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**SOIL, GEOLOGY, GEOLOGIC HAZARD,
AND WASTEWATER STUDY,
THE RESERVE AT CORRAL BLUFFS
EL PASO COUNTY, COLORADO**

Prepared for

Corral Ranches Development Company
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Respectfully Submitted,

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1.0 SUMMARY

Project Location

The project lies in portions of Sections 31 and 32, Township 13 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 5 miles east of Colorado Springs, Colorado.

Project Description

Total acreage involved in the project is approximately 186 acres. The proposed development consists of 31 single-family rural residential lots. The development will utilize individual wells and treatment systems.

Scope of Report

This report presents the results of our geologic evaluation, treatment of engineering geologic hazard study and wastewater study for individual sewage treatment systems.

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 constraints on development and land use. These include areas of potentially seasonal shallow groundwater areas, areas of ponded water, artificial fill, hydrocompaction, expansive soils, potentially collapsible soils, and potentially unstable slopes. 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 portions of Sections 31 and 32, Township 13 South, Range 64 West of the 6th Principal Meridian in El Paso County, Colorado. The site is located approximately 5 miles east of Colorado Springs, Colorado, south of Blaney Road South and east of Meridian Road. The location of the site is as shown on the Vicinity Map, Figure 1.

The topography of the site varies from gently to moderately sloping generally to the north with steeper slopes in the southern portions of the site that slope to the south. Minor drainages on site flow north on the main portion of the property. No water was observed flowing in any of these drainages at the time of this investigation however, minor areas of ponded water were observed behind an earthen dam in the northern central portion of the site. The site boundaries are indicated on the USGS Map, Figure 2. An aerial photograph of the area of the site is presented in Figure 3. Previous land uses have included grazing and pasture land. The site contains primarily field grasses and weeds with areas of yucca. Site photographs, taken December 19, 2011, are included in Appendix A.

Total acreage involved in the proposed development is approximately 183 acres. Thirty-one single-family rural residential lots are proposed with areas of open space in the southern portion of the site. Lot sizes range from 5.0 acres to 6.1 acres. The area will be serviced by individual wells and sewage treatment systems. The proposed Development Plan by Land Resource Associates, dated January 4, 2012, is presented in Figure 4.

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.
- The site will be evaluated for individual sewage treatment systems in accordance with El Paso Land Development Code.

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 Natural Resource Conservation Service (NRCS), previously 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 were performed by personnel of Entech Engineering, Inc. on December 19, 2011.

Nine (9) percolation tests were performed on the site to determine general suitability of the site for the use of individual wastewater treatment systems. The locations of these percolation tests are indicated on the Development Plan/Percolation Test Location Map, Figure 4. The Test Boring Logs from the Profile Holes are presented in Appendix B. Results of this testing will be discussed later in this report.

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

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 14 miles to the west 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 the southeastern 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 (Reference 1). The rocks in the area of the site are sedimentary in nature, and typically Tertiary to Upper Cretaceous in age. The bedrock underlying the site consists of the Dawson Arkose Formation. Overlying this formation are unconsolidated deposits of residual, colluvial, man-made, eolian and alluvial soils of the Quaternary Age. The residual soils are produced by the in-situ action of weathering of the bedrock on site. Some colluvial soils exist which are deposited by gravity and sheetwash. The alluvial soils were deposited by water in the minor drainage areas on site and as stream deposits. The eolian materials were deposited by wind. Fill material exist as earthen dams and erosion berms. The site's stratigraphy will be discussed in more detail in Section 5.3.

5.2 Soil Conservation Survey

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has mapped four soil types on the site (Figure 5). In general, they vary from sandy loam and clay loam to areas of sandstone. The soils are described as follows:

<u>Type</u>	<u>Description</u>
3	Ascalon Sandy Loam, 3-9% Slopes
4	Badland
13	Bresser Sandy loam, 5-9% Slopes
85	Stapleton – Bernal Sandy Loams, 3-20% Slopes

Complete descriptions of each soil type are presented in Appendix D. The soils have generally been described to have rapid to moderate permeabilities. Soil Type 4 (Badland) exists on the steeper slopes in the southern portion of the site where no development is proposed. Soil Types 3 and 13 have been described as having good potential for home sites. Limitations on soil Type 85 include steep slopes, and depth to bedrock. 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 erosion hazards with high erosion hazards on Soil Type 4 (Badland) due to the potential for gullying.

5.3 Site Stratigraphy

The Colorado Geology Map showing the site is presented in Figure 6 (Reference 4). The Corral Bluff/Falcon Geology Map, showing the site, is presented in Figure 7 (Reference 5). The Geology Map prepared for the site is presented in Figure 8. Five mappable units were identified on this site which are described as follows:

Artificial Fill of Holocene Age: These are man-made fill deposits associated with erosion berms and earthen dams on-site.

Recent Alluvium of Holocene Age: These are recent stream deposits associated with the drainages on-site. These materials generally consist of silty to clayey sands and may contain clay lenses.

Piney Creek Alluvium of Holocene Age: This material is a water-deposited terrace alluvium, typically classified as a silty to well-graded sand, brown to dark brown in color and of moderate density. The Piney Creek Alluvium can sometimes be very highly stratified containing thin layers of very silty and clayey soil.

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.

Colluvium of Quaternary Age overlying Dawson Arkose of Tertiary to Cretaceous Age:

These materials consist of silty to clayey sands and sandy clays, deposited by the action of sheetwash and gravity. Some areas contain residual soils derived from the in-situ weathering of the bedrock materials. These soils are overlying the Dawson Formation. The Dawson Formation typically consists of coarse-grained, arkosic sandstone with interbedded lenses of fine-grained sandstone, siltstone and claystone.

The soils listed above were mapped from site-specific mapping, the *Geologic Map of the Pueblo 1°x 2° Quadrangle* distributed by the US Geological Survey in 1978 (Reference 4) and the *Geologic Map of the Corral Bluffs and Falcon Quadrangles* by Charles S. Robinson and Associates, Inc. in 1977 (Reference 5). The Test Borings from the profile holes were also used in evaluating the site and are included in Appendix B. The Geology Map prepared for the site is presented in Figure 8.

5.4 Soil Conditions

The soils encountered in the Profile Holes of the percolation tests can be grouped into four general soil and rock types. The soils were classified using the Unified Soil Classification System (USCS).

Soil Type 1 is a silty to very silty sand (SM), encountered in the upper soil profile in all but one of the profile holes. These soils were encountered at medium dense to dense states and at moist conditions. Samples tested had 27% to 49% passing the No. 200 Sieve. A consolidation of 0.6% was measured in the Swell/Consolidation Test. This consolidation is in the low range.

Soil Type 2 consists of sandy to very sandy clay and clay-silt (CL, CL-ML). The clays were encountered in two of the profile holes at depths ranging from the surface to 9 feet below the surface. These soils were encountered at stiff to very stiff consistencies and moist conditions. Samples tested had 57% to 74% passing the No. 200 sieve. A swell of 3.3% was measured on the clays in the Swell/Consolidation Test. This swell is in the moderate to high expansion range. A consolidation of 0.2% was measured on the soils in the Swell/Consolidation Test indicating low potential for consolidation.

Soil Type 3 consists of sandy to very sandy silt (ML). This material was encountered in two of the test borings at the surface and extending to the depths explored. The silt was encountered at stiff to very stiff consistencies and at moist conditions. The samples tested had 52% to 64% passing the No. 200 sieve. A swell pressure of 850 psf was measured in the FHA Swell Test. This swell is in the low expansion range.

Soil Type 4 consists of very clayey to silty sandstone bedrock (SM, SC, SC-SM). This material was encountered in 4 of the test borings at 7 to 13 feet below the surface. The sandstone was encountered at very dense states and moist conditions. The samples tested had 40% to 44% passing the No. 200 sieve. A FHA swell pressure of 1330 psf was measured on the very clayey sandstone. This swell is in the moderate expansion range.

The Test Boring Logs from the Profile Holes are presented in Appendix B. Laboratory Test Results are presented in Appendix C. A Summary of Laboratory Test Results is presented in Table 1.

5.5 Groundwater

Groundwater was not encountered in any of the profile holes which were drilled to 10 and 15 feet. Areas of potentially seasonal shallow groundwater and ponded water have been mapped in the drainages on-site. These areas are discussed in the following section. Fluctuation in groundwater conditions may occur due to variations in rainfall and other factors not readily apparent at this time.

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 clays. 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, 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:

Artificial Fill

Fill associated with erosion berms and an earthen dam was observed on site. Additionally, other areas of artificial fill may be encountered in areas other than those mapped. These berms and dam are considered uncontrolled for construction purposes.

Mitigation: These areas are limited and it is anticipated they could be avoided by construction. Any uncontrolled fill encountered beneath foundation will require removal and recompaction at a minimum of 92% of its maximum Modified Proctor Dry Density, ASTM D-1557.

Collapsible soils

Collapsible soils were encountered in some of the profile holes of the percolation test drilled on-site. Consolidations ranging from 0.2% to 0.6% were measured on samples tested in the Swell/Consolidation Test. These soils are highly sporadic, therefore, none have been indicated on the map. Should loose or collapsible soils be encountered beneath foundations, mitigation will be necessary.

Mitigation: Mitigation for collapsible soils typically involves overexcavation and recompaction of the material to a minimum of 92% of its maximum Proctor Dry Density, ASTM D-1557. Overexcavation depths vary from 2 to 4 feet depending upon the materials present and proposed loads. Where collapsible clays are encountered, overexcavation and replacement with non-expansive structural fill compacted at a minimum of 92% of its maximum Proctor Dry Density, ASTM D-1557 may be necessary. Final recommendations should be determined after additional investigation on each building site.

Expansive Soils

Expansive soils were encountered in some of the test borings drilled on-site. These occurrences are typically sporadic; therefore, none have been indicated on the maps. These clays, if encountered beneath foundations, can cause differential movement in the structure foundation. These occurrences should be identified and mitigated on an individual basis.

Mitigation: Should expansive soils be encountered beneath the foundation, mitigation will be necessary. Mitigation of expansive soils will require special foundation design. Overexcavation and replacement with non-expansive soils at a minimum of 90% of its maximum Modified Proctor Dry Density, ASTM D-1557 is a suitable mitigation, which is common in the area. Another alternative in areas of highly expansive soils is the use of drilled pier foundation systems. Typical minimum pier depths are on the order of 24 feet or more and require penetration into the bedrock material a minimum of 4 to 6 feet, depending on building loads. Floor slabs on expansive soils should be expected to experience movement. Overexcavation and replacement has been successful in minimizing slab movements. The use of structural floors should be considered for basement construction on highly expansive clays. Final recommendations should be determined after additional investigation of each building site.

Potentially Seasonal Shallow Groundwater Area

In these areas, we would anticipate the potential for periodically high subsurface moisture conditions, frost heave potential and highly organic soils. The majority of these areas lie within minor drainage areas which can be avoided by the proposed development. Construction in any portions of these areas, if required, should follow these precautions.

Mitigation: Due to lot sizes, it is anticipated these areas can be avoided by structures. Should structures encroach on these areas, foundations should penetrate to a sufficient depth so as to discourage the formation of ice lenses beneath foundations. At this location and elevation, a foundation depth for frost protection of 30 inches is recommended. Any grading in these areas should be done in a manner that directs surface flow around construction to avoid areas of ponded water. Areas of organic material will require removal before fill placement. The site does not lie within any floodplain zones according to the FEMA Map Nos. 08041CO575F and 08041CO780F, dated March 17, 1997 (Figure 9, Reference 6). Exact locations of floodplain and specific drainage studies are beyond the scope of this report. Finished floor levels must be located a minimum of one foot above floodplain levels.

Areas of Ponded Water

These are areas of standing water behind an earth dam on site. We would not expect development in this area. Either the dam can be avoided by construction or the area may be completely regraded. Should complete regrading of the site be considered, all organic matter and soft, wet soils should be completely removed before filling. Any drainage into these areas should be rerouted in a non-erosive manner off of the site where it does not create areas of ponded water around proposed structures.

Hydrocompaction

Areas in which hydrocompaction have been identified are acceptable as building sites. In areas identified for this hazard classification, however, we anticipate a potential for settlement upon saturation of these surficial soils. The low density, uniform grain sized, windblown sand deposits are particularly susceptible to hydrocompaction.

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.

Slope Stability and Landslide Hazard

The majority of the slopes on-site are gently to moderately sloping and do not exhibit any past or potential unstable slopes or landslides. The steeply sloping areas in the southern portions of the site have been identified as potentially unstable slopes. These areas are designated as open space and non-build zones. The recommendations for these areas are as follows:

- Potentially Unstable Slopes:

Considerable care must be exercised in these areas not to create a condition which would tend to activate instability.

Mitigation: Building should be avoided in these areas. A building setback of 50 feet from the crest of these slopes is recommended. Proper control of drainage at both the surface and in the subsurface is extremely important. Areas of ponded water at the surface should be avoided above these slopes. Utility trenches, basement excavations and other subsurface features should not be permitted to become water traps which may promote saturation of the subsurface materials.

6.1 Relevance of Geologic Conditions to Land Use Planning

As mentioned earlier in this report, we understand that the development will be rural residential lots. It is our opinion that the existing geologic and engineering geologic conditions will impose some constraints on the proposed development and construction. The most significant problems affecting development will be those associated with the steeper slopes in the southern portion of the site that can be avoided. Other hazards on site may be satisfactorily mitigated through proper engineering design and construction practices.

The upper residual soils are typically at medium to dense states and stiff to very stiff consistencies. The granular soils encountered in the upper soil profiles of the test borings should provide good support for foundations. Expansive soils were encountered on portions of the site that will require mitigation. Additionally, collapsible soils could be encountered that will require mitigation. Foundations anticipated for the site are standard spread footings possibly in conjunction with overexcavation in areas of expansive or collapsible soils. Areas containing arkosic sandstone will have high allowable bearing conditions. Difficult excavation should be

anticipated in areas of shallow bedrock. Expansive or collapsible layers may also be encountered in the soil and bedrock on this site. Areas of expansive and collapsible soils encountered on site are sporadic; therefore, none have been indicated on the maps. Expansive or collapsible soils, if encountered, will require special foundation design and/or overexcavation. These soils will not prohibit development.

Areas of fill were encountered on the site associated with an earthen dam and erosion berms. Due to lot sizes, it is anticipated these areas could be avoided by construction. Any uncontrolled fill encountered beneath foundations will require recompaction to 92% of its Modified Proctor Dry Density ASTM D-1557.

Areas of hydrocompaction have been identified on this site where there is the potential for settlement movements upon saturation of the surficial soils. Good surface and subsurface drainage is critical in these areas and the ground surface should be positively sloped away from structures at all points. Roof drains should be made to discharge well away from structures and planting and watering in the immediate vicinity of structures should be minimized.

Areas of potentially seasonal high groundwater and ponded water were encountered on site. Due to the size of the lots and the proposed development, these areas can be avoided by construction. Structures should not block drainages. Septic fields should not be located in these areas due to the potential for periodic high groundwater conditions.

Potentially unstable slopes exist along the southern portion of the site. These areas are in the open space and no-build areas of the site. Buildings should be located a minimum of 50 feet from the crest of the potentially unstable slopes. Based on the proposed Development Plan, it appears there is sufficient room on all the lots for the setback.

In summary, development of the site can be achieved if the conditions mentioned above are mitigated. These items can be mitigated through proper design and construction or through avoidance. Investigation on each lot is recommended prior to construction.

7.0 ON-SITE DISPOSAL OF WASTEWATER

The site was evaluated for individual sewage treatment systems in accordance with El Paso Land Development Code. Nine (9) percolation tests were performed on the property. Percolation tests may not be located in the exact areas of proposed systems. The approximate locations of the percolation tests are indicated on Figure 4, the Geology Map, Figure 8 and the Septic Suitability Map Figure 10. Table 2 shows the results of the percolation tests. The specific test results are presented in Appendix E.

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has been mapped with 4 soil descriptions. The Soil Survey Map (Reference 2) is presented in Figure 5, and the Soil Survey Descriptions are presented in Appendix D. Soil Type 4 (Badland) is mapped in the southern portion of the site where steep slopes exist. No development is proposed in this area and it has been designated as a non-build zone. The majority of the soils are described as having rapid to moderate percolation rates.

The individual percolation test results ranged from 14 minutes per inch to 134 minutes per inch. Most of the percolation rates are suitable for conventional individual sewage treatment systems. Three of the percolation rates are slower than 60 minutes per inch which will require designed systems.

Standard penetration testing, ASTM D-1586, was performed in each profile hole to evaluate the density of the soil and the presence of bedrock. Bedrock was encountered in Profile Hole Nos. 4 through 7 at 7 to 13 feet. Bedrock was not encountered of the other profile holes which were drilled to 10 to 15 feet. Designed systems are generally required in areas of shallow bedrock (less than 6 feet).

Leach fields must be maintained a minimum of 4 feet above groundwater. Groundwater was not encountered in any of the profile holes, which were drilled to depths of 10 to 15 feet. Should groundwater be encountered within 6 feet of the surface, shallow leaching fields would be recommended. In areas where groundwater is less than 4 feet, designed systems will be required.

The percolation rates in six of the locations are suitable for conventional systems. Three tests had rates of slower than 60 minutes per inch. Additional drilling may reveal other areas where more suitable rates can be found. El Paso County guidelines require designed systems for percolation rates exceeding 60 minutes per inch. Bedrock was not encountered in any of the profile holes at a depth that would affect conventional systems, however, some areas may contain shallow bedrock. Where bedrock is encountered less than 6 feet, designed systems may be required. A Septic Suitability Map is presented in Figure 10. A possible house location, two potential on site wastewater treatment system (OWS) locations and a possible well site for each lot are indicated on Figure 10. Due to the size of the building lots, it is anticipated that suitable areas will be available where conventional systems may be utilized on most lots. In areas where suitable percolation rates cannot be found, shallow groundwater exists or shallow bedrock exists, designed systems will be required.

In summary, it is our opinion the site is suitable for individual onsite wastewater treatment systems (OWS) and that contamination of surface and subsurface water resources should not occur provided the OWS sites are evaluated, installed according to El Paso County and State Guidelines and properly maintained. Individual percolation testing is required on each lot prior to construction. Septic systems must be located a minimum of 100 feet from any well, including those on adjacent properties. Septic systems must also be located a minimum of 50 feet from any water courses, floodplains or ponded areas and 25 feet from dry gulches.

8.0 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 7), 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 8), areas of the site are mapped with U3: upland deposits-sand. According to the *Evaluation of Mineral and Mineral Fuel Potential* (Reference 9), the area of the site has been mapped as "Fair" for industrial minerals. Some of the sands encountered on site could be considered an aggregate resource, however, considering the silty to clayey nature of much of these materials, abundance of similar materials through the region and the close proximity to developed land, 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 9), the site is mapped within the Denver Basin Coal Region. The area of the site has been mapped as "Moderate" for coal resources. No active or inactive mines have been mapped in the area of the site. No metallic mineral resources have been mapped on the site (Reference 9).

The site has been mapped at "Fair" for oil and gas resources (Reference 9). No oil or gas fields have been discovered in the area of the site. The sedimentary rocks in the area may lack the geologic structure for trapping oil or gas; therefore, it may not be considered a significant resource. Hydraulic fracturing is a new method that is being used to extract oil and gas from rocks. It utilizes pressurized fluid to extract oil and gas from rocks that would not normally be productive. The area of the site has not been explored to determine if the rocks underlying the site would be commercially viable utilizing hydraulic fracturing. The practice of hydraulic fracturing has come under review due to concerns about environmental impacts, health and safety.

9.0 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 re-established, 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 or 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 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 Soil Conservation Service.

10.0 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 avoided by construction. Others can be mitigated through proper engineering design 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 non-homogeneous 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. Individual investigations for building sites and septic systems will be required prior to construction. 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 Corral Ranches Development Company 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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8. 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.
9. 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.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CORRAL RANCH DEVELOPMENT
 PROJECT RESERVE AT CORRAL BLUFFS
 JOB NO. 83691

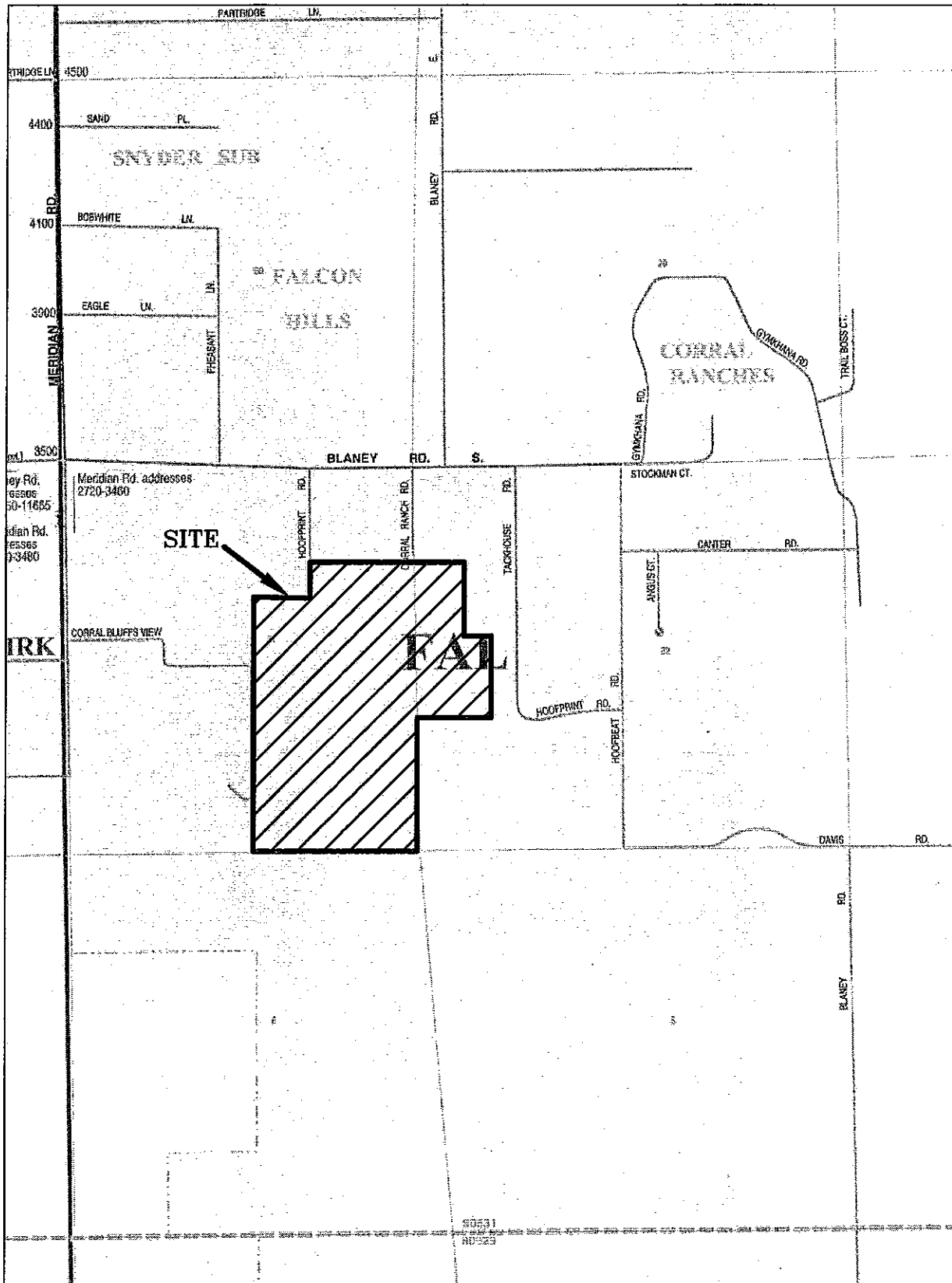
SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT (%)	PLASTIC INDEX (%)	SULFATE (WT %)	FHA SWELL (PSF)	SWELL/CONSOL (%)	UNIFIED CLASSIFICATION	SOIL DESCRIPTION
1	1	2-3	6.3	106.5	45.3					-0.6	SM	SAND, VERY SILTY
1	5	2-3			26.9						SM	SAND, SILTY
1	6	2-3			41.7						SM	SAND, VERY SILTY
1	7	2-3			45.5						SM	SAND, VERY SILTY
1	8	2-3			49.0						SM	SAND, VERY SILTY
1	9	2-3			28.0						SM	SAND, SILTY
2	1	10			57.0	18	7				CL-ML	CLAY-SILT, VERY SANDY
2	4	2-3	16.7	109.3	73.2	21	8			-0.2	CL	CLAY, SANDY
2	4	5	11.0	109.5	74.3	20	6			3.3	CL-ML	CLAY-SILT, SANDY
3	2	2-3			52.7						ML	SILT, VERY SANDY
3	2	10							850		ML	SILT, VERY SANDY
3	3	2-3			64.4						ML	SILT, SANDY
4	4	15			39.6	17	6				SC-SM	SANDSTONE, VERY CLAYEY, SILTY
4	6	10			43.8	28	16		1330		SC	SANDSTONE, VERY CLAYEY

Table 2: Summary of Percolation Test Results

Test Boring No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	80	>15	>15
2	14	>15	>15
3	20	>15	>15
4	134	13	>15
5	45	7	>10
6	18	7	>10
7	44	10	>15
8	12	>10	>10
9	67	>10	>10

FIGURES

\\fs01\proj\11111019\11111019.dwg (12-20-11 11:11:09 AM) GED MAP SET HP.DWG (12-20-11 11:11:09 AM)



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505 ELKTON DRIVE
 COLORADO SPRINGS, CO. 80907 (719) 531-5399

Vicinity Map
 The Reserve at Corral Bluffs
 El Paso County, CO.
 For: Corral Ranch Development Co.

