fault zone was originally mapped by Hanson and Small (1994) and Baumgardner and Collins (1991). It is exposed in the CR 308 road cut. On the subject site, the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature where it is inferred. No solution features are associated with this fault and where it is inferred. Where the fault is seen at the CR 308 road cut it is on a hill top. The fault is inferred to exist northward beyond the hill by the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S87 Fault zone. This fault zone was mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. On the subject site the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature. Solution cavity S-94 is the only solution feature associated with the fault that is inferred north of the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S88 Stock pond. This feature is located on a hillside and measures approximately 150 feet in diameter and up to 6 feet deep. The stock pond holds water, but was empty during field investigation. Its drainage area is less than 10 acres and infilled with fine sediments. No setback is recommended.

S89 Closed depression (quarry). This man-made depression is approximately 10 feet wide by 30 feet long and up to 3 feet deep, filled with household garbage. No setback is recommended.

S90 Closed depression (quarry). This feature is a road base quarry measuring 50 feet in diameter and up to 3 feet deep. The outcrop is very brecciaed with fractures trending 40°, most likely due to nearby faulting (S86 and S87). No setback is recommended for this feature.

S91 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

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S92 Closed depression. This depression contains a buried 50-gallon drum, apparently used to incinerate household garbage. No openings or internal drainages were observed within this feature. This feature is man-made. No setback is recommended.

S93 Stock pond. This feature is located within a drainage and measures approximately 20 feet in diameter, up to 4 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S94 Solution cavity. This feature consists of a solution cavity about 1.5 feet in diameter and extends 2 feet vertically to compact soil and leaf litter. No airflow or fauna were associated with this feature during Horizon's field investigation. This feature is located adjacent to a drainage and fault S-87. Setbacks for SCS and/or SAS may be appropriate.

S95 Solution cavity. This feature consists of a solution cavity about 1.2 feet in diameter, extending 1.5 feet to compact soil and leaf litter. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is located on a hillside with no defined catchment area. It is Horizon's opinion that this feature has limited recharge ability. No setback is recommended.

S96 Stock pond. This feature measures approximately 50 feet long by 15 feet wide, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S97 Stock pond. This feature measures approximately 50 feet in diameter, up to 8 feet deep, and apparently holds water, but was dry during field investigation. No setback is recommended.

S98 Closed depression (road-base quarry). This feature was apparently a quarry that measures approximately 100 feet long by 25 feet wide and up to 3 feet deep. Mud cracks within the depression indicate that it periodically holds water. No openings or internal drainages were observed within this man-made feature. No setback is recommended.

S99 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S100 Solution cavity within a small, closed depression. The closed depression measures about 6 feet in diameter and contains a solution cavity developed along a bedding plane. The entrance to the solution cavity measures 1 foot in diameter extending 2 feet subhorizontally (~45°) along the bedding plane to loose leaf debris.

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No air was around the entrance to this feature. This feature is located on a hillside with limited catchment area. Based on the location of the feature and infilling sediments, no setback is recommended.

S101 Solution cavity. This feature is an enlarged fracture located on a hillside. No airflow or cave fauna were observed for this feature. The opening is 2 feet long by 2 inches wide and extends to a depth of at least 2 feet. The feature is infilled with fine sediments at the bottom. It has a drainage area that is less than 1 acre and its ability to transmit fluids is moderate. The fractures are interpreted to be a result of weathering on a hillside and its recharge ability is interpreted to be low. No setback is recommended.

S102 Solution cavity. This feature is located on a hillside within thick vegetation. The solution cavity appears to be an enhanced fracture with a 6-inch diameter opening. The solution cavity extends down at least 2 feet and is in filled with fine sediments at the base. The feature's ability to transmit fluid is none to low with a drainage area less than 1 acre. No setback is recommended.

S103 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet in diameter and up to 2.5 feet deep. Mud cracks, mesic grasses, and a shallow pool of water indicated the ability to hold water. No openings or internal drainage were observed within this man-made feature. No setback is recommended.

S104 Fault zone. Exposed within the S103 road base quarry is a fault plane, striking 45° and dipping 55° west, containing strongly expressed vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a greyish-white, dense, and crystalline limestone bed; the minimum displacement is about 10 feet. This fault comprises the northwestern side of a horst structure. This feature is located on a hilltop and associated with solution feature S105. No setback is recommended along the fault except for the area near S105.

S105 Solution cavity. This feature is located along a hillside, with an opening that measures approximately 2 feet by 6 inches and a depth of at least 1 foot. The feature appears to be an enlarged fracture that is infilled with fine sediments. It has a drainage area of less than 1 acre. The feature appears to be along a fault/fracture trend (S104). Setbacks for SCS and/or SAS may be appropriate.

S106 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet by 100 feet and is up to 1.5 feet deep. Mud cracks and mesic grasses indicated the ability to hold water and no openings or internal drainage were observed within this feature. No setback is recommended.

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S107 Fault zone. Exposed within the S106 road base quarry is a fault plane, striking 30° and dipping 70° east, containing weak, vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a grayish-white, dense, and crystalline limestone bed an unknown distance. This fault comprises the southeastern side of a horst structure. No solution features are associated with this feature. This feature is within 150 feet of fault S30. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects on the northern side. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S108 Fractured and vuggy rock. This feature consists of a rock outcrop on a hilltop measuring about 200 feet in diameter. Fracture density is 1 every 1 foot with apertures up to 2 inches and a trend of 55°. Fractures are generally open (locally solutioned); however, locally, apertures are cemented and filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 1 foot, locally connected, with apertures up to 2 inches. Setbacks for SCS and/or SAS may be appropriate for this feature.

S109 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 1 inch, and a trend of 110° to 90°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S110 Fractured and vuggy rock. This feature consists of a rock outcrop measuring about 200 feet by 50 feet within a streambed. Fracture density is 1 every 1 foot with apertures up to 0.5 inches and a trend of 50°. Fractures are generally open (locally solutioned); however, locally, apertures are filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 3 inches, and locally connected with apertures up to 3 inches. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S111 Vuggy rock. This feature consists of a vuggy rock outcrop about 300 feet long and up to 30 feet wide within York Creek. Vugs are generally unconnected with a density of 1 per 3 inches and up to 3-inch diameters. Setbacks for SCS and/or SAS are appropriate for this feature within the creek bed.

S112 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 1 to 1.5 feet high, extending horizontally along the bedding plane up to 5 feet deep pinching out to soil and organic debris.

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This feature does not appear to hold water. No flowing air or fauna were observed for this feature. The feature is interpreted to be the result of weathering with little to no potential for recharge. No setback is recommended.

S113 Fractured rock and possible collapsed sinkhole. This feature consists of a rock outcrop measuring up to 100 feet in diameter containing fractures and limestone beds that dip toward one another. The dipping beds may be the result of minor folding, undocumented faulting, or perhaps solutioning and collapse. Alluvial deposits within the drainage partially cover this feature, obscuring a more definitive interpretation. Fenestral porosity within nearby limestone outcrops indicates that this feature is most likely developed within the Kirschberg Evaporite Member of the Kainer Formation. Collapsed features can occur associated with the dissolution of evaporite minerals. Fracture density within the exposed outcrop varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 2 inches, and a trend of 60° to 90°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature. Horizon recommends excavation to determine if additional abatement measures are warranted.

S114 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high, extending horizontally along the bedding plane up to 12 feet deep pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S115 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high extending horizontally along the bedding plane up to 8 feet deep and pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S116 Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil appeared to be piping into the feature, though no airflow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44). Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

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S117 Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil and cobble-sized rocks appeared to be piping into the feature, though no air flow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44) and located about 100 feet to the north of S116. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S118 Sinkhole (potential cave). This feature consists of sinkhole within a closed depression about 20 feet in diameter and surrounded by Texas Persimmon trees. The sinkhole measures about 6 feet by 3.5 feet and extends a minimum of 3 feet to loose cobble- to boulder-sized rocks. A weak current of cool air was observed to flow from the sinkhole, and soil and rocks pipe into this feature. This feature is coincident with a fault zone (S44). Fire ants were observed within the entrance to the sinkhole. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S119 Solution cavity. This feature consists of a bedding plane cavity about 1 foot in diameter extending horizontally up to 2 feet to compact soil. The entrance is located about 4 feet from the bottom of a drainage. No airflow was associated with this feature during Horizon's field investigation. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S120 Solution cavity. This feature consists of a bedding plane cavity about 1.5 feet long by 0.5 feet high, extending horizontally up to 3 feet to compact soil. The entrance to the bedding plane cavity is located along the margin of a closed depression measuring about 5 feet in diameter that pipes soil into the cavity. The closed depression contains a hole (about 0.25 feet in diameter) that appears to pipe soil and extends vertically 1 feet. No airflow was associated any of these features during Horizon's field investigation. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S121 Solution cavity. This feature consists of a solutioned fracture trending about 170° (parallel to the hillside) that is about 3 feet long by up to 0.5 wide extending vertically up to 2.5 feet to cobbles, soil and leaf debris. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

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S122 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 1 foot, with apertures up to 2 inches and a trend of 120°, 90° and 35°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature where it intersects a creek bed or drainage. No setbacks are recommended on uplands where fault is buried and inferred.

S123 Fractured rock. This feature consists of a rock outcrop measuring up to 25 feet wide and 100 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 35° and locally 135°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature within a creek bed or drainage. No setbacks are recommended on uplands where fault is buried.

S124 Solution cavities. This feature consists of 3 solution cavities with dimensions of 1 by 0.5 feet. The outcrop that contains the cavities is about 20 feet in diameter and located on a hillside. The cavities each extend approximately 1 foot deep to compact soil. No airflow or fauna was associated any of these features during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

S125 Fractured rock. This feature consists of a rock outcrop measuring up to 30 feet wide and 200 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 52° and 155°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS may be appropriate for this feature where it is exposed in the bed of the drainage.

S126 Stock pond. This feature is located on a hilltop and measures approximately 25 feet long by 10 feet wide and up to 2 feet deep. This feature most likely holds water, but not very much, and was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S127 Rock quarry. This small rock quarry is located adjacent to a dirt road and measures approximately 20 feet long by 10 feet wide by 3 feet deep. The feature has a drainage area that is less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

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S128 Solution cavity. This feature is located on a hillside, with a drainage area of less than 1 acre. The opening measures 6 inches long by 8 inches wide and has a depth of at least 1 foot. After a depth of 1 foot, a limestone floor is reached and the opening continues along a bedding plane. It is in filled with fine sediments and its ability to transmit fluids appears to be none to low. No setback is recommended.

S129 Rock quarry. This feature is located along a hillside adjacent to a road and the property fence line. The quarry measures approximately 20 feet in diameter, with a depth of about 1 foot. It has a drainage area of less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

S130 Rock quarry. This closed depression created by excavation for road base. The feature measures about 50 feet in diameter and up to 1 foot deep within a hillside. No openings or internal drainage were observed within this feature. No setback is recommended.

S131 Solution cavity. This feature consists of a solution cavity within a closed depression about 8 feet in diameter and up to 2.5 feet deep. The solution cavity is about 0.5 feet in diameter and extends up to 1 foot deep to loose leaf and soil debris that appear to pipe into the cavity. This feature was previously labeled S134 in a draft report and S137 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

S132 Stock pond. This pond measures about 150 feet in diameter and is up to 8 feet deep. This feature was observed to hold water and contain no exit portals. The ability to hold water for this feature indicates the low permeability. This feature was previously labeled S135 in a draft report and S138 in the field. No setback is recommended.

S133 Fractures and solution cavity. This feature consists of a rock outcrop measuring up to 50 feet in diameter. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 055°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. A solution cavity, measuring about 6 feet in diameter and up to 3 feet deep, is exposed in the outcrop. This feature was previously labeled S136 in a draft report and S139 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature

S134 Solution cavities. This feature consists of 3 solution cavities. One cavity is a solution fractures up to 4 feet long, 0.5 feet wide and 2.5 feet deep, trending 75°. The second cavity is about 1 foot in diameter and up to 2 feet deep on the same trend as the fracture. A third feature is a cavity about 1.5 by 0.5 feet and extends subhorizontally about 3 feet. This feature was previously labeled S137 in a draft report and S140 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature

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S135 Closed depression zone. This feature consists of a zone with up to 3 natural closed depressions measuring about 50 feet in diameter and up to 1.5 feet deep, filled with black soil and scattered chert cobbles. No openings or internal drainages were observed within the feature. This feature was previously labeled S138 in a draft report and S141 in the field. Any untreated runoff should be diverted away from this feature. No additional setbacks are warranted.

S136 Sinkhole (potential cave). This feature consists of a sinkhole measuring about 10 feet in diameter and about 5 feet deep, with exposed limestone around the perimeter of the feature. Two cavities extend into the subsurface to the east and west an unknown distance and appear to pipe soil and leaf debris. The sinkhole is filled with loose cobbles and organic debris. Fractures trend 235° coincident with 1 side of the sinkhole. This feature was previously labeled S139 in a draft report and S142 in the field. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

A1 Stock tank. This stock tank is located approximately 100 feet northwest of the subject site and exposes red soils and an outcrop of angular breccia composed of limestone and chert fragments within a fine-grained matrix interpreted to be fault gouge. This tank is approximately 25 feet in diameter and up to 5 feet deep and did not appear to hold water. However, due to its large catchment basin, exposed breccia, and its position on a fault zone, it may provide relatively minor recharge. This feature is coincident with the fault zone S29. Any untreated runoff should be diverted away from this feature.

A2 Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane strikes 20°, dips 50°E, and has a vertical displacement (vertical slickensides) of a crystalline limestone bed of about 1.5 feet. Beds dip 13°W within the quarry due to fault drag, indicating that a fault with larger displacement is likely nearby. Fractures within the quarry trend 70° and 45°. This feature is located off-site and within a drainage. No setback is recommended.

A3 Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane contains a 1-inch thick zone of fault gouge and strikes 115°. A crystalline limestone bed is apparently displaced about 0.5 feet. Beds dip 8°S within the quarry due to fault drag. Fractures within the quarry trend 035° and 050°. This feature is located on the side of a hill and off-site. No setback is recommended.

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A4 Fault zone. This feature consists of a fault zone located south of the subject site. A strong vegetation lineament is coincident with this feature. It does not cross any drainages that are within 300 feet of the subject site. No setback is recommended.

A5 Stock tank. This feature was mapped by Baumgardner and Collins (1991) as a karst sinkhole. This feature holds water along the eastern portion. This feature is coincident with fault zone A-4. Any untreated runoff from the subject site should be diverted away from this feature. Setbacks for SCS and/or SAS are appropriate for this feature.

5.0 PARTICIPATING PERSONNEL

Horizon's participating personnel for this Geologic Assessment are listed below. Resumes for participants are provided in Appendix F.

PERSON	PARTICIPATION
Kristin Miller, Senior Staff Geologist	Field Investigation
Jason John, Geologic Field Technician	Field Investigation
Greg Sherrod	Field Investigation, Records Search
Joe Waring	Field Investigation, Records Search

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6.0 REFERENCES

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(TNRCC) Texas Natural Resource Conservation Commission. *Complying with the Edwards Aquifer Rules: Administrative Guidance.* Revised August 1999.

_____. Edwards Aquifer Recharge Zone Boundary Maps. 1996

(TWDB) Texas Water Development Board. Water Well Drillers' Records. July 2000.

(UT-BEG) University of Texas - Bureau of Economic Geology. *Geologic Atlas of San Antionio Sheet.* The University of Texas at Austin. Revised 1983.

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APPENDIX A

GEOLOGIC ASSESSMENT TABLE

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GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch — **HJN 000211 GA**

RECEIVED
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COUNTY ENGINEER

FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																		
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB- TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
		C 35 CD 10 FR 0 FZ 15 MM 35 SC 10 SH 20 VR 0 Z 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
	S1	CD	10	Kek	150	150	15					0								5			0			15	15			0					10			10	10			YES
5,6,7,8	S2	FR	0	Kek						200/30	140-160	10			10		5			5			0			30		30					15				35			35	YES
5,6,7,8	*S3	SC	10	Kep	10	10	4														10				30	50		50		0					10			10	10			YES
	S4	C		Kep				30	6	30												15			30	45		45		0					10			10	10			YES
	S5	SC	10	Kek				2	2	1										5			0			15	15			0					10			10	10			YES
5,6,7,8	S6	FZ	15	Kek						50/15	15	10												10		35		35				15					20	35			35	YES
5,6,7,8	S7	FR	0	Kek						40/15	85-125	10			10	0			0				0			20	20				5				10			20	15		15		YES
5,6,7,8	S8	FR	0	Kek						40/30	120	10			10	0			0				0			20	20					15					20	35			35	YES
	S9	SC	10	Kep				1	1	1										5			0			15	15			0				5				5	5			YES
	S10	SC	10	Kep				0.5	4	4										5			0			15	15			0				5				5	5			YES
5,6,7,8	S11	FR	0	Kep						30/15	30-110	10		5		0				5			0			20	20					10					20	30			30	YES
5,6,7,8	S12	FR	0	Kek							60	10		5		0				5			0			20	20					10					20	30			30	YES
5,6,7,8	*S13	SH	20	Kek	3.5	3.5	3				45	10									10			10		50		50			5				10			15		15		YES
5,6,7,8	S14	FR	0	Kek						50/20	90-120-150	10		5			5			5			0			25		25				10					20	30			30	YES
5,6,7,8	S15	FR	0	Kek						50/20	100	10		5			5			5			0			25		25				10					20	30			30	YES
	S16	SC	10	Kep				1	6	1										5						15	15			0					10			10	10			YES
	S17	SC	10	Kek				1	1	1										5			0			15	15			0					10			10	10			YES
5,6,7,8	S18	FZ	15	Kek							45	10								5				10		40		40				15					20	35			35	YES
5,6,7,8	S19	FZ	15	Kek							30	10								5			0			30		30				15					20	35			35	YES
	S20	FR	0	Kek						20/20	100			5					0					10		15	15				10					20	30			30	YES
	S21	MM	35	KeP																					30	65			65	0					10			10	10			YES
	S22	MM	35	KeP																					30	65			65	0					10			10	10			YES
	S23	MM	35	Kep																					30	65			65	0					10			10	10			YES
	S24	MM	35	Kbu																					30	65			65	0					10			10	10			YES
5,6,7,8	S25	FR	0	KeK						50/50	115			5			5			5			0			15	15			0					10			10	10			YES
5,6,7,8	S26	FZ	15	Kek/Kep							~60	10								5			0			30		30				15					20	35			35	YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and followed the Texas Natural Resource Conservation Commission's Instructions to Geologists. TI information presented here complies with that document and is a true representation of the conditions observed in the field.

Kristin Miller — 19-Sep-01

Geologist signature — Date

TNRCC-0585-Table (Rev. 6/1/99)

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch — **HJN 000259 GA**

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COUNTY ENGINEER

| | FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch — HJN 000259 GA

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| | FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch **HJN 000259 GA**

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COUNTY ENGINEER

	FEATURE ID			FEATURE CHARACTERISTICS																												PHYSICAL SETTING															
	1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
	LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COMMENTS
					C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
		C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
4	S71	CD	10	Kek	60	60	5														5			0			15	15				5				10			15		15		YES
4	S72	CD	10	Kep	60	60	5														5			0			15	15				5				10			15		15		YES
4	S73	CD	10	Kep	30	30	7														5			0			15	15				5				10			15		15		YES
4	S74	SC	10	Kep	1	1	2														5				10		25		25		0					10			10	10			YES
4	S75	SC	10	Kep	1	1	5					20									5				10		25		25		0					10			10	10			YES
4	S76	CD	10	Kep	50	50	10														5			0			15	15					10			10			20		20		YES
4	S77	CD	10	Kep	50	50	7														5			0			15	15					10			10			20		20		YES
4	S78	CD	10	Kep	30	30	6														5			0			15	15					10			10			20		20		YES
4	S79	SC	10	Kep	1	1	3														5				10		25		25		0					5			5	5			YES
4	S80	SC	10	Kep	2.5	0.8	2.5																15			30	55		55				10			10			20		20		YES
4	S81	SC	10	Kep				1	3	1											5				10		25		25			5				10			15		15		YES
4	S82	CD	10	Kep	30	30	7														5			0			15	15				5				10			15		15		YES
4	S83	CD	10	Kep	30	30	7														5			0			15	15				5				10			15		15		YES
4	S84	CD	10	Kep	30	30	5														5			0			15	15				5				10			15		15		YES
	S85	CD	10	Kep	30	30	6														5			0			15	15				5				10			15		15		YES
5,6,7,8	S86	FZ	15	Kek/Kep								~45	10								5			0			30		30				10					20	35			35	YES
5,6,7,8	S87	FZ	15	Kek/Kep								~45	10								5			0			30		30				10					20	35			35	YES
	S88	CD	10	Kek	150	150	6														5			0			15	15					10			10			20		20		YES
	S89	CD	10	Kbu	10	30	3														5			0			15	15			0					5			5	5			YES
	S90	CD	10	Kbu	50	50	3														5			0			15	15			0					5			5	5			YES
	S91	MM	35	Kbu																	5					30	70			70	0					10			10	10			YES
	S92	CD	10	Kbu	2	2	3														5			0			15	15					10					20	30			30	YES
	S93	CD	10	Kek	20	20	4														5			0			15	15					10					20	30			30	YES

SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and 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.

Kristin Miller — 19-Sep-01

Geologist signature — Date

TNRCC-0585-Table (Rev. 6/1/99)

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch — **HJN 000259 GA**

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| | FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch — **HJN 000259 GA**

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	FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																					
	1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
	LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COMMENTS
					C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
		C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
4	S117	SC	10	Kek	1	1	1					~45	10									10					40		40			5					10			15		15		YES
4	S118	SH	20	Kek	3.5	6	3					~45	10									10				30	70			70			10					10			20		20		YES
5,6,7,8	S119	SC	10	Kek				1	2	1											5			0			15	15				5					10			15		15		YES
5,6,7,8	S120	SC	10	Kek				1.5	3	0.5											5			0			15	15				5					10			15		15		YES
5,6,7,8	S121	SC	10	Kek	3	0.5	2.5					170	10									10				10	40		40			5					10			15		15		YES
5,6,7,8	S122	FR	0	Kek							50/10	120,90	10		5			5			5				10		35		35			10							20	30			30	YES
5,6,7,8	S123	FR	0	Kek							25/100	135, 35	10		5			5			5				10		35		35			10							20	30			30	YES
5,6,7,8	S124	SC	10	Kek	1	0.5	1														5				10		25		25	0						10			10	10			YES
5,6,7,8	S125	FR	0	Kek							30/200	155, 052	10		5			5			5				10		35		35			15							20	35			35	YES
5,6,7,8	S126	CD	10	Kek	25	10	2														5			0			15	15		0					5				5	5			YES
5,6,7,8	S127	CD	10	Kek	20	10	3														5			0			15	15		0					5				5	5			YES
5,6,7,8	S128	SC	10	Kek	0.5	0.5	1														5				10		25		25	0						10			10	10			YES
5,6,7,8	S129	CD	10	Kek	20	20	1														5			0			15	15		0						10			10	10			YES
5,6,7,8	S130	CD	10	Kek	50	50	1														5			0			15	15		0						10			10	10			YES
5,6,7,8	*S131	SC	10	Kep	8	8	2.5														5			0			15	15		0						10			10	10			YES
5,6,7,8	S132	CD	10	Kep									10								5			0			25		25	0						10			10	10			YES
	S133	FRZ	35	Kep	10	10	5					50/50	10		5			5			5				10		25		25			5					10			15		15		YES
5,6,7,8	*S134	SC	10	Kep	4	0.5	2.5				60/60	75	10								5				10		70					5					10			15		15		YES
5,6,7,8	S135	CD	10	Kep	50	50	1														5			0			35		35			5					10			15		15		YES
	S136	SH	20	Kep	10	10	5					235	10									10				30	70			70	0						10			10	10			YES
5,6,7,8	A-1	CD	10	Kek	25	25	5						10								5			0			25		25			5					10			15		15		YES
5,6,7,8	A-2	FZ	15	Kek								~020	10								5			0			30		30			5					10			15		15		YES
5,6,7,8	A-3	FZ	15	Kek								~115	10								5			0			30		30			5								5	5			YES
5,6,7,8	A-4	FZ	15	Kek/Kep								~50	10								5				10		40		40			5								5	5			YES
5,6,7,8	A-5	CD	10	Kek	1000	400	15					~45	10								5			0			25		25				10				10			20		20		YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

TNRCC-0585-Table (Rev. 6/1/99)

I have read, understood, and 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.

Kristin Miller — 19-Sep-01

Geologist signature — Date

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APPENDIX B

GEOLOGIC STRATIGRAPHIC COLUMN

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GEOLOGIC STRATIGRAPHIC COLUMN

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
Quaternary		Quarternary Alluvium		~10	Qal	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits within creekbeds. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Late Tertiary to Quaternary		equivalent of the Uvalde Gravel deposits		~10	Q-Tgr	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Upper Cretaceous	Upper confining unit	Buda Limestone		40 to 50	Kbu	Hard limestone, gray to tan, dense, nodular, abundant fossil mollusks. Low porosity and permeability. Minor surface karst development.
		Del Rio Clay		40 to 50	Kdr	Dark gray to olive brown clay, pyritic, gypsiferous, calcareous with abundant *lymatogyra arietina, Waconella wacoensis*. No porosity or permeability. No cave development. Primary upper confining unit of Edwards Aquifer.
Lower Cretaceous	I	Georgetown Formation		less than 10	Kgt	Gray to light tan marly limestone containing abundant fossil shells *Waconella wacoensis*. Low porosity and permeability. No cave development.
	II	Person Formation of the Edwards Group	Cyclic & Marine members, undivided	80 to 100	Kep2	Light tan, massive mudstone to packstone and *Miliolid* grainstone with boxwork vugs and chert. One of the most permeable members. Many subsurface caves.

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System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	III	Person Formation of the Edwards Group	Leached and Collapsed members, undivided	80 to 100	Kep3	Light gray, bioturbated iron-stained beds separated by thick limestone composed of crystalline limestone, mudstone to wackestone and *Miliolid* grainstone; chert; collapsed breccia. One of the most porous and permeable. Many developed caves.
	IV	Person Formation of the Edwards Group	Regional Dense	20 to 24	Kep4	Light tan, wispy, dense, argillaceous mudstone. Low permeability and acts as a vertical barrier. No cave development.
	V	Kainer Formation of the Edwards Group	Grainstone	50 to 60	Kek5	Light gray to white, Miliolid, crossbedded grainstone; mudstone to wackestone; chert. Reduced permeability due to recrystallization. Few developed caves.
	VI	Kainer Formation of the Edwards Group	Kirschberg evaporite	50 to 60	Kek6	Light gray, highly altered crystalline limestone; chalky mudstone; chert; contains boxwork voids with neospar and travertine frame. One of the most porous and permeable subdivisions. Probably extensive cave development.
	VII	Kainer Formation of the Edwards Group	Dolomitic	110 to 130	Kek7	Thick-bedded, light gray mudstone to grainstone; crystalline limestone; chert. Massively bedded, light gray, with abundant *Toucasia*. Locally permeable and water-yielding. Caves related to structure or bedding planes.
	VIII	Kainer Formation of the Edwards Group	Basal Nodular	50 to 60	Kek8	Massive shaly, fossiliferous, nodular and mottled limestone; mudstone; miliolid grainstone. Usually low permeability and few caves.

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System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	Lower Confining Unit	Upper Glen Rose		350 to 500	Kgr	Alternating strata of marl, dolomite, and limestone. Lower confining unit of the Edwards Aquifer. Relatively impermeable with some surface cave development.

REFERENCES:

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_____. *Geologic Map of the Austin Area.* The University of Texas at Austin. Reprinted 1992.

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APPENDIX C

SITE GEOLOGIC MAP

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APPENDIX D

RESUMES OF PARTICIPANTS

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RESUMES OF KEY PERSONNEL

Corporate Experience

Horizon Environmental Services, Inc. (Horizon) has performed hundreds of Geologic Assessments to complete Water Pollution Abatement Plans within the Edwards Aquifer Recharge Zone. The geographic extent of Horizon's Geologic Assessments includes Bexar, Comal, Hays, Travis, and Williamson Counties of Texas, in support of Edwards Aquifer protection.

Horizon is particularly well-qualified to provide both the technical and administrative support required for project planning and permitting efforts related to various federal and state permits or approvals. Overall corporate services provided by Horizon focus primarily upon environmental services other than those related to hazardous substances. However, we have personnel who are ASTM-trained and who have several years of applied experience in performing Phase I Environmental Site Assessments (ESAs) and due diligence reviews for property (real estate) transfers. Horizon's capabilities and experience are very broad in compliance with the National Environmental Policy Act (NEPA), particularly as related to multidisciplinary Environmental Assessments and Environmental Impact Statements (EISs), jurisdictional wetlands, endangered species, cultural resource issues, geologic assessments, cave management, and expert testimony.

Horizon is an Austin-based Texas Corporation with additional offices in Beaumont and Houston, Texas, and Shreveport, Louisiana. Founded in 1987, Horizon is a small-business enterprise as defined by Section 3 of the Small Business Act and the standards established by the Small Business Administration Regulation under CAR 121.

Services which Horizon provides for various clients include jurisdictional wetland determinations; endangered species habitat assessments and surveys; archeological surveys and mitigation (prehistoric and historic); ecological risk and damage assessments; Phase I environmental site assessments; wildlife habitat and wetlands restoration or creation; baseline aquatic and terrestrial investigations (inland and coastal); HEP analyses; IFIM analyses; environmental constraints analyses for alternative project sites, routes, and land development scenarios ("fatal flaw" analyses); post-project land use planning and mitigation; multidisciplinary Environmental Assessments in support of federal and state Environmental Impact Statements; and permit management including preparation, agency coordination, and expert testimony.

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Kristin Miller, RPG

Kristin Miller is a graduate of the University of Texas at Austin with 2 bachelor degrees in Geological Sciences and Geography (Environmental Resource Management). Ms Miller is currently working on a master's program at UT-Austin in Geomorphology with a specialization in karst sediment transport. She is Registered Professional Geologist (Mississippi Registration #0523), Environmental Specialist, Senior Staff Project Manager, and Senior Staff Geologist with Horizon. Ms. Miller has more than 9 years experience in environmental consulting and 7 years experience at the Texas Natural Resource Conservation Commission (formerly Texas Water Commission) and Texas Water Development Board.

Ms. Miller is an ASTM-trained Environmental Site Assessment (ESA) Professional and has hundreds of Phase I ESAs in the State of Texas. Ms. Miller provides due diligence investigations regarding the potential for hazardous substance liabilities. Ms. Miller prepares Phase I ESAs that meet or exceed nationally accepted standards set by the ASTM Practice E-1527-97. Ms. Miller has been caving since 1982, where she began as a tour guide and part-time volunteer, surveying Inner Space Caverns in Georgetown, Texas. Ms. Miller has performed hundreds of geologic assessments within the Edwards Aquifer Recharge Zone in Central Texas. She is a member of the Geological Society of America, Austin Geological Society, and National Speleological Society.

Ms. Miller's resume includes geologic assessments; cave studies; karst investigations; cave closure and management plans; NOI and FERC documentation; biological sampling; integrated pest management; endangered species habitat assessments; population surveys; territory mapping; wetland determinations and planting, project management; and state, local, and federal environmental permitting assistance. She is authorized to conduct biological sampling and is listed on Horizon's Scientific Collection Permits. Ms. Miller has conducted hundreds of endangered species habitat assessments for the federally protected golden-cheeked warbler, black capped-vireo, and cave-invertebrate species. She provides technical, biological, and geological support and on-site investigations for Environmental Impact Statements throughout Texas and Louisiana.

Jason John

Jason John graduated from the Colorado School of Mines in 1995 with a Bachelor of Science degree in Geophysical Engineering and a minor in Geology. He is currently a geologic field technician at Horizon and is studying Stratigraphy in the graduate program at UT. While in undergraduate and graduate school, Mr. John worked as a geoscience intern in Texas, Louisiana, and Alaska where he produced isopach structural porosity, permeability, water saturation, and net sand maps for key reservoir horizons of an undeveloped reservoir and conducted research on stratigraphic, structural, exploration histories. Mr. John researched and compiled regional cross-sections of the Gulf of Mexico and synthesized several of them to gain a regional understanding of the subsurface structure, stratigraphic units, and facies changes of the onshore area. He also

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worked for the Department of Water Resources in Arizona as an Engineering Aide where he conducted snow and rain surveys and prepared geologic maps for digitization. Mr. John's computer skills include ARCview, GEOLOG, Geoquest, AutoCAD, and technical software programs.

Joe Waring

Joe Waring is an EMS-trained field technician at Horizon who provides administrative and technical support for field mapping, karst surveys, cave mapping and exploration, water well inventories, endangered species record searches, background research, and wetland restoration/design.

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Horizon

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Beaumont, TX
Houston, TX
Kames City, TX
Pittsburg, TX
San Antonio, TX
Shreveport, LA
Ann Arbor, MI

HJN 000259
GEOLOGIC ASSESSMENT
FOR
400-ACRE PROPERTY
PFEUFFER RANCH
AT
COUNTY ROAD 306
COMAL COUNTY, TEXAS

PREPARED FOR:

SOUTHERLAND PROPERTIES
WIMBERLY, AUSTIN

PREPARED BY:

HORIZON ENVIRONMENTAL SERVICES, INC.

JANUARY 2001

HORIZON ENVIRONMENTAL SERVICES, INC.
P.O. Box 162017 • Austin, Texas 78716 • 2600 Dellana Lane, Suite 200 • Austin, Texas 78746
(512) 328-2430 • FAX (512) 328-1804 • http://www.horizon-esi.com

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LIST OF FIGURES

FIGURE

1 RECHARGE ZONE BOUNDARY MAP 2

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APPENDIX

A GEOLOGIC ASSESSMENT TABLE
B STRATIGRAPHIC COLUMN
C SITE GEOLOGIC MAP
D TNRCC SOLUTION FEATURE NOTIFICATION FORM
E RESUMES OF PARTICIPANTS

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Horizon
ENVIRONMENTAL SERVICES, INC.

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TNRCC GEOLOGIC ASSESSMENT FORM

FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE/TRANSITION ZONES
AND RELATING TO 30 TAC §213.5(b)(3), EFFECTIVE JUNE 1, 1999

PROJECT NAME: 400-ACRE PROPERTY, PFEUFFER RANCH AT COUNTY ROAD 306, COMAL COUNTY, TEXAS.

TYPE OF PROJECT: X WPAP __ AST __ SCS __ UST

LOCATION OF PROJECT: X Recharge Zone __ Transition Zone __ Contributing Zone

PROJECT INFORMATION

1. X Geologic or manmade features are described and evaluated using the attached **GEOLOGIC ASSESSMENT TABLE (Appendix A)**.

2. Soil cover on the project site is up to 6.6 feet thick. In general, the soil present appears to have the ability to:

   __ transmit fluid flow to the subsurface.
   X impede fluid flow to the subsurface.

3. X **SOILS ATTACHMENT**. A narrative description of soil units and a soil profile, including thickness and hydrologic characteristics are provided in Section 5.0 of the Additional Comments section at the end of this form.

4. X A **STRATIGRAPHIC COLUMN** is attached at the end of this form that shows formations, members, and thicknesses. The outcropping unit should be at the top of the stratigraphic column (Appendix B).

5. X A **NARRATIVE DESCRIPTION OF SITE SPECIFIC GEOLOGY** is attached at the end of this form in the Additional Comments section. The description must include a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure, and karst characteristics of the site.

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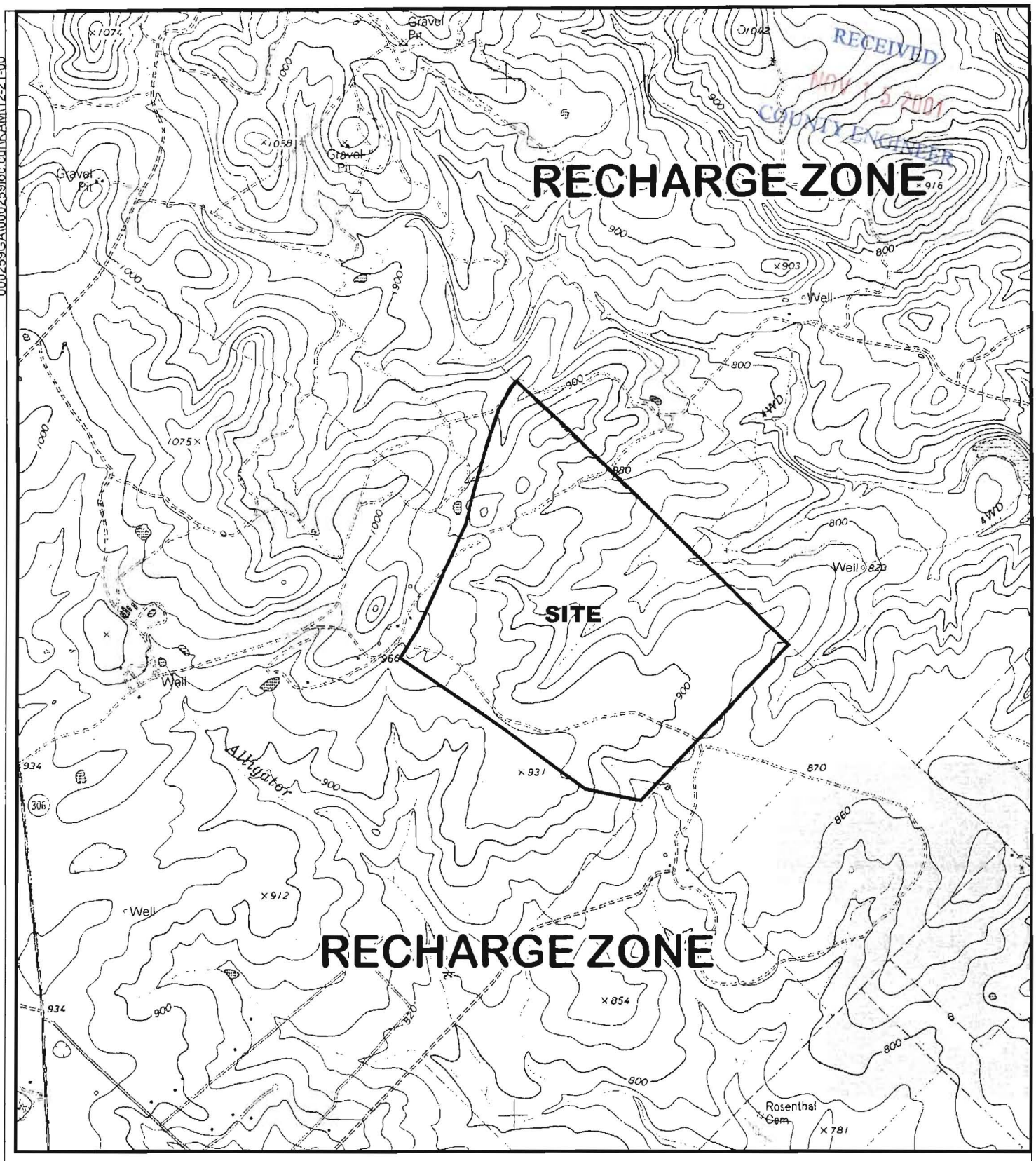

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BASE MAP SOURCE: U.S. GEOLOGICAL SURVEY, 7.5' SERIES, HUNTER QUADRANGLE, 1994.

0 1000 2000
SCALE IN FEET

N



SITE LOCATION MAP

400-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 000259 GA
December 2000

Horizon
ENVIRONMENTAL SERVICES, INC.

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6. X Appropriate **SITE GEOLOGIC MAP(S)** are attached (Appendix C):

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" = 400 '
Site Geologic Map Scale	1" = 400 '

7. Method of collecting positional data:
   X Global Positioning System (GPS) technology.
   __ Other method(s).

8. X The project site is shown and labeled on the Site Geologic Map.

9. X Surface geologic units are shown and labeled on the Site Geologic Map.

10. X 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.

11. X The Recharge Zone boundary is shown and labeled, if appropriate.

12. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.):

    __ There are ___(#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply.)
       __ The wells are not in use and have been properly abandoned.
       __ The wells are not in use and will be properly abandoned.
       __ The wells are in use and comply with 16 TAC §76.
    X There are no wells or test holes of any kind known to exist on the project site.

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ADMINISTRATIVE INFORMATION

13. X One (1) original and three (3) copies of the completed assessment has been provided.

Date(s) Geologic Assessment was performed:

7, 12, 19, 21, 26, 28 of September 2000
Date(s)

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 213.

Jason John
Print Name of Geologist

(512) 328-2430
Telephone

For Horizon Environmental Services, Inc.

(512) 328-1804
Fax

Signature of Geologist

2 January 2001
Date

Representing: Horizon Environmental Services, Inc., Austin, Texas

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400-ACRE PROPERTY
PFEUFFER RANCH
AT
COUNTY ROAD 306
COMAL COUNTY, TEXAS

ADDITIONAL COMMENTS
HJN 000259

This report provides the results of a geologic assessment conducted by Horizon Environmental Services, Inc. (Horizon) on the above-referenced site. Horizon conducted the field reconnaissance on the 7, 12, 19, 21, 26, 28 of September 2000. Horizon spent a minimum of 150 person hours in the field evaluating the site and surrounding area.

1.0 KARST INVESTIGATION METHODOLOGY

This geologic assessment includes a review of the site for potential aquifer recharge and documentation of general geologic characteristics for the subject site. Horizon conducted the necessary field and literature studies to meet or exceed Texas Natural Resource Conservation Commission (TNRCC) requirements. Horizon walked transects spaced 50 feet apart and mapped the location of features, if any, using a hand-held global positioning system (GPS), topographic maps, and aerial photographs. Horizon walked concentric circles (looking for karst features) around any areas showing evidence of internal drainage, including characteristics such as soil piping, solutionally enlarged voids or fractures, slumping, evidence of historic filling practices, extremely disturbed areas, or collapsed sinkholes.

