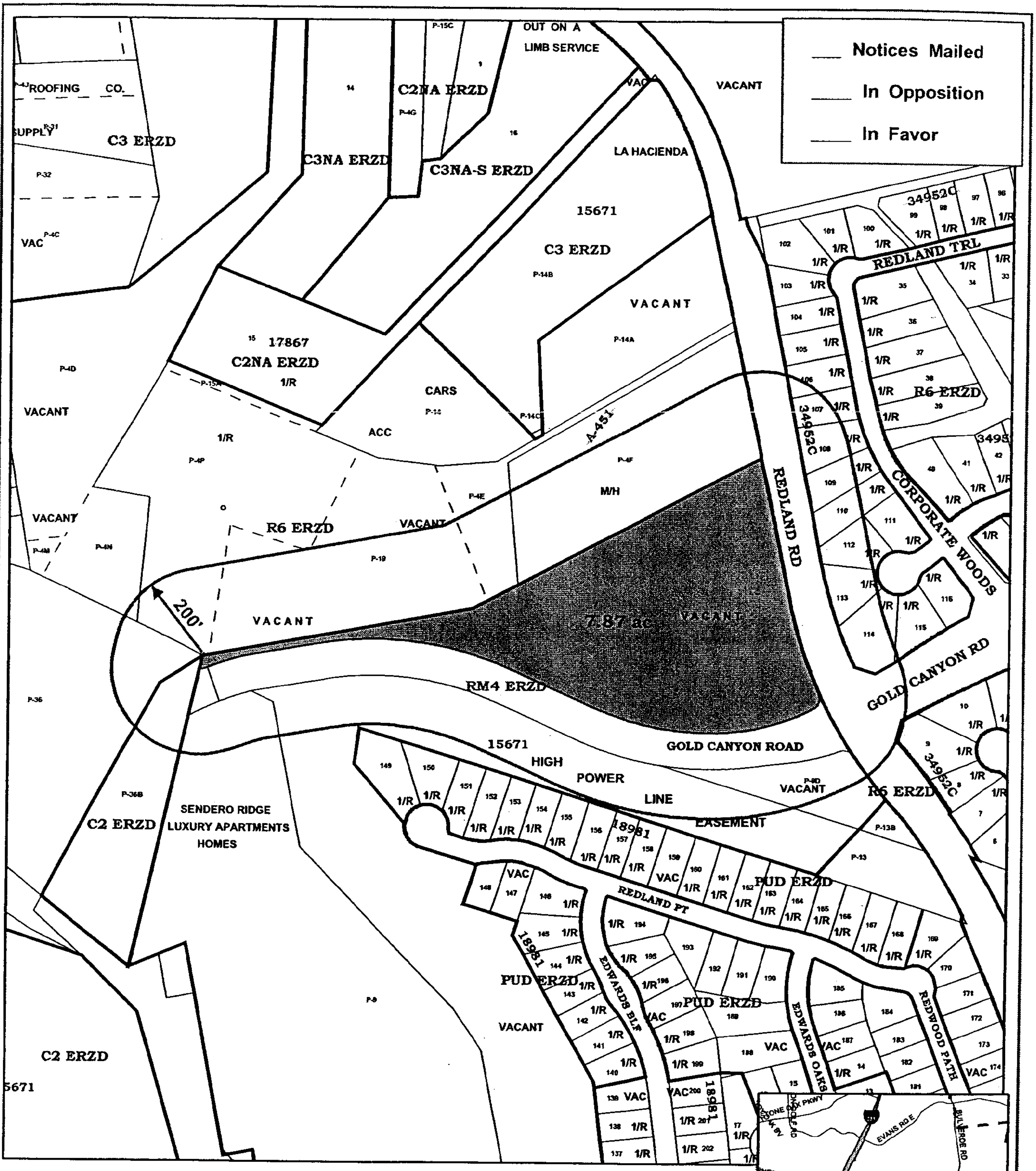
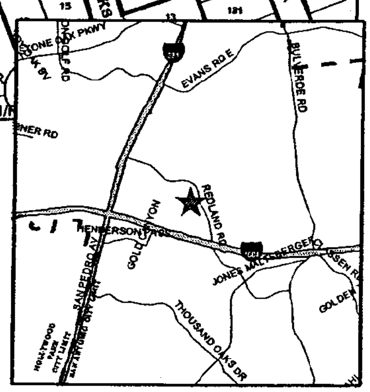




ZONING CASE: Z2004-151

City Council District NO. 9
Requested Zoning Change
From: RM-4 ERZD To PUD RM-4 ERZD
Date: August 26, 2004
Scale: 1" = 300'

Subject Property

200' Notification

C:\Jul_6_2004
(A.Z)

CASE NO: Z2004151

Staff and Zoning Commission Recommendation - City Council

Date: August 26, 2004

Zoning Commission Meeting Date: August 03, 2004

Council District: 9

Ferguson Map: 517 E2

Appeal: No

Applicant:

Details Development Group, LLC

Owner:

Inwood Heights Holdings, Ltd.

Zoning Request: From RM-4 ERZD Residential Mixed Edwards Recharge Zone District to PUD RM-4 ERZD Planned Unit Development Residential Mixed Edwards Recharge Zone District

7.8700 acres out of NCB 15671

Property Location: Redland Road and Gold Canyon Road

The northwest corner of the intersection of Redland Road and Gold Canyon Road

Proposal: Develop a PUD with single-family homes and townhomes

Neighborhood Association: Redland Woods Neighborhood Association

Neighborhood Plan: None

TIA Statement: A traffic impact analysis is not required

Staff Recommendation:

Approval. The subject property is located on Redland Road, a major thoroughfare, and is undeveloped. The subject property is adjacent to R-6 ERZD Residential Single-Family Edwards Recharge Zone District to the north and across Redland Road to the east. The RM-4 ERZD PUD Residential Mixed Edwards Recharge Zone Planned Unit Development District would be appropriate at this location.

Zoning Commission Recommendation:

Approval

VOTE	
FOR	8
AGAINST	0
ABSTAIN	0
RECUSAL	0

CASE MANAGER : Pedro Vega 207-7980

ZONING CASE NO. Z2004151 – August 3, 2004

Applicant: Details Development Group, LLC

Zoning Request: "RM-4" ERZD Residential Mixed Edwards Recharge Zone District to PUD "RM-4" ERZD Planned Unit Development Residential Mixed Edwards Recharge Zone District.

Marcus Moreno, 16601 Blanco Road, representing the applicant, stated they are requesting this change in zoning to allow for Marbella Villas, a PUD with single family and townhomes on the subject property. They are proposed to construct approximately 56 detached Villas and 8 townhomes.

Staff stated there were 27 notices mailed out to the surrounding property owners, 0 returned in opposition and 1 returned in favor and no response from Redland Woods Neighborhood Association.

Everyone present, for and against having been heard and the results of the written notices having been received, the Chairman declared the public hearing closed.

COMMISSION ACTION

The motion was made by Commissioner McAden and seconded by Commissioner Cardenas-Gamez to recommend approval.

1. Property is located on 7.8700 acres out of NCB 15671 at the northwest corner of the intersection of Redland Road and Gold Canyon Road.
2. There were 27 notices mailed, 0 returned in opposition and 1 in favor.
3. Staff recommends approval.

AYES: Martinez, Cardenas-Gamez, Kissling, Dixson, McAden, Avila, Stribling, Peel
NAYS: None
ABSTAIN: Sherrill
RECUSED: Grau, Dutmer

THE MOTION CARRIED.

RESULTS OF NOTICE FOR COUNCIL HEARING

To be provided at Council hearing.

SAN ANTONIO WATER SYSTEM
Interdepartment Correspondence Sheet

To: Zoning Commission Members

From: Kirk M. Nixon, Manager, Resource Protection Division, San Antonio Water System

Copies To: Scott R. Halty, Director, Resource Protection & Compliance Department, Julia I. Mireles, P.E., Karen Schubert, Resource Protection Specialist II, Aquifer Protection & Evaluation Section, File

Subject: Zoning Case Z2004151 (Marbella Village)

Date: July 23, 2004

SUMMARY

A request for a change in zoning has been made for an approximate 7.87-acre tract located on the city's north side. A change in zoning from **"RM-4 ERZD"** to **"RM-4 PUD ERZD"** is being requested by the applicant, Details Development Group, LLC., represented by Marcus C. Moreno. The change in zoning has been requested to allow for the owner to develop the site into a gated multifamily community with private streets.

As of the date of this report, an official request for a category determination has been received by the Aquifer Protection & Evaluation Division however a determination has not yet been made. Based on the information provided, if this property is a Category 2 property then it shall be developed in accordance with all the provisions stated in Ordinance No. 81491 governing development on the Edwards Aquifer Recharge Zone. However, if the appropriate information is provided to the Aquifer Protection & Evaluation Section, this property may be determined to be a Category 1 property. If the property is determined to be a Category 1 property, staff recommends that the owner/operator use criteria outlined in Section 34-970 "Best Management Practices".

Based on the site evaluation of the property, and the information submitted by the applicant, staff recommends approval provided that the applicant agrees to abide by all recommendations contained in this document.

LOCATION

The subject property is located in City Council District 9, at the northwest intersection of Gold Canyon and Redland Road. The property lies within the Edwards Aquifer Recharge Zone (Figures 1 and 2).

SITE EVALUATION

1. Development Description:

The proposed change is from RM-4 ERZD to RM-4 PUD ERZD and will allow for the construction of a new urbanism village. The project is proposed to have 8 townhomes and 56 detached villas.

2. Surrounding Land Uses:

Single-Family residential subdivisions currently exist to the south and east. An apartment complex exists to the southwest. The property to the north is undeveloped.

3. Geologic Features:

The Resource Protection Division of SAWS conducted an evaluation on June 24, 2004 of the referenced property to assess the geologic conditions and evaluate any environmental concerns present at the site. SAWS staff Geologist, Mr. Gregory James, P.G., was present during the site evaluation.

Using U.S. Geological Survey Water-Resources Investigations Report 95-4030 it was determined that the subject site is underlain by the Leached and Collapsed Member of the Edwards Limestone. This could not be verified by field observation due to coverage by alluvium, fill material and vegetation. This formation is known to possess the potential for lateral caverns. Therefore, it is possible that during excavation and development karst features may be found.

Records indicate the possible presence of a cave on or near the subject property. *The Caves of Bexar County, Second Edition, 1988*, by George Veni, shows "Council Cave" as being located within the USGS Longhorn Quadrangle near the subject property. In the description of "Council Cave", of the same report (Attachment 1), it identifies USGS Bulverde Quadrangle and the location. The upper portion of the sinkhole has since been filled with dirt and leveled. The cave is overlain by a sinkhole.

In *Significant Edwards Aquifer Karst Recharge Features of Bexar County, Texas 1989*, a report prepared by George Veni for the city of San Antonio , it states that the drainage area for the cave is approximately 22.04 acres and that the surrounding property is of low gradient. In addition, it states that included in the drainage is runoff from a nearby business via a pipe leading to the sinkhole. This report places the cave within the Longhorn Quadrangle (Attachment 2).

Professional Geologists employed by the San Antonio Water System and Frost GeoSciences investigated the aforementioned discrepancy between cave locations. While transects of the subject property did not identify any surface expression of a cave, it was noted that a large sinkhole is partially located in the north central portion of the property. In addition, the surrounding property exhibits fairly subdued topography. There is also some surface evidence of manmade structures within the project area

The proposed location for Council Cave within the Bulverde Quadrangle was also examined. This location possesses a large trash pile within the floodplain of Cibolo Creek. Also a depression was observed on the property in the proposed location of the cave. The evidence for this being a sinkhole was inconclusive. In addition, no evidence of the nearby business, noted in the 1989 Veni report, was observed. The topography of this site was well defined by Cibolo Creek. No cave entrance was noted. Soils in the area did not appear to have been disturbed.