DRAWN:
 KAH

DATE:
 12/15/11

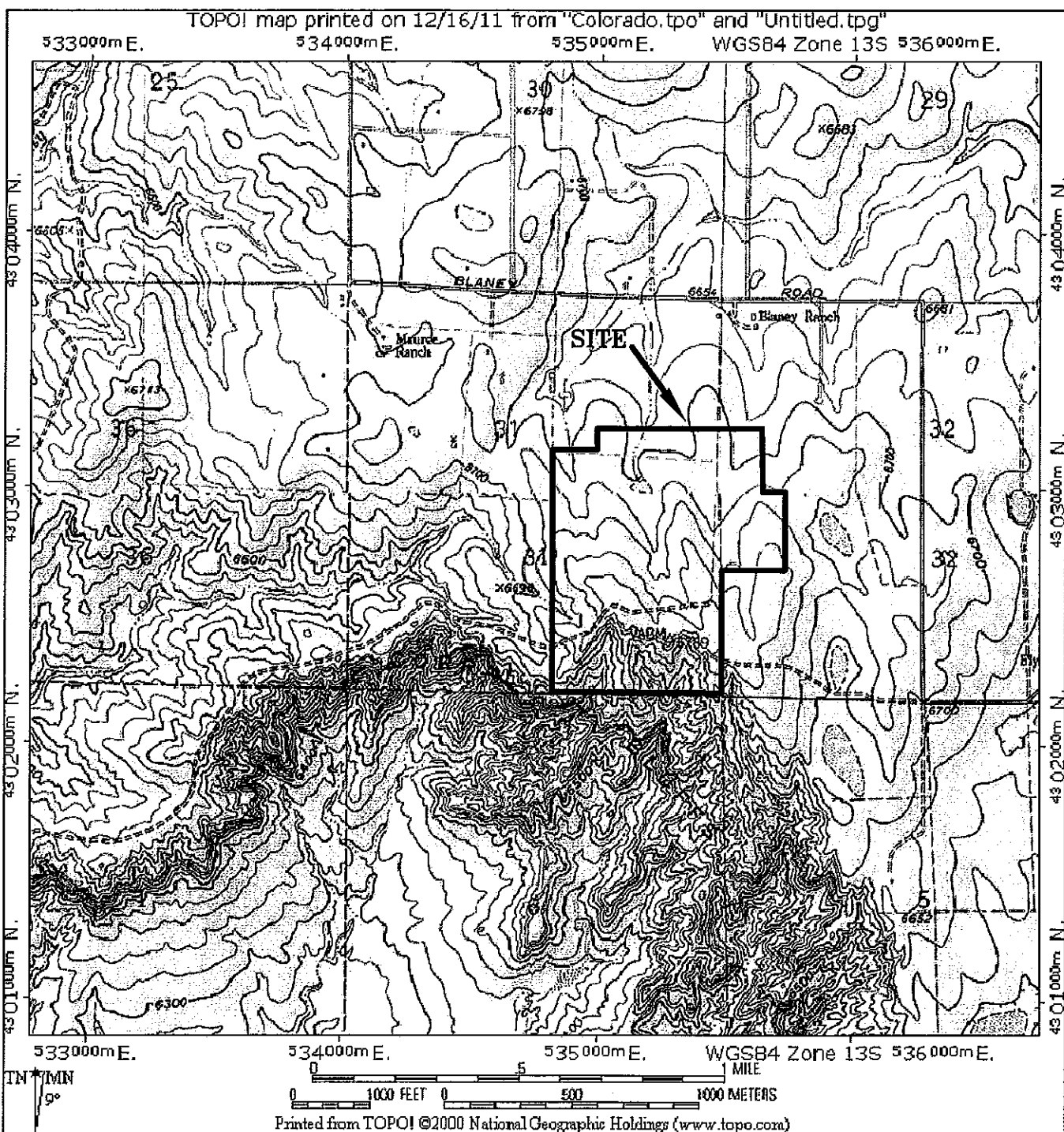
CHECKED:
[Signature]

DATE:
 1/19/12

JOB NO:
 83691

FIG NO:
 1

\\D:\affing\2011\GEOHAZ\MAPS\83691 (Corral Bluffs)\83691_Geo_Map_Sel_HP.dwg, USGS MAP, 12/20/2011 11:10:42 AM, 1:1



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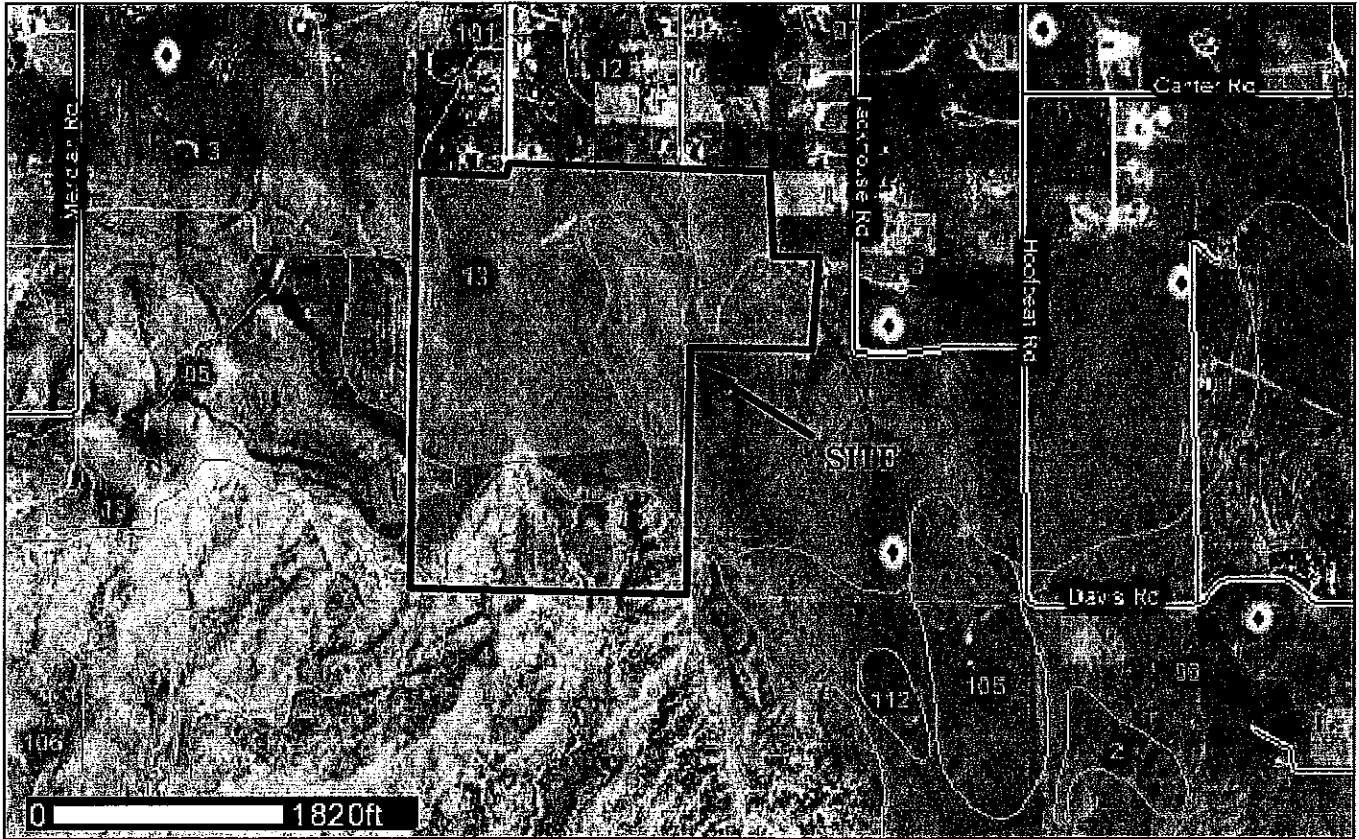
USGS Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN: KAH	DATE: 12/15/11	CHECKED: <i>W</i>	DATE: 1/19/12
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JOB NO.:
83691

FIG NO.:
2

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505 ELKTON DRIVE
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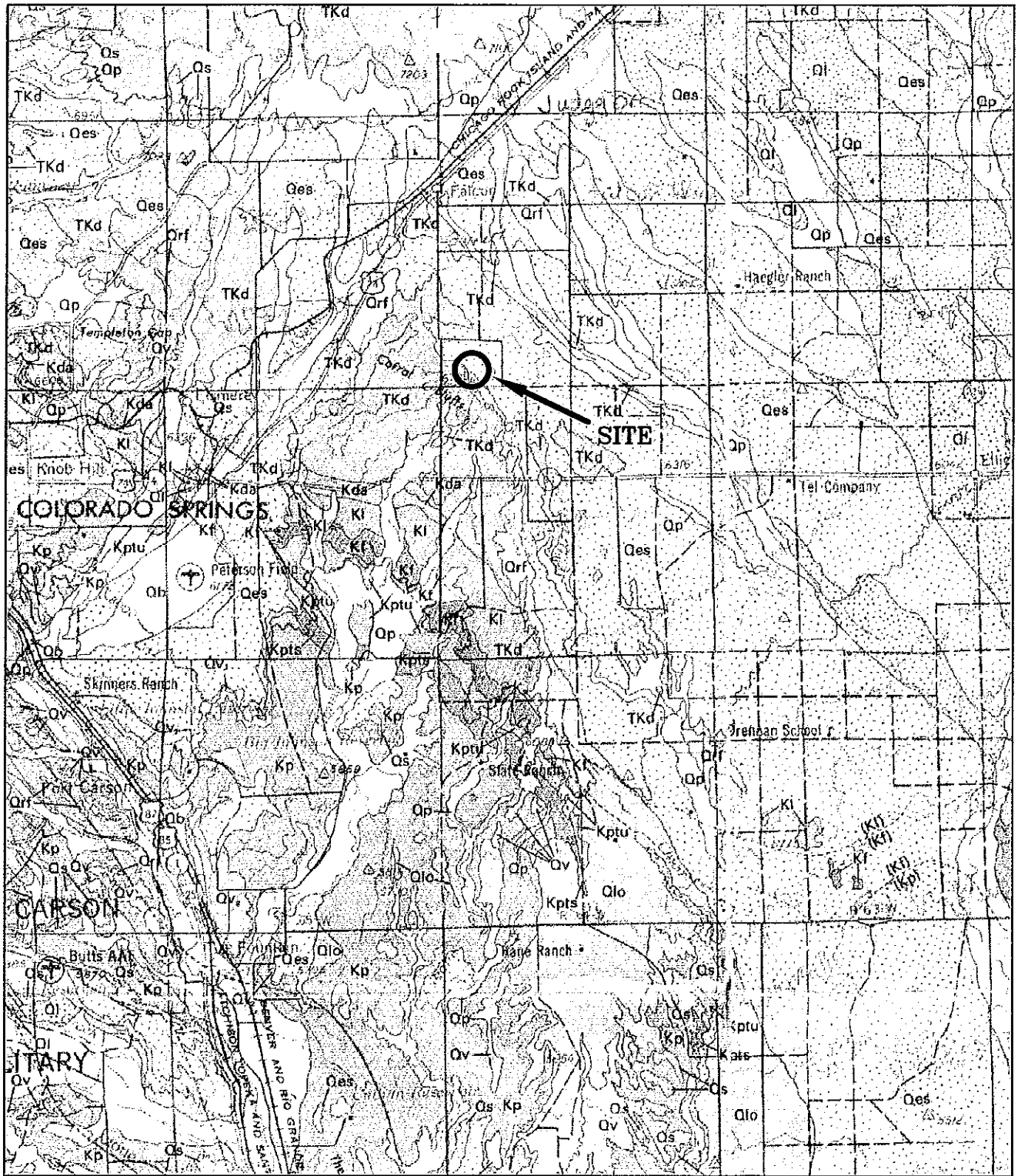
Soil Survey Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN: KAH	DATE: 12/15/11	CHECKED: <i>KAH</i>	DATE: 1/19/12
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JOB NO.:
83691

FIG NO.:
5

\\drp\p\corral\p\fig\2611\GEO\HAZ\269\MAPS\83691\GEO MAP SET HP.DWG (12-20-11 11:09:10AM)



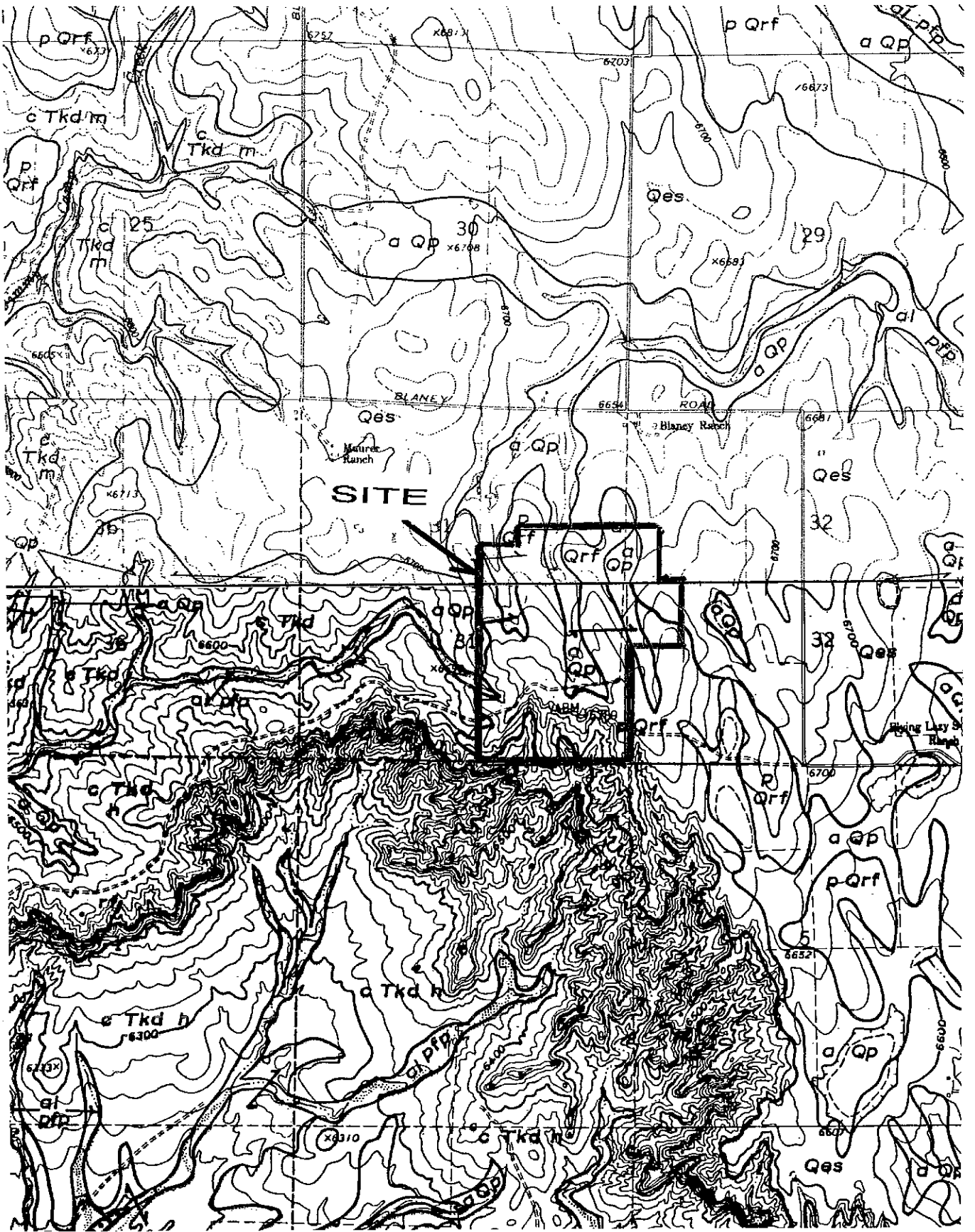
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ENGINEERING, INC.
555 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

Colorado Geology Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN: KAH	DATE: 12/15/11	CHECKED: <i>ka</i>	DATE: 1/19/12
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JOB NO.:
83691

FIG NO.:
6



D:\Drafting\2011\GEO\HAZ_Maps\GIS\36361_Corral Bluffs\36361_Geo Map Set_HP.dwg, BLACK-WHITE GEOLOGY MAP, 12/29/2011 10:46:54 AM, 1:1



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Corral Bluffs/Falcon Geology Map
 The Reserve at Corral Bluffs
 El Paso County, CO.
 For: Corral Ranch Development Co.

JOB NO.:
 83691

FIG NO.:
 7






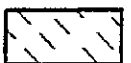






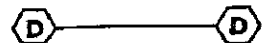
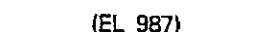


DRAWN:
 KAH

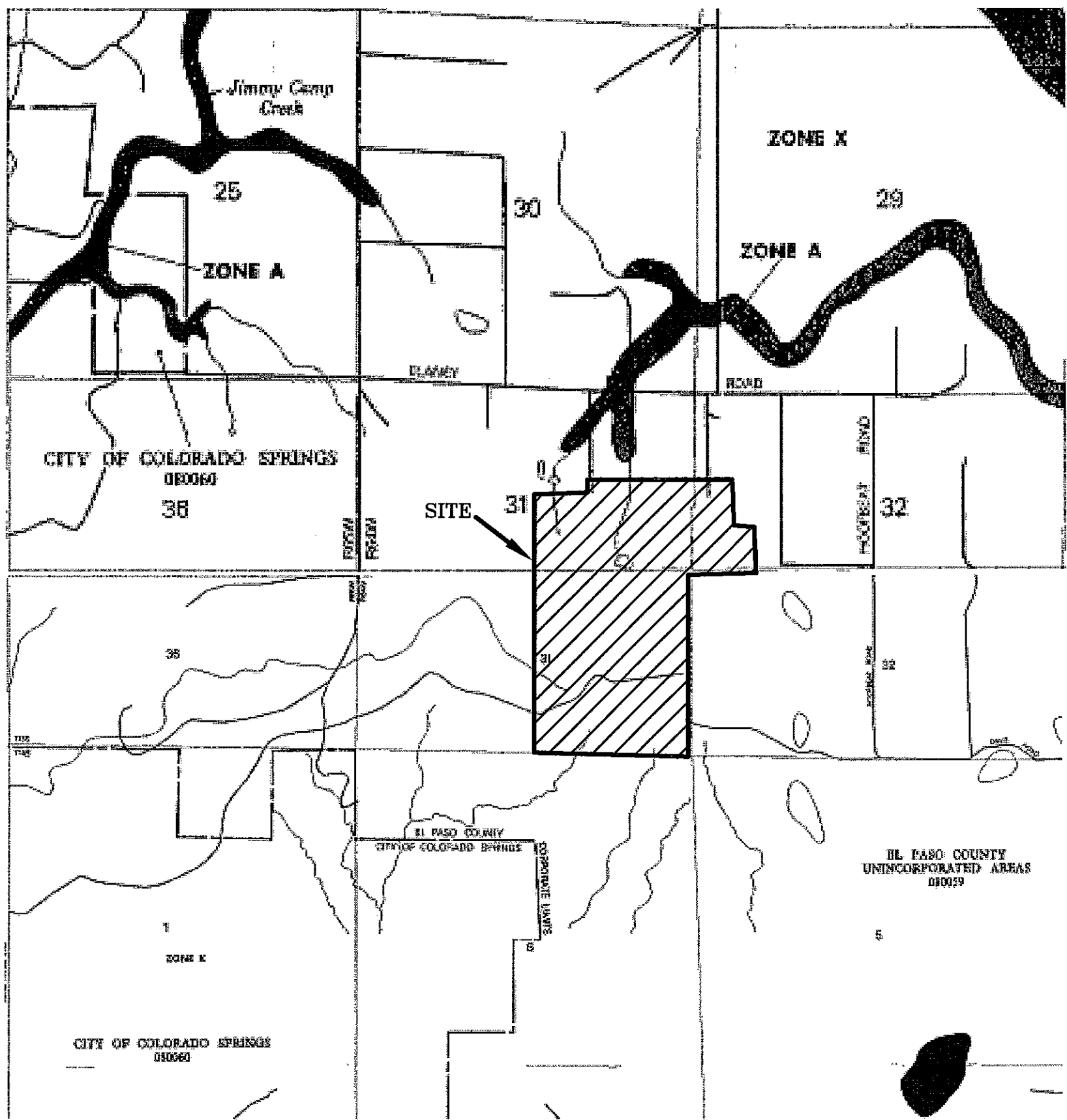
DATE:
 12/15/11

CHECKED:

DATE:
 1/19/12

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.
-  Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.
-  Cross Section Line
-  Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.
-  Elevation Reference Mark
-  River Mile
- Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.




REVISION	BY

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(719) 531-5599

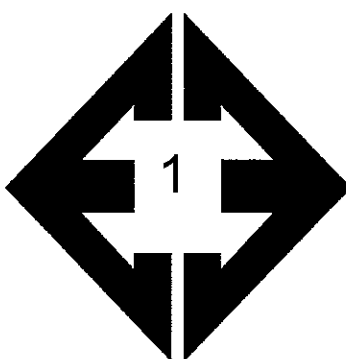


Floodplain Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co

DRAWN	KAH
CHECKED	
DATE	12/15/11
SCALE	AS SHOWN
JOB NO.	83891
FIGURE NO.	9

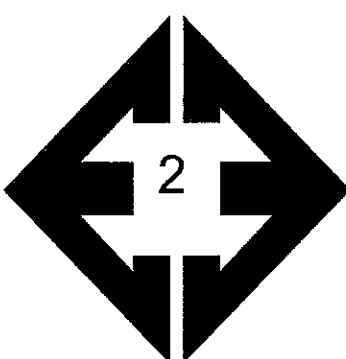
D:\Rating\2011\05\HAZ MAPS\83891 Corral Bluffs\83891 Geo Map Set HP.dwg, FLOODPLAIN, 12/20/2011 11:17:18 AM, 1:1

APPENDIX A: Site Photographs



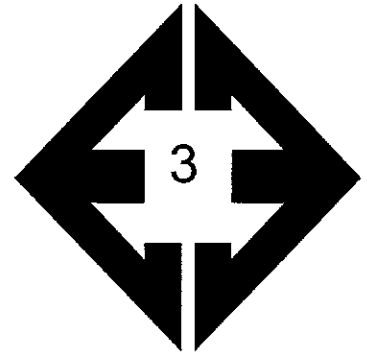
**Looking southwest
from the north central
portion of the site.**

December 19, 2011



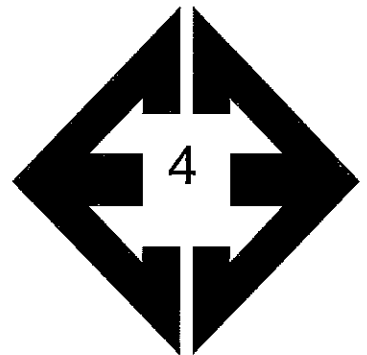
**Looking southeast
from the north central
portion of the site.**

December 19, 2011



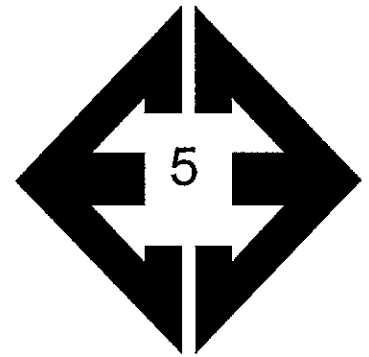
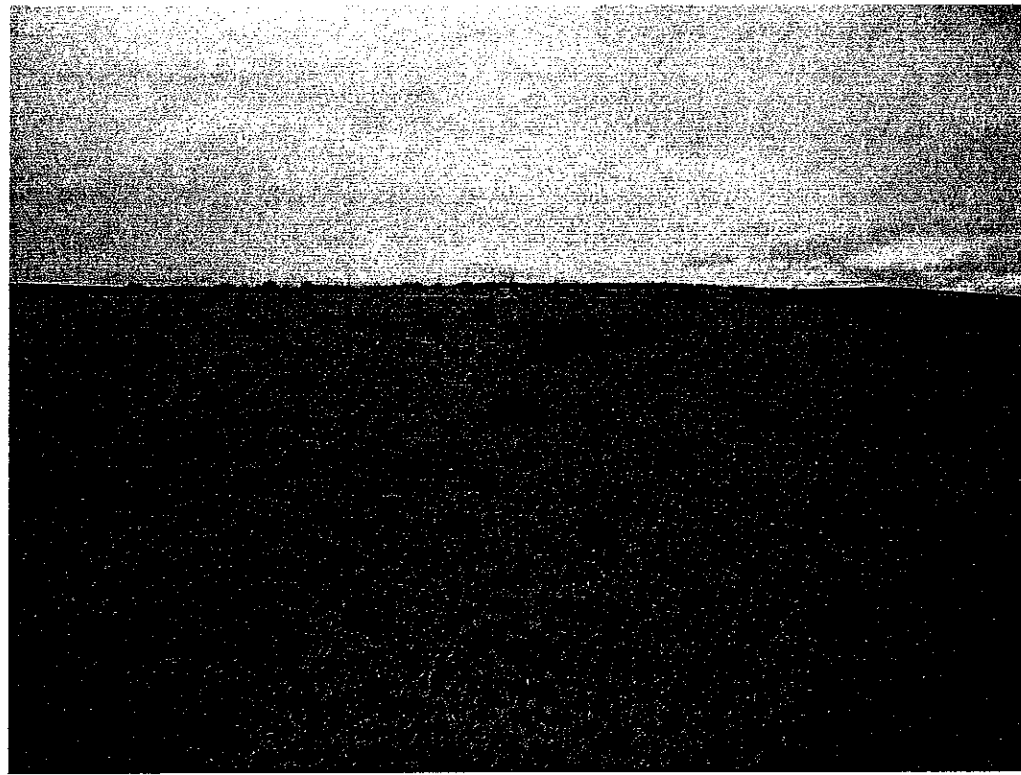
**Looking southwest
from the southeast
portion of the site.**

December 19, 2011



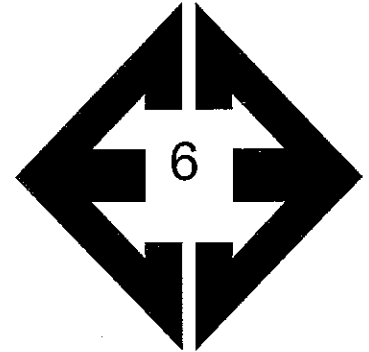
**Looking at dam and
pond in central portion
of the site.**

December 19, 2011



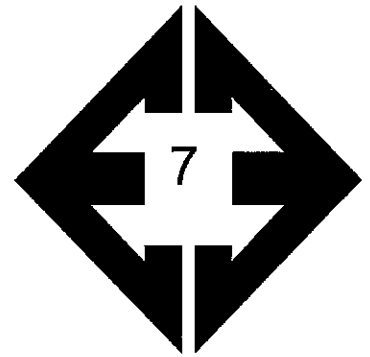
**Looking southeast
from the northwest
portion of the site.**

December 19, 2011



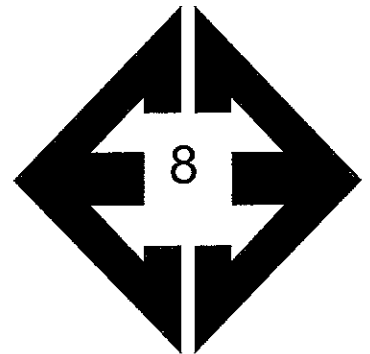
**Looking northeast
from the southwest
portion of the site.**

December 19, 2011



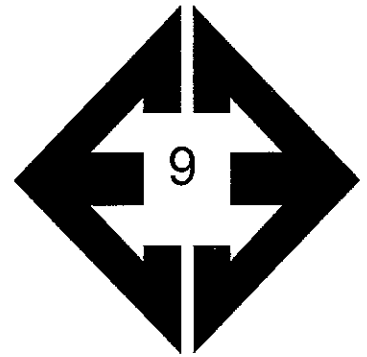
**Looking south at
potentially unstable
slopes in south central
portion of the site.**

