NEW DOC

ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599
FAX (719) 531-5238

June 12, 2007

Springs Engineering, LLC
25 North Tejon Street, Suite 200
Colorado Springs, Colorado 80903

Attn: Charles Cothern

Re: Soil, Geology and Geologic Hazard Study
Rolling Thunder Business Park
Woodmen Road and Golden Sage Road
El Paso County, Colorado

Dear Mr. Cothern:

As requested, personnel of Entech Engineering, Inc. have investigated the above referenced site to evaluate the conditions with respect to geology and geologic hazards affecting development of the site. The project consists of commercial development on a 10-acre site in Falcon, Colorado. The approximate location of the site is shown on the Vicinity Map, Figure 1.

The topography of the site is generally very gently sloping to the south. No major drainages exist on the site. The site lies in a portion of the NE¼ of Section 11, Township 13 South, Range 65 West of the 6th Principal Meridian in El Paso County, Colorado. The approximate boundaries of the site are shown on the USGS Map, Figure 2. The water tank for Falcon Highlands currently exists in the southeastern corner of the site. The Proposed Development Plan is presented in Figure 3. The site contains primarily field grasses and weeds. Site photographs taken June 5, 2007, are included in Appendix A. The locations of these photographs are indicated on Figure 3.

Investigations for Falcon Highlands east of the site performed by Entech Engineering, Inc. include Soils and Geology Studies dated January 24, 2002 (Reference 1) and November 22, 2004 (Reference 2), a Groundwater Investigation dated June 16, 2005 (Reference 3) and Subsurface Soil Investigations dated February 15, 2006 (Reference 4,) and March 15, 2004 (Reference 5). Information from these reports was used evaluating the site.

The scope of this report will include a geologic analysis of the site utilizing published geologic data, subsurface soils information and site-specific mapping of major geologic features, and identification of geologic hazards with respect to proposed development with recommended mitigation techniques. A preliminary subsurface soil investigation was performed by Entech Engineering, Inc. This investigation consisted of drilling 3 test borings on the site. The locations of the test borings are shown on the Development Plan/Test Boring Location Map, Figure 3. Results of this testing will be discussed later in this report. The Soil Conservation Service (SCS) Survey was also reviewed to evaluate the site.

SOIL AND GEOLOGIC CONDITIONS

Soil Conservation Service

The Soil Conservation Service has mapped one soil type on the site (Reference 6, Figure 4). In general, the soils consist of loamy sand, formed from alluvial and eolian deposits. The soils are described as follows:

Type	Description
9	Blakeland Complex, 1-9% slopes

Complete descriptions of the soils are presented in Figure 5. The soils have been described to have rapid permeabilities. The soils have been described by the Soil Conservation Service as having good potential for urban development. Possible hazards with soil erosion are present on the site. The erosion potential can be controlled with vegetation. The soils have been described to have moderate erosion hazards.

Soils

The soils encountered in the test borings consisted of slightly silty sands (SW-SM) and very sandy clays (CL) overlying clayey sandstone (SC) and sandy claystone (CL). The upper soils were encountered at loose to medium dense states and dry to wet conditions. The upper slightly silty sands are generally considered non-expansive, however, the clayey soils and bedrock are expansive. A swell pressure of 977 psf was measured on the very sandy clays in the FHA Swell Test. This swell is in the low expansion range. A swell pressure of 98 psf was measured on the clayey sandstone in the FHA Swell Test. This swell is in the low expansive range. A swell of 1.9 percent was measured in claystone in the Swell/Consolidation Test. This swell is in the moderate expansion range. Bedrock was encountered at depths ranging from 8 to 12 feet. The Test Boring Logs are presented in Appendix B. Laboratory testing is presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1. The depth to bedrock is summarized in Table 2.

Groundwater

Groundwater was encountered in all test borings at 6.5 to 7 feet. Groundwater will affect the installation of utilities and could affect construction depending on site grading. Perched water conditions were encountered on the site where water flows in permeable sands over impermeable bedrock. Fluctuations in groundwater conditions may occur due to variations in rainfall or other factors not readily apparent at this time. Isolated sand layers within the soil profile can carry water in the subsurface. Contractors should be cognizant of the potential for the occurrence of subsurface water features during construction.

Geology

Approximately 14 miles west of the site is a major structural feature known as the Rampart Range Fault. This fault marks the boundary between the Great Plains Physiographic Province and the Southern Rocky Mountain Province. The site exists within a large structural feature known as the Denver Basin. Bedrock in the area is typically gently dipping in a northerly direction. The bedrock underlying the site consists of the Dawson Formation of Tertiary to Cretaceous Age. The Dawson typically consists of coarse-grained arkosic sandstone with interbedded layers of fine-grained sandstone, siltstone or claystone.

The geology of the site was evaluated using Entech Engineering, Inc.'s subsurface soil investigation data, site-specific mapping of the site, the *Geology Map of the Falcon NW by Madole in 2003* (Reference 7, Figure 6) *Geologic Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado* by Scott *et al* in 1978, (Reference 8), and the *Geologic Map of the Colorado Springs – Castle Rock Area Front Range Urban Corridor* by Trimble and Machette in 1979 (Reference 9). The Geology Map prepared for the site is presented in Figure 7. Two mappable units were identified on this site which, from youngest to oldest, are identified as follows:

- **Qes - Eolian Sand of Quaternary Age:** These deposits are fine to medium grained soil deposited on the site by the action of the prevailing winds from the west and northwest. They typically occur as large dune deposits or narrow ridges. These soil types are typically tan to brown in color and tend to have very uniform or well-sorted gradation. These materials tend to have a relatively high permeability and low density.

- **Qlo - Louviers Alluvium of Pleistocene Age:** These deposits are light brown silty sands which can locally contain an abundance of gravels. They commonly occur as stream terrace deposits above the valley floors.

The bedrock underlying the site consists of the Dawson Formation of Tertiary to Cretaceous Age. This formation typically consists of sandstone with interbedded lenses of claystone or siltstone. The bedrock encountered in the test borings consisted of clayey sandstone and sandy claystone.

ENGINEERING GEOLOGIC HAZARDS

Detailed mapping has been performed on this site to identify areas where various geologic conditions exist of which developers should be cognizant during the panning, design and construction stages of the project (Figure 7). The engineering geologic hazards identified on this site include shallow groundwater, hydrocompaction, the potential for expansive soils and bedrock, and loose soils. These hazards and recommended mitigation techniques are discussed as follows:

sg - *Shallow Groundwater Area*

Groundwater was encountered at 7 and 6.5 feet in the test borings drilled on site. The site does not lie within any floodplain zones according to the FEMA Map No. 08041CO535F (Figure 8, Reference 10). The groundwater encountered may be associated with perched groundwater conditions. This is extremely common in the area, particularly where permeable sands associated with alluvial and eolian deposits exist over impermeable clayey sandstone or claystone.

Mitigation: Foundations must have a minimum 30-inch depth for frost protection. Overlot grading to raise the site will help to reduce the effects of groundwater on the development. Cuts in shallow water areas are not recommended. In areas where high subsurface moisture conditions are anticipated periodically, subsurface perimeter drains are recommended to help prevent the intrusion of water into areas below grade. Typical drain details are presented in Figure 9. Where high groundwater conditions are encountered, underslab drains or capillary breaks may be necessary to dewater the excavation. Typical drain details are shown on Figures 10 and 11. Dewatering of the building areas may be necessary. An underdrain system can be used for the outfall of the individual lot drain systems. Drain stubs shall be placed on each lot adjacent to sewer service stub. This type of drain system is common practice in areas of high groundwater. Dewatering and controlling groundwater will likely be required for utility installation. Utility trenches may affect the groundwater flow across this site. A utility underdrain may be recommended for the sanitary sewer line. A typical drain detail is presented in Figure 12.

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 five 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.

l - *Loose Soils*
Areas of loose soils were encountered in some of the test borings drilled on-site. These areas are sporadic; therefore, none have been indicated on the maps.
Mitigation: Should loose or collapsible soils be encountered beneath foundations, removal and recompaction with thorough moisture conditioning at a minimum of 90% of its maximum 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*
The majority of the upper soils encountered in the test borings are considered non-expansive, however, clays and claystone were encountered in the subsurface that have expansion potential. The expansive soils are highly sporadic, therefore, none have been indicated on the map. Expansive soils, if encountered, can cause differential movement in the structure foundations.
Mitigation: Should expansive soils be encountered below the foundation, mitigation will be necessary. Mitigation of expansive soils may include overexcavation and replacement with non-expansive structural fill compacted at a minimum of 90% of its maximum Modified Proctor Dry Density, ASTM D-1557. Another option is the use of drilled pier foundation systems. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement with compacted non-expansive soils has been successful in minimizing slab movements. Final recommendations should be determined after additional investigation of each building site.

RELEVANCE OF GEOLOGIC CONDITIONS TO LAND USE PLANNING

As mentioned earlier in this report, the development will be commercial. The existing geologic and engineering geologic conditions will impose some constraints on development and construction. The most significant problems affecting development will be those associated with the shallow groundwater on site. These conditions can be satisfactorily mitigated through proper engineering design and construction practices or grading.

The upper soils were encountered at loose to medium dense states. Spread footing configurations are anticipated for the foundations on the site. Areas of loose soils may be encountered on site. Loose or collapsible soils, if encountered beneath foundation, will require recompaction. Expansive layers may also be encountered in the soil on this site. These areas are sporadic, therefore no areas were indicated on the maps. Expansive soils, if encountered, will require special foundation design. These soils will not prohibit development.

Areas of hydrocompaction are associated with the eolian sand deposits on-site. The potential for settlement due to saturation of the soils exists in these areas. Good surface and subsurface drainage is required in these areas in order to minimize the potential for saturation of these soils.

Soil susceptible to erosion will also require consideration during development. Erosion problems are extremely common throughout the region and may be satisfactorily mitigated through proper engineering design and construction of drainage systems.

Shallow groundwater was encountered on this site that may require drain systems in order to prevent the intrusion of water into areas below grade, depending on site grading. Typical drain details are shown on Figures 9 through 11. This may be associated with perched groundwater conditions where permeable soils overlie impermeable bedrock. It is anticipated drains and dewatering will be necessary on this site. Groundwater will also affect utility installation. A utility underdrain may be required for the sanitary sewer on-site. Typical drain details are included in Figure 12. Site grading will affect groundwater levels. Fill placement will further raise foundations above the groundwater levels. No areas of the site are mapped in any floodplain zones. Exact floodplain locations and drainage studies are beyond the scope of this report. Finished floors must be a minimum of one foot above the floodplain level.

In summary, the granular soils will provide suitable support for shallow foundations on site. The geologic conditions encountered on site can be mitigated with proper engineering and construction practices. Shallow groundwater will affect construction on the site. These conditions may be mitigated with drainage improvements, grading and drain systems. Investigations on each building site are recommended prior to construction.

EROSION CONTROL

The soil types observed on the site are mildly to moderately 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 site, allowable velocities for unvegetated and unlined earth channels 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 revegetation 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 Soil Conservation Service.

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 11), the area is mapped as upland deposits. According to the *Atlas of Sand, Gravel and Quarry Aggregate Resources, Colorado Front Range Counties* distributed by the Colorado Geological Survey (Reference 12), areas of the site are mapped as A3 – Alluvial fan: sand resource and E3 – wind deposited sand: sand resource. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 13), the area of the site has been mapped as "good" for industrial minerals. The sands associated with the alluvial deposits
may be considered a sand resource. Considering the silty to clayey nature of much of these materials, abundance of similar materials through the region, and close proximity to urban development, 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 13), the site is mapped within the Denver Basin Coal Region. However, the area of the site has been mapped as "Poor" for coal resources. No active or inactive mines have been mapped in the area of the site. The *El Paso County Aggregate Resource Map* (Reference 11) has mapped coal resources in the Falcon area south of the site; however, the coal resources are estimated at 1,500 feet below the surface (Reference 12). At this depth, mining the coal would not be economical at this time. No metallic mineral resources have been mapped on the site (Reference 13).