George Veni, author of the previously mentioned reports, stated that he could not divulge a caves location without following procedure required by the Texas Speleological Survey. The Texas Speleological Survey has been contacted to obtain the location of the cave. As of this time no reply has been received. San Antonio U.S.G.S. staff produced a topographic map with a location for Council Cave that is north of the subject property (Attachment 3).

In addition, Integrated Testing and Engineering Company provided a preliminary soil and foundation engineering report (Attachment 4). A total of 5 borings were drilled to depths of 15 feet. Uniform hard, light-tan limestone was encountered at depths ranging from 2-5 feet. Voids were not noted in the boring logs, nor was groundwater observed.

Available data indicates that Council Cave is located north of, and not adjacent to, the property. It is possible that during construction and excavation other features may be exposed. All procedures currently in place, with regards to reporting of karst features, should be observed.

A copy of the Geologic Site Assessment (GSA), prepared by Frost GeoSciences, was provided. The GSA indicates one significant and sensitive recharge feature (S-3) on site. The feature will be required to be properly mitigated as approved by the Resource Protection and Compliance Department of SAWS. We are in general agreement the findings in the GSA.

4. Water Pollution Abatement Plan (WPAP):

   A WPAP will be required to be submitted and approved by the Texas Commission on Environmental Quality (TCEQ) prior to the commencement of construction. Building permits will not be released by SAWS until the WPAP is approved by the TCEQ.

ENVIRONMENTAL CONCERNS

The environmental concerns associated with this development being constructed on the Edwards Aquifer Recharge Zone are:

1. Geologic Concerns:

   A. The potentially sensitive member of the Edwards that the property lies within.

2. Standard Pollution/Abatement Concerns:

   A. The improper use of pesticides, herbicides, or fertilizers needed for landscape maintenance that may be carried off in the first flush of stormwater run-off.

   B. The build-up of hydrocarbons and other pollutants on streets, parking lots and other paved areas that are then carried off in the first flush of stormwater run-off.

ENVIRONMENTAL RECOMMENDATIONS

The following recommendations address the environmental concerns raised by the construction of this development on the Edwards Aquifer Recharge Zone:

1. If any significant geologic features such as, but not limited to, solution openings, caves, sinkholes, or wells are found during the excavation, construction, or blasting, the developer shall notify the Texas Commission on Environmental Quality at (210) 490-3096 and the Resource Protection Division of SAWS (210) 704-7305.

2. Development within the floodplain and floodplain buffer zones must be in accordance with Ordinance No. 81491 governing development on the Edwards Aquifer Recharge Zone in the Floodplain Preservation Area(s).

3. Prior to the release of any building permits the owner/operator of any Category 2 property shall submit an Aquifer Protection Plan (AqPP) to the Resource Protection Division of the San Antonio Water System.

4. The applicant shall notify the Construction Compliance Section of the Resource Compliance Division of SAWS at (210) 704-1158 no later than 48 hours prior to the commencement of construction at the site.

5. The land uses within the zoned areas shall be in conformance with the table of permitted uses at the time the re-zoning is approved. Should a proposed use be listed as requiring City Council approval, the owner/operator shall apply for re-zoning for that particular use at that site. If the land use is listed as special use, a special permit must be obtained for that use. If the land use is listed as prohibited, that land use will not be permitted on that site.

6. Prior to the release of any building permits, the following shall be submitted to the SAWS Aquifer Protection & Evaluation Section of the Resource Protection Division:

   A. A copy of the Water Pollution Abatement Plan (WPAP) shall be submitted for each particular development/use within the area being considered for re-zoning,

B. A set of site specific plans which must have a signed Engineers Seal from the State of Texas,

C. A WPAP approval letter from the Texas Commission on Environmental Quality (TCEQ),

D. A copy of the approved Water Pollution Abatement Plan.

7. The storage, handling, use and disposal of all over the counter hazardous materials within this development shall be consistent with the labeling of those materials. Failure to comply with the label warnings may constitute a violation of Federal law.

8. If a water quality basin is constructed on the property, the following is required:

A. Prior to the start of the basin construction, the owner will notify the Aquifer Protection and Evaluation Section of SAWS at (210) 704-7305 to schedule a site inspection.

B. After basin construction is complete and prior to the start of business, the owner will notify the SAWS Aquifer Protection and Evaluation Section at (210) 704-7305 to schedule a site inspection. Additionally, we recommend a maintenance plan and schedule be developed and submitted to SAWS Aquifer Protection and Evaluation Section.

C. If the basin fails to drain properly, the owner will notify the Construction Section of the Resource Compliance Division at (210) 704-1158 prior to any discharge of water.

D. If at any time the ownership of the property changes, the seller must inform the buyer of all requirements for maintenance of the Basin. A signed basin maintenance plan and schedule agreement, from the new owner, must be submitted to the Resource Protection Division.

9. Landscaped areas shall be sensitive to minimizing water needs (i.e. use of native plants). The owner/operator of this development and each purchaser or occupant of an individual lot within this development shall be informed in writing about Best Management Practices (BMP) of pesticide and fertilizer application. Preventing Groundwater Pollution, A Practical Guide to Pest Control, available from the Edwards Aquifer Authority (210/222-2204), or equivalent information produced by recognized authorities such as the Natural Resource Conservation Service, Texas Department of Agriculture, U.S. Department of Agriculture, etc. shall be used.

10. The City of San Antonio shall inspect all future construction of the sewage collection system to include service laterals and sewer mains for proper construction according to State and City Regulations and Code.

11. The Resource Protection Division staff shall have the authority to inspect the site to ensure that the approved recommendations are being strictly adhered to during and after construction of the project.

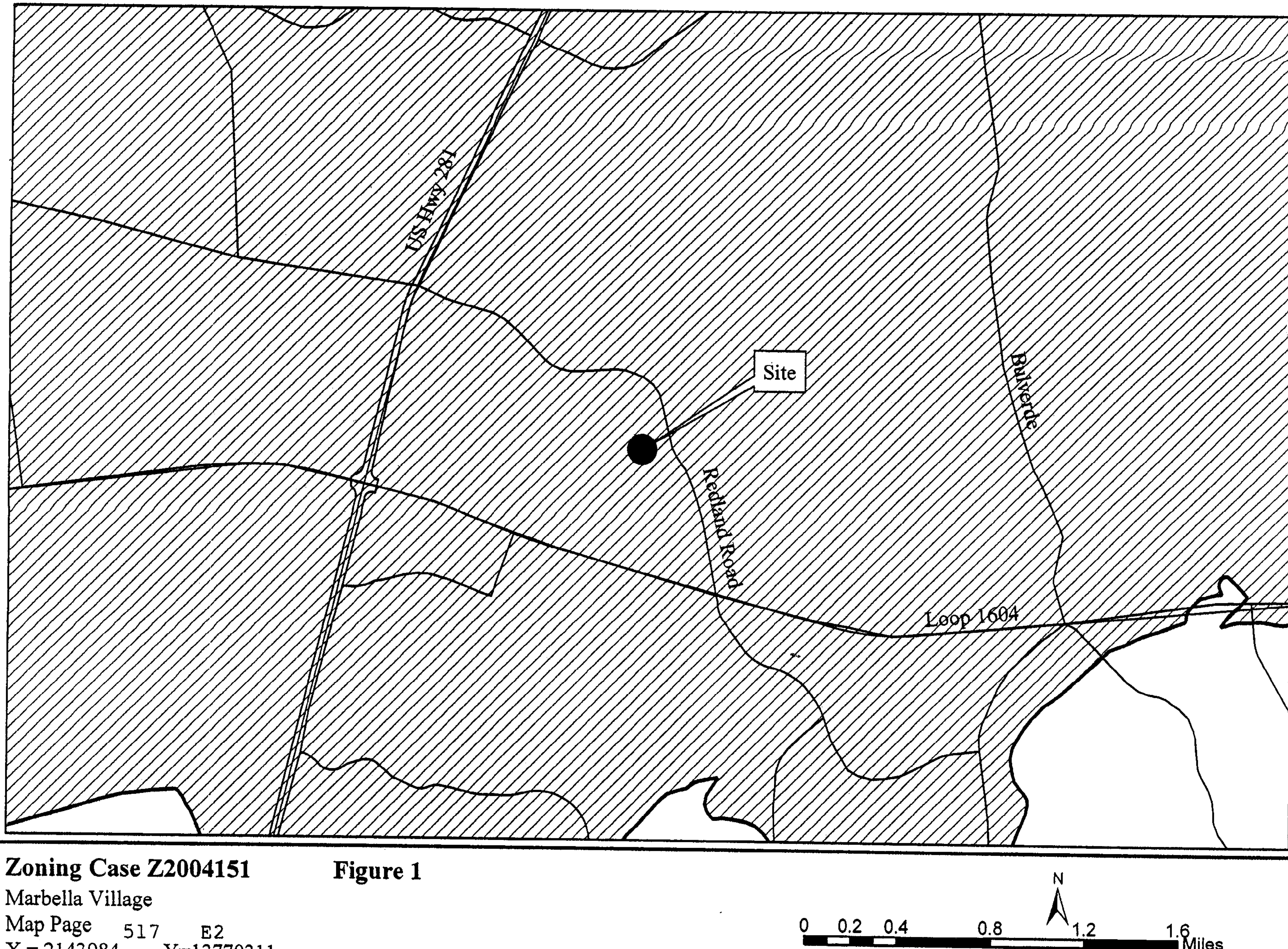
Based on the site evaluation of the property, and the information submitted by the applicant, staff recommends approval provided that the applicant agrees to abide by all recommendations contained in this document.

