ENTECH
ENGINEERING, INC.

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SOIL, GEOLOGY AND GEOLOGIC HAZARD STUDY LINCOLN PLAZA DRIVE AND BRADLEY ROAD SOUTHEAST CORNER EL PASO COUNTY, COLORADO

Prepared for

Harmony Homes
4525 North Park Drive, Suite 210
Colorado Springs, Colorado 80918

Attn: Tom Benkert

April 12, 2005

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Kristen A. Andrew-Hoeser
Professional Engineering Geologist

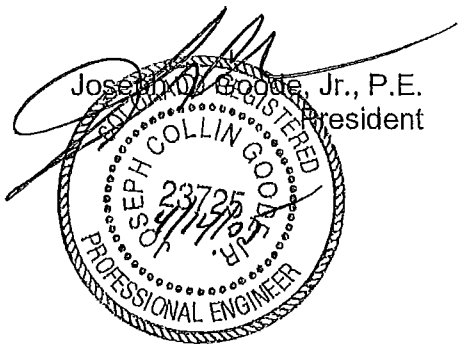
KAH/ek

Encl.

Entech Job No. 37545
2MSW/rep/2005/37545sgws

Reviewed by:

Joseph Collin Goode, Jr., P.E.
President



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1.0 SUMMARY

Project Location

The project lies in a portion of the SE ¼ Section 2, Township 15 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located on Bradley Road, ¾ mile south of the Colorado Springs city limits.

Project Description

Total acreage involved in the project is approximately 16.8 acres. The proposed site development consists of townhomes in the western portions of the site and commercial development on the eastern portions of the site. The development will be serviced by Security Water and Sanitation.

Scope of Report

This report presents the results of our geologic investigation and treatment of engineering geologic hazard study.

Land Use and Engineering Geology

This site was found to be suitable for the proposed development. Areas were encountered where the geologic conditions will impose some minor constraints on development and land use. These include areas of artificial fill, expansive soils, and hydrocompaction. Based on the proposed development plan, it appears that these areas will have some impact on the development. These conditions will be discussed in greater detail in the report.

In general, it is our opinion that the development can be achieved if the observed geologic conditions on site are either avoided or properly mitigated. All recommendations are subject to the limitations discussed in the report.

2.0 GENERAL SITE CONDITIONS AND PROJECT DESCRIPTION

The site is located in a portion of the SE ¼ Section 2, Township 15 South, Range 66 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located ¾ mile south of the Colorado Springs City limits on Bradley Road. The approximate location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site is very gently sloping generally to the south. The site boundaries are indicated on the USGS Map, Figure 2. Previous land uses have included open space and rangeland. Small fill piles were observed on the site. The site contains primarily low grasses and field weeds. No drainages exist on the site; however, the Fountain Mutual Irrigation ditch is piped underground beneath the extreme northeast corner of the site. Development is not proposed at this corner. Previously, Little Johnson Reservoir existed north of the site across Bradley Road. Aerial Photographs from 1979 show the reservoir area without any water. No areas of ponded water were observed at the time of this investigation. Low areas with internal drainage exist on the site. These areas are minor in extent and vegetation is indicative of dry conditions that do not collect water. Site Photographs are included in Appendix A. The approximate locations and directions of the photographs are indicated on Figure 3.

According to the *Phase I Environmental Site Assessment* prepared for the site by Entech Engineering, Inc. (Reference 1), a plume of contamination associated with Schlage Lock Company extends west of the site. It appears that the plume is migrating to the west and there are no indications that it extends beneath this site. Refer to the *Phase I Environmental Site Assessment* (Reference 1) for specific discussions concerning environmental conditions.

Total acreage involved in the proposed development is approximately 16.8 acres. Multi-family residential and commercial development is proposed. A development plan for the commercial portion, proposed on the eastern half of the site, was not available at the time of this investigation. The development plan for the western portion of the site, consisting of townhomes, is presented in Figure 3A. The area will be serviced by Security Water and Sanitation.

3.0 SCOPE OF THE REPORT

The scope of the report will include the following:

- A general geologic analysis utilizing published geologic data. Detailed site-specific mapping will be conducted to obtain general information in respect to major geographic and geologic features, geologic descriptions and their effects on the development of the property.

4.0 FIELD INVESTIGATION

Our field investigation on this site consisted of the preparation of a geologic map of any bedrock features and significant surficial deposits. The Soil Conservation Service (SCS) survey was also reviewed to evaluate the site. The position of mappable units within the subject property are shown on the Geologic Map. Our mapping procedures involved both field reconnaissance and measurements and air photo reconnaissance and interpretation. The same mapping procedures have also been utilized to produce the Engineering Geology Map which identified pertinent geologic conditions affecting development. The field mapping was performed by personnel of Entech Engineering, Inc. on February 22, 2005.

A subsurface investigation was performed as a part of the field investigation. This investigation consisted of drilling 8 test borings. The borings were drilled with a power driven continuous flight auger drill rig to 20 feet. Samples were obtained during drilling using the Standard Penetration Test, ASTM D-1586, utilizing a 2-inch O.D. Split Barrel Sampler and a California Sampler. Results of the penetration tests are shown on the drilling logs to the right of the sampling point. The drilling logs are included in Appendix B of this report. The locations of the test borings are shown on the Test Boring Location Plan, Figure 3.

Laboratory testing was performed on some of the soils to classify and determine the soils engineering characteristics. Laboratory tests include moisture content, ASTM D-2216, grain-size analysis, ASTM D-422, and Atterberg Limits, ASTM D-4318. Swell testing included FHA Swell Testing and Swell/ Consolidation Testing. Results of the laboratory testing are included in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

A *Soil, Geology, and Geologic Hazard Study* was prepared for a site immediately north of this site by Entech Engineering, Inc., dated September 15, 2002 (Reference 2). Information from this report was used in evaluating the site.

5.0 SOIL, GEOLOGY AND ENGINEERING GEOLOGY

5.1 General Geology

Physiographically, the site lies in the western portion of the Great Plains Physiographic Province. Approximately 6½ miles to the west is a major structural feature known as the Ute Pass Fault. This fault, with the Rampart Range Fault to the north, marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within the southern edge of a large structural feature known as the Denver Basin. Bedrock in the area tends to be very gently dipping in a northerly direction. The rocks in the area of the site are sedimentary in nature, and typically Cretaceous in age. The bedrock underlying the site consists of the Pierre Shale Formation. Overlying this formation are unconsolidated deposits of man-made fill and Eolian sand deposits of the Quaternary Age. The Eolian sands were deposited by wind in the form of low ridges or dunes. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Service

The Soil Conservation Service has mapped 1 soil type on the site (Figure 4)(Reference 3). In general, the soils consist of brown loamy sand grading to pale brown sand. The soils are described as follows:

Type	Description
8	Blakeland loamy sand, 1-9% slopes

Complete descriptions of the soil type are presented in Figure 5. The soils have generally been described to have rapid permeabilities. The soils have been described by the Soil Conservation Service to provide good potential for urban development. The main limitation includes soil blowing if protective vegetation is removed. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The majority of the soils have been described to have moderate to severe erosion hazards.

5.3 Site Stratigraphy

The Colorado Springs Geology Map by Scott and Wobus, 1973, showing the site is presented in Figure 6 (Reference 4). The Elsmere Quadrangle Geology Map by Madole and Thorson, 2003 is presented in Figure 7 (Reference 5). The Geology Map prepared for the site is presented in Figure 8. Two mappable units were identified on this site which are identified as follows:

- **Qaf** **Artificial Fill of Quaternary Age:** These man-made fill deposits are associated with areas of fill and grading and minor fill piles. Areas of fill may be encountered on other areas of the site. Unless records can be obtained, the fill will be considered uncontrolled for construction purposes.

- **Qes** **Eolian Sand of Quaternary Age:** These are wind blown fine grained sands that were deposited by the action of the prevailing winds from the west and northwest. They typically occur as large dune deposits or narrow ridges. The soils are typically tan to brown and have a uniform gradation. The materials tend to have a high permeability and low density.

The bedrock underlying the site is the Pierre Shale Formation of Cretaceous Age. The Pierre Shale Formation typically consists of claystone and gray shale. Bedrock was encountered at 18 feet in Test Boring No. 8. Bedrock was not encountered in any of the other test borings which were drilled to 20 feet.

The soils listed above were mapped from the *Reconnaissance Geologic Map, Colorado Springs and Vicinity, Colorado*, distributed by the USGS in 1973 (Reference 4, Figure 6), *The Geology Map of the Elsmere Quadrangle* distributed by the Colorado Geological Survey in 2003

(Reference 5, Figure 7) and the *Geologic Map of The Colorado Springs-Castle Rock Area*, distributed by the USGS in 1979 (Reference 6). The Robinson Study prepared for El Paso County Planning Department in 1977 (Reference 7) and the test borings drilled by Entech Engineering, Inc. were also used in evaluating the site. The Geology Map prepared for the site is presented in Figure 8.

5.4 Soil Conditions

The soils encountered in the test borings consisted of clayey, silty sand fill (SC-SM) and silty to slightly silty sands (SW-SM, SM) overlying sandy clays (CL) and sandy claystone (CL) using the Unified Soil Classification System (USCS). These soils were encountered at loose to medium dense states and moist conditions. The clay soils and claystone encountered are slightly expansive. A swell of 0.2% was measured in the Swell/ Consolidation Test on the clays. A swell of 0.4% was measured in the Swell/ Consolidation Test on the claystone. Bedrock was encountered at 18 feet in Test Boring No. 8. Bedrock was not encountered in any of the other test borings which were drilled to 20 feet. A Summary of Laboratory Test Results is presented in Table 1. Individual Laboratory Test Results are included in Appendix C.

5.5 Groundwater

Groundwater was not encountered in any of the test borings which were drilled to 20 feet. Shallow groundwater is not expected to affect shallow foundations on this site, however, fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time. The site does not lie with any floodplain zones according to the FEMA Map No. 08041CO763F (Figure 9, Reference 8).

It should be noted that in the sandy materials on site, some groundwater conditions might be encountered due to the variability in the soil profile. Isolated sand and gravel layers within the soils, sometimes only a few feet in thickness and width, can carry water in the subsurface. Groundwater may also flow on top of the underlying bedrock or clay lenses. Builders and planners should be cognizant of the potential for the occurrence of such subsurface water features during construction on-site and deal with each individual problem as necessary at the time of construction.

6.0 ENGINEERING GEOLOGY – IDENTIFICATION AND MITIGATION OF GEOLOGIC HAZARDS

As mentioned previously, detailed mapping has been performed on this site to produce an Engineering Geology Map (Figure 8). This map shows the location of various geologic conditions of which the developers should be cognizant during the planning, design and construction stages of the project. These hazards and the recommended mitigation techniques are as follows:

af *Artificial Fill*

These are areas of man-made fill associated with graded fill areas and fill piles on site.

Mitigation: It is anticipated that the fill piles would be removed during site grading. Any uncontrolled fill be encountered beneath foundations will require removal and recompaction at 90% of Modified Proctor Dry Density, ASTM D-1557.

h *Hydrocompaction:* Areas in which this hazard has been identified are acceptable as building sites. However, in areas identified for this hazard classification, we anticipate a potential for settlement movements upon saturation of these surficial soils. The low density, uniform grain sized, windblown sand deposits are particularly susceptible to this type of phenomenon.

Mitigation: The potential for settlement movement is directly related to saturation of the soils below the foundation areas. Therefore, good surface and subsurface drainage is extremely critical in these areas in order to minimize the potential for saturation of these soils. The ground surface around all permanent structures should be positively sloped away from the structure to all points, and water must not be allowed to stand or pond anywhere on the site. We recommend that the ground surface within 10 feet of the structures be sloped away with a minimum gradient of ten percent. If this is not possible on the upslope side of the structures, then a well-defined swale should be created to intercept the surface water and carry it quickly and safely around and away from the structures. Roof drains should be made to discharge well away from the structures and into areas of positive drainage. Where several structures are involved, the overall

drainage design should be such that water directed away from one structure is not directed against an adjacent building. Planting and watering in the immediate vicinity of the structures, as well as general lawn irrigation, should be minimized.

Additionally, loose or collapsible soils may be encountered on the site. Should loose or collapsible soils be encountered beneath foundations, removal and recompaction of the upper 2 to 3 feet with thorough moisture conditioning at 90% of Modified Proctor Dry Density, ASTM D-1557 will be necessary. Specific recommendations should be made after additional investigation of each building site.

ex *Expansive Soils:* Expansive soils were encountered at 17 and 14 feet below the surface in Test Boring Nos. 7 and 8, respectively. Expansive soils were not encountered in any of the other test borings which were drilled to 20 feet. The site is mapped within an area of windblown sand or silt according to the *Map for Potentially Swelling Soil and Rock in the Front Range Urban Corridor, Colorado* distributed by the Colorado Geological Survey in 1974 (Reference 9). This mapping generally has low swell potential, but the upper 6 to 12 inches may locally have moderate swell potential. Additionally, the thickness of the deposit is very variable therefore, the bedrock, having high swell potential, may be locally less than 10 feet as described by Hart (Reference 9). Bedrock was encountered at 18 feet in Test Boring No. 8. Expansive clays may be encountered in the subsurface, particularly in the northeast portion of the site. These clays can cause differential movement in the structure foundations. These occurrences should be identified and dealt with on an individual basis.