The results of this survey do not preclude the possibility of finding subsurface voids or abandoned test or water wells during the clearing or construction phases of the proposed project. If a subsurface void is encountered during any phase of the project, construction should be halted until the TNRCC (or appropriate agency) is contacted and the feature investigated by a geologist. Water well use and closure regulations are discussed in Section 3.0. Solution feature notification forms are provided in Appendix D and protocol is discussed in Section 3.0.

2.0 ENVIRONMENTAL SETTING

2.1 LAND USE

The subject property consists of partially cleared, unimproved pasture and woodlands used for and livestock grazing. Surrounding land use consists of undeveloped ranch land with single-family residential houses.

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2.2 VEGETATION

Vegetation on the site consists of mostly open grasslands with scattered trees on the uplands, and woodlands within and along lowlands (drainages). Ashe juniper (*Juniperus ashei*) control has been practiced on the subject site, creating open grasslands on the uplands. Woodlands are dominated by plateau live oak (*Quercus fusiformis)*, Texas oak (*Quercus buckleyi*), Ashe juniper, and cedar elm (*Ulmus crassifolia*).

2.3 TOPOGRAPHY AND SURFACE WATER

Topographically, the subject site contains hills and valleys, with surface elevations ranging from 820 to 960 feet above mean sea level (MSL). Surface water drains via overland sheetflow and along well-developed drainages that flow primarily northeast into York Creek. No portion of the subject site is within the 100-year floodplain (FEMA, 1986).

2.4 RECHARGE ZONE BOUNDARY

The above-referenced site is within the Edwards Aquifer Recharge Zone as mapped by the TNRCC (TNRCC, 1996). The Recharge Zone is known as the area where the stratigraphic units constituting the Edwards Aquifer are exposed at the surface and where water may filter in the aquifer through permeable features such as cracks, fissures, caves and other openings in these layers (TNRCC, 1999). The Recharge Zone includes other geologic formations in proximity to the Edwards Aquifer, where caves, sinkholes, faults, fractures, or other permeable features may create a potential for recharge of surface waters into the Edwards Aquifer (TNRCC, 1999). The Recharge Zone is identified as that area designated as such on official maps located in the appropriate regional office and groundwater conservation districts.

2.5 DESCRIPTION OF ON-SITE GEOLOGY AND RECHARGE ABILITY

The subject site is found within the Edwards Aquifer Recharge Zone (TNRCC, 1996). According to published geologic maps of the region and Horizon's field investigation, the subject site is underlain by the Kainer and Person Formations of the Edwards Group limestones and the Georgetown, Del Rio, and Buda limestone formations. The site geologic map (Appendix C) was created from outcrop maps and areal photographs allowing modification of published geologic maps (UT-BEG, 1982; Baumgardner and Collins, 1991; Hanson and Small, 1994). Following is a description of the site-specific geology, potential for fluid movement, stratigraphy, structure, and karstic characteristics of the site.

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2.5.1 Kirschberg Evaporite Member (Kek_6)

The Kirschberg Evaporite Member of the Kainer Formation (Hydrogeologic Subdivision VI of the Edwards Group) is regionally described as crystalline and chalky limestone with lenses and nodules of chert about 50 feet thick. Primary field characteristics of the Kirschberg Evaporite Member on the subject site include thin to thickly bedded buff to greyish-white mudstones with fenestral porosity. Fenestral porosity (arranged in long rows parallel to bedding) suggests the remains of dissolved gypsum nodules within this unit (Rose, 1972).

This unit is exposed in the northern corner of the subject site and contains several karst features associated with a fault zone (S-33) including solution cavities, fractured rock, and a closed depression. This member is described as the most porous and permeable member of the Kainer Formation and is host to extensive cave development in Comal County (Hanson and Small, 1994).

2.5.2 Grainstone Member (Kek_5)

The Grainstone Member of the Kainer Formation (Hydrologic Subdivision V of the Edwards Group) is exposed in northern corner of the subject site above the Kirschberg Evaporite Member. Primary field characteristics of the Grainstone Member on the subject site include white, cross-bedded, *Miliolid* and bivalve grainstones; locally, the member consists of bivalve wakestones and mudstones. Regionally, the Grainstone Member is described as a dense, tightly cemented *Miliolid* grainstone, with some mudstone and wackestone. The Grainstone Member is reported to be about 50 feet thick (Hason and Small, 1994). A *Toucasia* bed is reported to be located at the top of the Grainstone Member (Rose, 1972).

The Grainstone Member is highly recrystallized, thereby reducing its permeability and porosity. However, interparticle and intraparticle porosity and fracture porosity and permeability (due to faulting) are locally present. A single solution cavity (S-34) occurs within this member and is likely related to fractures parallel to the nearby faulting (S-34 and S-35). Few caves are known to develop in this formation in Comal County; however, many caves in Bexar County have entrances in the lower part of this subdivision that provide access to the Kirschberg Evaporite Member below (Hanson and Small, 1994; Stein and Ozuna, 1995).

2.5.3 Regional Dense Member (Kep_4)

The Regional Dense Member of the Person Formation (Hydrologic Subdivision IV of the Edwards Group) is regionally described as a dense, argillaceous mudstone (Rose, 1972; Hanson and Small, 1994). The Regional Dense Member is reported to be about 20 to 24 feet thick in Comal County (Hanson and Small, 1994). Primary field characteristics of the Regional Dense Member on the subject site include white, nodular, chalky, bivalve mudstones, which were extremely useful as a stratigraphic marker during geologic mapping.

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The Regional Dense Member has little permeability or porosity overall and is known as the least porous or permeable subdivision (Hanson and Small, 1994). The Regional Dense Member does not typically produce large caves near the subject site, though it does contain a few vertical-shaft caves with major horizontal cavern development either above or below the member. Hanson and Small (1994) describe this member as a possible confining unit locally within the Edwards Aquifer. However, faults and fractures (S-14, S-19, S-38) may greatly reduce the confining effects of this member locally.

2.5.4 Leached and Collapsed Member (Undivided) (Kep_3)

The Leached and Collapsed Member of the Person Formation (Hydrologic Subdivision III of the Edwards Group) overlies the Regional Dense Member and is about 80 to 100 feet thick in Comal County. The Leached and Collapsed Member is regionally described as variably burrowed mudstone to grainstone, with intervals of crystalline limestone. Chert is commonly found within this member (Hanson and Small, 1994). The common collapsed zones within this member are the result of collapse of the overlying limestone into the voids created by dissolved evaporite lenses and layers (Rose, 1972). Primary field identification characteristics of the Leached and Collapsed Member on the subject site include *Toucasia* sp. (rudist) fossils, bivalve wakestones to packstones, and thick red soils with abundant chert cobbles. Horizon noted a 2-foot thick *Toucasia* sp. grainstone bed occuring at the base of the Leached and Collapsed Member on the subject site, several feet above the contact with the Regional Dense Member.

The Leached and Collapsed Member is one of the most porous and permeable formations (Stein and Ozuna, 1995). It is known to have vuggy and burrow porosity and permeability associated with evaporites, burrowed zones, breccia, and caves. Permeability and porosity are associated with collapsed zones (where evaporites have been dissolved) and in areas where faulting or fractures occur. Most of the karst features found on the subject site occur within this member.

2.5.5 Georgetown Limestone Formation (Kgt)

The Georgetown Limestone Formation (Hydrologic Subdivision I of the Edwards Group) overlies the Edwards Group (Person and Kainer Formations) and is exposed in the northern portion of the subject site as a small fault-bound block. The Georgetown Formation is reported to be less than 10 feet thick in Comal County and is described as gray to light-tan, marly, fossiliferous limestone that usually contains brachiopods (*Waconella wacoensis*) (Small and Hanson, 1994). The contact between the Edwards and Georgetown Formations is pitted and bored and often contains iron-oxide staining with common *Toucasia* sp. fossils (Rose, 1972).

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Due to the relatively thin nature, low porosity, and low permeability of the Georgetown formation, it probably yields little water to wells in Comal County. Where outcrops of the Georgetown Formation are extensively weathered, the Georgetown Formation may be considered a part of the unsaturated zone of the Edwards Aquifer (Stein and Ozuna, 1995). No karst features were discovered within this formation on the site; however, the fault zone (S-36) could transmit fluids into the subsurface.

2.5.6 Del Rio Formation (Kdr)

Contrary to the published map of Hanson and Small (1994), the Del Rio and Buda formations, and not the Edwards Group limestones, underlie the subject site in the northern portion of the subject site. The Del Rio Formation underlies the lowlands in the northern portion of the subject site and is reported to be about 40 to 50 feet thick in Comal County. The Del Rio Formation is described as weathered, poorly compacted, friable, fossiliferous, blue-green to yellow-brown clay, with some thin lenticular, calcareous, siltstone beds (Rose, 1972; Hanson and Small, 1994). The primary marker fossil for the Del Rio Clay is the pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) that is found in abundance on the subject site (Hanson and Small, 1994).

The Del Rio Formation forms the primary upper confining unit of the Edwards Aquifer (Rose, 1972; Hanson and Small, 1994). The Del Rio Clay is described as having no porosity, low permeability, and no cavern development (Hanson and Small, 1994). No karst features occur within this formation on the subject site.

2.5.7 Buda Formation (Kbu)

The Buda Formation occupies the uplands of the northern portion of the subject site. The Buda Formation is reported to be about 40 to 50 feet thick in northeastern Comal County and consists of a buff, light gray, dense mudstone (Hanson and Small, 1994). Primary field identification includes small calcite-filled veins, porcelaneous limestone character, and pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994).

The Buda Formation is reported to have low porosity, and permeability with minor surface karst and no cavern development (Hanson and Small, 1994). The Buda limestone is lithologically indistinguishable from the Georgetown limestone, however, the reported thickness of the Buda (up to 50 feet) compared to the relatively thin Georgetown Formation (less than 10 feet) and the stratigraphic position confirm that the Buda limestone is found on the uplands subject site (Hanson and Small, 1994). Within the Balcones Fault Zone, the Buda Formation is reported to commonly contain red-stained intraclasts (Rose, 1972). No karst features occur within the Buda Formation on the subject site.

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2.5.8 Quaternary Alluvial deposits

This unit consists of unconsolidated, well rounded, poorly sorted pebble to cobble-size chert and limestone deposits within creekbeds on the subject site. These deposits are associated with the modern drainage systems and occur as narrow, discontinuous deposits with thicknesses from several feet to probably more than 5 feet locally. Due to the thin, relatively discontinuous nature of these deposits, they were not mapped on the Site Geologic Map (Appendix C) and are discussed here for completeness.

2.6 SOILS

Soils on the subject site are characterized as follows (Batte, 1984):

SOIL NAME	SOIL TYPE	SOIL DEPTH (FEET)	UNDERLYING MATERIAL	PERMEABILITY	AVAILABLE WATER CAPACITY	SHRINK-SWELL CAPACITY
Denton silty clay, 1 to 3% slopes (DeB)	clay	3.3	fractured, indurated limestone inter-bedded with calcareous clayey marl	slow	medium	high
Eckrant-rock outcrop complex, steep (ErG)	very stony clay	0.8	indurated fractured limestone	moderately slow	very low	moderate
Medlin-Eckrant association, hilly (MEC)	clay to 3.2 feet and marl to 6.7	6.7	fractured limestone	very slow	very low	high
Rumple-comfort association, undulating (RuD)	cherty clay loam to stony clay	3	indurated fractured limestone	moderately slow	very low	low to moderate
Brackett-Rock outcrop-Real complex, steep (BtD)	gravelly clay loam	1.5	Inter-bedded soft limestone and marl	moderately slow	medium	low

2.7 WATER WELLS

A search was made for water wells on the subject site. A review of the records of the TNRCC and the Texas Water Development Board (TWDB) revealed no water wells on the subject site (TWDB, 2000). No evidence of water wells was present on the subject site during Horizon's field investigation.

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The results of this survey do not preclude the possibility of finding an additional abandoned test or water well during the clearing or construction phases of the proposed project. If a well or casing is encountered during any phase of the project, construction should be halted until the TNRCC is contacted and the feature investigated by a geologist. Water well use and closure regulations are discussed in Section 3.0.

3.0 SPECIAL INSTRUCTIONS TO CONTRACTORS OR DEVELOPERS

The Edwards Aquifer Protection Plan (EAPP) and its associated documents address best management practices (BMPs) and describe recommended water pollution abatement strategies specifically for the subject site and surrounding area. Temporary and permanent BMPs should be used control any runoff during and after the proposed activities and should be based on the TNRCC Guidelines for BMPs which typically require that all runoff from areas of impervious cover be captured and filtered before leaving a site within the recharge zone (TNRCC, 1999).

3.1 WATER WELLS

If a water well or casing is encountered during construction, construction should be halted until the TNRCC is contacted. All abandoned wells must be capped or properly abandoned according to the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code (TAC), Chapter 76, effective 3 January 1999. A plugging report must be submitted (by a licensed water well driller) to the Texas Department of Licensing and Regulation, Water Well Driller's Program, Austin, Texas. If a well is intended for use, it must comply with 16 TAC §76.

3.2 ACTION PLAN FOR SENSITIVE FEATURES FOUND DURING CONSTRUCTION

If a sensitive recharge feature is discovered during construction, all construction activities near the feature should be suspended immediately until it can be evaluated by an environmental professional for terrestrial karst invertebrate (TKI) habitat and by a geologist for recharge potential and closure or abatement recommendations (as appropriate) The TNRCC should be notified immediately using the TNRCC Solution Feature Notification Form (Appendix D). This form should be completed by a geologist and submitted to the TNRCC.

Activities near a sensitive feature should not proceed until the appropriate agencies have reviewed and approved the abatement or closure methods. If the discovery is related to a sewage collection system, a Texas Registered Professional Engineer is required to approve and seal the protection plan.

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Sensitive features may not be visible at the surface and may not be limited to the areas identified in the Geologic Assessment. Abatement measures should be addressed as appropriate for sensitive features encountered during any phase of the project. Abatement measures should be designed to protect a sensitive feature and the Edwards Aquifer from any potentially adverse impacts to water quality.

3.3 PLUGGING OF GEOTECHNICAL BORINGS

TNRCC Rules (Chapter 213.5, Subchapter A), effective 1 June 1999, require that all borings with depths greater than or equal to 20 feet must be plugged with a non-shrink grout from the bottom of the hole to within 3 feet of the surface. The remainder of the hole must be backfilled with cuttings from the boring or gravel. All borings less than 20 feet must be backfilled with cuttings from the boring or gravel.

3.4 SEPTIC SYSTEMS AND SENSITIVE FEATURES

Per 30 TAC § 285, each lot or tract of land on the recharge zone on which on-site sewage facilities (OSSFs) are to be located must have an area of at least 1 acre (43,560 square feet) per single-family dwelling. Additionally, the minimum separation distances should be maintained from significant recharge features found during the geologic assessment. No sewage treatment tank or holding tank should be located within 50 feet of a significant recharge feature. No soil absorption system should be located within 150 feet of a recharge feature.

4.0 GEOLOGIC ASSESSMENT TABLE COMMENTS AND ABATEMENT RECOMMENDATIONS

The following features are shown and labeled on the Geologic Assessment Table (Appendix A) and on the Site Geologic Map (Appendix C). Below is a discussion of general abatement recommendations for features found on the subject site. Feature-specific abatement recommendations are provided for unique features not addressed below.

Stock ponds: It is the opinion of Horizon that these features are not significant recharge features and does not warrant any setbacks or abatement measures. Stock ponds are manmade features with no apparent recharge ability.

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Closed depressions: It is the opinion of Horizon that these features are not significant recharge features due to their relative impermeability and apparent ability to hold water. However, construction and removal of the thick clay sediments within these features may reveal subsurface voids.

Point recharge features: (solution cavities, vuggy rock, fractured rock outcrop): Unless otherwise noted, it is the opinion of Horizon that these features are generally not significant recharge features, but may transmit fluids. Horizon recommends diverting untreated runoff away from these features. Additionally, sewage treatment tanks or holding tanks should be located at least 50 feet from of these features. Soil absorption systems should be located no less than 150 feet from these features. If these features cannot be avoided, however, permanent abatement measures could include properly filling and capping these features according to according to BMPs.

Fault zones: Studies of recharge for the Edwards Aquifer indicate that a majority of the recharge occurs along fractures (primarily due to faulting) within creeks that traverse the recharge zone (Senger and Kreitler, 1984; Hanson and Small, 1994). It is Horizon's opinion that fault zones within the creeks on the site may transmit fluids. Generally, these fault zones are not exposed in the uplands of the subject site. No setbacks or permanent abatement measures are recommended. Permanent abatement measures for fault zones exposed within drainages should include diverting untreated runoff away from these features if possible. Additionally, sewage treatment tanks or holding tanks should be located at least 50 feet from of these features. Soil absorption systems should be located no less than 150 feet from these features. If these features cannot be avoided, however, permanent abatement measures could include properly filling and capping these features according to BMPs.

Sinkholes: Unless otherwise noted, it is Horizon's opinion that these features are not significant recharge features. These features may transmit fluids into the subsurface. If possible, untreated runoff should be diverted away from these features. Sewage treatment tanks or holding tanks should be located at least 50 feet from of these features. Soil absorption systems should be located no less than 150 feet from these features.

S-1 Solution cavity. This feature consists of a solutioned cavity measuring 5 feet long and up to 3 feet wide, extending 2 feet subhorizontal to loose leaf debris and compact soil. Soil and leaf debris infill the feature. This feature is located on a hilltop in a relatively flat area and has a very small catchment area.

S-2 Closed depression. This feature consists of a natural closed depression measuring approximately 60 feet in diameter and up to 1.5 feet deep, filled with coarse chert cobbles and black soil. This feature appears to hold water from the dried mudcracks and cattle footprints preserved. This feature is located on a hilltop in a relatively flat area and has a small catchment area.

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S-3 Solution cavities. This feature consists of an outcrop of limestone approximately 20 feet in diameter containing 2 solution cavities, measuring 1 foot and 1.5 feet in diameter, respectively. Both cavities extend horizontally about 2 feet to loose leaf debris and compact soil. Soil and leaf debris infill the feature, which is located on a hilltop in a relatively flat area and has a very small catchment area.

S-4 Fractured rock and solution cavity. Bedrock measuring approximately 10 feet wide and up to 50 feet long located within a drainage dips 010° to South. Fractures within the outcrop are spaced 1 every 0.5 feet, with apertures up to 0.5 inches, and trends of 090°. A solution cavity within the drainage has a diameter of 1 foot and extends down to the northwest (up slope) about 4 feet to loose soil and organic debris. No blowing air was observed to flow from the feature. This feature appears to be related to the fractures observed in the overlying outcrop and is likely related to the fault zone (S-19) located about 100 feet to the southeast.

S-5 Closed depression. This feature consists of a closed depression about 15 feet in diameter and up to 1 deep. The feature contains 2 apparent exit portals about 1 and 0.5 feet deep that extend 1.5 feet vertically to loose leaf material and compact soil beyond. No blowing air was observed to flow from the feature. This feature is located on a topographically high area between 2 drainages.

S-6 Solution cavity. This feature consists of a solution cavity measuring 4 feet long and up to 2 feet wide extending vertically 2 feet to loose leaf debris and semi-compact soil. No blowing air was observed to flow from the feature that would indicate a larger subsurface extent. This feature is located on a hilltop in a relatively flat area and has a small catchment area.

S-7 Solution cavity. This feature consists of an outcrop of limestone about 7 feet in diameter that has 3 solution cavities leading into the subsurface. The largest cavity is about 1.5 feet in diameter and extends subvertically about 2.5 feet to loose soil on top of a rock floor. This feature is located on a hilltop in a relatively flat area and has a small catchment area.

S-8 Solution cavities (Sinkhole). This feature consists of 2 solution cavities within an elongated closed depression about 25 feet long and up to 10 feet wide. The 2 portals are about 12 feet apart and trend ~60° parallel to the elongated closed depression. The most significant cavity measures about 1 foot in diameter and extends up to 5 feet vertically to limestone cobbles.

PRELIMINARY RECOMMENDATIONS: Horizon recommends hand-clearing of the feature to determine its subsurface extent and ability to provide recharge. If this feature is a cave, the TNRCC requires that the "footprint" of the cave is projected onto the site geologic map. Removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening may be appropriate.

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S-9 Stock pond. This stock pond is 30 feet in diameter and up to 3 feet deep with no exit portals. This feature is located within a drainage and is man-made.

S-10 Stock pond. This stock pond is 70 feet in diameter and up to 5 feet deep with no exit portals. This feature is located within a drainage and is man-made. A small exposure of fractured (~SE) and dipping limestone beds (dip ~10° to NNE) of the Georgetown Formation are exposed within this feature.

S-11 Stock pond. This stock pond is 30 feet in diameter and 5 feet deep with no exit portals. This feature is located within a drainage.

S-12 Solution cavity. This feature consists of an outcrop of rock on a hillside that contains several solution cavities measuring up to 1.5 feet in diameter and extend horizontally along the bedding plane up to 3 feet long. This feature is infilled with loose leaf debris and soil.

S-13 Solution cavity. This feature consists of a solution cavity measuring up to 1.5 feet in diameter and extending subhorizontally along the bedding plane up to 2 feet deep to loose leaf debris and compact soil. This feature has small catchment area.

S-14 Fault zone. Northeast-trending fault zone with a splay trending north-northeast. A vegetation lineament, fractures, dipping beds, and fault breccia are coincide with this feature.

S-15 Fault zone. Northeast-trending fault zone with a vegetation lineament; dipping beds, fractures, and breccia coincide with this feature. This fault zone juxtaposes the Del Rio Clay (Kdr) and the Leached and Collapsed member (Kep3) of the Edwards Group.

S-16 Solution cavity. This feature consists of a solution cavity measuring up to 1.5 feet in diameter and extending a minimum 4 to 5 feet vertically. Daddy longlegs were present in the cavity. This feature is located on a hillside and has a moderate catchment area.

PRELIMINARY RECOMMENDATIONS: Horizon recommends hand-clearing of the feature to determine its subsurface extent and ability to provide recharge. If this feature is a cave, the TNRCC requires that the "footprint" of the cave is projected onto the site geologic map. Removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening may be appropriate.

S-17 Solution cavity. This feature consists of a solution cavity measuring up to 1.5 feet in diameter and extending 2 feet subhorizontally. This feature is located on a hillside and has a small catchment area.

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GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 400-acre Pfeuffer tract — HJN 000259 GA

	FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																				
	1A	1B	1C	2	3				4			5	6		7			8			9				10			11	12			13				14					15	16			17
	LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)				HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
					C, CD, SC, SH				C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
		C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
5,6,7,8	S1	SC	10	Kep	3	5	2														5			0			15	15			0					5				5	5			YES
	S2	CD	10	Kep	60	60	2														5			0			15	15			0					5				5	5			YES
5,6,7,8	S3	SC	10	Kep	1.5	1.5	2														5			0			15	15			0						10			10	10			YES
5,6,7,8	S4	SC	10	Kep				1	4	1		90	10									10			10		40		40		0							20	20		20		YES
	S5	CD	10	Kep	15	15	1														5			0			15	15			0						10			10	10			YES
5,6,7,8	S6	SC	10	Kep	4	2	2														5			0			15	15			0					5				5	5			YES
5,6,7,8	S7	SC	10	Kep	1.5	1.5	2														5			0			15	15			0					5				5	5			YES
5,6,7,8	*S8	SC	10	Kep	1.5	1.5	2					60	10									10				30	60		60		0						10			10	10			YES
	S9	CD	10	Kep	30	30	3														5			0			15	15			0						10			10	10			YES
	S10	CD	10	Kep	70	70	5														5			0			15	15			0						10			10	10			YES
	S11	CD	10	Kep	30	30	5														5			0			15	15			0						10			10	10			YES
5,6,7,8	S12	SC	10	Kep				1.5	3	1.5											5			0			15	15			0						10			10	10			YES
5,6,7,8	S13	SC	10	Kep				1.5	2	1.5											5				10		25		25		0						10			10	10			YES
5,6,7,8	S14	FZ	15	Kep								stream crossing	45	10							5				10		40		40				15					20	35			35	YES
	S15	FZ	15	Kep								stream crossing	45	10							5				10		40		40				10				10		20		20		YES
5,6,7,8	S16	SC	10	Kep	1.5	1.5	5															10			10		30		30		0						10			10	10			YES
	S17	SC	10	Kep				1	0.5	1											5			5			20	20			0						10			10	10			YES
	S18	SCF RZ	35	Kep	3	0.5	3					45, 135	10		5			5				10			10		75			75	0						10			10	10			YES
5,6,7,8	S19	FZ	15	Kep								stream crossing	45	10							5				10		40		40				15					20	35			35	YES
	S20	CD	10	Kep	100	100	4														5			0			15	15			0						10			10	10			YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

TNRCC-0585-Table (Rev. 6/1/99)

I have read, understood, and 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.

Kristin Miller 19-Sep-01

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 400-acre Pfeuffer tract — HJN 000259 GA

	FEATURE ID			FEATURE CHARACTERISTICS																										PHYSICAL SETTING																	
	1A	1B	1C	2	3			4			5	6	7			8			9				10			11	12			13				14					15	16			17
	LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)	DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
					C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10			0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
		C CD 10 FR 0 FZ 15 MM 35 SC 10 SH 20 VR 0 Z 35			X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
5,6,7,8	S21	SC	10	Kep	0.5	0.5	2													5				10		25		25							10				10	10			YES
5,6,7,8	S22	SC	10	Kep	2	2	2													5				10		25		25		0						10			10	10			YES
5,6,7,8	S23	SC	10	Kep	2.5	2.5	3													5				10		25		25		0						10			10	10			YES
5,6,7,8	S24	SC	10	Kep				0.5	3	0.5										5				10		25		25		0						10			10	10			YES
5,6,7,8	S25	SC	10	Kep	1.5	1.5	6													5				10		25		25		0						10			10	10			YES
5,6,7,8	S26	SC	10	Kep	1.5	1.5	4					~45	10								10			10		30		30		0						10			10	10			YES
5,6,7,8	S27	FR	0	Kep							~10x15	~45	10			10		5		5				10		40		40		0						10			10	10			YES
	S28	CD	10	Kep	40	40	8													5			0			15	15										20	20		20		YES
5,6,7,8	S29	SC	10	Kep				1	2.5	1										5				10		25		25					15				20	35			35	YES
5,6,7,8	S30	CD	10	Kep							15x15x4	45	10									15		10		45		45		0					5				5	5			YES
5,6,7,8	S31	SC	10	Kep	0.3	0.5	1													5				10		25		25		0					5				5	5			YES
5,6,7,8	S32	SC	10	Kep	0.5	1.5	2													5				10		25		25		0						10			10	10			YES
5,6,7,8	S33	FZ	15	Kep								45	10							5				10		40		40					15				20	35			35	YES
5,6,7,8	S34	SC	10	Kep	0.5	0.5	5					~45	10							5				10		35		35		0						10			10	10			YES
5,6,7,8	S35	FZ	15	Kep								45								5				10		30		30					15				20	35			35	YES
5,6,7,8	S36	FZ	15	Kep								45								5				10		30		30					15				20	35			35	YES
5,6,7,8	S37	FR	0	Kep							~200x50	~45	10			10		10		5				10		45		45		0						10			10	10			YES
5,6,7,8	S38	FR	0	Kep							~20x20	~45	10			10		5		5				10		40		40		0						10			10	10			YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

TNRCC-0585-Table (Rev. 6/1/99)

I have read, understood, and 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.

Kristin Miller — 19-Sep-01

S-18 Solution cavity and fractured rock. This feature consists of an outcrop measuring ~60 feet in diameter with fractures trending 045° and 135° with a density of 1 every 1 to 2 feet and locally cemented apertures about 1 inch wide. Within the outcrop is a solution cavity developed along a northeast-trending fracture that measures 3 feet long and 0.5 feet wide and extends vertically a minimum of 3 feet to cobbles. The solution cavity has a catchment basin of ~20 feet in diameter.

S-19 Fault zone. This feature consists of a northeast-trending fault zone exposed within a creek. Large calcite crystals, fractures, and breccia were found within the fault zone. Fractured rock and dipping beds were locally exposed under a thin-narrow cobble-sized alluvium.

S-20 Closed depression. This feature consists of a closed depression measuring up to 100 feet in diameter and approximately 4 feet deep. Mature oaks, grasses, black soil, and cobbles are found within the depression. Black clayey soils most likely indicated low permeability.

S-21 Solution cavity. This feature consists of a solution cavity measuring 0.5 feet in diameter and extends 1.5 to 2 feet subhorizontally. The feature is filled with organic debris and soil piping is evident. The featured is located on a hillside with a minor catchment area.

S-22 Solution cavity. This feature consists of a solution cavity measuring 2 feet in diameter and extends 1.5 feet vertically. This feature is infilled with loosely compacted fine sediment. The feature is located on a hillside with a small catchment area.

S-23 Solution cavity. This feature consists of a solution cavity measuring 2.5 feet in diameter and extends 3 feet subhorizontally. This feature is infilled with loosely compacted fine sediment and considered to be related to a slope break. The feature is located on a hillside with a small catchment area.

S-24 Solution cavity. This feature consists of a solution cavity measuring 0.5 feet in diameter and extends 3 feet subhorizontally. This feature is infilled with loosely compacted fine sediment and related to an enlarged bedding plane. The feature is located on a hillside with a small catchment area.

S-25 Solution cavity. This feature consists of a solution cavity about 1.5 feet in diameter, extends vertically a minimum of 6 feet, and is within a closed depression about 4 feet in diameter. This feature is located on a topographically high spot between the 2 drainages.

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S-26 Solution cavity and fractured rock. This feature consists of 3 solution cavities with a fractured rock outcrop. The solution cavities measure 1.5 feet, 1 foot, and 0.75 feet in diameter and all extend 3.5 feet vertically. Fractures trend to the southeast and may be related to the nearby fault zone (S-15). The features are infilled with loosely compacted black soil. These features are located on a hillside and have a small catchment area.

S-27 Stock pond and fractured rock. This feature consists of a stock pond within a drainage, with fractured rock and fault breccia exposed along the eastern margin of the stock pond. The fractured and breccia rock is coincident with a northeast-trending fault zone (S-36). Fractures are spaced 1 every foot and have 0.25-inch apertures that are locally cemented. Mudcracks within the stock pond indicate that ponding of water occurs.

S-28 Stock pond. This feature consists of stock pond measuring 40 feet in diameter and 8 feet deep within the drainage and coincident with a fault zone (S-36). Mudcracks within the stock pond indicate that ponding of water occurs.

S-29 Solution cavity. This feature consists of a solution cavity measuring 1 foot in diameter and extends 2.5 feet subhorizontally. This feature is considered to be an enlarged bedding plane and infilled with fine sediment. This feature is located on a hillside and has small catchment basin.

S-30 Closed depression. This feature is a scour pit located within a stream channel and is bounded on all sides by limestone outcrop. The feature measures approximately 15 feet in diameter with a depth of about 4 feet. Fractures, small solution cavities (vugs), and bedding plane cavities are exposed within the limestone outcrop surrounding this feature and may provide an avenue for recharge. This feature has a very large catchment basin and is coincident with the northeast-trending fault zone S-33. This feature was numbered S-132 in the field.

S-31 Solution cavity. The solution cavity is located on a hillside and has an opening that measures 3 by 7 inches. The opening continues downward to a depth of 1 foot, then continues along an enlarged bedding plane to fine sediments. It has a drainage area that is less than 1 acre and its ability to transmit fluids appears to be low. This feature is coincident the northeast-trending fault zone S-33. This feature was numbered S-133 in the field.

S-32 Solution cavity. The solution cavity is located on a hillside in the center of large trees and has an opening that measures 6 inches by 1.5 feet. The opening continues downward to a depth of 1.5 feet, then continues along an enlarged bedding plane to fine sediments. It has a drainage area that is less than 1 acre and its ability to transmit fluids appears to be low. This feature was numbered S-134 in the field.

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S-33 Fault zone. This feature consists of a northeast-trending fault zone with fractures, dipping beds, karst features (S-31, S-30), vegetation lineaments, and fault breccia coincident with this feature. This fault zone juxtaposes the Grainstone and Kirschberg Evaporite members of the Kainer Formation on the subject site. This fault is documented on the adjacent property to the northwest.

S-34 Solution cavity. The solution cavity, located on a hillside, has an opening that measures 0.5 feet and extends vertically 5 feet and a moderate catchment basin. This feature was numbered A-4 in a previous report and in the field.

S-35 Fault zone. This northeast-trending fault zone has fractures, dipping beds, vegetation lineaments, and fault breccia coincident with this feature. This fault zone juxtaposes the Grainstone and Kirschberg Evaporite members of the Kainer Formation on the subject site. This fault zone is documented on the adjacent property to the northwest.

S-36 Fault zone. This northeast-trending fault zone is exposed within a creek and has fractures, dipping beds, vegetation lineaments, and fault breccia coincident with this feature. This fault zone juxtaposes the confining units of the Edwards Aquifer (Del Rio Clay) and the Leached and Collapsed member of the Person Formation of the Edwards Aquifer Group. This fault zone has a splay fault that completely bounds the Georgetown Formation. This fault zone is well-documented on the adjacent property to the northwest.

S-37 Fractured rock. Exposed fractured bedrock within a drainage measuring about 200 feet long and up to 50 feet wide. Fractures trend to the south-southeast with 1 spaced every 0.5 feet, up to 2 inches wide, and are partially filled and covered with coarse alluvium. This feature is coincident with the fault zone S-19.

S-38 Fractured rock. Exposed fractured bedrock within a drainage measuring about 20 feet in diameter. Fractures trend to the northeast with 1 spaced every 0.5 feet, up to 2 inches wide, and are partially filled and covered with coarse alluvium and soil.

5.0 PARTICIPATING PERSONNEL

Horizon's participating personnel for this Geologic Assessment are listed below. Resumes for participants are provided in Appendix E.

PERSON	PARTICIPATION
Brian Butler Hunt, Geologist	Field Investigation, Geologic Map, Report
Jason John, Geologist	Field Investigation
Kristin Miller, RPG, Senior Staff Geologist	Field Investigation, Report
Joe Waring, Field Technician	Field Investigation

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6.0 REFERENCES

Batte, Charles D. *Soil Survey of Comal and Hays County, Texas.* US Department of Agriculture, Soil Conservation Service, in cooperation with the Texas Agricultural Experiment Station, 1984.

Baumgardner, R.W., Collins, E.W., Geologic Map of the Hunter Quadrangle, Texas. Bureau of Economic Geology Open-File Map, 1991.

(FEMA) Federal Emergency Management Agency, Flood Insurance Rate Map, Comal County, Map No. 485463 0110 C, 29 September 1986.

Hanson, John A. and Ted A. Small. *Geologic Framework and Hydrogeologic Characteristics of the Edwards Aquifer Outcrop, Hays County, Texas.* US Geological Survey (USGS) Water Resources Investigations Report 95-4265. 1995.

Rose, P. R. *Edwards Group, Surface and Subsurface, Central Texas. Report of Investigations 74.* Bureau of Economic Geology, University of Texas, Austin, Texas. 1972.

Senger, Rainer K., and Kreitler, Charles W. *Hydrogeology of the Edwards Aquifer, Austin Area, Central Texas.* Report of Investigations 141. The University of Texas at Austin, Bureau of Economic Geology, 1984.

(TNRCC) Texas Natural Resource Conservation Commission. *Complying with the Edwards Aquifer Rules: Administrative Guidance.* Revised August 1999.

_____. Edwards Aquifer Recharge Zone Boundary Maps. 1996

(TWDB) Texas Water Development Board. Water Well Drillers' Records. July 2000.

(UT-BEG) University of Texas - Bureau of Economic Geology. *Geologic Atlas of Texas, San Antonio Sheet.* The University of Texas at Austin. Revised 1981.

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APPENDIX A

GEOLOGIC ASSESSMENT TABLE

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APPENDIX B

GEOLOGIC STRATIGRAPHIC COLUMN

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GEOLOGIC STRATIGRAPHIC COLUMN

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
Quaternary		Alluvium		up to 5	Qal	Unconsolidated, sand, silt, gravel, clay, and cobbles.
Cretaceous	Upper Confining Unit	Buda Limestone		35 to 50	Kbu	Hard limestone, gray to tan, dense, nodular, abundant fossil mollusks. Low porosity and permeability. Minor surface karst development.
Cretaceous	Upper Confining Unit	Del Rio Clay		60 to 75	Kdr	Dark gray to olive brown clay, pyritic, gypsiferous, calcareous with abundant *Exogyra arietina*. No porosity or permeability. No cave development. Primary upper confining unit of Edwards Aquifer.
Cretaceous	I	Georgetown Formation		50 to 55	Kgt	Gray to tan, interbedded, nodular-weathering, hard, fine-grained limestone, marly limestone, and marl, containing abundant fossil shells *Waconella wacoensis*. Low porosity and permeability. No cave development. Upper Confining unit of the Edwards Aquifer.
Cretaceous	II	Person Formation of the Edwards Group	Cyclic Marine (not exposed)	0 to 70	Kep2	Light tan, massive mudstone to packstone and miliolid grainstone with boxwork vugs.
Cretaceous	III	Person Formation of the Edwards Group	Leached and Collapsed	30 to 80	Kep3	Light gray, bioturbated iron-stained beds separated by thick limestone composed of crystalline limestone, mudstone to wakestone and miliolid grainstone; chert; collapsed breccia. One of the most porous and permeable. Many developed caves.
Cretaceous	IV	Person Formation of the Edwards Group	Regional Dense	20 to 30	Kep4	Light tan, wispy dense, argillaceous mudstone. Low permeability and acts as a vertical barrier. No cave development.
Cretaceous	V	Kainer Formation of the Edwards Group	Grainstone	45 to 60	Kek5	Light gray, miliolid, crossbedded grainstone; mudstone to wakestone; chert. Reduced permeability due to recrystallization. Few developed caves.

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
Cretaceous	VI	Kainer Formation of the Edwards Group	Kirschberg evaporite	65 to 75	Kek6	Light gray, crystalline limestone; chalky mudstone; chert; contains boxwork voids with neospar and travertine frame. One of the most porous and permeable subdivisions. Probably extensive cave development.
Cretaceous	VII	Kainer Formation of the Edwards Group	Dolomitic	110 to 150	Kek7	Thick-bedded, light gray mudstone to grain stone; crystalline limestone; chert. Massively bedded, light gray, with abundant *Toucasia*. Locally permeable and water-yielding. Caves related to structure or bedding planes.
Cretaceous	VIII	Kainer Formation of the Edwards Group	Basal Nodular	45 to 60	Kek8	Massive shaly, fossiliferous, nodular and mottled limestone; mudstone; miliolid grainstone. Usually low permeability and few caves.
Cretaceous	Lower Confining Unit	Glen Rose		each member ranges from 70 to 250	Kgr	Alternating strata of marl, dolomite, and limestone. Celestite may be present in Member 5 near Mt. Bonnell. Lower confining unit of the Edwards aquifer. Relatively impermeable with some surface cave development.

REFERENCES:

Brune, Gunnar, and Gail L. Duffin. Occurrence, Availability and Quality of Ground Water in Travis County, Texas. *Texas Department of Water Resources Report* 276. Austin, TX: TDWR, 1983.

Garner, L. E., and K. P. Young. Environmental Geology of the Austin Area: An Aid to Urban Planning. *Report of Investigations 86.* The University of Texas at Austin, Bureau of Economic Geology, 1976.

Rose, P.R. Edwards Group, Surface and Subsurface, Central Texas: Austin, Texas, *University of Texas, Bureau of Economic Geology, Report of Investigations 74.* 1972.

Senger, R. K., and C. W. Kreitler. Hydrogeology of the Northern Segment of the Edwards Aquifer, Austin Region. *Report of Investigations 192.* The University of Texas at Austin, Bureau of Economic Geology, 1990.

Small, Ted A., John A. Hanson, and Nico M. Hauwert. Geologic Framework and Hydrogeologic Characteristics of the Edwards Aquifer Outcrop (Barton Springs Segment), Northeastern Hays and Southwestern Travis Counties, Texas. *US Geological Survey (USGS) Water Resources Investigations Report* 96-4306. 1996.

(UT-BEG) University of Texas - Bureau of Economic Geology. *Geologic Atlas of Texas, Austin Sheet.* The University of Texas at Austin. Revised 1981.

_____. *Geologic Map of the Austin Area.* The University of Texas at Austin. Reprinted 1992.

APPENDIX C

SITE GEOLOGIC MAP

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APPENDIX D

TNRCC SOLUTION FEATURE NOTIFICATION FORM

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Horizon
ENVIRONMENTAL SERVICES, INC.

SOLUTION FEATURE DISCOVERY NOTIFICATION FORM

EDWARDS AQUIFER PROTECTION PROGRAM

For Regulated Activities on the Edwards Aquifer Recharge Zone and Transition Zone and Relating to 30 TAC 213.5(f)(2) Effective June 1, 1999

When reporting a solution feature encountered during construction activities please provide the following information:

Project Name:		Project ID #:	
Project Type:	WPAP SCS UST AST	Approval Date:	
Project Location:		Approval Dates/ID#'s of any Modifications:	
Date Feature(s) Discovered:		Date TNRCC Notified:	
Holder of Approved Plan:		Solution Feature Plan Submitted By:	
Contact:		Title:	
Title:		Company:	
Mailing Address:		Mailing Address:	
Phone:		Phone:	
Fax:		Fax:	

Feature No.	Feature Dimensions	Location of Feature (Reference features related to a SCS by Line and Station)	Case*/ Sensitivity**

* per TNRCC Guidance Document 96.004

** per Geologic Assessment Table

1. Plan, profile, cross section sketches, and photos for each feature are found as **Attachment 1**.
2. Geologic Assessment Table (if applicable) is found as **Attachment 2**.
3. Drawings and narrative descriptions of the proposed protection measures are found as **Attachment 3**.