The site has been mapped as "Fair" for oil and gas resources (Reference 13). No oil or gas fields have been discovered in the area of the site. A well was drilled north of the site to 2,100 feet. No oil or gas was reported and it was plugged. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it would not be considered a significant resource.

CLOSURE

It should be pointed out that because of the nature of data obtained by random sampling of such variable 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. Specific construction and foundation recommendations will be provided when investigations are completed for each specific site.

This report has been prepared for Springs Engineering, LLC for application to the proposed project in accordance with generally accepted geologic, soil and engineering practices. No other warranty expresses or implied is made.

We trust that this report has provided you with all the information that you required. Should you have any questions or require additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Kristen A. Andrew-Hoeser, P. G.
Engineering Geologist

Reviewed by:

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

COLORADO REGISTERED
JOSEPH COLLIN GOODE JR.
23725
6/13/07
PROFESSIONAL ENGINEER

KAH/mf

Encl.

Entech Job No. 95647
2MSW/let/geo haz/2007/95647sg&ghs

BIBLIOGRAPHY

1. Entech Engineering, Inc. January 24, 2002. *Soil and Geology Study, Falcon Highlands, Woodmen and Tamlin Road, El Paso County, Colorado. Entech Job No. 39431.*

2. Entech Engineering, Inc. November 22, 2004. *Addendum to Soil and Geology Study. Falcon Highlands Filing No. 2, Woodmen and Tamlin Road, El Paso County, Colorado.* Entech Job No. 31784.

3. Entech Engineering, Inc. June 16, 2005. *Groundwater Investigation, Falcon Highlands, F2, Woodmen and Tamlin Road, El Paso County, Colorado.* Entech Job No. 49185.

4. Entech Engineering, Inc. February 15, 2006. *Subsurface Soil Investigation, Proposed Wastewater Treatment Facility, Falcon Highlands Metropolitan District, Colorado Springs, Colorado.* Entech Job No. 65675.

5. Entech Engineering, Inc. March 15, 2004. *Subsurface Soil Investigation, Falcon Highlands, Water Tank and WTP Building, El Paso County, Colorado.* Entech Job No. 10774.

6. United States Department of Agriculture Soil Conservation Service. June, 1981. *Soil Survey of El Paso County Area, Colorado.*

7. Madole, Richard F. 2003. *Geologic Map of the Falcon NW Quadrangle, El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 03-8.

8. Scott, Glenn R.; Taylor, Richard B.; Epis, Rudy C. and Wobus, Reinhard A. 1978. *Geologic Map of the Pueblo 1° x 2° Quadrangle, South-Central Colorado.* Sheet 1. US Geological Survey. Map I-1022.

9. Trimble, Donald E. and Machette, Michael N. 1979. *Geologic Map of the Colorado Springs-Castle Rock area, Front Range Urban Corridor,* Colorado. U.S. Geological Survey Map I-847-F.

10. Federal Emergency Management Agency. March 17, 1997. *Flood Insurance Rate Maps for the City of Colorado Springs, Colorado.* Map Number 08041CO535F.

11. El Paso County Planning Department. December 1995. *El Paso County Aggregate Resource Evaluation*

12. Schwochow, S.D.; Shroba, R.R. and Wicklein, P.C. 1974. *Atlas of Sand, Gravel, and Quarry Aggregate Resources, Colorado Front Range Counties.* Colorado Geological Survey. Special Publication 5-B.

13. Keller, John W.; TerBest, Harry and Garrison, Rachel E. 2003. *Evaluation of Mineral and Mineral Fuel Potential of El Paso County State Mineral Lands Administered by the Colorado State Land Board.* Colorado Geological Survey. Open-File Report 03-07.
    Madole, Richard F. and Thorson, Jon P. 2003. *Geologic Map of the Elsmere Quadrangle, El Paso County, Colorado.* Colorado Geological Survey. Open-File Report 02-2.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT SPRINGS ENGINEERING
PROJECT FALCON HIGHLANDS
JOB NO. 95647

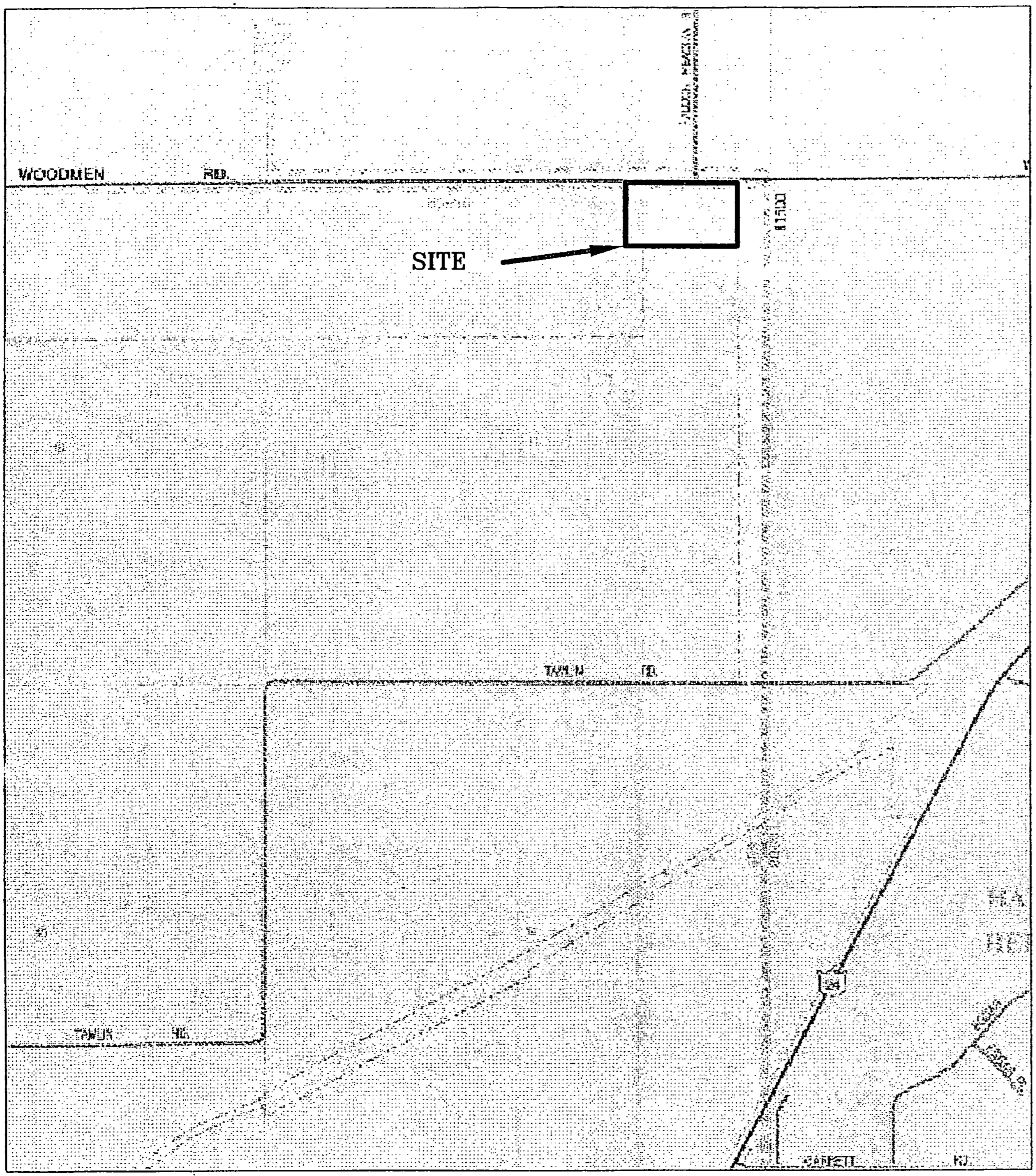
SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/ CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	2	5			10.1						SM-SW	SAND, SLIGHTLY SILTY
1	3	2-5			8.3	NV	NP				SM-SW	SAND, SLIGHTLY SILTY
2	1	10			58.4	29	14		977		CL	CLAY, VERY SANDY
3	2	15-20			21.8	27	12		98		SC	SANDSTONE, CLAYEY
4	3	15	14.2	119.6	70.0	28	10			1.9	CL	CLAYSTONE, SANDY

TABLE 2

Summary of Depth to Bedrock, Groundwater

Test Boring No.	Depth to Bedrock (ft)	Depth to Groundwater (ft)
1	12	7
2	8	7
3	11	6.5

FIGURES



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

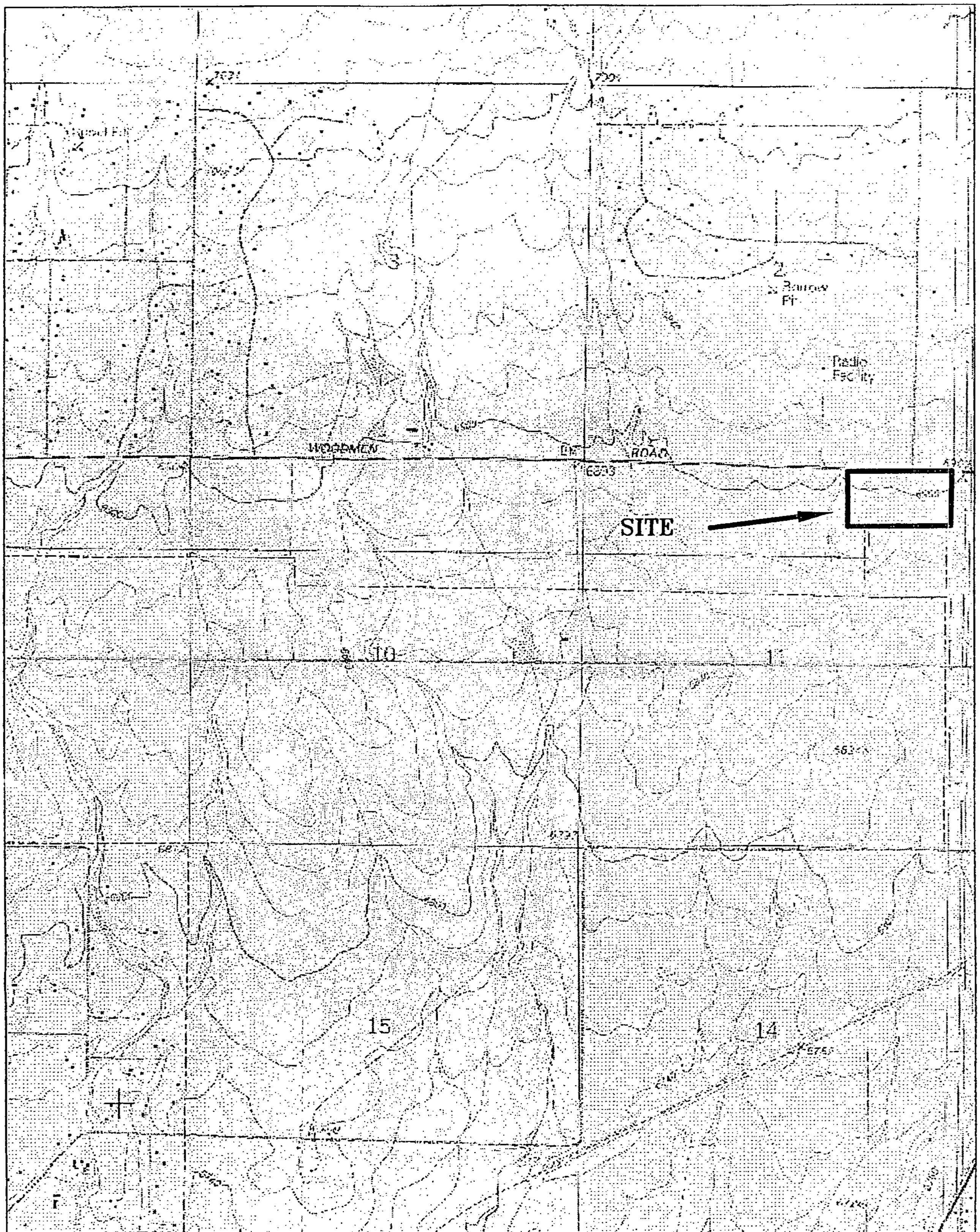
Vicinity Map
Rolling Thunder Business Park
El Paso County, CO.
For: Springs Engineering

DRAWN:	DATE:	CHECKED:	DATE:
KAH	6/7/07		

JOB NO.: 95647

FIG NO.: 1

M:\2007\GEOHAZ MAPS\95647 (FALCON)\95647 GEO MAP SET.DWG (06-07-07 11:47:04AM)



ENTECH ENGINEERING, INC.