Kirk M. Nixon
Manager
Resource Protection Division

APPROVED:

Scott R. Halty
Director,
Resource Protection & Compliance Department

KMN:KJS



Zoning Case Z2004151 **Figure 1**

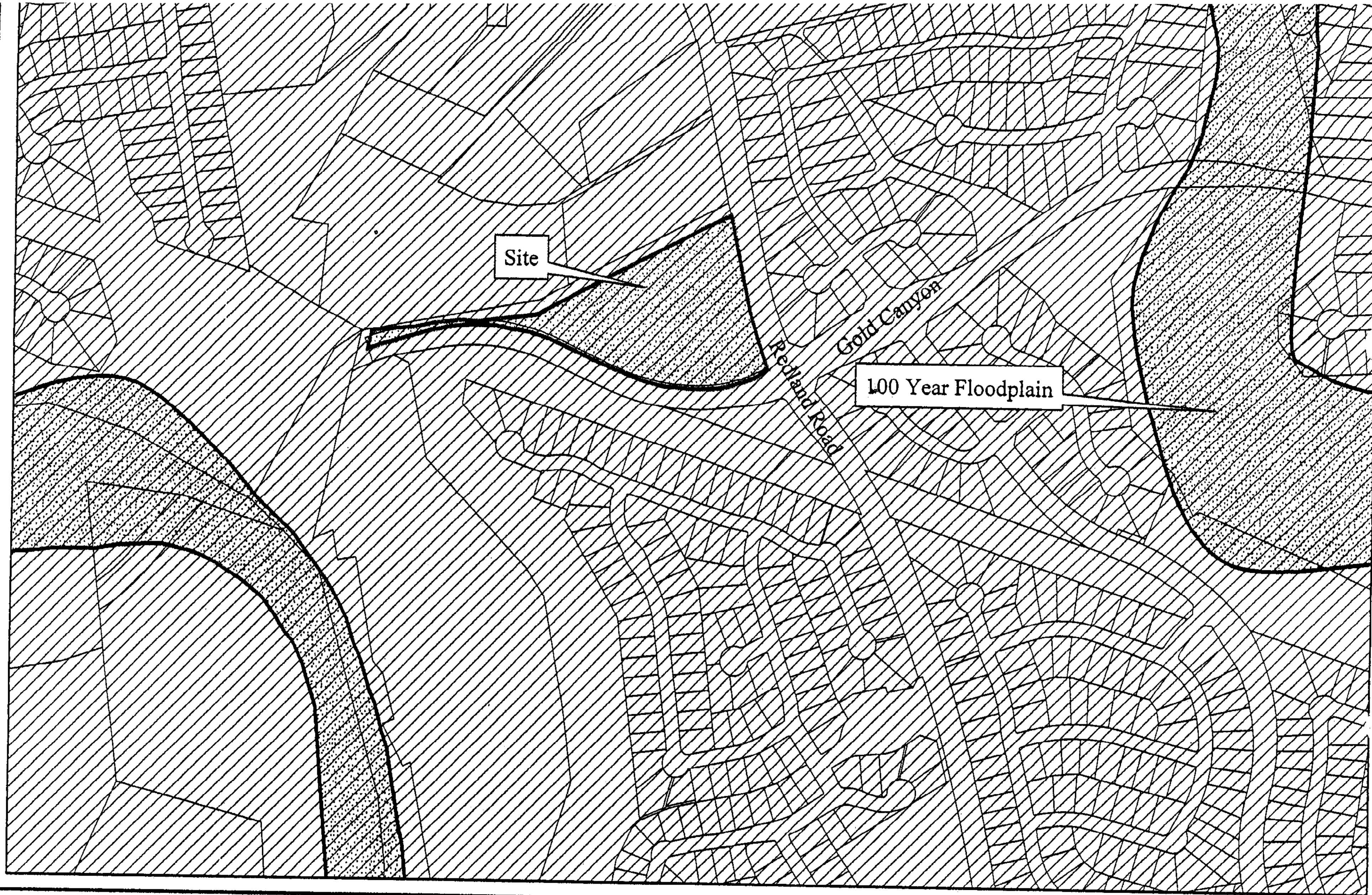
Marbella Village

Map Page 517 E2

X = 2143984 Y=13770311

Map Prepared by Aquifer Protection and Evaluation KJS 6/14/2004

1:34,931



Zoning Case Z2004151 **Figure 2**

Marbella Village

Map Page 517 E2

X = 2143984 Y=13770311

Map Prepared by Aquifer Protection and Evaluation KJS 6/14/2004

Attachment 1

In the western part of the cave, along the route from the entrance to the watercrawl, NE-SW joints guide passage development. This area has been developed and modified by aggressive stormwater runoff entering through the large sink. In sharp contrast, the middle and eastern portion of the cave has developed from the confluence of many small groundwater courses. These mud-floored passages and rooms are probably older than the western portion of the cave. They are developed along northwest-southeast fractures which probably predate the northeast-southwest fractures of the Balcones fault system. The western portion of the cave was probably a minor infeeder to the local base level to which the eastern portion of the cave drained. The western passages were later enlarged and modified by vadose water, while the enlarging entrance sink pirated water from the older eastern passages. Corkscrew Cave is developed in the recharge zone of the Edwards (Balcones Fault Zone) Aquifer. It is one of the few caves in Bexar County that provides human access to the local water table. In this case the water level averages 21 m below the floor of nearby Cibolo Creek (a major stream valley which is usually dry because it loses its water as recharge into the Edwards Aquifer). No research has determined if the recharge water from the cave is maintained in conduit flow or if it disperses into small fractures when under phreatic conditions. Based on the low success rate of drilling productive water wells in that region, the assumption that recharge in the Corkscrew Cave area enters and maintins itself as conduit flow is not unreasonable. The consequences of such a flow regime should be carefully weighed in considering problems of water quality for the regional groundwater supply.

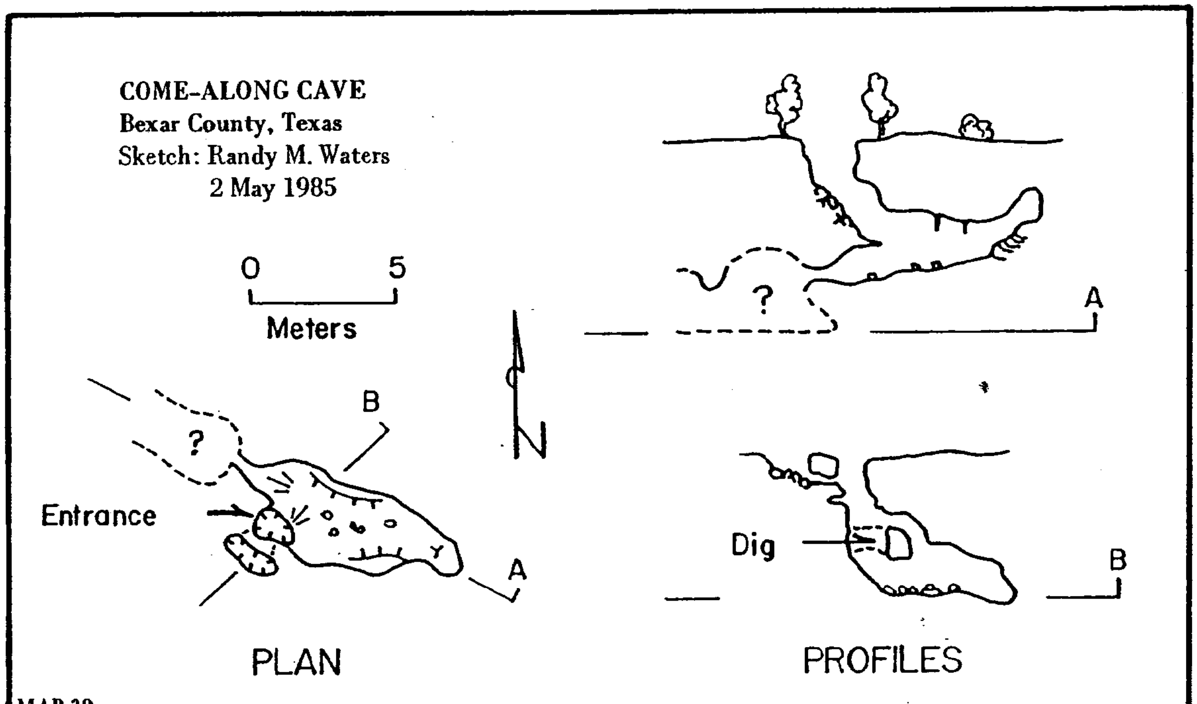
Technique: A 20 m rope or cable ladder is needed for the entrance pits, and another 15 m of rope or ladder is needed for the 9.1 m drop into the 10.7 m high room. Much of the cave is muddy, wet, and offers a fine variety of walking, crawling, and climbing experiences. No one has attempted to push the watercrawl with diving gear. Because of the sump's small dimensions and the overabundance of mud, a dive would probably not be fruitful.

Bibliography: Anonymous (1963c:16; 1965b:102; 1965c:122; 1966a:162; 1966c:127; 1967b:75-76; 1968d:147-148; 1968f:85; 1969a:25; 1973d:4; 1973q:11); Druding (1966:162); Fleming (1973b: 223; 1975:14); Litsinger (1973a:18-19); Miller (1975:25); O'Neill (1973b:158); Owens (1966:10; 1967:14); Passmore (1977:17); Pate (n.d.:32); Reddell (1961b:1); Reddell and Knox (1962:3-4, 11); Reddell and Russell (1962a:5); Reddell and Smith (1966:3); Streng (1974:58); Teates (n.d.:38); Veni (1978a:5; 1978e:4; 1978f:6; 1985).

COUNCIL CAVE (BCS #131)

Location: Bulverde 7.5' (508, 285)

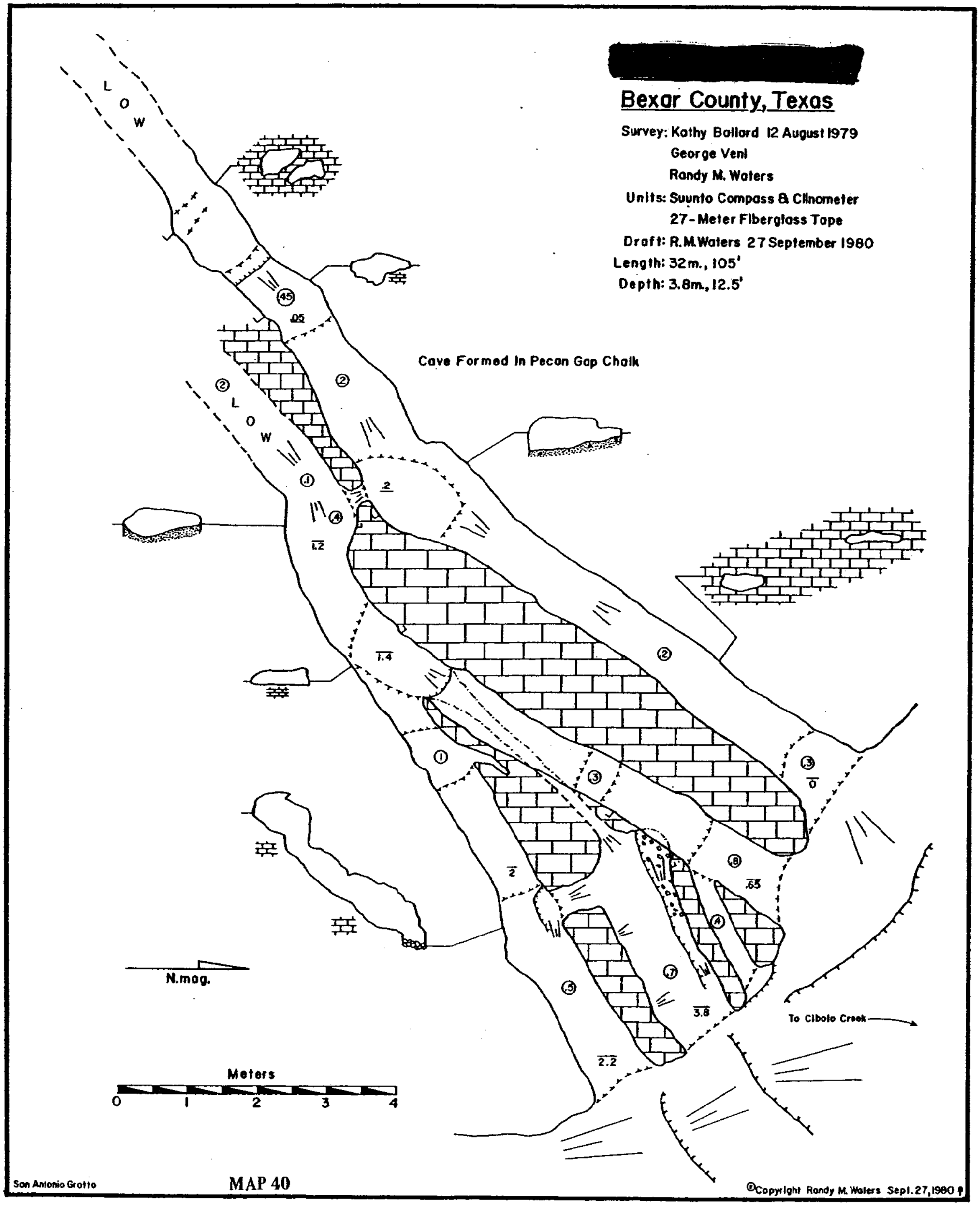
Description: The 5 m diameter trash-filled entrance sinkhole of Council Cave has been completely filled



MAP 39

with dirt and rocks. A small hole in the now-covered trash pile led into the cave. The wall indicated on the sketch map, separating the small entrance area from the "Council Chamber" (a half-moon-shaped room approximately 11 m long, 4 m wide, and 0.3 to 1.5 m high), was actually trash. Along the west wall of the Council Chamber was an adjoining small room, 4 m by 2.5 m by 1.5 m high. (See Map 42.)