If the discovery is related to a sewage collection system, a Texas Registered Professional Engineer is required to submit the protection plan.

4. Submitted by: _____, Date:_____
   Printed name: _____

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APPENDIX E

RESUMES OF PARTICIPANTS

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GEOLOGIC ASSESSMENT STATEMENT OF QUALIFICATIONS

Corporate Experience

Horizon Environmental Services, Inc. (Horizon) has performed hundreds of Geologic Assessments to complete Water Pollution Abatement Plans within the Edwards Aquifer Recharge Zone. The geographic extent of Horizon's Geologic Assessments includes Bexar, Comal, Hays, Travis, and Williamson Counties of Texas, in support of Edwards Aquifer protection.

Horizon is particularly well qualified to provide both the technical and administrative support required for project planning and permitting efforts related to various federal and state permits or approvals. Overall corporate services provided by Horizon focus primarily upon environmental services other than those related to hazardous substances. However, we have personnel who are ASTM-trained and who have several years of applied experience in performing Phase I Environmental Site Assessments (ESAs) and due diligence reviews for property (real estate) transfers. Horizon's capabilities and experience are very broad in compliance with the National Environmental Policy Act (NEPA), particularly as related to multidisciplinary Environmental Assessments and Environmental Impact Statements (EISs), jurisdictional wetlands, endangered species, cultural resource issues, geologic assessments, cave management, and expert testimony.

Horizon is an Austin-based Texas Corporation with additional offices in Beaumont and Houston, Texas, and Shreveport, Louisiana. Founded in 1987, Horizon is a small-business enterprise as defined by Section 3 of the Small Business Act and the standards established by the Small Business Administration Regulation under CAR 121.

Services which Horizon provides for various clients include jurisdictional wetland determinations; endangered species habitat assessments and surveys; archeological surveys and mitigation (prehistoric and historic); ecological risk and damage assessments; Phase I environmental site assessments; wildlife habitat and wetlands restoration or creation; baseline aquatic and terrestrial investigations (inland and coastal); HEP analyses; IFIM analyses; environmental constraints analyses for alternative project sites, routes, and land development scenarios ("fatal flaw" analyses); post-project land use planning and mitigation; multidisciplinary Environmental Assessments in support of federal and state Environmental Impact Statements; and permit management including preparation, agency coordination, and expert testimony.

RESUMES OF KEY PERSONNEL

Jason John

Jason John graduated from the University of Texas at Austin with a Masters of Science (MS) degree in Geological Sciences. Mr. John graduated from Colorado School of Mines with a Bachelor of Science (BS) degree in Geophysical Engineering and a minor in Geology. He is currently a geologist/environmental specialist at Horizon. Mr. John also worked as a geoscience intern in Texas, Louisiana, and Alaska where he produced isopach structural porosity, permeability, water saturation, and net sand maps for key reservoir horizons of an undeveloped reservoir and conducted research on stratigraphic, structural, exploration histories. Mr. John researched and compiled regional cross-sections of the Gulf of Mexico and synthesized several of them to gain a regional understanding of the subsurface structure, stratigraphic units, and facies changes of the onshore area. He also worked for the Department of Water Resources in Arizona as an Engineering Aide where he conducted snow and rain surveys and prepared geologic maps for digitization. Mr. John's computer skills include ARCview, GEOLOG, Geoquest, AutoCAD, and technical software programs.

Kristin Miller

Kristin Miller is a graduate of the University of Texas at Austin with 2 bachelor degrees in Geological Sciences and Geography (Environmental Resource Management). Ms Miller is currently working on a master's program at UT-Austin in Geomorphology with a specialization in karst sediment transport. She is Registered Professional Geologist (Mississippi Registration #0523), Environmental Specialist, Senior Staff Project Manager, and Senior Staff Geologist with Horizon. Ms. Miller has more than 9 years experience in environmental consulting and 7 years experience at the Texas Natural Resource Conservation Commission (formerly Texas Water Commission) and Texas Water Development Board.

Ms. Miller is an ASTM-trained Environmental Site Assessment (ESA) Professional and has conducted hundreds of Phase I ESAs in the State of Texas. Ms. Miller provides due diligence investigations regarding the potential for hazardous substance liabilities. Ms. Miller prepares Phase I ESAs that meet or exceed nationally accepted standards set by the ASTM Practice E-1527-97. Ms. Miller has been caving since 1982, where she began as a tour guide and part-time volunteer, surveying Inner Space Caverns in Georgetown, Texas. Ms. Miller has performed hundreds of geologic assessments within the Edwards Aquifer Recharge Zone in Central Texas. She is a member of the Geological Society of America, Austin Geological Society, and National Speleological Society.

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Ms. Miller's resume includes geologic assessments; cave studies; karst investigations; cave closure and management plans; NOI and FERC documentation; biological sampling; integrated pest management; endangered species habitat assessments; population surveys; territory mapping; wetland determinations and planting, project management; and state, local, and federal environmental permitting assistance. She is authorized to conduct biological sampling and is listed on Horizon's Scientific Collection Permits. Ms. Miller has conducted hundreds of endangered species habitat assessments for the federally protected golden-cheeked warbler, black capped-vireo, and cave-invertebrate species. She provides technical, biological, and geological support and on-site investigations for Environmental Impact Statements throughout Texas and Louisiana.

Brian Butler Hunt

Brian Hunt graduated from the University of Texas at Austin with a Master of Science degree in Geology. He is currently a staff geologist at Horizon with previous work experience with the US Geological Survey (USGS in Menlo Park, California) and the Anadarko Petroleum Corporation (Houston, Texas). Mr. Hunt worked as a field geologist for the USGS mapping Tertiary and Quaternary sediments and faults in western Oregon for hazard assessments of the northwestern United States. He also produced portions of digital geologic maps and cross-sections for publication by the USGS. Mr. Hunt developed depositional models based upon well log data for natural gas exploration for the Anadarko Petroleum Corporation. Mr. Hunt has additional mapping and field experience conducting his own MS field-based research and teaching summer field geology courses for the University of Texas Department of Geological Sciences.

Joe T. Waring

Joe Waring is a field technician at Horizon who provides administrative and technical support for field mapping, karst surveys, cave mapping and exploration, water well inventories, endangered species record searches, background research, wetland restoration, and plant collection. Mr. Waring is also certified by the Texas Department of Health as an Emergency Medical Technician (EMT) and is trained in basic life support.

WATER POLLUTION ABATEMENT PLAN APPLICATION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b), EFFECTIVE JUNE 1, 1999

PROJECT NAME: RIVER CHASE UNIT FIVE, SIX, SEVEN & EIGHT

PROJECT INFORMATION

1. The type of project is:
   1130 Residential: # of Lots: ___
   ___ Residential: # of Living Unit Equivalents: ___
   ___ Commercial
   ___ Industrial
   ___ Other: _____

2. Total site acreage (size of property): 1963

3. Projected population: 3164

4. The amount and type of impervious cover expected after construction are shown below:

Impervious Cover of Proposed Project	Sq. Ft.	Sq. Ft./Acre	Acres
Structures/Rooftops	3,955,000	÷ 43,560 =	90.8
Parking	2,260,000	÷ 43,560 =	51.8
Other paved surfaces	2,116,400	÷ 43,560 =	48.6
Total Impervious Cover	1,308,400	÷ 43,560 =	191.2
Total Impervious Cover ÷ Total Acreage x 100 =			10%

5. X **ATTACHMENT A - Factors Affecting Water Quality.** A description of any factors that could affect surface water and groundwater quality is provided at the end of this form.

6. X Only inert materials as defined by 30 TAC 330.2 will be used as fill material.

FOR ROAD PROJECTS ONLY
Complete questions 7-12 if this application is exclusively for a road project.

7. Type of project:
   ___ TXDOT road project.
   ___ County road or roads built to county specifications.
   ___ City thoroughfare or roads to be dedicated to a municipality.
   ___ Street or road providing access to private driveways.

8. Type of pavement or road surface to be used:

__ Concrete
__ Asphaltic concrete pavement
__ Other: _____

9. Length of Right of Way (R.O.W.): _____ feet.
Width of R.O.W.: _____ feet.
L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.

10. Length of pavement area: _____ feet.
Width of pavement area: _____ feet.
L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.
Pavement area _____ acres ÷ R.O.W. area _____ acres x 100 = ____% impervious cover.

11. __ A rest stop will be included in this project.
__ A rest stop will **not** be included in this project.

12. __ Maintenance and repair of existing roadways that do not require approval from the TNRCC Executive Director. Modifications to existing roadways such as widening roads/adding shoulders totaling more than one-half (1/2) the width of one (1) existing lane require prior approval from the TNRCC.

STORMWATER TO BE GENERATED BY THE PROPOSED PROJECT

13. **ATTACHMENT B - Volume and Character of Stormwater.** A description of the volume and character (quality) of the stormwater runoff which is expected to occur from the proposed project is provided at the end of this form. The estimates of stormwater runoff quality and quantity should be based on area and type of impervious cover. Include the runoff coefficient of the site for both pre-construction and post-construction conditions.

WASTEWATER TO BE GENERATED BY THE PROPOSED PROJECT

14. The character and volume of wastewater is shown below:

100 % Domestic	395,500 gallons/day
__ % Industrial	_____ gallons/day
__ % Commingled	_____ gallons/day
TOTAL	395,500 gallons/day

15. Wastewater will be disposed of by:
X **On-Site** Sewage Facility (OSSF/Septic Tank):
ATTACHMENT C - Suitability Letter from Authorized Agent. An on-site sewage facility will be used to treat and dispose of the wastewater. The appropriate licensing authority's (authorized agent) written approval is provided at the end of this form. It states that the land is suitable for the use of an on-site sewage facility or identifies areas that are not suitable.
X Each lot in this project/development is at least one (1) acre (43,560 square feet) in size. The system will be designed by a licensed professional engineer or registered sanitarian and installed by a licensed installer in compliance with 30 TAC §285.
__ Sewage Collection System (Sewer Lines):
__ Private service laterals from the wastewater generating facilities will be connected

to an existing SCS.

__ Private service laterals from the wastewater generating facilities will be connected to a proposed SCS.

__ The SCS was previously submitted on _____.

__ The SCS was submitted with this application.

__ The SCS will be submitted at a later date. The owner is aware that the SCS may not be installed prior to executive director approval.

The sewage collection system will convey the wastewater to the _____ (name) Treatment Plant. The treatment facility is :

__ existing.

__ proposed.

16. X All private service laterals will be inspected as required in 30 TAC 213.5.

SITE PLAN REQUIREMENTS

Items 17 through 27 must be included on the Site Plan.

17. The Site Plan must have a minimum scale of 1" = 400'.
Site Plan Scale: 1" = 200 '.

18. 100-year floodplain boundaries

X Some part(s) of the project site is located within the 100-year floodplain. The floodplain is shown and labeled.

_ No part of the project site is located within the 100-year floodplain.

The 100-year floodplain boundaries are based on the following specific (including date of material) sources(s):

FEDERAL EMERGENCY MANAGEMENT FLOOD INSURANCE RATE MAP
COMAL COUNTY MAP NO. 485463 0110C, SEPTEMBER 29, 1986

19. __ The layout of the development is shown with existing and finished contours at appropriate, but not greater than ten-foot contour intervals. Show lots, recreation centers, buildings, roads, etc.

X The layout of the development is shown with existing contours. Finished topographic contours will not differ from the existing topographic configuration and are not shown.

20. All known wells (oil, water, unplugged, capped and/or abandoned, test holes, etc.):

X There are 4 (#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply)

__ The wells are not in use and have been properly abandoned.

X-2 The wells are not in use and will be properly abandoned.

X-2 The wells are in use and comply with 30 TAC §238.

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

21. Geologic or manmade features which are on the site:

X All **sensitive and possibly sensitive** geologic or manmade features identified in the Geologic Assessment are shown and labeled.

__ No **sensitive and possibly sensitive** geologic or manmade features were identified in the Geologic Assessment.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to

the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. Geologic or manmade features were found and are shown and labeled.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. No geologic or manmade features were found.

22. X The drainage patterns and approximate slopes anticipated after major grading activities.

23. X Areas of soil disturbance and areas which will not be disturbed.

24. X Locations of major structural and nonstructural controls. These are the temporary and permanent best management practices.

25. X Locations where soil stabilization practices are expected to occur.

26. X Surface waters (including wetlands).

27. __ Locations where stormwater discharges to surface water or sensitive features.
X There will be no discharges to surface water or sensitive features.

ADMINISTRATIVE INFORMATION

28. X One (1) original and three (3) copies of the completed application have been provided.

29. X Any modification of this WPAP will require TNRCC executive director approval, prior to construction, and may require submission of a revised application, with appropriate fees.

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. This **WATER POLLUTION ABATEMENT PLAN APPLICATION FORM** is hereby submitted for TNRCC review and executive director approval. The form was prepared by:

KELLY KILBER, Agent
Print Name of Applicant/Agent

Signature of Applicant/Owner/Agent

10/25/01
Date

ATTACHMENT A

The major factor that affects surface water and groundwater quality will be from construction
Equipment on site with the potential for leakage. Soil Disturbance and Materials on site.

ATTACHMENT B

Volume and Character of Stormwater

The project is divided into three drainage basins, (1) York Creek, (2) Alligator Creek and (3) Isaac Creek. Drainage Basin Evaluations has been performed and is attached hereto showing pre-development conditions and post development conditions with "C" values. Due to low impervious cover and low density of the development, the character of the runoff will be similar to post development conditions.

DRAINAGE BASIN EVALUATION - 100 YEAR FREQUENCY
RIVER CHASE - EAST SECTION
COMAL COUNTY, TEXAS
10-Oct-01

Drainage Basin	Basin Area (ac)			Number	Exist. Conditions		Developed Conditions		Increase in Runoff	
York Creek	Off Site	On Site	Total	of Lots	C	Q	C	Q	Q	%
1	8	197	205	122	0.35	276	0.39	308	32	11.6%
2	700	1056	1756	653	0.35	6320	0.39	7042	722	11.4%
3	7	84	91	52	0.35	171	0.40	196	25	14.6%
4	0	52	52	32	0.35	104	0.41	122	18	17.3%
5	25	109	134	67	0.35	220	0.39	245	25	11.4%
6	0	148	148	92	0.35	270	0.41	316	46	17.0%
7	0	34	34	21	0.35	96	0.40	110	14	14.6%
Basin Total		1680	2420	1039		7181		8031	850	11.8%
Alligator Creek										
8	0	52	52	32	0.35	125	0.40	143	18	14.4%
9	0	153	153	95	0.35	288	0.41	338	50	17.4%
Basin Total		205	205	127		413		481	68	16.5%
Isaac Creek										
10	0	92	92	57	0.35	197	0.41	231	34	17.3%
11	0	173	173	107	0.35	326	0.41	382	56	17.2%
Basin Total		265	265	164		523		613	90	17.2%

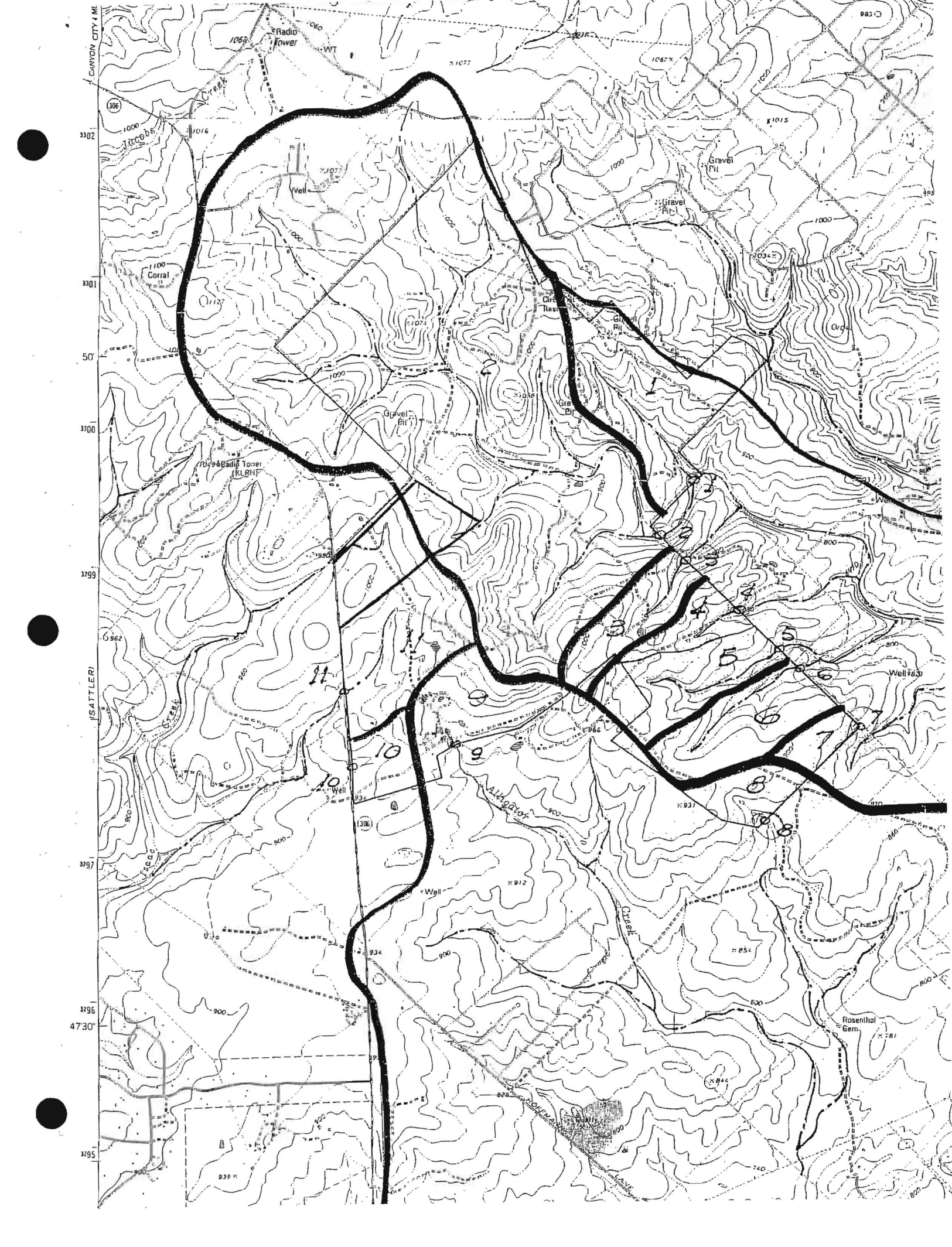
file:RvrChaDrng

Computation of storm water runoff is based upon TXDOT THYSYS Program Region 5 regression equations using intensity coefficients for Comal County and Rational Method analysis.

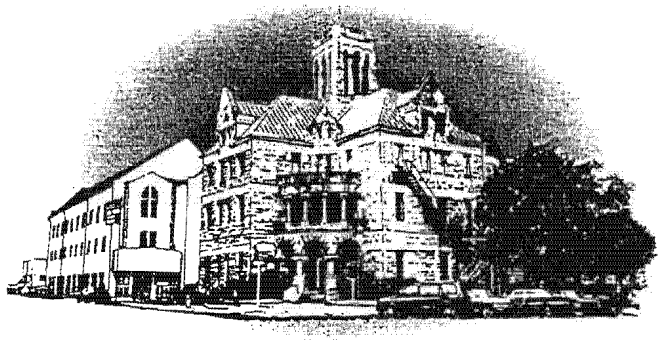
River Chase - East Section is composed of 2150 acres which is proposed to be developed into approximately 1330 lots with 113,140 feet of streets. The lots will range in size from 1 acre to 10 acres with an average density of one unit per 1.617 acres. Weighted post development runoff coefficients were computed based upon the development of the lots as follows:

Roof Area	0.080 ac. (3500 SF)	C = 0.97
Driveway Area	0.046 ac. (2000 SF)	C = 0.97
Landscape Area	0.500 ac.	C = 0.30
Natural Ground	0.948 ac.	C = 0.35
Street Paving	0.043 ac.	C = 0.95

Off site areas were assumed to be undeveloped for both existing and developed conditions.



CANYON CITY 4 MI.
Radio Tower
WT
Jacobs Creek
Well
Corral
Gravel Pit
Radio Tower (KLRN)
(SATTLER)
Isaac Creek
Alligator Creek
Rosenthal Gem
Quarry
HOFFMANN LANE
3302
3301
50'
3300
3299
3297
3296
47'30"
3295



COPY

Comal County

OFFICE OF COMAL COUNTY ENGINEER

October 11, 2001

Mr. Charles D. Patterson
River Chase Venture, Ltd.
P.O. Box 1629
Wimberley, TX 78676

Re: Proposed subdivision, RIVER CHASE, UNITS FIVE, SIX, SEVEN AND EIGHT, within Comal County, Texas

Dear Property Owner(s):

We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the property to be approved with the conditions that individual septic systems permits shall be required for the lots within this subdivision.

Please be advised that these individual permits will be required to meet 30 TAC 285.40, subchapter E (copy attached). Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

cc: Pro-Tech Engineering Group

195 David Jonas Drive • New Braunfels, Texas 78130 • (830) 608-2090 FAX (830) 608-2009

TEMPORARY STORMWATER SECTION

FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(A), (B), (D)(i) and (G); EFFECTIVE JUNE 1, 1999

PROJECT NAME: River Chase, Unit Five , Six, Seven & Eight

POTENTIAL SOURCES OF CONTAMINATION

Examples: Fuel storage and use, chemical storage and use, use of asphaltic products, construction vehicles tracking onto public roads, and existing solid waste.

1. Fuels for construction equipment and hazardous substances which will be used during construction:

   __ Aboveground storage tanks with a cumulative storage capacity of less that 250 gallons will be stored on the site for less than one (1) year.

   X Aboveground storage tanks with a cumulative storage capacity between 250 gallons and 499 gallons will be stored on the site for less than one (1) year.

   __ Aboveground storage tanks with a cumulative storage capacity of 500 gallons or more will be stored on the site. An **Aboveground Storage Tank Facility Plan** application must be submitted to the appropriate regional office of the TNRCC prior to moving the tanks onto the project.

   __ Fuels and hazardous substances will not be stored on-site.

2. x__ **ATTACHMENT A - Spill Response Actions**. A description of the measures to be taken to contain any spill of hydrocarbons or hazardous substances is provided at the end of this form.

3. X Temporary aboveground storage tank systems of 250 gallons or more cumulative storage capacity must be located a minimum horizontal distance of 150 feet from any domestic, industrial, irrigation, or public water supply well, or other sensitive feature.

4. X **ATTACHMENT B - Potential Sources of Contamination.** Describe in an attachment at the end of this form any other activities or processes which may be a potential source of contamination.

   __ The are no other potential sources of contamination.

SEQUENCE OF CONSTRUCTION

5. x **ATTACHMENT C - Sequence of Major Activities.** A description of the sequence of major activities which will disturb soils for major portions of the site (grubbing, excavation, grading, utilities, and infrastructure installation) is provided at the end of this form. For each activity described, an estimate of the total area of the site to be disturbed by each activity is given.

6. x Name the receiving water(s) at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project: Isaac , York & Alligator Creek

TEMPORARY BEST MANAGEMENT PRACTICES (TBMPs)

Erosion control examples: tree protection, interceptor swales, level spreaders, outlet stabilization, blankets or matting, mulch, and sod. Sediment control examples: stabilized construction exit, silt fence, filter dikes, rock berms, buffer strips, sediment traps, and sediment basins. Please refer to the Technical Guidance Manual for guidelines and specifications. **All structural BMPs must be shown on the site plan.**

7. x **ATTACHMENT D - Temporary Best Management Practices and Measures.** A description of the TBMPs and measures that will be used during and after construction are provided at the end of this form. For each activity listed in the sequence of construction, include appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented.

   x TBMPs and measures will prevent pollution of surface water, groundwater, and stormwater. The construction-phase BMPs for erosion and sediment controls have been designed to retain sediment on site to the extent practicable. The following information has been provided in the attachment at the end of this form

   a. A description of how BMPs and measures will prevent pollution of surface water, groundwater or stormwater that originates upgradient from the site and flows across the site.

   b. A description of how BMPs and measures will prevent pollution of surface water or groundwater that originates on-site or flows off site, including pollution caused by contaminated stormwater runoff from the site.

   c. A description of how BMPs and measures will prevent pollutants from entering surface streams, sensitive features, or the aquifer.

   d. A description of how, to the maximum extent practicable, BMPs and measures will maintain flow to naturally-occurring sensitive features identified in either the geologic assessment, TNRCC inspections, or during excavation, blasting, or construction.

8. The temporary sealing of a naturally-occurring sensitive feature which accepts recharge to the Edwards Aquifer as a temporary pollution abatement measure during active construction should be avoided.

   __ **ATTACHMENT E - Request to Temporarily Seal a Feature.** A request to temporarily seal a feature is provided at the end of this form. The request includes justification as to why no reasonable and practicable alternative exists for each feature.

   x There will be no temporary sealing of naturally-occurring sensitive features on the site.

9. X **ATTACHMENT F - Structural Practices.** Describe the structural practices that will be used to divert flows away from exposed soils, to store flows, or to otherwise limit runoff discharge of pollutants from exposed areas of the site. Placement of structural practices in floodplains has been avoided.

10. X **ATTACHMENT G - Drainage Area Map**. A drainage area map is provided at the end of this form to support the following requirements.

    __ For areas that will have more than 10 acres within a common drainage area

disturbed at one time, a sediment basin will be provided.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a smaller sediment basin and/or sediment trap(s) will be used.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a sediment basin or other equivalent controls are not attainable, but other TBMPs and measures will be used in combination to protect down slope and side slope boundaries of the construction area.

X There are no areas greater than 10 acres within a common drainage area that will be disturbed at one time. A smaller sediment basin and/or sediment trap(s) will be used in combination with other erosion and sediment controls within each disturbed drainage area.

11. NA **ATTACHMENT H - Temporary Sediment Pond(s) Plans and Calculations.** Temporary sediment pond or basin construction plans and design calculations for a proposed temporary BMP or measure has been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information must be signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed temporary BMPs and measures are provided as at the end of this form.

12. X **ATTACHMENT I - Inspection and Maintenance for BMPs.** A plan for the inspection of temporary BMPs and measures and for their timely maintenance, repair, and, if necessary, retrofit is provided at the end of this form. A description of documentation procedures and recordkeeping practices is included in the plan.

13. x All control measures must be properly selected, installed, and maintained in accordance with the manufacturers specifications and good engineering practices. If periodic inspections by the applicant or the executive director, or other information indicates a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations.

14. x If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).

15. x Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50%. A permanent stake will be provided that can indicate when the sediment occupies 50% of the basin volume.

16. x Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

SOIL STABILIZATION PRACTICES

Examples: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, or preservation of mature vegetation.

17. X **ATTACHMENT J - Schedule of Interim and Permanent Soil Stabilization Practices.** A schedule of the interim and permanent soil stabilization practices for the site is attached at the end of this form.

18. X Records must be kept at the site of the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.

19. X Stabilization practices must be initiated as soon as practicable where construction activities have temporarily or permanently ceased.

ADMINISTRATIVE INFORMATION

20. X All structural controls will be inspected and maintained according to the submitted and approved operation and maintenance plan for the project.

21. X If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TNRCC Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TNRCC has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.

22. X Silt fences, diversion berms, and other temporary erosion and sediment controls will be constructed and maintained as appropriate to prevent pollutants from entering sensitive features discovered during construction.

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. This **TEMPORARY STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

Kelly Kilber, Agent
Print Name of Applicant/Owner/Agent

Signature of Applicant/Owner/Agent

10/25/01
Date

ATTACHMENT A

Spill Response Actions

An earthen berm will be built immediately downgradient of any spill. Then all material will be removed from the site and disposed of in an approved manner.

ATTACHMENT B

The major factors that affects surface water and groundwater quality will be construction equipment on the site with the potential for leakage from maintenance and refueling.

ATTACHMENT C

CONSTRUCTION CONTROLS:

The major construction activities to take place at the project site consist of the construction of approximately 96,200 linear feet of asphalt road and the installation of water distribution lines. FM 306 will be used as the construction entrance. Rock Berms and silt fences for sediment traps will be constructed where shown on Drainage Map. All disturbed areas not covered with impervious material will be renegotiated with Rye-Bermuda grass mix immediately after completion of the grading. These areas will be prepared, seeded and watered by approved methods. Drainage Map shows guidelines for the restoration of grassed areas.

The following is an approximate chronological listing of the construction Activities and the Temporary Erosion Controls to be utilized during each activity.

CONSTRUCTION ACTIVITY	TEMPORARY EROSION CONTROL
Clearing and grubbing street right-of-way, rough grading of roads	Install rock berms, and silt fences and stabilized construction entrances.
Installation of water distribution system	No additional erosion controls necessary
Installation of drainage structures	No additional erosion controls necessary
Installation of base material	No additional erosion controls necessary
Installation of asphalt pavement	Seed disturbed areas immediately upon completion
Completion of construction	Remove sediment traps only after seed has established permanent growth.

All these construction activities will take place in the road row, approximately 133 acres.

ATTACHMENT D

Tempory Best Management Practices and Measures.

The major construction activities to take place at the project site consist of the construction of approximately 96,200 linear feet of asphalt road and the installation of water distribution lines. FM 306 will be used as the construction entrance. Rock Berms and silt fences for sediment traps will be constructed where shown on Drainage Map. All disturbed areas not covered with impervious material will be renegotiated with Rye-Bermuda grass mix immediately after completion of the grading. These areas will be prepared, seeded and watered by approved methods. Drainage Map shows guidelines for the restoration of grassed areas.

The following is an approximate chronological listing of the construction Activities and the Temporary Erosion Controls to be utilized during each activity.

CONSTRUCTION ACTIVITY	TEMPORARY EROSION CONTROL
Clearing and grubbing street right-of-way, rough grading of roads	Install rock berms, and silt fences and stabilized construction entrances.
Installation of water distribution system	No additional erosion controls necessary
Installation of drainage structures	No additional erosion controls necessary
Installation of base material	No additional erosion controls necessary
Installation of asphalt pavement	Seed disturbed areas immediately upon completion
Completion of construction	Remove sediment traps only after new seed has established permanent growth.

ATTACHMENT F

Structural Practices

Construction activities which will require soil disturbance will only take place in the proposed Street ROW. Rock berms will be built in all drainage intersects with the proposed roads, down gradient of these drainage courses to limit runoff discharge of pollutants from these disturbed areas.

ATTACHMENT G

DRAINAGE AREA MAP

MAP ENCLOSED

ATTACHMENT H

There are no temporary sediment ponds planned for this project.

ATTACHMENT I

INSPECTIONS AND MAINTENANCE FOR BMPS

a. Each Contractor will designate a qualified person or persons to perform the following inspections:

1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.

2. Erosion and sediment control measures identified in the plan will be observed to ensure that they are operating correctly.

3. Where discharge locations or points are accessible, they will be inspected to ascertain when the erosion control measures are effective in preventing significant impacts to receiving waters.

4. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking. The inspection will be conducted by the responsible person at least once every seven calendar days and within 24 hours after the end of a storm of 0.5 inch or greater.

   After a portion of the site is finally stabilized, inspection will be conducted at least once every month until construction activities have been completed.

b. Based on the results of the inspection, the site description and control measures will be revised by the Engineer as appropriate, but in no case later than seven calendar days following the inspection. Any modifications shall be implemented within seven days of the inspection.

c. A report prepared by the contractor summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the erosion controls, and actions taken in accordance with item" b" above will be made. The report will be signed and a copy of the report must be submitted to the Engineer within 2 days after the inspection.

Copies of the forms and certifications to be used for the Inspection and Maintenance report are included.

INSPECTION AND MAINTENANCE GUILDELINES FOR SILT FENCES

1. Inspect all fencing weekly, and after any rainfall.

2. Remove sediment when buildup reaches 6 inches, or install a second line of fencing parallel to the old fence.

3. Replace any torn fabric or install a second line of fencing parallel to the torn section.

4. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.

INSPECTION AND MAINTENANCE GUIDELINES FOR ROCK BERMS

1. Inspection should be made weekly and after each rainfall by the responsible party. For installations in streambeds, additional daily inspections should be made.

2. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt of in an approved manner.

3. Repair any loose wire sheathing.

4. The berm should be reshaped as needed during inspection.

5. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.

6. The rock berm should be left in place until all upstream areas are stabilized and accumulated silt removed.

INSPECTION REPORT

PROJECT NAME: RIVER CHASE, UNIT FIVE, SIX, SEVEN & EIGHT

REPORT NO._____ DATE:_____ PROJECT FILE NO:_____

INSPECTOR:_____ TITLE_____

REASON FOR INSPECTION (CHECK ONE) Weekly_____ or ½" Rain_____

DATE OF LAST RAINFALL_____AMOUNT_____

SITE CONDITIONS:

EROSION AND SEDIMENTATION CONTROLS	IN CONFORMANCE	EFFECTIVE
Construction Entrance	YES/NO/NA	YES/NO
Sediment Traps	YES/NO/NA	YES/NO
Inlet Protection	YES/NO/NA	YES/NO
Stabilization	YES/NO/NA	YES/NO
Silt Fence	YES/NO/NA	YES/NO
Straw/Hay Bales	YES/NO/NA	YES/NO
Vegetative Buffer Strips	YES/NO/NA	YES/NO
Rock Berms	YES/NO/NA	YES/NO

VIOLATIONS NOTED:

_____

_____

RECOMMENDED REMEDIAL ACTIONS:

_____

_____

COMMENTS:

_____

_____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision with a system designed to assure that qualified personnel property gathered and evaluated 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 that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

INSPECTOR:_____ **DATE:**_____

COPY_____

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize the tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site will be used as the main delivery route. This paved roadway can be easily cleaned by a front-end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the road. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at the entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

S69	WATER WELL TO BE SEALED TO TNRCC SPECIFICATIONS
S91	WATER WELL IS NOT LOCATED ON THIS PROJECT
S99	WATER WELL IS NOT LOCATED ON THIS PROJECT
S105	150' RADIUS OSSF SETBACK EASEMENT
S108	150' RADIUS OSSF SETBACK EASEMENT
S109	150' RADIUS OSSF SETBACK EASEMENT
S110	150' RADIUS OSSF SETBACK EASEMENT
S111	150' RADIUS OSSF SETBACK EASEMENT
S116	150' RADIUS OSSF SETBACK EASEMENT
S117	150' RADIUS OSSF SETBACK EASEMENT
S118	150' RADIUS OSSF SETBACK EASEMENT
S121	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S122	150' RADIUS OSSF SETBACK EASEMENT
S123	150' RADIUS OSSF SETBACK EASEMENT
S124	150' RADIUS OSSF SETBACK EASEMENT
S125	150' RADIUS OSSF SETBACK EASEMENT
S128	150' RADIUS OSSF SETBACK EASEMENT
S131	150' RADIUS OSSF SETBACK EASEMENT
S132	150' RADIUS OSSF SETBACK EASEMENT
S133	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S134	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S136	150' RADIUS OSSF SETBACK EASEMENT

S6, S18, S19, S26, S29, S30, S33, S42, S43, S44, S48, S54, S86, S87, S104, S107 THESE FEATURES TO HAVE OSSF SETBACK EASEMENTS IN DRAINAGE INTERSECTS.

ALL OSSF EASEMENTS TO BE SHOWN ON PLAT

ATTACHMENT D

400 Acres

S4	150' RADIUS OSSF SETBACK EASEMENT
S8	FEATURE TO BE SEALED BY ROAD CONSTRUCTION
S13	150' RADIUS OSSF SETBACK EASEMENT
S21	150' RADIUS OSSF SETBACK EASEMENT
S22	150' RADIUS OSSF SETBACK EASEMENT
S23	150' RADIUS OSSF SETBACK EASEMENT
S24	150' RADIUS OSSF SETBACK EASEMENT
S25	150' RADIUS OSSF SETBACK EASEMENT
S26	150' RADIUS OSSF SETBACK EASEMENT
S27	150' RADIUS OSSF SETBACK EASEMENT
S29	150' RADIUS OSSF SETBACK EASEMENT
S30	150' RADIUS OSSF SETBACK EASEMENT
S31	150' RADIUS OSSF SETBACK EASEMENT
S32	150' RADIUS OSSF SETBACK EASEMENT
S34	150' RADIUS OSSF SETBACK EASEMENT
S37	150' RADIUS OSSF SETBACK EASEMENT
S38	150' RADIUS OSSF SETBACK EASEMENT

S14, S15, S19, S33, S35 AND S36, THESE FEATURES TO HAVE OSSF SETBACK EASEMENTS IN DRAINAGE INTERSECTS.

1855 ACRES

S2	150' RADIUS OSSF SETBACK EASEMENT
S3	150' RADIUS OSSF SETBACK EASEMENT
S4	150' RADIUS OSSF SETBACK EASEMENT
S13	150' RADIUS OSSF SETBACK EASEMENT
S14	150' RADIUS OSSF SETBACK EASEMENT
S15	150' RADIUS OSSF SETBACK EASEMENT
S21	WATER WELL TO BE SEALED TO TNRCC SPECIFICATIONS.
S22	WATER WELL TO COMPLY WITH 30 TAC 238
S24	WATER WELL TO COMPLY WITH 30 TAC 238
S27	150' RADIUS OSSF SETBACK EASEMENT
S28	150' WIDE OSSF SETBACK EASEMENT
S32	150' RADIUS OSSF SETBACK EASEMENT
S49	150' RADIUS OSSF SETBACK EASEMENT
S50	150' RADIUS OSSF SETBACK EASEMENT

ATTACHMENT J

SCHEDULE OF INTERIM AND PERMANENT SOIL STABILIZATION PRACTICES

Interim soil stabilization practices will consist of the installation of rock berms, silt fences and stabilized construction entrances before construction to begin in accordance as shown on the site plan. If construction activity are to cease for more than ten (10) days, silt fences are to be installed downgradient of all disturbed areas and to be seeded or hydromulched to establish permanent growth. All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize the tracking of sediments by offsite vehicle hauling of materials, the State of Texas maintains FM 306 adjacent to the site will be used as the main delivery route. This paved roadway can be easily cleaned by a front-end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the road. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at the entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

PERMANENT STORMWATER SECTION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(C), (D)(ii), (E), and (5), EFFECTIVE JUNE 1, 1999

PROJECT NAME: River Chase, Unit Five, Six, Seven & Eight

Permanent best management practices (BMPs) and measures that will be used during and after construction is completed.

1. X Permanent BMPs and measures must be implemented to control the discharge of pollution from regulated activities after the completion of construction.

2. X These practices and measures have been designed, and will be constructed, operated, and maintained to insure that 80% of the incremental increase in the annual mass loading of total suspended solids (TSS) from the site caused by the regulated activity is removed. These quantities have been calculated in accordance with technical guidance prepared or accepted by the executive director.

   X The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

   __ A technical guidance other than the TNRCC TGM was used to design permanent BMPs and measures for this site. The complete citation for the technical guidance that was used is provided below

   _____

   _____

   _____

3. X Owners must insure that permanent BMPs and measures are constructed and function as designed. A Texas Licensed Professional Engineer must certify in writing that the permanent BMPs or measures were constructed as designed. The certification letter must be submitted to the appropriate regional office within 30 days of site completion.

4. X Where a site is used for low density single-family residential development and has 20 % or less impervious cover, other permanent BMPs are not required. This exemption from permanent BMPs must be recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

   X This site will be used for low density single-family residential development and has 20% or less impervious cover.

   __ This site will be used for low density single-family residential development but has more than 20% impervious cover.

   __ This site will not be used for low density single-family residential development.

5. X The executive director may waive the requirement for other permanent BMPs for multi-family residential developments, schools, or small business sites where 20% or less impervious cover is used at the site. This exemption from permanent BMPs must be

recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

X **ATTACHMENT A - 20% or Less Impervious Cover Waiver.** This site will be used for multi-family residential developments, schools, or small business sites and has 20% or less impervious cover. A request to waive the requirements for other permanent BMPs and measures is found at the end of this form.

__ This site will be used for multi-family residential developments, schools, or small business sites but has more than 20% impervious cover.

_ This site will not be used for multi-family residential developments, schools, or small business sites.

6. **ATTACHMENT B - BMPs for Upgradient Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site is identified as **ATTACHMENT B** at the end of this form.

__ If no surface water, groundwater or stormwater originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form.

X If permanent BMPs or measures are not required to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form .

7. **ATTACHMENT C - BMPs for On-site Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff from the site is identified as **ATTACHMENT C** at the end of this form.

X If permanent BMPs or measures are not required to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff, an explanation is provided as **ATTACHMENT C** at the end of this form.

8. X **ATTACHMENT D - BMPs for Surface Streams.** A description of the BMPs and measures that prevent pollutants from entering surface streams, sensitive features, or the aquifer is provided at the end of this form. Each feature identified in the Geologic Assessment as "sensitive" or "possibly sensitive" has been addressed.

9. X The applicant understands that to the extent practicable, BMPs and measures must maintain flow to naturally occurring sensitive features identified in either the geologic assessment, executive director review, or during excavation, blasting, or construction.

X The permanent sealing of or diversion of flow from a naturally-occurring "sensitive" or "possibly sensitive" feature that accepts recharge to the Edwards Aquifer as a permanent pollution abatement measure has not been proposed for any naturally-

occurring "sensitive" or "possibly sensitive" features on this site.

__ **ATTACHMENT E - Request to Seal Features.** A request to seal a naturally-occurring "sensitive" or "possibly sensitive" feature, that includes a justification as to why no reasonable and practicable alternative exists, is found at the end of this form. A request and justification has been provided for each feature.