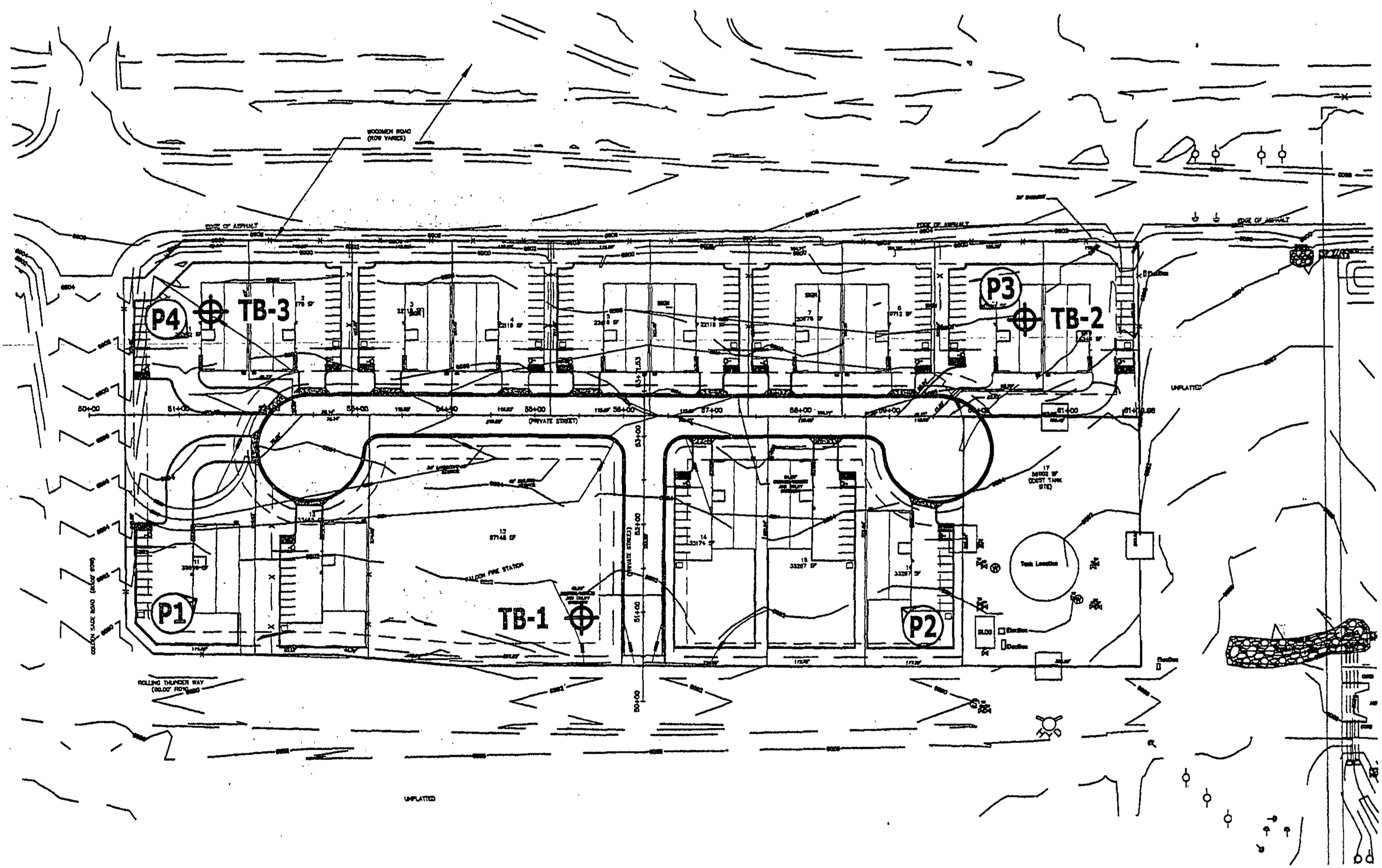
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

USGS Map
Rolling Thunder Business Park
El Paso County, CO.
For: Springs Engineering

DRAWN:	DATE:	CHECKED:	DATE:
KAH	6/7/07		

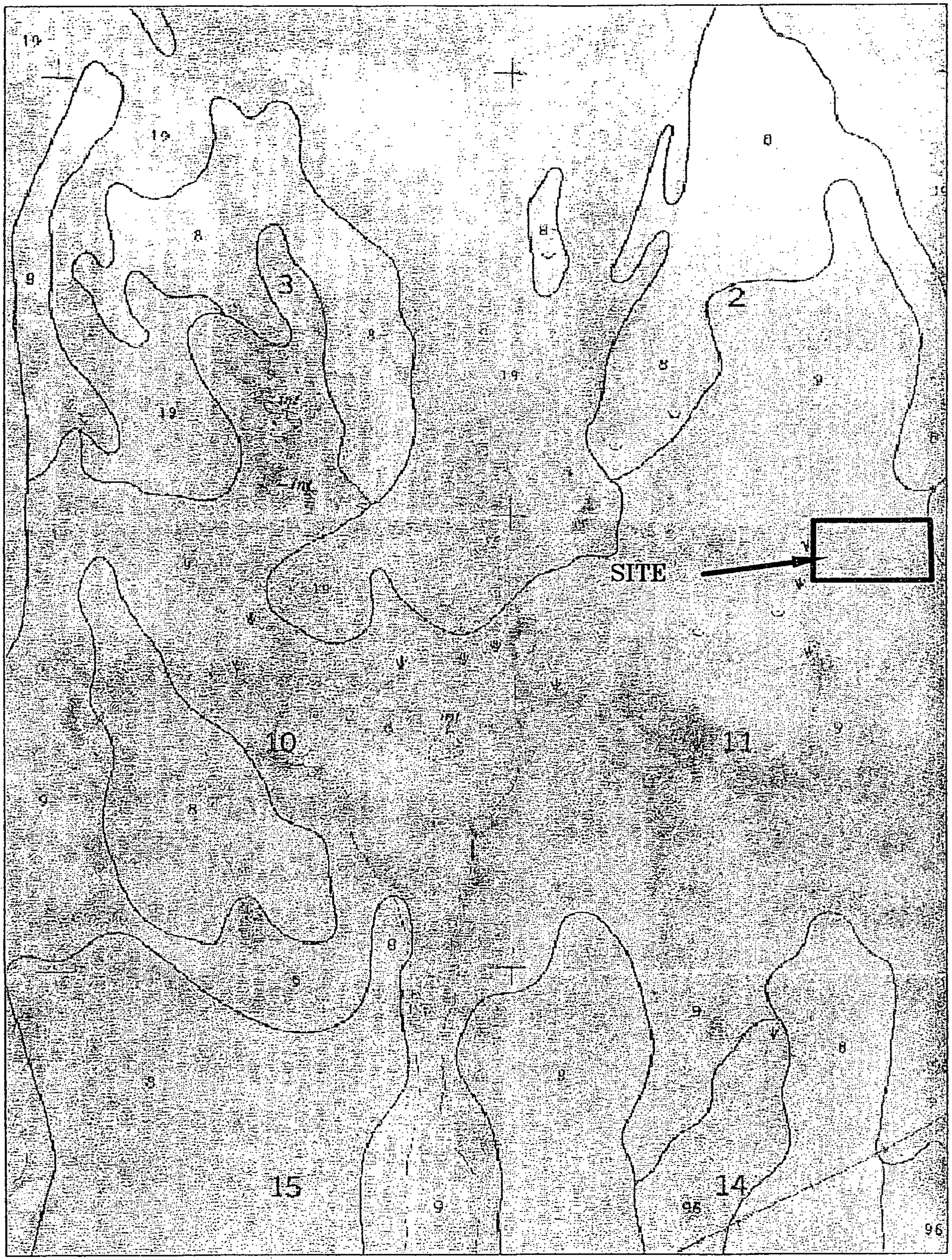
JOB NO.: 95647

FIG NO.: 2



TB-2 - DENOTES APPROXIMATE TEST BORING LOCATION & NUMBER

P2 - DENOTES APPROXIMATE LOCATION AND DIRECTION OF PHOTOS



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

SCS Map
Rolling Thunder Business Park
El Paso County, CO.
For: Springs Engineering

DRAWN:	DATE:	CHECKED:	DATE:
KAH	6/7/07		

JOB NO.: 95647

FIG NO.: 4

9—**Blakeland complex, 1 to 9 percent slopes.** This complex is on uplands, mostly in the Falcon area. The average annual precipitation is about 15 inches, the average annual air temperature is about 47 degrees F, and the frost-free period is about 135 days.

This complex is about 60 percent Blakeland loamy sand, about 30 percent Fluvaquentic Haplaquolls, and 10 percent other soils.

Included with these soils in mapping are areas of Columbine gravelly sandy loam, 0 to 3 percent slopes, Ellicott loamy coarse sand, 0 to 5 percent slopes, and Ustic Torrifluvents, loamy.

The Blakeland soil is in the more sloping areas. It is deep and somewhat excessively drained. It formed in sandy alluvium and eolian material derived from arkosic sedimentary rock. 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 or more.

Permeability of the Blakeland soil is rapid. The effective rooting depth is more than 60 inches. The available water capacity is moderate to low. Surface runoff is slow, and the hazard of erosion is moderate.

The Fluvaquentic Haplaquolls are in swale areas. They are deep, poorly drained soils. They formed in alluvium derived from arkosic sedimentary rock. Typically, the surface layer is brown. The texture is variable throughout. The water table is at a depth of 0 to 3 feet.

The Blakeland soil is well suited to deep-rooted grasses. Native vegetation is dominantly western wheatgrass, side-oats grama, and needleandthread. Rangeland vegetation on the Fluvaquentic Haplaquolls is dominantly tall grasses, including sand bluestem, switchgrass, prairie cordgrass, little bluestem, and sand reedgrass. Cattails and bulrushes are common in the swampy areas.

Proper range management is needed to prevent excess removal of plant cover from these soils. It is also needed to maintain the productive grasses. Interseeding improves the existing vegetation. Deferment of grazing during the growing season increases plant vigor and soil stability, and it helps to maintain and improve range condition. Proper location of livestock watering facilities helps to control grazing of animals.

Windbreaks and environmental plantings are fairly well suited to these soils. Blowing sand and low available water capacity are the main limitations to the establishment of trees and shrubs. The soils are 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.