Mitigation: Should expansive soils be encountered within 3 to 4 feet of foundation members, mitigation may be necessary. Mitigation of expansive soils on this site will require special foundation design. Overexcavation of 3 to 4 feet of expansive material encountered beneath foundations and replacement with non-expansive soils at a minimum of 90% of Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation which is common in the area. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. Final recommendations should be determined after additional investigation of each building site.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be multi-family residential and commercial. It is our opinion that the existing geologic and engineering geologic conditions will impose some minor constraints on the proposed development and construction. The most significant problem affecting development will be that of hydrocompaction which may be satisfactorily mitigated through proper engineering design and construction practices.

The upper soils are typically at loose to moderately dense states. Foundations anticipated for the site are standard spread footings. Areas of collapsible or loose soils may be encountered that require removal and recompaction. The soils should be thoroughly moisture conditioned and compacted at a minimum of 90% of Modified Proctor Dry Density, ASTM D-1557.

Typically the soils in the area are non-expansive. Slightly expansive soils were encountered in two of the test borings in the northeast portion of the site. If expansive soils are encountered beneath foundations, mitigation may be necessary. Overexcavation of 3 to 4 feet of the expansive soil and replacement with non-expansive structural fill compacted at a minimum of 90% of Modified Proctor Dry Density, ASTM D-1557 is a typical mitigation used in the area. The need for mitigation should be determined on an individual basis at the time of construction. These soils will not prohibit development.

Areas of hydrocompaction can occur across the entire site. The potential for settlement is directly related to saturation of the soils. The ground surface should be positively sloped away from all structures and roof drains should discharge well away from structures. The drainage design should be such that water directed away from one structure is not directed against an adjacent building. Planting and watering around structures should also be minimized.

Excavation of site materials should be easy with rubber-tired equipment. The on-site nonexpansive granular soils are suitable for use as fill materials if properly compacted. Loose or collapsible soils will require reworking prior to fill placement. All topsoil, organics, soft soils, or uncontrolled fill should be removed prior to any fill placement.

In summary, development of the site can be achieved if the items mentioned above are mitigated. These items can be mitigated through proper design and construction.

7.0 ECONOMIC MINERAL RESOURCES

Some of the sandy materials on-site could be considered a low grade sand resource. According to the *El Paso County Aggregate Resource Evaluation Map* (Reference 10), the site is mapped as Eolian deposits: wind blown sands. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 11), the site is mapped as E3: wind-deposited sand (eolian). According to the *Evaluation of Mineral* and *Mineral Fuel Potential of El Paso County State Mineral Lands by the Colorado Geological Survey* (Reference 12), the site is mapped as "Good" for industrial minerals. Alluvial and eolian deposits are commonly mined in the area for sand and gravel, particularly in the Eolian Sand and Verdos Alluvium deposits. No gravel quarries are known to have existed on the site itself. Considering the silty nature of the materials on-site and the abundance of similar materials through the region, they would be considered to have little significance as an economic resource.

According to *the Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands* (Reference 12), the tracts in the area of the site have been mapped as "Little or no Potential" for coal resources or metallic mineral resources.

The site has been mapped as "Fair" for oil and gas resources (Reference 12). No oil or gas fields or wells have been discovered or drilled in the area of the site. The sedimentary rocks in the area contain the essential elements for oil or gas; however, the geologic structure is not known to be sufficient to produce traps or reservoirs.

8.0 EROSION CONTROL

The soil types observed on the site are mildly to highly susceptible to wind erosion, and moderately to highly susceptible to water erosion. A minor wind erosion and dust problem may be created for a short time during and immediately after construction. Should the problem be considered severe enough during this time, watering of the cut areas or the use of chemical palliative may be required to control dust. However, once construction has been completed and vegetation reestablished, the potential for wind erosion should be considerably reduced.

With regard to water erosion, loosely compacted soils will be the most susceptible to water erosion, residually weathered soils and weathered bedrock materials become increasingly less susceptible to water erosion. For the typical soils observed on this site, allowable velocities for unvegetated and unlined earth channels for the soils on this site would be on the order of 3 to 4 feet/second, depending upon the sediment load carried by the water. Permissible velocities may be increased through the use of vegetation to something on the order of 4 to 7 feet/second, depending upon the type of vegetation established. Should the anticipated velocities exceed these values, some form of channel lining material may be required to reduce erosion potential. These might consist of some of the synthetic channel lining materials on the market or conventional riprap. In cases where ditch-lining materials are still insufficient to control erosion, small check dams or sediment traps may be required. The check dams will serve to reduce flow velocities, as well as provide small traps for containing sediment. The determination of the amount, location and placement of ditch linings, check dams and of the special erosion control features should be performed by or in conjunction with the drainage engineer who is more familiar with the flow quantities and velocities.

Cut and fill slope areas will be subjected primarily to sheetwash and rill erosion. Unchecked rill erosion can eventually lead to concentrated flows of water and gully erosion. The best means to combat this type of erosion is, where possible, the adequate re-vegetation of cut and fill slopes. Cut and fill slopes having gradients more than three (3) horizontal to one (1) vertical become increasingly more difficult to revegetate successfully. Therefore, recommendations pertaining to the vegetation of the cut and fill slopes may require input from a qualified landscape architect and/or the Natural Resource Conservation Service (previously the Soil Conservation Service).

9.0 CLOSURE

It is our opinion that the existing geologic engineering and geologic conditions will impose some constraints on development and construction of the site. The majority of these conditions can be mitigated by proper engineering and construction practices. The proposed development and use is consistent with anticipated geologic and engineering geologic conditions.

It should be pointed out that because of the nature of data obtained by random sampling of such variable and nonhomogeneous materials as soil and rock, it is important that we be informed of any differences observed between surface and subsurface conditions encountered in construction and those assumed in the body of this report. Construction and design personnel should be made familiar with the contents of this report. Reporting such discrepancies to Entech Engineering, Inc. soon after they are discovered would be greatly appreciated and could possibly help avoid construction and development problems.

This report has been prepared for the Harmony Homes for application to the proposed project in accordance with generally accepted geologic soil and engineering practices. No other warranty expressed or implied is made.

We trust that this report has provided you with all the information that you required. Should you require additional information, please do not hesitate to contact Entech Engineering, Inc.

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TABLE

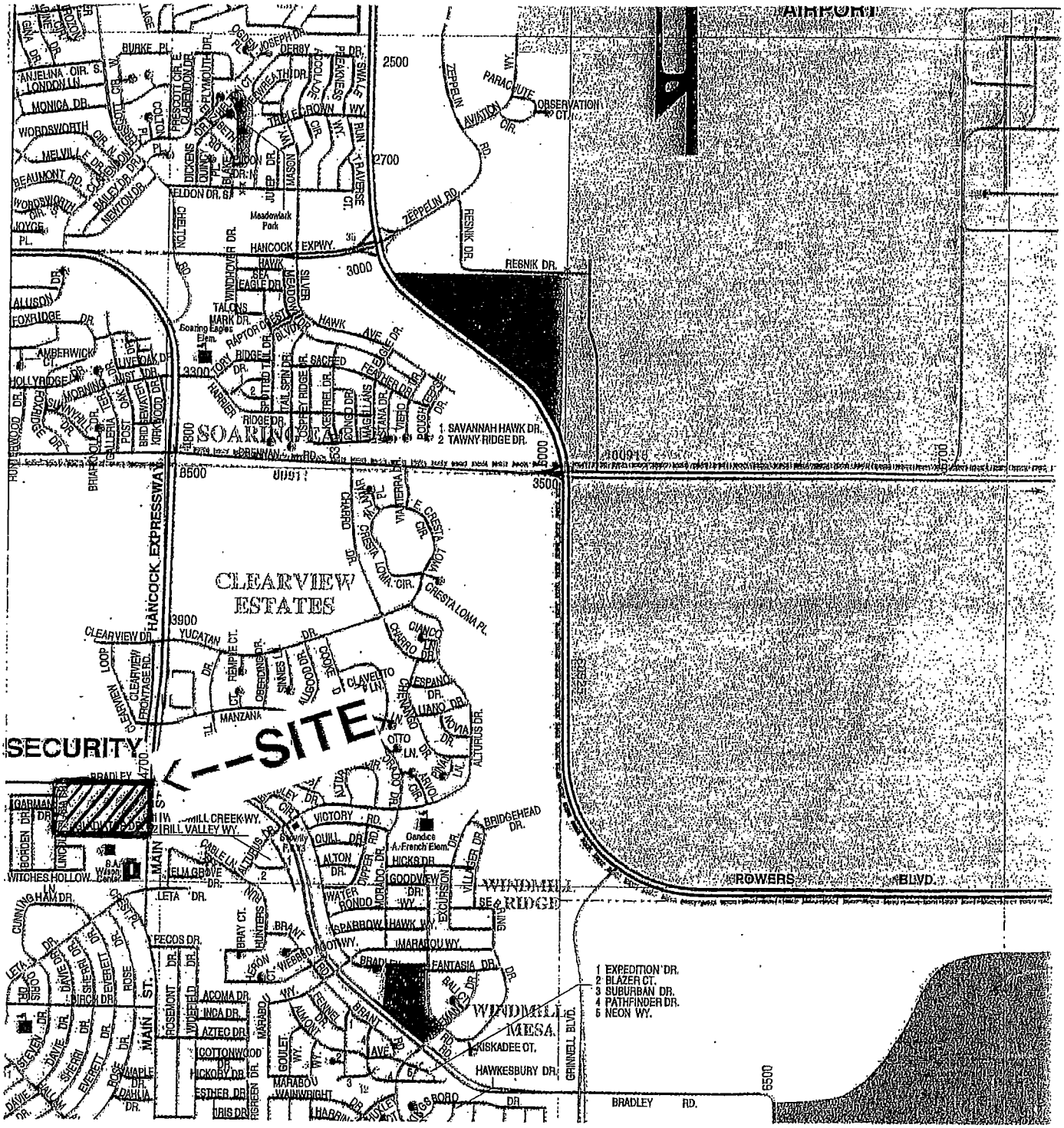
TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT HARMONY HOMES
PROJECT LINCOLN PLAZA & BRADLY RD.
JOB NO. 37545

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	TB-3	2-3'	35.1%	22	6			SC-SM	FILL, SAND, CLAYEY-SILTY
2	TB-1	2-5'	12.4%					SM	SAND, SILTY
2	TB-4	10'	6.9%					SM-SW	SAND, SLIGHTLY SILTY
2	TB-5	2-5'	9.5%	NV	NP			SM-SW	SAND, SLIGHTLY SILTY
2	TB-8	4'	18.3%					SM	SAND, SILTY
3	TB-7	20'	77.8%	35	20			CL	CLAY, SANDY
3	TB-7	20'					0.2%	CL	CLAY, SANDY
4	TB-8	20'	75.3%	36	21			CL	CLAYSTONE, SANDY
4	TB-8	20'					0.4%	CL	CLAYSTONE, SANDY