10. NA **ATTACHMENT F - Construction Plans.** Construction plans and design calculations for the proposed permanent BMPs and measures have been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information have been signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed permanent BMPs and measures are provided at the end of this form. Design Calculations, TNRCC Construction Notes, all man-made or naturally occurring geologic features, all proposed structural measures, and appropriate details must be shown on the construction plans.

11. NA **ATTACHMENT G - Inspection, Maintenance, Repair and Retrofit Plan.** A plan for the inspection, maintenance, repair, and, if necessary, retrofit of the permanent BMPs and measures is provided at the end of this form. The plan has been prepared and certified by the engineer designing the permanent BMPs and measures. The plan has been signed by the owner or responsible party. The plan includes procedures for documenting inspections, maintenance, repairs, and, if necessary, retrofits as well as a discussion of record keeping procedures.

12. NA The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

__ Pilot-scale field testing (including water quality monitoring) may be required for BMPs that are not contained in technical guidance recognized by or prepared by the executive director.

__ **ATTACHMENT H - Pilot-Scale Field Testing Plan.** A plan for pilot-scale field testing is provided at the end of this form.

13. X **ATTACHMENT I -Measures for Minimizing Surface Stream Contamination.** A description of the measures that will be used to avoid or minimize surface stream contamination and changes in the way in which water enters a stream as a result of the construction and development is provided at the end of this form. The measures address increased stream flashing, the creation of stronger flows and in-stream velocities, and other in-stream effects caused by the regulated activity which increase erosion that results in water quality degradation.

Responsibility for maintenance of permanent BMPs and measures after construction is complete.

14. X The applicant is responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another entity having ownership or control of the property (such as without limitation, an owner's association, a new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity. Such entity shall then be responsible for maintenance until another entity assumes such obligations in writing or ownership is transferred.

15. X A copy of the transfer of responsibility must be filed with the executive director at the

appropriate regional office within 30 days of the transfer if the site is for use as a multiple single-family residential development, a multi-family residential development, or a non-residential development such as commercial, industrial, institutional, schools, and other sites where regulated activities occur.

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. This **PERMANENT STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

Kelly Kilber, Agent
Print Name of Applicant/Owner/Agent

Signature of Applicant/Owner/Agent

12/3/01
Date

ATTACHMENT A

20% or Less Impervious Cover Waiver

We request a waiver to permanent BMPs due to the fact that there will be less than 20% impervious cover. This development is a low density single family residential subdivision.

ATTACHMENT B

This site has less than 20% impervious cover and no permanent BMPs will be constructed. Some storm water originates upgradient from the site and flows across the site. All drainage courses will be left in there natural state. No diversion or impounding of this drainage will take place. Temporary BMP's will consist of silt fences and rock berms and stabilized construction entrances.

ATTACHMENT C

This site has less than 20% impervious cover and no permanent BMPs will be constructed. All drainage courses will be left in there natural state. No diversion of Stormwater runoff or new channelization will take place.

ATTACHMENT E

FEATURES S8, S121, S133 AND S134 WILL BE SEALED BY ROAD CONSTRUCTION. ALTERNATE ROAD ALIGNMENT WAS NOT PRACTICAL.

ATTACHMENT I

All new drainage structures to have concrete rip-rap headwalls and disturbed areas to be revegetate to minimize erosion that could result in water quality degradation.

AGENT AUTHORIZATION FORM
FOR REQUIRED SIGNATURE
EDWARDS AQUIFER PROTECTION PROGRAM
RELATING TO 30 TAC CHAPTER 213
EFFECTIVE JUNE 1, 1999

I CHARLES D. PATTERSON,
Print Name

PRESIDENT
Title - Owner/President/Other

of SOUTHERLAND PROPERTIES, INC.
Corporation/Partnership/Entity Name

have authorized Kelly Kilber , P. E.
Print Name of Agent/Engineer

of Pro-Tech Engineering Group Inc.
Print Name of Firm

to represent and act on the behalf of the above named Corporation, Partnership, or Entity for the purpose of preparing and submitting this plan application to the Texas Natural Resource Conservation Commission (TNRCC) for the review and approval consideration of regulated activities.

I also understand that:

1. The applicant is responsible for compliance with 30 Texas Administrative Code Chapter 213 and any condition of the TNRCC's approval letter. The TNRCC is authorized to assess administrative penalties of up to $10,000 per day per violation.

2. A notarized copy of the Agent Authorization Form must be provided for the person preparing the application, and the forms must accompany the completed application.

3. Application fees are due and payable at the time the application is submitted. The application fee must be sent to the TNRCC cashier or to the appropriate regional office. The application will not be considered until the correct fee is received by the commission.

4. For applicants who are not the property owner, but who have the right to control and possess and control the property, additional authorization is required from the owner.

Applicant's Signature

10/5/01
Date

THE STATE OF Texas §

County of Hays §

BEFORE ME, the undersigned authority, on this day personally appeared CHARLES D. PATTERSON known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office on this 5 day of October, 2001.

RICHARD MCDANIEL
NOTARY PUBLIC STATE OF TEXAS
COMMISSION EXPIRES:
AUGUST 17, 2005

NOTARY PUBLIC

Typed or Printed Name of Notary

MY COMMISSION EXPIRES: _____

0002110A\000211e1ga.dwg\KAM\11-5-00

LEGEND

S-1 ✱	KARST or MAN-MADE FEATURE
A-1 ✱	OFF-SITE KARST or MAN-MADE FEATURE
S-69 -o-	WATER WELL (in use)
S-21 ◊	WATER WELL (abandoned)
S-9 ●	STOCK POND, CLOSED DEPRESTION (CD) or QUARRY
U / D	FAULTS: (dashed where inferred) UPTHROWN DOWNTHROWN
◊ / X	ANTICLINE & SYNCLINE
- - - - -	LITHOLOGIC CONTACT (dashed were inferred)

GEOLOGIC FORMATIONS:

Qal	QUATERNARY ALLUVIUM
Q-Tgr	QUATERNARY - TERTIARY GRAVELS
Kbu	BUDA FORMATION
Kdr	DEL RIO
Kgt	GEORGETOWN FORMATION
Kep2	PERSON FORMATION II (Cyclic & Marine Members, Undivided)
Kep3	PERSON FORMATION III (Leached and Collapsed Members, Undivided)
Kep4	PERSON FORMATION IV (Regional Dense Member)
Kek5	KAINER FORMATION V (Grainstone Member)
Kek6	KAINER FORMATION VI (Kirschberg Evaporite Members)
Kek7	KAINER FORMATION VII (Dolomitic Members)

BASE MAP SOURCE:
PRO-TECH ENGINEERING GROUP, INC.

GEOLOGY MODIFIED FROM:
SMALL, TED A. AND JOHN A. HANSON. GEOLOGIC FRAMEWORK AND HYDROGEOLOGIC CHARACTERISTICS OF THE EDWARDS AQUIFER OUTCROP, COMAL COUNTY, TEXAS. *U.S. GEOLOGICAL SURVEY (USGS) WATER-RESOURCES INVESTIGATIONS REPORT* 94-4117. 1994.

BAUMGARDNER AND COLLINS, GEOLOGIC MAP OF HUNTER QUAD., BUREAU OF ECONOMIC GEOLOGY OPEN FILE MAP. 1991.

(UT-BEG) UNIVERSITY OF TEXAS - BUREAU OF ECONOMIC GEOLOGY. REPRINTED 1992. SAN ANTONIO SHEET

0 200 400
SCALE IN FEET

N

SITE GEOLOGIC MAP

1855-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 010083 GA
March 2001

Horizon
ENVIRONMENTAL SERVICES, INC.

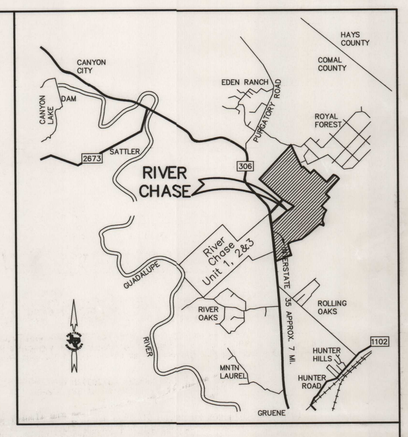
RECEIVED
NOV 1 5 2001
COUNTY ENGINEER

River Chase

UNIT FIVE, SIX, SEVEN & EIGHT

COMAL COUNTY, TEXAS

WPAP




UNIT SIX
UNIT FIVE
EXISTING UNIT FOUR
UNIT SEVEN
UNIT EIGHT
100 - YEAR FLOOD PLAIN
S-28 (ER) Zone
Kek7
Kek6
Kek5
Kep4
Kep3
Q-Tgr
Kbu
Kdr
Kgt
Kwu
S-1 (SH)
S-2 (FR)
S-3 (SC)
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S-24 (SC)
S-25 (SC)
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S-27 (SC)
S-28 (ER) Zone
S-29 (FZ)
S-30 (FR & CD)
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S-108 (FR)
S-109 (FR)
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S-154 (FZ)
S-155 (FZ)
S-156 (FZ)

River Chase

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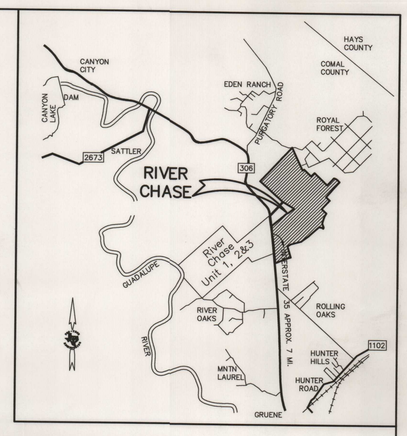
COUNTY ENGINEER

UNIT FIVE, SIX, SEVEN & EIGHT

COMAL COUNTY, TEXAS

DRAINAGE PLAN
ATTACHMENT G



NOTE:
DRAINAGE AREAS SHOWN ON THIS MAP ARE LOCATED IN THE ROAD ROW ONLY AND DO NOT EXCEED 10 ACRES.

DRAINAGE BASIN BOUNDARY

UNIT SIX

UNIT FIVE

EXISTING UNIT FOUR

UNIT SEVEN

UNIT EIGHT

100 - YEAR FLOOD PLAIN

SCALE: 1" =400'

OWNER/DEVELOPER:
SOUTHERLAND PROPERTIES, INC.
P.O. BOX 1629
WIMBERLEY, TEXAS 78676
(512) 847-5263

PREPARED OCTOBER 25, 2001

PRO·TECH ENGINEERING GROUP INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

Fri Nov 09 07:41:20 2001 AM

000259GA\000259c1ga.dwg\KAM\12-20-00

LEGEND

S-1 ✱ KARST FEATURE

S-9 ● STOCK POND

U / D FAULTS: (dashed where inferred)
UPTHROWN
DOWNTHROWN

ANTICLINE & SYNCLINE

LITHOLOGIC CONTACT (dashed were inferred)

GEOLOGIC FORMATIONS:

- Kbu — BUDA FORMATION
- Kdr — DEL RIO
- Kgt — GEORGETOWN FORMATION
- Kep3 — PERSON FORMATION III (Leached and Collapsed Members, Undivided)
- Kep4 — PERSON FORMATION IV (Regional Dense Member)
- Kek5 — KAINER FORMATION V (Grainstone Member)
- Kek6 — KAINER FORMATION VI (Kirschberg Evaporite Members)

Kek6, Kek5, Kep3, Kbu, Kgt, Kdr, Kep4

S-1 (SC), S-2 (CD), S-3 (SC), S-4 (FR & SC), S-5 (CD), S-6 (SC), S-7 (SC), S-8 (SC), S-9 (CD), S-10, S-11, S-12 (SC), S-13 (SC), S-14(FZ), S-15 (FZ), S-16 (SC), S-17 (SC), S-18 (FR & SC), S-19 (FZ), S-20 (CD), S-21 (SC), S-22 (SC), S-23 (SC), S-24 (SC), S-25 (SC), S-26 (SC), S-27, S-28, S-29, S-30 (FR & CD), S-31 (SC), S-32 (SC), S-33 (FZ), S-34 (SC), S-35 (FZ), S-36 (FZ), S-37 (FR), S-38 (FR)

RECEIVED
NOV 15 2001
COUNTY ENGINEER

BASE MAP SOURCE:
PRO-TECH ENGINEERING GROUP, INC.

GEOLOGY MODIFIED FROM:
SMALL, TED A. AND JOHN A. HANSON. GEOLOGIC FRAMEWORK AND HYDROGEOLOGIC CHARACTERISTICS OF THE EDWARDS AQUIFER OUTCROP, COMAL COUNTY, TEXAS. *U.S. GEOLOGICAL SURVEY (USGS) WATER-RESOURCES INVESTIGATIONS REPORT* 94-4117. 1994.

BAUMGARDNER AND COLLINS, GEOLOGIC MAP OF HUNTER QUAD., BUREAU OF ECONOMIC GEOLOGY OPEN FILE MAP. 1991.

(UT-BEG) UNIVERSITY OF TEXAS - BUREAU OF ECONOMIC GEOLOGY. REPRINTED 1992. SAN ANTONIO SHEET



0 200 400
SCALE IN FEET

N

SITE GEOLOGIC MAP

400-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 000259 GA
December 2000

Horizon
ENVIRONMENTAL SERVICES, INC.

GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 1855-acre Pfeuffer Ranch — HJN 000211 GA

FEATURE ID			FEATURE CHARACTERISTICS																					PHYSICAL SETTING																
1A	1B	1C	2	3			4			5	6		7			8				9			10	11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB- TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT	POSSIBLE	SENSITIVE	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW	MODERATE	HIGH	YES
																										<25	25 - 50	>50														
	S1	CD	10	Kek	150	150	15					0								5			0			15	15			0						10			10	10			YES
5,6,7,8	S2	FR	0	Kek							200/30	140-160	10			10		6			6			0			30		30							15			20	35			35	YES
5,6,7,8	*S3	SC	10	Kep	10	10	4															10			30	50		50		0					10				10	10			YES
	S4	C		Kep				30	6	30												15			30	45		45		0					10				10	10			YES
	S5	SC	10	Kek				2	2	1										5			0			15	15			0					10				10	10			YES
5,6,7,8	S6	FZ	15	Kek							50/15	15	10											10		35		35				15					20	35			35	YES
5,6,7,8	S7	FR	0	Kek							40/15	S5-125	10			10	0			0			0			20	20				5			10				15		15		YES
5,6,7,8	S8	FR	0	Kek							40/30	120	10			10	0			0			0			20	20					15				20	35			35	YES
	S9	SC	10	Kep				1	1	1											5		0			15	15			0				5				5	5			YES
	S10	SC	10	Kep				0.5	4	4											5		0			15	15			0				5				5	5			YES
5,6,7,8	S11	FR	0	Kep							30/15	30-110	10		5		0				5		0			20	20					10				20	30			30	YES
5,6,7,8	S12	FR	0	Kek								80	10		5		0				5		0			20	20					10				20	30			30	YES
5,6,7,8	*S13	SH	20	Kek	3.5	3.5	3					45	10									10		10		50		50			5			10				15		15		YES
5,6,7,8	S14	FR	0	Kek							50/20	90-120-150	10		5			5			5		0			25		25				10				20	30			30	YES
5,6,7,8	S15	FR	0	Kek							50/20	100	10		5			5			5		0			25		25				10				20	30			30	YES
	S16	SC	10	Kep				1	6	1											5					15	15			0					10				10	10			YES
	S17	SC	10	Kek				1	1	1											5				30	45		45		0					10				10	10			YES
5,6,7,8	S18	FZ	15	Kek								45	10								5			10		40		40				15				20	35			35	YES
5,6,7,8	S19	FZ	15	Kek								30	10								5		0			30		30				15				20	35			35	YES
	S20	FR	0	Kek							20/20	100			5					0				10		15	15					10				20	30			30	YES
	S21	MM	35	KeP																					30	65			65	0					10				10	10			YES
	S22	MM	35	KeP																					30	65			65	0					10				10	10			YES
	S23	MM	35	Kep																					30	65			65	0					10				10	10			YES
	S24	MM	35	Kbu																					30	65			65	0					10				10	10			YES
5,6,7,8	S25	FR	0	KeK							50/50	115			5			5			5		0			15	15			0					10				10	10			YES
5,6,7,8	S26	FZ	15	Kek/Kep								~80	10								5		0			30		30				15				20	35			35	YES

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(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and followed the Texas Natural Resource Conservation Commission's instructions to Geologists. information presented here complies with that document and is a true representation of the conditions observed in the field

Kristin Miller — 6-Feb-01

Geologist signature — Date

02/12/2002 TUE 15:21 FAX 005/006

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GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: 400-acre Pfeuffer tract — HJN 000259 GA

| | FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

"RECEIVED TNRCC"
SAN ANTONIO
REGION

2002 FEB 15 AM 9:52

100 E. San Antonio St. Suite 100
San Marcos, TX 78666-5568

512 / 353-3335
FAX 512 / 396-0224

PRO-TECH
ENGINEERING
GROUP
INCORPORATED

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February 13, 2002

TNRCC
140 Heimer Rd., Ste. 360
San Antonio, Tx 78232-5042

Attn: John Mauser

Re: River Chase, Units Five, Six, Seven & Eight
Comal County, Texas

John:

Enclosed please find the following items for the above referenced project:

1. Four copies of the revised site plan.
2. Four copies of the revised Attachment D.
3. Four copies of the Geologic Assessment Table and the report prepared by Horizon dealing with those features reviewed by the field investigation of January 2002.

Thank you for your assistance and if you have any questions please call.

Respectfully,
PRO-TECH ENGINEERING GROUP, INC.

Richard McDaniel

enclosures
xc: Mark Spencer

EO# 14677
Mauser ltr.

195 David Jonas Drive
New Braunfels, TX 78132
Phone: (830) 608-2090
Fax: (830) 608-2009

COMAL COUNTY ENGINEER'S OFFICE

Fax

To: Richard **Fax:** 512-396-0224

From: Betty

Pages: 5 **Date:** 10-12-01

Re: River Chase, Units Five, Six, Seven, and Eight and River Chase Business Park

☑ As Requested ☐ For Your Review ☑ Hard Copy to Follow via Mail ☐ Please Forward

• **Comments:**

Sent Ltr. of 10-11-01 - RE: Recommendation of Sewage Facilities requirement.



COPY

Comal County

OFFICE OF COMAL COUNTY ENGINEER

October 11, 2001

Mr. Charles D. Patterson
River Chase Venture, Ltd.
P.O. Box 1629
Wimberley, TX 78676

Re: Proposed subdivision, RIVER CHASE, UNITS FIVE, SIX, SEVEN AND EIGHT, within Comal County, Texas

Dear Property Owner(s):

We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the property to be approved with the conditions that individual septic systems permits shall be required for the lots within this subdivision.

Please be advised that these individual permits will be required to meet 30 TAC 285.40, subchapter E (copy attached). Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

cc: Pro-Tech Engineering Group

195 David Jonas Drive • New Braunfels, Texas 78130 • (830) 608-2090 FAX (830) 608-2009

SUBCHAPTER E : SPECIAL REQUIREMENTS FOR OSSFS LOCATED IN THE EDWARDS AQUIFER RECHARGE ZONE §285.40

§285.40. OSSFs on the Recharge Zone of the Edwards Aquifer.

(a) Applicability. In addition to the requirements given in this chapter, the following additional provisions apply to the Edwards Aquifer recharge zone as defined in §285.2 of this title (relating to Definitions) and is not intended to be applied to any other areas in the State of Texas.

(b) Additional application requirements for new OSSFs.

(1) All planning and design materials shall be submitted by a professional engineer or sanitarian registered in Texas.

(2) Site evaluation to be conducted by a certified site evaluator possessing a valid certificate.

(c) Conditions for obtaining a permit to construct. In order to obtain a permit to construct in the Edwards Aquifer recharge zone, the following conditions must be met.

(1) Minimum lot sizes. Each lot or tract of land on the recharge zone on which OSSFs are to be located must have an area of at least one acre (43,560 square feet) per single family dwelling.

(2) Minimum separation distances from recharge features. The following separation distances shall be maintained from recharge features found during a site evaluation or in accordance with a geologic assessment performed in accordance with Chapter 213 of this title (relating to Edwards Aquifer). No sewage treatment tank or holding tank may be located within 50 feet of a recharge feature. No soil absorption system may be located within 150 feet of a recharge feature.

(3) No OSSF may be installed closer than 75 feet from the banks of the Nueces, Dry Frio, Frio, or Sabinal Rivers downstream from the northern Uvalde county line to the recharge zone.

(d) Existing OSSFs. OSSFs licensed by, or registered with, the appropriate permitting authority at the time of adoption of this section shall remain licensed or registered under the terms and conditions of the current license or registration. Any relicensing shall be performed in accordance with §285.3 of this title (relating to Applicability). An OSSF installed on the recharge zone prior to April 11, 1977, in either Uvalde or Kinney Counties is not required to be permitted or licensed, provided the OSSF is not causing pollution, is not a threat to the public health, or is not a nuisance, and has not been substantially modified.

(e) Exceptions for certain lots. Lots platted and recorded with the county in its official plat record, deed, or tax records of the following counties prior to the dates for the counties indicated in this

subsection, are exempted from the one-acre minimum lot size requirement, pursuant to the conditions of subsection (f) of this section.

(1) Kinney, Uvalde, Medina, Bexar, and Comal Counties--March 26, 1974;

(2) Hays County--June 21, 1984;

(3) Travis County--November 21, 1983; and

(4) Williamson County--May 21, 1985.

(f) Notice. Any person, or his agents or assignees, desiring to construct a residential development with two or more lots in which OSSFs will be utilized in whole or in part on the recharge zone and desiring to sell, lease, or rent the lots therein, must inform in writing each prospective purchaser, lessee, or renter of the following.

(1) Each lot within the regulated development is subject to the terms and conditions of this section.

(2) A permit to construct shall be required before an OSSF can be constructed in the subdivision.

(3) A license to operate shall be required for the operation of an OSSF.

(4) Whether or not an application for a water pollution abatement plan as defined in Chapter 213 of this title (relating to Edwards Aquifer), has been made, and whether or not it has been approved, and whether any restrictions or conditions have been placed on that approval.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN (WPAP)

RIVER CHASE PARK
COMAL COUNTY, TEXAS

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PRO·TECH
ENGINEERING
GROUP
INCORPORATED

100 E. San Antonio St., Suite 100
San Marcos, Tx 78666
512-353-3335
512-396-0224 (Fax)

"RECEIVED TNRCC" SAN ANTONIO REGION
2002 MAR 20 PM 1:25
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MAR 26 2002
COUNTY ENGINEER

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
EDWARDS AQUIFER PROTECTION PLAN
APPLICATION FEE FORM

NAME OF PROPOSED PROJECT: River Chase Park
PROJECT LOCATION: Comal County, Texas
NAME OF APPLICANT: Southerland Properties, Inc.
APPLICANT'S ADDRESS: P. O. Box 1629
CONTACT PERSON: Charles D. Patterson PHONE: (512) 847-5263
Please Print

AUSTIN REGIONAL OFFICE (3373)
Hays
☐ Travis
☐ Williamson

SAN ANTONIO REGIONAL OFFICE (3362)
Bexar
☒ Comal
☐ Kinney
☐ Medina
☐ Uvalde

APPLICATION FEES MUST BE PAID BY CHECK, CERTIFIED CHECK, OR MONEY ORDER, PAYABLE TO THE TEXAS NATURAL RESOURCE CONSERVATION COMMISSION. YOUR CANCELED CHECK WILL SERVE AS YOUR RECEIPT. **THIS FORM MUST BE SUBMITTED WITH YOUR FEE PAYMENT**. THIS PAYMENT IS BEING SUBMITTED TO (CHECK ONE):

☒ **SAN ANTONIO REGIONAL OFFICE**
☐ **Mailed to TNRCC**:
TNRCC - Cashier
Revenues Section
Mail Code 214
P.O. Box 13088
Austin, TX 78711-3088

☐ **AUSTIN REGIONAL OFFICE**
☐ **Overnight Delivery to TNRCC**:
TNRCC - Cashier
12100 Park 35 Circle
Building A, 3rd Floor
Austin, TX 78753
512/239-0347

Type of Plan	Size	Fee Due
Water Pollution Abatement, One Single Family Residential Dwelling	Acres	$
Water Pollution Abatement, Multiple Single Family Residential and Parks	Acres	
Water Pollution Abatement, Non-residential	32.91 Acres	$3,.000.00
Sewage Collection System	L.F.	$
Lift Stations without sewer lines	Acres	$
Underground or Aboveground Storage Tank Facility	Tanks	$
Piping System(s)(only)	Each	$
Exception	Each	$
Extension of Time	Each	$

Signature Date 2-28-02

GENERAL INFORMATION FORM
FOR REGULATED ACTIVITIES ON THE
EDWARDS AQUIFER RECHARGE AND TRANSITION ZONES
AND RELATING TO 30 TAC §213.4(b) & §213.5(b)(2)(A), (B)
EFFECTIVE JUNE 1, 1999

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MAR 26 2002
COUNTY ENGINEER

PROJECT NAME: RIVER CHASE PARK
COUNTY: COMAL STREAM BASIN: ALLIGATOR CREEK

EDWARDS AQUIFER: X RECHARGE ZONE
__ TRANSITION ZONE

PLAN TYPE: X WPAP __ AST __ EXCEPTION
__ SCS __ UST __ MODIFICATION

APPLICANT INFORMATION

1. Applicant:

Contact Person: CHARLES D. PATTERSON
Entity: SOUTHERLAND PROPERTIES, INC.
Mailing Address: P. O. BOX 1629
City, State: WIMBERLEY, TX Zip: 78676
Telephone: (512) 847-5263 FAX: (512) 847-3690

2. Agent/Representative (If any):

Contact Person: KELLY KILBER
Entity: PRO-TECH ENGINEERING GROUP, INC.
Mailing Address: 100 E. SAN ANTONIO ST., SUITE 100
City, State: SAN MARCOS, TX Zip: 78676
Telephone: (512) 353-3335 FAX: (512) 396-0224

PROJECT LOCATION

3. Site Address: RIVER CHASE
Street: 6205 FM 306
City: NEW BRAUNFELS, TX Zip: 78132

4. __ This project is inside the city limits of _____.
__ This project is outside the city limits but inside the ETJ (extraterritorial jurisdiction) of _____.
X This project is not located within any city's limits or ETJ.

5. The location of the project site is described below. The description provides sufficient detail and clarity so that the TNRCC's Regional staff can easily locate the project and site boundaries for a field investigation.

2.5 MILES SOUTH OF PURGATORY ROAD ON FM 306

6. X **ATTACHMENT A - ROAD MAP.** A road map showing directions to and the location of the project site is attached at the end of this form.

7. X **ATTACHMENT B - USGS / EDWARDS RECHARGE ZONE MAP.** A copy of the official 7 ½ minute USGS Quadrangle Map (Scale: 1" = 2000') of the Edwards Recharge Zone is attached behind this sheet. The map(s) should clearly show:

   X Project site.
   X USGS Quadrangle Name(s).
   X Boundaries of the Recharge Zone (and Transition Zone, if applicable).
   X Drainage path from the project to the boundary of the Recharge Zone.

8. X Sufficient survey staking is provided on the project to allow TNRCC regional staff to locate the boundaries and alignment of the regulated activities and the geologic or manmade features noted in the Geologic Assessment. **The TNRCC must be able to inspect the project site or the application will be returned.**

9. X **ATTACHMENT C - PROJECT DESCRIPTION.** Attached at the end of this form is a detailed narrative description of the proposed project.

10. Existing project site conditions are noted below:
   __ Existing commercial site
   __ Existing industrial site
   __ Existing residential site
   __ Existing paved and/or unpaved roads
   __ Undeveloped (Cleared)
   X Undeveloped (Undisturbed/Uncleared)
   __ Other:

PROHIBITED ACTIVITIES

11. X I am aware that the following activities are prohibited on the **Recharge Zone** and are not proposed for this project:

   (1) waste disposal wells regulated under 30 TAC Chapter 331 of this title (relating to Underground Injection Control);
   (2) new feedlot/concentrated animal feeding operations, as defined in 30 TAC §213.3;
   (3) land disposal of Class I wastes, as defined in 30 TAC §335.1;
   (4) the use of sewage holding tanks as parts of organized collection systems; and
   (5) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41(b), (c), and (d) of this title (relating to Types of Municipal Solid Waste Facilities).

12. X I am aware that the following activities are prohibited on the **Transition Zone** and are not proposed for this project:

(1) waste disposal wells regulated under 30 TAC Chapter 331 (relating to Underground Injection Control);
(2) land disposal of Class I wastes, as defined in 30 TAC §335.1; and
(3) new municipal solid waste landfill facilities required to meet and comply with Type I standards which are defined in §330.41 (b), (c), and (d) of this title.

ADMINISTRATIVE INFORMATION

13. The fee for the plan(s) is based on:

X For a Water Pollution Abatement Plan and Modifications, the total acreage of the site where regulated activities will occur.
__ For an Organized Sewage Collection System Plans and Modifications, the total linear footage of all collection system lines.
__ For a UST Facility Plan or an AST Facility Plan, the total number of tanks or piping systems.
__ A Contributing Zone Plan.
__ A request for an exception to any substantive portion of the regulations related to the protection of water quality.
__ A request for an extension to a previously approved plan.

14. Application fees are due and payable at the time the application is filed. If the correct fee is not submitted, the TNRCC is not required to consider the application until the correct fee is submitted. Both the fee and the Edwards Aquifer Fee Form have been sent to the Commission's:

__ TNRCC cashier
__ Austin Regional Office (for projects in Hays, Travis, and Williamson Counties)
X San Antonio Regional Office (for projects in Bexar, Comal, Kinney, Medina, and Uvalde Counties)

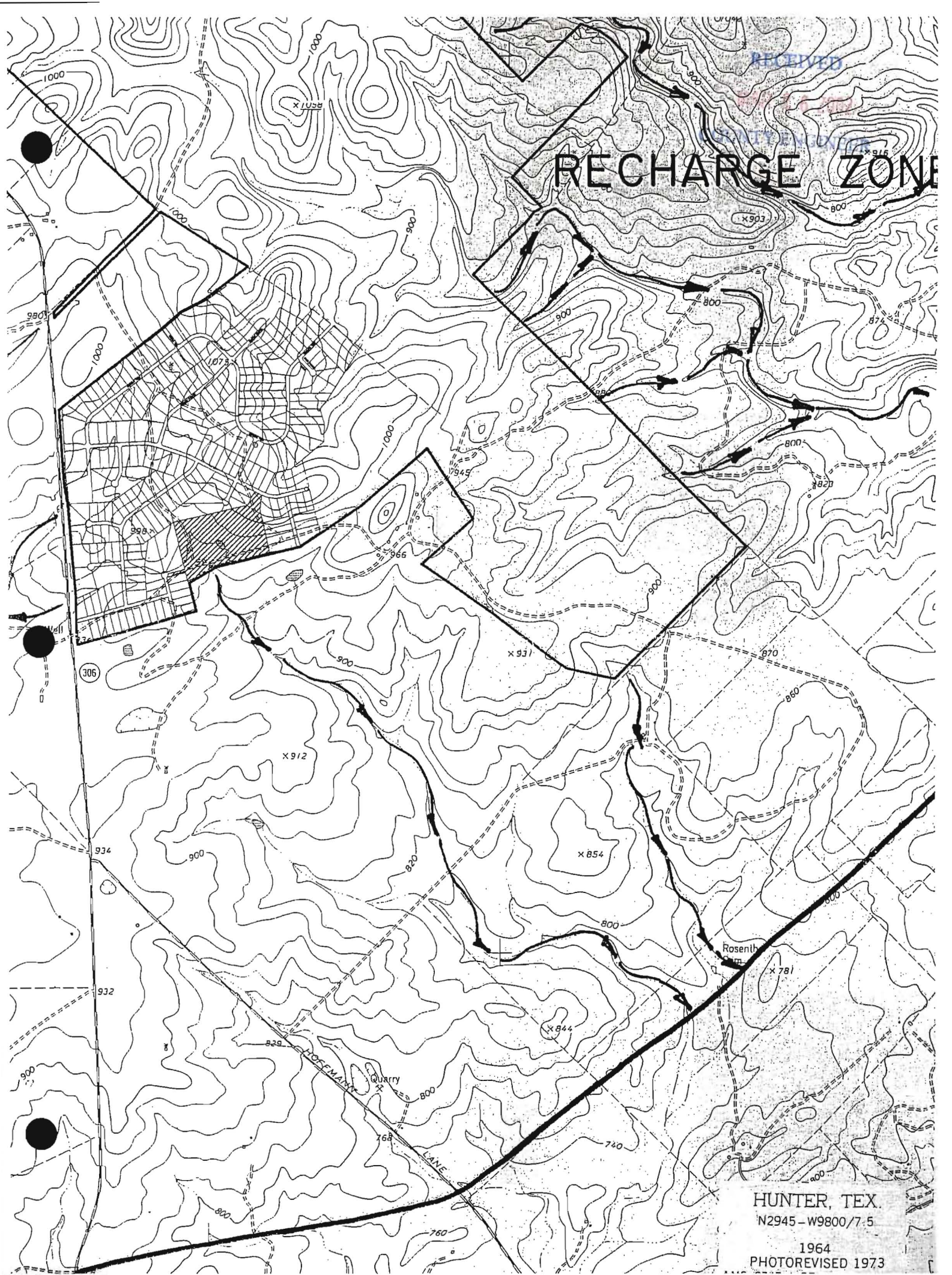
15. X Submit one (1) original and three (3) copies of the completed application to the appropriate regional office for distribution by the TNRCC to the local municipality or county, groundwater conservation districts, and the TNRCC's Central Office.

16. X No person shall commence any regulated activity until the Edwards Aquifer Protection Plan(s) for the activity has been filed with and approved by the executive director.
__ No person shall commence any regulated activity until the Contributing Zone Plan for the activity has been filed with the executive director

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. This **GENERAL INFORMATION FORM** is hereby submitted for TNRCC review. The application was prepared by:

KELLY KILBER, Agent
Print Name of Applicant/Agent

Signature of Applicant/Owner/Agent 3/19/02 Date


RECHARGE ZONE
HUNTER, TEX.
N2945 – W9800/7.5
1964
PHOTOREVISED 1973
HOFFMAN
Quarry
LANE
Rosenth
306

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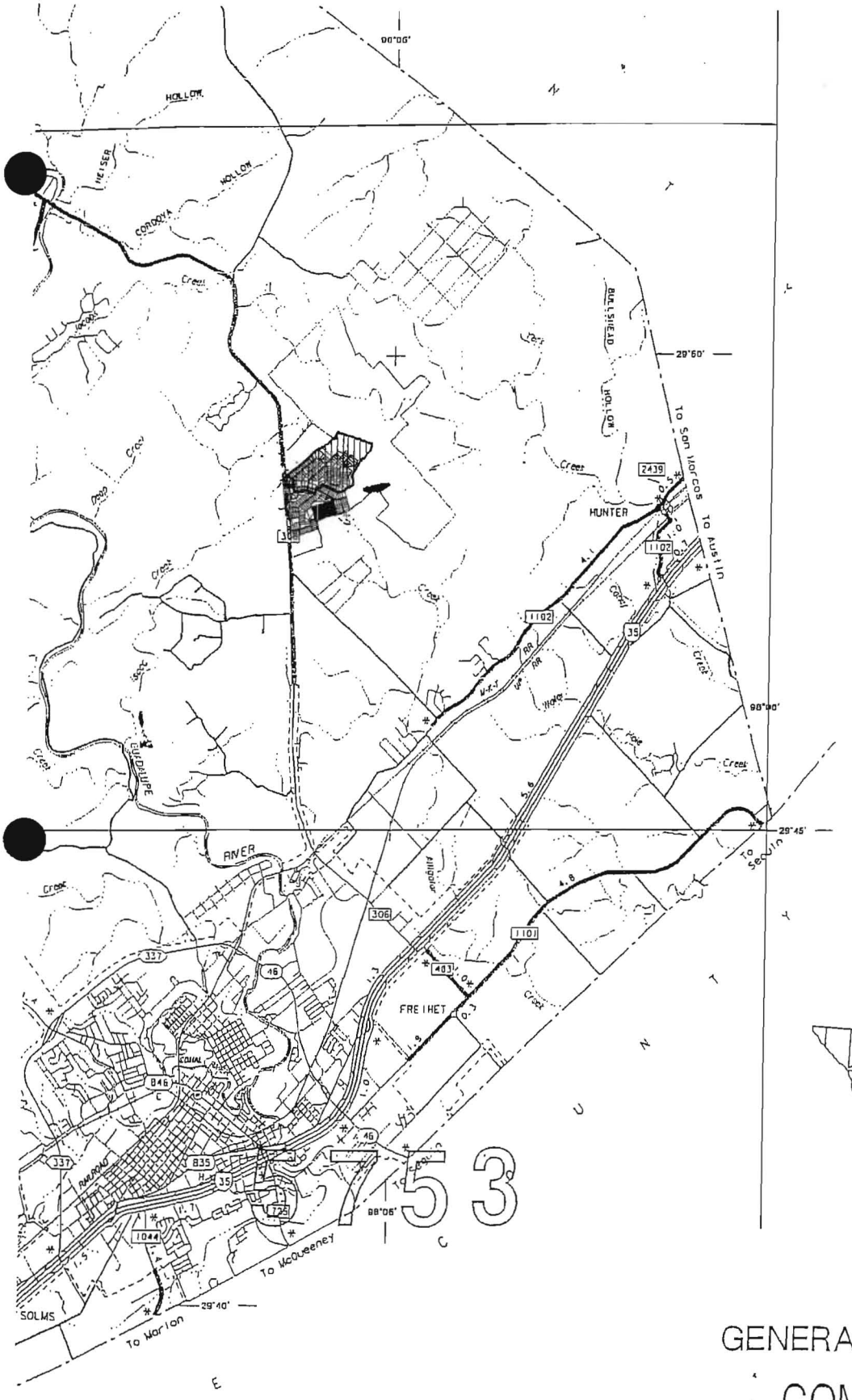
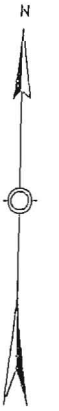






KEY TO COUNTIES

GENERAL HIGHWAY MAP

COMAL COUNTY

TEXAS

PREPARED BY THE

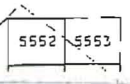
TEXAS DEPARTMENT OF TRANSPORTATION

TRANSPORTATION PLANNING AND PROGRAMMING DIVISION

IN COOPERATION WITH THE

U.S. DEPARTMENT OF TRANSPORTATION

FEDERAL HIGHWAY ADMINISTRATION



NOTICE

This map has been prepared for internal use within the Texas Department of Transportation. Accuracy is limited to the validity of available data as of dates shown.

TRAVEL INFORMATION

SCALE IN MILES



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PROJECT DESCRIPTION:

River Chase Park is located on 32.91 acres (Lot 645, River Chase Unit Five) for the home owners of the River Chase Subdivision. The park will consist of a 3,600 square foot club house with swimming pool, tennis court, softball field, soccer field with walking trail with picnic and asphalt parking areas. The site is located approximately 7 miles north of the city of New Braunfels off of FM 306 and is not located within any Extra Territorial Jurisdiction of any local city.

River Chase Subdivision is located on the eastern edge of the Edwards Plateau. Alligator Creek is located to the southeast of the site and is located within the Edwards Aquifer Zone as determined by the TNRCC. This property is currently open/unused land; past uses have been for ranching and grazing purposes.

New Braunfels Utility will supply water for the park. Wastewater will be treated and disposed of by private septic system constructed in accordance with the TNRCC and Comal County Health Department's rules and regulations. Sheet flow and open ditches to Alligator Creek will transport Stormwater runoff.

Fill material may be required for the soccer and softball fields. The TNRCC will be notified in writing with the source and type of fill materials to be used. The fill material will be tested for metals, pesticides and Total Petroleum Hydrocarbons. Test results shall be submitted to the TNRCC for approval before fill material is placed on site.

Horizon
ENVIRONMENTAL SERVICES, INC.

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TNRCC GEOLOGIC ASSESSMENT FORM

FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE/TRANSITION ZONES
AND RELATING TO 30 TAC §213.5(b)(3), EFFECTIVE JUNE 1, 1999

PROJECT NAME: 1855-ACRE PROPERTY, PFEUFFER RANCH AT FM 306, COMAL COUNTY, TEXAS.

TYPE OF PROJECT: X WPAP __ AST __ SCS __ UST

LOCATION OF PROJECT: X Recharge Zone __ Transition Zone __ Contributing Zone

PROJECT INFORMATION

1. X Geologic or manmade features are described and evaluated using the attached **GEOLOGIC ASSESSMENT TABLE (Appendix A)**.

2. Soil cover on the project site is up to 6.7 feet thick. In general, the soil present appears to have the ability to:

__ transmit fluid flow to the subsurface.
X impede fluid flow to the subsurface.

3. X **SOILS ATTACHMENT**. A narrative description of soil units and a soil profile, including thickness and hydrologic characteristics are provided in Section 5.0 of the Additional Comments section at the end of this form.

4. X A **STRATIGRAPHIC COLUMN** is attached at the end of this form that shows formations, members, and thicknesses. The outcropping unit should be at the top of the stratigraphic column (Appendix B).

5. X A **NARRATIVE DESCRIPTION OF SITE SPECIFIC GEOLOGY** is attached at the end of this form in the Additional Comments section. The description must include a discussion of the potential for fluid movement to the Edwards Aquifer, stratigraphy, structure, and karst characteristics of the site.