The Blakeland soil is well 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. Wetland wildlife can be attracted to the Fluvaquentic Haplaquolls and the wetland habitat can be enhanced by several means. Shallow water developments can be created by digging or by blasting potholes to create open-water areas. Fencing to control livestock grazing is beneficial, and it allows wetland plants such as cattails, reed canarygrass, and rushes to grow. Control of unplanned burning and prevention of drainage that would remove water from the wetlands are good practices. Openland wildlife use the vegetation on these soils for nesting and escape cover. These shallow marsh areas are especially important for winter cover if natural vegetation is allowed to grow.

The Blakeland soil has good potential for homesites, roads, and streets. It needs to be protected from erosion when vegetation has been removed from building sites. The Fluvaquentic Haplaquolls have poor potential for homesites. Their main limitations for this use are the high water table and the hazard of flooding. Capability subclass VIe.

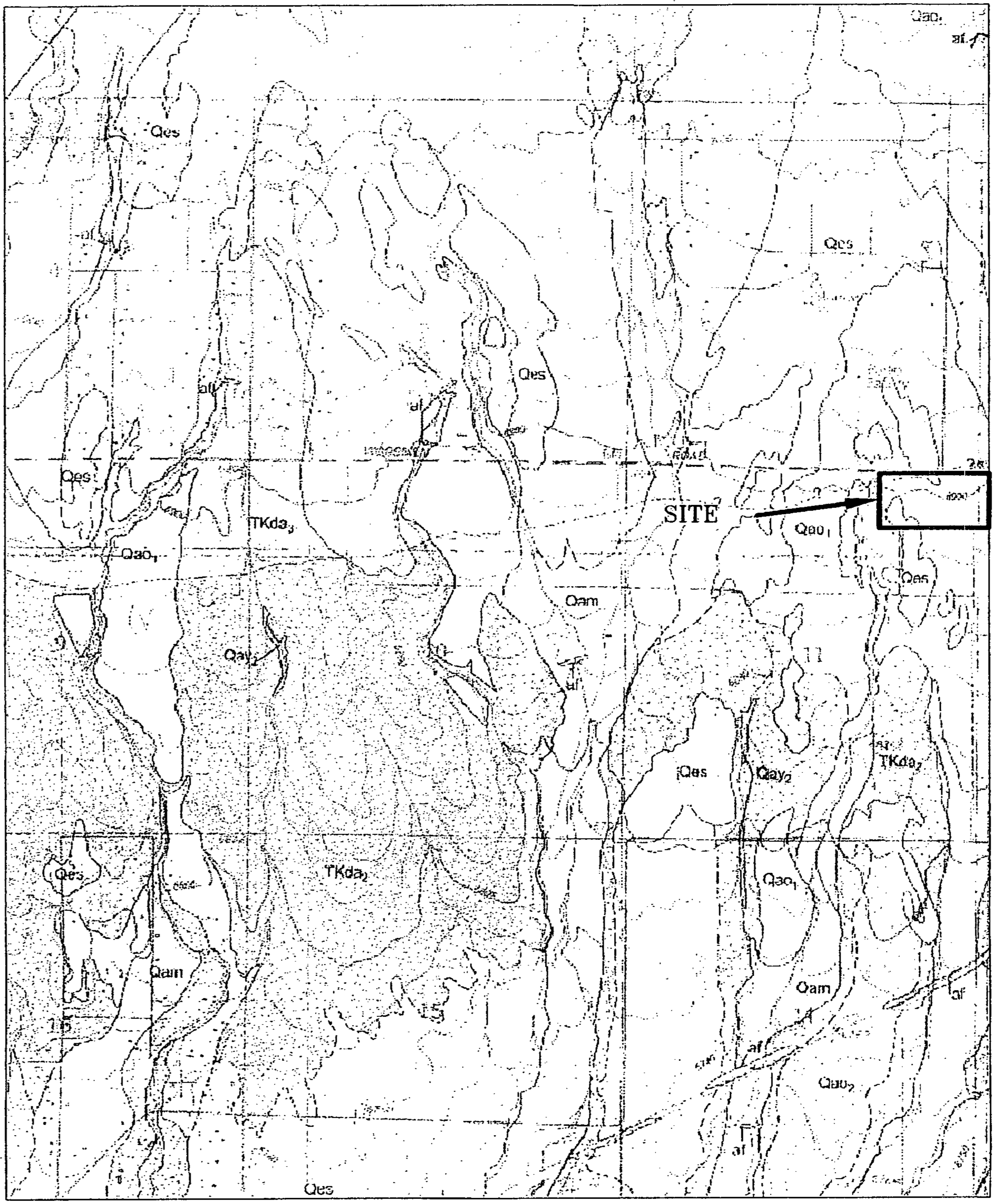
ENTECH ENGINEERING, INC.

SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date

Job No. 95647

Fig. No. 5



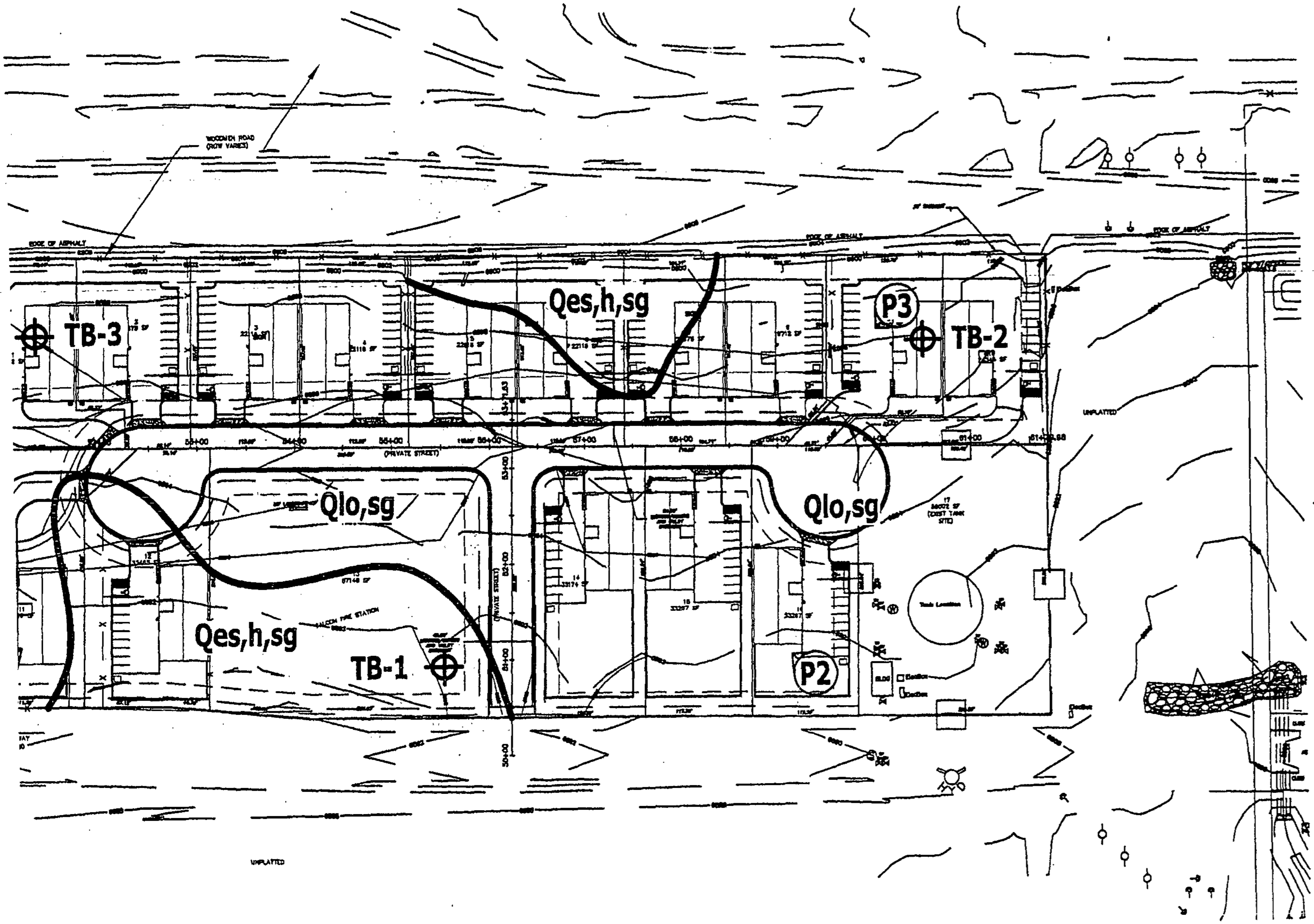
ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

Falcon NW Quadrangle Geology Map
Rolling Thunder Business Park
El Paso County, CO.
For: Springs Engineering

DRAWN:	DATE:	CHECKED:	DATE:
KAH	6/7/07		

JOB NO.: 95647

FIG NO.: 6



LEGEND

Qes - Eolian Sand of Qua
Wind blown sand d

Qlo - Louviers Alluvium
Sand stream terrac

h - hydrocompaction

sg - shallow groundwat

TB-2 - Test Borings

to 3 feet (usually areas
ase flood elevations

to 3 feet (usually sheet
terrain); average depths
as of alluvial fan flooding,
rmined.

rom 100-year flood by
otection system under
e elevations determined.

velocity hazard (wave
d elevations determined.

velocity hazard (wave
elevations determined.

IE AE

flood; areas of 100-year
e depths of less than
rainage areas less than
nd areas protected by
ear flood.

to be outside 500-year

flood hazards are

ARRIERS

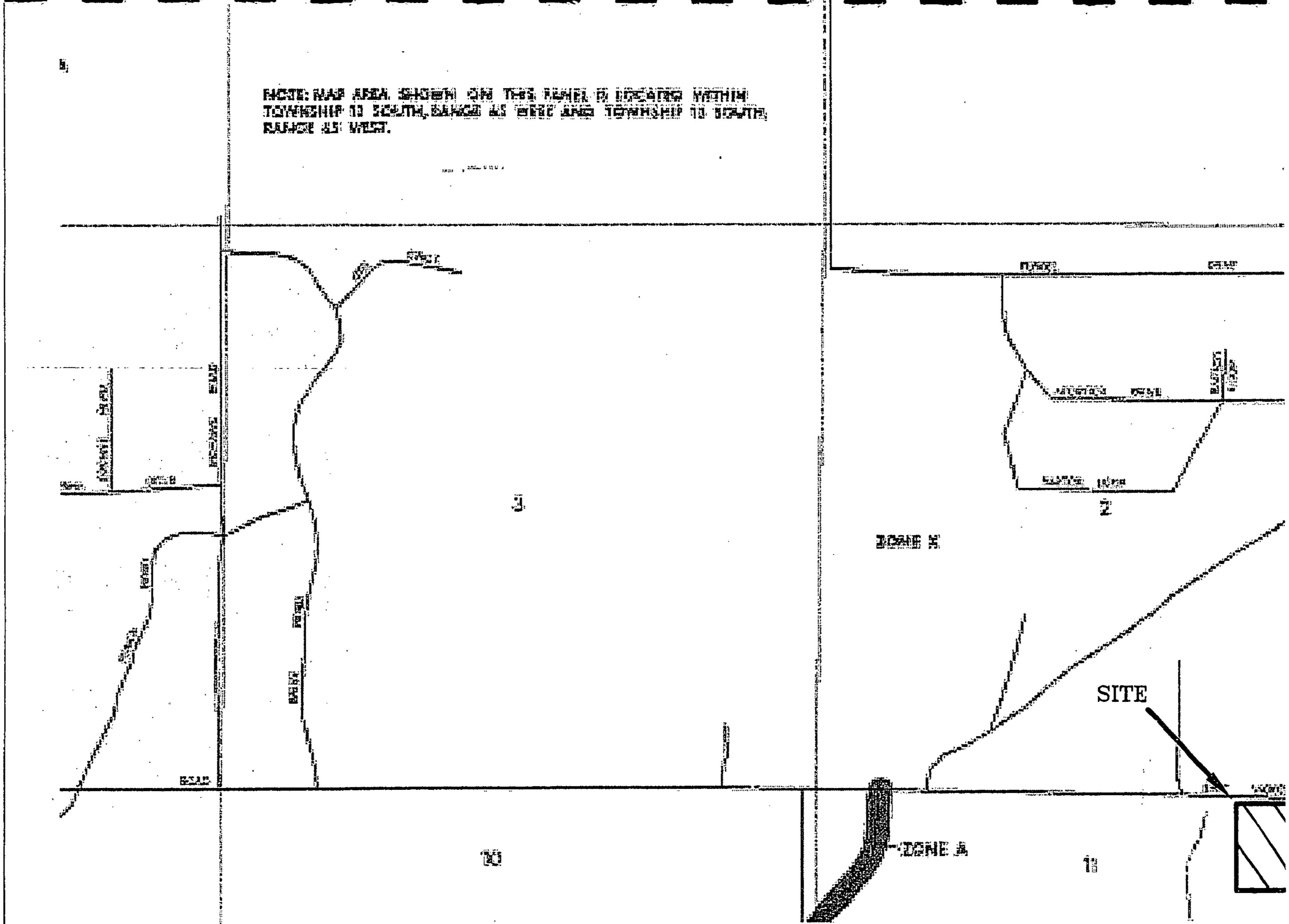
Otherwise
Protected Areas
r adjacent to Special