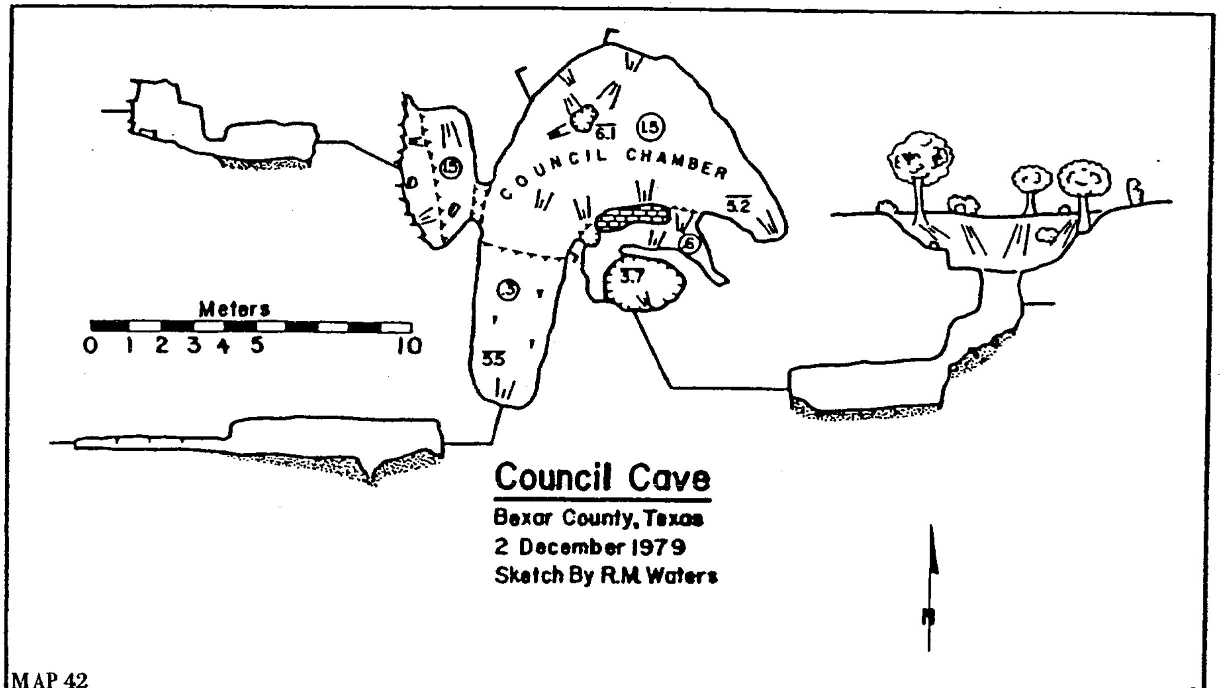
History: It is not known who used the sinkhole as a trash dump. Land developers found the cave in late 1979 and excavated enough trash to gain access. Chuck Stuehm received permission to explore and



MAP 40

made the only known exploration on 2 December 1979 with Dottie and Teeni Kern, Gary A. Poole, George Veni, and Randy M. Waters. The comfortable soft dirt floor seated a discussion of speleo-politics which inspired the cave's name.
Biology: Spiders, cave crickets (*Ceuthophilus* sp.), and beetles were observed.
Geology: The west wall of the small room, off the Council Chamber, is a recemented paleo-breccia whose collapse is not evident on the surface. As a one-time uncontrolled refuse dump in a sinkhole of the Edwards (Balcones Fault Zone) Aquifer recharge zone, Council Cave represents a potential source of contamination for the regional groundwater supply. A drainage pipe to the subsurface maintains some access to the cave for stormwater runoff collected from the roof and grounds of a nearby business.
Bibliography: Veni (1985).

CRANE BAT CAVE (BCS #14)
Alternate name: Crane's Cave
Location: Van Raub 7.5′ (049, 228)
Description: A 2.5 m deep elongate sink leads into a room 22 m long, 1 to 5 m high, and 5 to 7 m wide. Crawlways extend into the breakdown- and guano-covered floor but do not lead into any true solution passages. At the west end of the room is an opening to a second smaller room 8 m long, 3 m wide, and 1.6 m high. It is rumored that in early 1977 this area suffered some collapse, the extent of which is not known. Five meters from the entrance is a skylight that is too small to enter. Some small speleothems are present in the cave. (See Map 43.)
History: Carl Crane made the first reported entry into the cave in 1919. In later years, Greg Crane also explored the cave. Not until about 1960 did cavers first visit the cave when St. Mary's University Speleological Society took the Jefferson High School Science Club (San Antonio) to the cave. On 22 November 1964 the cave was surveyed by James Jasek, Dick Scherrer, and Ron Winfrey. A resurvey took place in 1982 by Duane Canny, Steve Gutting, and other members of the Alamo Chapter of the National Speleological Society, but a new map has not yet been drafted.
Biology: The small bat population inhabiting the cave is probably *Myotis velifer incautus*. Other observed fauna includes spiders, harvestmen (prob. *Leiobunum townsendii*), and cave crickets (*Ceuthophilus* sp.).
Geology: Located on a hilltop, the cave is developed along a predominant east-west joint trend in the upper Glen Rose Formation.
Technique: Caution should be observed in the area of potentially unstable breakdown.
Bibliography: Anonymous (1969a:25; 1973j:9; 1973q:11); Austin (1977:12); Passmore (1975c:28); Reddell (1961b:1); Reddell and Knox (1962:3-4, 12); Reddell and Russell (1962a:5); Reddell and Smith (1966:3); Veni (1978a:5; 1983:98).



MAP 42

Attachment 2

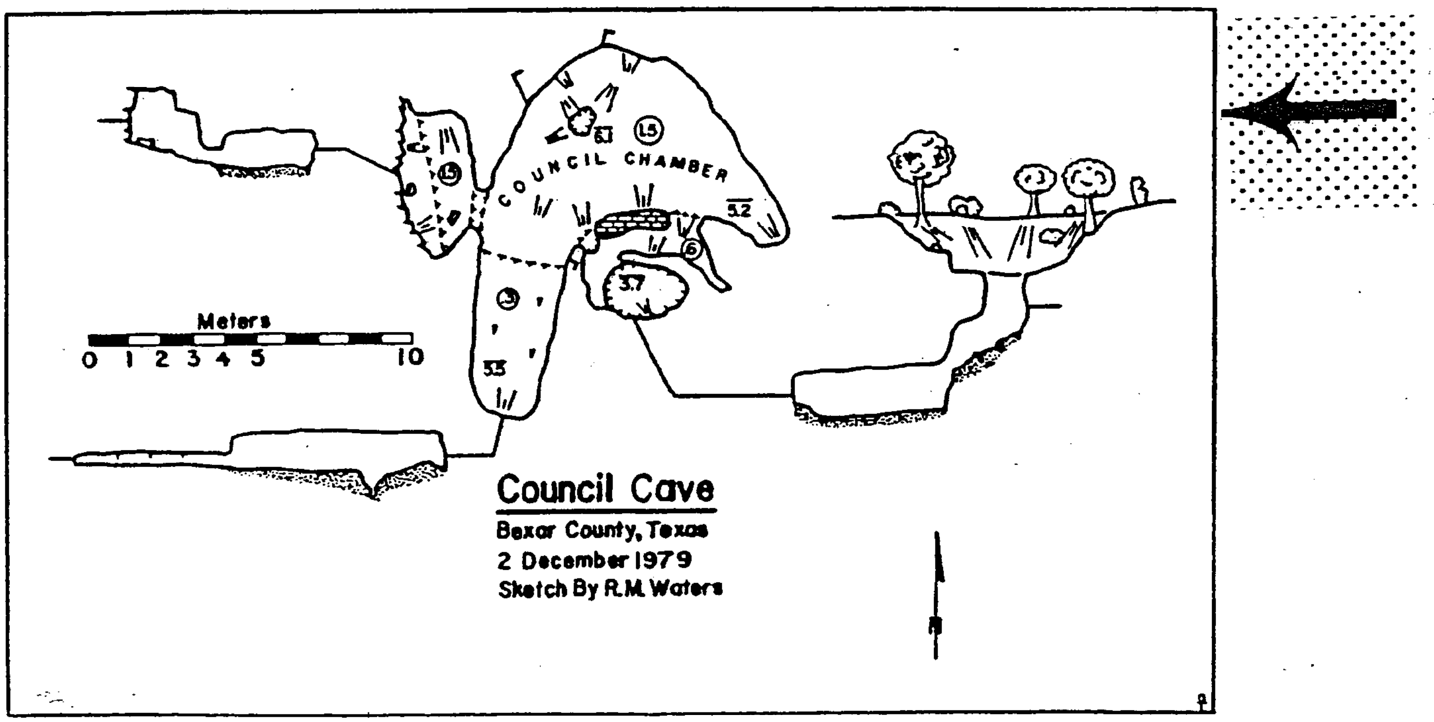
9. Council Cave

Location: Longhorn 7.5' USGS Quadrangle

Description: A 5 m diameter by estimated 2 m deep trash filled sinkhole served as the cave's entrance. Access through the refuse led into a semicircular chamber, concentric to the sinkhole, that was 11 m long, 4 m wide and up to 1.5 m high. Other portions of the cave were undoubtably blocked off by the trash. By 1985 the sinkhole had been filled in and leveled with dirt.

Hydrogeology: Only a small portion of the cave was accessible for study. The portion examined did not appear to serve as a significant recharge site to the Edwards Aquifer. The sinkhole's drainage area, however, may be large enough to classify the site as significant. Precise topographic surveying is needed, of the low gradient terrain surrounding the sinkhole, to support or refute the estimate below.