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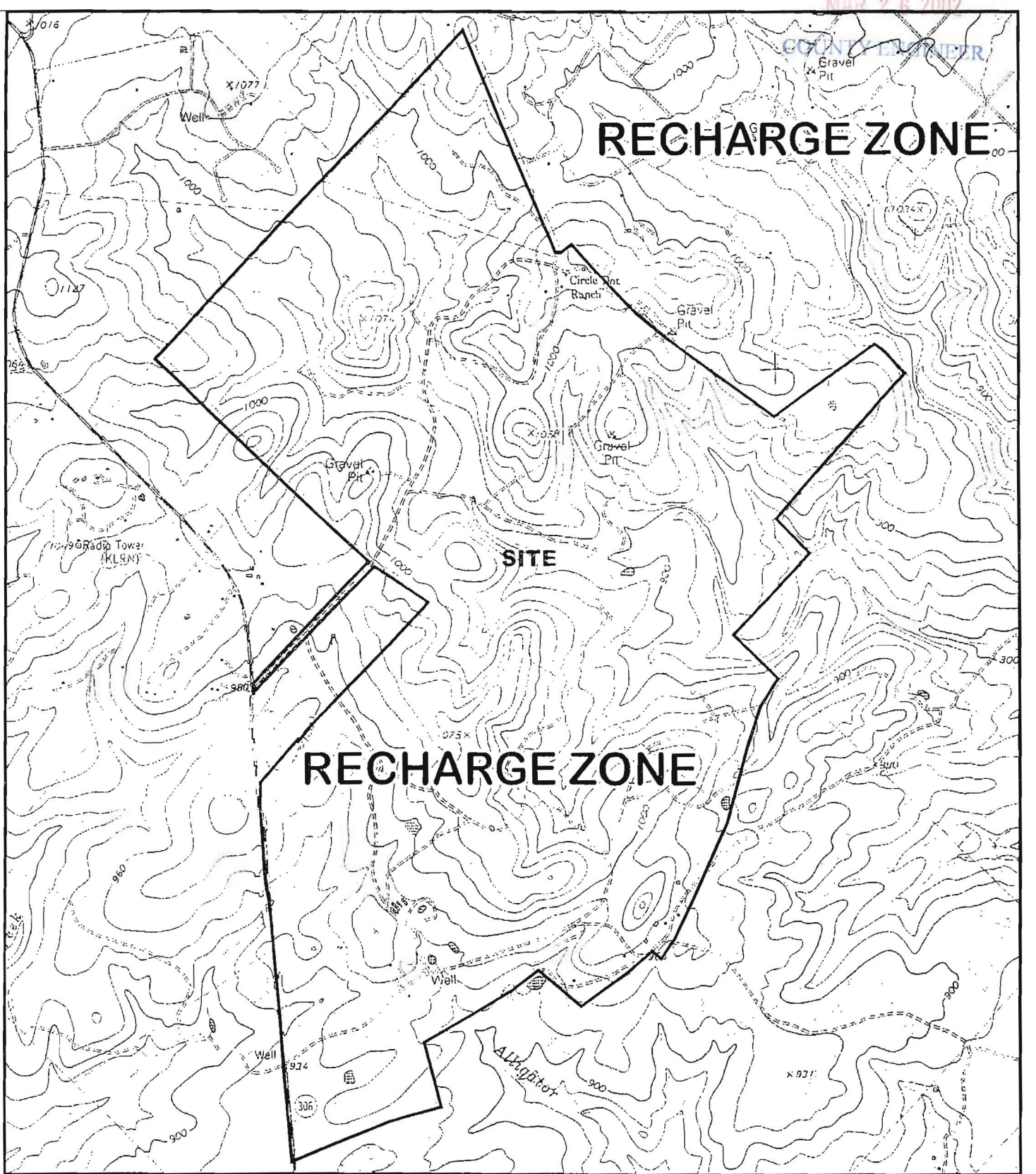

BASE MAP SOURCE: U.S. GEOLOGICAL SURVEY, 7.5' SERIES, HUNTER QUADRANGLE, 1994.

0 1000 2000
SCALE IN FEET

N



SITE LOCATION MAP

1855-ACRE PFUEFFER RANCH
COUNTY ROAD 306
COMAL COUNTY, TEXAS
HJN 000211 GA
November 2000

Horizon
ENVIRONMENTAL SERVICES, INC.

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6. X Appropriate **SITE GEOLOGIC MAP(S)** are attached (Appendix C).

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" = 400'
Site Geologic Map Scale	1" = 400'

7. Method of collecting positional data:
   X Global Positioning System (GPS) technology.
   X Other method(s).

8. X The project site is shown and labeled on the Site Geologic Map.

9. X Surface geologic units are shown and labeled on the Site Geologic Map.

10. X 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.

11. X The Recharge Zone boundary is shown and labeled, if appropriate.

12. All known wells (test holes, water, oil, unplugged, capped and/or abandoned, etc.):

    X There are 1 (#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply.)
    __ The wells are not in use and have been properly abandoned.
    1 The wells are not in use and will be properly abandoned.
    1 The wells are in use and comply with 16 TAC §76.
    __ There are no wells or test holes of any kind known to exist on the project site.

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ADMINISTRATIVE INFORMATION

13. X One (1) original and three (3) copies of the completed assessment have been provided.

Date(s) Geologic Assessment was performed:

28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000
Date(s)

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 213.

Jason John
Print Name of Geologist

(512) 328-2430
Telephone

For Horizon Environmental Services, Inc.

(512) 328-1804
Fax

Signature of Geologist

16 March 2001
Date

Representing: Horizon Environmental Services, Inc., Austin, Texas

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1855-ACRE
PFEUFFER RANCH
AT FM 306
COMAL COUNTY, TEXAS

ADDITIONAL COMMENTS
HJN 010083 GA

This report provides the results of a geologic assessment conducted by Horizon Environmental Services, Inc. (Horizon) on the above-referenced site. Horizon conducted the field reconnaissance on 28, 29 June; 5, 7, 13, 14, 18, 20 July; 4, 11, 14, 23 August; and 7 September 2000. Horizon spent a minimum of 260 hours in the field evaluating the site and surrounding area.

1.0 KARST INVESTIGATION METHODOLOGY

This geologic assessment includes a review of the site for potential aquifer recharge and documentation of general geologic characteristics for the subject site. Horizon conducted the necessary field and literature studies to meet or exceed Texas Natural Resource Conservation Commission (TNRCC) requirements. Horizon walked transects spaced 50 feet apart and mapped the location of features, if any, using a hand-held global positioning system (GPS), topographic maps, and aerial photographs. Horizon walked concentric circles (looking for karst features) around any areas showing evidence of internal drainage, including characteristics such as soil piping, solutionally enlarged voids or fractures, slumping, soil piping, extremely disturbed areas, or collapsed sinkholes. Section 4.0 provides a description of all features found during Horizon's survey.

2.0 ENVIRONMENTAL SETTING

2.1 LAND USE

The subject property consists of unimproved pasture and woodlands used for ranch and livestock activities. Several single-family residential houses are located on the subject site. Surrounding land use consists of undeveloped ranch land with sparse, single-family residential houses.

2.2 VEGETATION

Vegetation on the site consists of open grasslands and woodlands. Woodlands are dominated by plateau live oak (*Quercus fusiformis)*, Texas oak (*Quercus buckleyi*), Ashe juniper (*Juniperus ashei*), cedar elm (*Ulmus crassifolia*), with a few mesquite (*Prosopis glandulosa* var. *glandulosa*) interspersed. Ashe juniper removal has been practiced on the subject site, creating open grasslands.

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2.3 TOPOGRAPHY AND SURFACE WATER

Topography on the subject property contains hills and valleys with surface elevations ranging from 920 to 1070 feet above mean sea level (MSL). Surface water drains via overland sheetflow and along natural drainages and York Creek. York Creek flows to the southeast through the center of the subject site. The portion of the subject site adjacent to York Creek is within the 100-year floodplain (FEMA, 1986).

2.4 RECHARGE ZONE BOUNDARY

The above-referenced site is within the Edwards Aquifer Recharge Zone as mapped by the TNRCC (TNRCC, 1996). The Recharge Zone is known as the area where the stratigraphic units constituting the Edwards Aquifer are exposed at the surface and where water may filter in the aquifer through permeable features such as cracks, fissures, caves and other openings in these layers (TNRCC, 1999). The Recharge Zone is identified as that area designated as such on official maps located in the appropriate regional office and groundwater conservation districts.

2.5 DESCRIPTION OF ON-SITE GEOLOGY

The subject site is found within the Edwards Aquifer Recharge Zone (TNRCC, 1996). According to published geologic maps of the region and Horizon's field investigation, the subject site is underlain by the Kainer and Person Formations of the Edwards Group limestones and the Georgetown, Del Rio, and Buda limestone formations. The site geologic map (Appendix C) was created from outcrop maps and areal photographs, allowing modification of published geologic maps (UT-BEG, 1982; Baumgardner and Collins, 1991; Hanson and Small, 1994). Following is a description of the site-specific geology, stratigraphy, potential for fluid movement, karstic characteristics, and geologic structures of the subject site.

2.5.1 Kainer Formation of the Edwards Group

The Kainer Formation is subdivided into informal members by Rose (1972). The Dolomitic, Kirschberg Evaporite, and Grainstone members are exposed on the subject site. The Kainer Formation ranges in thickness from about 260 to 310 feet and includes marine sediments consisting of fossiliferous mudstones (commonly rudistids) and wackestones that grade upward into dolomitic mudstones and evaporites, terminating in a *miliolid* grainstone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Kirschberge Evaporite Member (Kek6) is reported to be the most porous and permeable of the Kainer Formation in Comal County (Hanson and Small, 1994).

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2.5.1.1 Dolomitic Member (Kek_7)

The Dolomitic Member of the Kainer Formation (Hydrogeologic Subdivision VII of the Edwards Group) is poorly exposed along the northwestern portion of the subject site north of Bat Cave Fault (Hanson and Small,1994), and inferred due to thickness constraints along the southern portion of York Creek. The Dolomitic Member is regionally described as mostly dense crystalline limestone, with occasional zones of grainstone and layers of variably burrowed mudstone. Chert nodules and thin, discontinuous beds of chert are scattered throughout this member. Commonly rudist fossils, *Toucasia* sp., are found near the top of this member (Hanson and Small, 1994. Primary field characteristics of the Dolomitic Member on the subject site include abundant chert nodules and bivalve wackestone to packstones.

The Dolomitic Member is generally porous and relatively permeable. Evaporite beds are burrowed and dissolved to the extent of being honeycombed. Many beds contain isolated molds, casts, and burrows with large secondary porosity, but low permeability because voids are often unconnected. Caves are often associated with open bedding planes (Stein and Ozuna, 1995). The upper part of the Dolomitic Member may be cavernous and highly altered with abundant, red, clay-filled cavities (Rose, 1972).

2.5.1.2 Kirschberg Evaporite Member (Kek_6)

The Kirschberg Evaporite Member of the Kainer Formation (Hydrogeologic Subdivision VI of the Edwards Group) is regionally described as crystalline and chalky limestone, with lenses and nodules of chert about 50 feet thick. Primary field characteristics of the Kirschberg Evaporite Member on the subject site include thin to thick bedded buff to greyish-white color mudstones with fenestral porosity. Fenestral porosity (arranged in long rows parallel to bedding) suggests the remains of dissolved gypsum nodules (Rose, 1972). This member is described as the most porous and permeable member of the Kainer Formation and is host to extensive cave development in Comal County (Hanson and Small, 1994).

2.5.1.3 Grainstone Member (Kek_5)

The Grainstone Member of the Kainer Formation (Hydrologic Subdivision V of the Edwards Group) is exposed throughout the subject site. Primary field characteristics of the Grainstone Member on the subject site include white, cross-bedded, *Miliolid* and bivalve grainstones, with locally bivalved wakestones and mudstones. Regionally, the Grainstone Member is described as a dense, tightly cemented *Miliolid* grainstone, with some mudstone and wackestone.

The Grainstone Member is reported to be about 50 feet thick (Hason and Small, 1994). A *Toucasia* sp. (rudist fossil) bed is reported to be located at the top of the Grainstone Member (Rose, 1972). The Grainstone Member is highly recrystallized, thereby reducing its permeability and porosity. However, interparticle and intraparticle porosity and fracture (due to faulting) porosity and permeability are locally present.

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Few caves are known to develop in this formation in Comal County; however, many caves in Bexar County have entrances in the lower part of this subdivision that provide access to the Kirschberg Evaporite Member below (Hanson and Small, 1994; Stein and Ozuna, 1995).

2.5.2 Person Formation of the Edwards Group

The Person Formation is subdivided into informal members by Rose (1972). The Regional Dense and Leached and Collapsed (Undivided) members are exposed on the subject site. The lithology of the Person Formation ranges from variably burrowed mudstone to grainstone to crystalline limestone (Hanson and Small, 1994). Though all members (hydrogeologic subdivisions) have some porosity and permeability, the Leached and Collapsed Member (Kek3) is reported to be the most porous and permeable of the Person Formation in Comal County (Hanson and Small, 1994).

2.5.2.1 Regional Dense Member (Kep_4)

The Regional Dense Member of the Person Formation (Hydrologic Subdivision IV of the Edwards Group) is regionally described as a dense, argillaceous mudstone (Rose, 1972; Hanson and Small, 1994). The Regional Dense Member is about 20 to 24 feet thick in Comal County (Hanson and Small, 1994). Primary field characteristics of the Regional Dense Member on the subject site include white, nodular, chalky, bivalve mudstones. Historically, the Regional Dense Member was quarried for road base throughout the subject site and was extremely useful as a stratigraphic marker during geologic mapping. The Regional Dense Member has little permeability or porosity overall and is known as the least porous or permeable subdivision (Hanson and Small, 1994). It does not typically produce large caves near the subject site. Hanson and Small (1994) describe this member as a possible confining unit locally within the Edwards Aquifer. However, caves, faults, and fractures may greatly reduce the confining effects of this member locally.

2.5.2.2 Leached and Collapsed Member (Kep_3)

The Leached and Collapsed Member of the Person Formation (Hydrologic Subdivision III of the Edwards Group) overlies the Regional Dense Member and is reported to be about 80 to 100 feet thick in Comal County. The Leached and Collapsed Member is regionally described as a variably burrowed mudstone to grainstone with intervals of crystalline limestone. Chert is commonly found within this member (Hanson and Small, 1994). The common collapsed zones within this member were the result of a collapse of the overlying limestone into the voids created by dissolved evaporite lenses and layers (Rose, 1972). Primary field identification characteristics of the Leached and Collapsed Member on the subject site include *Toucasia* sp. (rudist) fossils, bivalve wake- to packstones, and thick red soils with abundant chert cobbles. The Leached and Collapsed Member is one of the most porous and permeable formations (Stein and Ozuna, 1995). It is known to have vuggy and burrow porosity and permeability associated with evaporites, burrowed zones, breccia, and caves. Permeability and porosity are associated with collapsed zones, where evaporites have been dissolved and in areas where faulting or fractures occur.

2.5.3 Georgetown Formation (Kgt)

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The Georgetown Limestone Formation (Hydrologic Subdivision I of the Edwards Group) is exposed in the southwestern portion of the subject site and overlies the Edwards Group (Person and Kainer Formations). The Georgetown limestone is reported to be less than 10 feet thick in Comal County (Small and Hanson, 1994). The Georgetown Formation is described as gray to light-tan, marly, fossiliferous limestone that usually contains brachiopods (*Waconella wacoensis*). The contact between the Edwards and Georgetown formations is pitted and bored and often contains iron-oxide staining with common *Toucasia* sp. fossils (Rose, 1972).

No karst features occur within this formation on the subject site and due to the thin, low porosity, and low permeability nature of the Georgetown Formation, it probably yields little water to wells in Comal County. However, where outcrop of the Georgetown Formation is extensively weathered the Georgetown Formation may be considered a part of the unsaturated zone of the Edwards Aquifer (Stein and Ozuna, 1995).

2.5.4 Del Rio Clay Formation (Kdr)

Contrary to the published map of Hanson and Small (1994), the Del Rio and Buda formations, not the Edwards Group limestones is found on the southern portion of the subject site. The Del Rio Formation underlies the lowlands in the southern portion of the subject site primarily used for cultivating hay. Del Rio Clay is about 40 to 50 feet thick in Comal County and is described as weathered, poorly compacted, friable, fossiliferous, blue-green to yellow-brown clay, with some thin lenticular, calcareous, siltstone beds (Rose, 1972; Hanson and Small, 1994). The primary marker fossil for the Del Rio Clay is the pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994).

The Del Rio Formation forms the primary upper confining unit of the Edwards Aquifer (Rose, 1972; Hanson and Small, 1994). The Del Rio Clay is described as having no porosity, low permeability, and no cavern development (Hanson and Small, 1994).

2.5.5 Buda Formation (Kbu)

The Buda Formation occupies the uplands of the southern portion of the subject site. The Buda Formation is reported to be about 40 to 50 feet thick in northeastern Comal County and consists of a buff, light gray, dense mudstone (Hanson and Small, 1994). Primary field identification includes small, calcite-filled veins, red-stained intraclasts, porcelaneous limestone character, and pecten-type fossil clams and fossil oyster *Ilymatogyra arietina* (formerly *Exogyra arietina*) (Hanson and Small, 1994). The Buda limestone is lithologically indistinguishable from the Georgetown limestone; however, the reported thickness of the Buda (up to 50 feet) compared to the relatively thin Georgetown Formation (less than 10 feet) and the stratigraphic position confirm that the Buda limestone is found on the subject site (Hanson and Small, 1994). The Buda Formation has low porosity and permeability with minor surface karst and no cavern development in the region (Hanson and Small, 1994).

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2.5.6 Tertiary and Quaternary Gravel Deposits (T-Qgr)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits are not associated with the present drainage systems and appear to be similar to gravel deposits equivalent to the late Tertiary or Quaternary Uvalde Gravel with thicknesses reportedly ranging from several feet to more than 10 feet (Baumgardner and Collins, 1991). This unit contains high porosity and permeability, but does not develop karst features associated with recharge of the Edwards Aquifer.

2.5.7 Quaternary Alluvium Deposits (Qal)

This unit consists of unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone deposits within creekbeds and drainages on the subject site. These deposits are associated with the modern drainage systems and occur as narrow, discontinuous deposits, with thicknesses from several feet to more than probably 10 feet locally. These deposits were generally not mapped due to their discontinuous, narrow, and relatively thin nature. These deposits contain very high porosity and permeability, but do not develop karst features associated with recharge of the Edwards Aquifer.

2.5.8 Geologic Structures

All faults were identified in the field by stratigraphic displacement (primarily the Regional Dense Member of the Person Formation), in addition to one or more of the following characteristics related to faulting: fault gouge and breccia, slickensides, steeply dipping beds due to fault-drag, fractured rock zones, and vegetation lineaments on areal photographs. All faults mapped are normal faults, and generally all contain vertical fault planes.

Some potential recharge features found on the subject site appear to be related to inferred and mapped faults on the subject site. Folding of limestone beds within fault-bound blocks and dipping limestone beds throughout the subject site accounts for greater apparent thicknesses on the geologic map.

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2.6 SOILS

Soils on the subject site are characterized as follows (Batte, 1984):

SOIL NAME	SOIL TYPE	SOIL DEPTH (FEET)	UNDERLYING MATERIAL	PERMEABILITY	AVAILABLE WATER CAPACITY	SHRINK-SWELL CAPACITY
Comfort-rock outcrop complex (CrD), undulating	stony clay	1.1	indurated fractured limestone	slow	very low	low to moderate
Rumple-comfort association, undulating (RuD)	cherty clay loam to stony clay	2.3	indurated fractured limestone	moderately slow	very low	low to moderate
Perves clay, 1 to 5% slopes (PuC)	clay	1.6	indurated fractured limestone	moderately slow	very low	high
Medlin-Eckrant association, undulating (MEC)	clay to 3.2 feet and marl to 6.7 feet	6.7	fractured limestone	very slow	very low	high
Denton silty clay, 1 to 3% slopes (DeB)	clay	3.0	fractured, indurated limestone interbedded with calcareous clayey marl	slow	medium	high
Eckrant-rock outcrop complex, steep (ErG)	very stony clay	0.8	indurated fractured limestone	moderately slow	very low	moderate

2.7 WATER WELLS

A search was made for water wells on the subject site. A review of the records of the TNRCC and the Texas Water Development Board (TWDB) revealed 2 potential water wells on the subject site (TWDB, 2000). However, Horizon found 7 water wells (S21 through S24, S69, S91, and S99) on the subject site during field investigation. These wells are located on the site geologic map (Appendix C).

The results of this survey do not preclude the possibility of finding an additional abandoned test or water well during the clearing or construction phases of the proposed project. If a water well or casing is encountered during construction, construction should be halted until the TNRCC is contacted.

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All abandoned wells must be capped or properly abandoned according to the Administrative Rules of the Texas Department of Licensing and Regulation, 16 Texas Administrative Code (TAC), Chapter 76, effective 3 January 1999. A plugging report must be submitted (by a licensed water well driller) to the Texas Department of Licensing and Regulation, Water Well Driller's Program, Austin, Texas. If a well is intended for use, it must comply with 16 TAC §76.

3.0 SPECIAL INSTRUCTIONS TO CONTRACTORS OR DEVELOPERS

The Edwards Aquifer Protection Plan (EAPP) and its associated documents address best management practices (BMPs) and describe recommended water pollution abatement strategies specifically for the subject site and surrounding area. Temporary and permanent BMPs should be used to control any runoff during and after the proposed activities and should be based on the TNRCC Guidelines for BMPs, which typically require that all runoff from areas of impervious cover be captured and filtered before leaving a site within the recharge zone (TNRCC, 1999).

4.0 GEOLOGIC ASSESSMENT TABLE COMMENTS (DETAILED FEATURE DESCRIPTIONS) AND ABATEMENT RECOMMENDATIONS

The following features are shown and labeled on the Geologic Assessment Table in Appendix A and on the Site Geologic Map in Appendix C. Below is a description for features found on the subject site.

~~S1~~ Stock pond. This manmade cattle pond is approximately 150 feet in diameter and 15 feet deep. The tank is filled with fine-grained sediment and holds water. No openings or internal drainages were found within this feature. No setback is recommended.

~~S2~~ Fracture Rock in drainage. A fractured rock outcrop measuring approximately 30 feet wide and 200 feet long. No solution features were noted during the field investigation. Fractures are spaced 1 every 1 foot, with apertures up to 2 inches, locally filled with black soil and trend 140° to 160°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for Sewage Collection System (SCS) and/or Soil Adsorption System (SAS) may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S3~~ Solution cavity (sinkhole). This feature has a closed depression diameter of ~10 feet, extends vertically a minimum of 4 feet, and is filled with loose cobbles and organic debris. The feature appears to extend vertically into the subsurface an unknown distance. This feature is located 30 feet to the west of Feature S4. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that it is connected to S4. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

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S4 Cave. This feature consists of a 2-foot diameter cavity in solid limestone that extends vertically 4 feet into a small room about 30 feet in diameter. Harvestman arachnids and cave crickets were observed within this feature. Horizon conducted a preliminary removal of loose rocks by hand around the natural opening and determined that this feature is a cave. Horizon recommends a more detailed mapping of this feature to determine its subaerial extent. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S5 Solution cavity. This feature is an enlarged bedding plane cavity within the margins of a creek bed. The entrance to this feature measures approximately 2 feet in diameter and extends 2 feet horizontally into the hillside. No airflow or cave fauna were observed for this feature. No setback is recommended.

S6 Fault and fracture zone within drainage. The fault exposed in the creek bed trends 15° and is associated with steeply dipping beds, fault gouge and breccia, and fractures. The exposed outcrop measures approximately 15 feet wide and 50 feet long within the drainage, and contains fractures spaced 1 every 2 to 3 inches, with apertures up to 2 inches and trends of 75° and 150°. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S7 Fractures in drainage. An outcrop of rock measuring approximately 15 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 1 foot, with apertures up to 0.5 inches and trend 85° and 125°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S8 Fractures in drainage. An outcrop of rock measuring approximately 30 feet wide and 40 feet long within a drainage. Fractures are spaced 1 every 2 to 3 inches, with apertures up to 1 inch locally filled with black soil and trend 120°. No solution features were found. The fractures are difficult to trace onto the bordering hillsides due to soil coverage and vegetation. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S9 Solution cavity. This feature measures approximately 1 foot in diameter and extends 1 foot horizontally, representing a solutionally enhanced bedding plane feature. This feature is located at the top of a hill with limited potential for recharge due to its location and infilling soil. No setback is recommended.

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S10 Solution cavity. This feature is a solutionally enlarged fracture at the top of a hill. The feature measures approximately 4 feet long and 6 inches wide and extends 4 feet vertically. The base is infilled with soil. It is Horizon's opinion that this feature is a result of fracturing due to surficial weathering and the fracturing is limited in extent. No setback is recommended.

S11 Fractures within a drainage. An outcrop of fractured rock measuring approximately 15 feet wide and 30 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 2 inches trending 110° and 030°. No solution features were found. This feature is coincident with the Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S12 Fractures in drainage. An outcrop of rock measuring within a drainage containing fractures spaced 1 every 1 foot with apertures up to 0.5 inches trending 60°. No solution features were found. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S13 **Sinkhole (potential cave).** This feature is approximately 3.5 feet in diameter, rimmed with limestone, and extends 3 feet to loose cobbles. This feature was observed to have air flow during hand excavation. This feature is coincident with the Bat Cave Fault zone (S18). Horizon recommends excavation of this feature to determine the recharge potential of this feature. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S14 Fractures in drainage. An outcrop of fractured rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 2 to 3 feet, with apertures up to 1 inch, and trend 90°, 150°, and 120°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S15 Fractures in drainage. An outcrop of rock measuring approximately 20 feet wide and 50 feet long. Fractures are spaced 1 every 3 inches to 1.5 feet, with apertures up to 1 inch, and trend 100°. This feature is coincident with the nearby Bat Cave Fault Zone (S18). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage.

S16 Solution cavity. This feature is a solutionally enlarged bedding plane located on a hillside. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and its recharge ability is limited. No setback is recommended.

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S17 Solution cavity. This feature is a solutionally enlarged bedding plane located on the side of drainage. The feature measures approximately 1 foot long, 6 inches wide, and extends 1 foot vertically to a horizontal bedding plane. No airflow or cave fauna were observed for this feature. It is Horizon's opinion that this feature has a limited areal extent and recharge ability. No setback is recommended.

S18 Bat Cave Fault Zone. Horizon observed fault gouge, breccia, and fractures coincident with the fault zone mapped by Hanson and Small (1994). Additionally, Horizon field verified where the Bat Cave Fault intersects Country Road (CR) 306 and observed extensive fault breccia and gouge associated with this fault zone. This fault zone has fractured rock outcrops (S2, S11, S12, S14, S15) exposed within several drainages on the subject site. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages.

S19 Fault zone. Horizon observed fault gouge, fractures, and offset geologic members coincident with the fault zone mapped by Hanson and Small (1994). No solution cavities were observed along the fault. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for fractures within the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S20 Fractures within a drainage. Fractures are spaced 1 every 1 foot, with cemented apertures and trends of 100°. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S21 Water well. This feature is located at the top of a hill and consists of an inactive windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S22 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S23 Water well. This feature is an active windmill water well. If necessary, abatement measures are addressed in Section 2.7.

S24 Water well. This feature is an active water well. If necessary, abatement measures are addressed in Section 2.7.

S25 Fractures in drainage. This rock outcrop measures approximately 50 feet in diameter and located between 2 converging drainages. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 115°. Fractures on the hillsides were difficult to identify.

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Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S26~~ Fault Zone. This fault zone is originally mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. The fault is also exposed near the eastern boundary of the site. A vegetation lineament is coincident with this feature on the aerial photograph. No solution features are found within 200 feet of this fault, which is inferred over most of the property. Fractures on the hillsides were difficult to identify. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects and areas. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S27~~ Solution cavities. An outcrop of vuggy rock, measuring 8 feet in diameter, contains several solution cavities up to 2 feet in diameter and a 2-foot vertical depth. The cavities contain loose, fine-grained soil and leaf litter. No airflow or cave fauna were observed for this feature. One cavity contains mounded dirt apparently related to animal burrowing. Setbacks for SCS and/or SAS may be appropriate.

~~S28~~ Fractured rock zone. A rock outcrop measuring up to 20 feet wide and up to 1000 feet long is located within a creek bed. Fracture spacing is variable, with densities up to 1 every 0.25 feet, apertures up to 3 inches, and trends of 35°, 85° and 120°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Exposure of the outcrop is discontinuous, as it is partially covered with coarse alluvial deposits within the streambed. This feature is coincident with 2 fault zones (S29 and S30). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S29~~ Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fractures (S28 and S49), a linear exposure of red soils with rock breccia, and a vegetation lineament are coincident with this feature. No solution features are found within 200 feet of the fault on the property. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S30~~ Fault Zone. This fault zone juxtaposes the Kirschberg Evaporite and Grainstone members of the Kainer Formation within the same drainage as S-28. Additionally, fractures and a slight vegetation lineament on an aerial photograph are coincident with this feature.

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Setbacks for SCS and/or SAS may be appropriate for portions of the drainages the fault intersects, as well as features S121 and S124 that are not within drainages, but coincide with the fault. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S31~~ Stock pond. This manmade cattle pond is approximately 200 feet in diameter and approximately 15 feet deep. No setbacks are recommended.

~~S32~~ Solution cavity. This feature is a solutionally enlarged fracture. It measures approximately 3 feet long, up to 3 inches wide, and extends 2.5 feet vertically to a horizontal bedding plane cavity. The feature trends to the northeast and no airflow or cave fauna were observed for this feature. Setbacks for SCS and/or SAS may be appropriate.

~~S33~~ Fault Zone. This fault zone is originally mapped by Hanson and Small (1994) and is exposed in the CR 308 road cut east of the site, where it juxtaposes the Leached and Collapsed Member and the Eagle Ford Formations. On the subject site, this fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph were coincident with this feature. No solution features are located within 200 feet of this inferred fault. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S34~~ Stock pond. This manmade cattle pond is approximately 75 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

~~S35~~ Stock pond. This manmade pond is approximately 200 feet long, 100 feet wide of unknown depth, and holds water. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S36~~ Stock pond. This manmade cattle pond is approximately 50 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

~~S37~~ Stock pond. This manmade cattle pond is approximately 100 feet in diameter and approximately 10 feet deep. The pond was dry during the field investigation, did not contain any vegetation, and no openings or internal drainage were observed within this feature. No setback is recommended.

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~~S38~~ Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S39~~ Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S40~~ Stock ponds. Four parallel stock ponds measuring up to 200 feet long and 20 feet wide. These ponds hold water and no openings or internal drainage were observed within this feature. No setbacks are recommended.

~~S41~~ Stock pond. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S42~~ Fault Zone. This fault zone was originally mapped by Hanson and Small (1994). This feature juxtaposes the Regional Dense and the Grainstone members of the Person and Kainer Formations. Additionally, a vegetation lineament on an aerial photograph was coincident with this feature. No solution features are located within 200 feet of this fault. Setbacks for SCS and/or SAS may be appropriate for only for portions of the drainages it intersects. No other setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

~~S43~~ Inferred fault zone. This fault zone is inferred based on exposed fractured bedrock. Setbacks for SCS and/or SAS may be appropriate since it is entirely within a drainage system.

~~S44~~ Fault Zone. This fault zone juxtaposes the Regional Dense and Grainstone members of the Person and Kainer Formations. Additionally, fault gouge and a vegetation lineament on an aerial photograph were coincident with this feature. Setbacks for SCS and/or SAS may be appropriate for portions of the drainages it intersects and for features S-64, S-62, S-75, S-81, S-116, S-117, and S-118 that coincide with it.

~~S45~~ Man-made outhouse pit. A manmade closed depression approximately 8 feet in diameter and up to 3.5 feet deep. This feature is located near a house and was apparently used as an outhouse. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S46~~ Solution cavity. This feature is located along the margins of a drainage, with an entrance measuring approximately 0.5 feet in diameter extending at an angle of 30° to a depth of 3 feet. It is infilled with soil. It is Horizon's opinion that this is an enlarged bedding plane with a low relative infiltration rate. No setback is recommended.

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S47 Vuggy rock. An outcrop measuring up to 15 feet in diameter that contains unconnected and connected vugs. The vugs have a moderate density (1 per 2 to 4 inches) and apertures greater than 2 inches. It is Horizons opinion that the vugs are a result of surficial weathering. No setback is recommended.

S48 Fault and closed depression. A small fault zone, with gouge about 2 inches wide, striking 20° and dipping 79° to the east, is exposed in a quarry located within the Regional Dense Member. Additionally, dipping beds and fractures (trending 120° and 040°) within a nearby outcrop of the Grainstone Member, and a vegetation lineament on an aerial photograph are coincident with this feature. A small, closed depression, measuring about 30 feet in diameter and up to 2 feet deep, within the quarry contains mudcracks. The small fault has no associated solution cavities and the closed depression is man made. No setback is recommended for S-48.

S49 Fractured rock. A rock outcrop measuring up to 10 feet wide and 75 feet long is located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and a trend of 20°. Fractures are generally open; however, locally, apertures are cemented and filled with soil. This feature is coincident with a fault zone (S29). Setbacks for SCS and/or SAS may be appropriate for this portion of the drainages. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S50 Vuggy rock. A outcrop of vuggy rock about 100 feet long and 50 feet wide, containing unconnected and locally connected vugs located slightly up drainage (approximately 200 feet) from S-29. This feature is within what appears to be the Kirschberg Evaporite Member and characteristically contains vugs due to dissolution of evaporite minerals. Vug densities are 1 every 0.5 feet, with apertures up to 3 inches. It is Horizon's opinion that the dissolution is due to surficial weathering. No setback is recommended.

S51 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 1 foot in diameter extends 45° to the northwest to a depth of 1.5 feet where it is infilled with soil. It is located on a hillside and has a drainage area of less than 1 acre. It is Horizon's opinion that this feature has a low potential for recharge. No setback is recommended.

S52 Quarry and closed depression. This feature is a manmade quarry within the Regional Dense Member that contains a man-made closed depression measuring about 30 feet in diameter, up to 3 feet deep, and holding water. No openings or internal drainage were observed within this feature. No setback is recommended.

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S53 Solution cavity. The entrance of this feature is a solutionally enlarged entrance that measures approximately 0.5 feet in diameter, and extends to a minimum depth of 2 feet. No airflow was observed for this feature. It is partially infilled with soil and has a moderate infiltration rate. It is located near the top of a hill with no defined catchment area. No setback is recommended.

S54 Fault Zone. This fault zone is exposed in a quarry and trends 135°, juxtaposing steeply dipping beds of the Grainstone Member with the chalky, nodular beds of the Regional Dense Member. Additionally, the fault zone contains fractures and fault gouge exposed within the quarry that was used for road base. The fault has no associated solution features and is located on a hillside. No setback is recommended.

S55 Stock pond. This dry stock pond is 50 feet in diameter, 7 feet deep, and is located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S56 Stock ponds. Two stock ponds, approximately 50 feet in diameter and up to 5 feet deep, are located within a drainage and contain no water. No openings or internal drainage were observed within this feature. The ponds are located in adjacent and convergent drainages about 50 feet apart. No setback is recommended.

S57 Solution cavity. This feature is an enlarged bedding plane cavity with an entrance measuring 7 inches wide and 3 inches high, extending horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with little or no recharge ability. No setback is recommended.

S58 Solution cavities. Two solutionally enlarged bedding planes on a shallow hillside with no defined catchment area. Each measures approximately 1 foot in diameter and extends to a depth of 2 feet to soil and leaf debris. This feature appears to extend horizontally along a bedding plane that pinches out with distance. The feature is interpreted to have limited recharge ability based on the location and infilling sediments. No setback is recommended.

S59 Solution cavity. This feature is a bedding plane solution cavity with an entrance measuring 8 inches wide, 5 inches high, and extends horizontally along the bedding plane 1.5 feet deep. It is located on a hillside with no defined catchment area. It is infilled with fine sediments. No setback is recommended.

S60 Solution cavities. Two entrances within a limestone outcrop appear solutionally enlarged, and measure approximately 0.5 feet in diameter, and extend to a depth of 1.5 feet to soil and leaf debris. This feature appears to also be partially modified by animal burrowing. No setback is recommended.

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S61 Solution cavity. This feature is located on a hillside, measures 0.5 feet in diameter, and extends vertically a minimum of 3 feet. It is infilled with fine soil and loose leaf debris. No air or cave fauna was observed for this feature. It appears to have limited recharge ability based on location and infilling sediments. No setback is recommended.

S62 Collapsed sinkhole. This feature is a closed depression about 100 feet in diameter and 15 feet deep that does not appear to hold water, though no openings were observed within this feature. The feature is completely surrounded by limestone outcrop that locally contains caliche or possibly travertine along the exposed rock. The feature contains soil, chert, and limestone cobbles, and mature oak (up to 2 feet diameter) and persimmon trees. No evidence of manmade activities, such as spoil piles and dozer tracks/scrapes, was apparent surrounding the feature, although spoil piles (soil and Del Rio Clay) were dumped into 1 side of the sinkhole. This feature is coincident with S-44 (Fault). Setbacks for SCS and/or SAS is appropriate for this feature. Any untreated runoff should be diverted away from this feature.

S63 Solution cavity. This feature is an enlarged bedding with an entrance measuring 0.5 feet in diameter extending horizontally 2 feet deep. It is located on a hillside, infilled with fine sediments, and has a low relative infiltration rate. No setback is recommended.

S64 Fractures in drainage. A rock outcrop of steeply dipping fractures (20° to SE) measuring approximately 10 feet wide and 50 feet long located within a drainage. Fractures are spaced 1 every 1 foot with apertures up to 2 inches and trends of 55°. These fractures are coincident with S-44 (Fault). Setbacks for SCS and/or SAS may be appropriate for this drainage. No setbacks are recommended on the upland areas where the fractures either don't exist or are buried.

S65 Stock pond. This stock pond is 30 feet in diameter, 5 feet deep, and located within a drainage. No openings or internal drainage were observed within this feature. No setback is recommended.

S66 Stock pond. This stock pond is 150 feet in diameter and 8 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

S67 Stock pond. This stock pond is 50 feet long, 30 feet wide, and 5 feet deep. This feature is located within a drainage and contains standing water and wetland vegetation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S68 Solution cavity. This feature is a solution cavity developed along a bedding plane with an entrance measuring 0.5 feet in diameter extending horizontally along the bedding plane 1 foot deep until it pinches out. It is partially infilled with soil. This feature is located near a hilltop with no defined catchment area. Its relative infiltration rate and ability to transmit fluids appear to be none to low. No setback is recommended.

S69 Water well. This feature is an active water well with a large water storage tank. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S70 Stock pond. This feature measures approximately 25 feet in diameter, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S71 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S72 Stock pond. This feature measures approximately 60 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S73 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S74 Solution cavity. This feature consists of a solutioned limestone hole measuring 1 feet in diameter, extending 2 feet deep to loose soil and leaf litter. No soil was piping into the feature and no air was observed to flow from the feature. This feature is located on a hillside with no defined catchment area. The infiltration rate is interpreted to be none to low. No setback is recommended.

S75 Solution cavity. This feature consists of a solutioned limestone hole measuring 0.3 feet in diameter and extends 5 feet to limestone cobbles. No soil was observed piping into the feature and no air was observed to flow from the feature. This feature appears to be developed along a fracture trending 20° that is coincident with an interpreted fault (S-44). Setbacks for SCS and/or SAS may be appropriate for this feature.

S76 Stock pond. This feature measures approximately 50 feet in diameter, up to 10 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S77 Stock pond. This feature measures approximately 50 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S78 Stock pond. This feature measures approximately 30 feet in diameter and up to 6 feet deep and apparently holds water but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S79 Solution cavity. This feature is a solution cavity developed along a bedding plane, with an entrance measuring approximately 1 foot in diameter extending subhorizontally 3 feet along the bedding plane. This feature is located on a hillside near a hilltop. Soil was observed piping into this feature. It has a 10-foot diameter defined catchment area. Based on the limited catchment area, size, and infilling sediments, no setback is recommended.

S80 Solution cavities (sinkholes). This feature consists of 2 solution cavities about 5 feet apart, within a single rock outcrop about 30 feet in diameter, located on the side of a hill. The entrances measure approximately 2.5 by 0.75 feet and 1.5 diameter, and both extend about 2.5 feet vertically to loose leaves and dirt that fall into the entrances off the hillside (< 10 acres). These features are developed along fractures that trend 0° to 10°. The fractures are interpreted to be a result of weathering of the side of the hill. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S81 Solution cavities. This feature contains 2 solution cavities developed along a bedding plane with entrances measuring approximately 1 foot in diameter extending subhorizontally along the bedding plane 3 feet deep. This feature is located within a drainage and nearly coincident with the fault zone (S44). Limestone beds within the drainage are observed to dip up to 12° to the north due to fault drag. Setbacks for SCS and/or SAS may be appropriate for this feature in the drainage.

S82 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S83 Stock pond. This feature measures approximately 30 feet in diameter, up to 7 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

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S84 Stock pond. This feature measures approximately 30 feet in diameter, up to 5 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S85 Stock pond. This feature measures approximately 30 feet in diameter, up to 6 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S86 Fault zone. This fault zone was originally mapped by Hanson and Small (1994) and Baumgardner and Collins (1991). It is exposed in the CR 308 road cut. On the subject site, the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature where it is inferred. No solution features are associated with this fault and where it is inferred. Where the fault is seen at the CR 308 road cut it is on a hill top. The fault is inferred to exist northward beyond the hill by the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S87 Fault zone. This fault zone was mapped by Baumgardner and Collins (1991) and is exposed in the CR 308 road cut. On the subject site the fault juxtaposes the Buda-Del Rio Clay and the Kainer formations. A vegetation lineament on the aerial photograph is coincident with this feature. Solution cavity S-94 is the only solution feature associated with the fault that is inferred north of the road cut. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S88 Stock pond. This feature is located on a hillside and measures approximately 150 feet in diameter and up to 6 feet deep. The stock pond holds water, but was empty during field investigation. Its drainage area is less than 10 acres and infilled with fine sediments. No setback is recommended.