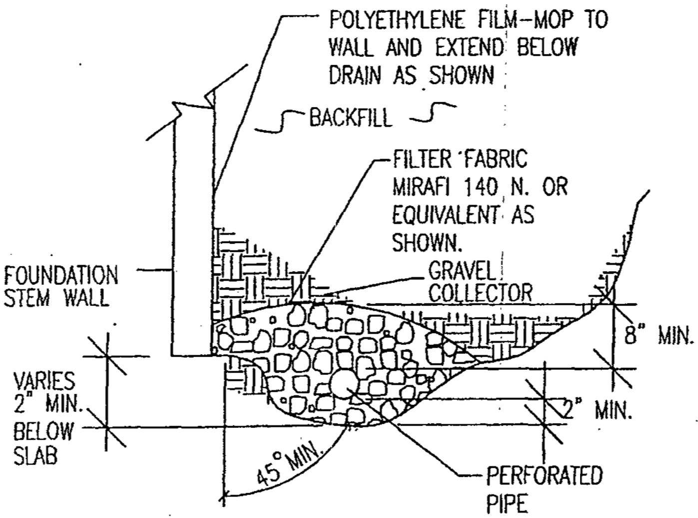
dary

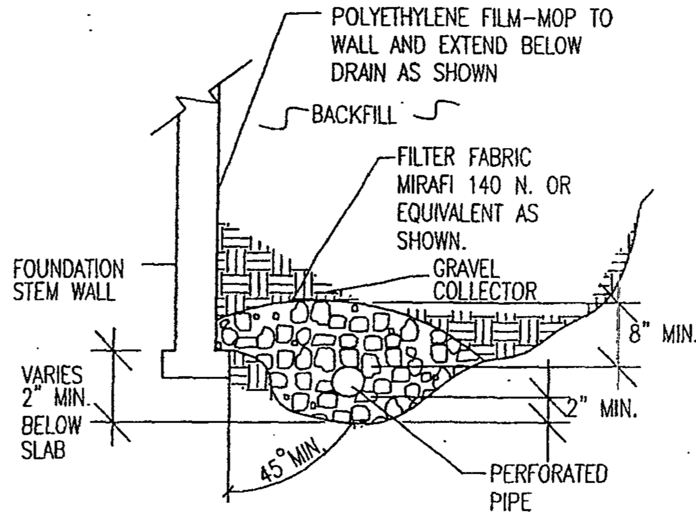
ary

ding Special Flood
, and Boundary
as of Different
Flood Elevations
al Flood Hazard

Elevation Line;
Feet. See Map Index
tum.
ine
Elevation in Feet
m Within Zone







NOTES:

--GRAVEL SIZE IS RELATED TO DIAMETER OF PIPE PERFORATIONS-85% GRAVEL GREATER THAN 2x PERFORATION DIAMETER.

-PIPE DIAMETER DEPENDS UPON EXPECTED SEEPAGE. 4-INCH DIAMETER IS MOST OFTEN USED.

-ALL PIPE SHALL BE PERFORATED PLASTIC. THE DISCHARGE PORTION OF THE PIPE SHOULD BE NON-PERFORATED PIPE.

-FLEXIBLE PIPE MAY BE USED UP TO 8 FEET IN DEPTH, IF SUCH PIPE IS DESIGNED TO WITHSTAND THE PRESSURES. RIGID PLASTIC PIPE WOULD OTHERWISE BE REQUIRED.

-MINIMUM GRADE FOR DRAIN PIPE TO BE 1% OR 3 INCHES OF FALL IN 25 FEET.

-DRAIN TO BE PROVIDED WITH A FREE GRAVITY OUTFALL, IF POSSIBLE. A SUMP AND PUMP MAY BE USED IF GRAVITY OUT FALL IS NOT AVAILABLE.

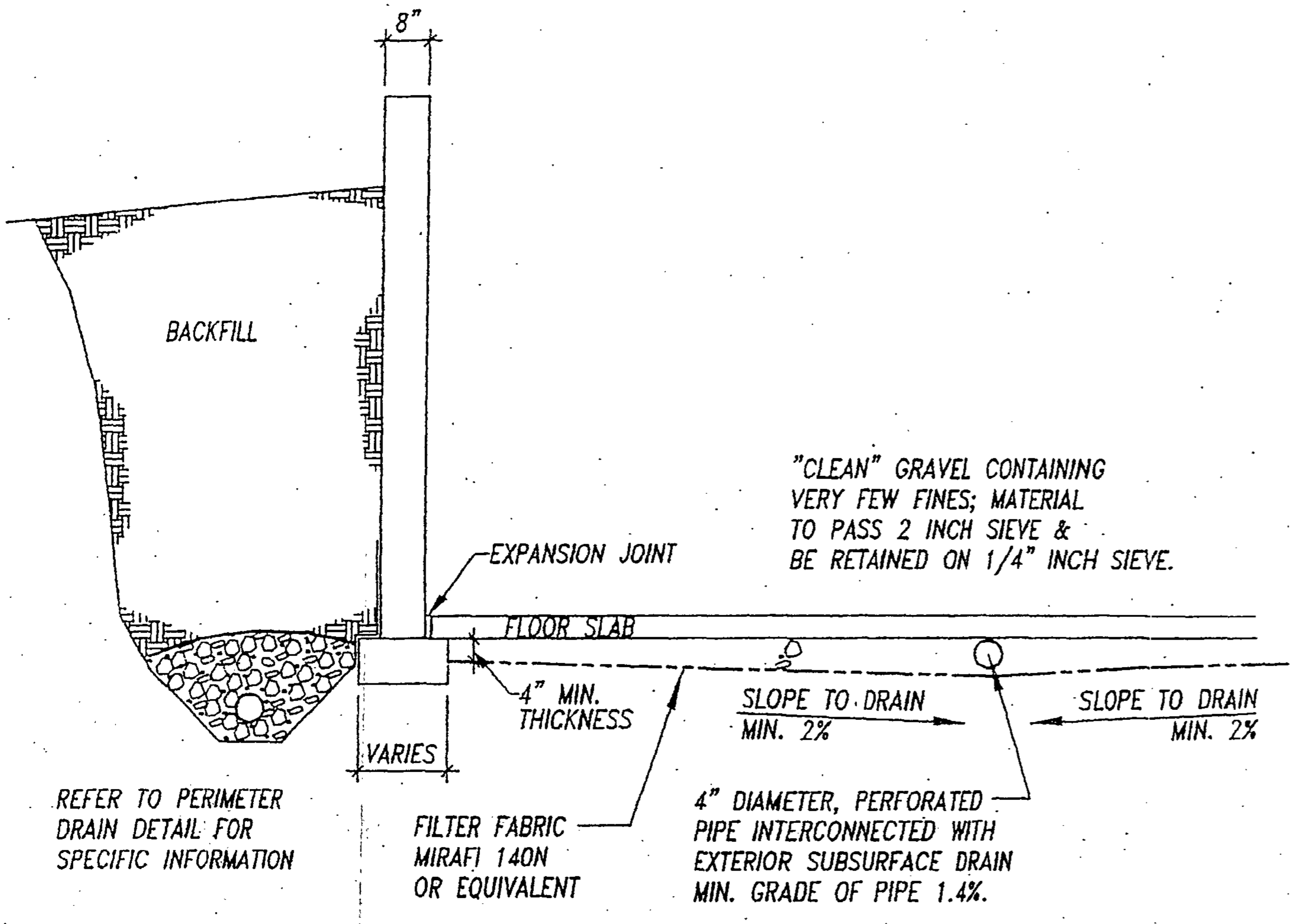
ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

PERIMETER DRAIN DETAIL

DRAWN:	DATE:	DESIGNED:	CHECKED:
R.J. OLSON			

JOB NO.: 95647

FIG NO.: 9

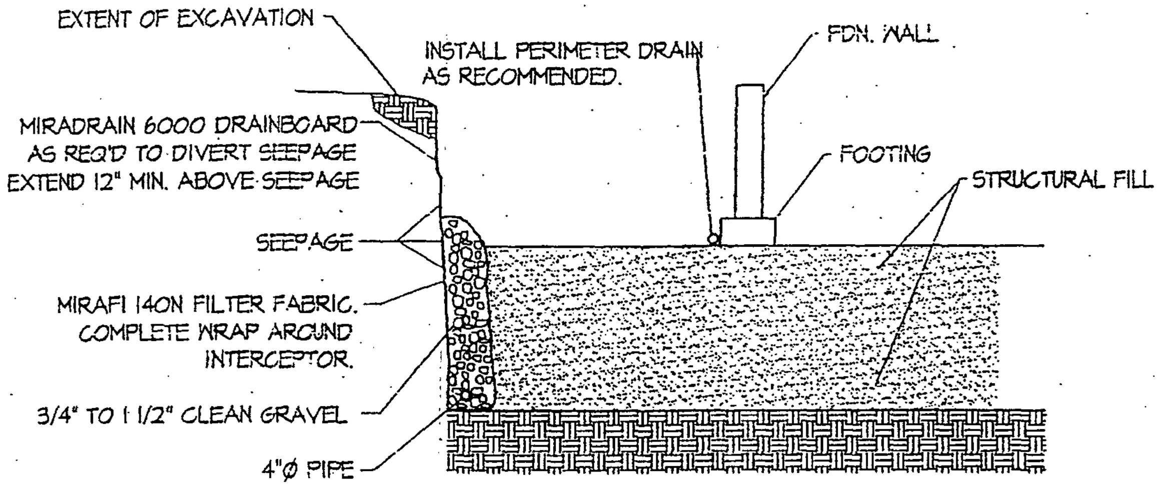


DRAWN	C. WALTON
CHECKED	
DATE	
SCALE	NTS
JOB NO.	95647
SHEET	10

TYP. UNDERSLAB DRAINAGE LAYER (CAPILLARY BREAK)

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

REVISION	BY



NOTE:
EXTEND INTERCEPTOR DRAIN TO DAYLIGHT

INTERCEPTOR DRAIN DETAIL

N.T.S.