FIGURES



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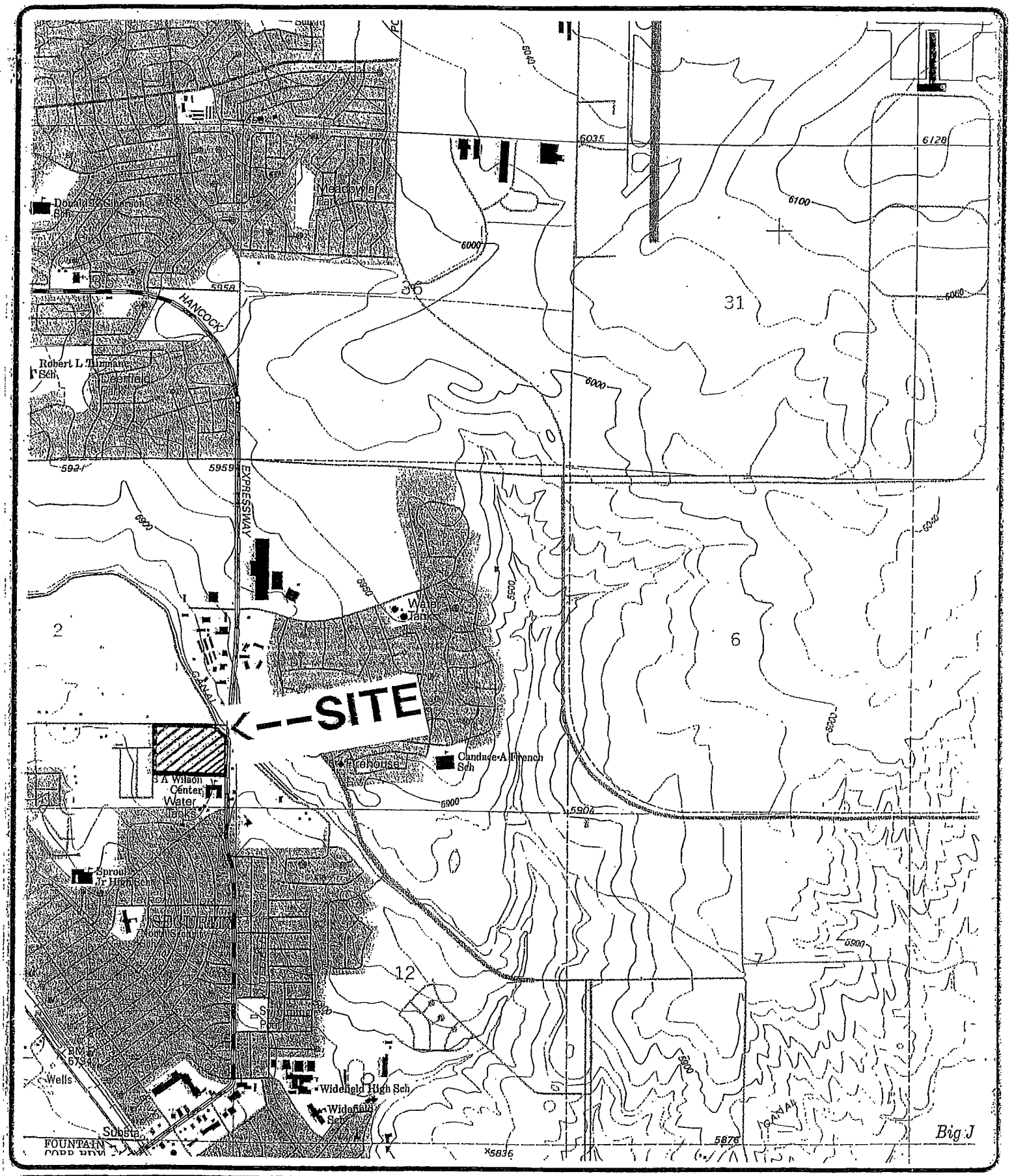
VICINITY MAP

DRAWN:	DATE:	CHECKED:	DATE:
			1/10/05

JOB NO.: 37545
FIG NO.: 1

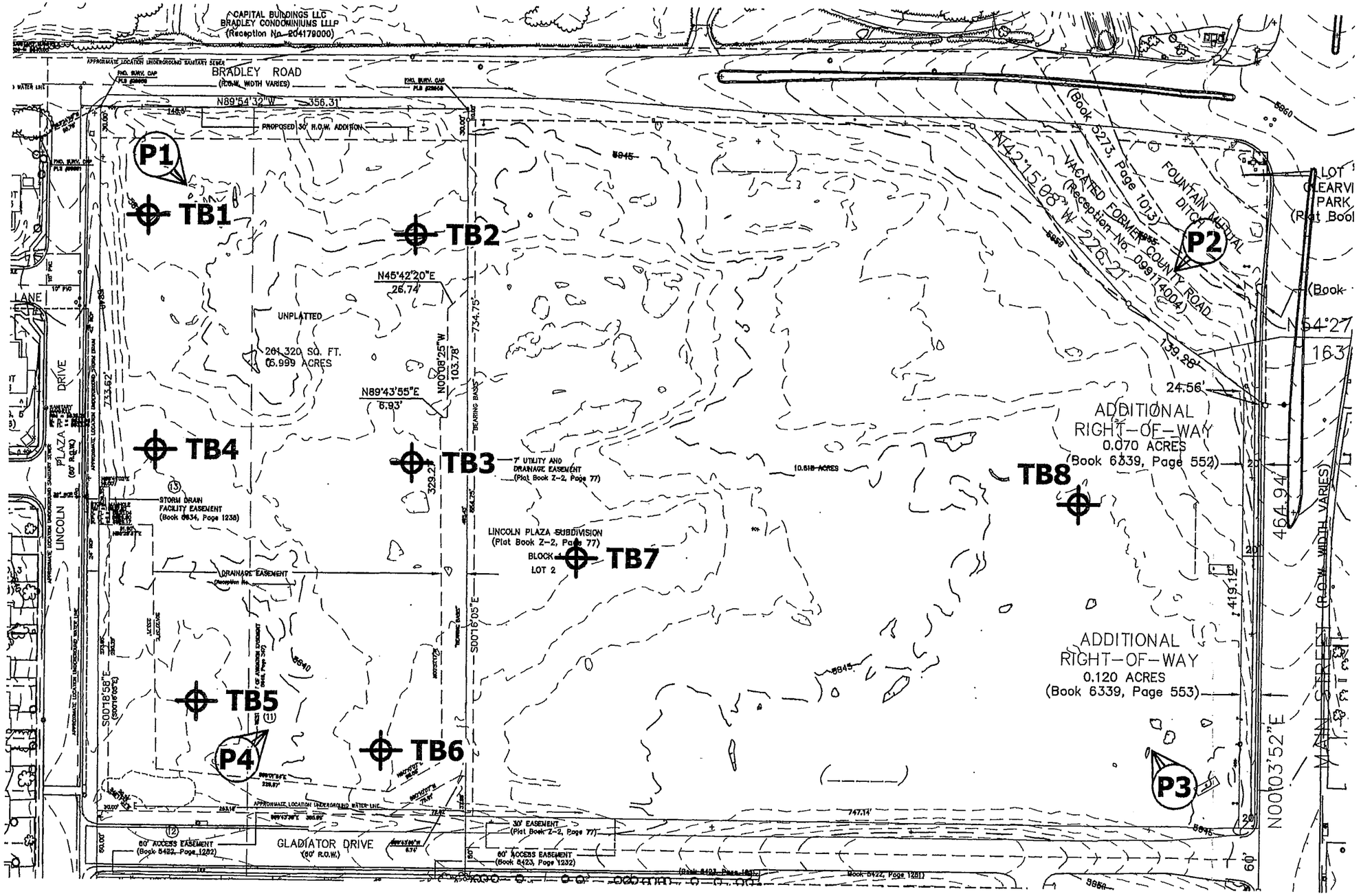


ENTECH ENGINEERING, INC.
565 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

USGS MAP

DRAWN:	DATE:	CHECKED:	DATE:
		AP	1/13/05

JOB NO.: 37545
FIG NO.: 2



LEGEND

TB - approximate location of Test Boring

P# - approximate Photograph location, direction and number

REVISION	BY

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
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DEVELOPMENT PLAN/ TEST BORING LOCATION PLAN
BRADLEY ROAD & LINCOLN PLAZA
EL PASO COUNTY, CO.
FOR: HARMONY HOMES

DRAWN	R.J.OLSON
CHECKED	
DATE	16MAR06
SCALE	1" = 100'
JOB NO.	37545
FIGURE No.	3

M:\2005\GEOHAZ_MAPS\37545_BRADLEY AND LINCOLN PLAZA\37545(BRADLEY AND LINCOLN PLAZA)GEO.dwg, 4/4/2006 12:20:04 PM, 1:1

ZONE: P.B.P.

BRADLEY ROAD (MINOR ARTERIAL 110' R.O.W.)
(R.O.W. WIDTH VARIES)

N89°54'32"W 356.31'

PROPOSED 30' R.O.W. ADDITION

6' CEDAR FENCE ON PERIMETER OF PROPERTY

20' BUILDING SETBACK (MINOR ARTERIAL)

25' BUILDING SETBACK (ADJACENT TO NON RESIDENTIAL)

TOTAL SITE AREA:
261,320 SQ. FT.
5.999 ACRES

N45°42'20"E
26.74'

N89°43'55"E
6.93'

7' UTILITY AND DRAINAGE EASEMENT (Plat Book Z-2, Page 77)

ZONE: P.B.P.
LINCOLN PLAZA SUBDIVISION
(Plat Book Z-2, Page 77)
BLOCK 1
LOT 2

TRACT 'B' (SEE NOTE DP1) DRAINAGE EASEMENT (DIMENSION VARIES)

S00°16'05"E

WITCHES HOLLOW LANE

ZONE: R-2

BRADLEY RANCH FILING NO. 5
(Reception No. 9507A288)

GARMEN DRIVE

LINCOLN PLAZA DRIVE (NON ARTERIAL 60' R.O.W.)

BRADLEY RANCH FILING NO. 3
PHASE 2
(Plat Book B-4, Page 61)

ZONE: R-2

GLADIATOR DRIVE
(60' R.O.W.)

60' ACCESS EASEMENT (Book 5422, Page 1252)

30' EASEMENT (Plat Book Z-2, Page 77)

60' ACCESS EASEMENT (Book 5423, Page 1232)

S89°43'38"E 355.64' (356.26')

ZONE: R-2

BRADLEY RANCH FILING NO. 4
PHASE 1
(Plat Book H-5, Page 29)

LOT 11

N

REVISION	BY

ENTECH ENGINEERING, INC.
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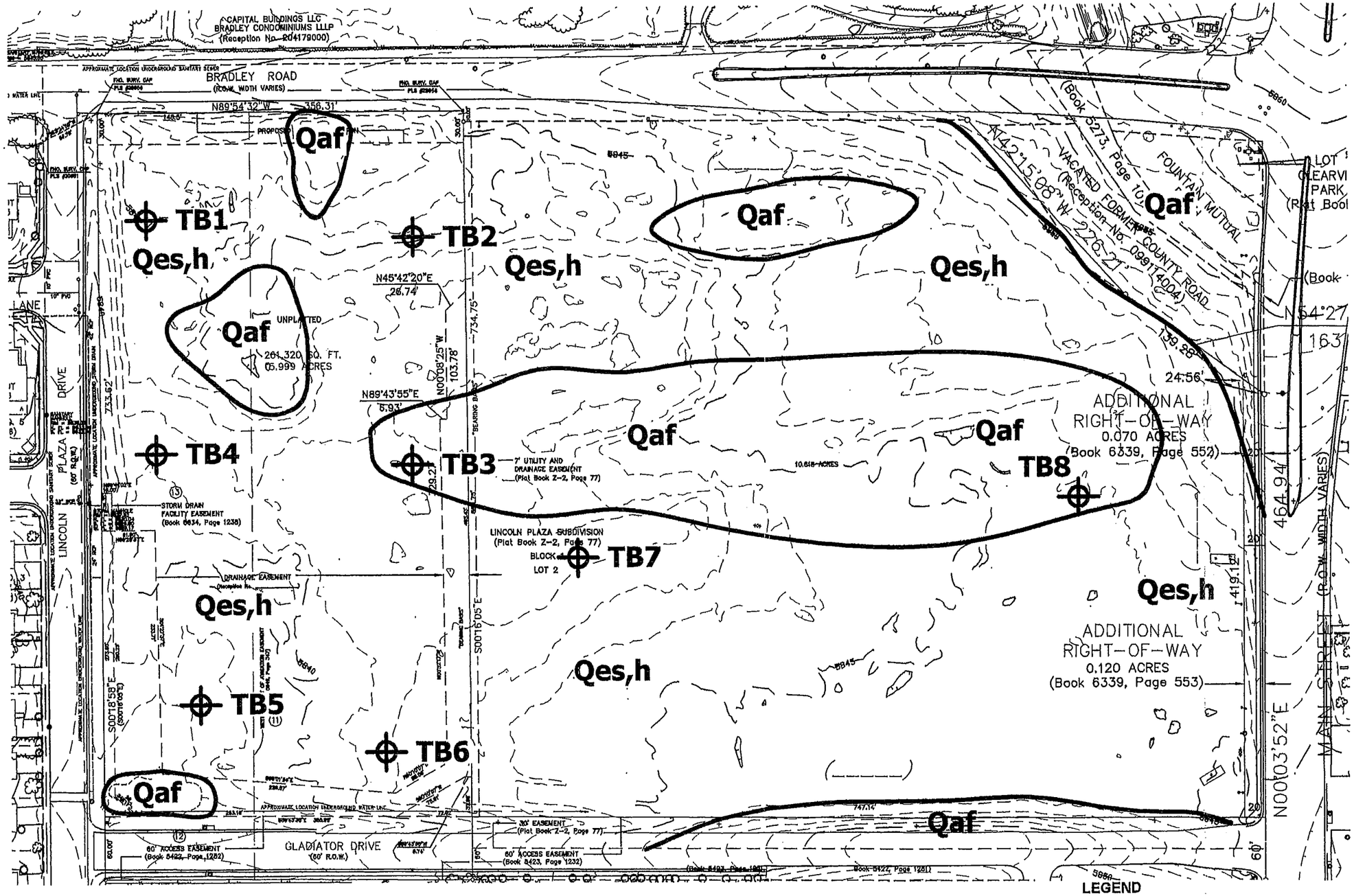
TOWNHOME DEVELOPMENT PLAN
BRADLEY ROAD & LINCOLN PLAZA
EL PASO COUNTY, CO.
FOR: HARMONY HOMES

DRAWN	R.J.OLSON
CHECKED	
DATE	4APR05
SCALE	1" = 100'
JOB NO.	97540
FIGURE No.	3A



LEGEND

Qaf - Artificial Fill of Quaternary Age:
Man made fill deposits.