S89 Closed depression (quarry). This man-made depression is approximately 10 feet wide by 30 feet long and up to 3 feet deep, filled with household garbage. No setback is recommended.

S90 Closed depression (quarry). This feature is a road base quarry measuring 50 feet in diameter and up to 3 feet deep. The outcrop is very brecciaed with fractures trending 40°, most likely due to nearby faulting (S86 and S87). No setback is recommended for this feature.

S91 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

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S92 Closed depression. This depression contains a buried 50-gallon drum, apparently used to incinerate household garbage. No openings or internal drainages were observed within this feature. This feature is man-made. No setback is recommended.

S93 Stock pond. This feature is located within a drainage and measures approximately 20 feet in diameter, up to 4 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S94 Solution cavity. This feature consists of a solution cavity about 1.5 feet in diameter and extends 2 feet vertically to compact soil and leaf litter. No airflow or fauna were associated with this feature during Horizon's field investigation. This feature is located adjacent to a drainage and fault S-87. Setbacks for SCS and/or SAS may be appropriate.

S95 Solution cavity. This feature consists of a solution cavity about 1.2 feet in diameter, extending 1.5 feet to compact soil and leaf litter. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is located on a hillside with no defined catchment area. It is Horizon's opinion that this feature has limited recharge ability. No setback is recommended.

S96 Stock pond. This feature measures approximately 50 feet long by 15 feet wide, up to 3 feet deep, and apparently holds water, but was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S97 Stock pond. This feature measures approximately 50 feet in diameter, up to 8 feet deep, and apparently holds water, but was dry during field investigation. No setback is recommended.

S98 Closed depression (road-base quarry). This feature was apparently a quarry that measures approximately 100 feet long by 25 feet wide and up to 3 feet deep. Mud cracks within the depression indicate that it periodically holds water. No openings or internal drainages were observed within this man-made feature. No setback is recommended.

S99 Active water well. Appropriate abatement measures include capping or properly abandoning the well as described in Section 2.7 of this report.

S100 Solution cavity within a small, closed depression. The closed depression measures about 6 feet in diameter and contains a solution cavity developed along a bedding plane. The entrance to the solution cavity measures 1 foot in diameter extending 2 feet subhorizontally (~45°) along the bedding plane to loose leaf debris.

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No air was around the entrance to this feature. This feature is located on a hillside with limited catchment area. Based on the location of the feature and infilling sediments, no setback is recommended.

S101 Solution cavity. This feature is an enlarged fracture located on a hillside. No airflow or cave fauna were observed for this feature. The opening is 2 feet long by 2 inches wide and extends to a depth of at least 2 feet. The feature is infilled with fine sediments at the bottom. It has a drainage area that is less than 1 acre and its ability to transmit fluids is moderate. The fractures are interpreted to be a result of weathering on a hillside and its recharge ability is interpreted to be low. No setback is recommended.

S102 Solution cavity. This feature is located on a hillside within thick vegetation. The solution cavity appears to be an enhanced fracture with a 6-inch diameter opening. The solution cavity extends down at least 2 feet and is in filled with fine sediments at the base. The feature's ability to transmit fluid is none to low with a drainage area less than 1 acre. No setback is recommended.

S103 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet in diameter and up to 2.5 feet deep. Mud cracks, mesic grasses, and a shallow pool of water indicated the ability to hold water. No openings or internal drainage were observed within this man-made feature. No setback is recommended.

S104 Fault zone. Exposed within the S103 road base quarry is a fault plane, striking 45° and dipping 55° west, containing strongly expressed vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a greyish-white, dense, and crystalline limestone bed; the minimum displacement is about 10 feet. This fault comprises the northwestern side of a horst structure. This feature is located on a hilltop and associated with solution feature S105. No setback is recommended along the fault except for the area near S105.

S105 Solution cavity. This feature is located along a hillside, with an opening that measures approximately 2 feet by 6 inches and a depth of at least 1 foot. The feature appears to be an enlarged fracture that is infilled with fine sediments. It has a drainage area of less than 1 acre. The feature appears to be along a fault/fracture trend (S104). Setbacks for SCS and/or SAS may be appropriate.

S106 Closed depression (road-base quarry). This quarry is within the Regional Dense Member and measures about 25 feet by 100 feet and is up to 1.5 feet deep. Mud cracks and mesic grasses indicated the ability to hold water and no openings or internal drainage were observed within this feature. No setback is recommended.

S107 Fault zone. Exposed within the S106 road base quarry is a fault plane, striking 30° and dipping 70° east, containing weak, vertical slickensides indicating normal motion. The fault juxtaposes a white, chalky, and soft limestone bed with a grayish-white, dense, and crystalline limestone bed an unknown distance. This fault comprises the southeastern side of a horst structure. No solution features are associated with this feature. This feature is within 150 feet of fault S30. Setbacks for SCS and/or SAS may be appropriate only for portions of the drainages it intersects on the northern side. No setbacks are recommended on the inferred upland areas where the fractures either don't exist or are buried.

S108 Fractured and vuggy rock. This feature consists of a rock outcrop on a hilltop measuring about 200 feet in diameter. Fracture density is 1 every 1 foot with apertures up to 2 inches and a trend of 55°. Fractures are generally open (locally solutioned); however, locally, apertures are cemented and filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 1 foot, locally connected, with apertures up to 2 inches. Setbacks for SCS and/or SAS may be appropriate for this feature.

S109 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 1 inch, and a trend of 110° to 90°. Fractures are generally open; however, locally, apertures are cemented and filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S110 Fractured and vuggy rock. This feature consists of a rock outcrop measuring about 200 feet by 50 feet within a streambed. Fracture density is 1 every 1 foot with apertures up to 0.5 inches and a trend of 50°. Fractures are generally open (locally solutioned); however, locally, apertures are filled with soil and loose organic debris. This feature also contains vuggy rock, with densities of 1 every 3 inches, and locally connected with apertures up to 3 inches. Setbacks for SCS and/or SAS are appropriate for this feature within the bed of the drainage.

S111 Vuggy rock. This feature consists of a vuggy rock outcrop about 300 feet long and up to 30 feet wide within York Creek. Vugs are generally unconnected with a density of 1 per 3 inches and up to 3-inch diameters. Setbacks for SCS and/or SAS are appropriate for this feature within the creek bed.

S112 Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 1 to 1.5 feet high, extending horizontally along the bedding plane up to 5 feet deep pinching out to soil and organic debris.

This feature does not appear to hold water. No flowing air or fauna were observed for this feature. The feature is interpreted to be the result of weathering with little to no potential for recharge. No setback is recommended.

~~S113~~ Fractured rock and possible collapsed sinkhole. This feature consists of a rock outcrop measuring up to 100 feet in diameter containing fractures and limestone beds that dip toward one another. The dipping beds may be the result of rninor folding, undocumented faulting, or perhaps solutioning and collapse. Alluvial deposits within the drainage partially cover this feature, obscuring a more definitive interpretation. Fenestral porosity within nearby limestone outcrops indicates that this feature is most likely developed within the Kirschberg Evaporite Member of the Kainer Formation. Collapsed features can occur associated with the dissolution of evaporite minerals. Fracture density within the exposed outcrop varies from 1 every 0.1 feet to 1 every 3 feet, with apertures up to 2 inches, and a trend of 60° to 90°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature. Horizon recommends excavation to determine if additional abatement measures are warranted.

~~S114~~ Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high, extending horizontally along the bedding plane up to 12 feet deep pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

~~S115~~ Solution cavity. This feature is a solution cavity developed along a bedding plane at the base of an exposed limestone cliff within York Creek. The bedding plane entrance measures approximately 3 feet high extending horizontally along the bedding plane up to 8 feet deep and pinching out to black soil and organic debris. This feature does not appear to hold water. No flowing air or fauna was observed for this feature. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

~~S116~~ Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil appeared to be piping into the feature, though no airflow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44). Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

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S117 Solution cavity. This feature consists of a cavity about 1 foot in diameter, extending up to 1 foot to compact soil and leaf litter. Soil and cobble-sized rocks appeared to be piping into the feature, though no air flow or fauna was associated with this feature during Horizon's field investigation. This feature is coincident with a fault zone (S44) and located about 100 feet to the north of S116. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S118 Sinkhole (potential cave). This feature consists of sinkhole within a closed depression about 20 feet in diameter and surrounded by Texas Persimmon trees. The sinkhole measures about 6 feet by 3.5 feet and extends a minimum of 3 feet to loose cobble- to boulder-sized rocks. A weak current of cool air was observed to flow from the sinkhole, and soil and rocks pipe into this feature. This feature is coincident with a fault zone (S44). Fire ants were observed within the entrance to the sinkhole. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S119 Solution cavity. This feature consists of a bedding plane cavity about 1 foot in diameter extending horizontally up to 2 feet to compact soil. The entrance is located about 4 feet from the bottom of a drainage. No airflow was associated with this feature during Horizon's field investigation. The feature is interpreted to be the result of scouring with little to no potential for recharge. No setback is recommended.

S120 Solution cavity. This feature consists of a bedding plane cavity about 1.5 feet long by 0.5 feet high, extending horizontally up to 3 feet to compact soil. The entrance to the bedding plane cavity is located along the margin of a closed depression measuring about 5 feet in diameter that pipes soil into the cavity. The closed depression contains a hole (about 0.25 feet in diameter) that appears to pipe soil and extends vertically 1 feet. No airflow was associated any of these features during Horizon's field investigation. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature.

S121 Solution cavity. This feature consists of a solutioned fracture trending about 170° (parallel to the hillside) that is about 3 feet long by up to 0.5 wide extending vertically up to 2.5 feet to cobbles, soil and leaf debris. No airflow or fauna was associated with this feature during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

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S122 Fractured rock. This feature consists of a rock outcrop measuring up to 10 feet wide and 50 feet long located within a drainage. Fracture density varies from 1 every 1 foot, with apertures up to 2 inches and a trend of 120°, 90° and 35°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature where it intersects a creek bed or drainage. No setbacks are recommended on uplands where fault is buried and inferred.

S123 Fractured rock. This feature consists of a rock outcrop measuring up to 25 feet wide and 100 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 35° and locally 135°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. This feature is coincident with a fault zone (S30). Setbacks for SCS and/or SAS may be appropriate for this feature within a creek bed or drainage. No setbacks are recommended on uplands where fault is buried.

S124 Solution cavities. This feature consists of 3 solution cavities with dimensions of 1 by 0.5 feet. The outcrop that contains the cavities is about 20 feet in diameter and located on a hillside. The cavities each extend approximately 1 foot deep to compact soil. No airflow or fauna was associated any of these features during Horizon's field investigation. This feature is associated with an interpreted fault (S30). Setbacks for SCS and/or SAS may be appropriate for this feature.

S125 Fractured rock. This feature consists of a rock outcrop measuring up to 30 feet wide and 200 feet long located within a drainage. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 52° and 155°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. Setbacks for SCS and/or SAS may be appropriate for this feature where it is exposed in the bed of the drainage.

S126 Stock pond. This feature is located on a hilltop and measures approximately 25 feet long by 10 feet wide and up to 2 feet deep. This feature most likely holds water, but not very much, and was dry during field investigation. No openings or internal drainage were observed within this feature. No setback is recommended.

S127 Rock quarry. This small rock quarry is located adjacent to a dirt road and measures approximately 20 feet long by 10 feet wide by 3 feet deep. The feature has a drainage area that is less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

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~~S128~~ Solution cavity. This feature is located on a hillside, with a drainage area of less than 1 acre. The opening measures 6 inches long by 8 inches wide and has a depth of at least 1 foot. After a depth of 1 foot, a limestone floor is reached and the opening continues along a bedding plane. It is in filled with fine sediments and its ability to transmit fluids appears to be none to low. No setback is recommended.

~~S129~~ Rock quarry. This feature is located along a hillside adjacent to a road and the property fence line. The quarry measures approximately 20 feet in diameter, with a depth of about 1 foot. It has a drainage area of less than 1 acre and no openings or internal drainages were observed within this feature. No setback is recommended.

~~S130~~ Rock quarry. This closed depression created by excavation for road base. The feature measures about 50 feet in diameter and up to 1 foot deep within a hillside. No openings or internal drainage were observed within this feature. No setback is recommended.

~~S131~~ Solution cavity. This feature consists of a solution cavity within a closed depression about 8 feet in diameter and up to 2.5 feet deep. The solution cavity is about 0.5 feet in diameter and extends up to 1 foot deep to loose leaf and soil debris that appear to pipe into the cavity. This feature was previously labeled S134 in a draft report and S137 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

~~S132~~ Stock pond. This pond measures about 150 feet in diameter and is up to 8 feet deep. This feature was observed to hold water and contain no exit portals. The ability to hold water for this feature indicates the low permeability. This feature was previously labeled S135 in a draft report and S138 in the field. No setback is recommended.

~~S133~~ Fractures and solution cavity. This feature consists of a rock outcrop measuring up to 50 feet in diameter. Fracture density is 1 every 0.5 feet, with apertures up to 2 inches and trends of 055°. Fractures are generally open; however, locally, apertures are filled with soil and loose organic debris. A solution cavity, measuring about 6 feet in diameter and up to 3 feet deep, is exposed in the outcrop. This feature was previously labeled S136 in a draft report and S139 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature

~~S134~~ Solution cavities. This feature consists of 3 solution cavities. One cavity is a solution fractures up to 4 feet long, 0.5 feet wide and 2.5 feet deep, trending 75°. The second cavity is about 1 foot in diameter and up to 2 feet deep on the same trend as the fracture. A third feature is a cavity about 1.5 by 0.5 feet and extends subhorizontally about 3 feet. This feature was previously labeled S137 in a draft report and S140 in the field. Setbacks for SCS and/or SAS are appropriate for this feature. Any runoff should be diverted away from this feature

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~~S135~~ Closed depression zone. This feature consists of a zone with up to 3 natural closed depressions measuring about 50 feet in diameter and up to 1.5 feet deep, filled with black soil and scattered chert cobbles. No openings or internal drainages were observed within the feature. This feature was previously labeled S138 in a draft report and S141 in the field. Any untreated runoff should be diverted away from this feature. No additional setbacks are warranted.

~~S136~~ Sinkhole (potential cave). This feature consists of a sinkhole measuring about 10 feet in diameter and about 5 feet deep, with exposed limestone around the perimeter of the feature. Two cavities extend into the subsurface to the east and west an unknown distance and appear to pipe soil and leaf debris. The sinkhole is filled with loose cobbles and organic debris. Fractures trend 235° coincident with 1 side of the sinkhole. This feature was previously labeled S139 in a draft report and S142 in the field. Horizon recommends removal of loose rocks by hand (no backhoes or jack hammers) around a natural opening to determine appropriate abatement measures. Setbacks for SCS and/or SAS are appropriate for this feature. Any untreated runoff should be diverted away from this feature.

A1 ~~A7~~ Stock tank. This stock tank is located approximately 100 feet northwest of the subject site and exposes red soils and an outcrop of angular breccia composed of limestone and chert fragments within a fine-grained matrix interpreted to be fault gouge. This tank is approximately 25 feet in diameter and up to 5 feet deep and did not appear to hold water. However, due to its large catchment basin, exposed breccia, and its position on a fault zone, it may provide relatively minor recharge. This feature is coincident with the fault zone S29. Any untreated runoff should be diverted away from this feature.

A2 ~~A8~~ Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane strikes 20°, dips 50°E, and has a vertical displacement (vertical slickensides) of a crystalline limestone bed of about 1.5 feet. Beds dip 13°W within the quarry due to fault drag, indicating that a fault with larger displacement is likely nearby. Fractures within the quarry trend 70° and 45°. This feature is located off-site and within a drainage. No setback is recommended.

A3 ~~A9~~ Fault zone. This feature consists of a minor fault zone exposed within a quarry of the Regional Dense Member. The fault plane contains a 1-inch thick zone of fault gouge and strikes 115°. A crystalline limestone bed is apparently displaced about 0.5 feet. Beds dip 8°S within the quarry due to fault drag. Fractures within the quarry trend 035° and 050°. This feature is located on the side of a hill and off-site. No setback is recommended.

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A4 Fault zone. This feature consists of a fault zone located south of the subject site. A strong vegetation lineament is coincident with this feature. It does not cross any drainages that are within 300 feet of the subject site. No setback is recommended.

A5 Stock tank. This feature was mapped by Baumgardner and Collins (1991) as a karst sinkhole. This feature holds water along the eastern portion. This feature is coincident with fault zone A-4. Any untreated runoff from the subject site should be diverted away from this feature. Setbacks for SCS and/or SAS are appropriate for this feature.

5.0 PARTICIPATING PERSONNEL

Horizon's participating personnel for this Geologic Assessment are listed below. Resumes for participants are provided in Appendix F.

PERSON	PARTICIPATION
Kristin Miller, Senior Staff Geologist	Field Investigation
Jason John, Geologic Field Technician	Field Investigation
Greg Sherrod	Field Investigation, Records Search
Joe Waring	Field Investigation, Records Search

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APPENDIX A

GEOLOGIC ASSESSMENT TABLE

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GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch

HJN 000211 GA

| FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

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GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch

HJN 000259 GA

FEATURE ID			FEATURE CHARACTERISTICS																						PHYSICAL SETTING																					
1A	1B	1C	2	3				4			5	6		7			8			9				10			11	12			13					14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)					TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15		0	5	10	15	20					
	C CD FR FZ MM SC SH VR Z	35 10 0 15 35 10 20 0 35		X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
5,6,7,8	S27	SC	10	Kep				2	2	2										5				10		25		25		0					5				5	5			YES
5,6,7,8	S28	FR	0	Kek							1000/20	35-85-120	10			10			10			10		10		50		50					15				20	35			35	YES
5,6,7,8	S29	FZ	15	Kek/Kep								45	10							5				10		40		40					15				20	35			35	YES
5,6,7,8	S30	FZ	15	Kek/Kep								45	10							5				10		40		40					15				20	35			35	YES
	S31	CD	10	Kek	200	200	15													5			0			15	15					10					20		20		YES
5,6,7,8	S32	SC	10	Kep	3	0.3	2.5					~45	10							5				10		35		35		0					5				5	5			YES
5,6,7,8	S33	FZ	15	Kek/Kep								50	10							5				10		40		40					15				20	35			35	YES
	S34	CD	10	Kbu	75	75	10													5			0			15	15				5					10			15		15		YES
	S35	CD	10	Kbu	200	100	10													5			0			15	15				5					10			15		15		YES
	S36	CD	10	Kep	60	50	10													5			0			15	15				5					10			15		15		YES
4	S37	CD	10	Kek	100	100	10													5			0			15	15				5					10			15		15		YES
4	S38	CD	10	Kep	20	20	5													5			0			15	15				5					10			15		15		YES
	S39	CD	10	Kdr	20	20	5													5			0			15	15				5					10			15		15		YES
	S-40	CD	10	Kek	20	20	5													5			0			15	15				5					10			15		15		YES
	S-41	CD	10	Kek	50	50	10													5			0			15	15				5					10			15		15		YES
5,6,7,8	S-42	FZ	15	Kek/Kep								~45	10							5			0			30		30					10				20	30			30	YES
5,6,7,8	S-43	FZ	15	Kek/Kep								~135	10							5				10		40		40			5					10			15		15		YES
5,6,7,8	S-44	FZ	15	Kek/Kep								~45	10							5				10		40		40				10					20	30			30	YES
	S-45	CD	10	Kep	8	8	4													5			0			15	15			0					5				5	5			YES
5,6,7,8	S-46	SC	10	Kek	1	1	3													5			0			15	15			0					10				10	10			YES
5,6,7,8	S-47	VR	0	Kep							15 X 15			5			5			5			0			15	15			0					10				10	10			YES
5,6,7,8	S-48	FZ	15	Kek/Kep								20	10							5			0			30		30				10				10	20		20		YES
5,6,7,8	S49	FR	0	Kek							75/10	20	10			10		5		5				10		40		40				10				20	30			30	YES

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

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I have read, understood, and 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.

Kristen Miller — 19-Sep-01

Geologist signature — Date

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GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: 1855-acre Pfeuffer Ranch HJN 000259 GA

FEATURE ID			FEATURE CHARACTERISTICS																										PHYSICAL SETTING																						
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13					14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VF)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)					TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM- MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15		0	5	10	15	20					
	C 35 CD 10 FR 0 FZ 15 MM 35 SC 10 SH 20 VR 0 Z 35			X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 - 20	HIGH >20	YES
4	S71	CD	10	Kek	60	60	5													5			0			15	15				5				10				15		15		YES
4	S72	CD	10	Kep	60	60	5													5			0			15	15				5				10				15		15		YES
4	S73	CD	10	Kep	30	30	7													5			0			15	15				5				10				15		15		YES
4	S74	SC	10	Kep	1	1	2													5			0			15	15				5				10				15		15		YES
4	S75	SC	10	Kep	1	1	5				20									5				10		25		25		0					10				10	10			YES
4	S76	CD	10	Kep	50	50	10													5				10		25		25		0					10				10	10			YES
4	S77	CD	10	Kep	50	50	7													5			0			15	15					10			10				20		20		YES
4	S78	CD	10	Kep	30	30	6													5			0			15	15					10			10				20		20		YES
4	S79	SC	10	Kep	1	1	3													5			0			15	15					10			10				20		20		YES
4	S80	SC	10	Kep	2.5	0.8	2.5													5				10		25		25		0					5				5	5			YES
4	S81	SC	10	Kep				1	3	1												15			30	55		55				10				10			20		20		YES
4	S82	CD	10	Kep	30	30	7													5				10		25		25			5				10				15		15		YES
4	S83	CD	10	Kep	30	30	7													5			0			15	15				5				10				15		15		YES
4	S84	CD	10	Kep	30	30	5													5			0			15	15				5				10				15		15		YES
	S85	CD	10	Kep	30	30	6													5			0			15	15				5				10				15		15		YES
5,6,7,8	S86	FZ	15	Kek/Kep							-45	10								5			0			30		30				10				20		35			35		YES
5,6,7,8	S87	FZ	15	Kek/Kep							-45	10								5			0			30		30				10				20		35			35		YES
	S88	CD	10	Kek	150	150	6													5			0			15	15					10			10				20		20		YES
	S89	CD	10	Kbu	10	30	3													5			0			15	15			0			5					5	5			YES
	S90	CD	10	Kbu	50	50	3													5			0			15	15			0			5					5	5			YES
	S91	MM	35	Kbu																5					30	70			70	0					10				10	10			YES
	S92	CD	10	Kbu	2	2	3													5			0			15	15					10			20			30			30		YES
	S93	CD	10	Kek	20	20	4													5			0			15	15					10			20			30			30		YES

SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

I have read, understood, and 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.

Kristin Miller 19-Sep-01

Geologist signature Date

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APPENDIX B

GEOLOGIC STRATIGRAPHIC COLUMN

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GEOLOGIC STRATIGRAPHIC COLUMN

System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
Quaternary		Quarternary Alluvium		~10	Qal	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits within creekbeds. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Late Tertiary to Quaternary		equivalent of the Uvalde Gravel deposits		~10	Q-Tgr	Unconsolidated, well-rounded, poorly sorted, pebble- to cobble-size chert and limestone gravel deposits that locally cap topographically high areas on the subject site. These deposits have high porosity and permeability. No karst features are associated with these deposits.
Upper Cretaceous	Upper confining unit	Buda Limestone		40 to 50	Kbu	Hard limestone, gray to tan, dense, nodular, abundant fossil mollusks. Low porosity and permeability. Minor surface karst development.
		Del Rio Clay		40 to 50	Kdr	Dark gray to olive brown clay, pyritic, gypsiferous, calcareous with abundant *Iymatogyra arietina, Waconella wacoensis.* No porosity or permeability. No cave development. Primary upper confining unit of Edwards Aquifer.
Lower Cretaceous	I	Georgetown Formation		less than 10	Kgt	Gray to light tan marly limestone containing abundant fossil shells *Waconella wacoensis.* Low porosity and permeability. No cave development.
	II	Person Formation of the Edwards Group	Cyclic & Marine members, undivided	80 to 100	Kep2	Light tan, massive mudstone to packstone and *Miliolid* grainstone with boxwork vugs and chert. One of the most permeable members. Many subsurface caves.

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System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	III	Person Formation of the Edwards Group	Leached and Collapsed members, undivided	80 to 100	Kep3	Light gray, bioturbated iron-stained beds separated by thick limestone composed of crystalline limestone, mudstone to wackestone and *Miliolid* grainstone; chert; collapsed breccia. One of the most porous and permeable. Many developed caves.
	IV	Person Formation of the Edwards Group	Regional Dense	20 to 24	Kep4	Light tan, wispy, dense, argillaceous mudstone. Low permeability and acts as a vertical barrier. No cave development.
	V	Kainer Formation of the Edwards Group	Grainstone	50 to 60	Kek5	Light gray to white, Miliolid, crossbedded grainstone; mudstone to wackestone; chert. Reduced permeability due to recrystallization. Few developed caves.
	VI	Kainer Formation of the Edwards Group	Kirschberg evaporite	50 to 60	Kek6	Light gray, highly altered crystalline limestone; chalky mudstone; chert; contains boxwork voids with neospar and travertine frame. One of the most porous and permeable subdivisions. Probably extensive cave development.
	VII	Kainer Formation of the Edwards Group	Dolomitic	110 to 130	Kek7	Thick-bedded, light gray mudstone to grainstone; crystalline limestone; chert. Massively bedded, light gray, with abundant *Toucasia*. Locally permeable and water-yielding. Caves related to structure or bedding planes.
	VIII	Kainer Formation of the Edwards Group	Basal Nodular	50 to 60	Kek8	Massive shaly, fossiliferous, nodular and mottled limestone; mudstone; miliolid grainstone. Usually low permeability and few caves.

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System	Hydrologic Subdivision	Group or Formation	Member	Thickness in feet	Symbol	Description
	Lower Confining Unit	Upper Glen Rose		350 to 500	Kgr	Alternating strata of marl, dolomite, and limestone. Lower confining unit of the Edwards Aquifer. Relatively impermeable with some surface cave development.

REFERENCES:

Brune, Gunnar, and Gail L. Duffin. Occurrence, Availability and Quality of Ground Water in Travis County, Texas. *Texas Department of Water Resources Report* 276. Austin, TX: TDWR, 1983.

Garner, L. E., and K. P. Young. Environmental Geology of the Austin Area: An Aid to Urban Planning. *Report of Investigations 86.* The University of Texas at Austin, Bureau of Economic Geology, 1976.

Rose, P.R. Edwards Group, Surface and Subsurface, Central Texas: Austin, Texas, *University of Texas, Bureau of Economic Geology, Report of Investigations 74.* 1972.

Senger, R. K., and C. W. Kreitler. Hydrogeology of the Northern Segment of the Edwards Aquifer, Austin Region. *Report of Investigations 192.* The University of Texas at Austin, Bureau of Economic Geology, 1990.

Hanson, John A. and Ted A. Small. Geologic Framework and Hydrogeologic Characteristics of the Edwards Aquifer Outcrop, Comal County, Texas. *US Geological Survey (USGS) Water Resources Investigations Report* 94-4117. 1994.

(UT-BEG) University of Texas - Bureau of Economic Geology. *Geologic Atlas of Texas, Austin Sheet.* The University of Texas at Austin. Revised 1981.

_____. *Geologic Map of the Austin Area.* The University of Texas at Austin. Reprinted 1992.

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APPENDIX C

SITE GEOLOGIC MAP

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River Chase PARK

LOT 645
RIVER CHASE, UNIT FIVE
COMAL COUNTY, TEXAS

SITE PLAN

NOTE:

1. UPON COMPLETION OF EARTHMOVING ACTIVITY, ALL DISTURBED AREAS WILL BE IMMEDIATELY SEEDED WITH BERMUDA GRASS OR OTHER APPROPRIATE SEED. THIS ACTIVITY WILL BE DONE PRIOR TO PAVING OR SUBGRADE TREATMENT.

2. ALL SILT FENCES ARE TO BE INSPECTED AT THE START OF EACH DAY AND NECESSARY REPAIRS ARE TO BE MADE.

The contractor shall hydromulch or sod all exposed cuts and fills upon completion of grading and installation of all utilities. The seeding or erosion control shall be applied at the specified rate over areas disturbed by construction as follows:

From September 15 to March 1, seeding shall be with a combination of (1) one pound per (1000) thousand square feet of unhulled bermuda and (3) three pounds per (1000) thousand square feet of winter rye with a purity of 95% with 85% germination.

From March 1 to September 15, seeding shall be with hulled bermuda grass (Cynoden Dactolyn) at a rate of (1) one pound per (1000) thousand square feet with a purity of 95% with 85% germination.

Fertilizer shall have an analysis of 15-10-5 and shall be applied at the rate of 600 pounds per acre. Mulch type to be Conwed, applied at a rate of 2100 pounds per acre. Restoration shall be acceptable when the grass has reached a height of at least 1-1/2" (95%) coverage and no bare spots larger than 16 square feet exist.

The seeded or planted area is to be irrigated or sprinkled in a manner which will not erode the topsoil but will sufficiently soak the soil to a depth of 6 inches. The irrigation shall occur at seven day intervals for the first two months. Rainfall occurrences of at least 1 inch shall postpone the watering operation for one week.

LANDSCAPE AND REVEGETATION SPECIFICATIONS:

AREAS ADJACENT TO BUILDING AS SHOWN TO BE XERISCAPE LANDSCAPED USING BOTH NATIVE AND ENDEMIC PLANT SPECIES SUITABLE TO THE COMAL COUNTY SITE. PLANT SPECIES ARE TO INCLUDE BUT NOT LIMITED TO Sophora secundiflora TEXAS MOUNTAIN LAUREL, Leucophyllum sp. TEXAS PURPLE SAGE, Dasylirion sp. TEXAS SOTOL, Ilex vomitoria YAUPON HOLLY, Salvia greggii AUTUMN SAGE, Nandina domestica HEAVENLY BAMBOO AND OTHER SELECT NATIVE PLANT SPECIES.

AREAS SHOWN HYDROMULCHED TO BE WITH Cynodon dactylon var. 'Sahara' AT A SEEDING RATE OF 2.5 POUNDS PER THOUSAND SQUARE FEET.

CONSTRUCTION SEQUENCE:

1. INSTALL ROCK BERM
2. INSTALL STABILIZED CONSTRUCTION ENTRANCE.
3. CONSTRUCT SUBGRADE AND BASE FOR DRIVES AND PARKING AREA.
4. CONSTRUCT BUILDING & POOL.
5. REMOVE STABILIZED CONSTRUCTION ENTANCE AND INSTALL ASPHALT.
6. INSTALL LANDSCAPPING, GRASS SOD AND HYDROMULCHED SEED (VEGATATIVE FILTER STRIP)
7. REMOVE SILT FENCE ONLY AFTER VEGATATIVE FILTER STRIP HAS ESTABLISHED PERMANENT GROWTH.

NOTE:

THIS SITE DRAINS BY SHEET FLOW AND NO CONCENTRATED FLOWS (ie, DRAINAGE CHANNELS, DITCHES OR SWALES) WILL BE ALLOWED.



SCALE: 1" =100'

PRE-DEVELOPMENT CONDITIONS

A= 32.91 AC
C= 0.45
TC= 25 MIN.
I=6.0
Q25= 32.91(0.45)6.0 = 88.9 CFS

POST-DEVELOPMENT CONDITIONS

A= 32.91 AC
C= 0.52
TC= 25 MIN.
I=6.0
Q25= 32.91(0.52)6.0 = 102.6 CFS

GENERAL NOTES:
1. Stone size unless otherwise specified, aggregate shall conform to Grade 1 for coarse aggregates under Item 520 "Weed Control" of the Texas DOT Spec.
2. Length as effective, not less than fifty (50) feet.
3. Thickness not less than eight (8) inches.
4. Width not less than full width of points of ingress or it'ress.
5. Washing when necessary, shall be required to remove sediment prior to entrance onto public right-of-way. When washing is required, it shall be done in an area ensureded with crushed stone which drains into an approved sediment trap or sediment pond. All sediment shall be removed from entering any storm drain, ditch, or watercourse through use of sand bags, gravel, boards or other approved devices.
6. All surface water flow shall be maintained in a condition which will prevent tracking or flowing of sediment onto public right-of-way. This may require periodic top dressing with additional stone as conditions demand, and repair and/or cleanout of any measures used to trap sediment. All sediment spilled, dropped, washed or blowed onto public right-of-way must be removed immediately.

STABILIZED CONSTRUCTION ENTRANCE
N.T.S.

ROCK BERM
(not to scale)

GENERAL NOTES
1. Use only open-graded rock, with most of the fines removed.
2. Stone shall be crushed and, unless otherwise specified, shall be at least 3 inches in diameter and less than 1 cubic foot in volume.
3. The rock berm shall be embedded into the soil a minimum of 4 inches.
4. The rock berm shall be inspected after each rain, and the stone shall be replaced when the structure ceases to function as intended, due to silt accumulation among the rocks, washout, construction traffic damage, etc.
5. When silt reaches a depth equal to one-third the height of the berm or one foot, whichever is less, the silt will be removed and disposed of in an approved site and in such a manner as to not create a siltation problem.
6. When the site is completely stabilized, the berm will be removed and disposed of in an approved manner.

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
WATER POLLUTION ABATEMENT PLAN
GENERAL CONSTRUCTION NOTES

1. Written construction notification must be given to the appropriate TNRCC regional office no later than 48 hours prior to commencement of the regulated activity. The information must include the date on which the regulated activity will commence, the name of the approved plan for the regulated activity, and the name of the prime contractor and the name and telephone number of the contact person.

2. All contractors conducting regulated activities associated with this project must be provided with complete copies of the approved Water Pollution Abatement Plan and the TNRCC letter indicating the specific conditions of its approval. During the course of these regulated activities, the contractors are required to keep on-site copies of the approved plan and approval letter.

3. If any sensitive feature is discovered during construction, all regulated activities near the sensitive feature must be suspended immediately. The appropriate TNRCC regional office must be immediately notified of any sensitive features encountered during construction. The regulated activities near the sensitive feature may not proceed until the TNRCC has reviewed and approved the methods proposed to protect the sensitive feature and the Edwards Aquifer from any potentially adverse impacts to water quality.

4. No temporary aboveground hydrocarbon and hazardous substance storage tank system is installed within 150 feet of a domestic, industrial, irrigation, or public water supply well, or other sensitive feature.

5. All temporary erosion and sedimentation (E&S) control measures must be properly selected, installed, and maintained in accordance with the manufacturers specifications and good engineering practices. Controls specified in the temporary storm water section of the approved Edwards Aquifer Protection Plan are required during construction. If inspections indicate a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations. The controls must remain in place until disturbed areas are revegetated and the areas have become permanently stabilized.

6. If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).

7. Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50 that can indicate when the sediment occupies 50

8. Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

9. All spoils (excavated material) generated from the project site must be stored on-site with proper E&S controls. For storage or disposal of spoils at another site on the Edwards Aquifer Recharge Zone, the owner of the site must receive approval of a water pollution abatement plan for the placement of fill material or mass grading prior to the placement of spoils at the other site.

10. Stabilization measures shall be initiated as soon as practicable in portions of the site where construction activities have temporarily or permanently ceased, but in no case more than 14 days after the construction activity in that portion of the site has temporarily or permanently ceased. Where the initiation of stabilization measures by the 14th day after construction activity temporary or permanently cease is precluded by weather conditions, stabilization measures shall be initiated as soon as practicable. Where construction activity on a portion of the site is temporarily ceased, and earth disturbing activities will be resumed within 21 days, temporary stabilization measures do not have to be initiated on that portion of site. In areas experiencing droughts where the initiation of stabilization measures by the 14th day after construction activity has temporarily or permanently ceased is precluded by seasonal arid conditions, stabilization measures shall be initiated as soon as practicable.

11. The following records shall be maintained and made available to the TNRCC upon request: the dates when major grading activities occur; the dates when construction activities temporarily or permanently cease on a portion of the site; and the dates when stabilization measures are initiated.

12. The holder of any approved Edward Aquifer protection plan must notify the appropriate regional office in writing and obtain approval from the executive director prior to initiating any of the following:

A. any physical or operational modification of any water pollution abatement structure(s), including but not limited to ponds, dams, berms, sewage treatment plants, and diversionary structures;

B. any change in the nature or character of the regulated activity from that which was originally approved or a change which would significantly impact the ability of the plan to prevent pollution of the Edwards Aquifer;

C. any development of land previously identified as undeveloped in the original water pollution abatement plan.

OWNER/DEVELOPER:
SOUTHERLAND PROPERTIES, INC.
P.O. BOX 1629
WIMBERLEY, TEXAS 78676
(512) 847-5263

Austin Regional Office
1921 Cedar Bend, Suite 150
Austin, Texas 78758-5336
Phone (512) 339-2929
Fax (512) 339-3795

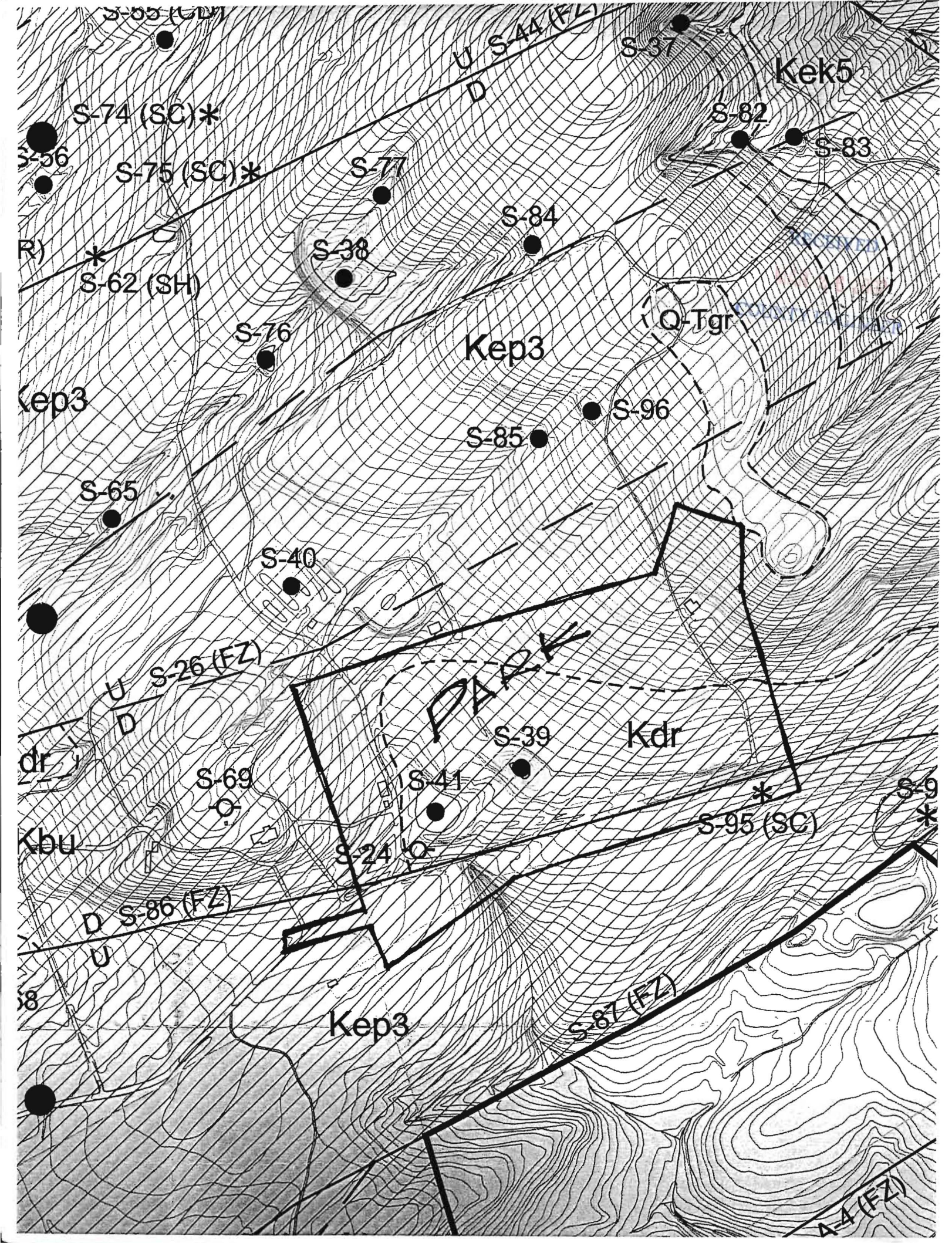
San Antonio Regional Office
14250 Judson Road
San Antonio, Texas 78233-4480
Phone (210) 490-4025
Fax (210) 545-4329

PRO·TECH ENGINEERING GROUP INCORPORATED
100 E. San Antonio St., Suite 100
San Marcos, TX. 78666
(512) 353-3335

EO 14677

PREPARED FEBRUARY 25, 2002

Mon Mar 18 09:52:08 2002 RM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S-38
S-62 (SH)
S-76
Kep3
Q-Tgr
S-96
S-85
S-65
S-40
S-26 (FZ)
PARK
Kdr
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S-41
S-69
S-95 (SC)
S-24
Kbu
S-86 (FZ)
S-87 (FZ)
Kep3

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APPENDIX D

RESUMES OF PARTICIPANTS

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Horizon
ENVIRONMENTAL SERVICES, INC.

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RESUMES OF KEY PERSONNEL

Corporate Experience

Horizon Environmental Services, Inc. (Horizon) has performed hundreds of Geologic Assessments to complete Water Pollution Abatement Plans within the Edwards Aquifer Recharge Zone. The geographic extent of Horizon's Geologic Assessments includes Bexar, Comal, Hays, Travis, and Williamson Counties of Texas, in support of Edwards Aquifer protection.