December 19, 2011



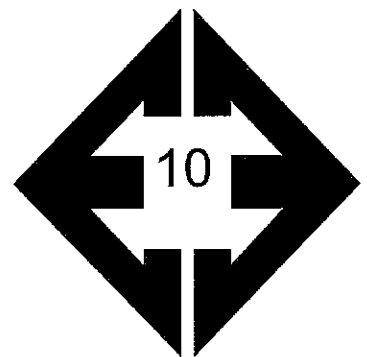
**Looking southeast at
potentially unstable
slopes in south central
portion of the site.**

December 19, 2011



**Looking northeast
from the south central
portion of the site.**

December 19, 2011



**Looking northwest
from the southeast
portion of the site.**

December 19, 2011

APPENDIX B: Test Boring Logs from Profile Holes

PROFILE HOLE NO 1
 DATE DRILLED 12/28/2011
 Job # 83691

PROFILE HOLE NO 2
 DATE DRILLED 12/28/2011
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 14', 12/29/11
 SAND, VERY SILTY, FINE
 GRAINED, BROWN TO TAN,
 MEDIUM DENSE, MOIST

CLAY-SILT, VERY SANDY,
 TAN, VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	6.1	1
5			12	8.2	1
10			35	9.0	2
15			35		2
20					

DRY TO 15', 12/29/11
 SILT, VERY SANDY, TAN TO
 BROWN, STIFF TO VERY STIFF,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	10.1	3
5			19	12.0	3
10			21	11.9	3
15			32	20.7	3
20					



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PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED: <i>th</i>	DATE: 1/17/12
--------	-------	--------------------	---------------

JOB NO.:

83691

FIG NO.:

B-1

PROFILE HOLE NO 3
 DATE DRILLED 12/28/2011
 Job # 83691

PROFILE HOLE NO 4
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

DRY TO 15', 12/29/11
 SILT, SANDY, TAN TO BROWN,
 STIFF TO VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			17	13.9	3
5			27	12.6	3
10			21	13.7	3
15			41	7.9	3
20					

REMARKS

DRY TO 14', 1/5/12
 CLAY, SANDY, DARK BROWN,
 STIFF, MOIST
 CLAY-SILT, SANDY, TAN,
 VERY STIFF TO STIFF, MOIST
 SANDSTONE, VERY CLAYEY,
 VERY SILTY, FINE GRAINED,
 TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
			19	16.4	2
5			30	10.9	2
10			24	5.8	2
15			50 10"	6.0	4
20					



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PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>me</i>	1/17/12

JOB NO.:

83691

FIG NO.:

B-2

PROFILE HOLE NO 5
 DATE DRILLED 1/4/2012
 Job # 83691

PROFILE HOLE NO 6
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 7', 1/5/12
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, TAN TO BROWN,
 MEDIUM DENSE, MOIST

DRY TO 9', 1/5/12
 SAND, VERY SILTY, FINE
 GRAINED, DENSE, TAN, MOIST

SANDSTONE, SILTY, FINE TO
 MEDIUM GRAINED, TAN, VERY
 DENSE, MOIST

SANDSTONE, VERY CLAYEY,
 FINE GRAINED, TAN, VERY
 DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			28	7.4	1	5			32	10.4	1
5			24	8.9	1	5			40	6.9	1
10			50 9"	6.1	4	10			50 11"	7.6	4



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PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>lw</i>	1/17/12

JOB NO.:

83691

FIG NO.:

B-3

PROFILE HOLE NO 7
 DATE DRILLED 1/4/2012
 Job # 83691

PROFILE HOLE NO 8
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 14', 1/5/12							DRY TO 10', 1/5/12						
SAND, VERY SILTY, FINE GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST	5			21	10.8	1	SAND, VERY SILTY, FINE GRAINED, TAN, DENSE, MOIST	5			30	7.5	1
	5			40	8.0	1	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, DENSE, MOIST	5			47	6.7	1
SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, DENSE, MOIST	10			38	4.5	1		10			40	5.0	1
SANDSTONE, SILTY, FINE TO MEDIUM GRAINED, TAN, VERY DENSE, MOIST	15			50	8.1	4		15					
				11"				20					



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 COLORADO SPRINGS, COLORADO 80907

PROFILE HOLE LOG

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/17/12

JOB NO.:

83691

FIG NO.:

B-4

POFILE HOLE NO. 9
 DATE DRILLED 1/4/2012
 Job # 83691

POFILE HOLE NO.
 DATE DRILLED
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 10', 1/5/12
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, TAN, MEDIUM DENSE
 TO DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			26	8.6	1	5					
5			33	7.4	1	5					
10			45	6.4	1	10					
15						15					
20						20					



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *an*

DATE: 1/17/12

JOB NO.:

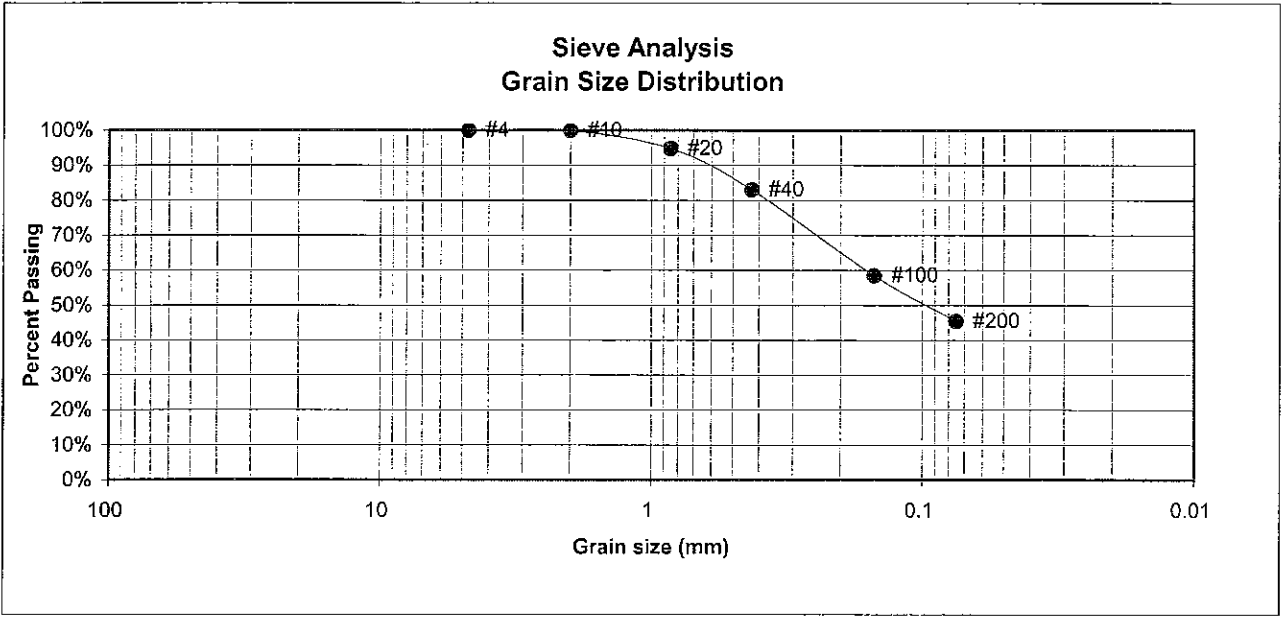
83691

FIG NO.:

B-5

APPENDIX C: Laboratory Test Results

<u>UNIFIED CLASSIFICATION SM</u>		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	1	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	99.9%	Moisture at start
20	94.8%	Moisture at finish
40	83.0%	Moisture increase
100	58.5%	Initial dry density (pcf)
200	45.3%	Swell (psf)



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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED: <i>w</i>	DATE: <i>1/17/12</i>
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JOB NO.: *83691*
FIG NO.: *C-1*

UNIFIED CLASSIFICATION SM

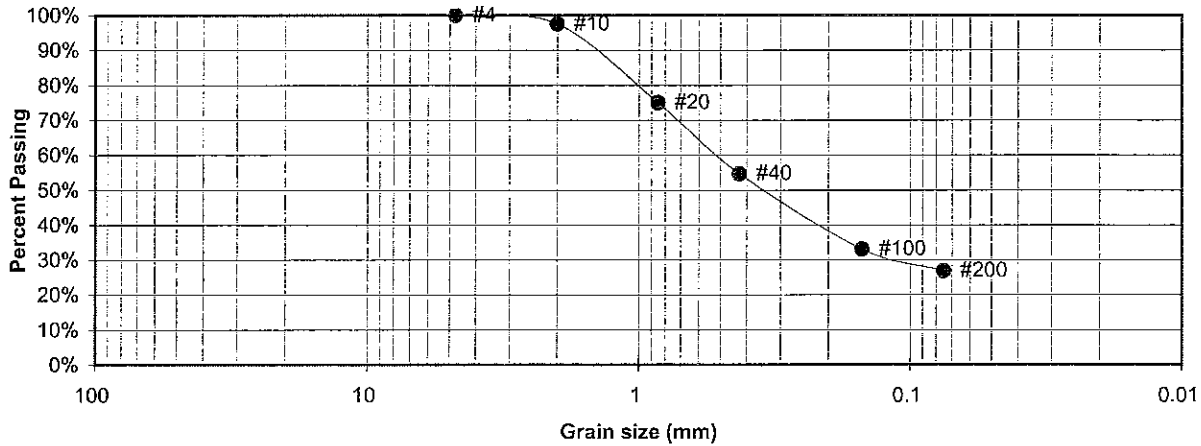
SOIL TYPE # 1
TEST BORING # 5
DEPTH (FT) 2-3

CLIENT

PROJECT
JOB NO.
TEST BY

CORRAL RANCH DEV.
RESERVE AT CORRAL BLUFFS
83691
BL

**Sieve Analysis
Grain Size Distribution**



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	97.5%
20	75.0%
40	54.7%
100	33.2%
200	26.9%

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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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

[Handwritten signature] 1/17/12

JOB NO.:

83691

FIG NO.:

C-2

UNIFIED CLASSIFICATION SM

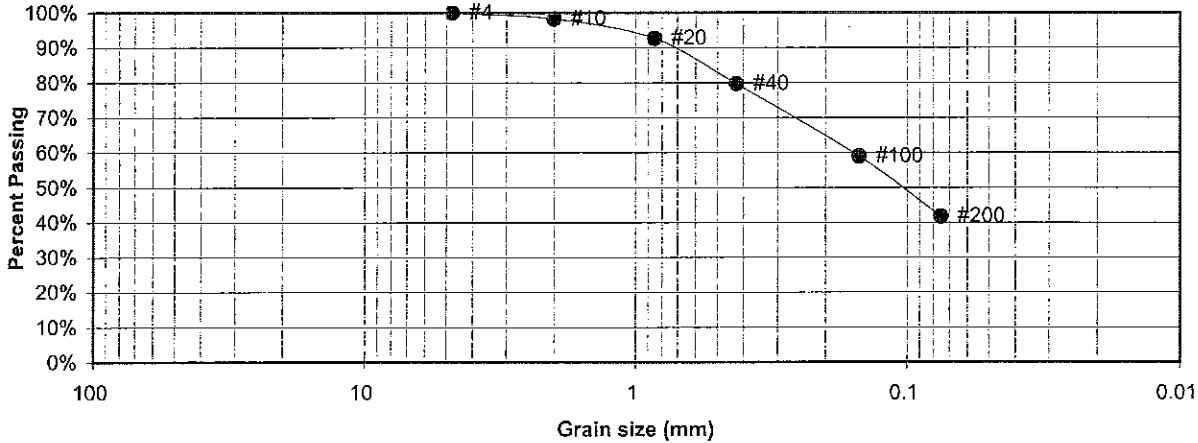
SOIL TYPE # 1
TEST BORING # 6
DEPTH (FT) 2-3

CLIENT

PROJECT
JOB NO.
TEST BY

CORRAL RANCH DEV.
RESERVE AT CORRAL BLUFFS
83691
BL

**Sieve Analysis
Grain Size Distribution**



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.2%
20	92.7%
40	79.7%
100	58.9%
200	41.7%

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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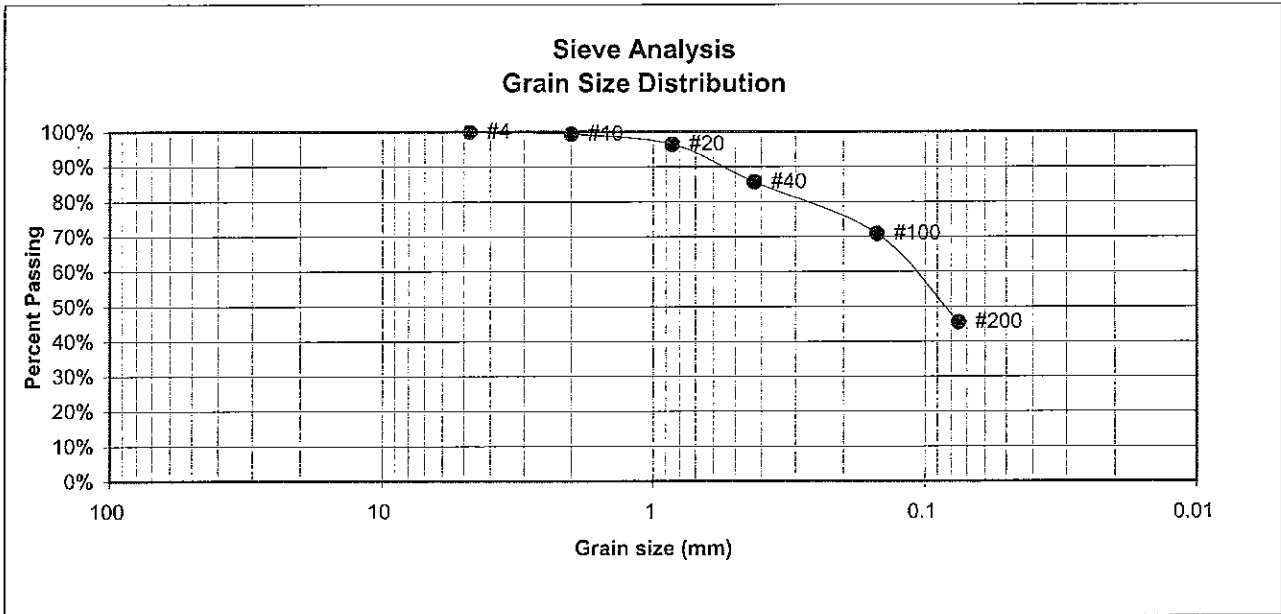
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

DRAWN:	DATE:	CHECKED: <i>W</i>	DATE: 1/17/12
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JOB NO.: 83691
FIG NO.: C-3

<u>UNIFIED CLASSIFICATION</u> SM		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	7	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	99.3%	Moisture at start
20	96.4%	Moisture at finish
40	85.7%	Moisture increase
100	70.8%	Initial dry density (pcf)
200	45.5%	Swell (psf)



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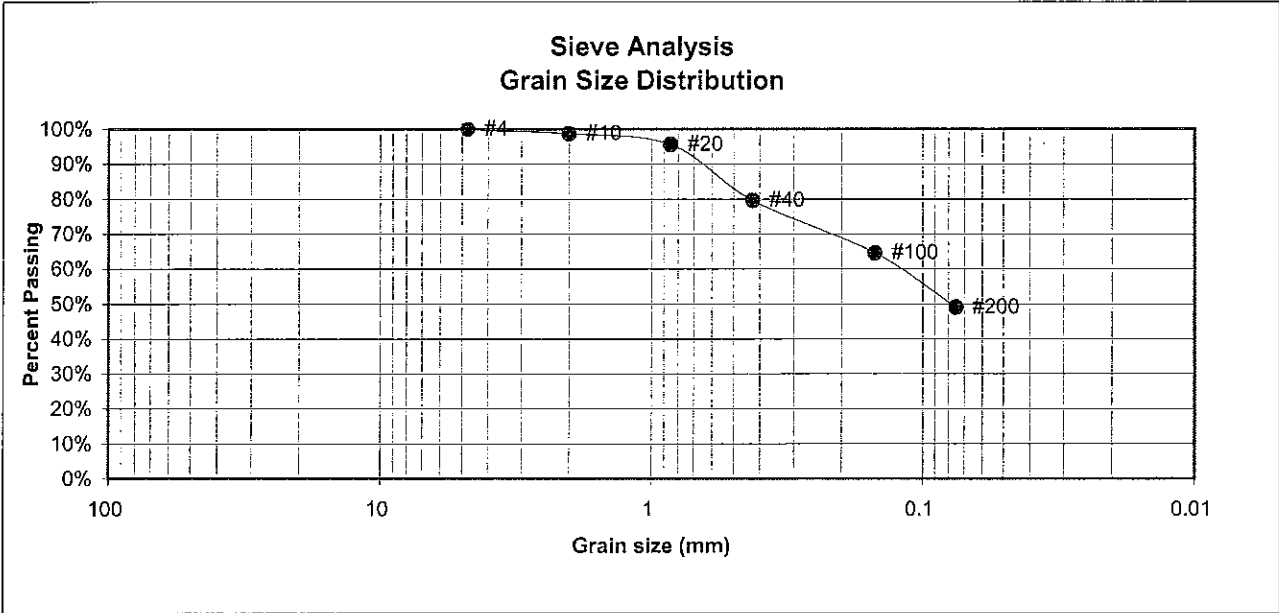
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>lm</i>	1/17/12

JOB NO.:
83691
FIG NO.:
C-4

<u>UNIFIED CLASSIFICATION</u> SM		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	8	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.7%
20	95.6%
40	79.6%
100	64.6%
200	49.0%

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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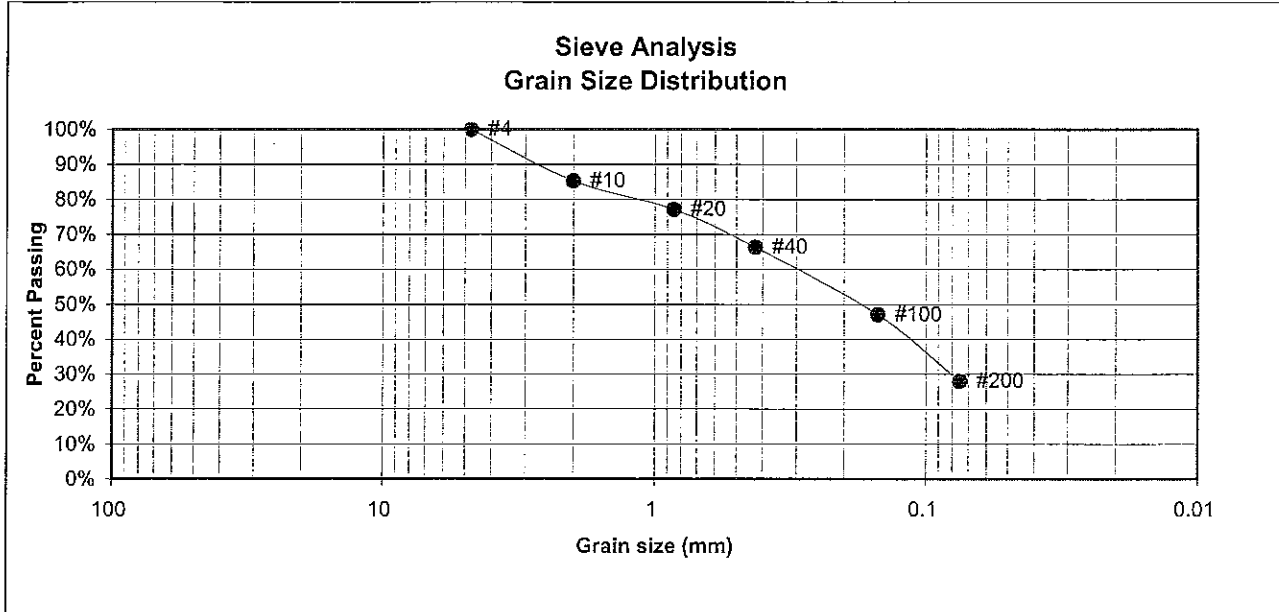
**LABORATORY TEST
 RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>W</i>	1/17/12

JOB NO.:
 83691
 FIG NO.:
 C-5

UNIFIED CLASSIFICATION SM
 SOIL TYPE # 1
 TEST BORING # 9
 DEPTH (FT) 2-3

CLIENT CORRAL RANCH DEV.
 PROJECT RESERVE AT CORRAL BLUFFS
 JOB NO. 83691
 TEST BY BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	85.3%
20	77.1%
40	66.3%
100	47.0%
200	28.0%

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:

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DATE: 1/17/12

JOB NO.:

83691

FIG NO.:

C-6

UNIFIED CLASSIFICATION CL-ML

SOIL TYPE # 2

TEST BORING # 1

DEPTH (FT) 10

CLIENT

PROJECT

JOB NO.

TEST BY

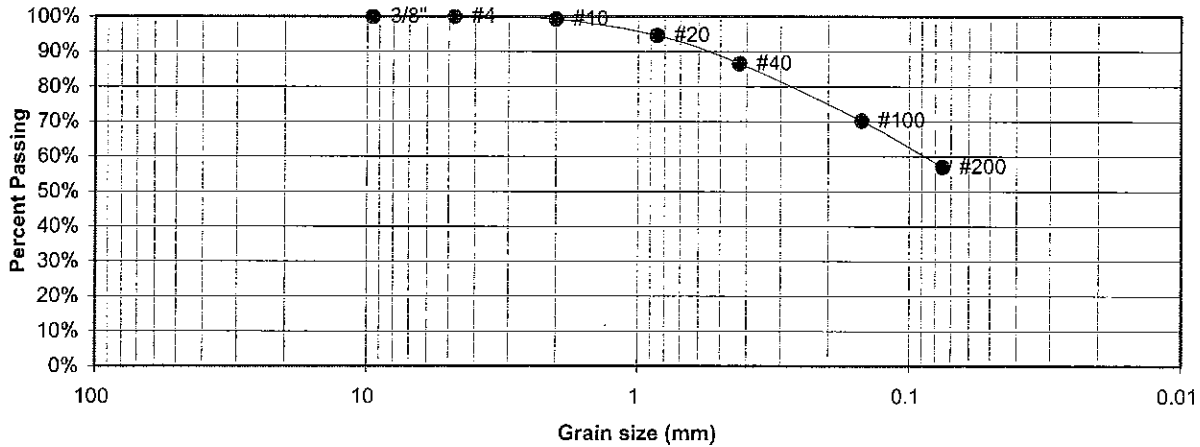
CORRAL RANCH DEV.

RESERVE AT CORRAL BLUFFS

83691

BL

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	100.0%
10	99.3%
20	94.6%
40	86.5%
100	70.2%
200	57.0%

Atterberg Limits	
Plastic Limit	12
Liquid Limit	18
Plastic Index	7

Swell	
Moisture at start	#DIV/0!
Moisture at finish	#DIV/0!
Moisture increase	#DIV/0!
Initial dry density (pcf)	0
Swell (psf)	0



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505 ELKTON DRIVE
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LABORATORY TEST RESULTS

DRAWN:

DATE:

CHECKED: *W*

DATE: 1/17/12

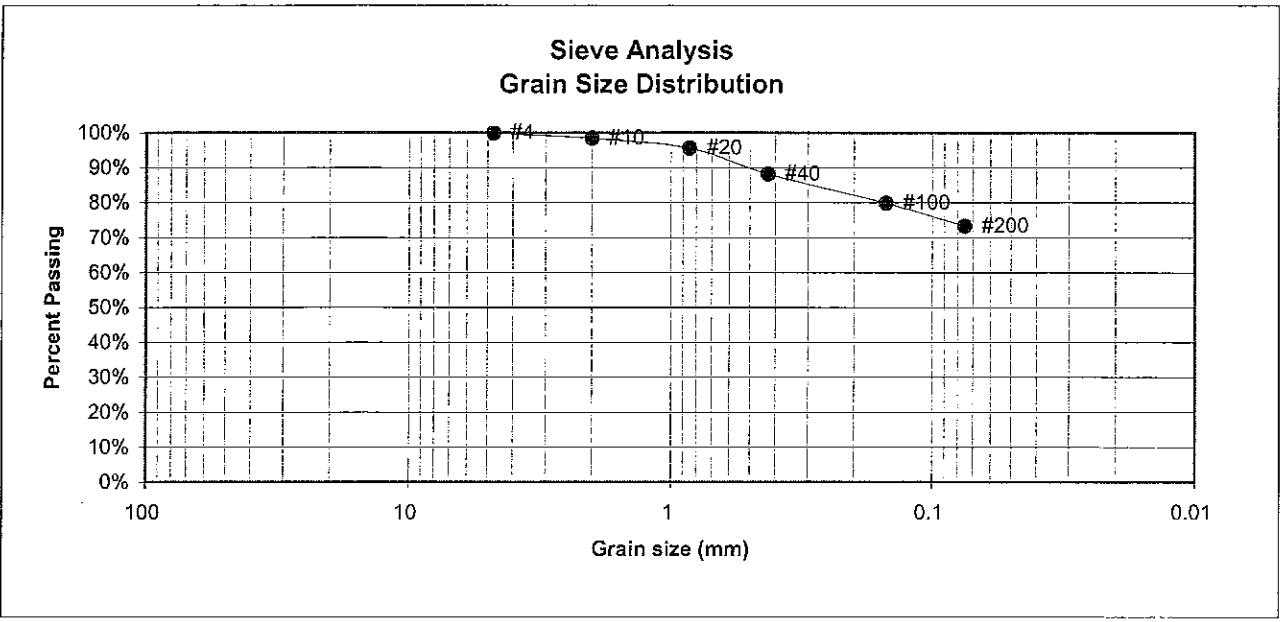
JOB NO.:

83691

FIG NO.:

C-7

<u>UNIFIED CLASSIFICATION</u>	CL	<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>	
3"		Plastic Limit	13
1 1/2"		Liquid Limit	21
3/4"		Plastic Index	8
1/2"			
3/8"		<u>Swell</u>	
4	100.0%	Moisture at start	
10	98.4%	Moisture at finish	
20	95.6%	Moisture increase	
40	88.2%	Initial dry density (pcf)	
100	79.9%	Swell (psf)	
200	73.2%		