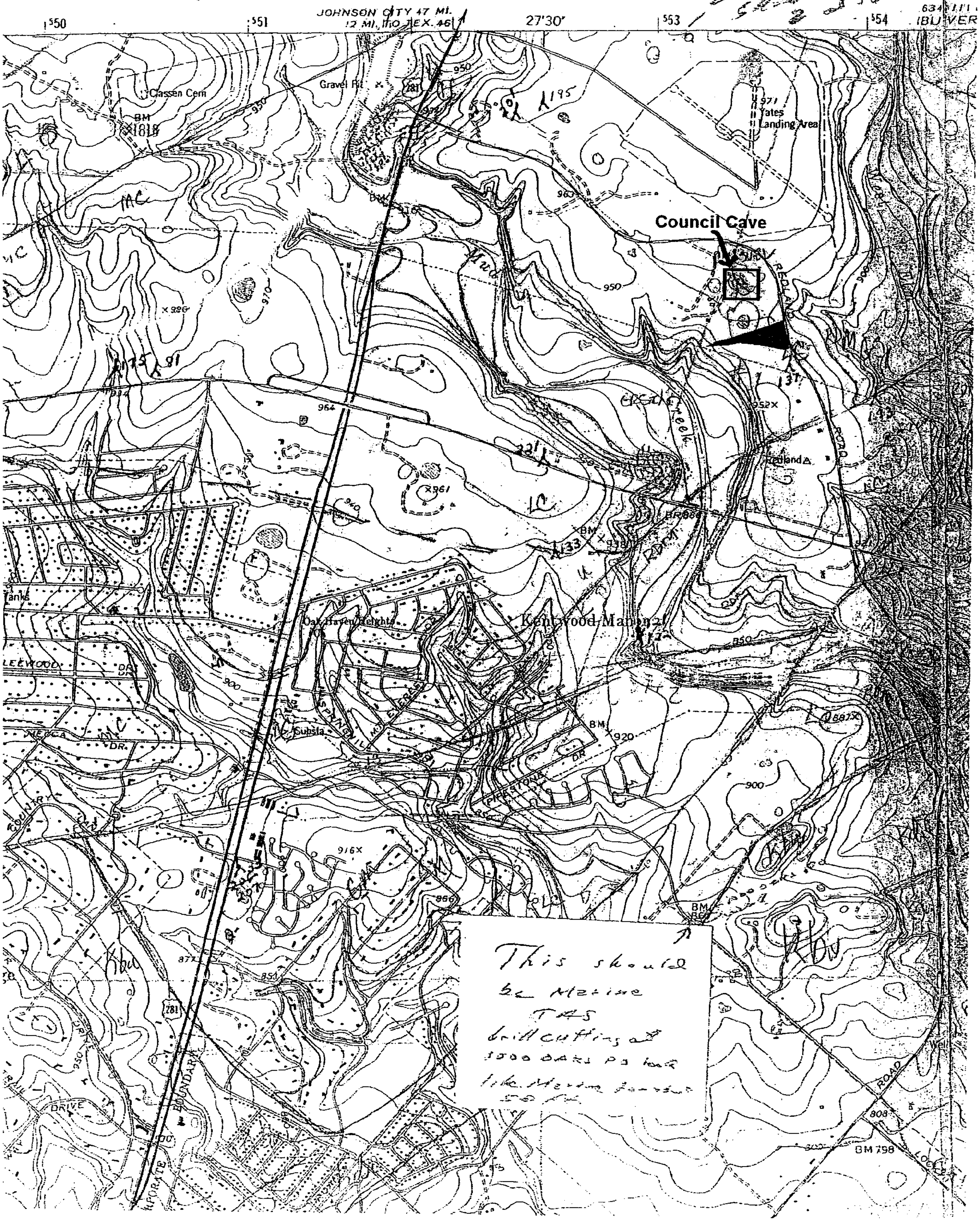
Recharge: The cave's estimated drainage area is 89,196 sq m (22.04 acres). Its annual recharge, based on that estimate would be 2.30 acre-feet. Part of the cave's drainage includes runoff from a nearby business that is channeled into a pipe leading into the sinkhole.



Attachment 3

Rec'd 7/201

RIOR



Attachment 4

InTEC Integrated Testing and Engineering Company
Geotechnical & Environmental Engineering • Construction Services • Geologic Assessment

May 26, 2004

E.A. "Paul" Palaniappan, Ph. D., P.E.
Murali Subramaniam, Ph. D.
Kaushi Subramaniam, B.S.

Details Development Group, Inc.
16601 N. Blanco Road, Suite 150
San Antonio, Texas 78232

Attention: **Mr. Marcus Moreno**

Re: Preliminary Soil Survey
7.91 Acre Tract
At the NW Corner of
Redland and Gold Canyon Road Intersection
San Antonio, Texas

InTEC Project No. S041187

Gentlemen:

Integrated Testing and Engineering Company (InTEC) has completed a **preliminary soil and foundation engineering report** at the above referenced project site. The results of the exploration are presented in this report.

We appreciate and wish to thank you for the opportunity to be of service to you on this project. If we can be of additional assistance during the foundations explorations, and materials testing-quality control phase of construction, please call us.

Respectfully Submitted,

STATE OF TEXAS
E. A. PALANIAPPAN
49055
REGISTERED
PROFESSIONAL ENGINEER

Very Truly Yours,
InTEC of San Antonio, L.P.

Murali Subramaniam, Ph.D.

E.A. "Paul" Palaniappan, Ph.D., P.E.
CHIEF ENGINEER

Copies Submitted: Above (4)

EXECUTIVE SUMMARY

The soil conditions at the location of **7.91 Acre Tract on the NW Corner of the Redland and Gold Canyon Road intersection in San Antonio, Texas** were explored by drilling **5 borings** to depths of **15** feet. Laboratory tests were performed on selected specimens to evaluate the engineering characteristics of various soil strata encountered in our borings.

The results of our exploration, laboratory testing and engineering evaluation indicate the underlying shallow clays at this site **are moderately to highly expansive in character.** Potential vertical movements on the order of **1 to 2 ½ inches** were estimated.

The proposed single family residences may be supported by stiffened grid type beam and slab or post-tensioned beam and slab foundations. Grade beams of the stiffened grid type beam and slab foundation founded on or within the natural undisturbed soils or compacted structural fill may be sized for an allowable bearing capacity value on the order of **1700 lbs per sq ft.**

Ground water was not observed in our borings at the time of our drilling.

Detailed descriptions of subsurface conditions, engineering analysis, and design recommendations are included in this report.

INTRODUCTION

General

This report presents the results of our **preliminary subsurface exploration and foundation analysis** at the location of **7.91 Acre Tract on the NW Corner of the Redland and Gold Canyon Road intersection in San Antonio, Texas.** This project was authorized by **Mr. Marcus Moreno.**

Purpose and Scope of Services

The purpose of our preliminary geotechnical investigation was to evaluate the site's subsurface and ground water conditions and provide **preliminary geotechnical engineering recommendations** for the planning and development phase of the project. Our scope of services includes the following:

1) drilling and sampling of a limited number of **five borings - to depths of 15 feet;**
2) evaluation of the in-place conditions of the subsurface soils through **field penetration tests;**
3) observation of the **ground water conditions** during drilling operations;
4) performing **laboratory tests** such as Atterberg limits and Moisture content tests;
5) review and evaluation of the field and laboratory test programs during their execution with **modifications of these programs,** when necessary, **to adjust to subsurface conditions revealed by them;**
6) compilation, **generalization and analysis** of the field and laboratory data in relation **to the project requirements;**

7) estimation of potential vertical movements;

8) preparation of recommendations for the **planning, and development phase of the project;**

9) consultations with **Prime Professional and members of the design team on findings and recommendations;** and preparation of a written preliminary geotechnical engineering report for use by the members of the Evaluation team in their preparation of planning and development documents.

The Scope of Services **did not include any environmental assessment** for the presence or absence of wetlands or hazardous or toxic materials in the soil, surface water, groundwater, or air, on or below or around this site. Any statements in this report or on the boring logs regarding odors, colors or unusual or suspicious items or conditions are strictly for the information of the client.

SUBSURFACE EXPLORATION

Scope

The field exploration to determine the engineering characteristics of the subsurface materials included a reconnaissance of the project site, **drilling a limited number of borings,** performing standard penetration tests and obtaining disturbed split-barrel samples.

Five soil test borings were drilled at the approximate locations shown on the Boring Location Plan, Plate 1 included in the Illustration Section of this report. These borings were drilled **to depths of 15 feet** below the presently existing ground surface. Boring locations were selected by the project geotechnical engineer and established in the field by the drilling crew using normal taping procedures.

Drilling and Sampling

The soil borings were performed with a drilling rig equipped with a rotary head. Conventional solid stem augers were used to advance the holes and samples of the subsurface materials were obtained **using a standard 2.0-inch O.D. split-barrel sampler.** Hand auger samples were obtained using a hand auger. The samples were identified according to boring number and depth, encased in polyethylene plastic wrapping to protect against moisture loss, and transported to our laboratory in special containers.

In summary, the following samples as presented in Table No. 1 were collected as a part of our field exploration procedure:

Table No. 1

Type of Sample	Number Collected
Split-barrel Samples	23
Auger Samples	2

Field Tests and Measurements

Penetration Tests - During the sampling procedures, **standard penetration tests were performed** in the borings in conjunction with the split-barrel sampling. The standard penetration value (N) is defined as the number of blows of a 140 pound hammer, falling thirty inches, required to advance the split-spoon sampler one foot into the soil. The sampler is lowered to the bottom of the drill hole and the number of blows recorded for each of the three successive increments of six inches penetration. The "N" value is obtained by adding the second and third incremental numbers. The results of the standard penetration test indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components.

Water Level Measurements - **Water level observations were made** during the boring operations and **the results are noted on the boring logs.** In relatively pervious soils, such as sandy soils, the indicated elevations are considered reliable ground water levels. In relatively impervious soils, the accurate determination of the ground water elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the ground water table and volumes of water will depend on the permeability of the soils.

Field Logs

A field log was prepared for each boring. Each log contained information concerning the boring method, samples attempted and recovered, indications of the presence of various materials such as silt, clay, gravel or sand and observations of ground water. It also contained an interpretation of subsurface conditions between samples. **Therefore, these logs included both factual and interpretive information.**

Presentation of the Data

The final logs represent our interpretation of **the contents of the field logs for the purpose delineated by our client.** The final logs are included on **Plates 2 thru 6** included in the Illustration Section. A key to classification terms and symbols used on the logs is presented on **Plate 7.**

LABORATORY TESTING PROGRAM

Purpose

In addition to the field exploration, a supplemental laboratory testing program was conducted to determine additional **pertinent engineering characteristics** of the subgrade materials necessary in evaluating the soil parameters.

Laboratory Tests

All phases of the laboratory testing program were performed **in general accordance with the indicated applicable ASTM Specifications.**

In the laboratory, each sample **was examined and classified by a geotechnical engineer.** As a part of this classification procedure, the natural water contents of selected specimens were determined. Liquid and plastic limit tests were performed on representative specimens to determine the plasticity characteristics of the different soil strata encountered.

Presentation of the Data

In summary, the following tests as presented in Table No. 2 were conducted in the laboratory to evaluate the engineering characteristics of the subsurface materials:

Table No. 2

Type of Test	Number Conducted
Natural Moisture Content	25
Atterberg Limits	8

The results of all these tests are presented on appropriate boring logs.

GENERAL SUBSURFACE CONDITIONS

Soil Stratigraphy

The soils underlying the site may be grouped into **two to three generalized strata** with similar physical and engineering properties. The lines designating the interface between soil strata on the logs represent approximate boundaries. Transition between materials may be gradual. The soil stratigraphy information at the boring locations are presented in **Boring Logs, Plates 2 thru 6.**

The engineering characteristics of the underlying soils, based on the test results on selected samples, are summarized and presented in Table No. 3

Table No. 3

Stratum No. and Description	Depth, Range, Feet	Liquid Limit Range	Plasticity Index, Range	Blows Per Foot, Range
Stratum I Dark Brown Clay	0 - 5	56 – 58	38 – 40	21 - 51
Stratum II Tan Weathered Limestone	3 – 7	58	39	31 – 50/2"
Stratum III Tan to Light Tan Limestone	2 – 15	21 – 33	10 – 17	50/3 – 50/1"

The above description is of a generalized nature to highlight the major soil stratification features and soil characteristics. The test boring logs should be consulted for specific information at each boring location.