Qes - Eolian Sand of Quaternary Age:
Wind blown sand deposits.

h - hydrocompaction

TB - approximate location of Test Boring

REVISION	BY

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GEOLOGY/ ENGINEERING GEOLOGY PLAN
BRADLEY ROAD & LINCOLN PLAZA
EL PASO COUNTY, CO.
FOR: HARMONY HOMES

DRAWN	R.J.OLSON
CHECKED	
DATE	10MAR05
SCALE	1" = 100'
JOB NO.	37545
FIGURE No.	8

2005\GEOHAZ MAPS\37545_BRADLEY AND LINCOLN PLAZA\37545(BRADLEY AND LINCOLN PLAZA)GEO.dwg, 3/10/2005 9:10:24 AM, 1:1

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No. base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

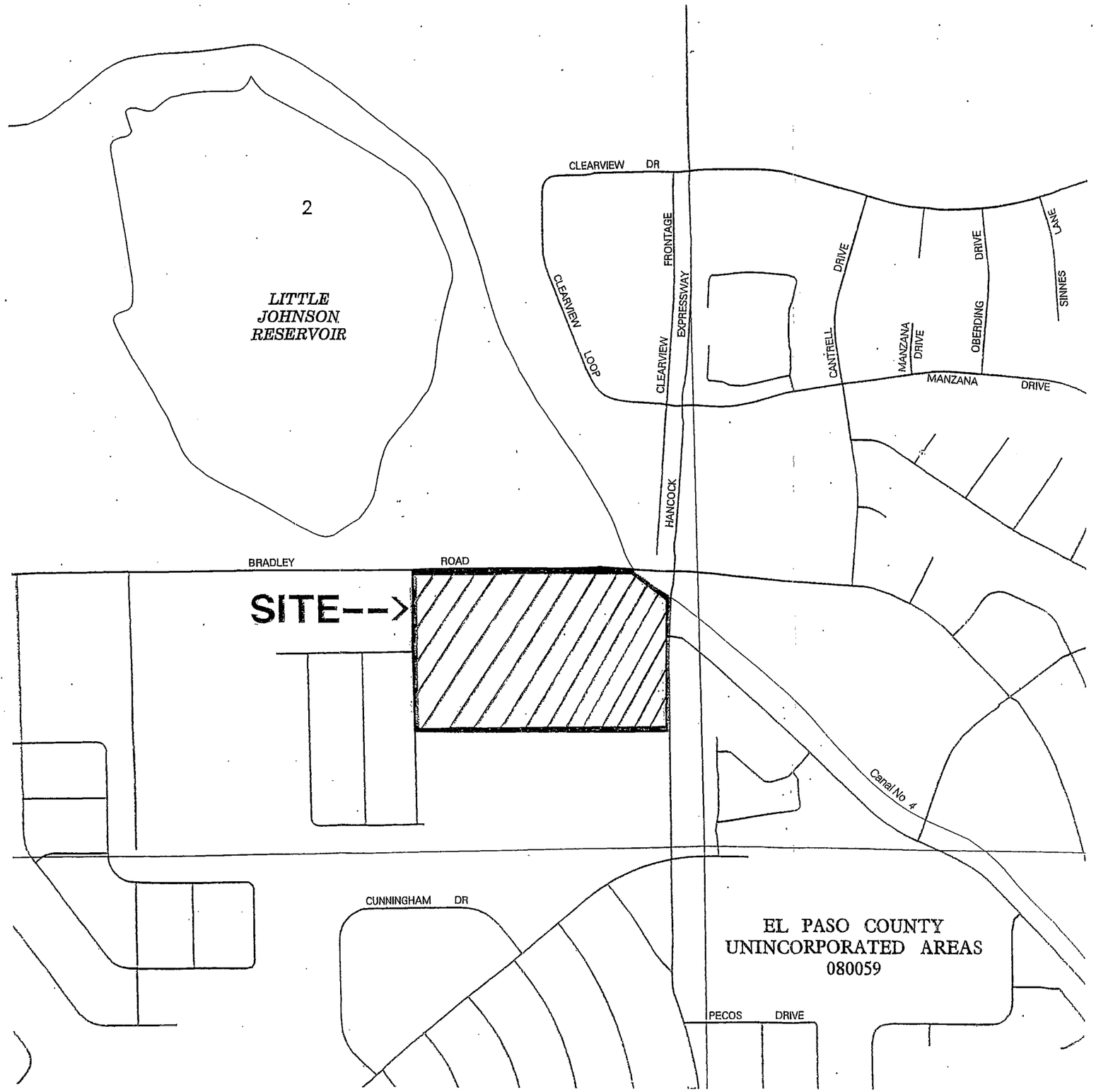
D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.



REVISION	BY

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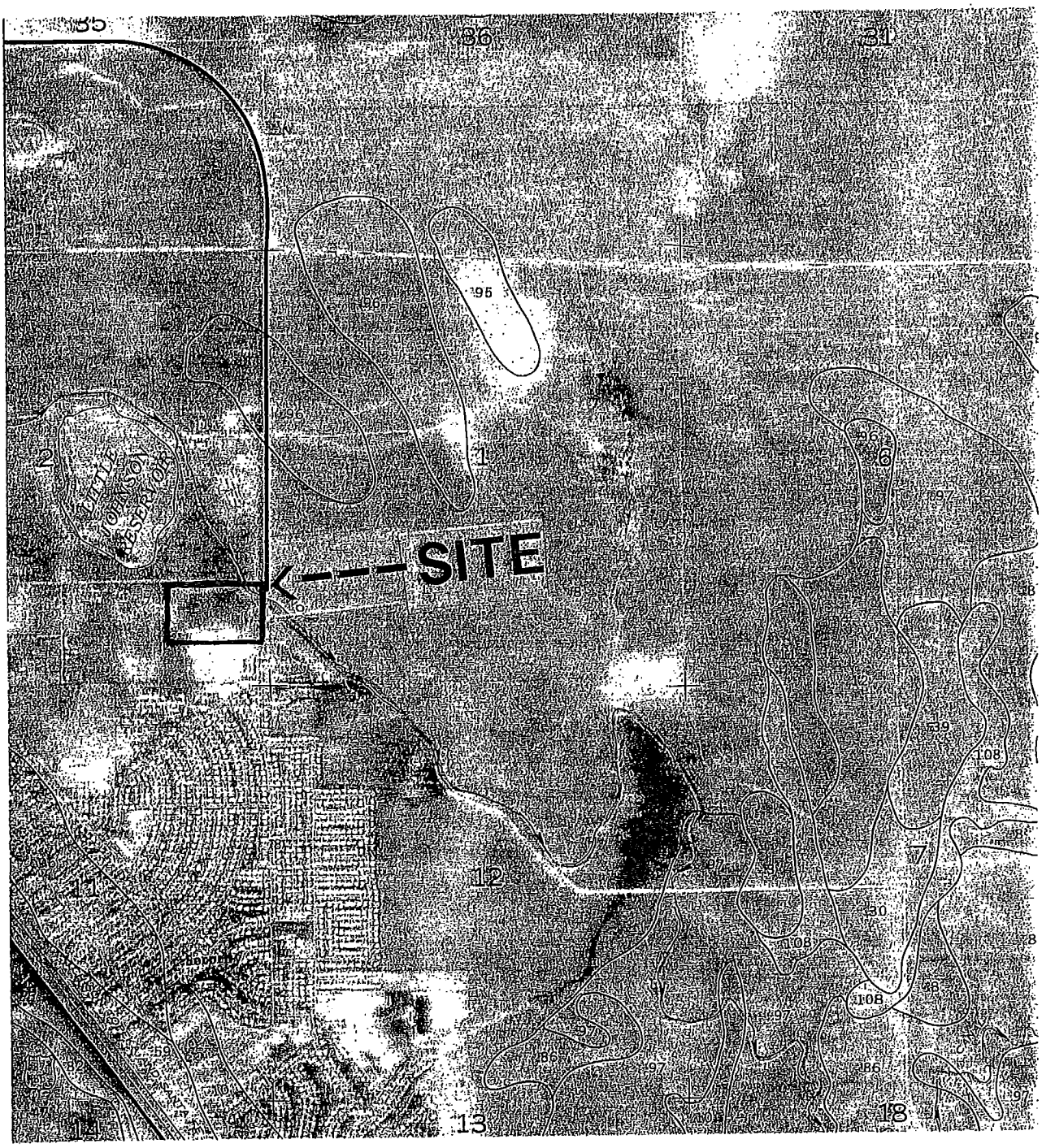
FLOODPLAIN MAP

DRAWN
CHECKED
DATE 11/23/05
SCALE NTS
JOB NO. 375095
FIGURE No. 2



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SCS MAP

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/15/05

JOB NO.: 37545
FIG NO.: 4

8—**Blakeland loamy sand, 1 to 9 percent slopes.** This deep, somewhat excessively drained soil formed in alluvial and eolian material derived from arkosic sedimentary rock on uplands. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the average frost-free period is about 135 days.

Typically, the surface layer is dark grayish brown loamy sand about 11 inches thick. The substratum, to a depth of 27 inches, is brown loamy sand; it grades to pale brown sand that extends to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser sandy loam, 0 to 3 percent slopes; Bresser sandy loam, 3 to 5 percent slopes; Truckton sandy loam, 0 to 3 percent slopes; Truckton sandy loam, 3 to 9 percent slopes; and Stapleton sandy loam, 3 to 8 percent slopes. In some areas, mainly north of Colorado Springs in the Cottonwood Creek area, arkosic beds of sandstone and shale are at a depth of 0 to 40 inches.

Permeability of this Blakeland soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low to moderate. Organic matter content of the surface layer is medium. Surface runoff is slow, the hazard of erosion is moderate, and the hazard of soil blowing is severe.

Most areas of this soil are used for range, homesites, and wildlife habitat.

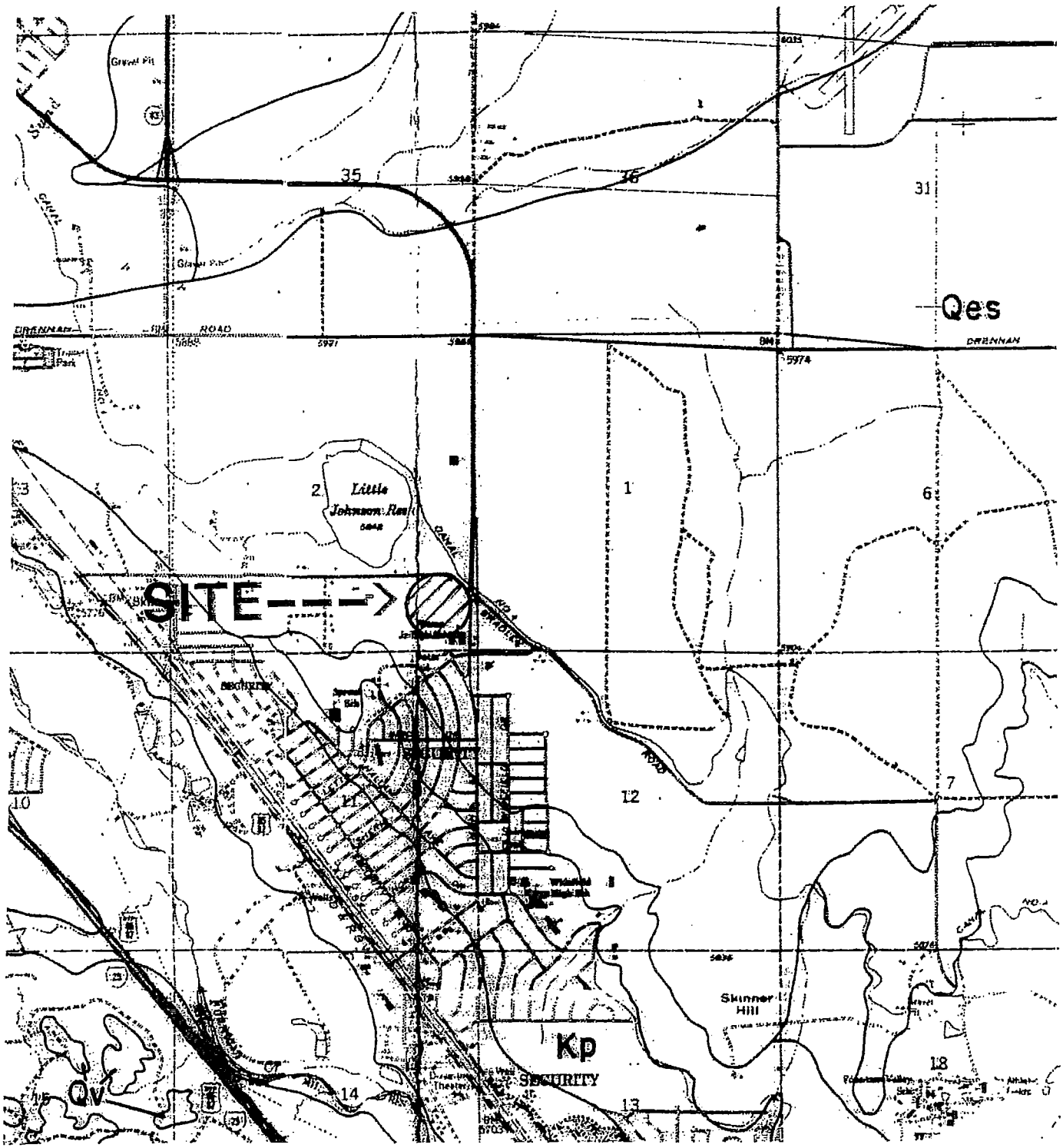
Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread. This soil is best suited to deep-rooted grasses.

