Ground
Engineering
Consultants, Inc.

21555 2nd Ave

September 10, 1991

Subject: Soil and Foundation Investigation, Proposed Grant Residence, Lots 14-17, Block 10, Town of Milner, Colorado.

Job Number 91-542

Lynn Grant
P.O. Box 770849
Steamboat Springs, CO 80477

Ladies and Gentlemen:

This report presents the results of a soil and foundation investigation for the proposed Grant Residence to be constructed within Lots 14-17, Block 10, located at the corner of 2nd Avenue and Pine Street in Milner, Colorado. The project site is shown on Figure 1.

A field exploration program was conducted on September 4, 1991 to obtain information on subsurface conditions. Material samples obtained during the subsurface investigation were tested in the laboratory to provide data on the classification and engineering characteristics of the on-site soils. The results of the field and laboratory investigations are presented herein.

This report has been prepared to summarize the data obtained and to present our conclusions and recommendations based on the proposed construction and the subsurface conditions encountered. Design parameters and a discussion of geotechnical engineering considerations related to construction of the proposed residence are included.

Proposed Construction: We understand that the construction will consist of a modular, single story wood frame structure with no basement. The lower level will be constructed with a structural wood floor system. The floor of the residence is to be constructed near the existing ground surface.

For design purposes, we have assumed that building loads will be light, typical of residential construction. If loadings or conditions are significantly different from those described above, we should be notified to reevaluate the recommendations outlined in this report.

Site Conditions: At the time of our field investigation, the lot was vacant and was vegetated with natural grass and weeds. The lots situated to the west of the proposed residence along McKinley Lane were occupied by existing residences.

The topography of the site is relatively flat with a slight slope down to the south on the order of 1 to 3 percent. A maximum elevation difference of approximately 1 foot exists across the building site.

Subsoil Conditions: To investigate the subsoil conditions at the site, one test pit was excavated at the approximate location shown on Figure 1. The subsoils encountered consisted of a layer of topsoil overlying natural silty clays to the maximum depth explored, 8.5 feet. A graphic log of the test pit is presented in Figure 2.

The depth of topsoil varied from approximately 12 to 18 inches in the test pit. The natural clays encountered beneath the topsoil were slightly sandy and silty, low plastic, medium stiff, slightly moist to moist and brown in color.

A swell-consolidation test conducted on a sample of the clay indicates that the material tested will exhibit a negligible swell potential when wetted and loaded. The laboratory test results are presented on Figure 3 and are summarized in Table 1.

Free groundwater was not encountered in the test pit at the time of this investigation.

Foundation Recommendations: Considering the subsurface conditions encountered in the test pit and the nature of the proposed construction, we recommend the structure to be constructed on the site be founded on spread footings placed on undisturbed natural clays.

The design and construction criteria presented below should be observed for a spread footing foundation system. The construction details should be considered when preparing project documents.

(1) Footings placed on undisturbed natural clays may be designed for an allowable soil bearing pressure of 1,250 psf.

(2) Exterior footings should be provided with adequate soil cover above their bearing elevation for frost protection.

(3) Continuous foundation walls should be reinforced top and bottom to span an unsupported length of at least 10 feet.

(4) Based on experience, we estimate settlement for footings designed and constructed as discussed in this section will be approximately 1 inch. Bearing Capacity values related with associated settlements are given in Figure 4.

(5) Areas of loose or soft material or existing fill encountered within the foundation excavation should be removed and footings extended to adequate natural bearing material.

(6) Care should be taken when excavating the foundations to avoid disturbing the supporting materials. Hand excavation or careful backhoe soil removal, may be required in excavating the last few inches.

(7) A representative of the soil engineer should observe all footing excavations prior to concrete placement.

Foundation Walls: Foundation walls which are laterally supported and can be expected to undergo only a moderate amount of deflection may be designed for a lateral earth pressure computed on the basis of an equivalent fluid unit weight of 45 pcf for granular backfill.

All foundation walls should be designed for appropriate surcharge pressures such as adjacent buildings, traffic and construction materials. An upward sloping backfill surface also increases the earth pressures on foundation walls.

We recommend imported granular soils for backfilling foundation walls because their use results in lower lateral earth pressures. Imported granular foundation backfill should contain less than 15 percent passing the No. 200 sieve. Granular material should be placed to within 2 feet of the ground surface and to a minimum of 3 feet beyond the walls. The upper 2 feet of the wall backfill should be a relatively impervious on-site soil or a pavement structure to prevent surface water infiltration into the backfill.

Backfill should be carefully placed in uniform lifts and compacted to between 90 percent and 95 percent of the maximum standard Proctor density, near optimum moisture. Care should be taken not to overcompact the backfill since this could cause excessive lateral pressure on the walls. Some settlement of deep foundation wall backfills will occur even if the material is placed correctly.

Underdrain System: The lower level of the structure should be protected by an underdrain system to help reduce the problems associated with surface drainage during high runoff periods. An underdrain system should consist of a perimeter drain. Free draining granular material used in the drain system should contain less than 5 percent passing the No. 200 sieve and more than 50 percent retained on the No. 4 sieve.

The drains should consist of drain tile surrounded with a minimum of 6 inches of free draining granular material. The drain line should be placed at least 1 foot below the floor elevation and graded at a minimum slope of 1 percent. The granular underdrain system should be sloped to multiple sumps where water can be removed by pumping or gravity drainage.

Surface Drainage: The following drainage precautions should be observed during construction and maintained at all times after the facility has been completed:

(1) Excessive wetting or drying of the foundation excavations and underslab areas should be avoided during construction.

(2) Exterior backfill should be moistened and compacted to at least 90 percent of the maximum standard Proctor density.

(3) The ground surface surrounding the exterior of the buildings should be sloped to drain away from the foundation in all directions. We recommend a minimum slope of 6 inches in the first 10 feet.

(4) Roof downspouts and drains should discharge well beyond the limits of all backfill.

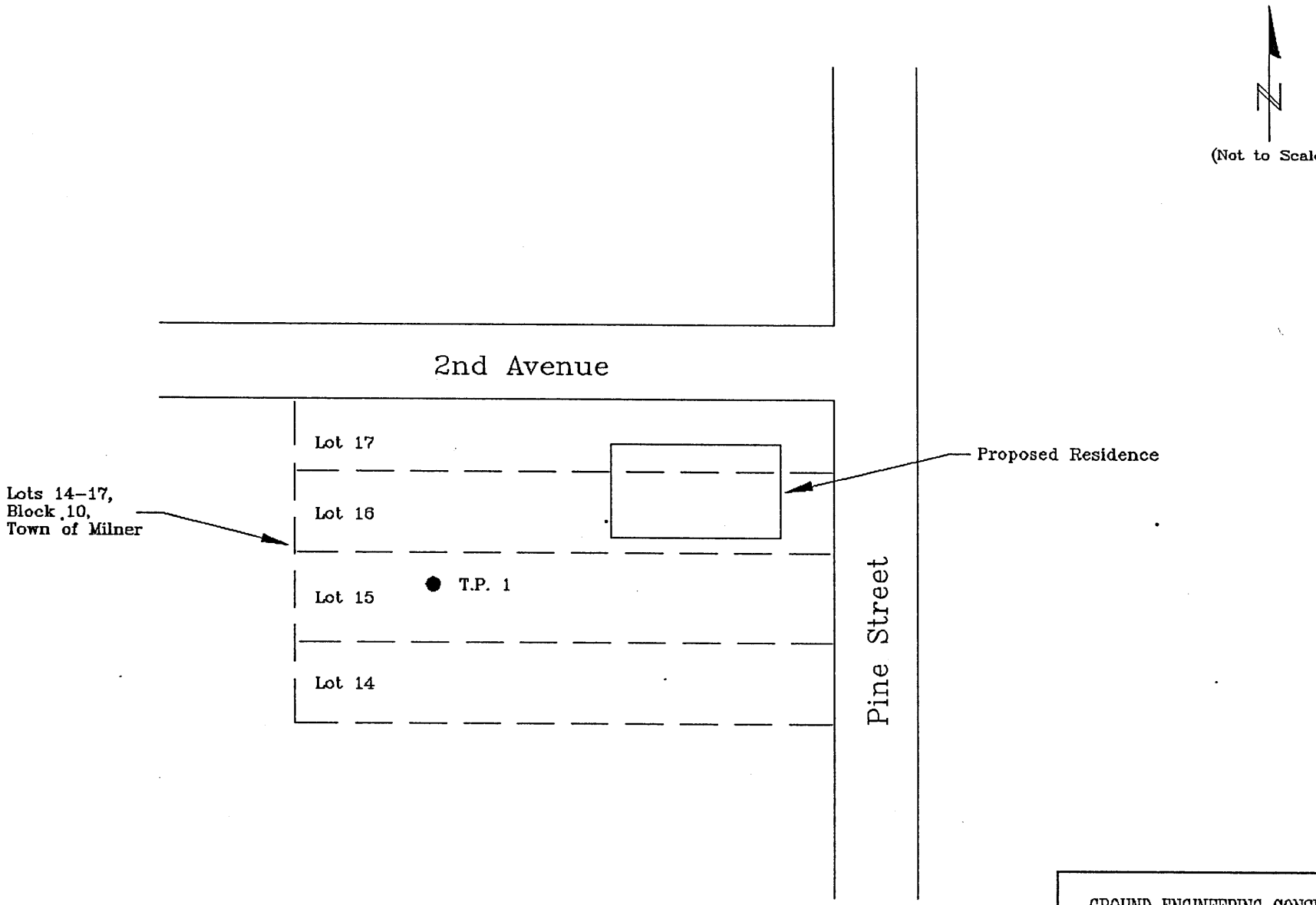
Limitations: This report has been prepared in accordance with generally accepted soil and foundation engineering practices in this area for use by the client for design purposes. The conclusions and recommendations submitted in this report are based upon the data obtained from the test pit advanced at the location indicated on the site plan. The nature and extent of variations across the site may not become evident until excavation is performed. If during construction, soil, rock and groundwater conditions appear to be different from those described herein, this office should be advised at once so that reevaluation of the recommendations may be made. We recommend on-site observation of excavations and foundation bearing strata by a soil engineer.

Sincerely,
GROUND ENGINEERING CONSULTANTS, INC.

Harold Schlicht

COLORADO REGISTERED BRIAN D. LEN 25750 PROFESSIONAL ENGINEER

Reviewed by Brian D. Len, P.E.



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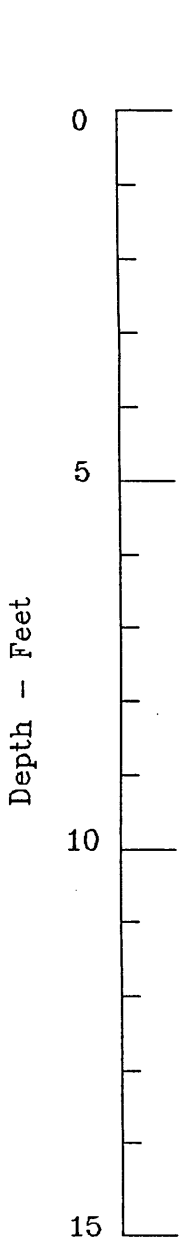
Location of Test Pit

Job No. 91-542 Figure 1



LEGEND:

Topsoil.

Clay: Slightly sandy and silty, low plastic, medium stiff, slightly moist to moist and brown.

Hand drive sample, 2-inch I.D. California liner sample

Small disturbed sample

NOTES:

1) Test pit was excavated on September 4, 1991 with an International 125 dozer.

2) Location of the test pit was provided by the client.

3) Elevation of the test pit was not measured and the log of the test pit is drawn to depth.

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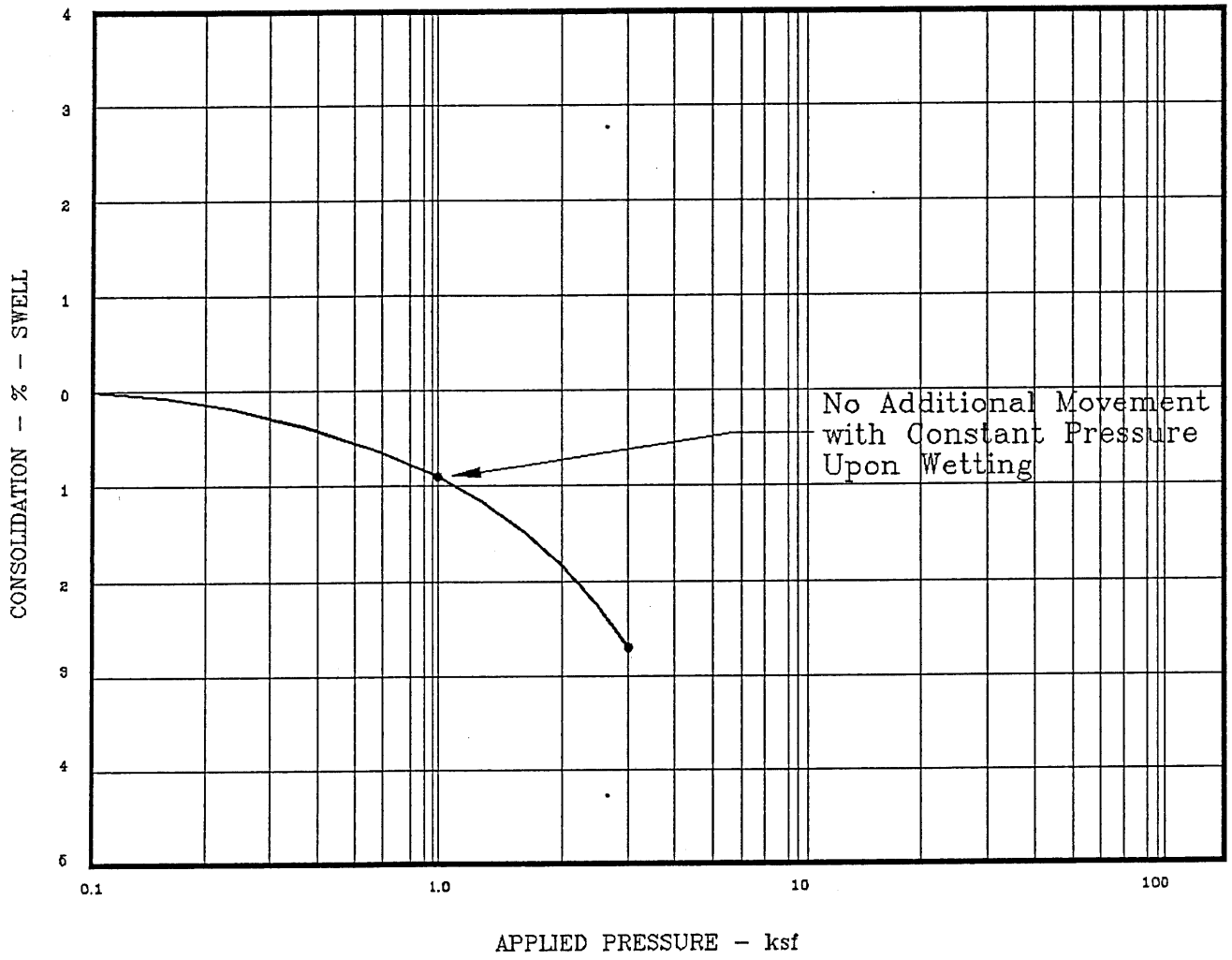
Log of Test Pit
Legend and Notes

Job No. 91-542 Figure 2



Moisture Content = 18.4 percent

Dry Unit Weight = 93.9 pcf

Sample of: Slightly Sandy Clay

From: Test Pit 1 at 5 feet

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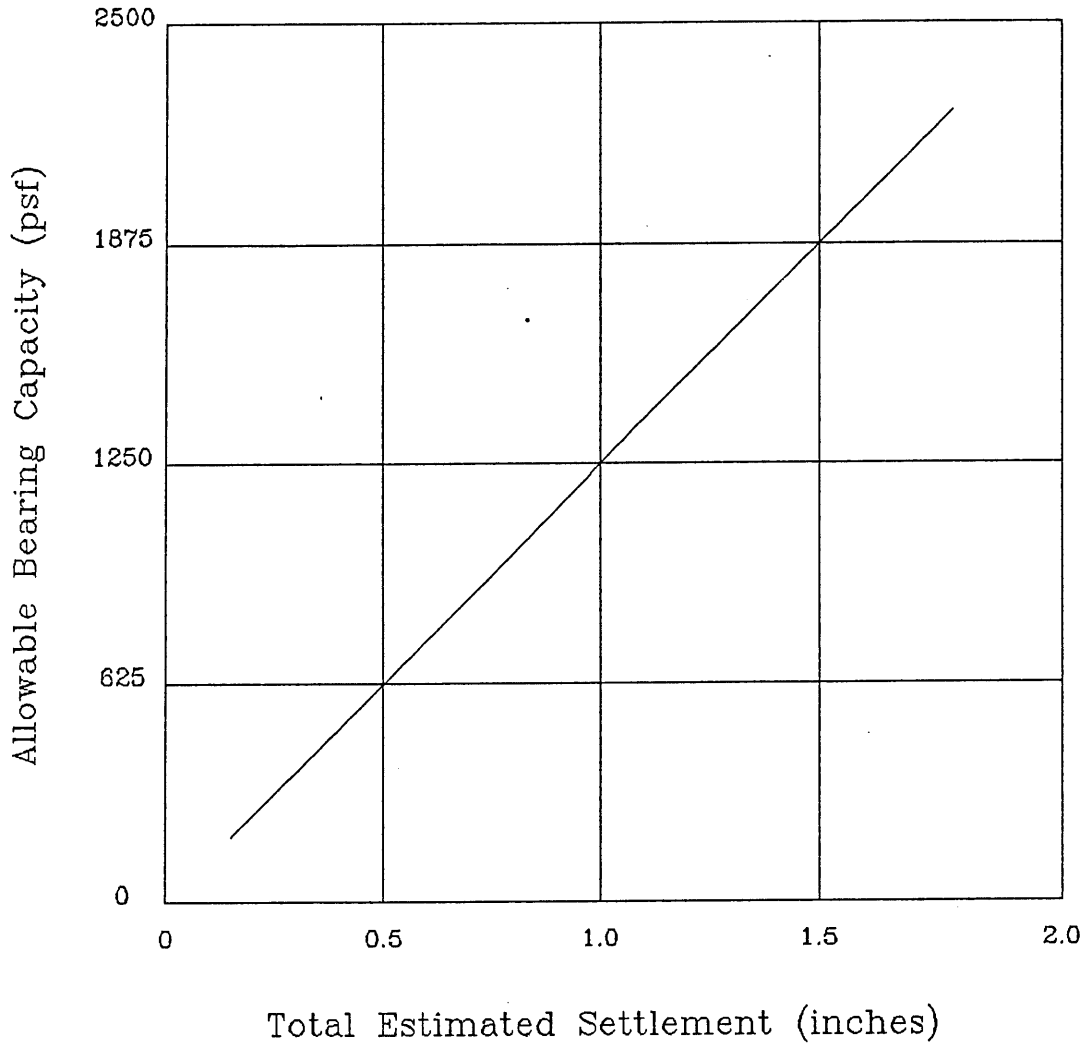
Swell Consolidation
Test Results

Job No. 91-542 Figure 3



Note: These values are based on footing widths of 1 to 4 feet. If the footing width is to be greater than 4 feet in width, then we should be notified to reevaluate these recommendations

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Bearing Capacity Chart

Job No. 91-542 Figure 4

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TABLE 1

SUMMARY OF LABORATORY TEST RESULTS

Sample Location		Natural	Natural	Gradation		Percent	Atterberg Limits		Unconfined	Water	
Hole	Depth *(feet)*	Moisture Content *(%)*	Dry Density *(pcf)*	Gravel *(%)*	Sand *(%)*	Passing No. 200 Sieve	Liquid Limit *(%)*	Plasticity Index *(%)*	Compressive Strength *(psf)*	Soluble Sulfates *(%)*	Soil or Bedrock Type
1	5	18.4	93.9		9	91	29	12			Slightly Sandy Clay

GEC Form No. 69