Horizon is particularly well-qualified to provide both the technical and administrative support required for project planning and permitting efforts related to various federal and state permits or approvals. Overall corporate services provided by Horizon focus primarily upon environmental services other than those related to hazardous substances. However, we have personnel who are ASTM-trained and who have several years of applied experience in performing Phase I Environmental Site Assessments (ESAs) and due diligence reviews for property (real estate) transfers. Horizon's capabilities and experience are very broad in compliance with the National Environmental Policy Act (NEPA), particularly as related to multidisciplinary Environmental Assessments and Environmental Impact Statements (EISs), jurisdictional wetlands, endangered species, cultural resource issues, geologic assessments, cave management, and expert testimony.

Horizon is an Austin-based Texas Corporation with additional offices in Beaumont and Houston, Texas, and Shreveport, Louisiana. Founded in 1987, Horizon is a small-business enterprise as defined by Section 3 of the Small Business Act and the standards established by the Small Business Administration Regulation under CAR 121.

Services which Horizon provides for various clients include jurisdictional wetland determinations; endangered species habitat assessments and surveys; archeological surveys and mitigation (prehistoric and historic); ecological risk and damage assessments; Phase I environmental site assessments; wildlife habitat and wetlands restoration or creation; baseline aquatic and terrestrial investigations (inland and coastal); HEP analyses; IFIM analyses; environmental constraints analyses for alternative project sites, routes, and land development scenarios ("fatal flaw" analyses); post-project land use planning and mitigation; multidisciplinary Environmental Assessments in support of federal and state Environmental Impact Statements; and permit management including preparation, agency coordination, and expert testimony.

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Kristin Miller, RPG

Kristin Miller is a graduate of the University of Texas at Austin with 2 bachelor degrees in Geological Sciences and Geography (Environmental Resource Management). Ms Miller is currently working on a master's program at UT-Austin in Geomorphology with a specialization in karst sediment transport. She is Registered Professional Geologist (Mississippi Registration #0523), Environmental Specialist, Senior Staff Project Manager, and Senior Staff Geologist with Horizon. Ms. Miller has more than 9 years experience in environmental consulting and 7 years experience at the Texas Natural Resource Conservation Commission (formerly Texas Water Commission) and Texas Water Development Board.

Ms. Miller is an ASTM-trained Environmental Site Assessment (ESA) Professional and has hundreds of Phase I ESAs in the State of Texas. Ms. Miller provides due diligence investigations regarding the potential for hazardous substance liabilities. Ms. Miller prepares Phase I ESAs that meet or exceed nationally accepted standards set by the ASTM Practice E-1527-97. Ms. Miller has been caving since 1982, where she began as a tour guide and part-time volunteer, surveying Inner Space Caverns in Georgetown, Texas. Ms. Miller has performed hundreds of geologic assessments within the Edwards Aquifer Recharge Zone in Central Texas. She is a member of the Geological Society of America, Austin Geological Society, and National Speleological Society.

Ms. Miller's resume includes geologic assessments; cave studies; karst investigations; cave closure and management plans; NOI and FERC documentation; biological sampling; integrated pest management; endangered species habitat assessments; population surveys; territory mapping; wetland determinations and planting, project management; and state, local, and federal environmental permitting assistance. She is authorized to conduct biological sampling and is listed on Horizon's Scientific Collection Permits. Ms. Miller has conducted hundreds of endangered species habitat assessments for the federally protected golden-cheeked warbler, black capped-vireo, and cave-invertebrate species. She provides technical, biological, and geological support and on-site investigations for Environmental Impact Statements throughout Texas and Louisiana.

Jason John

Jason John graduated from the Colorado School of Mines in 1995 with a Bachelor of Science degree in Geophysical Engineering and a minor in Geology. He is currently a geologic field technician at Horizon and is studying Stratigraphy in the graduate program at UT. While in undergraduate and graduate school, Mr. John worked as a geoscience intern in Texas, Louisiana, and Alaska where he produced isopach structural porosity, permeability, water saturation, and net sand maps for key reservoir horizons of an undeveloped reservoir and conducted research on stratigraphic, structural, exploration histories. Mr. John researched and compiled regional cross-sections of the Gulf of Mexico and synthesized several of them to gain a regional understanding of the subsurface structure, stratigraphic units, and facies changes of the onshore area. He also

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worked for the Department of Water Resources in Arizona as an Engineering Aide where he conducted snow and rain surveys and prepared geologic maps for digitization. Mr. John's computer skills include ARCview, GEOLOG, Geoquest, AutoCAD, and technical software programs.

Joe Waring

Joe Waring is an EMS-trained field technician at Horizon who provides administrative and technical support for field mapping, karst surveys, cave mapping and exploration, water well inventories, endangered species record searches, background research, and wetland restoration/design.

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WATER POLLUTION ABATEMENT PLAN APPLICATION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b), EFFECTIVE JUNE 1, 1999

PROJECT NAME: RIVER CHASE PARK

PROJECT INFORMATION

1. The type of project is:
   - _ Residential: # of Lots:
   - __ Residential: # of Living Unit Equivalents:
   - X Commercial
   - __ Industrial
   - __ Other:

2. Total site acreage (size of property): 32.91

3. Projected population: ___

4. The amount and type of impervious cover expected after construction are shown below:

Impervious Cover of Proposed Project	Sq. Ft.	Sq. Ft./Acre	Acres
Structures/Rooftops	3,800	÷ 43,560 =	0.09
Parking	30,850	÷ 43,560 =	0.71
Other paved surfaces	62,350	÷ 43,560 =	1.43
Total Impervious Cover	97,000	÷ 43,560 =	2.23
Total Impervious Cover ÷ Total Acreage x 100 =			0.07%

5. X **ATTACHMENT A - Factors Affecting Water Quality.** A description of any factors that could affect surface water and groundwater quality is provided at the end of this form.

6. X Only inert materials as defined by 30 TAC 330.2 will be used asfill material.

FOR ROAD PROJECTS ONLY
Complete questions 7-12 if this application is exclusively for a road project.

7. Type of project:
   - __ TXDOT road project.
   - __ County road or roads built to county specifications.
   - __ City thoroughfare or roads to be dedicated to a municipality.
   - __ Street or road providing access to private driveways.

8. Type of pavement or road surface to be used:
   __ Concrete
   __ Asphaltic concrete pavement
   __ Other:

9. Length of Right of Way (R.O.W.): _____ feet.
   Width of R.O.W.: _____ feet.
   L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.

10. Length of pavement area: _____ feet.
    Width of pavement area: _____ feet.
    L x W = _____ Ft^2 ÷ 43,560 Ft^2/Acre = _____ acres.
    Pavement area _____ acres ÷ R.O.W. area _____ acres x 100 = ____% impervious cover.

11. __ A rest stop will be included in this project.
    __ A rest stop will **not** be included in this project.

12. __ Maintenance and repair of existing roadways that do not require approval from the TNRCC Executive Director. Modifications to existing roadways such as widening roads/adding shoulders totaling more than one-half (1/2) the width of one (1) existing lane require prior approval from the TNRCC.

STORMWATER TO BE GENERATED BY THE PROPOSED PROJECT

13. **ATTACHMENT B - Volume and Character of Stormwater.** A description of the volume and character (quality) of the stormwater runoff which is expected to occur from the proposed project is provided at the end of this form. The estimates of stormwater runoff quality and quantity should be based on area and type of impervious cover. Include the runoff coefficient of the site for both pre-construction and post-construction conditions.

WASTEWATER TO BE GENERATED BY THE PROPOSED PROJECT

14. The character and volume of wastewater is shown below:

100 % Domestic	1000 gallons/day
__ % Industrial	_____ gallons/day
__ % Commingled	_____ gallons/day
TOTAL	1000 gallons/day

15. Wastewater will be disposed of by:
    X **On-Site** Sewage Facility (OSSF/Septic Tank):
    ATTACHMENT C - Suitability Letter from Authorized Agent. An on-site sewage facility will be used to treat and dispose of the wastewater. The appropriate licensing authority's (authorized agent) written approval is provided at the end of this form. It states that the land is suitable for the use of an on-site sewage facility or identifies areas that are not suitable.
    X Each lot in this project/development is at least one (1) acre (43,560 square feet) in size. The system will be designed by a licensed professional engineer or registered sanitarian and installed by a licensed installer in compliance with 30 TAC §285.
    __ Sewage Collection System (Sewer Lines):
    __ Private service laterals from the wastewater generating facilities will be connected

to an existing SCS.

__ Private service laterals from the wastewater generating facilities will be connected to a proposed SCS.

__ The SCS was previously submitted on _____.

__ The SCS was submitted with this application.

__ The SCS will be submitted at a later date. The owner is aware that the SCS may not be installed prior to executive director approval.

The sewage collection system will convey the wastewater to the (name) Treatment Plant. The treatment facility is :

__ existing.

__ proposed.

16. X All private service laterals will be inspected as required in 30 TAC 213.5.

SITE PLAN REQUIREMENTS

Items 17 through 27 must be included on the Site Plan.

17. The Site Plan must have a minimum scale of 1" = 400'.
Site Plan Scale: 1" = ~~30~~ 400'

18. 100-year floodplain boundaries

__ Some part(s) of the project site is located within the 100-year floodplain. The floodplain is shown and labeled.

X No part of the project site is located within the 100-year floodplain.

The 100-year floodplain boundaries are based on the following specific (including date of material) sources(s):
FEDERAL EMERGENCY MANAGEMENT FLOOD INSURANCE RATE MAP
COMAL COUNTY MAP NO. 485463 0110C, SEPTEMBER 29, 1986

19. __ The layout of the development is shown with existing and finished contours at appropriate, but not greater than ten-foot contour intervals. Show lots, recreation centers, buildings, roads, etc.

X The layout of the development is shown with existing contours. Finished topographic contours will not differ from the existing topographic configuration and are not shown.

20. All known wells (oil, water, unplugged, capped and/or abandoned, test holes, etc.):

x There are 1(#) wells present on the project site and the locations are shown and labeled. (Check all of the following that apply)

__ The wells are not in use and have been properly abandoned.

__ The wells are not in use and will be properly abandoned.

X The wells are in use and comply with 30 TAC §238.

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

21. Geologic or manmade features which are on the site:

X All **sensitive and possibly sensitive** geologic or manmade features identified in the Geologic Assessment are shown and labeled.

__ No **sensitive and possibly sensitive** geologic or manmade features were identified in the Geologic Assessment.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. Geologic or manmade features were found and are shown and labeled.

__ **ATTACHMENT D - Exception to the Required Geologic Assessment.** An exception to the Geologic Assessment requirement is requested and explained in ATTACHMENT D provided at the end of this form. No geologic or manmade features were found.

22. X The drainage patterns and approximate slopes anticipated after major grading activities.

23. X Areas of soil disturbance and areas which will not be disturbed.

24. X Locations of major structural and nonstructural controls. These are the temporary and permanent best management practices.

25. X Locations where soil stabilization practices are expected to occur.

26. X Surface waters (including wetlands).

27. __ Locations where stormwater discharges to surface water or sensitive features.
X There will be no discharges to surface water or sensitive features.

ADMINISTRATIVE INFORMATION

28. X One (1) original and three (3) copies of the completed application have been provided.

29. X Any modification of this WPAP will require TNRCC executive director approval, prior to construction, and may require submission of a revised application, with appropriate fees.

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. This **WATER POLLUTION ABATEMENT PLAN APPLICATION FORM** is hereby submitted for TNRCC review and executive director approval. The form was prepared by:

KELLY KILBER
Print Name of Applicant/Agent

Signature of Applicant/Owner/Agent

3/19/02
Date

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ATTACHMENT A

The major factor that affects surface water and groundwater quality will be from construction activities that disturb ground cover and equipment on site with the potential for leakage.

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ATTACHMENT B

Volume and Character of Stormwater

The site will drain by means of sheet flow and after improvements are completed, the Stormwater runoff for the twenty-five year storm will be 102.6 cfs. Due to low impervious cover the character of the runoff will be similar to post development conditions.

Pre-Development Conditions

A= 32.91 Ac
C= 0.45
TC = 25 min
I = 6.0
Q25 = 32.91 (0.45) 6.0 = 88.9 cfs

Post Development Conditions

A= 32.91 Ac
C = 0.52
TC = 25 min.
I = 6.0
Q25 = 32.91 (0.52) 6.0 = 102.6 cfs

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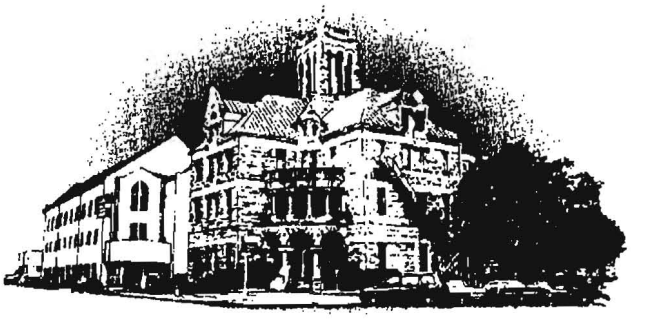

Comal County

OFFICE OF COMAL COUNTY ENGINEER

March 15, 2002

Mr. Charles D. Patterson
River Chase Venture, Ltd.
P.O. Box 1629
Wimberley, TX 78676

Re: Proposed subdivision, RIVER CHASE PARK, within Comal County, Texas

Dear Property Owner(s):

We have completed the field inspection of the referenced for the recommendation for private sewage facilities and have found the property to be approved with the conditions that individual septic systems permits shall be required for the lots within this subdivision.

Please be advised that these individual permits will be required to meet 30 TAC 285.40, subchapter E (copy attached). Please specifically reference the one acre minimum lot size and 150 foot distance requirement to recharge features.

Should you have any questions, please feel free to contact us.

Sincerely,

Thomas H. Hornseth, P.E.
Comal County Engineer

cc: Pro-Tech Engineering Group

195 David Jonas Drive • New Braunfels, Texas 78130 • (830) 608-2090 FAX (830) 608-2009

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SUBCHAPTER E : SPECIAL REQUIREMENTS FOR OSSFS LOCATED IN THE EDWARDS AQUIFER RECHARGE ZONE §285.40

§285.40. OSSFs on the Recharge Zone of the Edwards Aquifer.

(a) Applicability. In addition to the requirements given in this chapter, the following additional provisions apply to the Edwards Aquifer recharge zone as defined in §285.2 of this title (relating to Definitions) and is not intended to be applied to any other areas in the State of Texas.

(b) Additional application requirements for new OSSFs.

(1) All planning and design materials shall be submitted by a professional engineer or sanitarian registered in Texas.

(2) Site evaluation to be conducted by a certified site evaluator possessing a valid certificate.

(c) Conditions for obtaining a permit to construct. In order to obtain a permit to construct in the Edwards Aquifer recharge zone, the following conditions must be met.

(1) Minimum lot sizes. Each lot or tract of land on the recharge zone on which OSSFs are to be located must have an area of at least one acre (43,560 square feet) per single family dwelling.

(2) Minimum separation distances from recharge features. The following separation distances shall be maintained from recharge features found during a site evaluation or in accordance with a geologic assessment performed in accordance with Chapter 213 of this title (relating to Edwards Aquifer). No sewage treatment tank or holding tank may be located within 50 feet of a recharge feature. No soil absorption system may be located within 150 feet of a recharge feature.

(3) No OSSF may be installed closer than 75 feet from the banks of the Nueces, Dry Frio, Frio, or Sabinal Rivers downstream from the northern Uvalde county line to the recharge zone.

(d) Existing OSSFs. OSSFs licensed by, or registered with, the appropriate permitting authority at the time of adoption of this section shall remain licensed or registered under the terms and conditions of the current license or registration. Any relicensing shall be performed in accordance with §285.3 of this title (relating to Applicability). An OSSF installed on the recharge zone prior to April 11, 1977, in either Uvalde or Kinney Counties is not required to be permitted or licensed, provided the OSSF is not causing pollution, is not a threat to the public health, or is not a nuisance, and has not been substantially modified.

(e) Exceptions for certain lots. Lots platted and recorded with the county in its official plat record, deed, or tax records of the following counties prior to the dates for the counties indicated in this

subsection, are exempted from the one-acre minimum lot size requirement, pursuant to the conditions of subsection (f) of this section.

(1) Kinney, Uvalde, Medina, Bexar, and Comal Counties--March 26, 1974;

(2) Hays County--June 21, 1984;

(3) Travis County--November 21, 1983; and

(4) Williamson County--May 21, 1985.

(f) Notice. Any person, or his agents or assignees, desiring to construct a residential development with two or more lots in which OSSFs will be utilized in whole or in part on the recharge zone and desiring to sell, lease, or rent the lots therein, must inform in writing each prospective purchaser, lessee, or renter of the following.

(1) Each lot within the regulated development is subject to the terms and conditions of this section.

(2) A permit to construct shall be required before an OSSF can be constructed in the subdivision.

(3) A license to operate shall be required for the operation of an OSSF.

(4) Whether or not an application for a water pollution abatement plan as defined in Chapter 213 of this title (relating to Edwards Aquifer), has been made, and whether or not it has been approved, and whether any restrictions or conditions have been placed on that approval.

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TEMPORARY STORMWATER SECTION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(A), (B), (D)(i) and (G); EFFECTIVE JUNE 1, 1999

PROJECT NAME: River Chase Park

POTENTIAL SOURCES OF CONTAMINATION

Examples: Fuel storage and use, chemical storage and use, use of asphaltic products, construction vehicles tracking onto public roads, and existing solid waste.

1. Fuels for construction equipment and hazardous substances which will be used during construction:

   __ Aboveground storage tanks with a cumulative storage capacity of less that 250 gallons will be stored on the site for less than one (1) year.

   __ Aboveground storage tanks with a cumulative storage capacity between 250 gallons and 499 gallons will be stored on the site for less than one (1) year.

   __ Aboveground storage tanks with a cumulative storage capacity of 500 gallons or more will be stored on the site. An **Aboveground Storage Tank Facility Plan** application must be submitted to the appropriate regional office of the TNRCC prior to moving the tanks onto the project.

   X Fuels and hazardous substances will not be stored on-site.

2. x **ATTACHMENT A - Spill Response Actions**. A description of the measures to be taken to contain any spill of hydrocarbons or hazardous substances isprovided at the end of this form.

3. NA Temporary aboveground storage tank systems of 250 gallons or more cumulative storage capacity must be located a minimum horizontal distance of 150 feet from any domestic, industrial, irrigation, or public water supply well, or other sensitive feature.

4. X **ATTACHMENT B - Potential Sources of Contamination.** Describe in an attachment at the end of this form any other activities or processes which may bea potential source of contamination.

   __ The are no other potential sources of contamination.

SEQUENCE OF CONSTRUCTION

5. x **ATTACHMENT C - Sequence of Major Activities.** A description of the sequence of major activities which will disturb soils for major portions of the site (grubbing, excavation, grading, utilities, and infrastructure installation) is provided at the end of this form. For each activity described, an estimate of the total area of the site to be disturbed by each activity is given.

6. x Name the receiving water(s) at or near the site which will be disturbed or which will receive discharges from disturbed areas of the project: Alligator Creek

TEMPORARY BEST MANAGEMENT PRACTICES (TBMPs)

Erosion control examples: tree protection, interceptor swales, level spreaders, outlet stabilization, blankets or matting, mulch, and sod. Sediment control examples: stabilized construction exit, silt fence, filter dikes, rock berms, buffer strips, sediment traps, and sediment basins. Please refer to the Technical Guidance Manual for guidelines and specifications. **All structural BMPs must be shown on the site plan.**

7. x **ATTACHMENT D - Temporary Best Management Practices and Measures.** A description of the TBMPs and measures that will be used during and after construction are provided at the end of this form. For each activity listed in the sequence of construction, include appropriate control measures and the general timing (or sequence) during the construction process that the measures will be implemented.

x TBMPs and measures will prevent pollution of surface water, groundwater, and stormwater. The construction-phase BMPs for erosion and sediment controls have been designed to retain sediment on site to the extent practicable. The following information has been provided in the attachment at the end of this form

a. A description of how BMPs and measures will prevent pollution of surface water, groundwater or stormwater that originates upgradient from the site and flows across the site.

b. A description of how BMPs and measures will prevent pollution of surface water or groundwater that originates on-site or flows off site, including pollution caused by contaminated stormwater runoff from the site.

c. A description of how BMPs and measures will prevent pollutants from entering surface streams, sensitive features, or the aquifer.

d. A description of how, to the maximum extent practicable, BMPs and measures will maintain flow to naturally-occurring sensitive features identified in either the geologic assessment, TNRCC inspections, or during excavation, blasting, or construction.

8. The temporary sealing of a naturally-occurring sensitive feature which accepts recharge to the Edwards Aquifer as a temporary pollution abatement measure during active construction should be avoided.

__ **ATTACHMENT E - Request to Temporarily Seal a Feature.** A request to temporarily seal a feature is provided at the end of this form. The request includes justification as to why no reasonable and practicable alternative exists for each feature.

x There will be no temporary sealing of naturally-occurring sensitive features on the site.

9. X **ATTACHMENT F - Structural Practices.** Describe the structural practices that will be used to divert flows away from exposed soils, to store flows, or to otherwise limit runoff discharge of pollutants from exposed areas of the site. Placement of structural practices in floodplains has been avoided.

10. X **ATTACHMENT G - Drainage Area Map**. A drainage area map is provided at the end of this form to support the following requirements.

__ For areas that will have more than 10 acres within a common drainage area

disturbed at one time, a sediment basin will be provided.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a smaller sediment basin and/or sediment trap(s) will be used.

__ For areas that will have more than 10 acres within a common drainage area disturbed at one time, a sediment basin or other equivalent controls are not attainable, but other TBMPs and measures will be used in combination to protect down slope and side slope boundaries of the construction area.

X There are no areas greater than 10 acres within a common drainage area that will be disturbed at one time. A smaller sediment basin and/or sediment trap(s) will be used in combination with other erosion and sediment controls within each disturbed drainage area.

11. NA **ATTACHMENT H - Temporary Sediment Pond(s) Plans and Calculations.** Temporary sediment pond or basin construction plans and design calculations for a proposed temporary BMP or measure has been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information must be signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed temporary BMPs and measures are provided as at the end of this form.

12. X **ATTACHMENT I - Inspection and Maintenance for BMPs.** A plan for the inspection of temporary BMPs and measures and for their timely maintenance, repair, and, if necessary, retrofit is provided at the end of this form. A description of documentation procedures and recordkeeping practices is included in the plan.

13. x All control measures must be properly selected, installed, and maintained in accordance with the manufacturers specifications and good engineering practices. If periodic inspections by the applicant or the executive director, or other information indicates a control has been used inappropriately, or incorrectly, the applicant must replace or modify the control for site situations.

14. x If sediment escapes the construction site, off-site accumulations of sediment must be removed at a frequency sufficient to minimize offsite impacts to water quality (e.g., fugitive sediment in street being washed into surface streams or sensitive features by the next rain).

15. x Sediment must be removed from sediment traps or sedimentation ponds not later than when design capacity has been reduced by 50%. A permanent stake will be provided that can indicate when the sediment occupies 50% of the basin volume.

16. x Litter, construction debris, and construction chemicals exposed to stormwater shall be prevented from becoming a pollutant source for stormwater discharges (e.g., screening outfalls, picked up daily).

SOIL STABILIZATION PRACTICES

Examples: establishment of temporary vegetation, establishment of permanent vegetation, mulching, geotextiles, sod stabilization, vegetative buffer strips, protection of trees, or preservation of mature vegetation.

17. X **ATTACHMENT J - Schedule of Interim and Permanent Soil Stabilization Practices.** A schedule of the interim and permanent soil stabilization practices for the site is attached at the end of this form. See TNRCC Note No. 10 on Site Plan

18. X Records must be kept at the site of the dates when major grading activities occur, the dates when construction activities temporarily or permanently cease on a portion of the site, and the dates when stabilization measures are initiated.

19. X Stabilization practices must be initiated as soon as practicable where construction activities have temporarily or permanently ceased.

ADMINISTRATIVE INFORMATION

20. X All structural controls will be inspected and maintained according to the submitted and approved operation and maintenance plan for the project.

21. X If any geologic or manmade features, such as caves, faults, sinkholes, etc., are discovered, all regulated activities near the feature will be immediately suspended. The appropriate TNRCC Regional Office shall be immediately notified. Regulated activities must cease and not continue until the TNRCC has reviewed and approved the methods proposed to protect the aquifer from any adverse impacts.

22. X Silt fences, diversion berms, and other temporary erosion and sediment controls will be constructed and maintained as appropriate to prevent pollutants from entering sensitive features discovered during construction.

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. This **TEMPORARY STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

Kelly Kilber, Agent
Print ~~Name~~ of Applicant/Owner/Agent

Signature of Applicant/Owner/Agent 3/19/02 Date

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ATTACHEMENT A

Spill Response Actions

An earthen berm will be built immediately downgradient of any spill. Then all material will be removed from the site and disposed of in a approved manner.

Call TNRCC IN THE San Antonio Office

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ATTACHMENT B

Potential Sources of contamination will be disturbed soil and use of construction equipment with the possibility of fuel leaks from use and maintenance.

EO# 14677
Attachments

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ATTACHMENT C

CONSTRUCTION CONTROLS:

The major construction activities to take place at the project site consist of the construction of 3600 square foot building and swimming pool with associated drives and parking area. River Chase Blvd. will be used as the construction entrance. Stabilized construction entrance and silt fences for sediment traps will be constructed where shown on the Site Plan. All disturbed areas not covered with impervious material will be re-vegetated with Rye-Bermuda grass mix immediately after completion of the grading. These areas will be prepared, seeded and watered by approved methods. Site Plan shows guidelines for the restoration of grassed areas.

The following is an approximate chronological listing of the construction Activities and the Temporary Erosion Controls to be utilized during each activity.

CONSTRUCTION ACTIVITY	TEMPORARY EROSION CONTROL
Clearing and rough grading of site	Install silt fences and stabilized construction entrance.
Construct Building	No additional erosion controls necessary
Installation of base material	No additional erosion controls necessary
Installation of asphalt pavement	Seed disturbed areas immediately upon completion
Completion of construction	Remove silt fence only after grass seed has established permanent growth.

EO# 14677
Projdes.

EROSION AND SEDIMENT CONTROLS:

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

Temporary erosion and sediment controls will consist of rock berms and silt fences installed downslope of construction activities at all drainage courses.

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The final permit requires offsite vehicle tracking of sediments and the generation of dust be minimized. To minimize the tracking of sediments by offsite vehicle hauling of materials, the County of Comal maintains River Chase Blvd adjacent to the site, will be used as the main delivery route. This paved roadway can be easily cleaned by a front-end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the road. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at the entrance to the site.

Efforts shall be made at all times to prevent the unnecessary accumulation of dust. Earth surfaces subject to dusting shall be kept moist with water.

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ATTACHEMENT F

STRUCTURAL PRACTICES:

Erosion and sediment controls for construction activities have three goals: (1) to divert upslope water around disturbed areas of the site; (2) limit the exposure of disturbed areas; and (3) remove sediment from storm water before it leaves the site. The site will require the use of stabilization practices to reduce erosion and control sediment from leaving the site. Stabilization practices refers to the covering or maintaining an existing cover over soils. This practice is one of the most important factors in minimizing erosion while construction activities are in progress.

All natural drainage channels and swells will be left in their natural state so that the flow will not erode the receiving downstream reach and will also act as a sediment trap. There will be no installation of devices to divert flow, store flow or limit runoff.

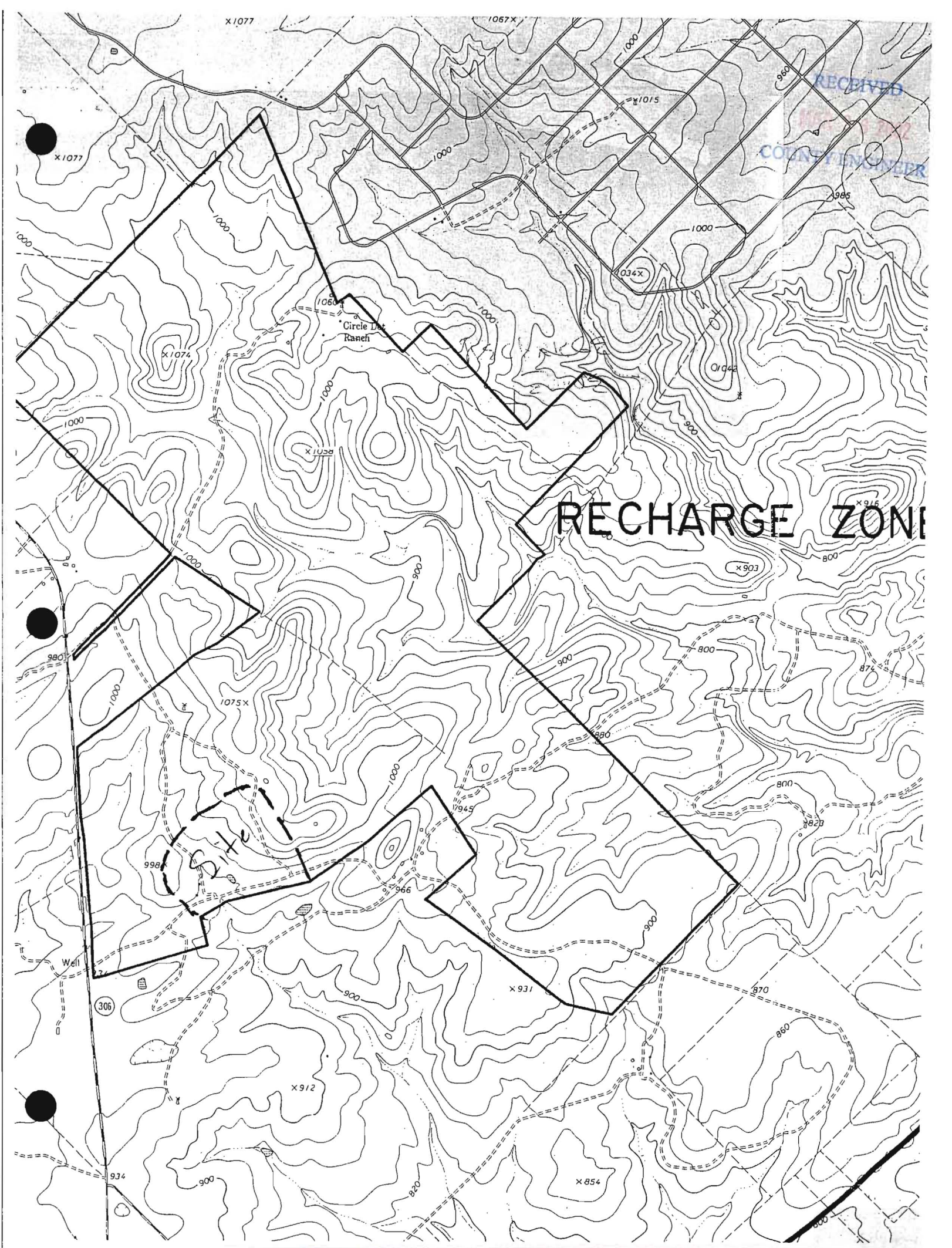
Temporary erosion and sediment controls will consist of rock berms ~~and silt fence~~s installed downslope of construction activities at all drainage courses. RM 3/20/02

Permanent erosion and sediment controls will consist of seeding and/or hydromulching areas all areas disturbed during construction.

OTHER CONTROLS:

The prevention of pollutants from entering the storm water system includes the requirement that no no-storm water solid materials, including building material wastes, shall be discharged at the site. Daily cleaning is required to keep the site free from accumulation of waste material and rubbish. All waste materials must be disposed of daily in onsite containers. These containers shall be removed from the site periodically and disposed of at a legal disposal area away from the site. All collection and disposal methods shall be in strict compliance with local codes.

The offsite vehicle tracking of sediments and the generation of dust be minimized. To meet this requirement, River Chase Drive, located adjacent to the site, will be used as the main delivery route. This paved roadway, which is maintained by Comal County, can be easily cleaned by a front-end loader or motor grader to prevent sediment from entering the storm water ditches located on both sides of the road. The pavement surface should be cleaned as necessary but not less than once a day. By using the asphalt roadway for a delivery route, sediments can be controlled onsite by the previously discussed sediment control procedures. Also stabilized construction entrances shall be installed at the entrance to the site.


RECHARGE ZONE
Circle Dot Ranch
Site
Well
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ATTACHMENT H

There are no temporary sediment ponds planned for this project.

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ATTACHMENT I

INSPECTIONS AND MAINTENANCE FOR BMPS

a. Each Contractor will designate a qualified person or persons to perform the following inspections:

1. Disturbed areas and areas used for storage of materials that are exposed to precipitation will be inspected for evidence of, or the potential for, pollutants entering the drainage system.

2. Erosion and sediment control measures identified in the plan will be observed to ensure that they are operating correctly.

3. Where discharge locations or points are accessible, they will be inspected to ascertain when the erosion control measures are effective in preventing significant impacts to receiving waters.

4. Locations where vehicles enter or exit the site will be inspected for evidence of offsite sediment tracking. The inspection will be conducted by the responsible person at least once every seven calendar days and within 24 hours after the end of a storm of 0.5 inch or greater.

   After a portion of the site is finally stabilized, inspection will be conducted at least once every month until construction activities have been completed.

b. Based on the results of the inspection, the site description and control measures will be revised by the Engineer as appropriate, but in no case later than seven calendar days following the inspection. Any modifications shall be implemented within seven days of the inspection.

c. A report prepared by the contractor summarizing the scope of the inspection, name(s) and qualifications of personnel making the inspection, the date(s) of the inspection, major observations relating to the implementation of the erosion controls, and actions taken in accordance with item" b" above will be made. The report will be signed and a copy of the report must be submitted to the Engineer within 2 days after the inspection.

Copies of the forms and certifications to be used for the Inspection and Maintenance report are included.

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INSPECTION AND MAINTENANCE GUILDELINES FOR SILT FENCES

1. Inspect all fencing weekly, and after any rainfall.

2. Remove sediment when buildup reaches 6 inches, or install a second line of fencing parallel to the old fence.

3. Replace any torn fabric or install a second line of fencing parallel to the torn section.

4. Replace or repair any sections crushed or collapsed in the course of construction activity. If a section of fence is obstructing vehicular access, consider relocating it to a spot where it will provide equal protection, but will not obstruct vehicles. A triangular filter dike may be preferable to a silt fence at common vehicle access points.

INSPECTION AND MAINTENANCE GUIDELINES FOR ROCK BERMS

1. Inspection should be made weekly and after each rainfall by the responsible party. For installations in streambeds, additional daily inspections should be made.

2. Remove sediment and other debris when buildup reaches 6 inches and dispose of the accumulated silt of in an approved manner.

3. Repair any loose wire sheathing.

4. The berm should be reshaped as needed during inspection.

5. The berm should be replaced when the structure ceases to function as intended due to silt accumulation among the rocks, washout, construction traffic damage, etc.

6. The rock berm should be left in place until all upstream areas are stabilized and accumulated silt removed.

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INSPECTION REPORT

PROJECT NAME: RIVER CHASE PARK

REPORT NO._____ DATE:_____ PROJECT FILE NO:_____

INSPECTOR:_____ TITLE_____

REASON FOR INSPECTION (CHECK ONE) Weekly_____ or ½" Rain_____

DATE OF LAST RAINFALL_____AMOUNT_____

SITE CONDITIONS:

EROSION AND SEDIMENTATION CONTROLS	IN CONFORMANCE	EFFECTIVE
Construction Entrance	YES/NO/NA	YES/NO
Sediment Traps	YES/NO/NA	YES/NO
Inlet Protection	YES/NO/NA	YES/NO
Stabilization	YES/NO/NA	YES/NO
Silt Fence	YES/NO/NA	YES/NO
Straw/Hay Bales	YES/NO/NA	YES/NO
Vegetative Buffer Strips	YES/NO/NA	YES/NO
Rock Berms	YES/NO/NA	YES/NO

VIOLATIONS NOTED:

_____

_____

RECOMMENDED REMEDIAL ACTIONS:

_____

_____

COMMENTS:

_____

_____

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision with a system designed to assure that qualified personnel property gathered and evaluated 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 that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

INSPECTOR:_____ **DATE:**_____

COPY_____

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PERMANENT STORMWATER SECTION
FOR REGULATED ACTIVITIES
ON THE EDWARDS AQUIFER RECHARGE ZONE
AND RELATING TO 30 TAC §213.5(b)(4)(C), (D)(ii), (E), and (5), EFFECTIVE JUNE 1, 1999

PROJECT NAME: River Chase Park

Permanent best management practices (BMPs) and measures that will be used during and after construction is completed.

1. X Permanent BMPs and measures must be implemented to control the discharge of pollution from regulated activities after the completion of construction.

2. X These practices and measures have been designed, and will be constructed, operated, and maintained to insure that 80% of the incremental increase in the annual mass loading of total suspended solids (TSS) from the site caused by the regulated activity is removed. These quantities have been calculated in accordance with technical guidance prepared or accepted by the executive director.

   X The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

   __ A technical guidance other than the TNRCC TGM was used to design permanent BMPs and measures for this site. The complete citation for the technical guidance that was used is provided below

3. X Owners must insure that permanent BMPs and measures are constructed and function as designed. A Texas Licensed Professional Engineer must certify in writing that the permanent BMPs or measures were constructed as designed. The certification letter must be submitted to the appropriate regional office within 30 days of site completion.

4. X Where a site is used for low density single-family residential development and has 20 % or less impervious cover, other permanent BMPs are not required. This exemption from permanent BMPs must be recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

   __ This site will be used for low density single-family residential development and has 20% or less impervious cover.

   __ This site will be used for low density single-family residential development but has more than 20% impervious cover.

   X This site will not be used for low density single-family residential development.

5. X The executive director may waive the requirement for other permanent BMPs for multi-family residential developments, schools, or small business sites where 20% or less impervious cover is used at the site. This exemption from permanent BMPs must be

recorded in the county deed records, with a notice that if the percent impervious cover increases above 20% or land use changes, the exemption for the whole site as described in the property boundaries required by 30 TAC §213.4(g) (relating to Application Processing and Approval), may no longer apply and the property owner must notify the appropriate regional office of these changes.

X **ATTACHMENT A - 20% or Less Impervious Cover Waiver.** This site will be used for multi-family residential developments, schools, or small business sites and has 20% or less impervious cover. A request to waive the requirements for other permanent BMPs and measures is found at the end of this form.

__ This site will be used for multi-family residential developments, schools, or small business sites but has more than 20% impervious cover.

_ This site will not be used for multi-family residential developments, schools, or small business sites.

6. **ATTACHMENT B- BMPs for Upgradient Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site is identified as **ATTACHMENT B** at the end of this form.

__ If no surface water, groundwater or stormwater originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form.

X If permanent BMPs or measures are not required to prevent pollution of surface water, groundwater, or stormwater that originates upgradient from the site and flows across the site, an explanation is provided as **ATTACHMENT B** at the end of this form .

7. **ATTACHMENT C- BMPs for On-site Stormwater.**

__ A description of the BMPs and measures that will be used to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff from the site is identified as **ATTACHMENT C** at the end of this form.

X If permanent BMPs or measures are not required to prevent pollution of surface water or groundwater that originates on-site or flows off the site, including pollution caused by contaminated stormwater runoff, an explanation is provided as **ATTACHMENT C** at the end of this form.

8. X **ATTACHMENT D - BMPs for Surface Streams.** A description of the BMPs and measures that prevent pollutants from entering surface streams, sensitive features, or the aquifer is provided at the end of this form. Each feature identified in the Geologic Assessment as "sensitive" or "possibly sensitive" has been addressed.

9. X The applicant understands that to the extent practicable, BMPs and measures must maintain flow to naturally occurring sensitive features identified in either the geologic assessment, executive director review, or during excavation, blasting, or construction.

X The permanent sealing of or diversion of flow from a naturally-occurring "sensitive" or "possibly sensitive" feature that accepts recharge to the Edwards Aquifer as a permanent pollution abatement measure has not been proposed for any naturally-

occurring "sensitive" or "possibly sensitive" features on this site.

__ **ATTACHMENT E - Request to Seal Features.** A request to seal a naturally-occurring "sensitive" or "possibly sensitive" feature, that includes a justification as to why no reasonable and practicable alternative exists, is found at the end of this form. A request and justification has been provided for each feature.

10. NA **ATTACHMENT F - Construction Plans.** Construction plans and design calculations for the proposed permanent BMPs and measures have been prepared by or under the direct supervision of a Texas Licensed Professional Engineer. All construction plans and design information have been signed, sealed, and dated by the Texas Licensed Professional Engineer. Construction plans for the proposed permanent BMPs and measures are provided at the end of this form. Design Calculations, TNRCC Construction Notes, all man-made or naturally occurring geologic features, all proposed structural measures, and appropriate details must be shown on the construction plans.

11. NA **ATTACHMENT G - Inspection, Maintenance, Repair and Retrofit Plan.** A plan for the inspection, maintenance, repair, and, if necessary, retrofit of the permanent BMPs and measures is provided at the end of this form. The plan has been prepared and certified by the engineer designing the permanent BMPs and measures. The plan has been signed by the owner or responsible party. The plan includes procedures for documenting inspections, maintenance, repairs, and, if necessary, retrofits as well as a discussion of record keeping procedures.

12. __ The TNRCC Technical Guidance Manual (TGM) was used to design permanent BMPs and measures for this site.

__ Pilot-scale field testing (including water quality monitoring) may be required for BMPs that are not contained in technical guidance recognized by or prepared by the executive director.

__ **ATTACHMENT H - Pilot-Scale Field Testing Plan.** A plan for pilot-scale field testing is provided at the end of this form.

13. ____ **ATTACHMENT I - Measures for Minimizing Surface Stream Contamination.** A description of the measures that will be used to avoid or minimize surface stream contamination and changes in the way in which water enters a stream as a result of the construction and development is provided at the end of this form. The measures address increased stream flashing, the creation of stronger flows and in-stream velocities, and other in-stream effects caused by the regulated activity which increase erosion that results in water quality degradation.