Proper range management is necessary to prevent excessive removal of plant cover from the soil. Interseeding improves the existing vegetation. Deferment of grazing in spring increases plant vigor and soil stability. Proper location of livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings are fairly well suited to this soil. Blowing sand and low available water capacity are the main limitations for the establishment of trees and shrubs. The soil is so loose that trees need to be planted in shallow furrows and plant cover needs to be maintained between the rows. Supplemental irrigation may be needed to insure survival. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, and Siberian elm. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

This soil is suited to wildlife habitat. It is best suited to habitat for openland and rangeland wildlife. Rangeland wildlife, such as pronghorn antelope, can be encouraged by developing livestock watering facilities, properly managing livestock grazing, and reseeding range where needed.

This soil has good potential for urban development. Soil blowing is a hazard if protective vegetation is removed. Special erosion control practices must be provided to minimize soil losses. Capability subclass VIe.



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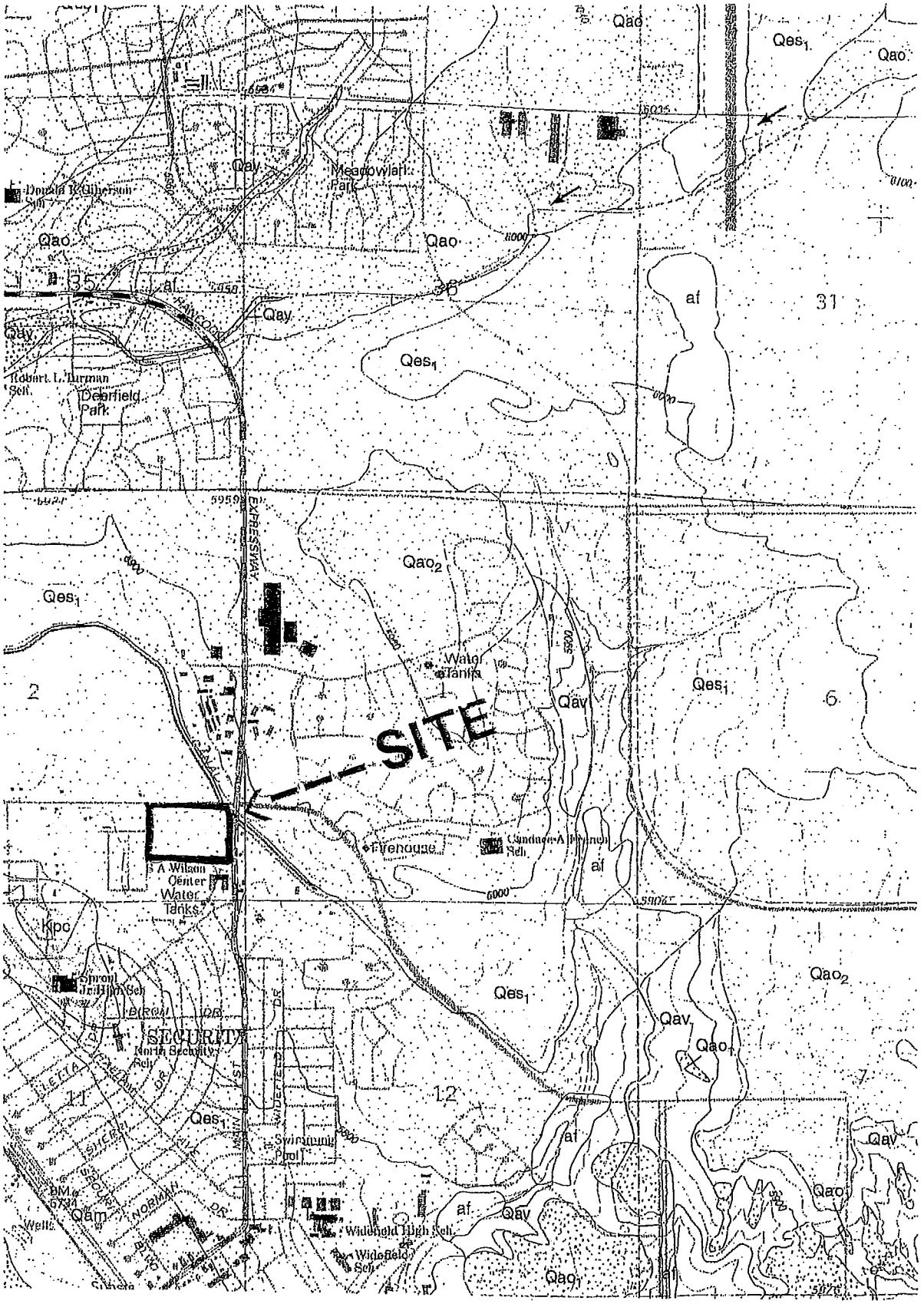
COLORADO SPRINGS GEOLOGY MAP

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/15/05

JOB NO.: 37545

FIG NO.: 6



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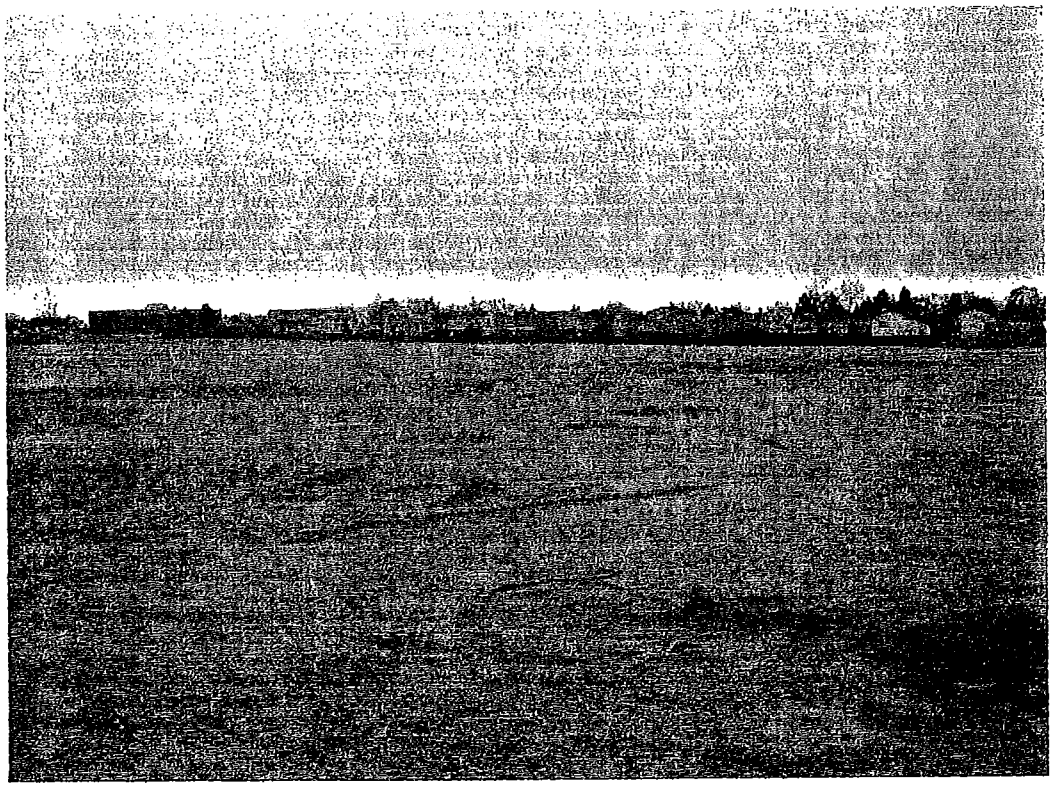
ELSMERE QUADRANGLE GEOLOGY MAP

DRAWN:	DATE:	CHECKED:	DATE:
		KAK	3/15/05

JOB NO.: 37545

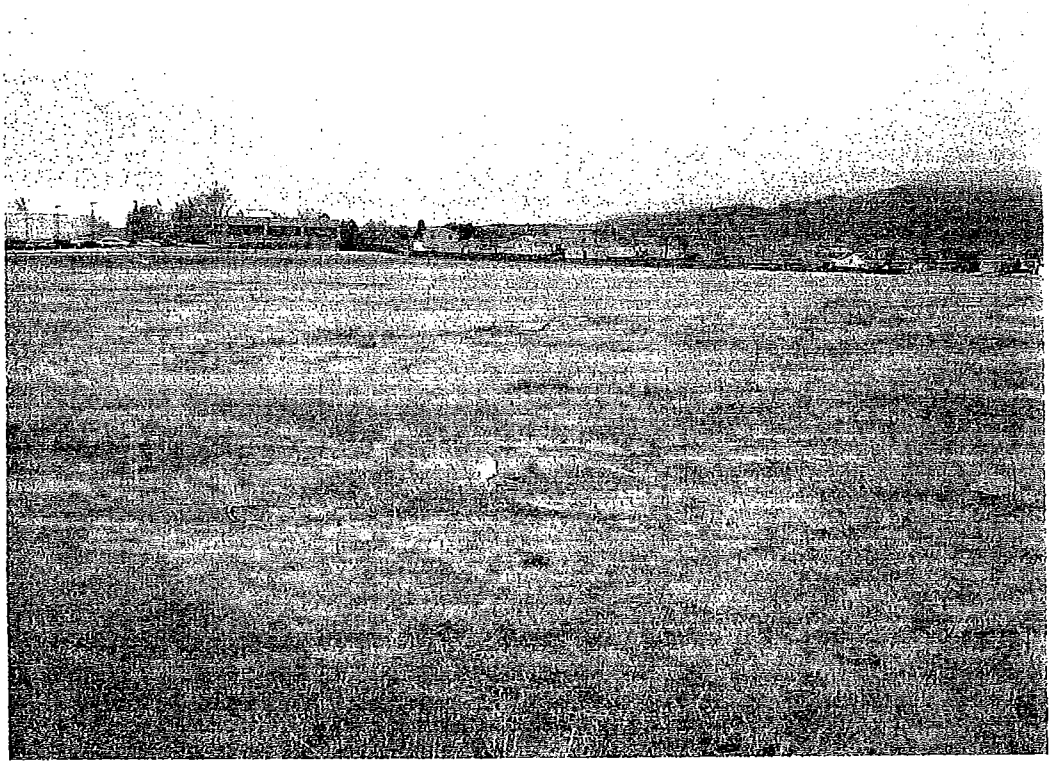
FIG NO.: 7

APPENDIX A: Site Photographs



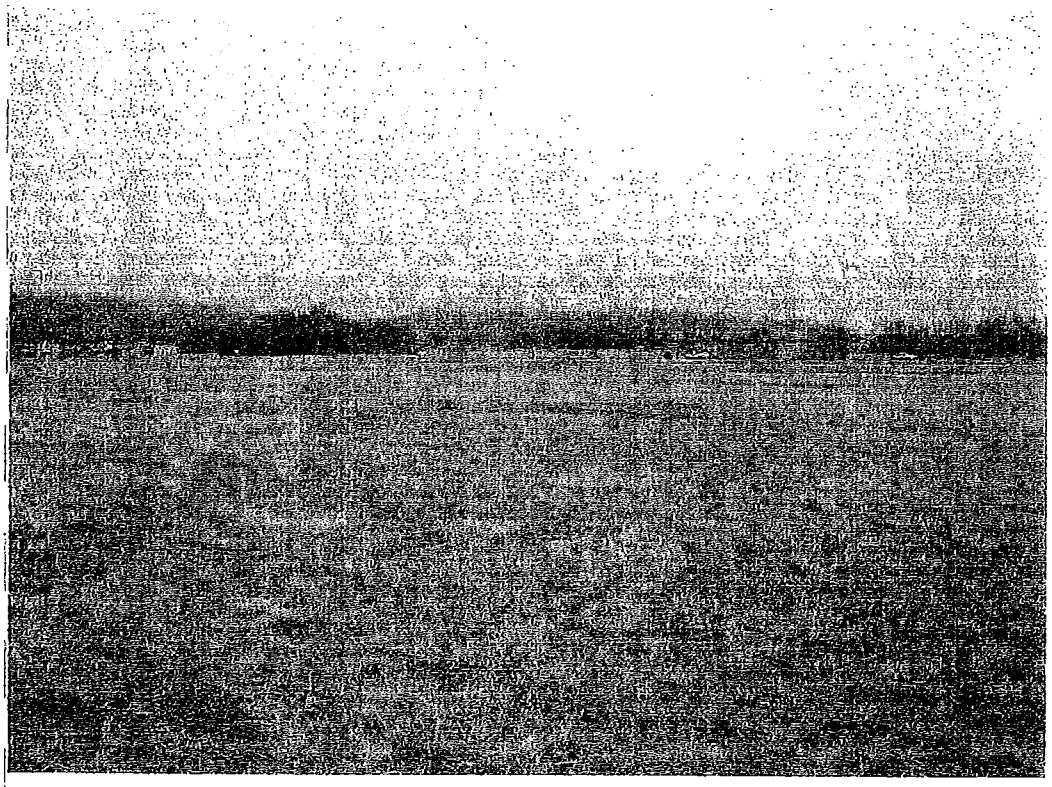
1

From northwest corner of site, looking southeast.