Ground Water Observations

Ground water **was not observed in our borings during drilling.** The low permeability of the soils would require several days or longer for ground water to enter and stabilize in the bore holes. Ground water levels will fluctuate with seasonal climatic variations and changes in the land use.

It is not unusual to encounter shallow ground water during or after periods of rainfall. The surface water tends to percolate down through the surface soils until it encounters a relatively impervious layer.

FOUNDATIONS ON EXPANSIVE SOIL

General

There are many plastic clays **that swell considerably** when **water is added to them and then shrink with the loss of water.** Foundations constructed on these clays are **subjected to large uplifting forces caused by the swelling.**

In the characterization of a building site, two major factors that contribute to potential shrink-swell problems must be considered. Problems can arise if a) **the soil has expansive or shrinkage properties** and b) the environmental conditions that cause **moisture changes to occur in the soil.**

Evaluation Of The Shrink-Swell Potential Of The Soils

Subsurface sampling, laboratory testing and data analysis is used in the evaluation of the shrink-swell potential of the soils under the foundations.

The Mechanism Of Swelling

The mechanism of swelling in expansive clays is complex and is influenced by a **number of factors.** Basically, expansion is a result of changes in the soil-water system that disturbs the internal stress equilibrium. Clay particles in **general have negative electrical charges** on their surfaces and positively charged ends. The negative charges are balanced by actions in the soil water and give rise to an electrical interparticle force field. In addition, adsorptive forces exist between the clay crystals and water molecules, and Van Der Waals surface forces exist between particles. Thus, there exists an internal electro-chemical force system **that must be in equilibrium with the externally applied stresses and capillary tension in the soil water.** If the soil water chemistry is changed either by changing the amount of water or the chemical composition, the interparticle force field will change. If the change in internal forces is not balanced by a corresponding change in the state of stress, **the particle spacing will change** so as to adjust the interparticle forces until equilibrium is reached. **This change in particle spacing manifests itself as a shrinkage or swelling.**

Antecedent Rainfall Ratio This is a measure of the local climate and is defined as **the total monthly rainfall for the month of and the month prior to laying the slab divided by twice the average monthly rate measured for the period.** The intent of this ratio is to give a relative measure of ground moisture conditions at the time the slab is placed. Thus, if a slab is placed at the end of a wet period, the slab should be expected to experience some loss of support around the perimeter as the wet soil begins to dry out and shrink. The opposite effect could be anticipated if the slab is placed at the end of an extended dry period; as the wet season occurs, uplift around the perimeter may occur as the soil at the edge of the slab gains in moisture content.

Age of Slab **The length of time since the slab was cast provides an indication of the type of swelling of the** soil profile that can be expected to be found beneath the slab.

Initial Moisture Condition And Moisture Variation

Volume change in an expansive soil mass is the result of increases or decreases in water content. The initial moisture content influences the swell and shrink potential relative to possible limits, or ranges, in moisture content. Moisture content alone is useless as an indicator or predictor of shrink-swell potential. **The relationship of moisture content to limiting moisture contents such as the plastic limit and liquid limit must be known.**

If the moisture content is below or near plastic limit, the soils have high potential to swell. It has been reported that **expansive soils with liquidity index*** in the range of **0.20 to 0.40 will tend to experience little additional swell.**

The availability of water to an expansive soil profile is influenced by many environmental and man made factors. Generally, the upper few feet of the profile are subjected to the widest ranges of moisture variation, and is least restrained against movement by overburden. **This upper stratum of the profile is referred to as the active zone.** Moisture variation in the active zone of a natural soil profile is affected by climatic cycles at the surface, and fluctuating groundwater levels at the lower moisture boundary. The surficial boundary moisture conditions are changed

* LIQUIDITY INDEX = $\frac{\text{NATURAL WATER CONTENT - PLASTIC LIMIT}}{\text{LIQUID LIMIT - PLASTIC LIMIT}}$

significantly simply by placing a barrier such as a building floor slab or pavement between the soil and atmospheric environment. **Other obvious and direct causes of moisture variation result from altered drainage conditions or man-made sources of water, such as irrigation or leaky plumbing.** The latter factors are difficult to quantify and incorporate into the analysis, but should be controlled to the extent possible for each situation. **For example, proper drainage and attention to landscaping are simple means of minimizing moisture fluctuations near structures, and should always be taken into consideration.**

Man Made Conditions That Can Be Altered

There are a number of factors that can influence whether a soil might shrink or swell and the magnitude of this movement. **For the most part, either the owner or the designer has some control over whether the factor will be avoided altogether or if not avoided, the degree to which the factor will be allowed to influence the shrink-swell process.**

Lot Drainage This provides a measure of the slope of the ground surface with respect to available free surface water that may accumulate around the slab. **Most builders are aware of the importance of sloping the final grade of the soil away from the structure so that rain water is not allowed to collect and pond against or adjacent to the foundations.** If water were allowed to accumulate next to the foundation, it would provide an available source of free water to the expansive soil underlying the foundation. Similarly, surface water drainage patterns or swales must not be altered so that runoff is allowed to collect next to the foundation.

<u>Topography</u> **This provides a measure of the downhill movement that is associated with light foundations built on slopes in expansive soil areas.** The designer should be aware that as the soil swells, it heaves perpendicularly to the ground surface or slope, but when it shrinks, it recedes in the direction of gravity and gradually moves downslope in a sawtooth fashion over a number of shrink-swell cycles. In addition to the shrink-swell influence, the soil will exhibit viscoelastic properties and creep downhill under the steady influence of the weight of the soil. Therefore, if the building constructed on this slope is not to move downhill with the soil, it must be designed to compensate for this lateral soil influence.

<u>Pre-Construction Vegetation</u> **Large amount of vegetation existing on a site before construction may have desiccated the site to some degree, especially where large trees grew before clearing. Constructing over a desiccated soil can produce some dramatic instances of heave and associated structural distress and damage as it wets up.**

<u>Post-Construction Vegetation</u> The type, amount, and location of vegetation that has been allowed to grow since construction can cause localized desiccation. **Planting trees or large shrubs near a building can result in loss of foundation support as the tree or shrub removes water from the soil and dries it out. Conversely, the opposite effect can occur if flowerbeds or shrubs are planted next to the foundation and these beds are kept well watered or flooded. This practice can result in swelling of the soil around the perimeter where the soil is kept wet.**

Summation It is beyond the scope of this investigation to do more than point out that the above factors have a definite influence on the amount and type of swell to which a slab-on-ground is subjected during its useful life. **The design engineer must be aware of these factors as he develops his design and make adjustments as necessary according to the results of special measurements or from his engineering experience and judgment.**

DESIGN ENGINEERING ANALYSIS

Foundation Design Considerations

Review of the borings and test data indicates that the factors presented in the following page will affect the foundation design and construction at this site.

1) The site is underlain by subsoils of moderate to high plasticity. Structures supported at shallow depths will be subjected to high potential vertical movements on the order of **1 to 2 ½ inches.**
2) The strengths of the underlying soils are adequate to support shallow foundations.
3) Ground water was not encountered in our borings at the time of the subsurface exploration phase.

Vertical Movements

The potential vertical rise (PVR) for slab-on grade construction at the store location had been estimated using Texas Department of Transportation Test Method TXDOT-124-E. This method utilizes the liquid limits, plasticity indices, and in-situ moisture contents for soils in the seasonally active zone, estimated to be about twelve feet in the San Antonio area.

The estimated P.V.R. value provided is based on the proposed floor system applying a sustained surcharge load of approximately 1.0 lb. per square inch on the subgrade materials. **Potential vertical movement on the order of 1 to 2 ½ inches was estimated at the finish grade** elevation. These high P.V.R values will be realized if the subsoils are subjected to **moisture changes from the present soil moisture conditions or average soil moisture conditions, whichever is lower, to fully saturated conditions.**

The PVR values are based on the grade levels which are 0.5 to 1-ft below the existing grades. Select structural fill should be used to raise the elevation by 0.5 to one foot. If cut and fill operations in excess of 6 inches are performed, the P.V.R. values could change significantly. Higher P.V.R. values than the above mentioned values will occur in areas where water is allowed to pond for extended periods.

PRELIMINARY RECOMMENDATIONS

General

The following preliminary recommendations are based on the data obtained from our field and laboratory tests, our past experience with geotechnical conditions similar to those at this site, and our engineering design analysis.

Stiffened grid type beam and slab foundations may be used to support the residences provided the potential vertical movements will not impair the performance of the residences and structures.

Stiffened Grid Type Beam and Slab Foundations

It is desirable to design the foundations system utilizing the simplifying assumption that the loads are carried by the beams; a maximum **allowable unit load on the order of 1700 pounds per square foot should be used** for beams founded within the hard existing soils or limestone or compacted structural fill **at a minimum depth of 12 inches below finish grade. The beams should be a minimum of 10 inches wide to prevent local shear failure.** Design plasticity indices were evaluated at the existing grade level at the boring locations and the values are presented in Table No. 4.

Table No. 4

BORING LOCATION	DESIGN PLASTICITY INDEX
B-1	35
B-2	37
B-3	35
B-4	35
B-5	27

The design plasticity indices presented in Table No. 4 are based on the current site grades. If cut and fill operations in excess of 6 inches are performed, the design plasticity indices could change significantly.

Post-Tensioned Beam and Slab Foundation

Post-tensioned slab-on-grade foundation may also be used to support the proposed residences provided the **anticipated movements will not impair the performance of the residences and multi-family buildings.** Pertinent design parameters were evaluated and are presented in the following paragraphs.

Differential vertical movements should be expected for shallow type foundations at this site **due to expansive soil conditions which were encountered.** Differential vertical movements have been estimated for both the center lift and edge lift conditions for post-tensioned slab-on grade construction at this site. These movements were estimated using the procedures and criteria discussed in the Post-Tensioning Institute Manual entitle **"Design and Construction of Post-Tensioned Slabs-on-Ground". The PTI computer program (VOLFLO) was used to derive the estimated PTI differential movements (Ym).** We recommend that the structural engineer consider the limitations of the VOLFLO program by establishing minimum PTI design parameters for foundation system design to account for the relatively low Ym values produced when analyzing certain soil conditions.

The edge moisture variation distances (Em) for center lift and edge lift conditions were derived based on a **Thornthwaite Index of -16 for the project site.** The edge moisture variation distances are provided in the following page.

Center Lift Condition **Em = 6.0 feet**
Edge Lift Condition **Em = 3.0 feet**

PTI differential movement (Ym) for the soil conditions encountered at the site will be estimated and presented in the report after a final soil and foundation analysis investigation.

Utilities

Utilities which project through slab-on-grade floors should be designed with either some degree of flexibility or with **sleeves in order to prevent damage to these lines should vertical movement occur.**

Utility Excavation **Utility excavations such as for sewerlines-excavated deeper than 5-ft may encounter some hard materials. High power excavation equipments may be required.**

CONSTRUCTION GUIDELINES

Site Preparation

Site preparation will consist of **preparation of the subgrade, and placement of select structural fill.** The project geotechnical **engineer InTEC should approve the subgrade preparation, the fill materials, and the method of fill placement and compaction.**

In any areas where soil-supported floor slabs or pavement are to be used, vegetation and all loose or excessively organic material should be stripped to a minimum depth of six inches and removed from the site. Subsequent to stripping operations, the subgrade should be scarified prior to fill placement and recompacted to **95 percent of the maximum dry density as determined by ASTM D 698 test method within one percent below or three percent above optimum moisture content.** The exposed subgrade should not be allowed to dry out prior to placing structural fill.