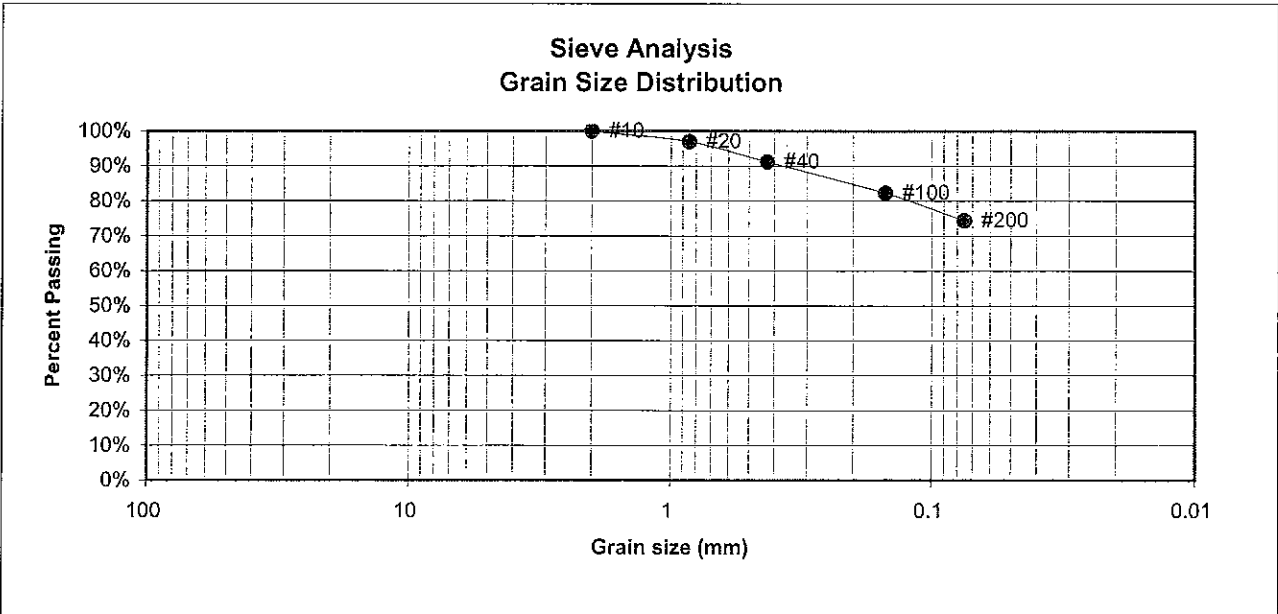


LABORATORY TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/17/12

JOB NO.:
83691
FIG NO.:
C-8

<u>UNIFIED CLASSIFICATION</u>	CL-ML	<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	2	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	4	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	97.0%
40	91.2%
100	82.2%
200	74.3%

<u>Atterberg Limits</u>	
Plastic Limit	14
Liquid Limit	20
Plastic Index	6

<u>Swell</u>	
Moisture at start	
Moisture at finish	
Moisture increase	
Initial dry density (pcf)	
Swell (psf)	



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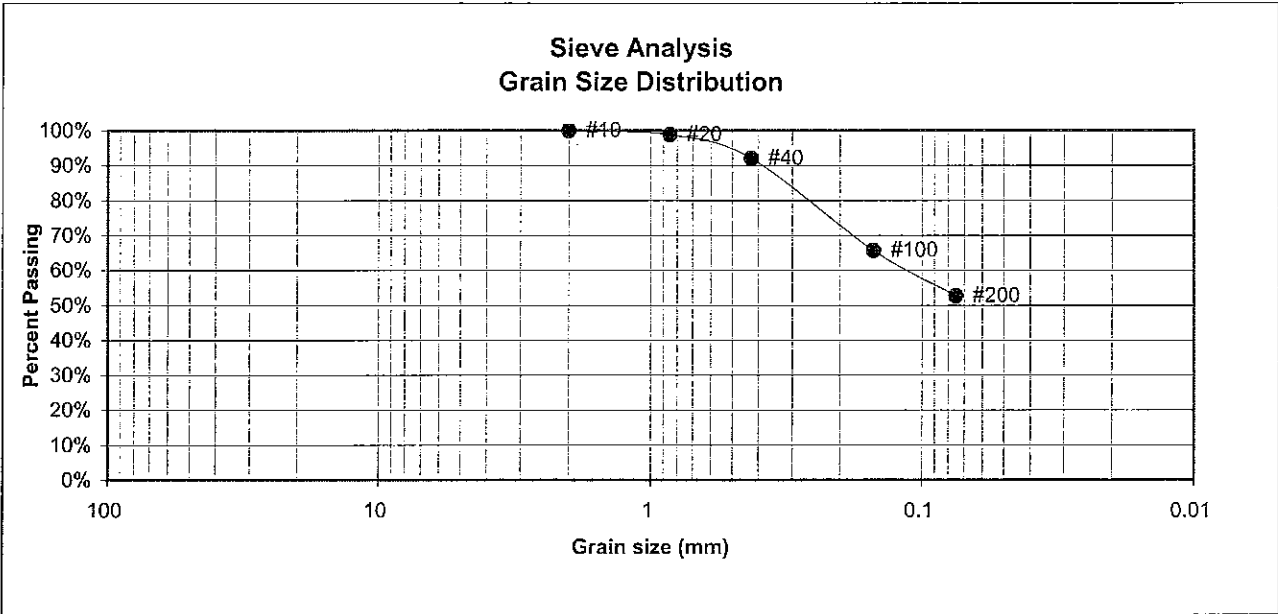
505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> <i>m</i>	<u>DATE:</u> 1/17/12
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JOB NO.:
83691
FIG NO.:
C-9

UNIFIED CLASSIFICATION ML		CLIENT	CORRAL RANCH DEV.
SOIL TYPE #	3	PROJECT	RESERVE AT CORRAL BLUFFS
TEST BORING #	2	JOB NO.	83691
DEPTH (FT)	2-3	TEST BY	BL



U.S. Sieve #	Percent Finer	Atterberg Limits
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4		<u>Swell</u>
10	100.0%	Moisture at start
20	98.8%	Moisture at finish
40	92.0%	Moisture increase
100	65.7%	Initial dry density (pcf)
200	52.7%	Swell (psf)



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**LABORATORY TEST
RESULTS**

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		<i>[Signature]</i>	1/17/12

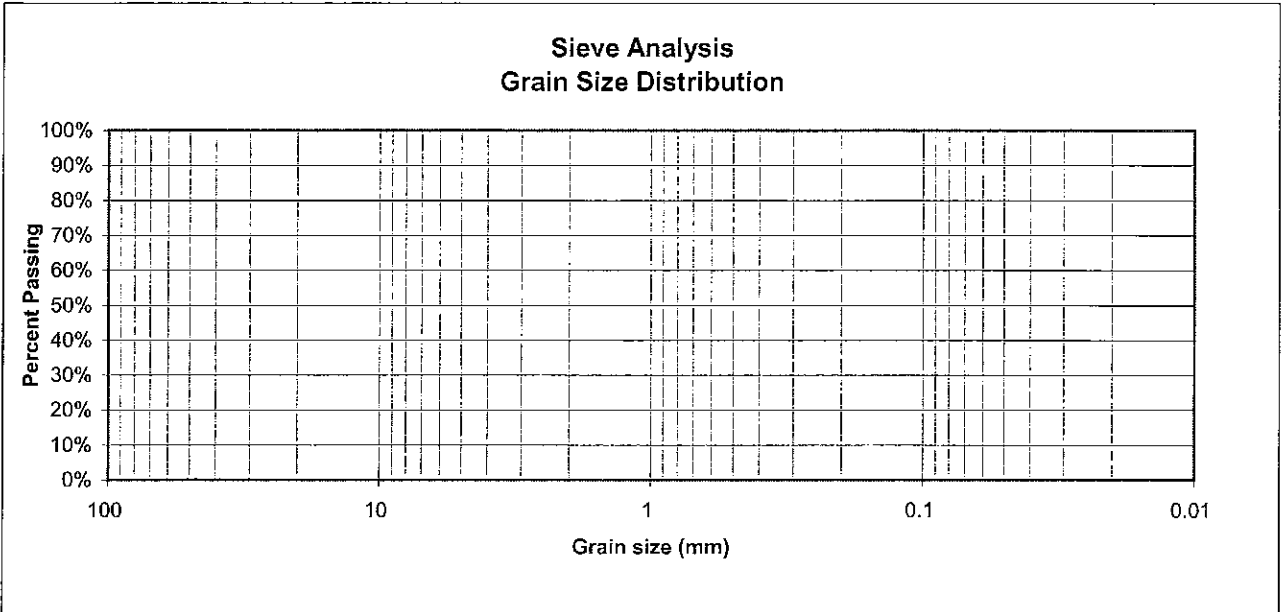
JOB NO.:

83691

FIG NO.:

C-10

UNIFIED CLASSIFICATION ML		CLIENT	CORRAL RANCH DEV.
SOIL TYPE #	3	PROJECT	RESERVE AT CORRAL BLUFFS
TEST BORING #	2	JOB NO.	83691
DEPTH (FT)	10	TEST BY	BL



U.S. <u>Sieve #</u>	Percent <u>Finer</u>	Atterberg <u>Limits</u>	
3"		Plastic Limit	
1 1/2"		Liquid Limit	
3/4"		Plastic Index	
1/2"			
3/8"		<u>Swell</u>	
4		Moisture at start	9.4%
10		Moisture at finish	15.3%
20		Moisture increase	5.9%
40		Initial dry density (pcf)	103
100		Swell (psf)	850
200			



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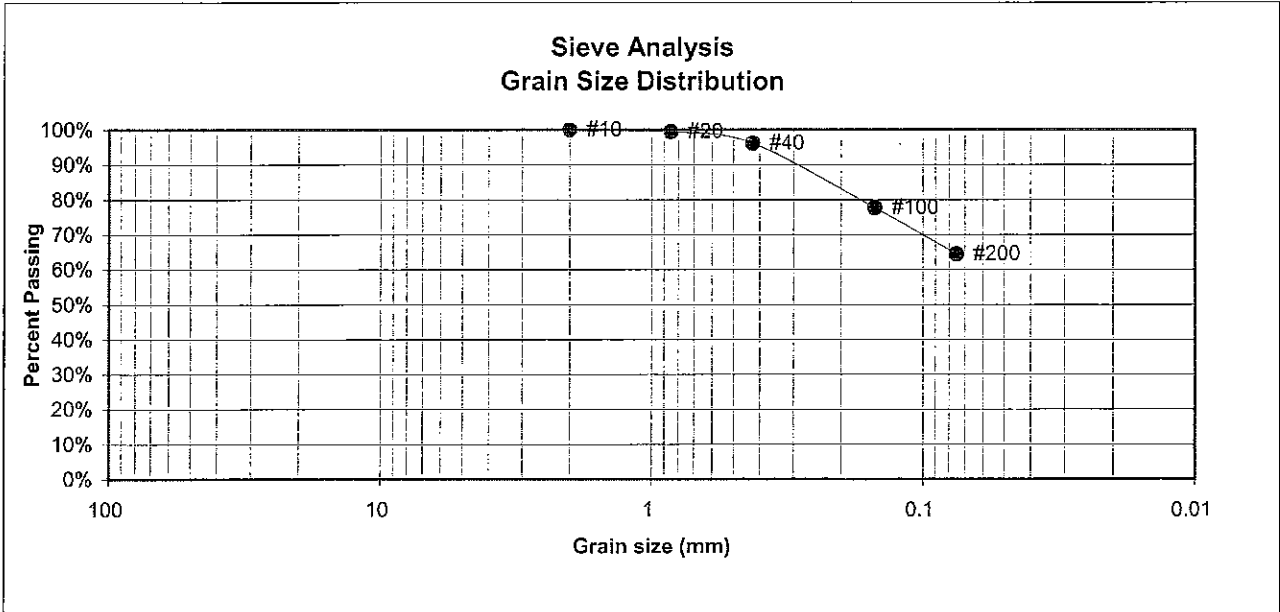
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COLORADO SPRINGS, COLORADO 80907

LABORATORY TEST
RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>BL</i>	11/17/12

JOB NO.:
83691
FIG NO.:
C-11

<u>UNIFIED CLASSIFICATION</u> ML		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	3	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	3	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	2-3	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.4%
40	96.2%
100	77.7%
200	64.4%

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:

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DATE: 1/17/12

JOB NO.:

83691

FIG NO.:

C-12

UNIFIED CLASSIFICATION SC-SM

SOIL TYPE # 4

TEST BORING # 4

DEPTH (FT) 15

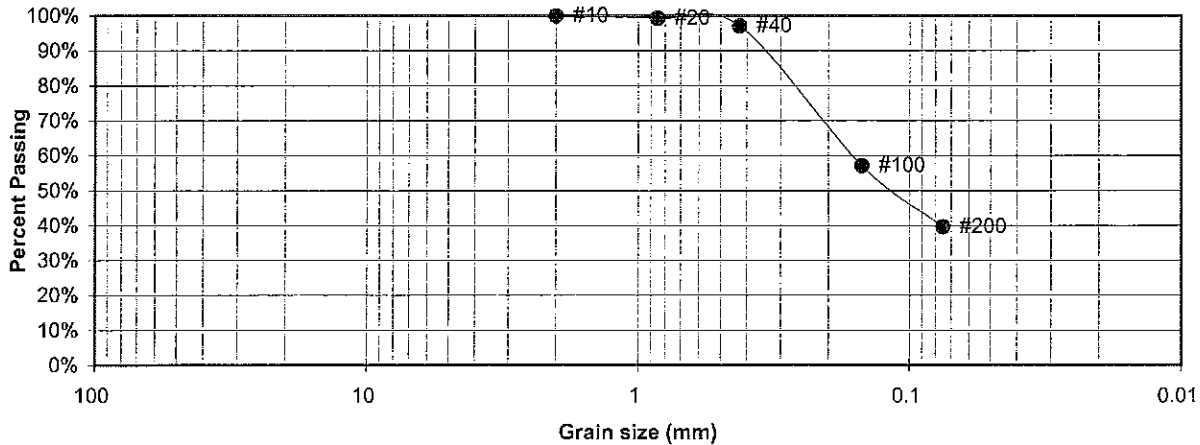
CLIENT CORRAL RANCH DEV.

PROJECT RESERVE AT CORRAL BLUFFS

JOB NO. 83691

TEST BY BL

Sieve Analysis Grain Size Distribution



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	
10	100.0%
20	99.3%
40	97.0%
100	57.1%
200	39.6%

Atterberg Limits	
Plastic Limit	10
Liquid Limit	17
Plastic Index	6

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



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LABORATORY TEST RESULTS

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DATE: 1/17/12

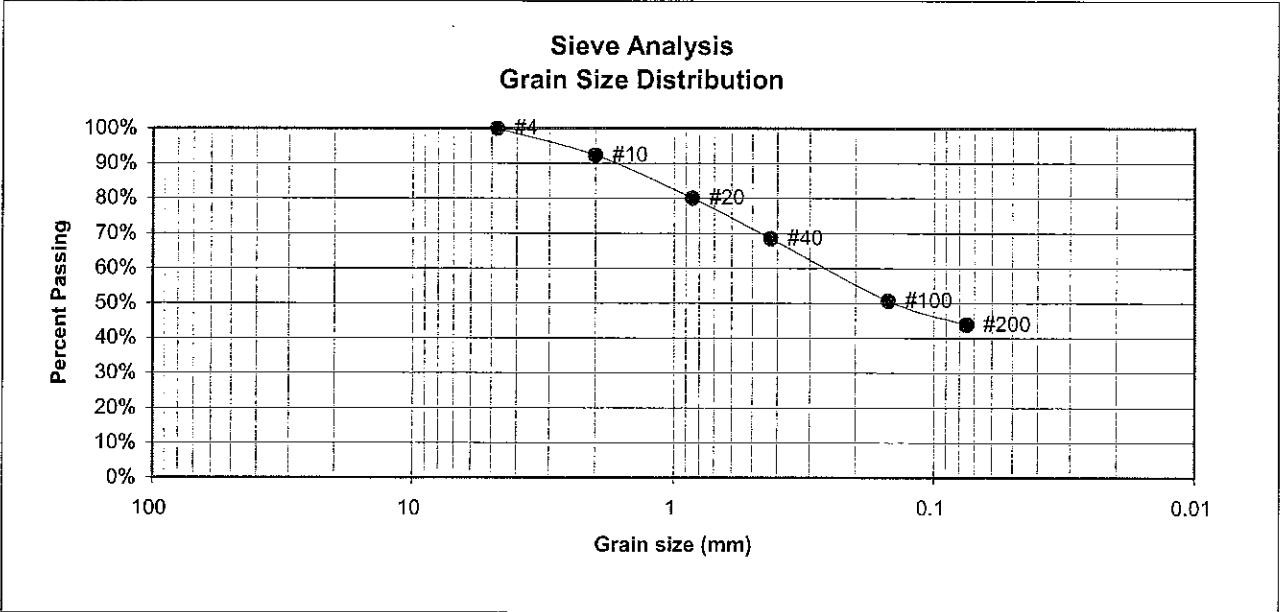
JOB NO.:

83691

FIG NO.:

C-13

UNIFIED CLASSIFICATION	SC	CLIENT	CORRAL RANCH DEV.
SOIL TYPE #	4	PROJECT	RESERVE AT CORRAL BLUFFS
TEST BORING #	6	JOB NO.	83691
DEPTH (FT)	10	TEST BY	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	92.3%
20	80.0%
40	68.5%
100	50.6%
200	43.8%

Atterberg Limits

Plastic Limit	12
Liquid Limit	28
Plastic Index	16

Swell

Moisture at start	14.2%
Moisture at finish	23.6%
Moisture increase	9.4%
Initial dry density (pcf)	103
Swell (psf)	1330



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**LABORATORY TEST
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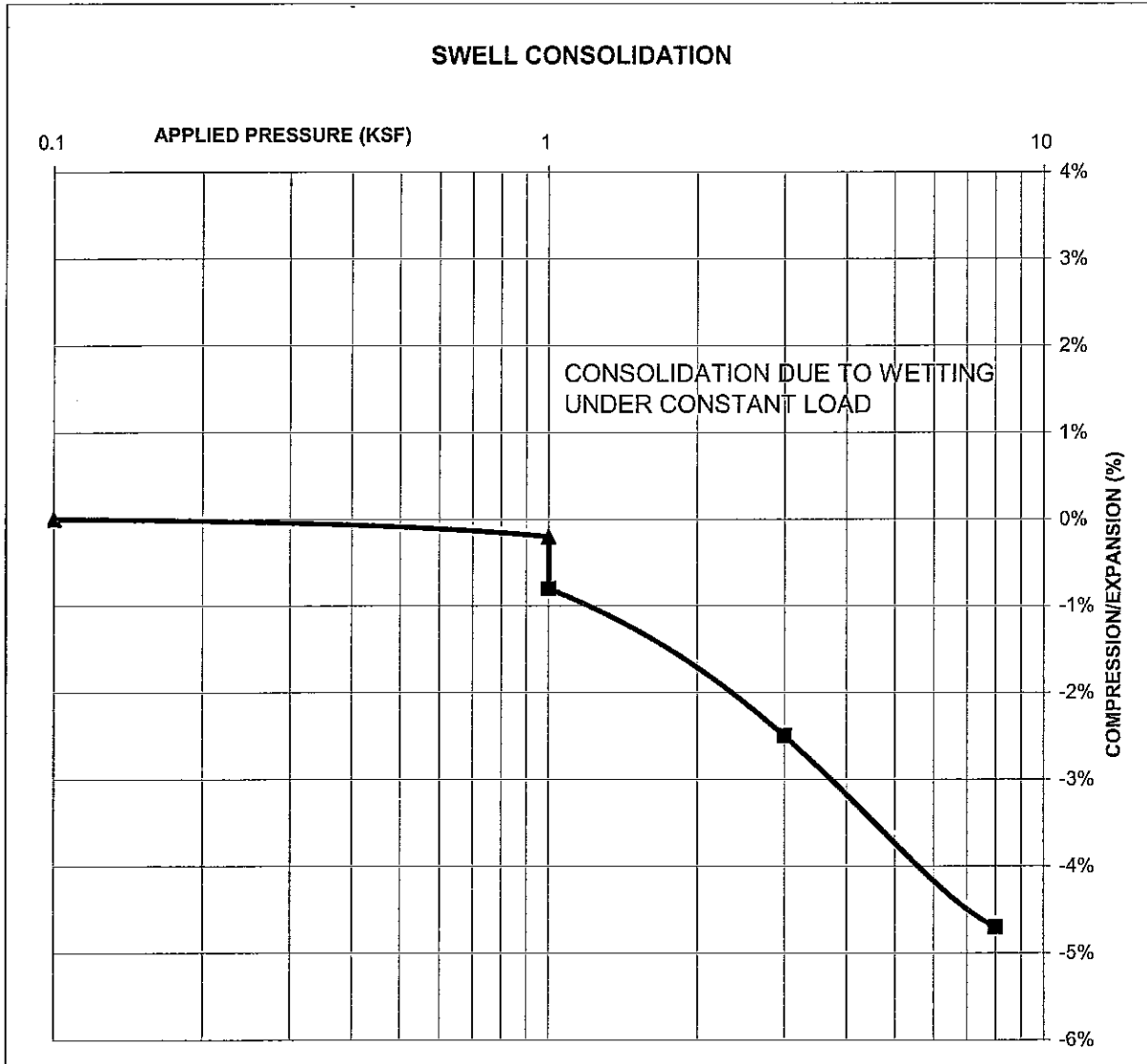
DRAWN:	DATE:	CHECKED:	DATE:
		<i>Kav</i>	1/23/12

JOB NO.:
83691
FIG NO.:
C-14

CONSOLIDATION TEST RESULTS

TEST BORING #	1	DEPTH(ft)	2-3
DESCRIPTION	SM	SOIL TYPE	1
NATURAL UNIT DRY WEIGHT (PCF)			107
NATURAL MOISTURE CONTENT			6.3%
SWELL/CONSOLIDATION (%)			-0.6%

JOB NO. 83691
 CLIENT CORRAL RANCH DEV.
 PROJECT RESERVE AT CORRAL BLUFFS




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 505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
 TEST RESULTS

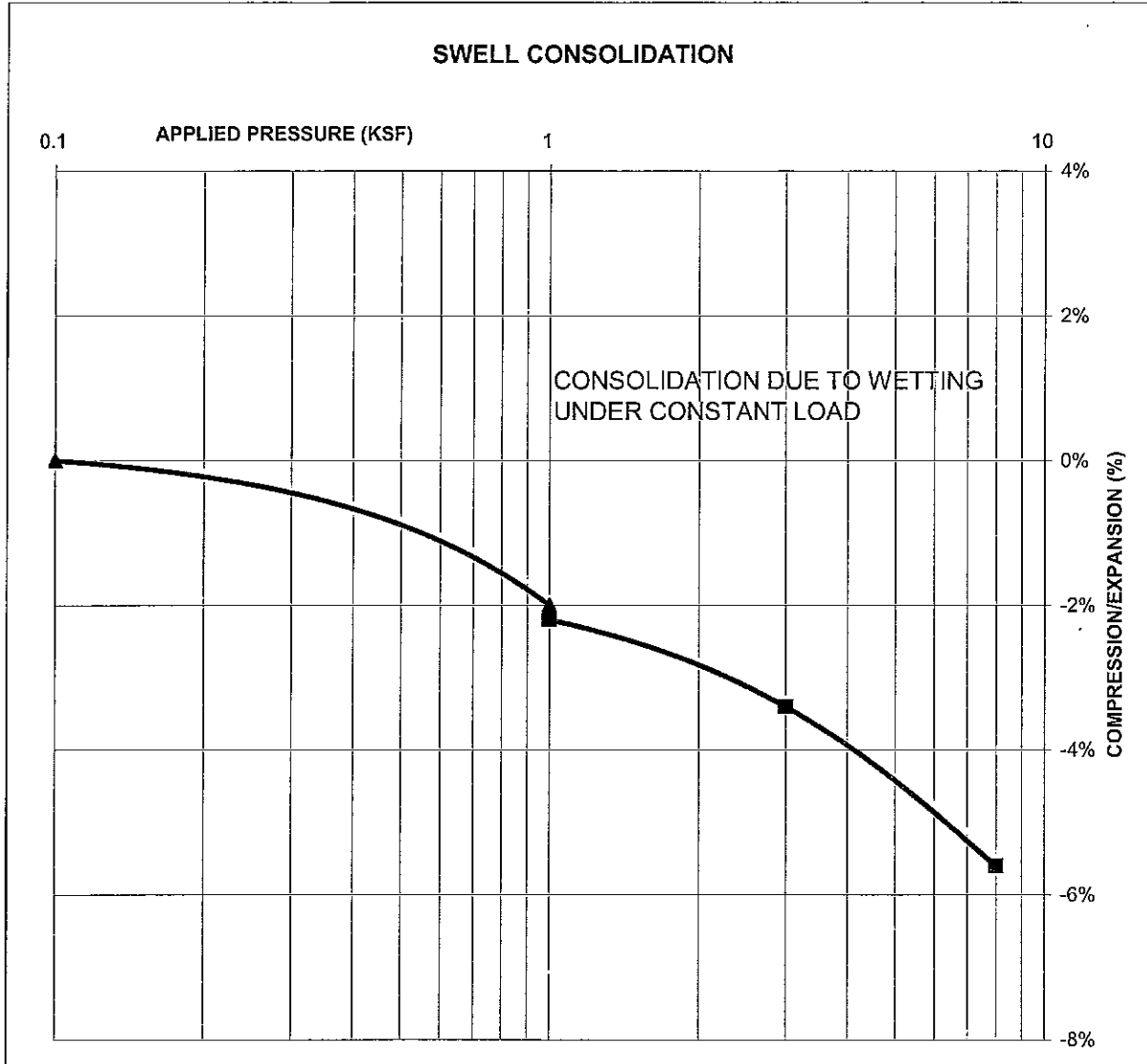
DRAWN:	DATE:	CHECKED:	DATE:
		<i>hr</i>	1/17/12

JOB NO.:
 83691
 FIG NO.:
 C-15

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	2-3
DESCRIPTION	CL	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)			109
NATURAL MOISTURE CONTENT			16.7%
SWELL/CONSOLIDATION (%)			-0.2%

JOB NO. 83691
 CLIENT CORRAL RANCH DEV.
 PROJECT RESERVE AT CORRAL BLUFFS



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SWELL CONSOLIDATION
 TEST RESULTS

DRAWN:

DATE:

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DATE:

1/17/12

JOB NO.:

83691

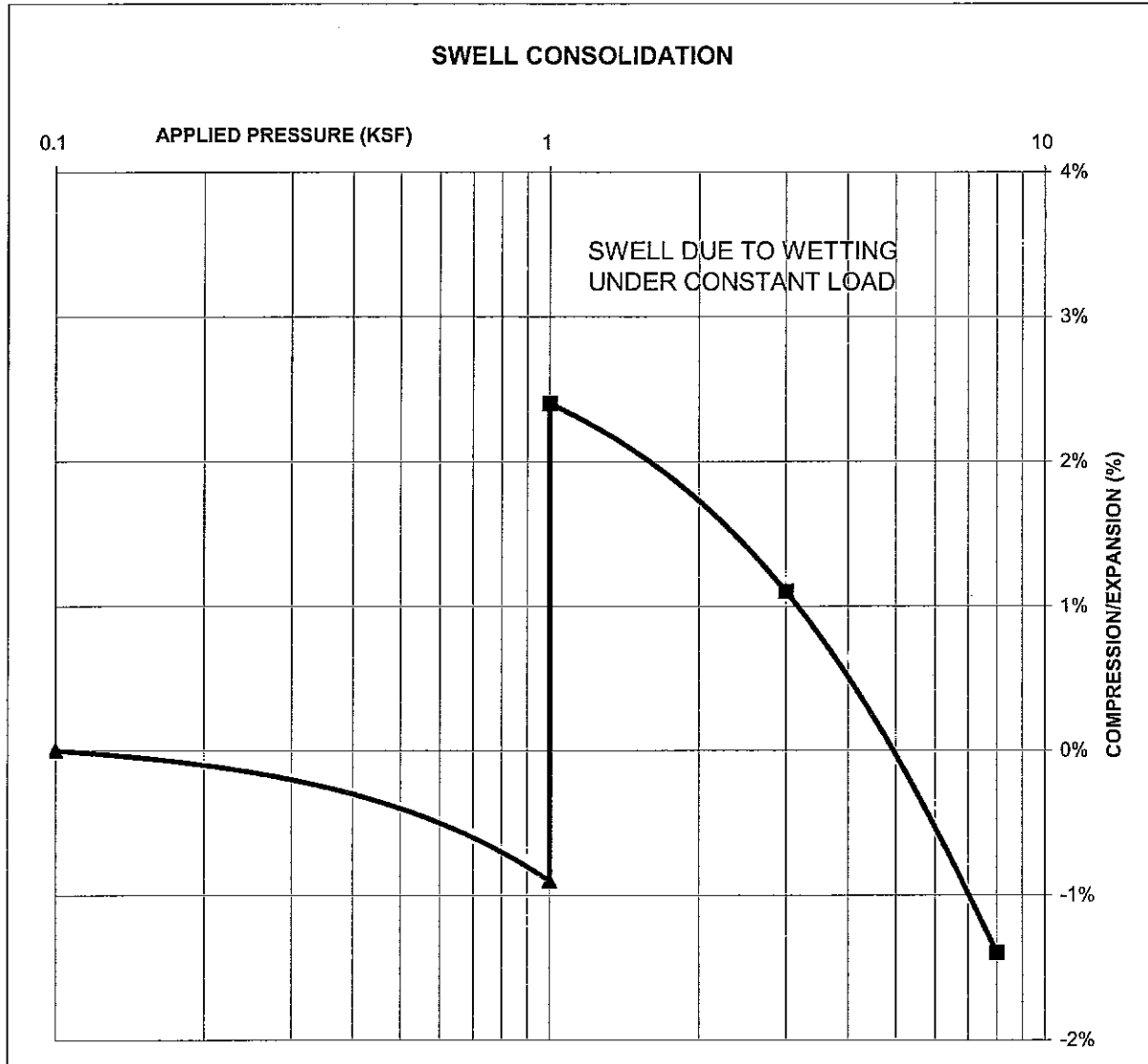
FIG NO.:

C-16

CONSOLIDATION TEST RESULTS

TEST BORING #	4	DEPTH(ft)	5
DESCRIPTION	CL-M	SOIL TYPE	2
NATURAL UNIT DRY WEIGHT (PCF)	110		
NATURAL MOISTURE CONTENT	11.0%		
SWELL/CONSOLIDATION (%)	3.3%		

JOB NO. 83691
 CLIENT CORRAL RANCH DEV.
 PROJECT RESERVE AT CORRAL BLUFFS



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

SWELL CONSOLIDATION
 TEST RESULTS

DRAWN:

DATE:

CHECKED: *[Signature]*

DATE: 1/17/12

JOB NO.:

83691

FIG NO.:

C-17

APPENDIX D: Soil Survey Descriptions

3—Ascalon sandy loam, 3 to 9 percent slopes. This deep, well drained soil formed in mixed alluvium and wind-laid materials on uplands. Elevation ranges from 5,500 to 6,500 feet. The average annual precipitation is about 15 inches, the average annual air temperature is about 48 degrees F, and the average frost-free period is about 140 days.

Typically, the surface layer is brown sandy loam about 8 inches thick. The subsoil is brown, yellowish brown, and pale brown sandy clay loam about 22 inches thick. The substratum is calcareous, very pale brown sandy loam and loamy sand.

Included with this soil in mapping are small areas of Bresser sandy loam, 3 to 5 percent slopes; Olney sandy loam, 3 to 5 percent slopes; Vona sandy loam, 3 to 9 percent slopes; and Fort Collins loam, 3 to 8 percent slopes.

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

Most areas of this soil are used as range, but some areas on the more gentle slopes are cultivated. Wheat is the main crop, but some sorghum is also grown.

Native vegetation is dominantly blue grama, needle-andthread, side-oats grama, sand dropseed, and buckwheat. Western wheatgrass, junegrass, and mountain muhly are also present, predominantly where this soil occurs in the northern part of the survey area.

Seeding is a good practice if the range has deteriorated. Native grasses should be used. If the range is severely eroded and blowouts have developed, fertilizing the new seeding is a good practice. Brush control and grazing management may be needed to improve the depleted range. Grazing of animals should be managed so that enough forage is left standing to protect the soil from blowing, to increase infiltration of water, and to catch and hold snow.

Windbreaks and environmental plantings are generally suited to this soil. Soil blowing is the principal limitation to the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be necessary at the time of planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. 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. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. 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 use as homesites. Its main limitation for foundations, roads, and streets is moderate shrink-swell potential. Special design of roads is also necessary because of potential frost action. Capability subclasses IVE, nonirrigated, and IIIe, irrigated.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>W</i>	11/19/72

Job No.

83691

Fig. No.

D-1

4—Badland. Badland occupies steep, rough, eroding areas. Slopes range from 0 to more than 100 percent. Depending on the location, Badland formed from material derived from shale, sandstone, siltstone, and gold ore mill tailings. Areas of Badland are in the vicinity of the town of Calhan; the Corral Bluffs, east of Colorado Springs; the southwestern part of the survey area on Fort Carson; and the old Golden Cycle gold ore processing mill in the western part of Colorado Springs.

Runoff is very rapid, and the hazard of erosion is high. The reaction of the tailings material is slightly acid to extremely acid. Little or no soil development has taken place. Gullying is severe in most areas of Badland.

Vegetation grows only in small patches of soil material in drainageways and in some of the less eroded areas. The sloping part of Badland is extremely gullied and lacks vegetation.

Most areas of Badland are used for wildlife habitat. In the mill tailings area in the western part of Colorado Springs, some urban development has taken place in level areas that have had a layer of topsoil applied to the surface. Capability subclass VIIIs.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>[Signature]</i>	1/19/12

Job No.
83691
Fig. No.

D-2

13—Bresser sandy loam, 5 to 9 percent slopes. This deep, well drained soil formed in arkosic alluvium and residuum on terraces and uplands. Elevation ranges from 6,000 to 6,800 feet. 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 grayish brown sandy loam about 5 inches thick. The subsoil is brown sandy clay loam about 31 inches thick. The substratum is light yellowish brown loamy coarse sand to a depth of 60 inches.

Included with this soil in mapping are small areas of Bresser soils that have a loam surface layer, mostly along the western side of the survey area; Truckton sandy loam, 3 to 9 percent slopes; Yoder gravelly sandy loam, 1 to 8 percent slopes; Kutch clay loam, 3 to 5 percent slopes; and Kutch clay loam, 5 to 20 percent slopes. Some areas of Ustic Torrfluvents, loamy, are along narrow drainageways. In some areas, arkose beds are at a depth of 0 to 40 inches. These beds occur as sandstone or shale.

Permeability of this Bresser soil is moderate. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate. Some gullies are present.

Most areas of this soil are used for range. A small acreage is used for dryland crops, mostly wheat.

This soil is suited to limited cultivation. It is better suited to use as rangeland or pastureland because these uses protect the soil by providing permanent cover. Basin terraces may be needed before seeding this soil back to grass.

Native vegetation is mainly cool- and warm-season grasses such as western wheatgrass, side-oats grama, and needleandthread.

Proper range management is needed 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 generally suited to this soil. Soil blowing is the main limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. 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. In cropland areas, habitat favorable for ring-necked pheasant, mourning dove, and many nongame species can be developed by establishing areas for nesting and escape cover. For pheasant, undisturbed nesting cover is vital and should be provided for in plans for habitat development. This is especially true in areas of intensive farming. 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 homesites. Practices are needed to control surface runoff and keep soil losses to a minimum. Limiting the disturbance of the soil and the removal of existing plant cover during construction helps to control erosion. Capability subclass IVe.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>M</i>	1/19/12

Job No.

8309

Fig. No.

D-3

85--Stapleton-Bernal sandy loams. 3 to 20 percent slopes. These gently sloping to moderately steep soils are on upland ridges and hills. Elevation ranges from about 6,500 to 6,800 feet. 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.

The Stapleton soil makes up about 40 percent of the complex, the Bernal soil about 30 percent, and included soils about 30 percent.

Included with these soils in mapping are areas of Blakeland loamy sand, 1 to 9 percent slopes; Louviers silty clay loam, 3 to 18 percent slopes; Travessilla-Rock outcrop complex, 8 to 90 percent slopes; Truckton sandy loam, 3 to 9 percent slopes; and small outcrops of arkose sandstone and shale.

The Stapleton soil is commonly on the lower part of slopes. It is deep and well drained. It formed in sandy alluvium derived from arkosic bedrock. Typically, the surface layer is grayish brown sandy loam about 11 inches thick. The subsoil is grayish brown gravelly sandy loam about 6 inches thick. The substratum extends to a depth of 60 inches or more. It is pale brown gravelly sandy loam in the upper part and grades to gravelly loamy sand in the lower part.

Permeability of the Stapleton soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is medium, and the hazard of erosion is moderate.

The Bernal soil is commonly on ridges and hills. It is shallow and well drained. It formed in material weathered from sandstone and modified by eolian sediment. Typically, the surface layer is dark grayish brown sandy loam about 4 inches thick. The subsoil is brown sandy clay loam about 7 inches thick. The substratum is brown sandy loam about 2 inches thick. Hard, light colored sandstone is at a depth of about 13 inches.

Permeability of the Bernal soil is moderate. Effective rooting depth is 8 to 20 inches. Available water capacity is low. Surface runoff is medium, and the hazard of erosion is moderate.

The soils in this complex are used for grazing livestock, for wildlife habitat, and as homesites.

The native vegetation on the Stapleton soil is mainly western wheatgrass, side-oats grama, needleandthread, and little bluestem. The dominant shrub on this soil is true mountainmahogany. Yucca is present in some places.

The native vegetation on the Bernal soil is mainly blue grama, side-oats grama, western wheatgrass, Scribner needlegrass, and needleandthread. The dominant shrubs and trees are mountainmahogany, skunkbush sumac, and one-seeded juniper. There are lesser amounts of pinyon pine.

Deferred grazing late in summer and early in fall improves the condition of the range on the Stapleton soil. Careful management of plant cover is essential because of the difficulty of vegetating the Bernal soil. Properly locating livestock watering facilities helps to control grazing.

Windbreaks and environmental plantings generally are suited to the Stapleton soil. Soil blowing is the main limitation for the establishment of trees and shrubs. This limitation can be overcome by cultivating only in the tree rows and leaving a strip of vegetation between the rows. Supplemental irrigation may be needed when planting and during dry periods. Trees that are best suited and have good survival are Rocky Mountain juniper, eastern redcedar, ponderosa pine, Siberian elm, Russian-olive, and hackberry. Shrubs that are best suited are skunkbush sumac, lilac, and Siberian peashrub.

Windbreaks and environmental plantings generally are not suited to the Bernal soil. Onsite investigation is needed to determine if plantings are feasible.

Rangeland wildlife, such as antelope, cottontail, coyote, and scaled quail, is best adapted for life on the soils in this complex. Proper livestock grazing management is necessary if wildlife and livestock share the range. Livestock watering developments are also important, and they are used by various wildlife species.

The main limitations of the Stapleton soil for urban use are frost-action potential and slope. The main limitations of the Bernal soil are depth to bedrock, frost-action potential, and slope. Special designs for sites, buildings, and roads and streets are needed to control soil blowing and water erosion on construction sites where vegetation has been removed. Capability subclass VIe.



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SCS SOIL DESCRIPTION

Drawn	Date	Checked	Date
		<i>[Signature]</i>	1/19/12

Job No.

83691

Fig. No.

D-4

APPENDIX E: Percolation Test Results

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 1

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 32"

Depth: 23"

Depth: 30"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/4	1	10	1/4	1	10	1/16
2	10	1/4	2	10	1/4	2	10	1/16
3	10	1/4	3	10	1/4	3	10	1/16

Perc Rate (min./in.): 40

Perc Rate (min./in.): 40

Perc Rate (min./in.): 160

Average Perc Rate (min./in.) 80

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

Depth	Visual Classification	Remarks
0-9'	Sand, very silty, fine grained, brown to tan	
9-15'	Clay-silt, very sandy, tan	No Bedrock No Groundwater

- 21 Blows / ft. @ 2'
- 12 Blows / ft. @ 4'
- 35 Blows / ft. @ 9'
- 35 Blows / ft. @ 14'

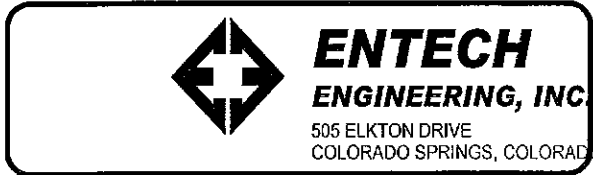
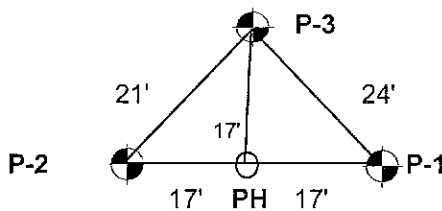
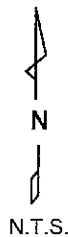
Required Area of Absorption Field: 1.79 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 402 Sq. Ft./bedroom
 Required Area of Absorption Field: 644 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 34.0" N, 104° 35' 24.1" W

Observer: Joey Goode

By:



PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/19/12

JOB NO.: 83691
 FIG NO.: E-1

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 2

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 31"

Depth: 31"

Depth: 30"

Water			Water			Water		
	Time	Level		Time	Level		Time	Level
<u>Trial</u>	<u>(min.)</u>	<u>Change (in.)</u>	<u>Trial</u>	<u>(min.)</u>	<u>Change (in.)</u>	<u>Trial</u>	<u>(min.)</u>	<u>Change (in.)</u>
1	10	1/2	1	10	9	1	10	1
2	10	1/2	2	10	7	2	10	1
3	10	1/2	3	10	6	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 2

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 14

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

<u>Depth</u>	<u>Visual Classification</u>	<u>Remarks</u>
0-15'	Silt, very sandy, tan to brown	
		No Bedrock
		No Groundwater

- 21 Blows / ft. @ 2'
- 19 Blows / ft. @ 4'
- 21 Blows / ft. @ 9'
- 32 Blows / ft. @ 14'

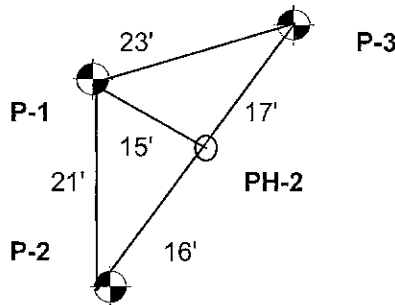
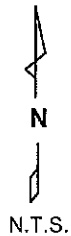
Required Area of Absorption Field: 0.75 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 168 Sq. Ft./bedroom
 Required Area of Absorption Field: 269 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 32.4" N, 104° 35' 38.0" W

Observer: Joey Goode

By:



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PERCOLATION TEST RESULTS

DRAWN: _____ DATE: _____ CHECKED: *m* DATE: 1/19/12

JOB NO.: 83691
 FIG NO.: E-2

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 3

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 29"

Depth: 27"

Depth: 28"

Water Level			Water Level			Water Level		
Trial	Time (min.)	Change (in.)	Trial	Time (min.)	Change (in.)	Trial	Time (min.)	Change (in.)
1	10	1	1	10	1	1	10	1
2	10	3/4	2	10	1/2	2	10	1/2
3	10	1/2	3	10	1/2	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 20

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

Depth	Visual Classification	Remarks
0-15'	Silt, sandy, tan to brown	No Bedrock No Groundwater

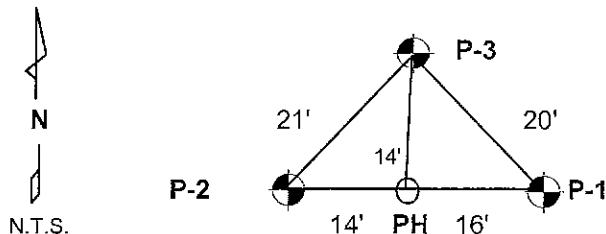
- 17 Blows / ft. @ 2'
- 27 Blows / ft. @ 4'
- 21 Blows / ft. @ 9'
- 41 Blows / ft. @ 14'

Required Area of Absorption Field: 0.89 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 201 Sq. Ft./bedroom
 Required Area of Absorption Field: 322 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 33.4" N, 104° 35' 47.9" W

Observer: Joey Goode By:



PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED:	DATE:
		<i>[Signature]</i>	1/19/12

JOB NO.: 83691
 FIG NO.: E-3

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 4

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 39"

Depth: 27"

Depth: 29"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/16	1	10	1/16	1	10	1/8
2	10	1/16	2	10	1/16	2	10	1/8
3	10	1/16	3	10	1/16	3	10	1/8

Perc Rate (min./in.): 160

Perc Rate (min./in.): 160

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 134

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-9'	Clay, sandy, dark brown	
9-13'	Clay-silt, sandy, tan	Sandstone Bedrock at 13'
13-15'	Sandstone, very clayey, very stilty, fine grained, tan	No Groundwater
19 Blows / ft. @ 2'		
30 Blows / ft. @ 4'		
24 Blows / ft. @ 9'		
50 Blows / 10" @ 14'		

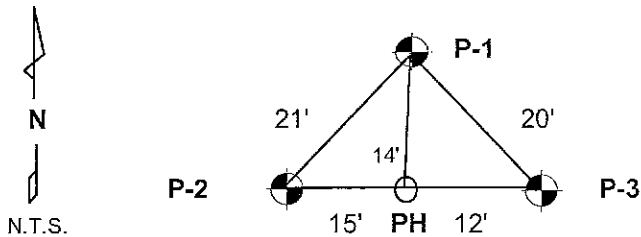
Required Area of Absorption Field: 2.32 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 521 Sq. Ft./bedroom
 Required Area of Absorption Field: 833 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 25.9" N, 104° 35' 50.5" W

Observer: Blake Leonard

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: *W* CHECKED: DATE: *1/19/12*

JOB NO.:
83691

FIG NO.:
E-4

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 5

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 36"

Depth: 33"

Depth: 35"

Water			Water			Water		
Trial	Time (min.)	Level Change (in.)	Trial	Time (min.)	Level Change (in.)	Trial	Time (min.)	Level Change (in.)
1	10	1/8	1	10	1/2	1	10	7/8
2	10	1/8	2	10	1/2	2	10	3/4
3	10	1/8	3	10	3/8	3	10	1/2

Perc Rate (min./in.): 80

Perc Rate (min./in.): 27

Perc Rate (min./in.): 27

Average Perc Rate (min./in.) 45

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

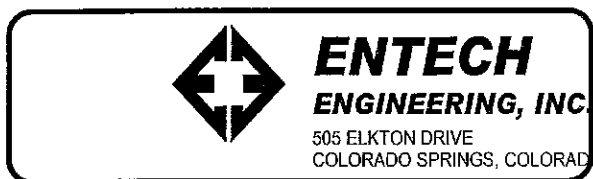
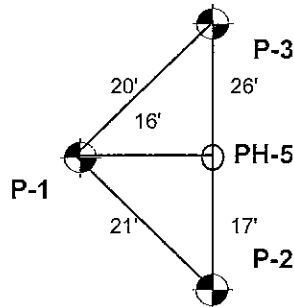
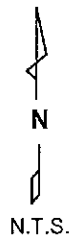
Depth	Visual Classification	Remarks
0-7'	Sand, silty, fine to medium grained, tan to brown	
7-10'	Sandstone, silty, fine to medium grained, tan	Sandstone Bedrock at 7' No Groundwater
28 Blows / ft. @ 2'		
24 Blows / ft. @ 4'		
50 Blows / 9" @ 9'		

Required Area of Absorption Field: 1.34 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 302 Sq. Ft./bedroom
 Required Area of Absorption Field: 483 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 17.8" N, 104° .35' 53.6" W

Observer: Blake Leonard

By:



PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED: <i>[Signature]</i>	DATE: 1/19/12
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JOB NO.: 83691
 FIG NO.: E-5

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 6

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1
 Depth: 29"

Hole No. 2
 Depth: 34"

Hole No. 3
 Depth: 33"

Water			Water			Water		
<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>
1	10	1/2	1	10	3/4	1	10	2 3/8
2	10	3/8	2	10	5/8	2	10	2 3/8
3	10	3/8	3	10	1/2	3	10	1 5/8

Perc Rate (min./in.): 27

Perc Rate (min./in.): 20

Perc Rate (min./in.): 6

Average Perc Rate (min./in.) 18

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

<u>Depth</u>	<u>Visual Classification</u>	<u>Remarks</u>
0-7'	Sand, silty, fine grained, tan	
7-10'	Sandstone, very clayey, fine grained, tan	Sandstone Bedrock at 7' No Groundwater

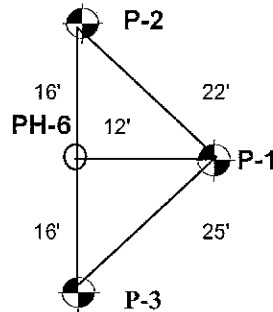
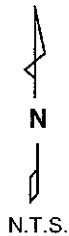
32 Blows / ft. @ 2'
 40 Blows / ft. @ 4'
 50 Blows / ft. @ 9'

Required Area of Absorption Field: 0.85 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 191 Sq. Ft./bedroom
 Required Area of Absorption Field: 305 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 16.5" N, 104° 35' 42.5" W

Observer: Blake Leonard

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: _____ DATE: 1/19/12 CHECKED: _____ DATE: _____

JOB NO.:

83691

FIG NO.:

E-6

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 7

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 31"

Depth: 32"

Depth: 31"

Water			Water			Water		
<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>	<u>Trial</u>	<u>Time (min.)</u>	<u>Level Change (in.)</u>
1	10	2	1	10	5/8	1	10	1/4
2	10	1 1/8	2	10	3/8	2	10	1/4
3	10	1	3	10	1/4	3	10	1/8

Perc Rate (min./in.): 10

Perc Rate (min./in.): 40

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 44

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

<u>Depth</u>	<u>Visual Classification</u>	<u>Remarks</u>
0-7'	Sand, very silty, fine grained, tan	
7-10'	Sand, silty, fine to medium grained, brown	Sandstone Bedrock at 10'
10-15'	Sandstone, silty, fine to medium grained, tan	No Groundwater
21 Blows / ft. @ 2'		
40 Blows / ft. @ 4'		
38 Blows / ft. @ 9'		
50 Blows / 11" @ 14'		

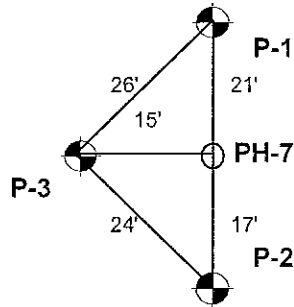
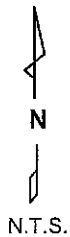
Required Area of Absorption Field: 1.33 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 298 Sq. Ft./bedroom
 Required Area of Absorption Field: 478 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 16.2" N, 104° 35' 31.2" W

Observer: Blake Leonard

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: DATE:

JOB NO.:
 83691
 FIG NO.:

6-7

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 8

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 35"

Depth: 37"

Depth: 32"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	4	1	10	5/8	1	10	2 1/2
2	10	2 1/4	2	10	5/8	2	10	2 3/8
3	10	1 1/8	3	10	5/8	3	10	1

Perc Rate (min./in.): 9

Perc Rate (min./in.): 16

Perc Rate (min./in.): 10

Average Perc Rate (min./in.) 12

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-3'	Sand, very silty, fine grained, tan	
3-10'	Sand, silty, fine to medium grained, brown	No Bedrock No Groundwater

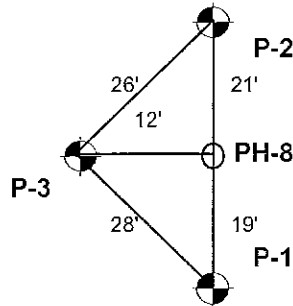
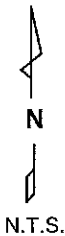
30 Blows / ft. @ 2'
 47 Blows / ft. @ 4'
 40 Blows / ft. @ 9'

Required Area of Absorption Field: 0.69 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 156 Sq. Ft./bedroom
 Required Area of Absorption Field: 249 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 23.4" N, 104° 35' 34.0" W

Observer: Blake Leonard

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.: 83691
 FIG NO.: E-8

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 9

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1
 Depth: 28"

Hole No. 2
 Depth: 29"

Hole No. 3
 Depth: 32"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1/2	1	10	3/8	1	10	1
2	10	1/8	2	10	1/4	2	10	7/8
3	10	1/8	3	10	1/8	3	10	1/4

Perc Rate (min./in.): 80 Perc Rate (min./in.): 80 Perc Rate (min./in.): 40

Average Perc Rate (min./in.) 67

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

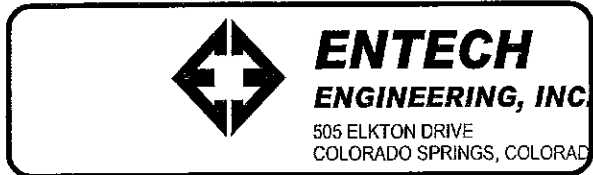
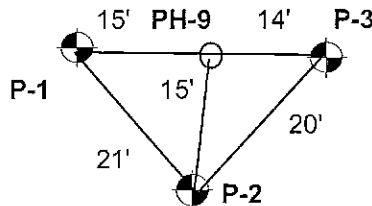
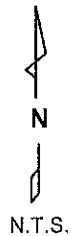
Depth	Visual Classification	Remarks
0-10'	Sand, silty, fine to medium grained, tan	No Bedrock No Groundwater
26 Blows / ft. @ 2'		
33 Blows / ft. @ 4'		
45 Blows / ft. @ 9'		

Required Area of Absorption Field: 1.64 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 368 Sq. Ft./bedroom
 Required Area of Absorption Field: 589 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 25.0" N, 104° 35' 23.5" W

Observer: Blake Leonard By:



PERCOLATION TEST RESULTS

DRAWN:	DATE:	CHECKED: <i>m</i>	DATE: 1/19/12
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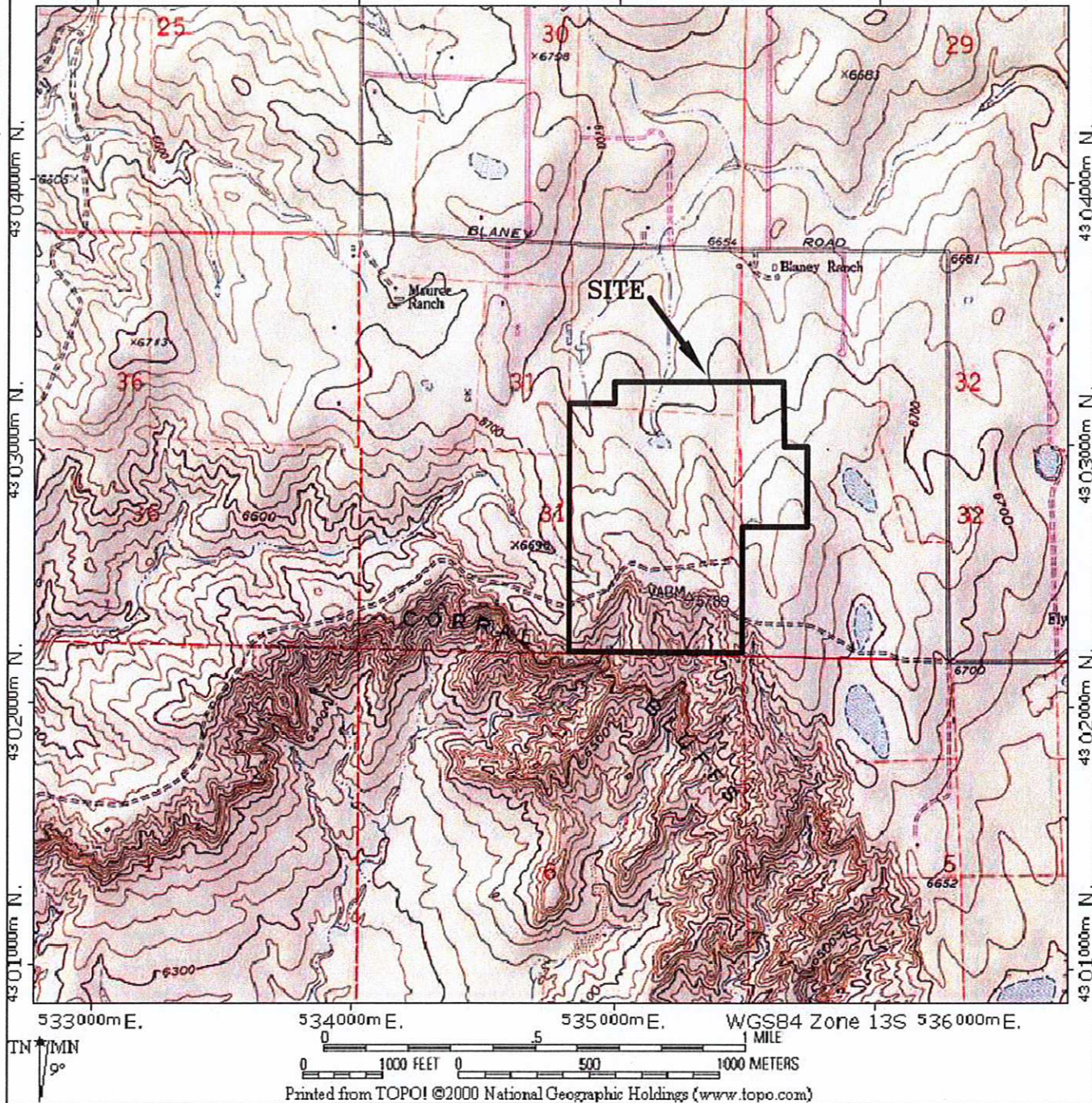
JOB NO.: 83691
 FIG NO.: E-9

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TOPO! map printed on 12/16/11 from "Colorado.tpo" and "Untitled.tpg"

533000m E. 534000m E. 535000m E. WGS84 Zone 13S 536000m E.



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

USGS Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN:
KAH

DATE:
12/15/11

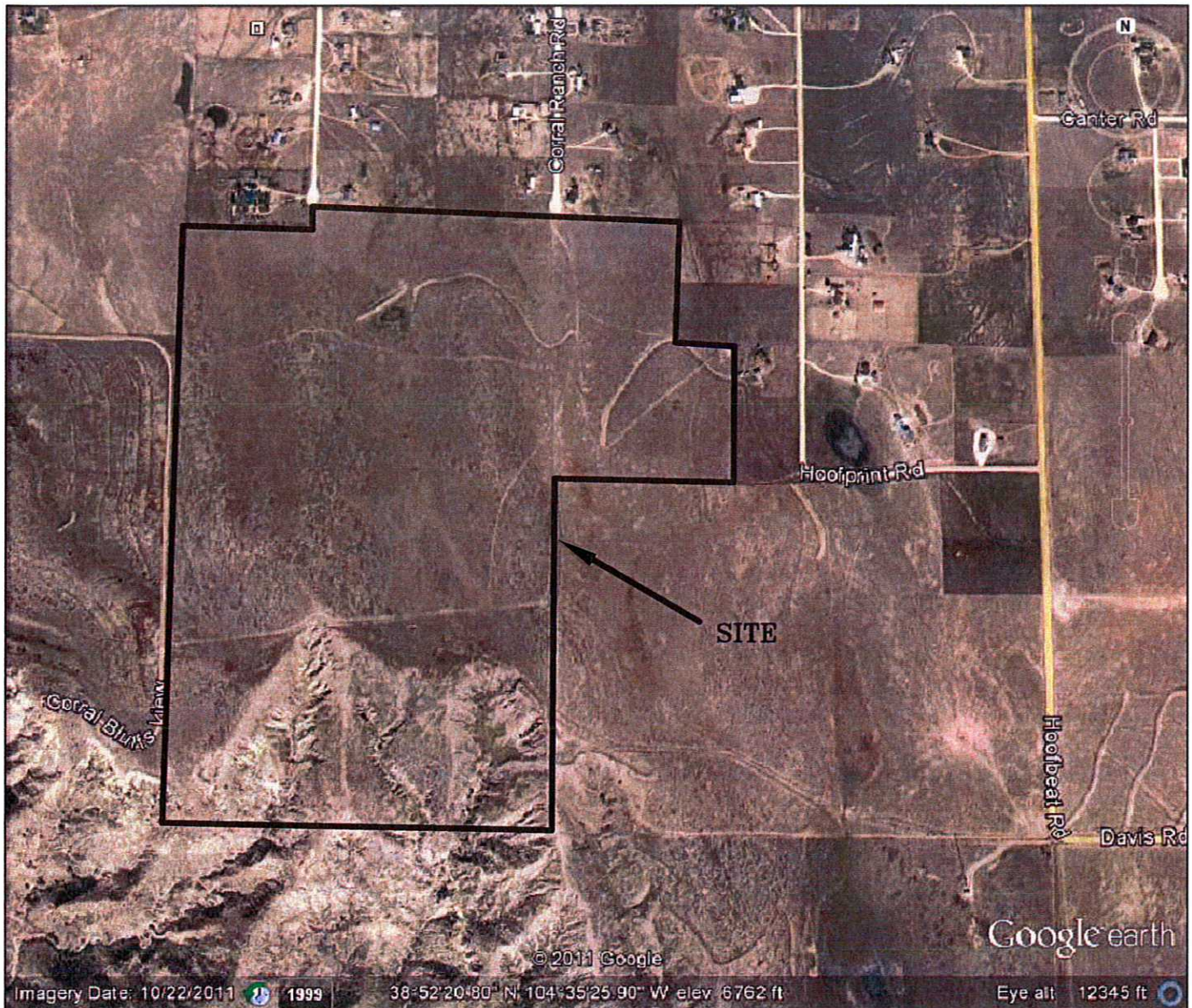
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DATE:
1/19/12

JOB NO.:
83691

FIG NO.:
2

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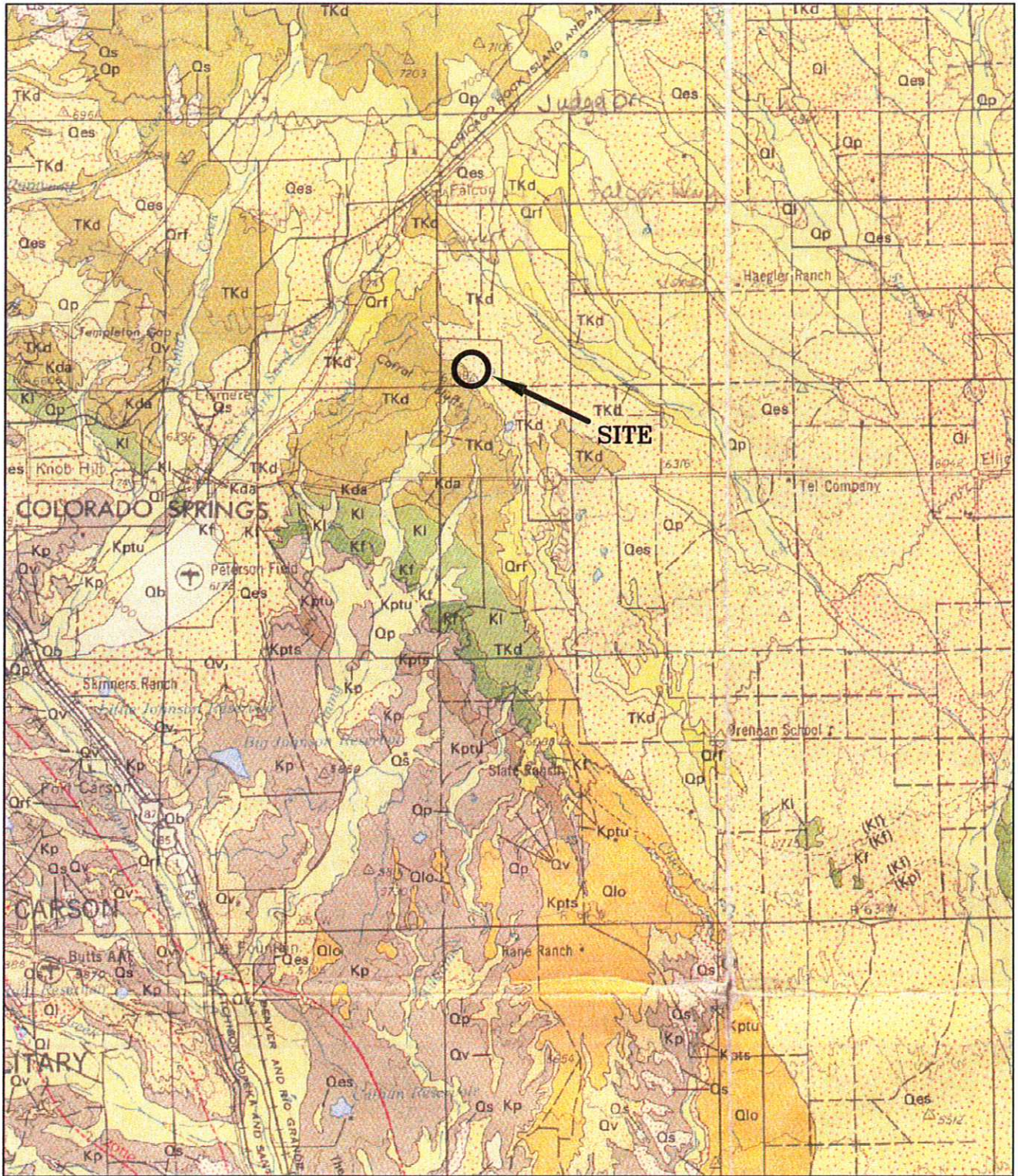
Aerial Photograph
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN: KAH	DATE: 12/15/11	CHECKED: <i>W</i>	DATE: 1/19/12
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JOB NO.:
83691

FIG NO.:
3

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

Colorado Geology Map
The Reserve at Corral Bluffs
El Paso County, CO.
For: Corral Ranch Development Co.

DRAWN:
KAH

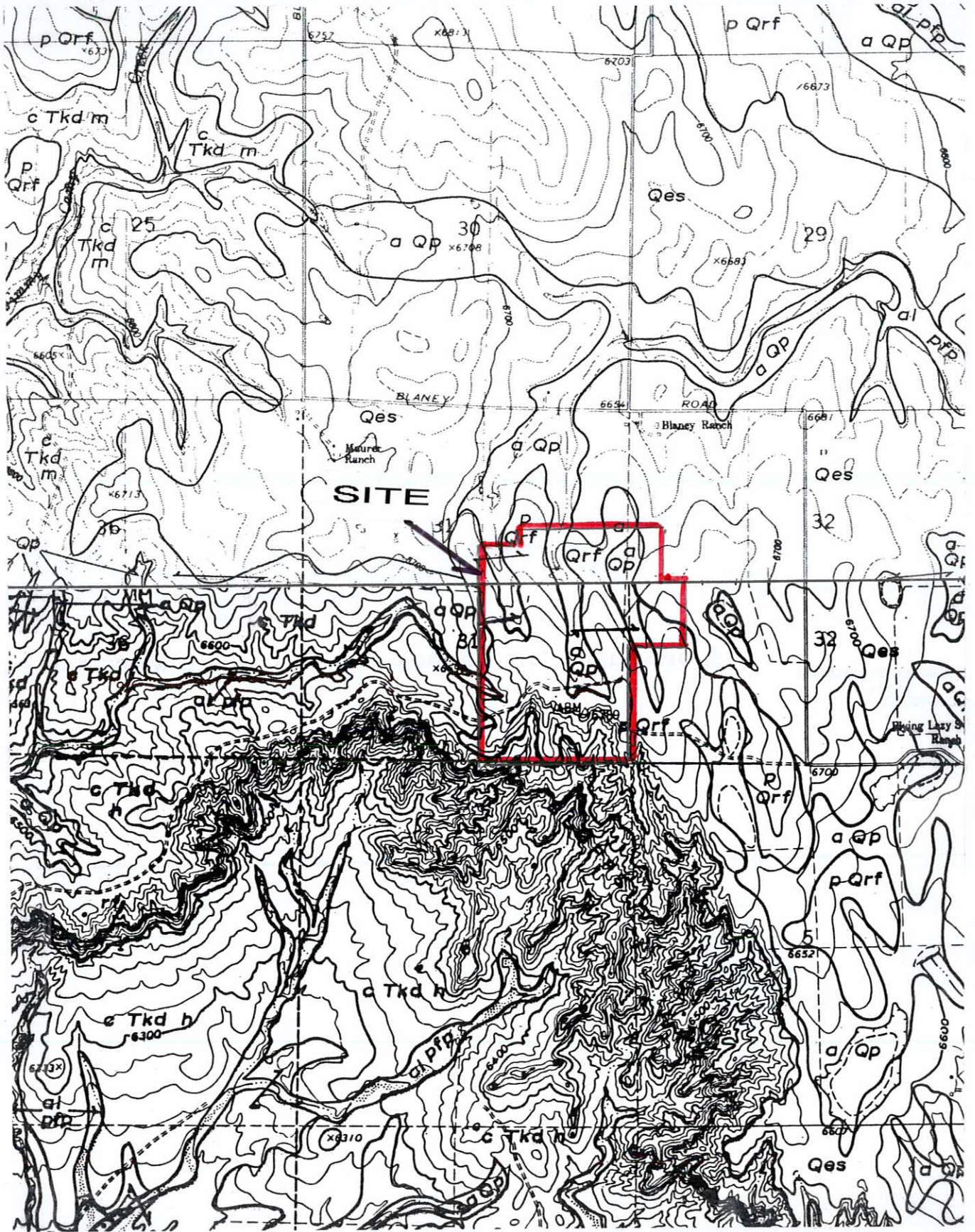
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1/19/12

JOB NO.:
83691

FIG NO.:
6



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

Corral Bluffs/Falcon Geology Map
 The Reserve at Corral Bluffs
 El Paso County, CO.
 For: Corral Ranch Development Co.

JOB NO.:
 83691

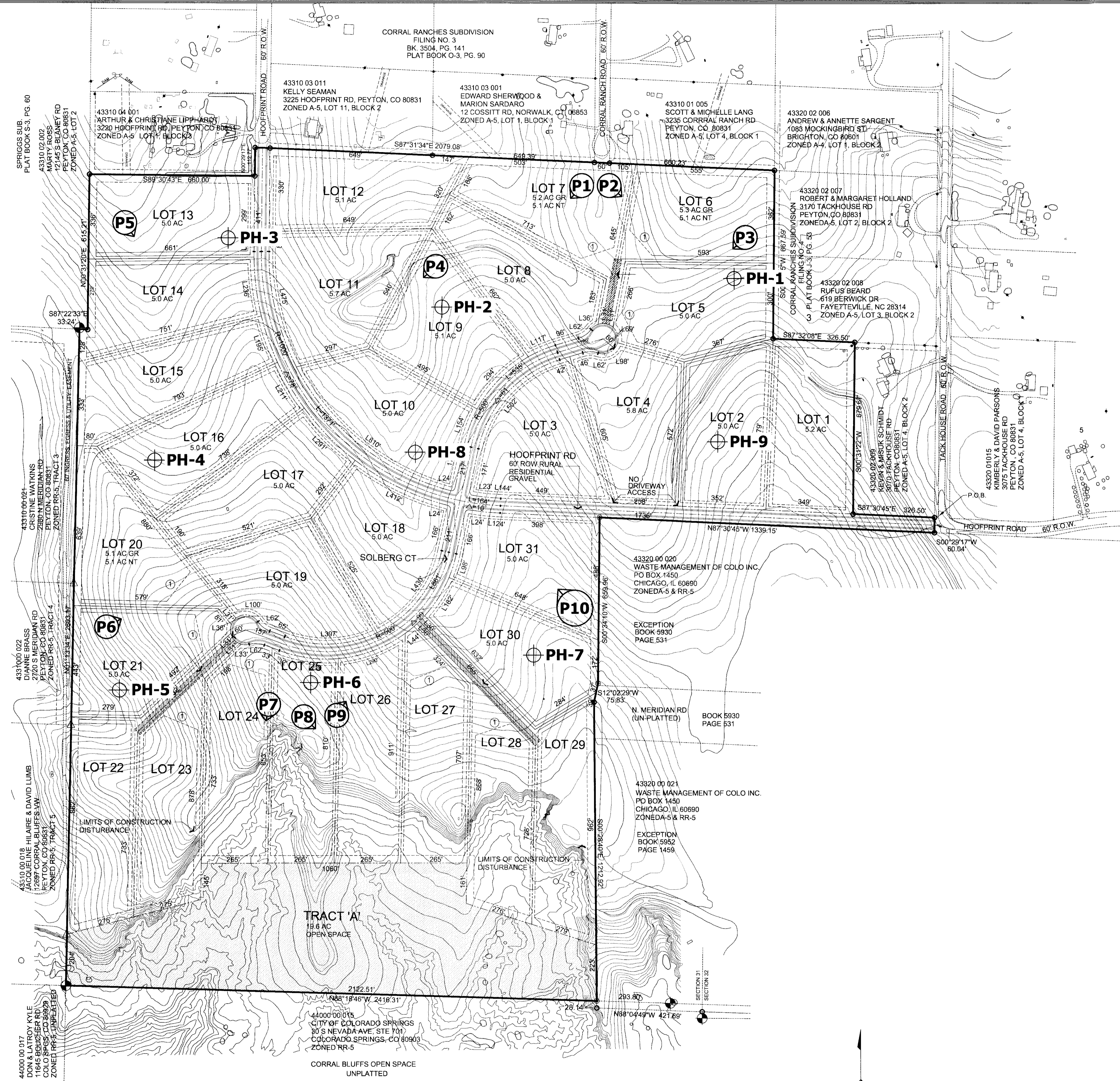
FIG NO.:
 7

DRAWN:
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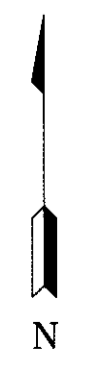
DATE:
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DATE:
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- APPROXIMATE LOCATION AND DIRECTION OF PHOTOS
 - APPROXIMATE LOCATION AND NUMBER OF PERCOLATION TEST



REVISIONS	BY:

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ENGINEERING, INC.

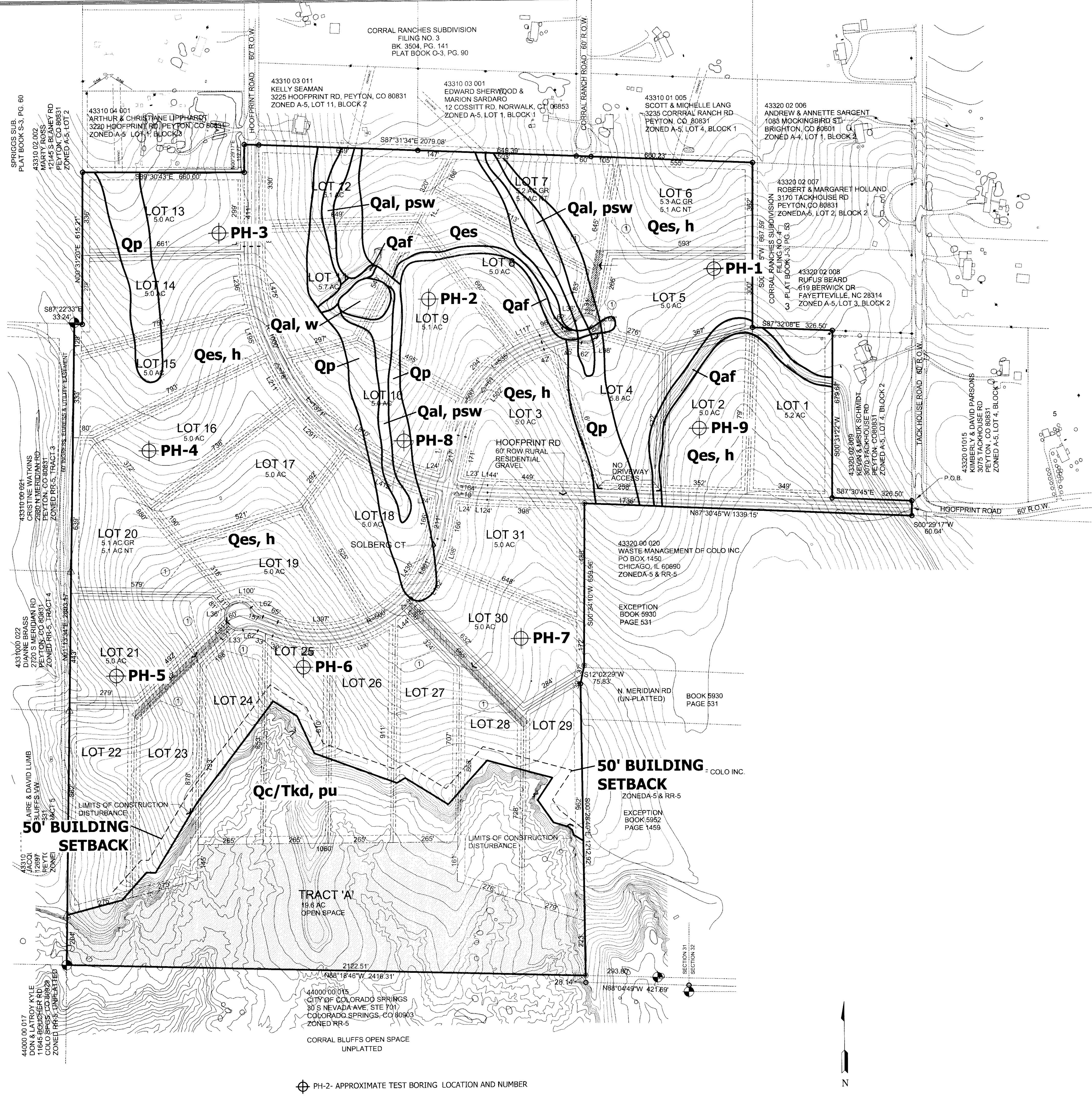
505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

DEVELOPMENT PLAN / PERCOLATION
 TEST LOCATION MAP
 THE RESERVE AT CORRAL BLUFFS
 EL PASO COUNTY, CO
 FOR: CORRAL RANCH DEVELOPMENT

DRAWN BY: MAL
DESIGNED BY: KAH
CHECKED BY:
DATE: 01/17/12
SCALE: 1:200
JOB NO.: 83691
FIGURE NO.: 4

LEGEND

- Qaf - Artificial Fill of Holocene Age:
Man-made fill deposits.
- Qal - Recent Alluvium of Holocene Age:
Recent water deposited materials
- Qp - Piney Creek Alluvium of Holocene Age:
Water deposited sands and clays
- Qes - Eolian Sand of Quaternary Age:
Wind blown sand deposits
- Qc/Tkd - Colluvium of Quaternary Age Overlying
the Dawson Formation of Tertiary to
Cretaceous Age:
Sheetwash and residual soil deposits
overlying arkosic sandstone with
interbedded siltstone and claystone.
- w - areas of ponded water
- psw - potentially seasonal shallow groundwater
- h - hydrocompaction
- pu - potentially unstable slope

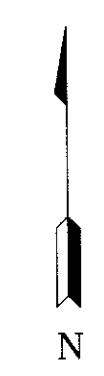


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505 ELKTON DRIVE
COLORADO SPRINGS, CO. 80907 (719) 531-5599

GEOLOGY/ENGINEERING GEOLOGY MAP
THE RESERVE AT CORRAL BLUFFS
EL PASO COUNTY, CO
FOR: CORRAL RANCH DEVELOPMENT

DRAWN BY: MAL
DESIGNED BY: KAH
CHECKED BY:
DATE: 01/17/12
SCALE: 1:200
JOB NO.: 83691
FIGURE NO.: 8

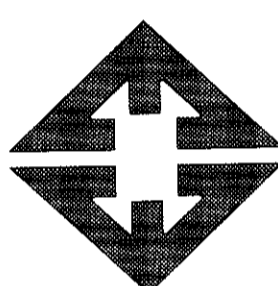
PH-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER



REVISIONS	BY:

ENTTECH
ENGINEERING, INC.

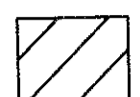





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COLORADO SPRINGS, CO. 80907 (719) 531-5599

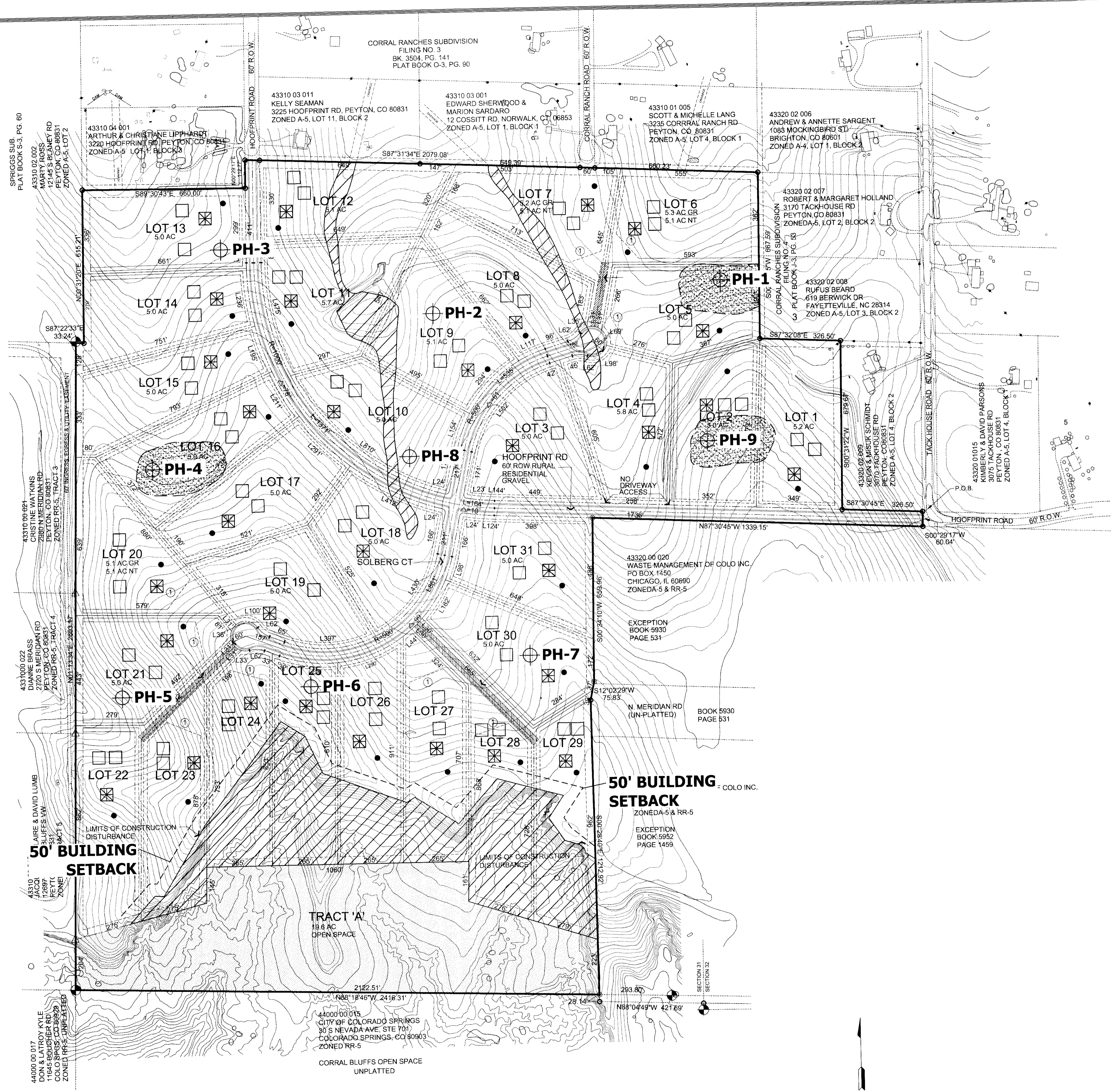


SEPTIC SUITABILITY MAP
THE RESERVE AT CORRAL BLUFFS
EL PASO COUNTY, CO
FOR: CORRAL RANCH DEVELOPMENT

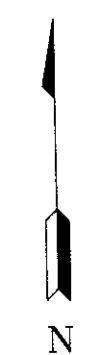
DRAWN BY:	MAL
DESIGNED BY:	KAH
CHECKED BY:	
DATE:	01/17/12
SCALE:	1:200
JOB NO.:	83691
FIGURE NO.:	10

LEGEND

-  AREAS WHERE SEPTIC SYSTEMS ARE NOT RECOMMENDED DUE TO DRAINAGE AREA OR POTENTIALLY UNSTABLE SLOPES
-  AREAS WHERE DESIGNED SYSTEMS MAY BE REQUIRED DUE TO SLOW PERCOLATION RATES
-  AREAS WHERE CONVENTIONAL SYSTEMS MAY BE USED UNLESS SLOW PERCOLATION RATES, SHALLOW GROUNDWATER, OR SHALLOW BEDROCK IS ENCOUNTERED REQUIRING DESIGNED SYSTEMS
-  POSSIBLE HOUSE LOCATION
-  TWO POSSIBLE SEPTIC FIELD SITES
-  POSSIBLE WELL LOCATION



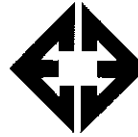
⊕ PH-2 - APPROXIMATE TEST BORING LOCATION AND NUMBER



C:\Users\mal\Desktop\83691\83691.dwg 1/17/12 11:52 AM 10/1000

April 9, 2013

Corral Ranch Development Company
6 South Tejon Street Suite 515
Colorado Springs, Colorado 80903



ENTECH
ENGINEERING, INC.

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

Attn: Dave Jones

Re: On-Site Wastewater Report
The Reserve at Corral Bluffs
El Paso County, Colorado

Ref: Entech Engineering, Inc. January 30, 2012. *Soil Geology, Geologic Hazard and Wastewater Study, The Reserve at Corral Bluffs, El Paso County, Colorado.*
Entech Job No. 83691

Entech Engineering, Inc. August 30, 2012. *Additional Test Borings/Percolation Testing, Lots 23-29, The Reserve at Corral Bluffs, El Paso County, Colorado.*
Entech Job No. 83691

Dear Mr. Jones:

This letter is to summarize the on-site wastewater study performed by Entech Engineering, Inc. The Reserve at Corral Bluffs. The site was originally investigated in the above referenced Soil Geology, Geologic Hazard and Wastewater Study which included conducting nine percolation tests on the property. An additional three percolation tests and three test borings were drilled in the above referenced report to determine soil characteristics along the southern lots that border the north side of Corral Bluffs. The additional testing is presented in Appendix 1. The original percolation test results from the original Soil, Geology, Geologic Hazard and Wastewater Study are presented in Appendix 2.

Of the twelve percolation tests conducted on the site, nine of the percolation rates are suitable for conventional individual sewage treatment systems. Three of the rates were slower than 60 minutes per inch, which would require designed systems. Bedrock and groundwater was not encountered at depths that would affect the use of conventional sewage treatment systems. Designed systems will be required where shallow bedrock or groundwater (less than 6 feet) is encountered.

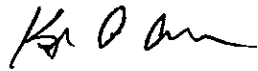
In summary it is our opinion that areas will likely be found on most lots where conventional individual sewage treatment systems can be used. Where slow percolation rates, shallow bedrock, or shallow groundwater are encountered designed systems will be required.

Corral Ranch Development Company
Summary of Percolation Testing
The Reserve at Corral Bluffs
El Paso County, Colorado
Page Two

We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.



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

KAH/vlm

Encl.

Entech Job No. 83691
2MSW/lts/2012/83691summary

Reviewed by:



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



**APPENDIX 1:
Additional Testing by Entech Engineering, Inc.
August 13, 2012**



ENTECH
ENGINEERING, INC.

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

August 30, 2012

Corral Ranch Development Company
6 South Tejon Street, Suite 515
Colorado Springs, CO 80903

Attn: Dave Jones

Re: Additional Test Borings/Percolation Testing
Lots 23-29
The Reserve at Corral Bluffs
El Paso County, Colorado

Ref: Entech Engineering, Inc. January 30, 2012. *Soil, Geology, Geologic Hazard and Wastewater Study, The Reserve at Corral Bluffs, El Paso County, Colorado Springs, Colorado.* Entech Job No. 83691

Dear Mr. Jones:

As requested, personnel of Entech Engineering, Inc. have completed additional soils/percolation testing on the above referenced site. Nine percolation tests were performed on the site as a part of the above referenced Soil, Geology, Geologic Hazard and Wastewater Study by Entech Engineering, Inc. As a result of the county review an additional three test borings and three percolation tests with profile holes were performed on the lots on the southern portion of the site to evaluate the soils suitability for on site wastewater treatment systems (OWS). The locations of the new test borings and percolation tests are indicated on Figure 1. The test borings and profile hole logs are included in Appendix A. The additional Laboratory Test Results are included in Appendix B and are summarized on Table 1. The individual Percolation Test Results are included in Appendix C and are summarized in Table 2.

The individual percolation test results on Lots 23, 27, and 29 ranged from 15 to 25 minutes per inch (PH 11, 12, and 15). The percolation rates for the additional testing are suitable for conventional sewage treatment systems.

Standard Penetration testing, ASTM D-1586, was performed in each profile hole and test borings to evaluate the density of the soil and presence of bedrock. Bedrock was not encountered in any of the test borings or profile borings (test borings were drilled on Lots 24, 26 and 28). Soils consisted of silty sands encountered at medium dense to dense states. Groundwater was not encountered in any of the borings which were drilled to 10 feet.

In summary, the additional investigation indicates the lots along the southern portion of the site are suitable for individual on site wastewater treatment systems (ows) and will likely be able to utilize conventional systems. El Paso County guidelines require designed systems for percolation rates exceeding 60 minutes per inch. Where bedrock or groundwater is encountered at less than 6 feet, designed systems will be required.

Corral Ranch Development Company
Additional Test Borings/Percolation Testing
Lots 23-29
The Reserve at Corral Bluffs
El Paso County, Colorado
Page Two

We trust this has provided you with the information you required. If you have any questions or need additional information, please do not hesitate to contact us.

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Reviewed by:

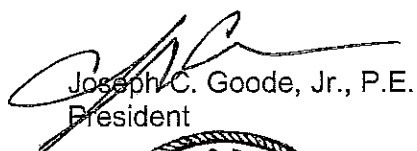


Kristen A. Andrew-Hoeser, P.G.
Engineering Geologist

KAH/mw

Encl.

Entech Job No. 83691
2MSW/et/2011/83691atb-pt



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



TABLES

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

CLIENT CORRAL RANCH DEVELOPMENT
 PROJECT RESERVE AT CORRAL BLUFFS
 JOB NO. 83691

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	11	5			40.0						SM	SAND, VERY SILTY
1	12	5			30.5						SM	SAND, SILTY
1	15	5			38.3						SM	SAND, VERY SILTY

Table 2: Summary of Test Boring/Percolation Test Results

Test Boring No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
10	N/A	>10	>10
11	25	>10	>10
12	16	>10	>10
13	N/A	>10	>10
14	N/A	>10	>10
15	15	>10	>10

FIGURES

APPENDIX A: Profile Hole Logs

TEST BORING NO. 10
 DATE DRILLED 8/13/2012
 Job # 83691

PROFILE HOLE NO. 11
 DATE DRILLED 8/13/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 28 DRY TO 10', 8/14/12 SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST	5			15	10.3	1	LOT 29 DRY TO 10', 8/14/12 SAND, VERY SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST	5			10	9.9	1
	10			28	4.3	1		10			18	8.2	1
	15							15					
	20							20					



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING / PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *h*

DATE: 8/30/12

JOB NO.:
 83691
 FIG NO.:

A-1

PROFILE HOLE NO. 12
 DATE DRILLED 8/13/2012
 Job # 83691

TEST BORING NO. 13
 DATE DRILLED 8/13/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 27							LOT 26						
DRY TO 10', 8/14/12							DRY TO 10', 8/14/12						
SAND, SILTY, FINE TO MEDIUM GRAINED, TAN, DENSE TO MEDIUM DENSE, MOIST	5			30	7.7	1	SAND, SILTY, FINE GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST	5			10	7.4	1
	10			23	10.2	1		10			16	9.2	1
	15							15					
	20							20					



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING / PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *L*

DATE:

8/30/12

JOB NO.:

83691

FIG NO.:

A-2

TEST BORING NO. 14
 DATE DRILLED 8/13/2012
 Job # 83691

PROFILE HOLE NO. 15
 DATE DRILLED 8/13/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
LOT 24							LOT 23						
DRY TO 10', 8/14/12							DRY TO 10', 8/14/12						
SAND, SILTY, FINE GRAINED, TAN, MEDIUM DENSE, MOIST							SAND, VERY SILTY, FINE TO MEDIUM GRAINED, BROWN TO TAN, MEDIUM DENSE, MOIST						
	5			21	9.7	1		5			17	6.2	1
	10			29	6.8	1		10			20	4.6	1
	15							15					
	20							20					



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ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

TEST BORING / PROFILE HOLE LOG

DRAWN:

DATE:

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DATE:

[Signature] 8/30/12

JOB NO.:

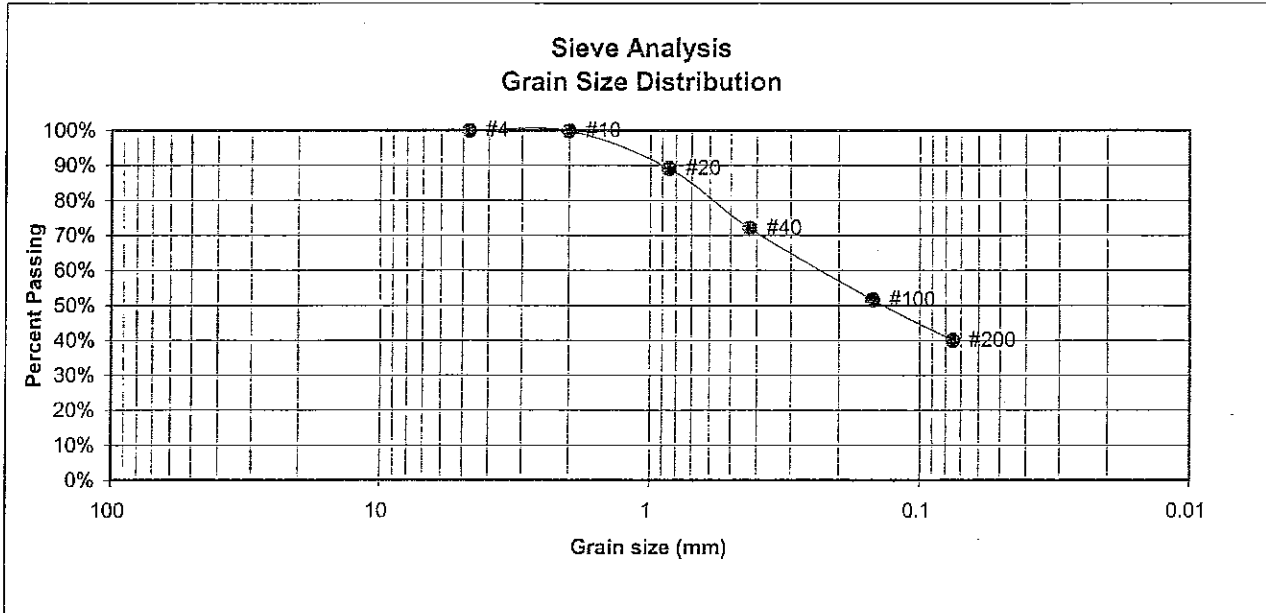
83691

FIG NO.:

A-3

APPENDIX B: Laboratory Test Results

<u>UNIFIED CLASSIFICATION</u>	SM	<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	11	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	99.9%	Moisture at start
20	89.1%	Moisture at finish
40	72.0%	Moisture increase
100	51.6%	Initial dry density (pcf)
200	40.0%	Swell (psf)



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505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u> <i>hw</i>	<u>DATE:</u> 8/21/12
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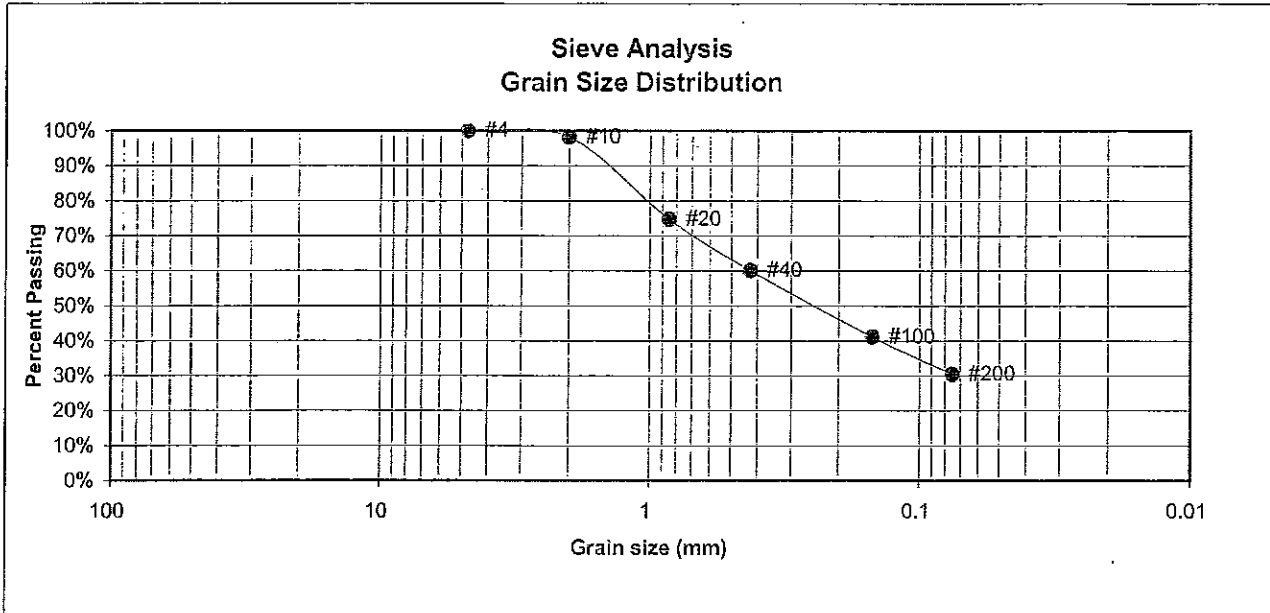
JOB NO.:

83691

FIG NO.:

B-1

<u>UNIFIED CLASSIFICATION</u> SM		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	12	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	98.3%
20	74.8%
40	60.1%
100	41.2%
200	30.5%

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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ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
 RESULTS**

DRAWN:

DATE:

CHECKED:

DATE:

be *8/2/12*

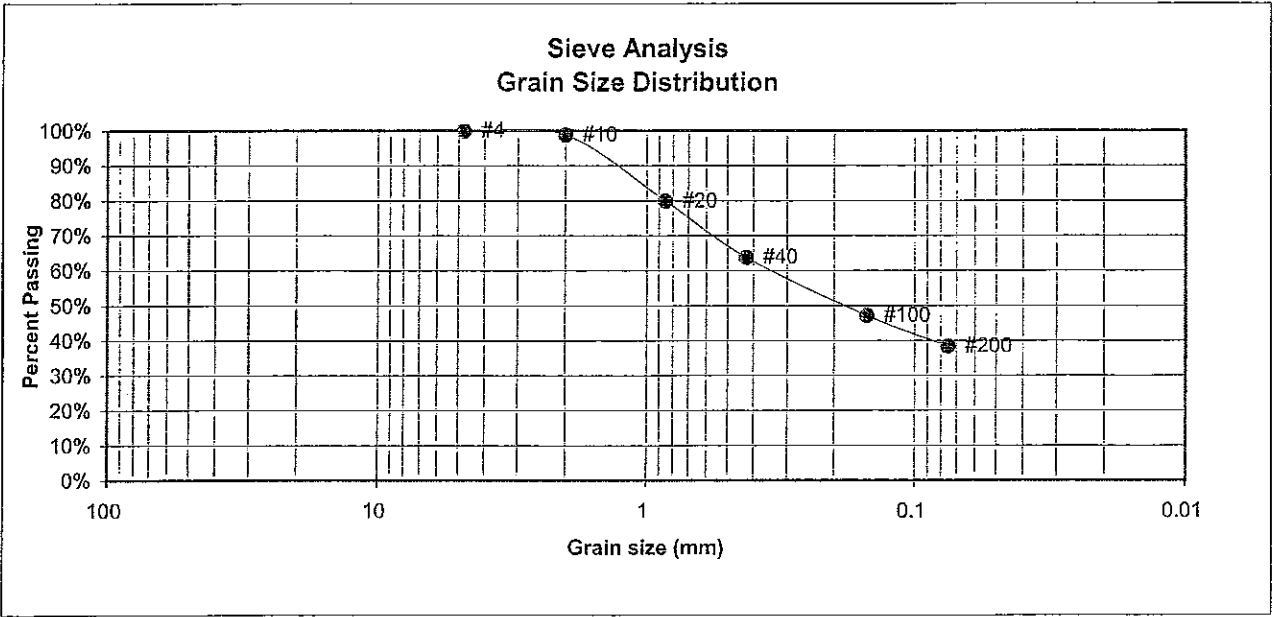
JOB NO.:

83691

FIG NO.:

B-2

<u>UNIFIED CLASSIFICATION</u> SM		<u>CLIENT</u>	CORRAL RANCH DEV.
<u>SOIL TYPE #</u>	1	<u>PROJECT</u>	RESERVE AT CORRAL BLUFFS
<u>TEST BORING #</u>	15	<u>JOB NO.</u>	83691
<u>DEPTH (FT)</u>	5	<u>TEST BY</u>	BL



<u>U.S. Sieve #</u>	<u>Percent Finer</u>	<u>Atterberg Limits</u>
3"		Plastic Limit
1 1/2"		Liquid Limit
3/4"		Plastic Index
1/2"		
3/8"		
4	100.0%	<u>Swell</u>
10	98.8%	Moisture at start
20	79.9%	Moisture at finish
40	63.7%	Moisture increase
100	47.2%	Initial dry density (pcf)
200	38.3%	Swell (psf)



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
COLORADO SPRINGS, COLORADO 80907

**LABORATORY TEST
RESULTS**

<u>DRAWN:</u>	<u>DATE:</u>	<u>CHECKED:</u>	<u>DATE:</u>
		<i>u</i>	9/21/12

JOB NO.:

83691

FIG NO.:

B-3

APPENDIX C: Percolation Test Results

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 11

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 31"

Depth: 38"

Depth: 38"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	0	1	10	3/4	1	10	1/2
2	10	1/2	2	10	1/2	2	10	1/2
3	10	1/4	3	10	1/2	3	10	3/4

Perc Rate (min./in.): 40

Perc Rate (min./in.): 20

Perc Rate (min./in.): 13

Average Perc Rate (min./in.) 25

PROFILE HOLE

Date Profile Hole Completed: 8/13/2012

Depth	Visual Classification	Remarks
0-10'	Sand, clayey, fine grained, tan	No Bedrock No Groundwater

10 Blows / ft. @ 4'

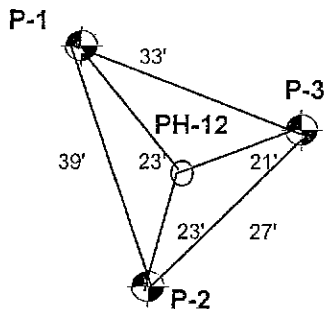
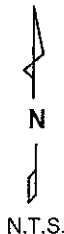
18 Blows / ft. @ 9'

Required Area of Absorption Field: 1.00 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 225 Sq. Ft./bedroom
 Required Area of Absorption Field: 360 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

Observer: Hansel Bjork

By:



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505 ELKTON DRIVE
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PERCOLATION TEST RESULTS

DRAWN: _____ DATE: _____ CHECKED: *[Signature]* DATE: *8/21/12*

JOB NO.:

83691

FIG NO.:

C-1

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 12

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 42"

Depth: 39"

Depth: 39"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1 1/2	1	10	2 1/8	1	10	1
2	10	2	2	10	2 7/8	2	10	1/2
3	10	1/2	3	10	1 7/8	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 5

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 16

PROFILE HOLE

Date Profile Hole Completed: 8/13/2012

Depth	Visual Classification	Remarks
0-10'	Sand, silty, fine to medium grained, tan	No Bedrock No Groundwater

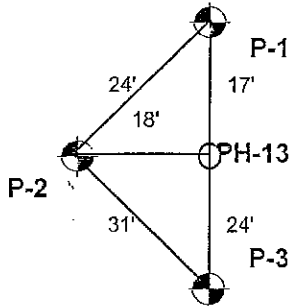
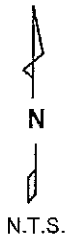
30 Blows / ft. @ 4'

23 Blows / ft. @ 9'

Required Area of Absorption Field: 0.80 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 180 Sq. Ft./bedroom
 Required Area of Absorption Field: 288 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

Observer: Hansel Bjork

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: DATE:

JOB NO.:

83691

FIG NO.:

C-2

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 15

Date Holes Prepared: 8/13/2012

Date Hole Completed: 8/14/2012

Hole No. 1
 Depth: 34"

Hole No. 2
 Depth: 37"

Hole No. 3
 Depth: 31"

Hole No. 1			Hole No. 2			Hole No. 3		
Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)	Trial	Time (min.)	Water Level Change (in.)
1	10	1	1	10	3/4	1	10	7/8
2	10	1/2	2	10	3 1/2	2	10	1/8
3	10	1/2	3	10	2 1/4	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 4

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 15

PROFILE HOLE

Date Profile Hole Completed: 8/13/2012

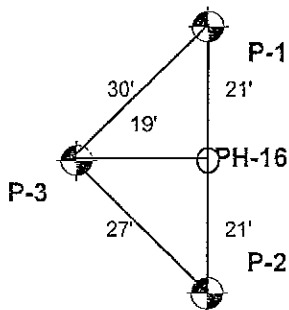
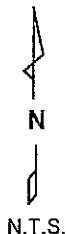
Depth	Visual Classification	Remarks
0-10'	Sand, clayey to silty, fine to medium grained, brown	No Bedrock No Groundwater

17 Blows / ft. @ 4'
 20 Blows / ft. @ 9'

Required Area of Absorption Field: 0.77 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 174 Sq. Ft./bedroom
 Required Area of Absorption Field: 279 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

Observer: Hansel Bjork

By:



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PERCOLATION TEST RESULTS

DRAWN: _____ DATE: _____ CHECKED: *[Signature]* DATE: *8/14/12*

JOB NO.:

83691

FIG NO.:

C-3

APPENDIX 2:
Original Percolation Testing by Entech Engineering, Inc.
January 30, 2012

7.0 ON-SITE DISPOSAL OF WASTEWATER

The site was evaluated for individual sewage treatment systems in accordance with El Paso Land Development Code. Nine (9) percolation tests were performed on the property. Percolation tests may not be located in the exact areas of proposed systems. The approximate locations of the percolation tests are indicated on Figure 4, the Geology Map, Figure 8 and the Septic Suitability Map Figure 10. Table 2 shows the results of the percolation tests. The specific test results are presented in Appendix E.

The Natural Resource Conservation Service (Reference 2), previously the Soil Conservation Service (Reference 3) has been mapped with 4 soil descriptions. The Soil Survey Map (Reference 2) is presented in Figure 5, and the Soil Survey Descriptions are presented in Appendix D. Soil Type 4 (Badland) is mapped in the southern portion of the site where steep slopes exist. No development is proposed in this area and it has been designated as a non-build zone. The majority of the soils are described as having rapid to moderate percolation rates.

The individual percolation test results ranged from 14 minutes per inch to 134 minutes per inch. Most of the percolation rates are suitable for conventional individual sewage treatment systems. Three of the percolation rates are slower than 60 minutes per inch which will require designed systems.

Standard penetration testing, ASTM D-1586, was performed in each profile hole to evaluate the density of the soil and the presence of bedrock. Bedrock was encountered in Profile Hole Nos. 4 through 7 at 7 to 13 feet. Bedrock was not encountered of the other profile holes which were drilled to 10 to 15 feet. Designed systems are generally required in areas of shallow bedrock (less than 6 feet).

Leach fields must be maintained a minimum of 4 feet above groundwater. Groundwater was not encountered in any of the profile holes, which were drilled to depths of 10 to 15 feet. Should groundwater be encountered within 6 feet of the surface, shallow leaching fields would be recommended. In areas where groundwater is less than 4 feet, designed systems will be required.

The percolation rates in six of the locations are suitable for conventional systems. Three tests had rates of slower than 60 minutes per inch. Additional drilling may reveal other areas where more suitable rates can be found. El Paso County guidelines require designed systems for percolation rates exceeding 60 minutes per inch. Bedrock was not encountered in any of the profile holes at a depth that would affect conventional systems, however, some areas may contain shallow bedrock. Where bedrock is encountered less than 6 feet, designed systems may be required. A Septic Suitability Map is presented in Figure 10. A possible house location, two potential on site wastewater treatment system (OWS) locations and a possible well site for each lot are indicated on Figure 10. Due to the size of the building lots, it is anticipated that suitable areas will be available where conventional systems may be utilized on most lots. In areas where suitable percolation rates cannot be found, shallow groundwater exists or shallow bedrock exists, designed systems will be required.

In summary, it is our opinion the site is suitable for individual onsite wastewater treatment systems (OWS) and that contamination of surface and subsurface water resources should not occur provided the OWS sites are evaluated, installed according to El Paso County and State Guidelines and properly maintained. Individual percolation testing is required on each lot prior to construction. Septic systems must be located a minimum of 100 feet from any well, including those on adjacent properties. Septic systems must also be located a minimum of 50 feet from any water courses, floodplains or ponded areas and 25 feet from dry gulches.

TABLES

TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

CLIENT CORRAL RANCH DEVELOPMENT
 PROJECT RESERVE AT CORRAL BLUFFS
 JOB NO. 83691

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	1	2-3	6.3	106.5	45.3					-0.6	SM	SAND, VERY SILTY
1	5	2-3			26.9						SM	SAND, SILTY
1	6	2-3			41.7						SM	SAND, VERY SILTY
1	7	2-3			45.5						SM	SAND, VERY SILTY
1	8	2-3			49.0						SM	SAND, VERY SILTY
1	9	2-3			28.0						SM	SAND, SILTY
2	1	10			57.0	18	7				CL-ML	CLAY-SILT, VERY SANDY
2	4	2-3	16.7	109.3	73.2	21	8			-0.2	CL	CLAY, SANDY
2	4	5	11.0	109.5	74.3	20	6			3.3	CL-ML	CLAY-SILT, SANDY
3	2	2-3			52.7						ML	SILT, VERY SANDY
3	2	10						850			ML	SILT, VERY SANDY
3	3	2-3			64.4						ML	SILT, SANDY
4	4	15			39.6	17	6				SC-SM	SANDSTONE, VERY CLAYEY, SILTY
4	6	10			43.8	28	16		1330		SC	SANDSTONE, VERY CLAYEY

Table 2: Summary of Percolation Test Results

Test Boring No.	Percolation Rate (min/in)	Depth to Bedrock (ft.)	Depth to Groundwater (ft.)
1	80	>15	>15
2	14	>15	>15
3	20	>15	>15
4	134	13	>15
5	45	7	>10
6	18	7	>10
7	44	10	>15
8	12	>10	>10
9	67	>10	>10

FIGURES

APPENDIX B: Test Boring Logs from Profile Holes

PROFILE HOLE NO 1
 DATE DRILLED 12/28/2011
 Job # 83691

PROFILE HOLE NO 2
 DATE DRILLED 12/28/2011
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 14', 12/29/11

SAND, VERY SILTY, FINE
 GRAINED, BROWN TO TAN,
 MEDIUM DENSE, MOIST

CLAY-SILT, VERY SANDY,
 TAN, VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	6.1	1
5			12	8.2	1
10			35	9.0	2
15			35		2
20					

DRY TO 15', 12/29/11

SILT, VERY SANDY, TAN TO
 BROWN, STIFF TO VERY STIFF,
 MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			21	10.1	3
5			19	12.0	3
10			21	11.9	3
15			32	20.7	3
20					



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *rk*

DATE: 1/17/12

JOB NO.:

83691

FIG NO.:

B-1

PROFILE HOLE NO 3
 DATE DRILLED 12/28/2011
 Job # 83691

PROFILE HOLE NO 4
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 15', 12/29/11
 SILT, SANDY, TAN TO BROWN,
 STIFF TO VERY STIFF, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			17	13.9	3
5			27	12.6	3
10			21	13.7	3
15			41	7.9	3

DRY TO 14', 1/5/12
 CLAY, SANDY, DARK BROWN,
 STIFF, MOIST

CLAY-SILT, SANDY, TAN,
 VERY STIFF TO STIFF, MOIST

SANDSTONE, VERY CLAYEY,
 VERY SILTY, FINE GRAINED,
 TAN, VERY DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			19	16.4	2
5			30	10.9	2
10			24	5.8	2
15			50	6.0	4
			10"		



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED:

DATE:

h 1/17/12

JOB NO.:

83691

FIG NO.:

B-2

PROFILE HOLE NO 5
 DATE DRILLED 1/4/2012
 Job # 83691

PROFILE HOLE NO 6
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 7', 1/5/12						
SAND, SILTY, FINE TO MEDIUM GRAINED, TAN TO BROWN, MEDIUM DENSE, MOIST	5			28	7.4	1
				24	8.9	1
SANDSTONE, SILTY, FINE TO MEDIUM GRAINED, TAN, VERY DENSE, MOIST	10			50 9"	6.1	4

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 9', 1/5/12						
SAND, VERY SILTY, FINE GRAINED, DENSE, TAN, MOIST	5			32	10.4	1
				40	6.9	1
SANDSTONE, VERY CLAYEY, FINE GRAINED, TAN, VERY DENSE, MOIST	10			50 11"	7.6	4



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED:

DATE:

JOB NO.:

83691

FIG NO.:

B-3

PROFILE HOLE NO 7
 DATE DRILLED 1/4/2012
 Job # 83691

PROFILE HOLE NO 8
 DATE DRILLED 1/4/2012
 CLIENT CORRAL RANCH DEVELOPMENT
 LOCATION RESERVE AT CORRAL BLUFFS

REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	REMARKS	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
DRY TO 14', 1/5/12							DRY TO 10', 1/5/12						
SAND, VERY SILTY, FINE GRAINED, TAN, MEDIUM DENSE TO DENSE, MOIST	5			21	10.8	1	SAND, VERY SILTY, FINE GRAINED, TAN, DENSE, MOIST	5			30	7.5	1
				40	8.0	1	SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, DENSE, MOIST	5			47	6.7	1
SAND, SILTY, FINE TO MEDIUM GRAINED, BROWN, DENSE, MOIST	10			38	4.5	1		10			40	5.0	1
SANDSTONE, SILTY, FINE TO MEDIUM GRAINED, TAN, VERY DENSE, MOIST	15			50	8.1	4		15					
				11"				20					



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED:

DATE:

[Signature] 1/12/12

JOB NO.:

83691

FIG NO.:

B-4

POFILE HOLE NO. 9
 DATE DRILLED 1/4/2012
 Job # 83691

POFILE HOLE NO.
 DATE DRILLED
 CLIENT
 LOCATION CORRAL RANCH DEVELOPMENT
 RESERVE AT CORRAL BLUFFS

REMARKS

REMARKS

DRY TO 10', 1/5/12
 SAND, SILTY, FINE TO MEDIUM
 GRAINED, TAN, MEDIUM DENSE
 TO DENSE, MOIST

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
5			26	8.6	1	5					
			33	7.4	1						
10			45	6.4	1	10					
15						15					
20						20					



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PROFILE HOLE LOG

DRAWN:

DATE:

CHECKED: *an*

DATE: 1/17/12

JOB NO.:

83691

FIG NO.:

B-5

APPENDIX E: Percolation Test Results

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 1

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 32"

Depth: 23"

Depth: 30"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/4		1	10	1/4		1	10	1/16	
2	10	1/4		2	10	1/4		2	10	1/16	
3	10	1/4		3	10	1/4		3	10	1/16	

Perc Rate (min./in.): 40

Perc Rate (min./in.): 40

Perc Rate (min./in.): 160

Average Perc Rate (min./in.) 80

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

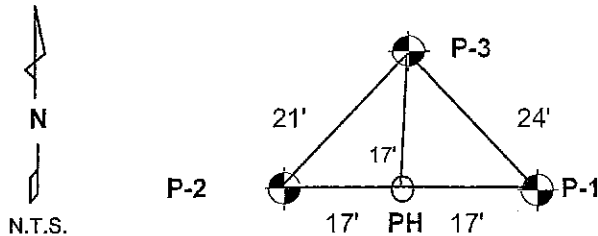
Depth	Visual Classification	Remarks
0-9'	Sand, very silty, fine grained, brown to tan	
9-15'	Clay-silt, very sandy, tan	No Bedrock No Groundwater

21 Blows / ft. @ 2'
 12 Blows / ft. @ 4'
 35 Blows / ft. @ 9'
 35 Blows / ft. @ 14'

Required Area of Absorption Field: 1.79 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 402 Sq. Ft./bedroom
 Required Area of Absorption Field: 644 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 34.0" N, 104° 35' 24.1" W

Observer: Joey Goode By:



N.T.S.



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PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.:

83691

FIG NO.:

E-1

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 2

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 31"

Depth: 31"

Depth: 30"

Trial	Time (min.)	Water	Trial	Time (min.)	Water	Trial	Time (min.)	Water
		Level Change (in.)			Level Change (in.)			Level Change (in.)
1	10	1/2	1	10	9	1	10	1
2	10	1/2	2	10	7	2	10	1
3	10	1/2	3	10	6	3	10	1/2

Perc Rate (min./in.): 20

Perc Rate (min./in.): 2

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 14

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

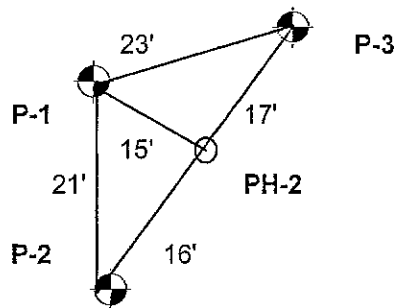
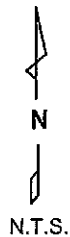
Depth	Visual Classification	Remarks
0-15'	Silt, very sandy, tan to brown	No Bedrock No Groundwater
21 Blows / ft. @ 2'		
19 Blows / ft. @ 4'		
21 Blows / ft. @ 9'		
32 Blows / ft. @ 14'		

Required Area of Absorption Field: 0.75 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 168 Sq. Ft./bedroom
 Required Area of Absorption Field: 269 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 32.4" N, 104° 35' 38.0" W

Observer: Joey Goode

By:



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PERCOLATION TEST RESULTS

DRAWN: _____ DATE: _____ CHECKED: m DATE: 1/19/12

JOB NO.:

83691

FIG NO.:

E-2

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 3

Date Holes Prepared: 12/28/2011

Date Hole Completed: 12/29/2011

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 29"

Depth: 27"

Depth: 28"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1		1	10	1		1	10	1	
2	10	3/4		2	10	1/2		2	10	1/2	
3	10	1/2		3	10	1/2		3	10	1/2	

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Perc Rate (min./in.): 20

Average Perc Rate (min./in.) 20

PROFILE HOLE

Date Profile Hole Completed: 12/28/2011

Depth	Visual Classification	Remarks
0-15'	Silt, sandy, tan to brown	No Bedrock No Groundwater

- 17 Blows / ft. @ 2'
- 27 Blows / ft. @ 4'
- 21 Blows / ft. @ 9'
- 41 Blows / ft. @ 14'

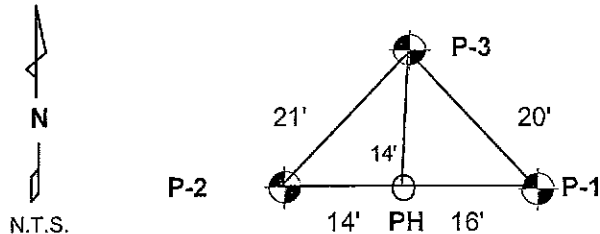
Required Area of Absorption Field: 0.89 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 201 Sq. Ft./bedroom
 Required Area of Absorption Field: 322 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 33.4" N, 104° 35' 47.9" W

Observer: Joey Goode

By:



N.T.S.



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: DATE:

[Signature] 1/19/12

JOB NO.:

83691

FIG NO.:

E-3

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 4

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 39"

Depth: 27"

Depth: 29"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10		1/16	1	10		1/16	1	10		1/8
2	10		1/16	2	10		1/16	2	10		1/8
3	10		1/16	3	10		1/16	3	10		1/8

Perc Rate (min./in.): 160

Perc Rate (min./in.): 160

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 134

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-9'	Clay, sandy, dark brown	
9-13'	Clay-silt, sandy, tan	Sandstone Bedrock at 13'
13-15'	Sandstone, very clayey, very silty, fine grained, tan	No Groundwater
	19 Blows / ft. @ 2'	
	30 Blows / ft. @ 4'	
	24 Blows / ft. @ 9'	
	50 Blows / 10" @ 14'	

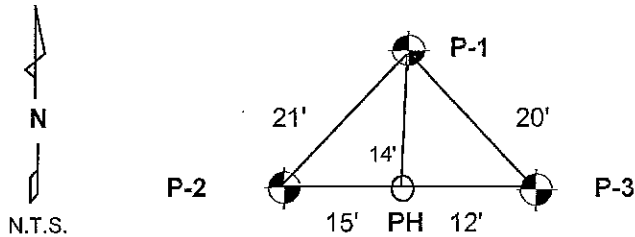
Required Area of Absorption Field: 2.32 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 521 Sq. Ft./bedroom
 Required Area of Absorption Field: 833 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 25.9" N, 104° 35' 50.5" W

Observer: Blake Leonard

By:



N.T.S.



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505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: *W* CHECKED: DATE: 1/19/12

JOB NO.:

83691

FIG NO.:

E-4

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 5

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 36"

Depth: 33"

Depth: 35"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/8		1	10	1/2		1	10	7/8	
2	10	1/8		2	10	1/2		2	10	3/4	
3	10	1/8		3	10	3/8		3	10	1/2	

Perc Rate (min./in.): 80

Perc Rate (min./in.): 27

Perc Rate (min./in.): 27

Average Perc Rate (min./in.) 45

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-7'	Sand, silty, fine to medium grained, tan to brown	
7-10'	Sandstone, silty, fine to medium grained, tan	Sandstone Bedrock at 7' No Groundwater

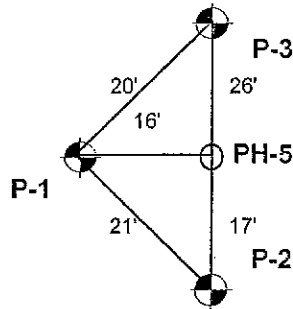
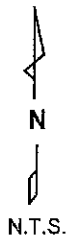
28 Blows / ft. @ 2'
 24 Blows / ft. @ 4'
 50 Blows / 9" @ 9'

Required Area of Absorption Field: 1.34 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 302 Sq. Ft./bedroom
 Required Area of Absorption Field: 483 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 17.8" N, 104° 35' 53.6" W

Observer: Blake Leonard

By:



ENTECH
ENGINEERING, INC.

505 ELKTON DRIVE
 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.:

83691

FIG NO.:

E-5

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 6

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 29"

Depth: 34"

Depth: 33"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/2		1	10	3/4		1	10	2 3/8	
2	10	3/8		2	10	5/8		2	10	2 3/8	
3	10	3/8		3	10	1/2		3	10	1 5/8	

Perc Rate (min./in.): 27

Perc Rate (min./in.): 20

Perc Rate (min./in.): 6

Average Perc Rate (min./in.) 18

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-7'	Sand, silty, fine grained, tan	
7-10'	Sandstone, very clayey, fine grained, tan	Sandstone Bedrock at 7' No Groundwater

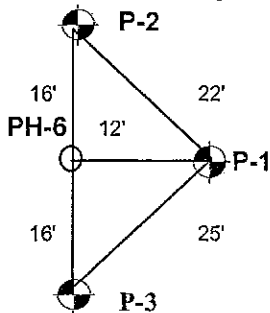
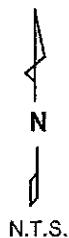
32 Blows / ft. @ 2'
 40 Blows / ft. @ 4'
 50 Blows / ft. @ 9'

Required Area of Absorption Field: 0.85 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 191 Sq. Ft./bedroom
 Required Area of Absorption Field: 305 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 16.5" N, 104° 35' 42.5" W

Observer: Blake Leonard

By:



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PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: DATE: 1/19/12

JOB NO.:

83691

FIG NO.:

E-6

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 7

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 31"

Depth: 32"

Depth: 31"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	2		1	10	5/8		1	10	1/4	
2	10	1 1/8		2	10	3/8		2	10	1/4	
3	10	1		3	10	1/4		3	10	1/8	

Perc Rate (min./in.): 10

Perc Rate (min./in.): 40

Perc Rate (min./in.): 80

Average Perc Rate (min./in.) 44

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-7'	Sand, very silty, fine grained, tan	
7-10'	Sand, silty, fine to medium grained, brown	Sandstone Bedrock at 10'
10-15'	Sandstone, silty, fine to medium grained, tan	No Groundwater
	21 Blows / ft. @ 2'	
	40 Blows / ft. @ 4'	
	38 Blows / ft. @ 9'	
	50 Blows / 11" @ 14'	

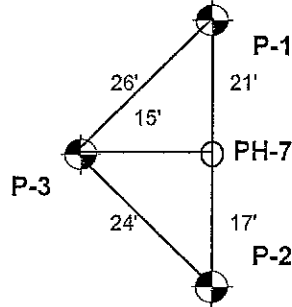
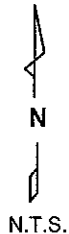
Required Area of Absorption Field: 1.33 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 298 Sq. Ft./bedroom
 Required Area of Absorption Field: 478 Sq. Ft./bedroom with garbage disposal and washing machine

Remarks:

GPS Coordinates: 38° 52' 16.2" N, 104° 35' 31.2" W

Observer: Blake Leonard

By:



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PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: DATE: 1/19/12

JOB NO.:

83691

FIG NO.:

E-7

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 8

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 35"

Depth: 37"

Depth: 32"

Trial	Time (min.)	Water	Trial	Time (min.)	Water	Trial	Time (min.)	Water
		Level			Level			Level
		Change (in.)			Change (in.)			Change (in.)
1	10	4	1	10	5/8	1	10	2 1/2
2	10	2 1/4	2	10	5/8	2	10	2 3/8
3	10	1 1/8	3	10	5/8	3	10	1

Perc Rate (min./in.): 9

Perc Rate (min./in.): 16

Perc Rate (min./in.): 10

Average Perc Rate (min./in.) 12

PROFILE HOLE

Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-3'	Sand, very silty, fine grained, tan	
3-10'	Sand, silty, fine to medium grained, brown	No Bedrock No Groundwater

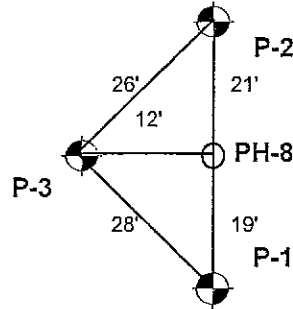
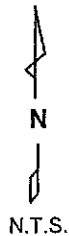
30 Blows / ft. @ 2'
 47 Blows / ft. @ 4'
 40 Blows / ft. @ 9'

Required Area of Absorption Field: 0.69 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 156 Sq. Ft./bedroom
 Required Area of Absorption Field: 249 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 23.4" N, 104° 35' 34.0" W

Observer: Blake Leonard

By:



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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.:

83691

FIG NO.:

E-8

Client: Corral Ranch Development
 Test Location: The Reserve at Corral Bluffs

Job Number: 83691

PERCOLATION HOLES-TEST NO. 9

Date Holes Prepared: 1/4/2012

Date Hole Completed: 1/5/2012

Hole No. 1

Hole No. 2

Hole No. 3

Depth: 28"

Depth: 29"

Depth: 32"

Trial	Time (min.)	Water		Trial	Time (min.)	Water		Trial	Time (min.)	Water	
		Level	Change (in.)			Level	Change (in.)			Level	Change (in.)
1	10	1/2		1	10	3/8		1	10	1	
2	10	1/8		2	10	1/4		2	10	7/8	
3	10	1/8		3	10	1/8		3	10	1/4	

Perc Rate (min./in.): 80

Perc Rate (min./in.): 80

Perc Rate (min./in.): 40

Average Perc Rate (min./in.) 67

PROFILE HOLE

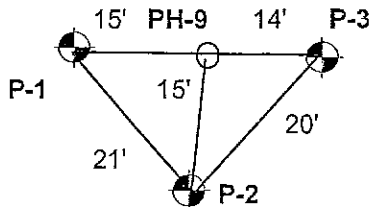
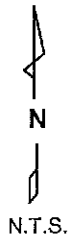
Date Profile Hole Completed: 1/4/2012

Depth	Visual Classification	Remarks
0-10'	Sand, silty, fine to medium grained, tan	No Bedrock No Groundwater
26 Blows / ft. @ 2'		
33 Blows / ft. @ 4'		
45 Blows / ft. @ 9'		

Required Area of Absorption Field: 1.64 Sq. Ft./gpd sewage volume
 Required Area of Absorption Field: 368 Sq. Ft./bedroom
 Required Area of Absorption Field: 589 Sq. Ft./bedroom with garbage disposal and washing machine
 Remarks:

GPS Coordinates: 38° 52' 25.0" N, 104° 35' 23.5" W

Observer: Blake Leonard By:



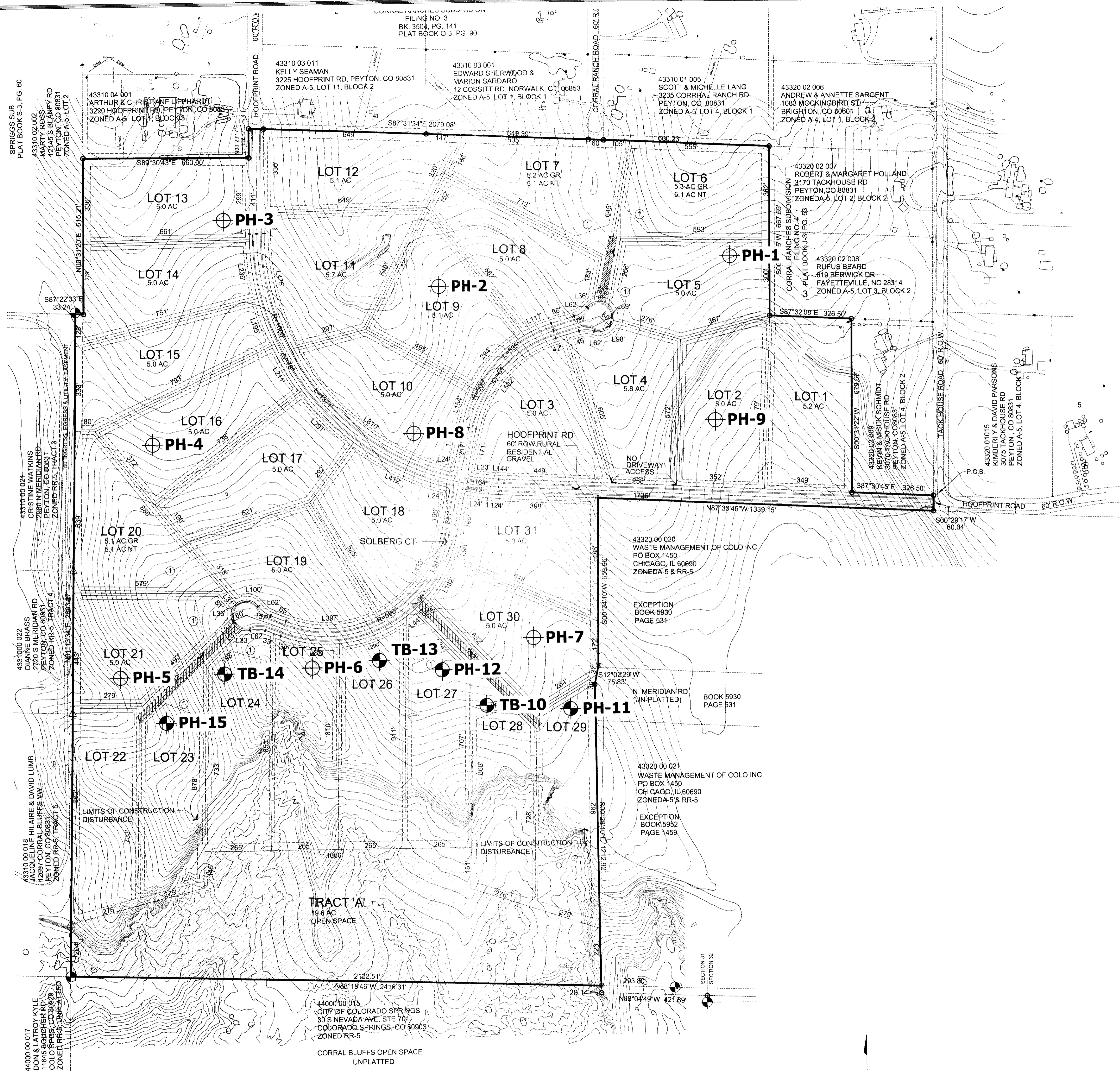
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 COLORADO SPRINGS, COLORADO 80907

PERCOLATION TEST RESULTS

DRAWN: DATE: CHECKED: 1/19/12 DATE:

JOB NO.: 83691
 FIG NO.: E-9



REVISIONS BY:

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

DEVELOPMENT PLAN / PERCOLATION
TEST LOCATION MAP
THE RESERVE AT CORRAL BLUFFS
EL PASO COUNTY, CO
FOR: CORRAL RANCH DEVELOPMENT

DRAWN BY: MAL
DESIGNED BY: KAH
CHECKED BY:
DATE: 01/17/12
SCALE: 1:200
JOB NO.: 83691
FIGURE NO.:
1

- APPROXIMATE LOCATION AND DIRECTION OF PHOTOS
- APPROXIMATE LOCATION AND NUMBER OF PERCOLATION TEST FROM ORIGINAL REPORT
- APPROXIMATE LOCATION AND NUMBER OF ADDITIONAL PERCOLATION TEST
- APPROXIMATE LOCATION AND NUMBER OF ADDITIONAL TEST BORING