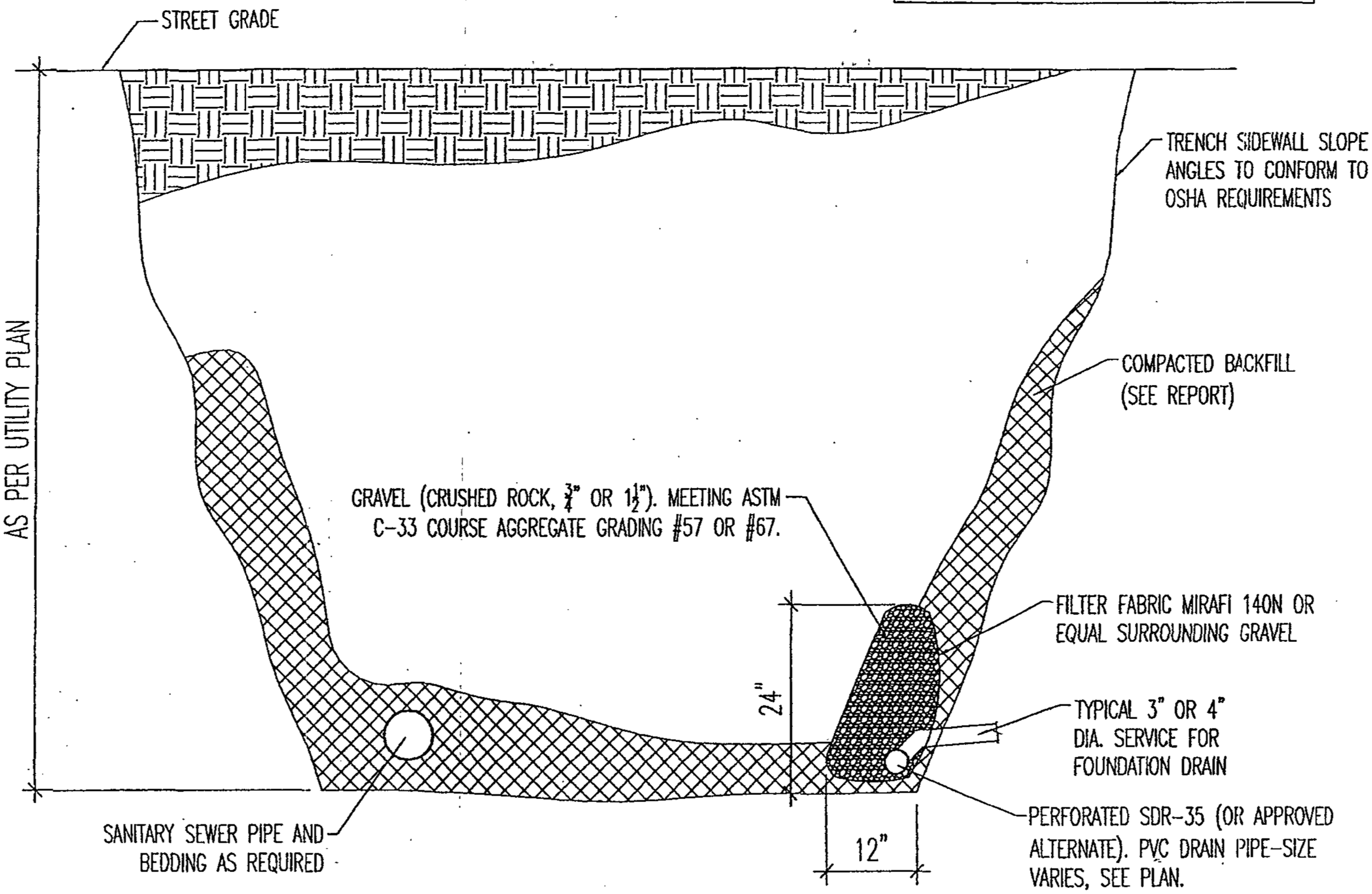
DRAWN	R.TEN
CHECKED	
DATE	
SCALE	NTS
JOB NO.	95647
SHEET 11 OF SHEETS	

INTERCEPTOR DRAIN DETAIL

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

REVISION	BY

NOTE:
TO BE USED IN CASES WHERE GROUNDWATER IS FOUND DURING TRENCHING OR WHERE SHALLOW GROUNDWATER IS KNOWN TO EXIST.



ACTIVE DRAIN BESIDE SEWER

N.T.S.

SIZE NUMBER	NOMINAL SIZE (SLEAVES WITH SQUARE OPENINGS)	AMOUNTS FINER THAN EACH LABORATORY SIEVE (SQUARE-OPENINGS), WEIGHT PERCENT											
		4" (100MM)	3½" (90MM)	3" (75MM)	2½" (63MM)	2" (50MM)	1½" (37.5MM)	1" (25.0MM)	¾" (19.0MM)	½" (12.5MM)	⅜" (9.5MM)	#4 (4.5MM)	#8 (2.36MM)
67	¾" TO #4 (19.0 TO 4.75 MM)	--	--	--	--	--	--	100	90 TO 100	--	20 TO 55	0 TO 10	0 TO 5
57	1" TO #4 (25.0 TO 9.5 MM)	--	--	--	--	--	100	95 TO 100	--	25 TO 60	--	0 TO 10	0 TO 5

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

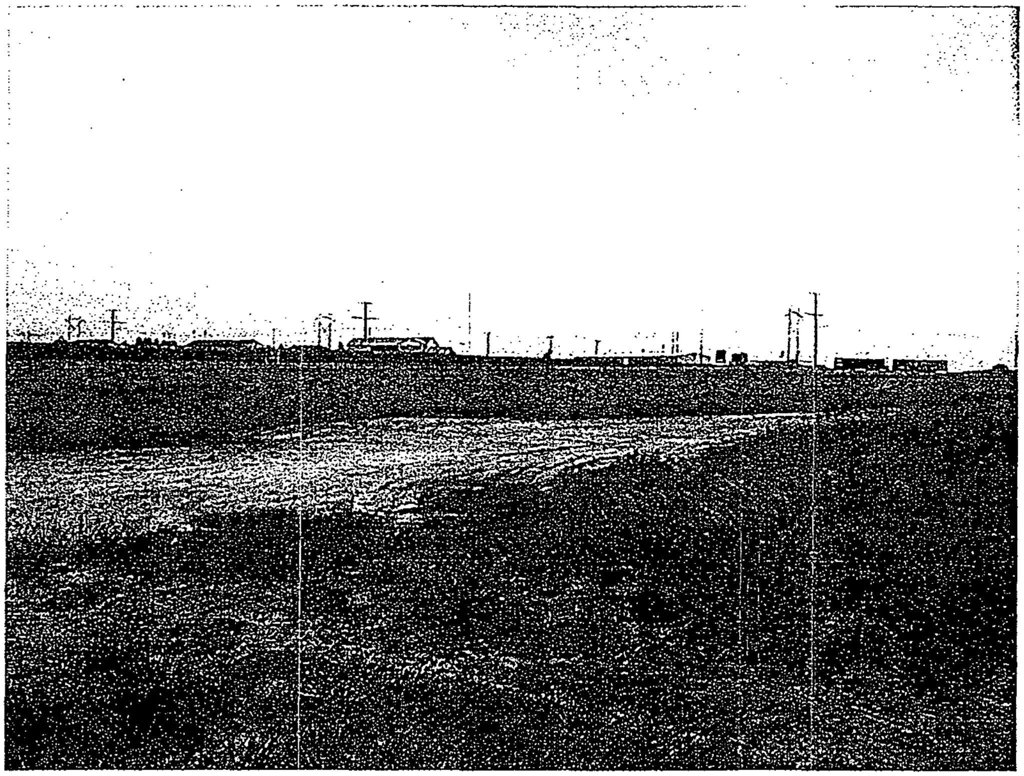
ACTIVE DRAIN BESIDE SEWER

DRAWN BY:	DATE DRAWN:	DESIGNED BY:	CHECKED:
J. MEIERHENRY	23MAY06	KAH	

JOB NO.: 95647

FIG. NO.: 12

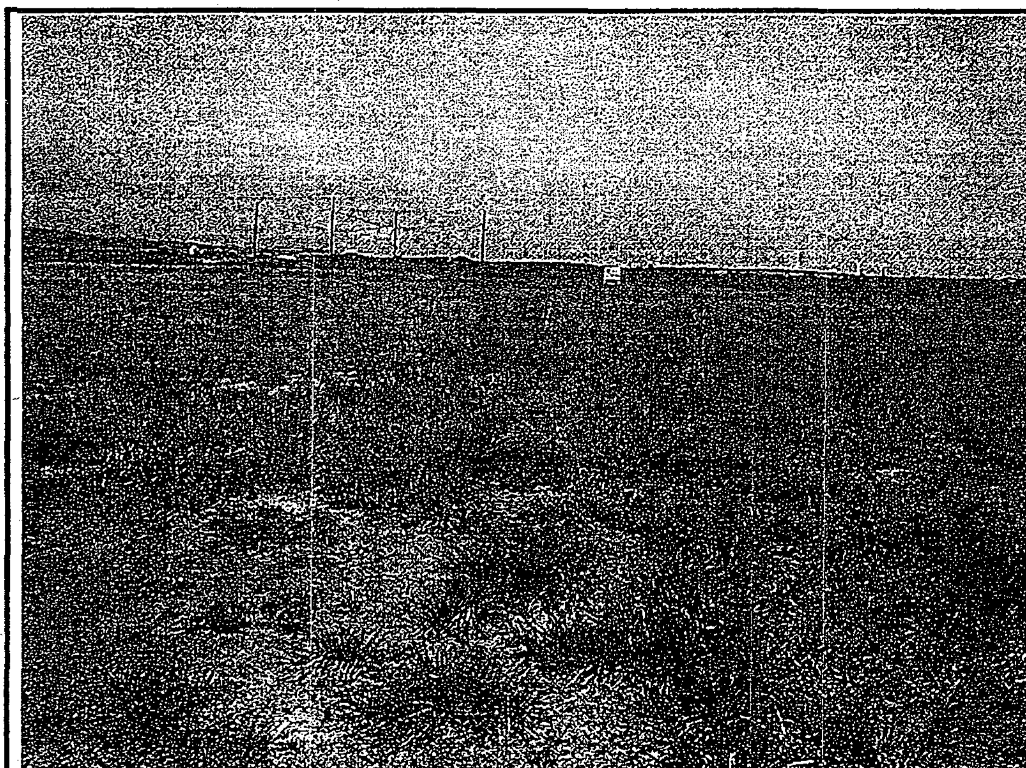
APPENDIX A: Site Photographs



1

Looking northeast from southwest portion of site.