Voids caused by site preparation should be replaced with select structural fill and compacted in accordance with the select fill compaction recommendations.

Select Structural Fill

Any select structural fill used at the site should have **a liquid limit less than 40 and a plasticity index in between 5 and 20.** The fill should contain no particles greater than 3 inches in diameter.

The fill materials should be placed in 8 inch thick loose lifts and compacted to 95 percent of the maximum dry density as determined by ASTM D 698 test method at a moisture content within 3 percent of the optimum water content.

Ground Water

In any areas where significant cuts (2-ft or more) are made to establish final grades for building pads, attention should be given to possible seasonal water seepage that could occur through natural cracks and fissures in the newly exposed stratigraphy. Subsurface drains may be required to intercept seasonal groundwater seepage. The need for these or other dewatering devices on building pads should be carefully addressed during construction. Our office could be contacted to visually inspect final pads to evaluate the need for such drains.

The ground water seepage may happen several years after construction if the rainfall rate or drainage changes within the project site or outside the project site. If seepage run off occurs towards the residence an engineer should be called on to evaluate its effect and provision of French Drains at this location.

Control Testing and Field Observation

Subgrade preparation and select structural fill placement should be monitored by the project geotechnical engineer or his representative of InTEC. As a guideline, at least one in-place density test should be **performed for each 3,000 square feet of compacted surface lift.** However, a minimum of three density tests should be performed by InTEC on the subgrade or per lift of compaction. Any areas not meeting the required compaction should be re-compacted and retested until compliance is met.

Foundation Construction and Field Observation

It is recommended that all grade beam excavations be extended to the final grade and grade beams constructed as soon as possible to minimize potential damage to the bearing soils. Exposure to environment may weaken the soils at the bearing level if the foundation excavation remains open for long periods of time. The foundation bearing level should be free of loose soil, ponded water or debris. **The bearing level should be inspected by the project geotechnical engineer or his representative of InTEC and approved before placement of concrete.**

Foundation concrete should not be placed on soils that have been disturbed by rainfall or seepage. If the bearing soils are softened by surface water intrusions during exposure or by desiccation, the unsuitable soils must be removed from the foundation excavation and replaced prior to placement of concrete.

DRAINAGE AND MAINTENANCE

Final drainage is very important for the performance of the proposed structures and the pavement. Landscaping, plumbing, and downspout drainage is also very important. It is vital that all roof drainage be **transported away from the building** so that no water ponds around the buildings which can result in soil volume change under the buildings. **Plumbing leaks should be repaired as soon as possible in** order to minimize the magnitude of moisture change under the slab. Large trees and shrubs should not be planted in the immediate vicinity of the structures, since root systems can cause a substantial reduction in soil volume in the vicinity of the trees during dry periods.

Adequate drainage should be provided to reduce seasonal variations in moisture content of foundation soils. **All pavement and sidewalks within 10-ft of the structures should be sloped away from the structures to prevent ponding of water around the foundations.** Final grades within 10-ft of the structures should be adjusted to slope away from structures preferably at a minimum slope of 3 percent. Maintaining positive surface drainage throughout the life of the structures is essential.

In areas with pavement or sidewalks adjacent to the new structures, a positive seal must be provided and maintained between the structures and the pavement or sidewalk to minimize seepage of water into the underlying supporting soils. **Post-construction movement of pavement and flat-work is not uncommon.** Maximum grades practical should be used for paving and flatwork to prevent areas where water can pond. In addition, allowances in final grades should take into consideration post construction movement of flatwork particularly if such movement would be critical. **Normal maintenance should include inspection of all joints in paving and sidewalks, etc. as well as re-sealing where necessary.**

Several factors relate to civil and architectural design and/or maintenance which can significantly affect future movements of the foundation and floor slab systems:

1. Where positive surface drainage cannot be achieved by sloping the ground surface adjacent to the buildings, a complete system of gutters and downspouts should carry runoff water a minimum of 10-ft from the completed structures.

2. Planters located adjacent to the structures should preferably be **self contained.** Sprinkler mains should be located a minimum of five feet from the building line.

3. Planter box structures placed adjacent to building should be provided with a means to assure concentrations of water are not available to the subsoils stratigraphy.

4. Large trees and shrubs should not be allowed closer to the foundations than a horizontal distance equal to roughly their mature height due to their significant moisture demand upon maturing.

5. Moisture conditions should be maintained **"constant" around the edge of the slabs.** Ponding of water in planters, in unpaved areas, and around joints in paving and sidewalks can cause slab movements beyond those predicted in this report.

6. **Roof drains should discharge on pavement** or be extended away from the structures. Ideally, roof drains should discharge to storm sewers by closed pipe.

Trench backfill for utilities should be properly placed and compacted as outlined in this report and in accordance with requirements of local City Standards. Since granular bedding backfill is used for most utility lines, the backfilled trench should be prevented from becoming a conduit and allowing an access for surface or subsurface water to travel toward the new structures. Concrete cut-off collars or clay plugs should be provided where utility lines cross building lines to prevent water traveling in the trench backfill and entering beneath the structures.

The P.V.R. values estimated and stated under Vertical Movements are based on provision and maintenance of positive drainage to divert water away from the structures and the pavement areas. If the drainage is not maintained, the wetted front may move below the assumed twelve feet depth, and resulting **P.V.R. will be much greater than 2 or 3 times the stated values under Vertical Movements. Utility line leaks may contribute water and cause similar movements to occur.**

LIMITATIONS

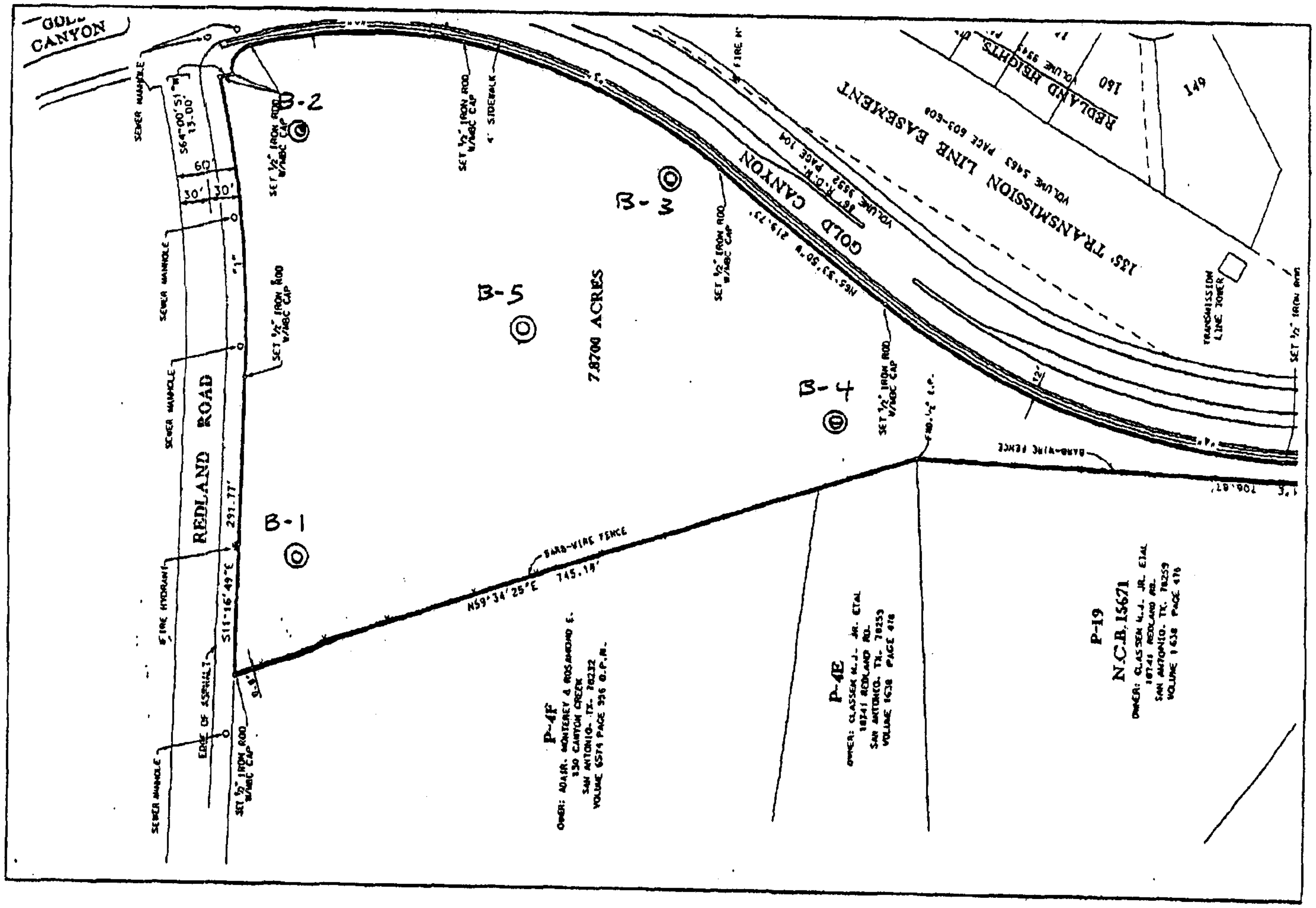
The analysis and recommendations submitted in this report are based upon the data obtained from **five widely spaced borings drilled at the site.** This report may not reflect the exact variations of the soil conditions across the site.

The project geotechnical engineer declares that the findings, recommendations or professional advice contained herein have been made and this report prepared in accordance with generally accepted professional engineering practice in the fields of geotechnical engineering and engineering geology. No other warranties are implied or expressed.

This report is considered to be preliminary and we recommend that additional investigation be performed once building locations, grade and special loading criteria are established.