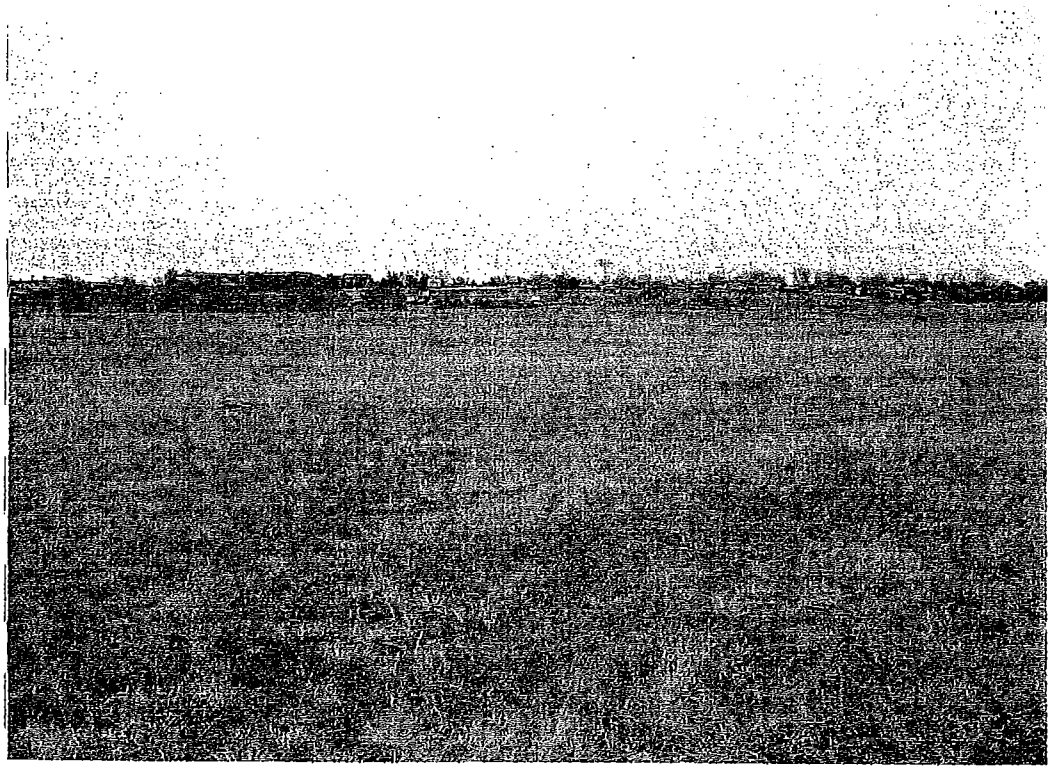
2

From northeast corner of site, looking southwest.



3

From southeast corner of site, looking northwest.



4

From southwest corner of site, looking northeast.

APPENDIX B: Test Boring Logs

TEST BORING NO. 1
DATE DRILLED 2/11/2005
Job # 37545

REMARKS

DRY TO 20', 2/22/05

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN TO LIGHT BROWN, LOOSE, MOIST		7	6.7	2
5			9	6.1	2
10			8	7.4	2
15	SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, LIGHT BROWN, MEDIUM DENSE, MOIST		14	4.0	2
20			24	4.9	2

TEST BORING NO. 2
DATE DRILLED 2/11/2005
CLIENT HARMONY HOMES
LOCATION LINCOLN PLAZA & BRADLEY RD.

REMARKS

CAVED TO 18', 2/22/05, DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN TO LIGHT BROWN, LOOSE TO MEDIUM DENSE, MOIST		8	6.7	2
5			15	4.5	2
10			19	2.6	2
15			14	2.8	2
20			13	3.7	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAK	5/15/05

JOB NO.:
FIG NO.: B-1

TEST BORING NO. 3
DATE DRILLED 2/11/2005
Job # 37545

REMARKS

DRY TO 20', 2/22/05

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
FILL 0-4', SAND, SILTY-CLAYEY, FINE GRAINED, DARK BROWN, LOOSE, MOIST			6	15.0	1
SAND, SILTY, FINE TO MEDIUM GRAINED, LIGHT BROWN, LOOSE, MOIST	5		8	11.9	2
	10		7	6.4	2
	15		8	6.4	2
	20		9	8.7	2

TEST BORING NO. 4
DATE DRILLED 2/11/2005
CLIENT HARMONY HOMES
LOCATION LINCOLN PLAZA & BRADLEY RD.

REMARKS

CAVED TO 19', 2/22/05, DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
SAND, SLIGHTLY SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST			9	5.6	2
	5		7	5.5	2
	10		8	4.6	2
	15		11	7.7	2
	20		13	5.7	2

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAK	3/15/05

JOB NO.: 37545
FIG NO.: B-2

TEST BORING NO. 5
DATE DRILLED 2/11/2005
Job # 37545

REMARKS

DRY TO 19.5', 2/22/05

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			6	5.0	2	SAND, SLIGHTLY SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST
5			4	6.1	2	
10			5	6.1	2	
15			12	7.2	2	
20			13	5.0	2	

TEST BORING NO. 6
DATE DRILLED 2/11/2005
CLIENT HARMONY HOMES
LOCATION LINCOLN PLAZA & BRADLEY RD.

REMARKS

CAVED TO 19', 2/22/05, DRY

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			6	3.9	2	SAND, SILTY, FINE TO COARSE GRAINED, LOOSE, MOIST
5			8	5.4	2	
10			6	7.7	2	
15			7	4.8	2	
20			7	5.9	2	

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TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
		KAK	3/15/05

JOB NO.: 37545
FIG NO.: B-3

TEST BORING NO. 7
DATE DRILLED 2/11/2005
Job # 37545

REMARKS

DRY TO 20', 2/22/05

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			6	9.7	2
5			8	4.5	2
10			12	6.0	2
15			11	8.9	2
			*	14.2	3
20			18	21.1	3

SAND, SILTY, FINE GRAINED, DARK BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST

CLAY, SANDY, LIGHT BROWN, STIFF, MOIST

* - BULK SAMPLE TAKEN

TEST BORING NO. 8
DATE DRILLED 2/11/2005
CLIENT HARMONY HOMES
LOCATION LINCOLN PLAZA & BRADLEY RD.

REMARKS

DRY TO 20', 2/11/05

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			19	5.9	2
5			6	3.5	2
10			8	7.6	2
15			19	13.4	3
20			50/6"	13.3	4

FILL-0-1', SAND, SILTY, BROWN
SAND, SILTY, FINE TO MEDIUM GRAINED, DARK BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST

CLAY, SANDY, RUSTY GRAY BROWN, STIFF, MOIST

CLAYSTONE, SANDY, BROWN, HARD, MOIST

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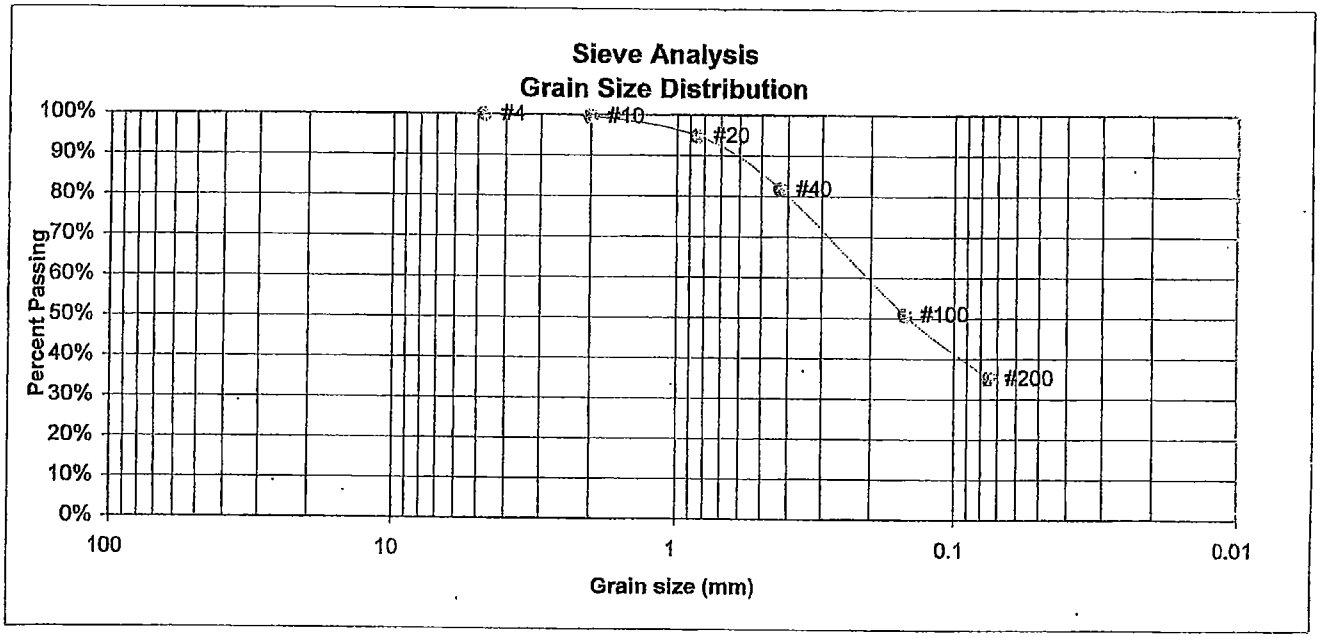
TEST BORING LOG

DRAWN:	DATE:	CHECKED:	DATE:
			3/15/05

JOB NO.: 37545
FIG NO.: B-4

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SC-SM	CLIENT	HARMONY HOMES
SOIL TYPE #	1	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-3	JOB NO.	37545
DEPTH	2-3'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	94.8%
40	81.8%
100	50.9%
200	35.1%

Atterberg Limits

Plastic Limit	16
Liquid Limit	22
Plastic Index	6

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

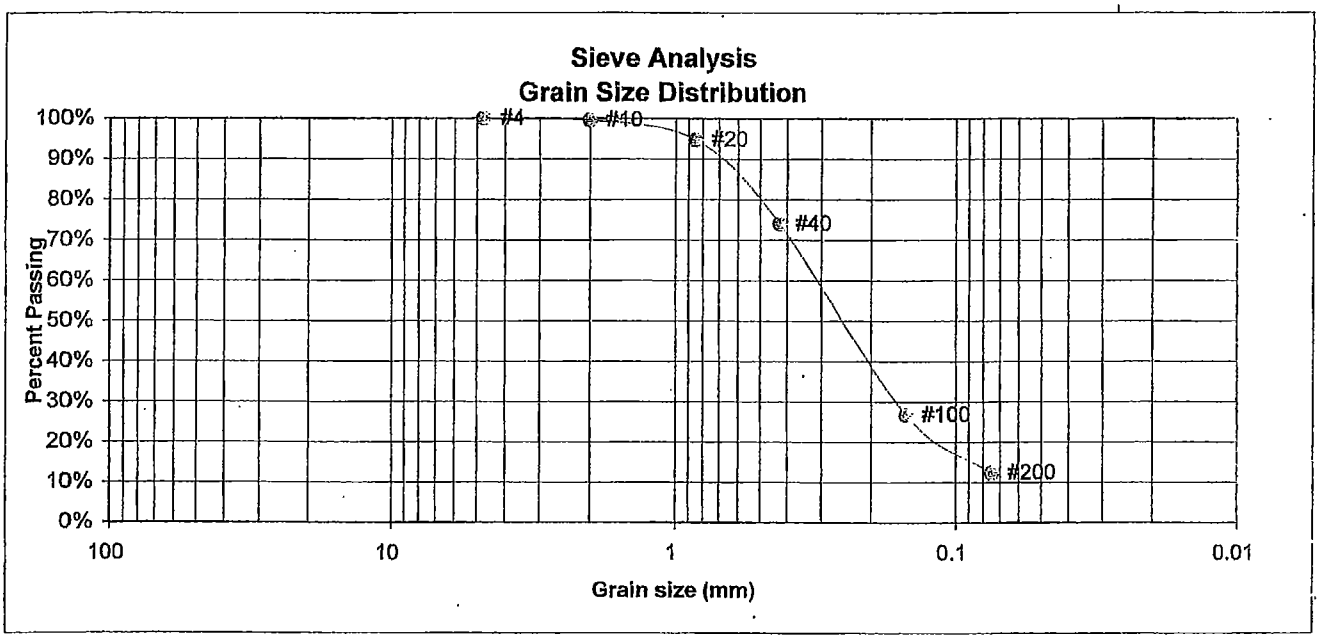
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		VAK	5/15/05

JOB NO.: 37545

FIG NO.: C-1

UNIFIED CLASSIFICATION	SM	CLIENT	HARMONY HOMES
SOIL TYPE #	2	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-1	JOB NO.	37545
DEPTH	2-5'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.6%
20	94.8%
40	74.1%
100	26.8%
200	12.4%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

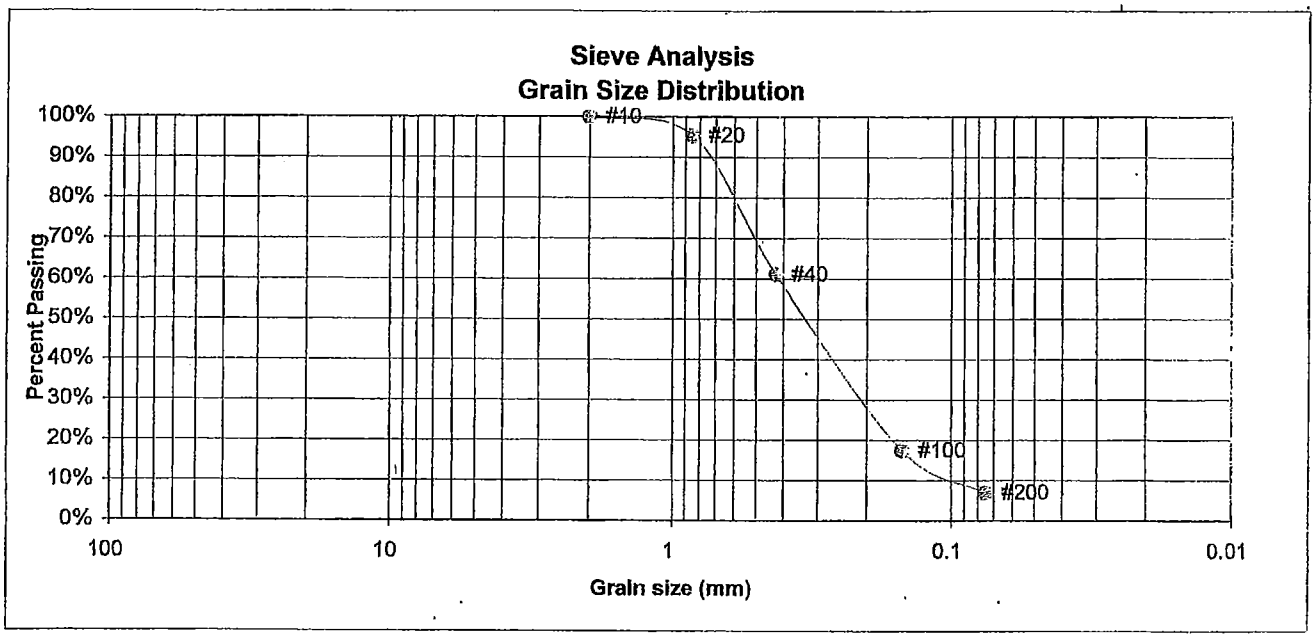
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/15/05

JOB NO.: 37545
FIG NO.: 1-2

UNIFIED CLASSIFICATION	SM-SW	CLIENT	HARMONY HOMES
SOIL TYPE #	2	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-4	JOB NO.	37545
DEPTH	10'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	95.3%
40	61.0%
100	17.4%
200	6.9%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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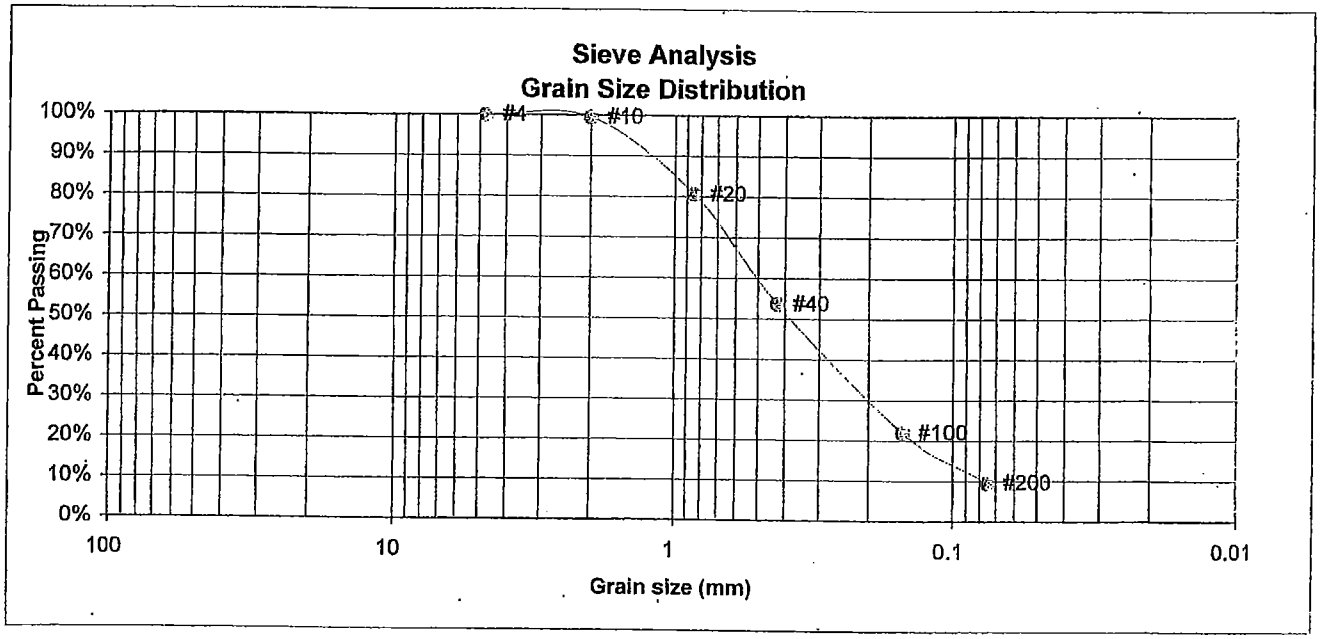
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KLH	3/16/05

JOB NO.: 37545
FIG NO.: A-3

UNIFIED CLASSIFICATION	SM-SW	CLIENT	HARMONY HOMES
SOIL TYPE #	2	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-5	JOB NO.	37545
DEPTH	2-5'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.5%
20	80.6%
40	53.6%
100	21.9%
200	9.5%

Atterberg Limits

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

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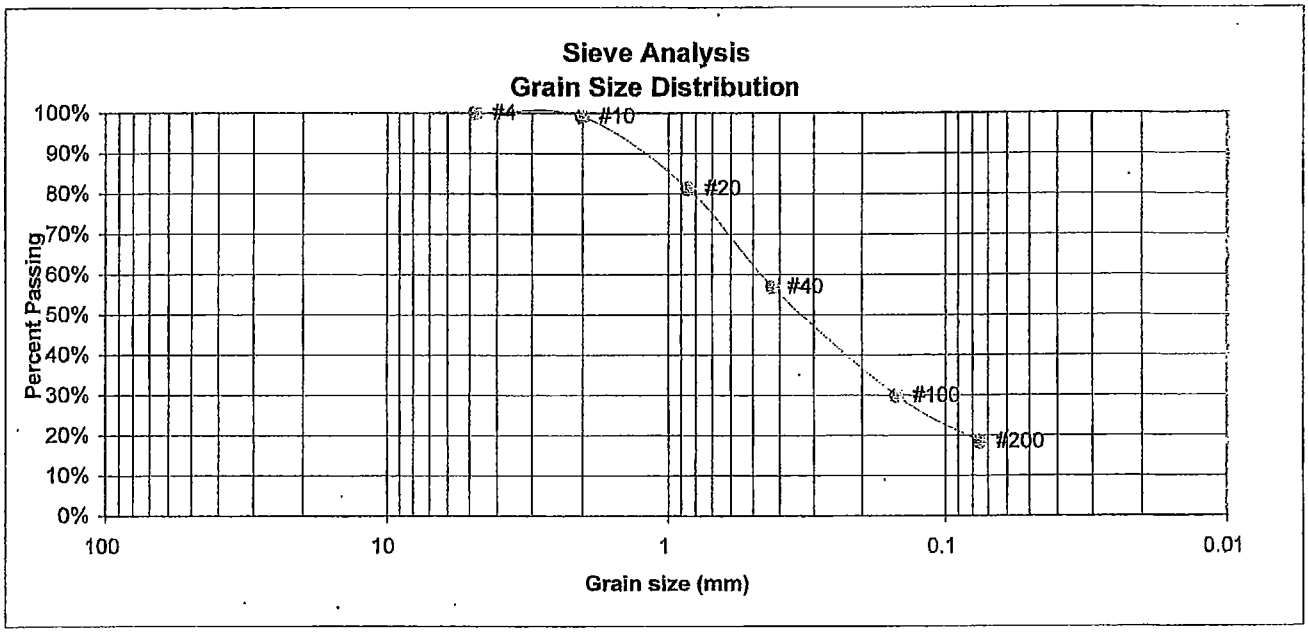
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/15/05

JOB NO.: 37545

FIG NO.: C-4

UNIFIED CLASSIFICATION	SM	CLIENT	HARMONY HOMES
SOIL TYPE #	2	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-8	JOB NO.	37545
DEPTH	4'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.1%
20	81.3%
40	57.0%
100	29.8%
200	18.3%

Atterberg Limits
Plastic Limit
Liquid Limit
Plastic Index

Swell
Moisture at start
Moisture at finish
Moisture increase
Initial dry density (pcf)
Swell (psf)

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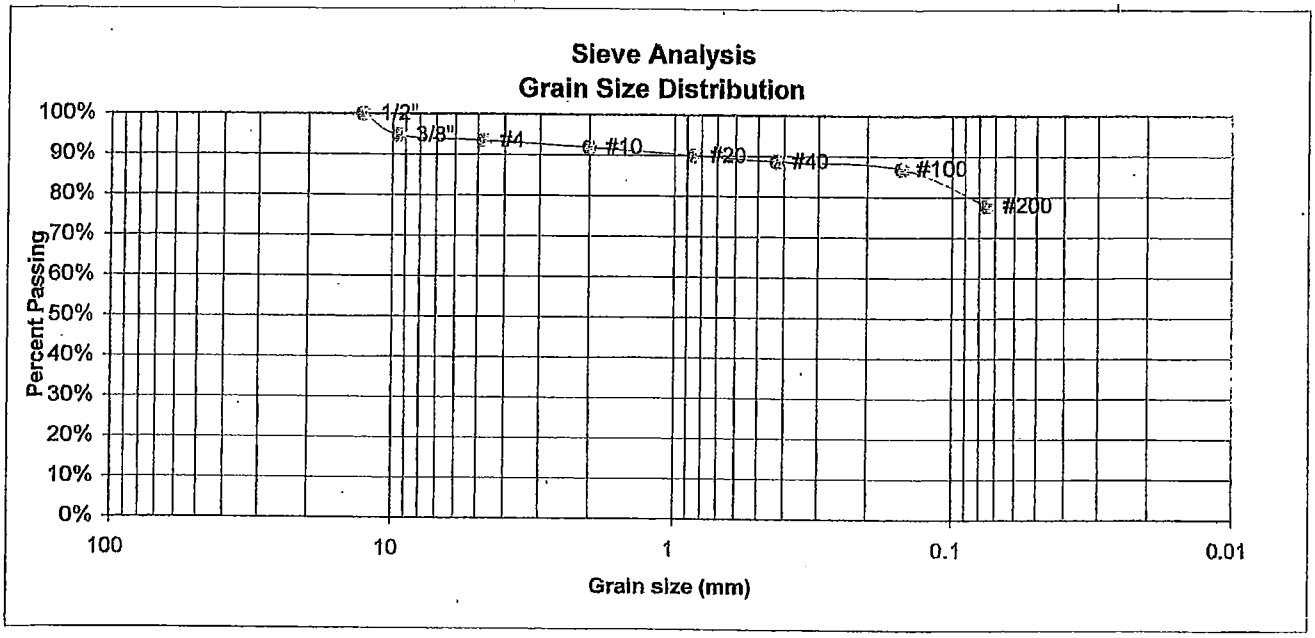
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907 (719) 531-5599