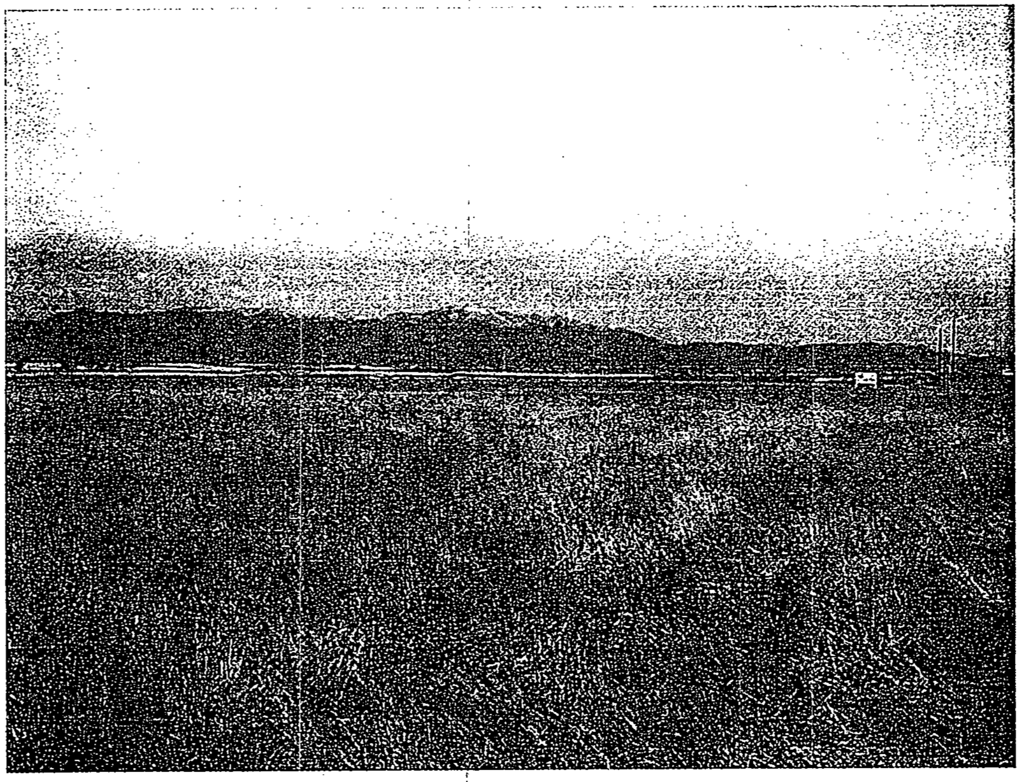
June 5, 2007



2

Looking northwest from southeast portion of site.

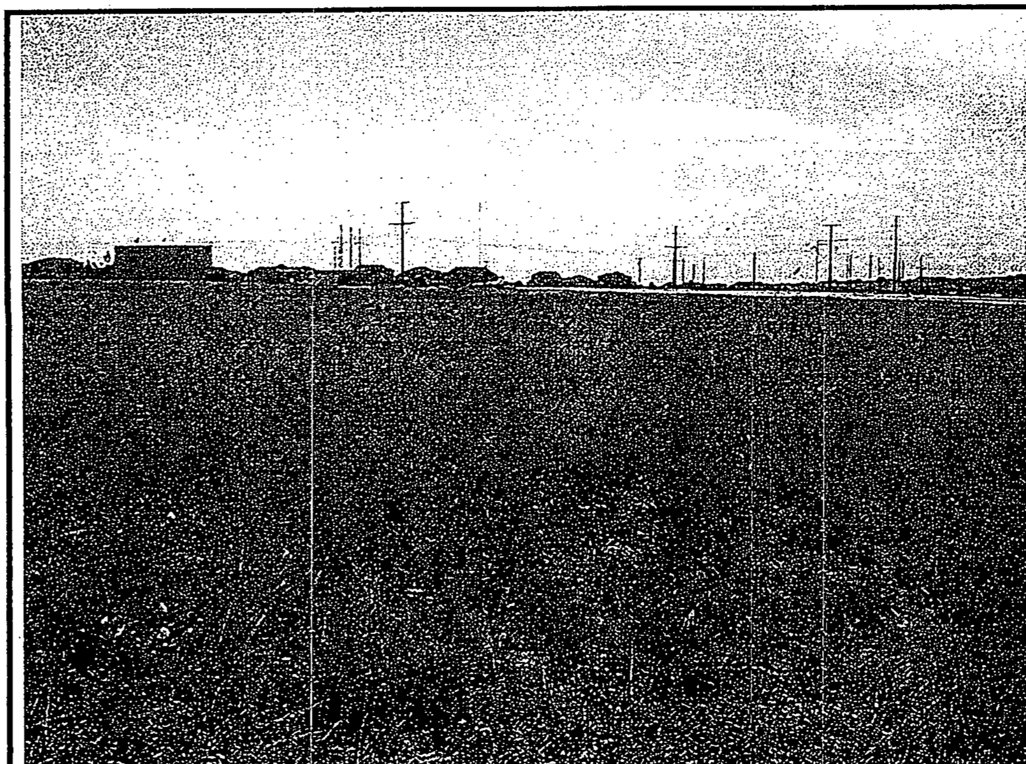
June 5, 2007



3

Looking southwest from northeast portion of site.

June 5, 2007



4

Looking southeast from northwest portion of site.

June 5, 2007

APPENDIX B: Test Boring Logs

TEST BORING NO.	1
DATE DRILLED	6/4/2007
Job #	95647

REMARKS

WATER @ 7', 6/5/07

SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, DARK BROWN TO TAN, MEDIUM DENSE, DRY TO WET

CLAY, VERY SANDY, GRAY BROWN, FIRM, MOIST

CLAYSTONE, SANDY, GRAY, HARD, MOIST

SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	16	1.5	1
5	23	2.2	1
10	12	11.3	2
15	50/11"	13.5	4
20	50/6"	10.3	3

TEST BORING NO.	2
DATE DRILLED	6/4/2007
CLIENT	SPRINGS ENGINEERING
LOCATION	FALCON HIGHLANDS

REMARKS

WATER @ 7', 6/5/07

SAND, SLIGHTLY SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST TO WET

WEATHERED SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY BROWN, DENSE, MOIST

SANDSTONE, CLAYEY, FINE TO COARSE GRAINED, GRAY, VERY DENSE, MOIST

Depth (ft)	Blows per foot	Watercontent %	Soil Type
	11	4.7	1
5	14	6.5	1
10	33	11.6	3
15	50/9"	11.0	3
20	50/5"	14.4	

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

DRAWN: DATE: CHECKED: [signature] DATE: 6/8/07

JOB NO.:

FIG NO.:

TEST BORING NO. 3
DATE DRILLED 6/4/2007
Job # 95647

TEST BORING NO.
DATE DRILLED
CLIENT SPRINGS ENGINEERING
LOCATION FALCON HIGHLANDS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
WATER @ 6.5', 6/5/07						
SAND, SLIGHTLY SILTY, FINE TO COARSE GRAINED, BROWN TO TAN, LOOSE TO MEDIUM DENSE, MOIST			■	6	3.2	1
	5		■	24	8.8	1
CLAY, VERY SANDY, GRAY BROWN, STIFF, MOIST			■	*	11.8	2
	10		■	27	11.0	2
CLAYSTONE, SANDY, GRAY, HARD, MOIST						
	15		■	50/10"	14.9	4
SANDSTONE, CLAYEY, FINE GRAINED, GRAY, VERY DENSE, MOIST	20		■	50/5"	10.8	3

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
	5					
	10					
	15					
	20					

* - BULK SAMPLE TAKEN

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

TEST BORING LOG

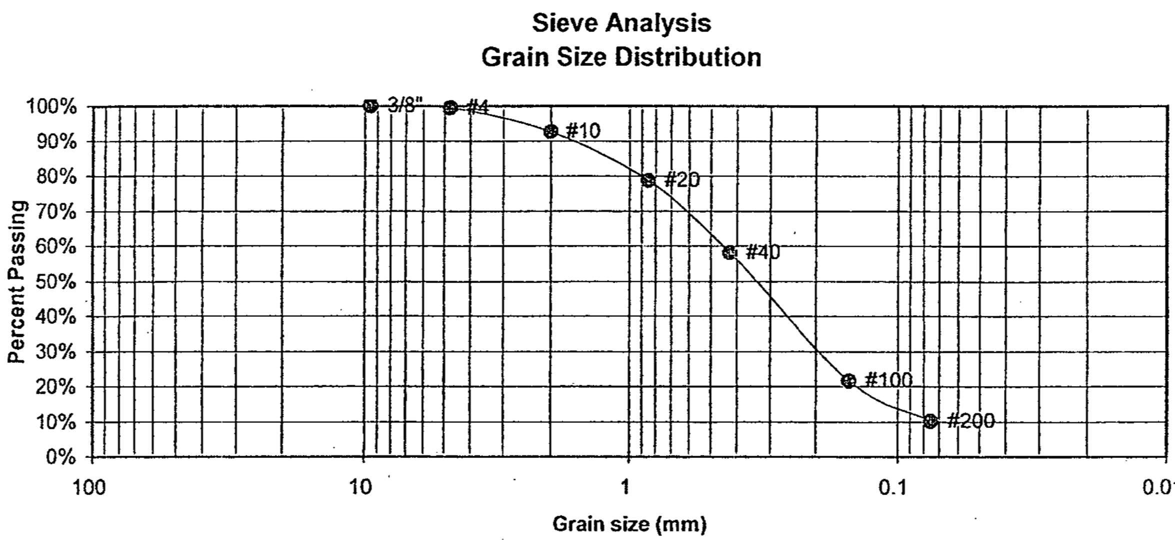
DRAWN: DATE: CHECKED: [signature] DATE: 6/8/07

JOB NO.:

FIG NO.:

APPENDIX C: Laboratory Test Results

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SPRINGS ENGINEERING
SOIL TYPE #	1	PROJECT	FALCON HIGHLANDS
TEST BORING #	2	JOB NO.	95647
DEPTH (FT)	5	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.4%
10	92.7%
20	78.6%
40	58.1%
100	21.6%
200	10.1%

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, COLORADO 80907

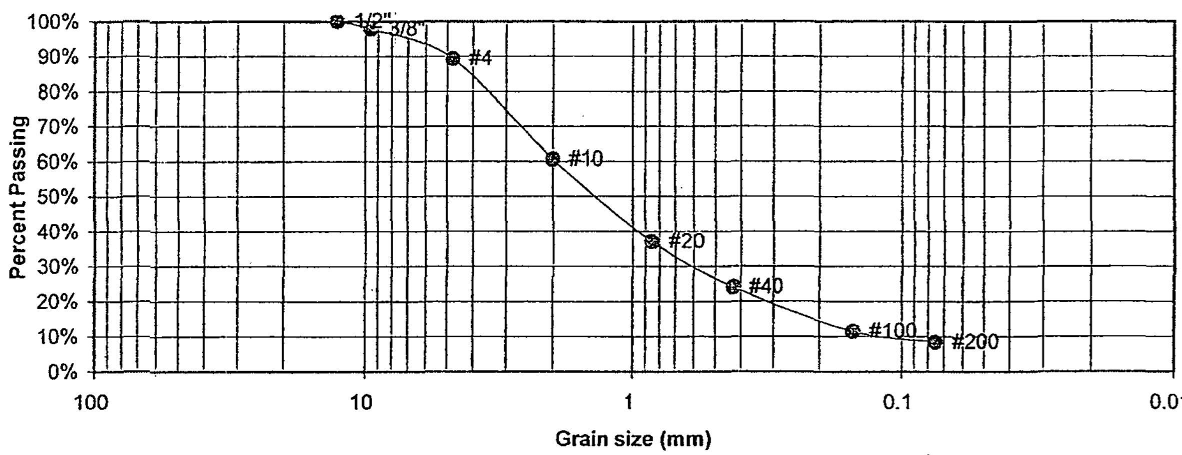
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		[illegible]	6/7/01

JOB NO.:

FIG NO.:

UNIFIED CLASSIFICATION	SM-SW	CLIENT	SPRINGS ENGINEERING
SOIL TYPE #	1	PROJECT	FALCON HIGHLANDS
TEST BORING #	3	JOB NO.	95647
DEPTH (FT)	2-5	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.8%
4	89.3%
10	60.6%
20	37.1%
40	24.1%
100	11.4%
200	8.3%

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)