Responsibility for maintenance of permanent BMPs and measures after construction is complete.

14. X The applicant is responsible for maintaining the permanent BMPs after construction until such time as the maintenance obligation is either assumed in writing by another entity having ownership or control of the property (such as without limitation, an owner's association, a new property owner or lessee, a district, or municipality) or the ownership of the property is transferred to the entity. Such entity shall then be responsible for maintenance until another entity assumes such obligations in writing or ownership is transferred.

15. X A copy of the transfer of responsibility must be filed with the executive director at the

appropriate regional office within 30 days of the transfer if the site is for use as a multiple single-family residential development, a multi-family residential development, or a non-residential development such as commercial, industrial, institutional, schools, and other sites where regulated activities occur.

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. This **PERMANENT STORMWATER SECTION** is hereby submitted for TNRCC review and executive director approval. The application was prepared by:

Kelly Kilber, Agent
Print Name of Applicant/Owner/Agent

Signature of Applicant/Owner/Agent Date 3/19/02

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ATTACHMENT A

20% or Less Impervious Cover Waiver

We request a waiver to permanent BMPs due to the fact that there will be less than 20% impervious cover. ~~and that no potential recharge features were located on the site.~~

Private recreational facility for a single family subdivision. RM 3/20/02

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ATTACHMENT B,C & D

Low impervious cover and natural vegetation will be used to prevent pollution of surface water, groundwater , or storm water that flows across the site

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ATTACHMENT I

MEASURES FOR MINIMIZING SURFACE STREAM CONTAMINATION

Drainage courses are to be kept in there natural state. There will be no diversion or new channelization for Storm water runoff. All groundcover disturbed by construction activities will be revegetated. Natural vegetative buffers will be used to filter soil erosion and reduce velocities of storm water runoff. Due to low impervious cover there will be no substantial increase in flows or velocities and there will be a minimal impact on water quality.

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AGENT AUTHORIZATION FORM
FOR REQUIRED SIGNATURE
EDWARDS AQUIFER PROTECTION PROGRAM
RELATING TO 30 TAC CHAPTER 213
EFFECTIVE JUNE 1, 1999

I CHARLES D. PATTERSON,
Print Name

PRESIDENT
Title - Owner/President/Other

of SOUTHERLAND PROPERTIES, INC.
Corporation/Partnership/Entity Name

have authorized Kelly Kilber , P. E.
Print Name of Agent/Engineer

of Pro-Tech Engineering Group Inc.
Print Name of Firm

to represent and act on the behalf of the above named Corporation, Partnership, or Entity for the purpose of preparing and submitting this plan application to the Texas Natural Resource Conservation Commission (TNRCC) for the review and approval consideration of regulated activities.

I also understand that:

1. The applicant is responsible for compliance with 30 Texas Administrative Code Chapter 213 and any condition of the TNRCC's approval letter. The TNRCC is authorized to assess administrative penalties of up to $10,000 per day per violation.

2. A notarized copy of the Agent Authorization Form must be provided for the person preparing the application, and the forms must accompany the completed application.

3. Application fees are due and payable at the time the application is submitted. The application fee must be sent to the TNRCC cashier or to the appropriate regional office. The application will not be considered until the correct fee is received by the commission.

4. For applicants who are not the property owner, but who have the right to control and possess and control the property, additional authorization is required from the owner.

Applicant's Signature

Date 2-28-02

THE STATE OF Texas §

County of Hays §

BEFORE ME, the undersigned authority, on this day personally appeared CHARLES D. PATTERSON known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed same for the purpose and consideration therein expressed.

GIVEN under my hand and seal of office on this 28 day of February, 2002.

NOTARY PUBLIC

RICHARD MCDANIEL
NOTARY PUBLIC STATE OF TEXAS
COMMISSION EXPIRES:
AUGUST 17, 2006

Typed or Printed Name of Notary

MY COMMISSION EXPIRES:

Raba Kistner

Raba-Kistner Consultants, Inc.
12821 W. Golden Lane
P.O. Box 690287, San Antonio, TX 78269-0287
(210) 699-9090 • FAX (210) 699-6426

Project No. AAB98-003-00
August 17, 1999

Mr. Kelly Kilber, P.E., R.P.L.S.
Pro-Tech Engineering Group
100 East San Antonio Street
Suite 100
San Marcos, Texas 78666

Re: Reevaluation of Portions of 1500-Acre Site
Geologic Assessment of Proposed River Chase Subdivision (Harmon Ranch)
New Braunfels, Comal County, Texas

Dear Mr. Kilber:

Attached is a reevaluation of the Geologic Assessment for the Proposed River Chase Subdivision located in Comal County. The purpose of the reevaluation was to assess the zone designations used in the initial submittal of the Geologic Assessment report dated September 11, 1998 and a subsequent revision dated February 25, 1999. Kevin L. Wooster, R.G., C.P.G conducted the reevaluation. Assisting him was Richard V. Klar. Messrs. Wooster and Klar used the following procedures during this reevaluation effort to ensure accuracy of the site geologic map and associated geologic assessment tables:

1) *Field Reconnaissance:* In order to reevaluate features formerly classified as combination zones, Mr. Klar performed a field reconnaissance of the site. The reconnaissance consisted of field mapping along a series of transects across the zones. Mr. Klar was devoted full-time to the reconnaissance for approximately 3 weeks. He regularly conferred with Mr. Wooster on the progress of the field study and mapping of the features. Features identified during the field reconnaissance were mapped in accordance with TNRCC-0586.

2) *Field Verification of Features:* In order to verify quality of field mapping and feature identification, Mr. Wooster performed field verification of selected features within the zones. Random features were evaluated independently in the field and compared with data that had been generated during the field reconnaissance effort. Mr. Wooster's independent evaluation corroborated the results of Mr. Klar's reconnaissance efforts with regard to feature location and classification.

I have complete confidence in the quality of work produced by these gentlemen. Both have extensive experience performing geologic assessments in south central Texas. Additionally, Mr. Wooster and Mr. Klar have been graduated with Bachelor and Master of Science degrees in geology and have a good understanding of limestone diagenisis and karst geology.

Mr. Wooster has been employed as a geologist by Raba-Kistner for over 13 years. During that time he has conducted numerous geotechnical/environmental investigations on the Edwards Aquifer recharge zone. He has been the Geologist of Record for at least 20 Geologic Assessments including the La Cantera Golf Course and portions of the proposed Shavano Park

Mall located at the intersection of Loop 1604 and N.W. Military Highway. He has also conducted a number of engineering geologic studies requiring mapping of faulting and fracturing in limestone. As examples he mapped the fractures and back blast effects on high walls at La Cantera and Lincoln Heights for the redevelopment of these quarries.

Mr. Klar has been employed with Raba-Kistner for over 3 years. During that time he has assisted in the preparation of 6 geologic assessments and has been the Geologist of Record for several more. The latter group includes Geologic Assessments for Stewart Place and Shavano Park Units 18 and 19 (approximately 250 acres and 700 acres in size, respectively).

Pro-Tech Engineering Group and the TNRCC can rely upon the Geologic Assessment of the proposed River Chase Subdivision as having been performed in accordance with TNRCC-0586 with the degree of professionalism expected of experienced geologists.

We appreciate the opportunity to be of continued assistance to you on this important project. If you have any questions concerning this information, please call our office at 210-699-9090.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.

Steven W. Funderburg, P.E.
Manager, Environmental Engineering

SWF/srw

Copies submitted: Above (2)

Attachments

Raba Kistner

Raba-Kistner Consultants, Inc.
12821 W. Golden Lane
P.O. Box 690287, San Antonio, TX 78269-0287
(210) 699-9090 • FAX (210) 699-6426

Project No. AAB98-003-00
August 17, 1999

Mr. Kelly Kilber, P.E., R.P.L.S.
Pro-Tech Engineering Group
100 East San Antonio Street
Suite 100
San Marcos, Texas 78666

RECEIVED-TNRCC
1999 AUG 19 AM 11:04
SAN ANTONIO REGION

Re: Reevaluation of Portions of 1500-Acre Site
Geologic Assessment of Proposed River Chase Subdivision (Harmon Ranch)
New Braunfels, Comal County, Texas

Dear Mr. Kilber:

Submitted herein is a reevaluation of certain portions of the above-referenced site documented in the Geologic Assessment report dated September 11, 1998 and a subsequent revision dated February 25, 1999.

BACKGROUND

In the September 11, 1998 report, recharge features S-1, S-54, S-117, S-57, S-82, and S-83 are shown as large combination zones of fractured vuggy rock (FRVRZ) on the site geologic map. As per the definition of zones in Instructions to Geologists (TNRCC-0586), the mapping of combination zones is intended to be applied to discontinuous features spanning a few hundred feet in size. The zone designation should not be used to describe discontinuous feature types covering areas on the order of thousands of feet in size. The referenced combination zone features have been reevaluated to determine their appropriate classification with respect to the size and sensitivity under the definitions presented in TNRCC-0586.

R-K hired Tommy Matthews of Westward Environmental, Boerne, TX to review GA submittals and to assist geologists from the R-K San Antonio office in evaluating of the distribution of feature types present at the Harmon Ranch site. On June 23, 1999 Tommy Matthews and Rick Klar performed limited site reconnaissance in order to develop a better understanding of previously classified large combination-feature zones. Traverses were made across feature zones formerly designated as S-1 and S-117. Results of this limited field investigation indicated that the combination-zone designations had been inappropriately applied and that large areas formerly classified as zones should be resolved into respective smaller-scale components. Additionally, field evidence of two large fault zones was noted during this investigation.

HYDROLOGY OF EDWARDS RELATIVE TO RECHARGE POTENTIAL AT SITE

One possible conceptual model of the flow regime at the site consisted of the possibility that recharge to the Edwards at the site was not hydraulically connected to the major portion of the aquifer. As such, any identified recharge feature would be logically considered as not sensitive,

since the resulting infiltration would ultimately flow to the Glen Rose formation or to the adjacent Guadalupe River. R-K attempted to determine if such a conceptual model could be supported by site specific information.

R-K geologists reviewed pertinent geologic reference materials including aerial photographs, well driller's logs, interpretations of geophysical logs, and published geologic maps in an attempt to develop a conceptual model of flow regimes within the Edward's Aquifer beneath the project site.

The following is a summary of the review of available data and site observations:

- Observed depths to water at the site indicated that portions of the Edwards were under saturated conditions within fault blocks.
- Spring flow was identified to occur along the northwest portion of the site along drainageways above the upper Glen Rose contact.
- Spring flow was not observed on the southeast side of the fault.
- Regional dip of beds is estimated to be gently to the southeast.
- A major fault (potential barrier to flow) is located on the southeast portion of the site.

Following a review and interpretation of the above, potential Edwards flow within fault blocks was considered with regard to recharge features identified within the block. Flow from springs to the northwest and a lack of spring flow to the southeast may indicate that the major fault is acting as a hydrologic barrier. Such a barrier could prevent recharge to the Edwards on the site from migrating to the southeast to the major portion of the aquifer. Spring flow to the northwest would be expected if ground water achieved sufficient hydraulic (elevation) head. Increased head would be expected if a hydrologic barrier existed. However, without additional information, the exact behavior of this flow regime and its relationship with recharge features could not be verified. Without verification, it was conservatively assumed that the Edwards fault blocks were hydraulically connected to the major portion of the aquifer.

FIELD RECONNAISSANCE

A field reconnaissance of the features was conducted by Raba-Kistner from July 21, 1999 to August 3, 1999. The purpose of the reconnaissance was to assess the status of the features as zones and to reexamine the previously assigned sensitivities and recharge potential values of the features.

Based upon our reconnaissance, feature types tend to occur within drainageways oriented roughly northwest/southeast throughout the project site. Additionally, features identified within drainageways inclusive of vuggy and fractured rock outcrops, and solution cavities, tended to be better developed in terms of potential transmissivity. This is probably due to increased limestone dissolution resulting from (i) increased exposure due to the removal of soil cover; and (ii) increased contact with storm runoff due to channelization of flows collected over large areas.

Based on a review of the data, our site specific observations, and TNRCC guidance documents, it is our opinion that these features are comprised of separate and distinct smaller scale features, and are not considered to be zones of both vuggy and fractured rock. The combination zone designation appears to have been inappropriately applied to the referenced areas.

For example, feature S54 was found to be a discontinuous series of bands consisting of boulder float along hillsides, instead of the zone of outcrops as shown on the original site geologic map. Each of these bands of float were observed along the hillside and found to be noncontiguous with respect to actual outcrops.

Similarly, features S1 and S117 were reevaluated and found to be comprised of separate and distinct individual features and are not considered to be zones. Instead of being classified as zones of fractured and vuggy rock, each of these six features was reclassified as a fractured or vuggy rock outcrops or combinations of individual outcrops at the site.

RESULTS OF REEVALUATION

Former zone features were resolved into their respective components. Components consisted of individual feature types, which generally were discontinuous and spanned areas of less than 100 to 200 ft. The additional features have been described individually and are shown on the attached revised Site Geologic Map. The features' descriptions and assessment are presented on the attached Geologic Assessment Table (TNRCC-0629), and associated additional comments are provided.

We appreciate the opportunity to be of continued assistance to you on this important project. If you have any questions concerning this information, please call our office at 210-699-9090.

Very truly yours,

RABA-KISTNER CONSULTANTS, INC.

Richard V. Klar
Environmental Geologist

Kevin L. Wooster, R.G., C.P.G.
Hydrogeologist

RVK/KLW/srw

Copies subrnitted: Above (5)

Attachments: Revised Geologic Assessment (5)

Additional Comments
Site Location

S-6, and S-7:
Closed depression formed due to scour from surface runoff. Features showed evidence of holding water but were observed to be dry at the time of field reconnaissance.

S-9, and S-11:
Same as S-6. Feature S-9 was observed to be holding water at the time of field reconnaissance.

S-14 Man-made closed depressions formed by automobile tires.

S-15 Man-made closed depression formed by the uprooting of a tree.

S-16 through S-19:
Same as S-14.

S-20 Feature is an approximately 4-in diameter water well. This feature was observed to be properly completed and sealed from surface runoff. Should the surface completion of this well be compromised, it is possible that this feature may serve as a conduit for the vertical migration of fluids during precipitation / runoff events.

S-21 Feature is an approximately 1-ft diameter active water well. This feature is associated with a windmill, water tank, and pumping apparatus located immediately adjacent and is presumed to have been used historically to supply water for domestic/stock purposes. To the extent that the surface completion may have been degraded through time, this feature may potentially serve as a conduit for the vertical migration of fluids during precipitation / runoff events.

S-25 Man-made water retention feature for livestock. Feature contained water at the time of field reconnaissance.

S-29 Same as S-25.

S-30 Man-made closed depression formed by the uprooting of a tree.

S-39, S-40, and S-42:
Closed depressions formed by stream scour along drainageway. Feature S-39 is located at a knickpoint in drainage channel.

S-44, and S-48:
Same as S-40

S-49 Man-made closed depression formed by excavation of soils.

S-50 Natural closed depression formed by the uprooting of a tree.

S-51, and S-52:
Same as S-20.

S-54A Several laterally discontinuous vuggy rock outcrops were observed within the drainage channel at this location. Vugs were observed to be infilled with fine-grained soils and not interconnected. It was noted that a large area surrounding this vuggy rock zone contained extensive areal exposures of what initially appeared to be in-situ vuggy rock. Upon further examination, it was determined that these exposures were not in-situ and represented "float rock" or blocks of vuggy Edwards Limestone which had eroded from higher elevations and been subsequently emplaced downslope.

S-54B Several laterally discontinuous vuggy rock outcrops were observed along the drainage channel at this location. Vugs were observed to be infilled with fine-grained soils and not interconnected.

S-57 Several laterally discontinuous vuggy rock outcrops were observed within the drainage channel at this location. Vugs were observed to be infilled with fine-grained soils and not interconnected.

S-63 Several laterally discontinuous vuggy rock outcrops were observed at this location. Vugs were observed to be infilled with fine-grained soils and appeared to be interconnected.

S-65 Closed depression appears to have been constructed as a water retention structure and used as a stock tank. Feature was not observed to be holding water during the time of field reconnaissance.

S-66 Feature is a manmade excavation measuring approximately 141x21x6.5-ft and appears to have been constructed as a water retention structure.

S-71 Closed depressions appear to have been formed as the result of scour and differential erosion during precipitation/runoff events.

S-80 Vugs appeared to be interconnected.

S-82, and S-83:
Same as Feature S-54A

S-84 Same as Feature S-71.

S-86, and S-87:
Vugs appeared to be interconnected.

S-90 Closed depressions appeared to have been formed as the result of scour along the drainageway.

S-97 through S-99:
Closed depressions appeared to have been formed as the result of scour and differential erosion along the drainageway. These features were observed in association with a normal fault zone (S-200) which appeared to roughly trend along the drainage channel.

S-100 Vugs appeared to be interconnected.

S-117A Several laterally discontinuous vuggy rock outcrops were observed along the drainage channel at this location. Density, aperture, and infilling varied across feature but generally zone is high density, with large apertures and fine-grained infilling. Vugs generally appear to be interconnected but varied with density.

S-118 This zone contains all man-made roads and clearings. Numerous man-made closed depressions were found in this zone due primarily to the uprooting of trees. Although none of the individual "pseudo-karst" features were classified as sensitive, the zone has collectively been classified as moderately sensitive with a moderate potential for recharge due to the large areal extent as per guidance provided in TNRCC-0586.

S-200 This normal fault zone was mapped based upon an interpretation of lineations present on aerial photographs in conjunction with published geologic references including Barnes (1983) and Small and Hanson (1994). Evidence of this feature (E.g. Lineations and drag folding within fractured rock zone) was observed during field reconnaissance in association with feature S-201.

S-203 Several laterally discontinuous vuggy rock outcrops were observed within a knickpoint in the drainage channel at this location. Vugs were observed to be infilled with fine-grained soils and appeared interconnected.

S-211 / S-235:
This normal fault zone was mapped based upon an interpretation of lineations present on aerial photographs in conjunction with published geologic references including Barnes (1983) and Small and Hanson (1994). Evidence of this feature (E.g. Lineations and drag folding within fractured rock zones) was observed during field reconnaissance primarily at intersections with drainage channels across the subject property.

S-218 Closed depression appeared to have been formed as the result of scour and differential erosion along the drainageway and is exposed at the base of a knickpoint.

S-219 / S-306:
Feature consists of a horizontal zone of dissolution located within the Kainer Formation immediately above the contact with the Glen Rose Limestone. Dissolution appears to have occurred parallel to bedding as the result of erosion along the drainage channel. The largest identified feature measures roughly 2x4x1.5 ft and is oriented at 280 degrees.

S-220 / S-308:
Vuggy rock zone contains numerous horizontal solution cavities that appeared to have resulted from the enlargement of interconnected vuggy areas. In general, solution cavities measure 0.5x0.5x0.5 ft. Solution cavities are randomly oriented.

S-235 / S-211:
See Feature S-211 / S-235 above.

S-238 Vuggy rock zone contains numerous horizontal solution cavities that appeared to have resulted from the enlargement of interconnected vuggy areas. In general, solution cavities measure 1x1x0.5 ft and are oriented parallel to bedding planes.

S-248 Solution cavity was inhabited by daddy-long-legs spiders.

S-250 Feature consists of laterally discontinuous vuggy rock exposed along a knickpoint within the drainageway. Vugs were classified as generally high density, moderate aperture, infilled with fine-grained materials, and appeared to be interconnected. A crescent-shaped zone of horizontal solution cavities was identified parallel to bedding planes at the knickpoint within the vuggy rock exposure. Horizontal dissolution appears to have resulted from stream undercutting at the knickpoint during runoff events.

S-251 Vugs appeared to be interconnected.

S-274 Closed depression appeared to have been formed as the result of scour and differential erosion along the drainageway.

S-275 Vuggy rock zone contains scattered horizontal solution cavities that appeared to have resulted from the enlargement of interconnected vuggy areas. In general, solution cavities measure 0.5x0.5x0.5 ft and are randomly oriented.

S-276 Closed depression appeared to have been formed as the result of scour and differential erosion along the drainageway and is exposed at the base of a knickpoint.

S-288, and S-297:
Vugs appeared to be interconnected.

S-299 Feature is a horizontal cave located within solution cavity zone (S-298) and associated with vuggy rock zone (S-297). Horizontal dissolution appears to have resulted from stream undercutting along the drainage channel during runoff events. Feature was observed to extend at least 8 ft into the Kainer Formation.

S-302 Feature consists of an exposure of vuggy rock (moderate density, large aperture, fine-grained infilling) containing moderate density, medium aperture fractures. Fractures appear to be preferentially oriented at approximately 15 degrees and occur along a 90-degree bend in the drainageway at the intersection with the Isaac Creek 100-yr floodplain boundary. This feature is thought to be associated with normal fault zone S-211/S-235.

S-306 / S-219:
See Feature S-219 / S-306 above.

S-308 / S-220:
See Feature S-220 / S-308 above.

S-319 Feature consists of laterally discontinuous vuggy rock exposed along a knickpoint within the drainageway. Vugs were classified as generally high density, large aperture, infilled with fine-grained materials, and appeared to be interconnected. A crescent-shaped zone of horizontal solution cavities was identified parallel to bedding planes at the knickpoint within the vuggy rock exposure. Horizontal dissolution appears to have resulted from stream undercutting at the knickpoint during runoff events.

S-323 Vugs appeared to be interconnected.

S-336 Closed depression appeared to have been formed as the result of scour and differential erosion along the drainageway and is exposed at the base of a knickpoint. Feature was observed to be holding water at the time of field reconnaissance.

S-339 Vugs do not appear to be interconnected.

S-349, S-350, S-353, and S-354:
Horizontal solution cavities appear to be ground water discharge points within the drainage channel and were observed to be transmitting water to the drainageway at the time of field reconnaissance.

S-357, and S-359:
Closed depressions appeared to have been formed as the result of scour and differential erosion along the drainageway and are exposed at the base of knickpoints. Features were observed to be holding water at the time of field reconnaissance.

S-362 Feature is a horizontal cave located within vuggy rock zone (S-361). Horizontal dissolution appears to have resulted from stream undercutting along the drainage channel during runoff events. Feature was observed to extend at least 5 ft into the Kainer Formation. Feature appeared to be a ground water discharge point within the drainage channel and was observed to be transmitting water to the drainageway at the time of field reconnaissance.

S-365 Closed depression appeared to have been formed as the result of scour and differential erosion along the drainageway and is exposed at the base of a knickpoint. Feature exhibited evidence of holding water during precipitation/runoff events.

S-373, S-374, S-376, and S-378:
Horizontal solution cavity zones appeared to facilitate ground water discharge within the drainage channel and were observed to be transmitting water to the drainageway at the time of field reconnaissance.

S-391 Vuggy rock zone contains numerous horizontal solution cavities that appeared to have resulted from the enlargement of interconnected vuggy areas. In general, solution cavities measure 0.5x0.5x0.5 ft and are oriented parallel to bedding planes.

S-394, and S-396:
Vugs appear to be interconnected.

S-397 Solution cavity was inhabited by daddy-long-legs spiders.

S-405 A crescent-shaped zone of horizontal solution cavities was identified parallel to bedding planes at the knickpoint within the drainageway. One horizontal cave measuring approximately 8x4x3.5 ft was included as part of this zone dissolution. The cave opening was observed to funnel into a solution-cavity-sized opening measuring approximately 1x3x0.5 ft and oriented at 120 degrees. Horizontal dissolution appears to have resulted from stream undercutting at the knickpoint during runoff events.

S-408 Closed depression appeared to have been formed as the result of scour along the drainageway.

S-410, and S-418:
Vugs do not appear to be interconnected.

S-419 This normal fault zone was mapped based upon an interpretation of lineations present on aerial photographs in conjunction with published geologic references including Barnes (1983) and Small and Hanson (1994). Evidence of this feature was not observed during field reconnaissance.

S-420 Same as S-20.

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: River Chase Subdivision, Comal County, Texas

| FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

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GEOLOGIC ASSESSMENT TABLE — PROJECT NAME: River Chase Subdivision, Comal County, Texas

FEATURE ID			FEATURE CHARACTERISTICS																								PHYSICAL SETTING																						
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VR)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC, SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20				
				X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 50	SENSITIVE >50	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
S-315	VRZ	10	Kek							75 x 20				5		0				5			0			20	✓				5				10			15		✓		
S-316	SC	10	Kek				2	3	1.5		70									5			0			15	✓				5				10			15		✓		
S-317	VRZ	0	Kek							100 x 20			0				5			5			0			10	✓				5				10			15		✓		
S-318	VRZ	0	Kek							75 x 20				5		0				5			0			10	✓				5				10			15		✓		
S-319	VRSCZ	35	Kek							150 x 20													0			35		✓			5				10			15		✓		✓
S-320	CD	10	Kek	6	10	1					10 / 190										10		0			20	✓				5				10			15		✓		
S-321	CD	10	Kek	12	15	3					5 / 185										10		0			20	✓				5				10			15		✓		
S-322	SCZ	10	Kek							50 x 5									5				0			15	✓					10			10			20		✓		
S-323	VRZ	0	Kek							150 x 20					10			10	5				0			25		✓				10			10			20		✓		✓
S-324	SC	10	Kgr				1	2	0.5		110								5				0			15	✓					10			10			20		✓		
S-325	CD	10	Kgr	20	30	4					70 / 250										10		0			20	✓					10			10			20		✓		
S-326	CD	10	Kgr	20	40	3					70 / 250										10		0			20	✓					10			10			20		✓		
S-327	CD	10	Kek	15	25	3					90 / 270										10		0			20	✓					10			10			20		✓		
S-328	CD	10	Kek	15	20	3					90 / 270								5				0			15	✓					10			10			20		✓		
S-329	CD	10	Kek	10	15	2					90 / 270								5				0			15	✓					10			10			20		✓		
S-330	SC	10	Kek				7	5	1.5		170								5				0			15	✓					10			10			20		✓		
S-331	SC	10	Kek				2	3	1		80								5				0			15	✓					10			10			20		✓		
S-332	CD	10	Kek	20	30	4					150 / 330								5				0			15	✓					10			10			20		✓		
S-333	SCZ	10	Kek							50 x 5									5				0			15	✓					10			10			20		✓		
S-334	VRZ	0	Kek							150 x 20				5			5		5				0			15	✓					10			10			20		✓		

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

TNRCC - 0629 (2/1/97)

I have read, understood, and 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.

Richard V. Ike — 8·16·99

Geologist signature — Date

geotable12

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: River Chase Subdivision, Comal County, Texas

FEATURE ID			FEATURE CHARACTERISTICS																							PHYSICAL SETTING																	
1A	1B	1C	2	3			4			5	6		7			8			9				10			11	12			13				14					15	16			17
LOCATION	TYPE (1)	POINTS	GEOLOGIC FORMATION	VERTICAL FEATURE (FEET)			HORIZONTAL FEATURE (FEET)			LENGTH & WIDTH (FEET)	TREND (C, CD, FR, FZ, SC, SH)		DENSITY (FR, VR)			APERTURE (FR, VR)			INFILLING (CD, FR, FZ, SC SH, VR)				RELATIVE INFILTRATION RATE			SUB-TOTAL	SENSITIVITY			DRAINAGE AREA (ACRES)				TOPOGRAPHY (2)					SUB-TOTAL	POTENTIAL RECHARGE			COM-MENTS
				C, CD, SC, SH			C, SC			FZ, FR, VR, Z		10	0	5	10	0	5	10	0	5	10	15	0	10	30					0	5	10	15	0	5	10	15	20				
				X	Y	Z	X	Y	Z		DIRECTION	DOMINANT	LOW	MODERATE	HIGH	SMALL	MEDIUM	LARGE	CEMENTED	FINE	COARSE	NONE	NONE/LOW	MODERATE	HIGH		NOT <25	POSSIBLE 25 - 60	SENSITIVE >60	<1	<10	<50	>50	WALL	HILLTOP	HILLSIDE	FLOODPLAIN	STREAM BED		NONE/LOW <15	MODERATE 15 -20	HIGH >20	YES
S-335	SCZ	10	Kek							50 x 5										5			0			15	✓					10					20		✓		
S-336	CD	10	Kek	20	30	4					60 / 240	10								5			0			25		✓				10					20		✓		
S-337	CD	10	Kek	10	20	2					110 / 290										10		0			20	✓					10					20		✓		✓
S-338	SCZ	10	Kek							75 x 5										5			0			15	✓					10					20		✓		
S-339	VRZ	0	Kek							150 x 30					10			10		5			0			25		✓				10					20		✓		✓
S-340	VRZ	0	Kek							100 x 20					10		5			5			0			20	✓					10					20		✓		
S-341	SCZ	10	Kek							50 x 5										5			0			15	✓					10					20		✓		
S-342	VRZ	0	Kek							75 x 20					10		5			5			0			20	✓					10					20		✓		
S-343	SC	10	Kek				0.5	2	0.5											5			0			15	✓					10					20		✓		
S-344	VRZ	0	Kek							75 x 20				5			5			5			0			15	✓					10					20		✓		
S-345	FR	0	Kek							50 x 20	140 / 320		0			0			0				0			0	✓					10					20		✓		
S-346	SC	10	Kek				1.5	2	0.5		190									5			0			15	✓					10					20		✓		
S-347	VRSCZ	35	Kek							175 x 30													0			35		✓				10					20		✓		
S-348	CD	10	Kek	8	12	3					125 / 305									5			0			15	✓					10					20		✓		
S-349	SC	10	Kek				2.5	3	1		220	10								5			0			25		✓				10					20		✓		✓
S-350	SC	10	Kek				2.5	3	1.5		40	10										15	0			35		✓				10					20		✓		✓
S-351	FRZ	0	Kek							50 x 20	40 / 220	10	0			0			0				0			10	✓					10					20		✓		
S-352	VRZ	0	Kek							125 x 20			0				5			5			0			10	✓					10					20		✓		
S-353	SC	10	Kek				3	3	1		220	10								5			0			25		✓				10					20		✓		✓
S-354	SC	10	Kek				3.5	3	1		220	10								5			0			25		✓				10					20		✓		✓

(1) C = 35, CD = 10, FR = 0, FZ = 15, MM = 35,
SC = 10, SH = 20, VR = 0, ZONE = 35

(2) WALL = Vertical/near vertical wall above 100-yr floodplain
FLOODPLAIN = 100-yr floodplain
STREAM BED = Ordinary High Water Mark

TNRCC - 0629 (2/1/97)

I have read, understood, and 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.

Richard V. Ken — 8·16·99

Geologist signature — Date

geotable13

GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: River Chase Subdivision, Comal County, Texas

| FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |

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PROJECT NAME: River Chase Subdivision, Comal County, Texas

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GEOLOGIC ASSESSMENT TABLE

PROJECT NAME: River Chase Subdivision, Comal County, Texas

| FEATURE ID | | | FEATURE CHARACTERISTICS | | | | | | | | | | | | | | | | | | | | | | | | | | | | | PHYSICAL SETTING | | | | | | | | | | | | | | | | | | |



Harmon Ranch
Photo Date: 4-28-98

LEGEND

- SITE BOUNDARY
- CONTOUR OF SURFACE ELEVATION. CONTOUR INTERVAL = 10 FT.
- FENCE
- STREAM
- EXTENT OF 100-YEAR FLOODPLAIN
- RECHARGE ZONE BOUNDARY
- C/CZ — CAVE/CAVE ZONE *
- FR/FRZ — FRACTURED ROCK/FRACTURED ROCK ZONE *
- U / D — FAULT/FAULT ZONE (F/FZ). DASHED WHERE INFERRED. * U AND D INDICATE UPTHROWN AND DOWNTHROWN SIDES, RESPECTIVELY.
- SC/SCZ — SOLUTION CAVITY/SOLUTION CAVITY ZONE *
- CD/CDZ — CLOSED DEPRESSION/CLOSED DEPRESSION ZONE *
- MM/MMZ — MANMADE/MANMADE ZONE
- VR/VRZ — VUGGY ROCK/VUGGY ROCK ZONE * * SEE NOTE 8
- FORMATION CONTACT
- Kgr — GLEN ROSE FORMATION
- Kep — PERSON FORMATION, EDWARDS LIMESTONE GROUP
- Kek — KAINER FORMATION, EDWARDS LIMESTONE GROUP
- S-211/S-235 (FZ) — FEATURE MAPPED COINCIDENTALLY

NOTES:

1.) BASE MAP AND SITE BOUNDARY PROVIDED BY PRO-TECH ENGINEERING GROUP, INC.

2.) THE RECHARGE ZONE BOUNDARY IS LOCATED ON-SITE. INFORMATION BASED ON THE OFFICIAL EDWARDS AQUIFER RECHARGE ZONE MAPS, 31 TEXAS ADMINISTRATIVE CODE CHAPTER 313-SUBCHAPTER A-SAN ANTONIO REGION, 1963 REVISED 1973; SATTLER AND 1964 REVISED 1973; HUNTER, TEXAS QUADRANGLES.

3.) FLOODPLAIN BOUNDARIES BASED ON FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA), SEPTEMBER 26, 1986; COMAL COUNTY, TEXAS AND INCORPORATED AREAS, FLOOD INSURANCE RATE MAPS (FIRM), PANELS 0085C, 0110C, AND 0105C, FEMA, WASHINGTON D.C.

4.) SOIL COVER IS 0 TO 5 FEET THICK AND APPEARS TO IMPEDE FLUID FLOW TO THE SUBSURFACE.

5.) THERE ARE 4 TEST HOLES AND 1 WELL PRESENT ON THE PROJECT SITE. THE WELL IS NOT IN USE AND WILL BE PROPERLY ABANDONED.

6.) MOST OF THE FEATURES ILLUSTRATED ARE DEPICTED LARGER THAN ACTUAL SIZE IN AN ATTEMPT TO MAKE THEM MORE VISIBLE.

7.) THE MAJORITY OF ROADS AND CLEARINGS PRESENT WITHIN THE SITE BOUNDARY APPEAR TO HAVE BEEN CREATED IN ASSOCIATION WITH PRE-DEVELOPMENT ACTIVITIES. THESE AREAS HAVE BEEN COLLECTIVELY DESIGNATED AS MANMADE FEATURE ZONE S-118. DUE TO THE PRESENCE OF NUMEROUS "PSEUDO-KARST" FEATURE TYPES ENCOUNTERED, THIS ZONE HAS BEEN CLASSIFIED AS POTENTIALLY SENSITIVE.

8.) ZONES CONTAINING MULTIPLE FEATURE TYPES WERE LABELED IN ACCORDANCE WITH TNRCC-0586. e.g. "VRSCZ" WOULD DESCRIBE A PREDOMINANTLY VUGGY ROCK ZONE CONTAINING NUMEROUS SOLUTION CAVITIES.

9.) FEATURE NUMBERS ARE NOT CONTINUOUS OR CONSECUTIVE. SOME FEATURES NUMBERED ON PREVIOUS REVISIONS HAVE BEEN CHANGED FOR CLARITY FOLLOWING FIELD VERIFICATION. SOME FEATURES HAVE DUAL DESIGNATIONS DUE TO COINCIDENT MAPPING. ALL FEATURES ON THIS MAP ARE PRESENTED IN THE REVISED GEOLOGIC FEATURES TABLE.

N

0 500 1000
SCALE IN FEET

00SGM01R

REVISIONS			
NO.	BY	DATE	APPD
1	RVK	2/99	GWR
2	RVK	8/99	KLW

Raba Kistner

Engineers, Geologists, Hygienists and Environmental Scientists

REVISED SITE GEOLOGIC MAP
HARMON RANCH, 1500 ACRES GEOLOGIC ASSESSMENT
COMAL COUNTY, TEXAS

SCALE: AS SHOWN PROJECT NO.: AAB98-003-00

DRAWN BY: EAJ CHK. BY: MLA APPD.: RVK DATE: 9/11/98



Harmon Ranch
Photo Date: 4-28-98

LEGEND

- SITE BOUNDARY
- 1030 CONTOUR OF SURFACE ELEVATION. CONTOUR INTERVAL = 10 FT.
- FENCE
- STREAM
- EXTENT OF 100-YEAR FLOODPLAIN
- RECHARGE ZONE BOUNDARY
- C/CZ CAVE/CAVE ZONE *
- FR/FRZ FRACTURED ROCK/FRACTURED ROCK ZONE *
- U / D FAULT/FAULT ZONE (F/FZ). DASHED WHERE INFERRED. * U AND D INDICATE UPTHROWN AND DOWNTHROWN SIDES, RESPECTIVELY.
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- * SEE NOTE 8
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- Kgr GLEN ROSE FORMATION
- Kep PERSON FORMATION, EDWARDS LIMESTONE GROUP
- Kek KAINER FORMATION, EDWARDS LIMESTONE GROUP
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N

0 500 1000
SCALE IN FEET

00SGM01R

REVISIONS			
NO.	BY	DATE	APPD
1	RVK	2/99	GWR
2	RVK	8/99	KLW

Raba Kistner

Engineers, Geologists, Hygienists and Environmental Scientists

SUPPLEMENTAL SITE GEOLOGIC MAP
HARMON RANCH, 1500 ACRES GEOLOGIC ASSESSMENT
COMAL COUNTY, TEXAS

SCALE: AS SHOWN PROJECT NO.: AAB98-003-00

DRAWN BY: EAJ CHK. BY: MLA APPD.: RVK DATE: 9/11/98

Kathleen Hartnett White, *Chairman*
R. B. "Ralph" Marquez, *Commissioner*
Larry R. Soward, *Commissioner*
Glenn Shankle, *Executive Director*

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

Protecting Texas by Reducing and Preventing Pollution

September 15, 2005

Mr. Eric Goodwin
123 E. Main St.
Uvalde, TX 78801

Re: EDWARDS AQUIFER, Comal County
PROJECT: River Chase (924 Indian Ridge), Project number 1124.02
TYPE: Solution Feature/Sensitive Feature; 30 Texas Administrative Code (TAC) §213.5(f)(2); Edwards Aquifer Protection Program
Regulated Entity Number: RN102748878
Investigation Number: 431965

Dear Mr. Goodwin:

The Texas Commission on Environmental Quality (TCEQ) received a plan which addresses the discovery of a solution feature encountered during excavation for a swimming pool for the above referenced project. It was submitted on your behalf by Richard V. Klar, P.G. of Raba-Kistner Consultants, Inc. and received by the San Antonio Regional Office on August 30, 2005. The feature location and assessment is outlined in Table I below.

TABLE I

Feature No.	Solution Feature Dimension	Location	Case*
1	7' x 5' x 2'	Deep end of swimming pool excavation	NA

* For SCS & Storm Sewer lines, see TABLE II (enclosed). For other types of utility excavations, "Case" is not applicable.

The San Antonio office did not conduct a site investigation. The report describes the feature as observed after discovery and concludes that the feature was entirely removed upon excavation to final depth. Therefore no protection measures were proposed.

Should additional karst features be discovered during the remaining excavation activities, all regulated activities near the feature must be suspended immediately. The applicant or his agent must

immediately notify the San Antonio Regional Office of the discovery of the feature. Regulated activities near the feature may not proceed until the executive director has reviewed and approved the methods proposed to protect the feature and the aquifer from potentially adverse impacts to water quality.

Should clarification of this letter be desired or if we may be of any other assistance, please contact Lynn M. Bumguardner of our San Antonio Regional office at 210/403-4023. Please reference project number 1124.02.

Sincerely,

Bobby D. Caldwell
Water Section Manager
San Antonio Regional Office

BDC/LMB/eg

Enclosure: Table II (Minimum Standards for Closing Solution Features in Sewer Line Trenches)

fc: Richard V. Klar, P.G., Raba-Kistner Consultants, Inc.
Tom Hornseth, P.E. Comal County
cc: Robert J. Potts, Edwards Aquifer Authority
TCEQ Central Records, Building F, MC-212

TABLE II

EDWARDS AQUIFER PROTECTION PROGRAM - TCEQ
Minimum Protective Standards for Sewer Line and Storm Sewer Trenches
(from Edwards Aquifer Guidance Document 96.004, Effective 8/11/98)

Case	Description	Concern	Treatment	Notification/Approval
1	Sensitive feature is less than or equal to six (6) inches in all directions and is located above the embedment of the pipe. All rock within and surrounding the feature is sound.	Not environmental nor pipe integrity	No abatement required.	None required.
2	Sensitive feature is either larger than six (6) inches in at least one direction or is located within the level of the pipe embedment. No portion of the sensitive feature may intersect the plane of trench floor. All rock within and surrounding the feature is sound.	Environmental	The sensitive feature shall be filled with concrete. Gravel to "fist sized" rock or sacks of gravel may be placed in feature prior to placement of the concrete as long as a minimum of eighteen (18) inches of concrete is used to close the feature. minimum).	Requires notification and prior written approval from TCEQ.
3	Sensitive feature intersects the plane of the trench floor is less than four (4) feet in any direction. All rock within and surrounding the feature is sound.	Environmental	Sensitive feature shall be filled with concrete. Gravel to "fist sized" rock or sacks of gravel may be placed in feature prior to placement of concrete at least eighteen (18) inches of concrete is used to close the feature. The sewer line or storm sewer lines shall be concrete encased for width of the sensitive feature plus a minimum of five (5) feet on either end. The encasement shall provide a minimum of six (6) inches of concrete on all sides of the pipe and shall have a compression strength of at least two thousand five hundred (2,500) psi (28-day strength). The concrete may be steel reinforced.	Requires notification and prior written approval from TCEQ.
4	Sensitive feature intersects the plane of the trench floor and any opening in trench floor is greater than four (4) feet in any direction or the trench floor is unstable.	Environmental & Structural	Requires an engineered resolution at least as protective as Case 3 above. Additional protective measures, including rerouting of line, may be required.	Requires notification and prior written approval from TCEQ.

All plans submitted to the TCEQ regional office shall have a signed and dated seal of a Texas licensed Professional Engineer. All plans will be reviewed on a case-by-case basis and additional protective measures or additional information may be required.