This report has been prepared for the exclusive use of Ryland Homes for the Preliminary Site Evaluation at the location of **7.91 Acre Tract on the NW Corner of the Redland and Gold Canyon Road intersection in San Antonio, Texas.**

Illustration Section



PROJECT NAME		
Preliminary Soil Survey 7.91 Acre Tract At the NW Corner of Redland and Gold Canyon Road Intersection San Antonio, Texas	PROJECT NO. S041187	DATE May 26, 2004

INTEGRATED TESTING AND ENGINEERING COMPANY

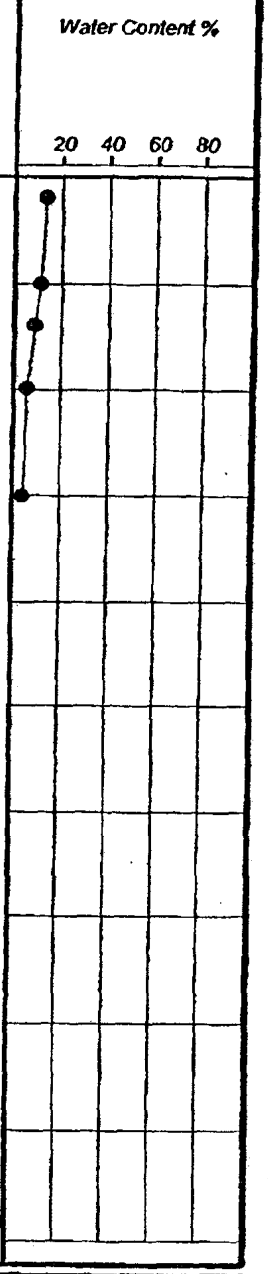
LOG OF BORING NO. B-1

InTEC

PROJECT: 7.91 Acre Tract - Redland & Gold Canyon **DATE:** 5/25/2004

LOCATION: San Antonio, Texas **PROJECT NO:** S041187

DEPTH	SYMBOL	SAMPLES	SUBSURFACE PROFILE: SOIL DESCRIPTION (Surf. Elev.)	UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
		SS	Very Stiff to Hard Dark Brown Clay			36			
		SS	Hard Tan Weathered Limestone						
5		SS	Hard Light Tan Limestone			98/11"		58	39
						50/3"			
		SS							
10						50/2"		32	17
		SS							
15						50/1"			
20									
25									
30									
35									
40									
45									
50									



Completion Depth 15' Ground Water Observed No Date: 5/25/2004

S.S. by P.P.- Shear Strength in TSF by Hand Penetrometer
S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample
L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 2

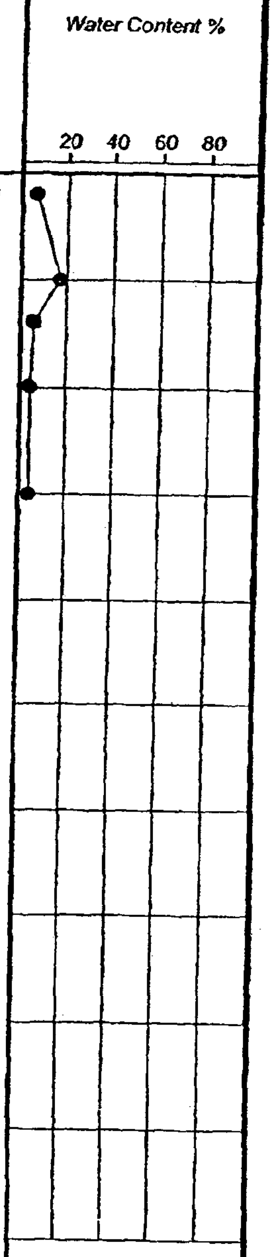
LOG OF BORING NO. B-2

hiTEC

PROJECT: 7.91 Acre Tract - Redland & Gold Canyon **DATE:** 5/25/2004

LOCATION: San Antonio, Texas **PROJECT NO:** S041187

Depth	Symbol	Samples	Soil Description (Surf. Elev.)	Unit Dry Wt. in PCF	S.S. by P.P.	Blows per Foot	Shear Strength TSF	Liquid Limit	Plasticity Index
0		SS	Very Stiff to Hard Dark Brown Clay			80/8"		58	40
		SS	- With Limestone Fragments						
5		SS	Hard Light Tan Limestone			50/6"			
			- With Tan Calcareous Clay Seam at 7'			50/2"		52	35
		AU							
10									
		SS							
15						50/3"			



Completion Depth 15' Ground Water Observed No Date: 5/25/2004

S.S. by P.P.- Shear Strength in TSF by Hand Penetrometer
S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample
L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 3

LOG OF BORING NO. B-3

InTEC

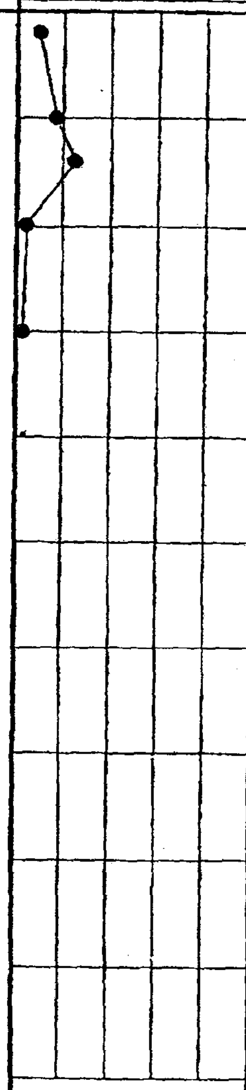
PROJECT: 7.91 Acre Tract - Redland & Gold Canyon **DATE:** 5/25/2004

LOCATION: San Antonio, Texas **PROJECT NO:** S041187

SUBSURFACE PROFILE

DEPTH	SAMPLES	SOIL DESCRIPTION Surf. Elev.	UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
	SS	Very Stiff to Hard Dark Brown Clay			44			
	SS	Hard Tan Weathered Limestone						
5					31			
	SS	- With Calcareous Clay Seams and Chert			50/2"			
		Hard Light Tan Limestone						
	AU							
10								
	SS							
15					50/1"		24	12
20								
25								
30								
35								
40								
45								
50								

Water Content %



Completion Depth 15' Ground Water Observed No Date: 5/25/2004

S.S. by P.P.- Shear Strength in TSF by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample

L.L.- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 4

LOG OF BORING NO. B-4

InTEC

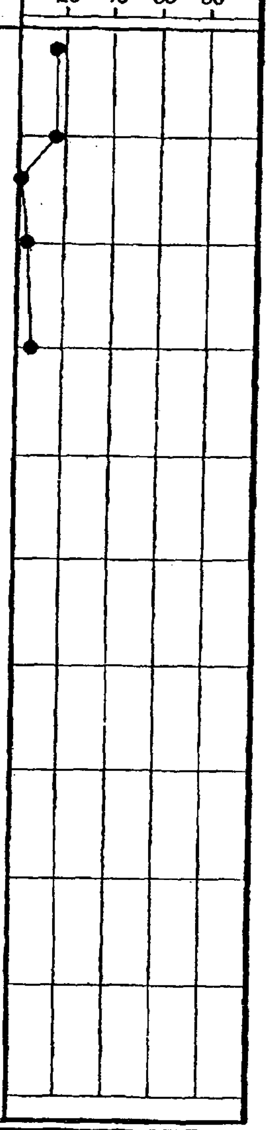
PROJECT: 7.91 Acre Tract - Redland & Gold Canyon **DATE:** 5/25/2004

LOCATION: San Antonio, Texas **PROJECT NO:** S041187

SUBSURFACE PROFILE

DEPTH	SYMBOL	SAMPLES	SOIL DESCRIPTION Surf. Elev.	UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
		SS	Very Stiff to Hard Dark Brown Clay			21		56	38
		SS							
5		SS	Hard Light Tan Limestone			41			
						50/2"		24	13
		SS							
10						50/3"			
		SS							
15						50/2"			
20									
25									
30									
35									
40									
45									
50									

Water Content %



Completion Depth 15' Ground Water Observed No Date: 5/25/2004

S.S. by P.P.- Shear Strength in TSF by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample

L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 5

LOG OF BORING NO. B-5

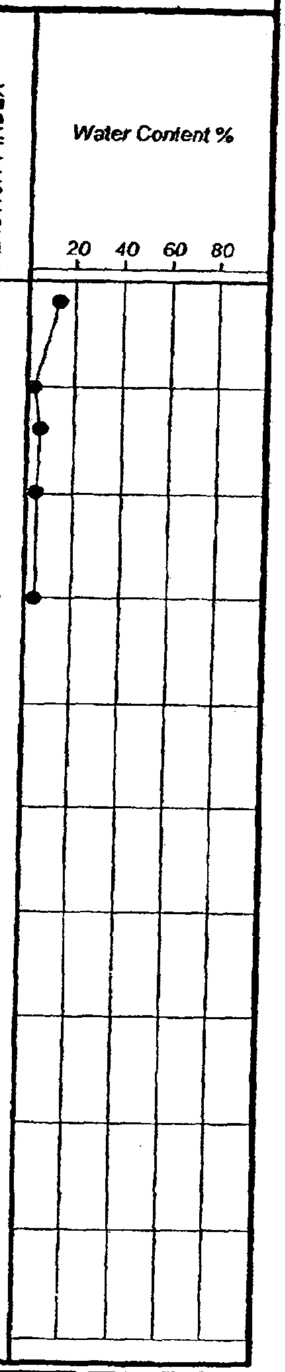
InTEC

PROJECT: 7.91 Acre Tract - Redland & Gold Canyon **DATE:** 5/25/2004

LOCATION: San Antonio, Texas **PROJECT NO:** S041187

SUBSURFACE PROFILE

DEPTH	SYMBOL	SAMPLES	SOIL DESCRIPTION Surf. Elev.	UNIT DRY WT. IN PCF	S.S. BY P.P.	BLOWS PER FOOT	SHEAR STRENGTH TSF	LIQUID LIMIT	PLASTICITY INDEX
		SS	Very Stiff to Hard Dark Brown Clay			51			
			Hard Light Tan Limestone						
		SS							
5		SS				50/2"			
						50/2"			
		SS							
10						50/3"			
		SS							
15						50/2"		21	10
20									
25									
30									
35									
40									
45									
50									



Completion Depth 15' Ground Water Observed No Date: 5/25/2004

S.S. by P.P.- Shear Strength in TSF by Hand Penetrometer

S.S.- Split Spoon Sample
S.T.- Shelby Tube Sample
AU- Auger Sample

L.L- Liquid Limit
P.L.- Plastic Limit
M.C.- Moisture Content

Plate: 6

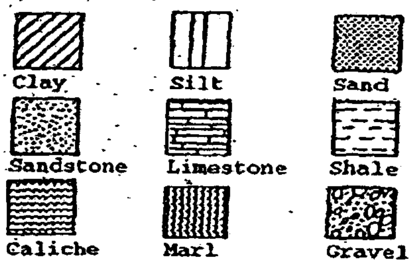
KEY TO CLASSIFICATIONS AND SYMBOLS

Soil Fractions

Component	Size Range
Boulders	Greater than 12"
Cobbles	3" - 12"
Gravel	3" - #4 (4.76mm)
Coarse	3" - ¾"
Fine	¾" - #4
Sand	#4 - #200 (0.074mm)
Coarse	#4 - #10 (2.00mm)
Medium	#10 - #40 (0.42mm)
Fine	#40 - #200 (0.074mm)
Silt and Clay	Less tan #200

Soil or Rock Types

(Shown in symbols column)
(Predominate Soil Types Shown Heavy)



TERMS DESCRIBING SOIL CONSISTENCY

Description (Cohesive Soils	Unconfined Compression TSF	Blows/Ft. Std. Pen. Test
Very soft	0.25	<2
Soft	0.25-0.50	2 - 4
Firm	0.50-1.00	4 - 8
Stiff	1.00-2.00	8 -15
Very stiff	2.00-4.00	15 - 30
Hard	>4.00	>30

Description (Cohesionless Soils	Blows/Ft. Std. Pen. Tests
Very loose	0-4
Loose	4-10
Medium Dense	10-30
Dense	30-50
Very Dense	50

Soil Structure

Calcareous	Containing deposits of calcium carbonate; generally nodular.
Slickensided	Having inclined planes of weakness that are slick and glossy in appearance.
Laminated	Composed of thin layers of varying color and texture.
Fissured	Containing shrinkage cracks frequently filled with fine sand or silt. Usually more or less vertical.
Interbedded	Composed of alternate layers of different soil types.
Jointed	Consisting of hair cracks that fall apart as soon as the confining pressure is removed.
Varved	Consisting of alternate thin layers of sand, silt or clay formed by variations in sedimentation during the various seasons of the year, of often exhibiting contrasting colors when partially dried. Each layer is generally less than ½ inch in thickness.
Stratified	Composed of, or arranged in layers (usually 1 inch or more)
Well-graded	Having a wide range of grain sizes and substantial amounts of all intermediate particle sizes.
Poorly or Gap-graded	Having a range of sizes with some intermediate sizes missing.
Uniformly-graded	Predominantly of one grain size.

Plate 7