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAK	3/15/05

JOB NO.: 37545
FIG NO.: 1-5

UNIFIED CLASSIFICATION	CL	CLIENT	HARMONY HOMES
SOIL TYPE #	3	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-7	JOB NO.	37545
DEPTH	20'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	94.7%
4	93.5%
10	91.9%
20	90.0%
40	88.7%
100	86.9%
200	77.8%

Atterberg Limits

Plastic Limit	15
Liquid Limit	35
Plastic Index	20

Swell

Moisture at start

Moisture at finish

Moisture increase

Initial dry density (pcf)

Swell (psf)

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

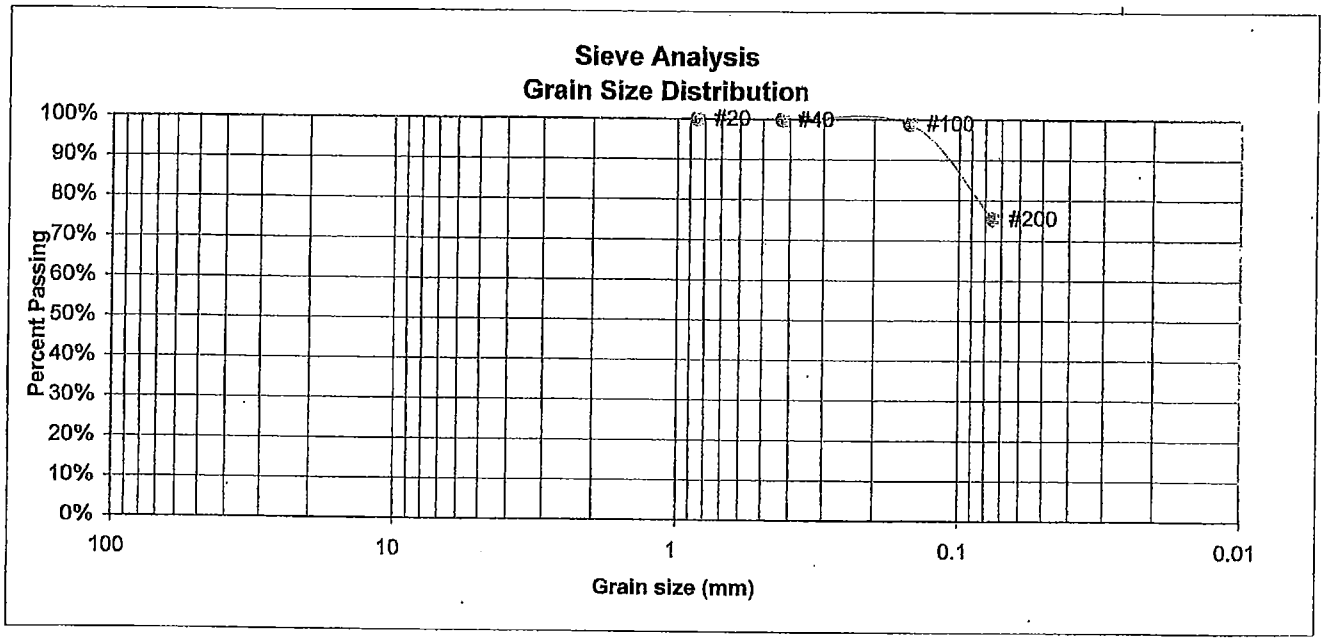
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	3/15/10

JOB NO.: 37545

FIG NO.: C-6

UNIFIED CLASSIFICATION	CL	CLIENT	HARMONY HOMES
SOIL TYPE #	4	PROJECT	LINCOLN PLAZA & BRADLY RD.
TEST BORING #	TB-8	JOB NO.	37545
DEPTH	20'	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	
20	100.0%
40	99.8%
100	98.9%
200	75.3%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	36
Plastic Index	21

Swell	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	

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LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAA	3/15/05

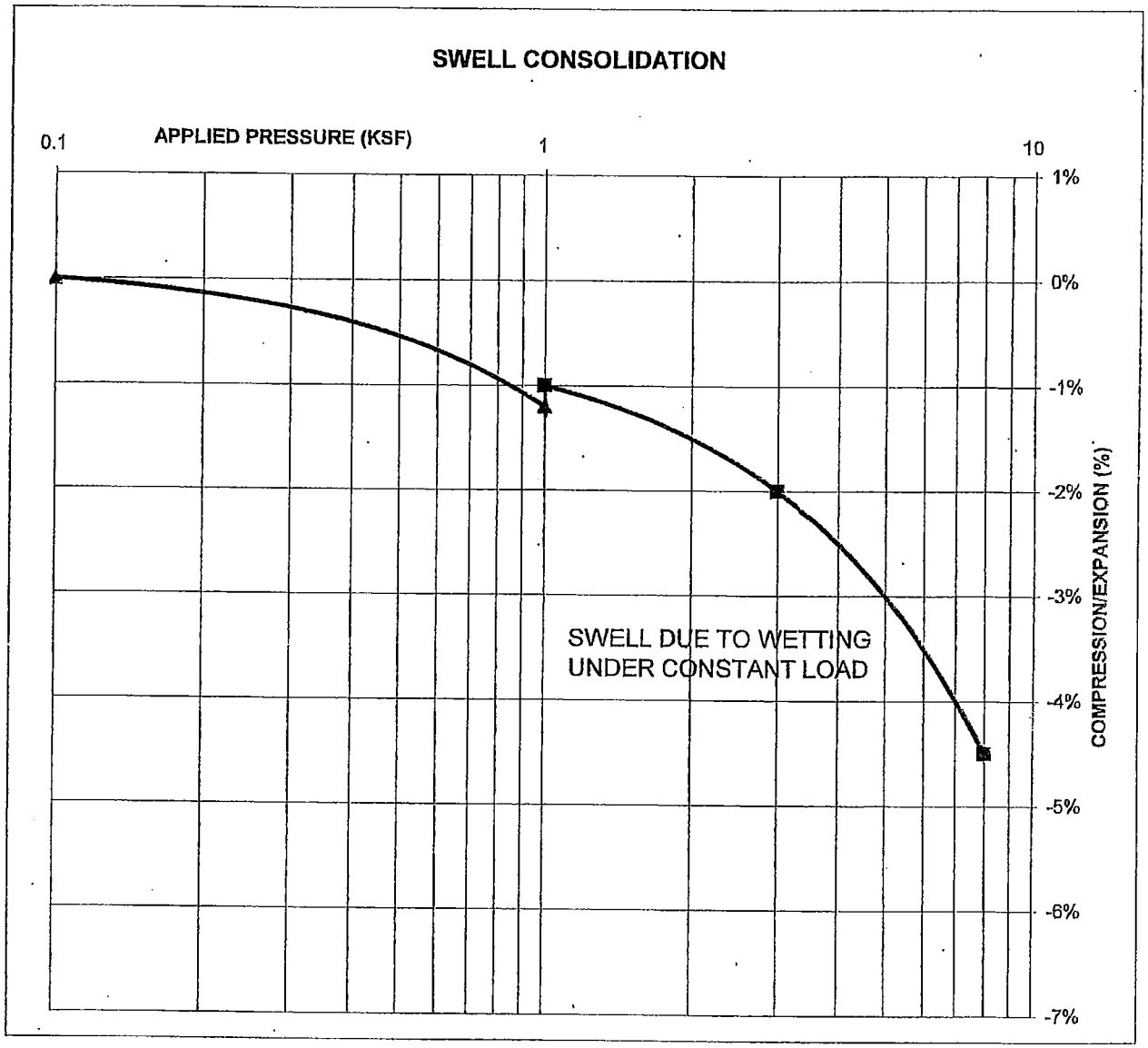
JOB NO.: 37545

FIG NO.: 4-7

CONSOLIDATION TEST RESULTS

SAMPLE FROM:	TB-7	AT DEPTH	20'
DESCRIPTION	CL	SOIL TYPE	3
NATURAL UNIT DRY WEIGHT (PCF)			104
NATURAL MOISTURE CONTENT			21.1%
SWELL/CONSOLIDATION (%)			0.2%

JOB NO. 37545
CLIENT HARMONY HOMES
PROJECT LINCOLN PLAZA & BRADLY RD.



ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

SWELL CONSOLIDATION TEST RESULTS

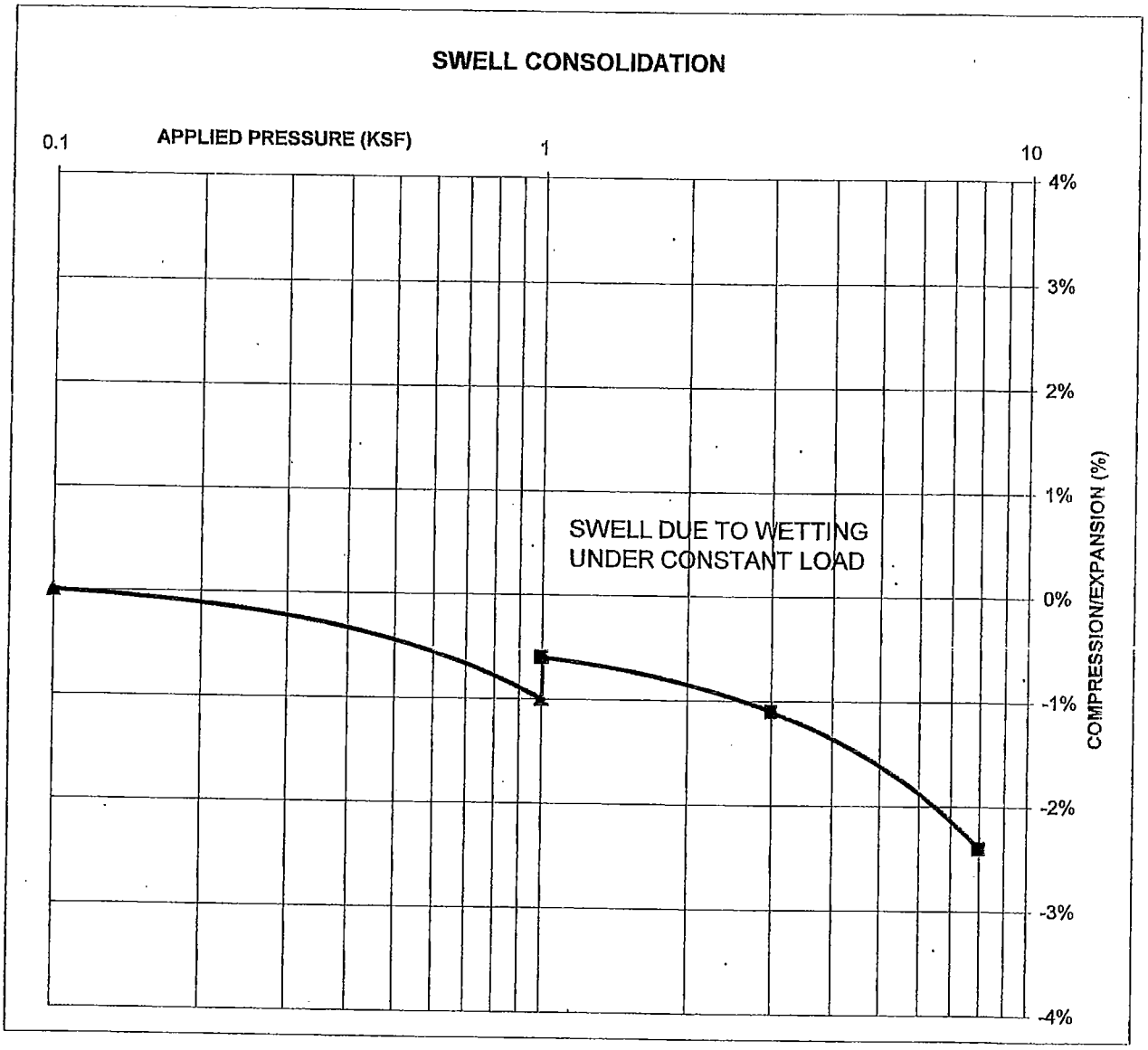
DRAWN:	DATE:	CHECKED:	DATE:
		KAH	5/15/07

JOB NO.: 37545
FIG NO.: C-8

CONSOLIDATION TEST RESULTS

SAMPLE FROM:	TB-8	AT DEPTH	20'
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			115
NATURAL MOISTURE CONTENT			16.2%
SWELL/CONSOLIDATION (%)			0.4%

JOB NO. 37545
CLIENT HARMONY HOMES
PROJECT LINCOLN PLAZA & BRADLY RD.



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SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		AHK	3/15/05

JOB NO.: 37545
FIG NO.: C-9