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

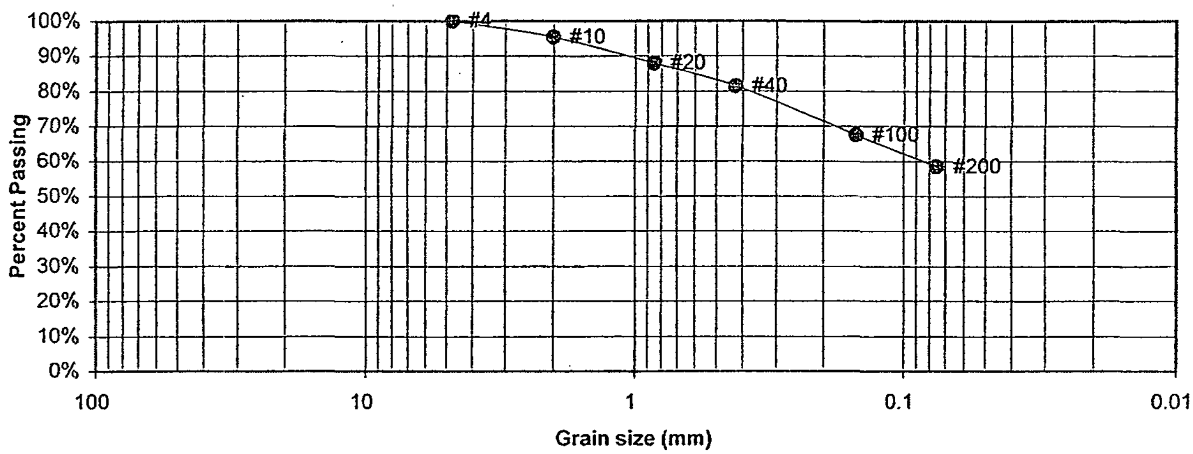
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		Kat	6/7/07

JOB NO.:

FIG NO.:

UNIFIED CLASSIFICATION	CL	CLIENT	SPRINGS ENGINEERING
SOIL TYPE #	2	PROJECT	FALCON HIGHLANDS
TEST BORING #	1	JOB NO.	95647
DEPTH (FT)	10	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	95.4%
20	87.9%
40	81.4%
100	67.6%
200	58.4%

Atterberg Limits

Plastic Limit	15
Liquid Limit	29
Plastic Index	14

Swell

Moisture at start	8.5%
Moisture at finish	21.5%
Moisture increase	13.0%
Initial dry density (pcf)	103
Swell (psf)	977

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

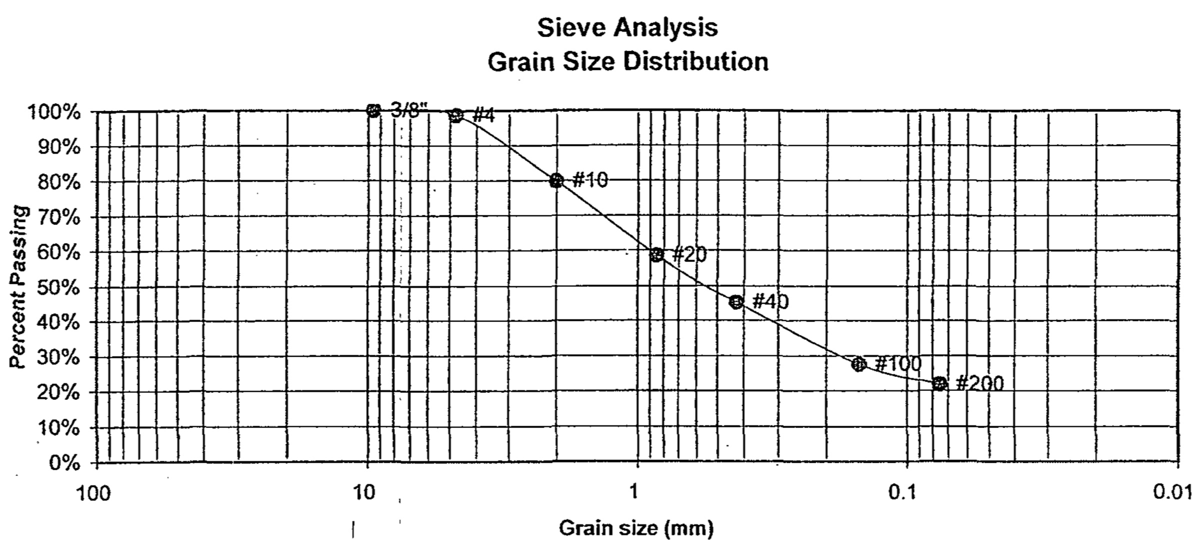
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		RSH	6/7/07

JOB NO.:

FIG NO.:

UNIFIED CLASSIFICATION	SC	CLIENT	SPRINGS ENGINEERING
SOIL TYPE #	3	PROJECT	FALCON HIGHLANDS
TEST BORING #	2	JOB NO.	95647
DEPTH (FT)	15-20	TEST BY	DG



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	98.6%
10	79.8%
20	58.6%
40	45.1%
100	27.5%
200	21.8%

Atterberg Limits	
Plastic Limit	15
Liquid Limit	27
Plastic Index	12

Swell	
Moisture at start	7.8%
Moisture at finish	17.4%
Moisture increase	9.6%
Initial dry density (pcf)	105
Swell (psf)	98

ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

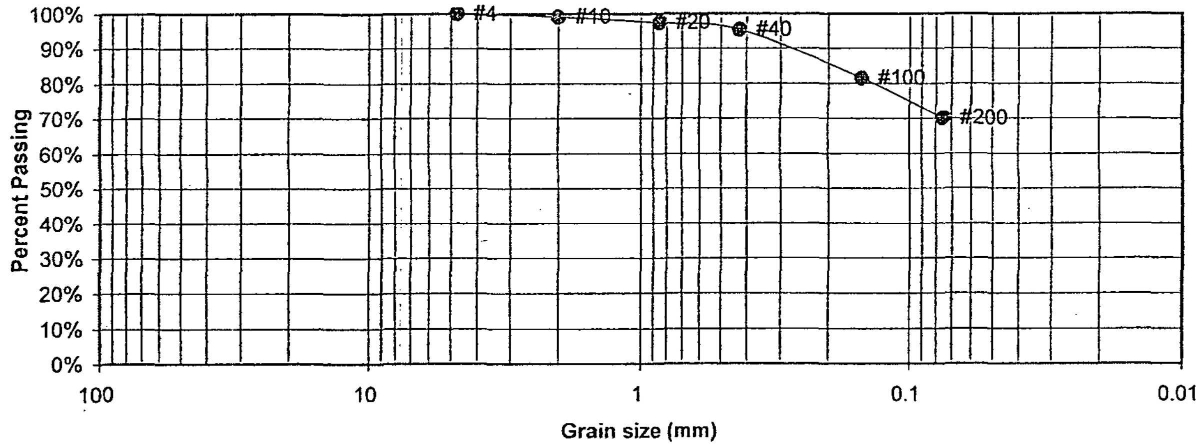
LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		KAH	6/7/07

JOB NO.:

FIG NO.:

UNIFIED CLASSIFICATION	CL	CLIENT	SPRINGS ENGINEERING
SOIL TYPE #	4	PROJECT	FALCON HIGHLANDS
TEST BORING #	3	JOB NO.	95647
DEPTH (FT)	15	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	97.3%
40	95.3%
100	81.4%
200	70.0%

Atterberg Limits	
Plastic Limit	18
Liquid Limit	28
Plastic Index	10

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

ENTECH ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		[signature]	6/7/07

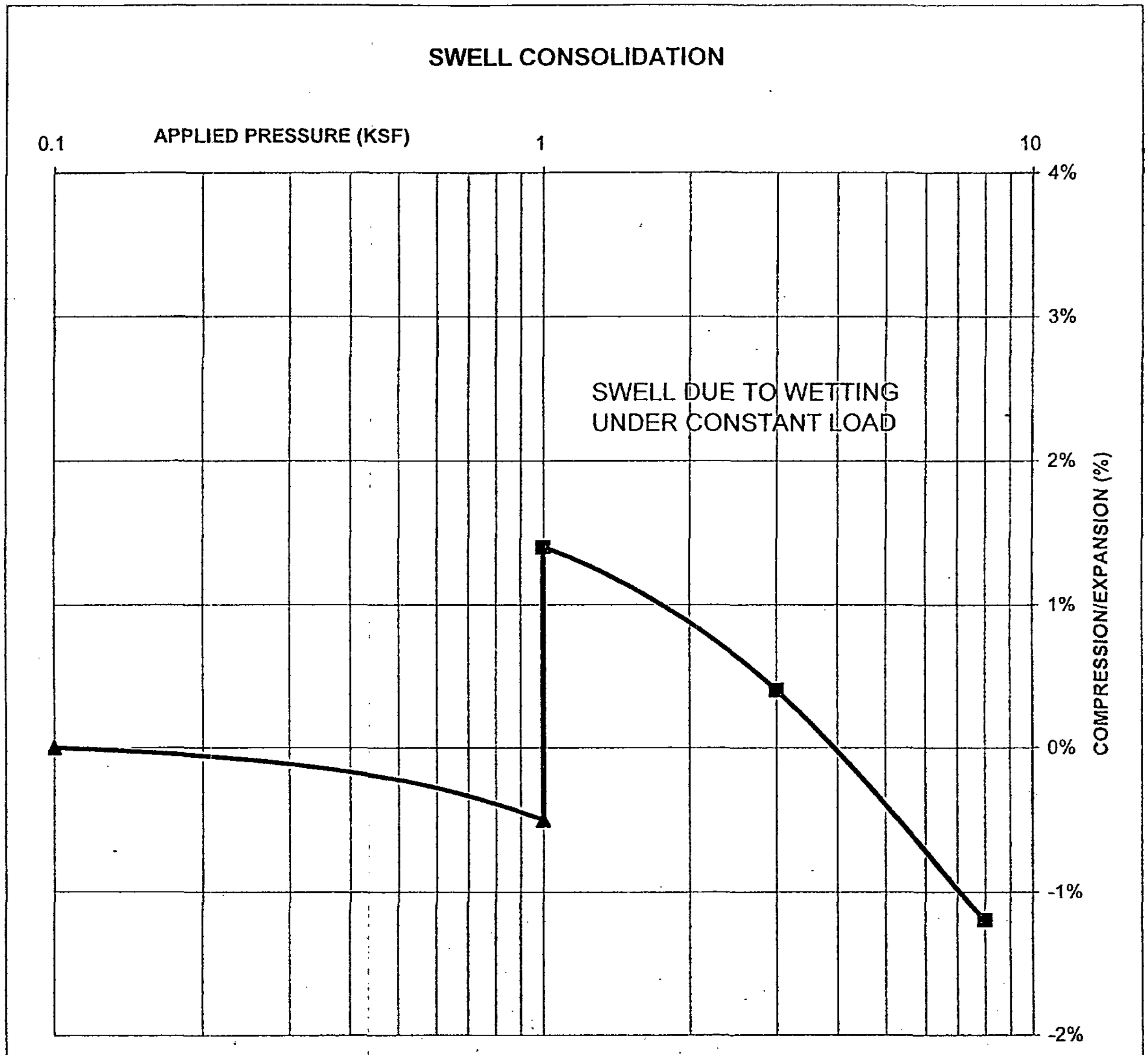
JOB NO.:

FIG NO.:

CONSOLIDATION TEST RESULTS

TEST BORING #	3	DEPTH(ft)	15
DESCRIPTION	CL	SOIL TYPE	4
NATURAL UNIT DRY WEIGHT (PCF)			120
NATURAL MOISTURE CONTENT			14.2%
SWELL/CONSOLIDATION (%)			1.9%

JOB NO. 95647
CLIENT SPRINGS ENGINEERING
PROJECT FALCON HIGHLANDS



ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		[signature]	6/7/07

JOB NO.:

FIG NO.: