Kumar & Associates, Inc.®
Geotechnical and Materials Engineers
and Environmental Scientists

5020 County Road 154
Glenwood Springs, CO 81601
phone: (970) 945-7988
fax: (970) 945-8454
email: kaglenwood@kumarusa.com
www.kumarusa.com

An Employee Owned Company

Office Locations: Denver (HQ), Parker, Colorado Springs, Fort Collins, Glenwood Springs, and Summit County, Colorado

October 21, 2024

Griffin Development
Attn: Rocky Cortina
701 West Lionshead Circle
Vail, Colorado 81657
rcortina@pegaso.net

Project No. 23-7-513

Subject: Supplemental Subsoil Study, Proposed Residential Development, Parcel 1, Red Mountain Ranch, U.S. Highway 6, Eagle, Colorado

Gentlemen:

As requested, Kumar & Associates performed a supplemental subsoil study for the proposed development at the subject site. The data obtained and our geotechnical recommendations including those for foundation design are presented in this report. The study is supplemental to our agreement for professional services to Griffen Development dated August 3, 2023.

Background Information: We previously performed a preliminary subsoil study for foundation design for the site development submitting our findings in a report dated December 21, 2023 under the above project number. Additionally, we have been provided a preliminary subsoil study for the property prepared by Hepworth-Pawlak Geotechnical (H-P Geotech) dated February 29, 2016, Job. No. 115 548A. We have reviewed the information in those reports and considered it in the preparation of this report.

Proposed Construction: The proposed construction is generally similar to that discussed in our previous report and will consist of single family, duplex and multifamily residential townhome buildings located on the site as shown on Figure 1. The buildings will be two story wood frame structures with slab-on-grade ground floors, some with walkout basements. Storage buildings shown in the northwest part of the site may not be constructed. Cut depths for the individual buildings is expected to range between about 3 to 10 or 12 feet. Foundation loadings for this type of construction are assumed to be relatively light and typical of the proposed type of construction. There may be some overlot grading during the subdivision infrastructure construction.

If building conditions, grading or foundation loadings are significantly different from those described above, we should be notified to re-evaluate the recommendations presented in this report.

Site Conditions: At the time of our current field exploration, the site conditions were similar to those described in our previous report. A drainage outlet from a culvert below Highway 6 has been identified through about the middle of the property, see Figure 1. There is a moderately steep riverbank slope beyond the planned building locations along the northwest side of the Eagle River. Elevation differences across the individual building foot-prints is about 3 to 10 or 12 feet.

Subsurface Conditions: The subsurface conditions at the site were evaluated by excavating five exploratory pits at the approximate locations shown on Figure 1. The number of pits and their locations were selected and dug with a backhoe by the client. Our previous boring locations, as well as the previous H-P Geotech boring locations, are also shown on Figure 1.

The logs of the current pits are presented on Figure 2. The subsoils encountered were somewhat variable and, in general, below up to 1 foot of topsoil, consisted of 7 feet of fill at Pits 2 and 3 or 1½ to 13½ feet of loose, silty to very silty sand overlying dense, silty sandy gravel and cobbles below depths from ½ to 14½ feet. At Pit 2, below 1 foot of topsoil and 3 feet of fill, stiff sandy to very sandy silty clay was encountered underlain at a depth of 7½ by hard, claystone/siltstone bedrock down to the Pit 2 depth of 9 feet. The dense, silty sandy gravel and cobble (coarse granular soils) included boulders and extended down to the maximum depth explored at Pits 1 and 3 through 5 of 15 feet. The claystone/siltstone bedrock is the Eagle Valley Evaporite Formation. Based on our experience in the area, the bedrock is not expansive but should be further evaluated as needed.

Results of swell-consolidation testing performed on relatively undisturbed samples of the fine grained soils, presented on Figures 4 through 7, indicate moderate to high compressibility under conditions of loading and wetting and a low to moderate collapse potential when wetted under a constant 1,000 psf surcharge. Results of a gradation analyses performed on disturbed bulk samples of the coarse granular soils (minus 3-inch fraction) obtained from the pits are presented on Figure 7. The laboratory testing is summarized in Table 1.

No groundwater was observed in the pits at the time of excavation and the soils were slightly moist to moist, and the claystone/siltstone bedrock was slightly moist.

Foundation Bearing Conditions: The bearing soils expected to be encountered at building excavation subgrades will vary from unsuitable fill to low bearing and compressible fine grain soils to dense coarse granular soils depending on the building location. Spread footings (or well reinforced structural slabs) bearing on the natural soils or on properly placed and compacted structural fill can be used for foundation support of the buildings, with some risk of settlement in the fine grained soils and deeper fill areas. A lower risk of foundation movement would be to bear the footings entirely on the underlying dense coarse granular soils or bedrock such as by subexcavation or use of a deep foundation system such as helical piers and/or drilled piers.

We understand spread footings with a uniform design criteria for all the buildings is the desired approach for the foundation system. This can be done by designing the footings for a relatively low soil bearing pressure and removing all existing fill (e.g. at Pit 5 and previous Boring 4) and either extending the footings down to suitable natural soils or re-establishing design footing bearing elevation with compacted structural fill. In fine grained bearing soil area (e.g. at Pits 1 and 2), sub-excavation of a depth (typically 3 feet) of the compressible fine grained soils and

replacement with compacted structural fill should be done to reduce foundation settlement and building distress.

All structural fill below footing (and floor slab) areas should be properly processed, and placed and compacted. The structural fill can consist of the onsite soils excluding of debris, topsoil and oversized (plus 6-inch) rocks. The on-site coarse granular soils or similar granular material (minus 6-inch fraction) or CDOT Class 2, 5 or 6 aggregate base course is preferred for ease of construction and to help reduce settlements. The onsite fine grained (and possibly fill) soils can be used as the structural fill but may be difficult to process and compact. The need for structural fill and suitability of the on-site soils as structural fill below footing (and floor slab) areas should be further evaluated at the time of construction.

Similar subgrade preparation and removal and replacement of fine grained soils (typically 2 to 3 feet) and replacement with structural fill as discussed above should also be observed for floor slabs on grade. It may be feasible to remove a partial depth of the fill and replace with a geo-grid and compacted structural fill, but needs to be further evaluate at the time of construction. Structural floor slabs over crawlspace, commonly used in area, would provide a relatively low risk of floor movement.

It appears that obtaining additional subsoil information of the bearing soils at each individual building site, prior to construction and/or at the time of the building foundation excavation, is desirable to better evaluate the needed subgrade preparation. This could be done by backhoe pits or borings.

Recommendations: The previous foundation design recommendations provided in our 2023 report remain applicable. The buildings can be designed on be supported on spread footings or well reinforced structural slabs using an allowable soil bearing pressure of 1,500 psf for bearing on the natural soils or compacted structural fill. Settlements similar to those discussed in our previous report are expected with the lower settlement potential for bearing on the dense coarse granular soils. The structural fill should be placed and compacted as discussed on page 4 of our previous report. We should evaluate the foundation bearing conditions at the time of construction, approve any structural fill material planned to be placed below footing (and floor slab) areas, and test structural fill compaction on a regular basis during placement.

For the access roads/drives, we understand the buildings will be constructed and sold as the project progresses, and the roads/drives subjected to construction traffic. For this condition we recommend a pavement section consisting of a minimum 4 inches of asphalt pavement on 12 inches of CDOT Class 6 base course, or a minimum 4 inches of asphalt on 6 inches of CDOT Class 6 base course on 8 inches of CDOT Class 2 sub-base (minus 3-inch base course) should be used. These recommended pavement sections assume some construction traffic loading but the section with the granular sub-base (minimum 8 inches of CDOT Class 2 material) should hold up better to the construction traffic. Also, it may be desirable to delay placing the surface layer of the asphalt paving until the end of the construction when the building has been completed. For automobile only parking areas, the pavement section can consist of 3 inches of asphalt on

8 inches of CDOT Class 6 base course. Other applicable recommendations provided on pages 6 and 7 of our previous report should also be observed.

8 inches of CDOT Class 6 base course. Other applicable recommendations provided on pages 6 and 7 of our previous report should also be observed.

Perimeter foundation drains should not be needed around floor "slab-at grade" construction. It has been our experience in mountainous areas that local perched groundwater can develop during times of heavy precipitation or seasonal runoff. Frozen ground during spring runoff can also create a perched condition. We recommend below-grade construction, such as retaining walls, crawlspace and basement areas, be protected from wetting and hydrostatic pressure buildup by an underdrain and wall drain system as discussed on page 6 on our previous report.

Limitations: This study has been conducted in accordance with generally accepted geotechnical engineering principles and practices in this area at this time. We make no warranty either express or implied. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory pits excavated at the locations indicated on Figure 1 and to the depths shown on Figure 2, the previous exploratory boring information at the site, the proposed type of construction, and our experience in the area. Our services do not include determining the presence, prevention or possibility of mold or other biological contaminants (MOBC) developing in the future. If the client is concerned about MOBC, then a professional in this special field of practice should be consulted.

This report has been prepared for the exclusive use by our client for planning and design purposes. We are not responsible for technical interpretations by others of our information. As the project evolves, we should provide continued consultation and field services during construction to review and monitor the implementation of our recommendations, and to verify that the recommendations have been appropriately interpreted. Significant design changes may require additional analysis or modifications to the recommendations presented herein. We recommend on-site observation of excavations and foundation bearing strata and testing of structural fill on a regular basis by a representative of the geotechnical engineer.

If you have any questions or if we may be of further assistance, please let us know.

Respectfully Submitted,

Kumar & Associates, Inc.

COLORADO REGISTERED DAVID A. YOUNG 32216 10.23.24 PROFESSIONAL ENGINEER

David A. Young, P.E.

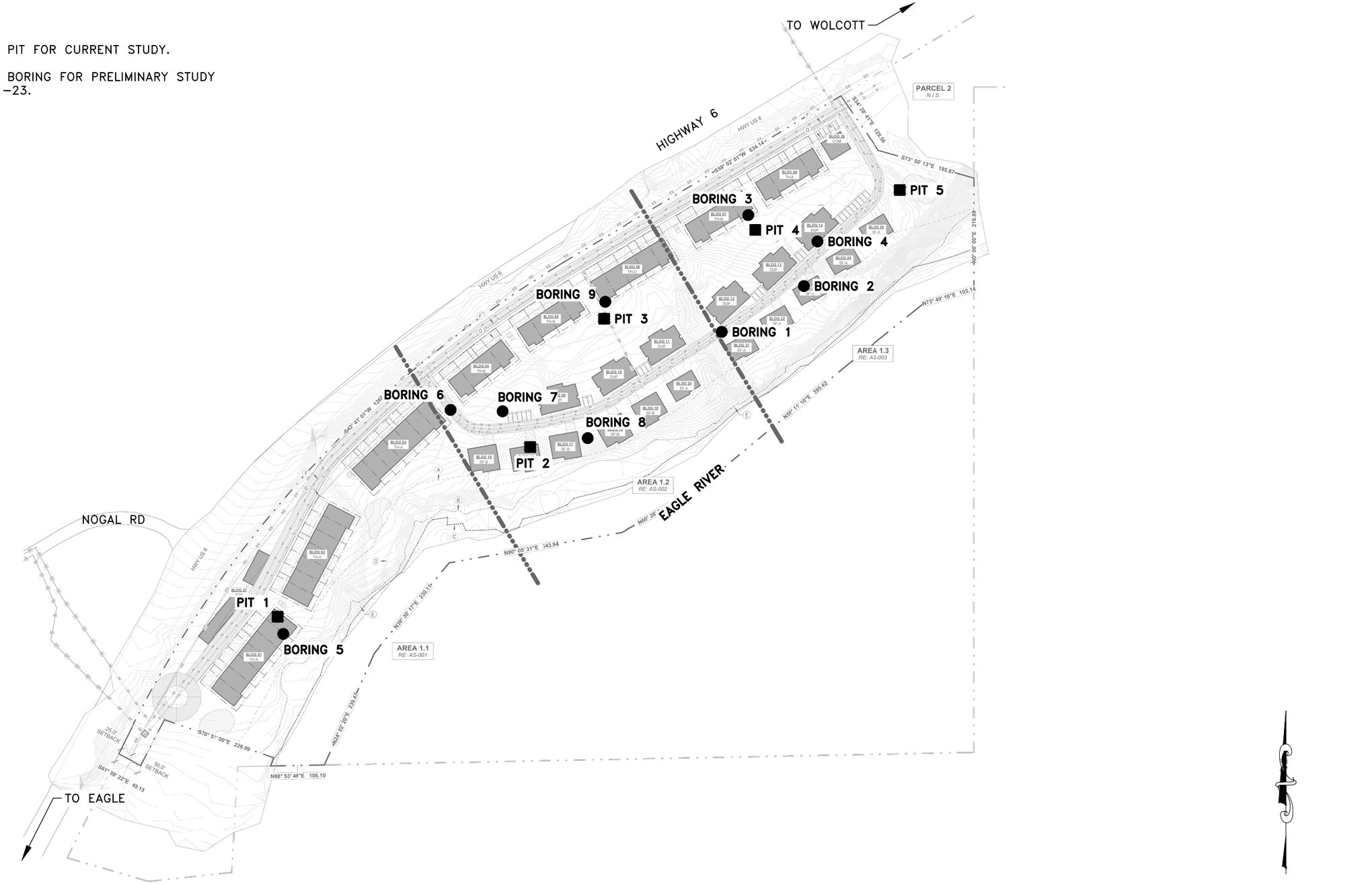
DAY/kac

attachments Figure 1 – Location of Exploratory Pits
Figure 2 – Logs of Exploratory Pits
Figure 3 – Legend and Notes
Figures 4 through 6 – Swell-Consolidation Test Results
Figure 7 – Gradation Test Results
Table 1 – Summary of Laboratory Test Results

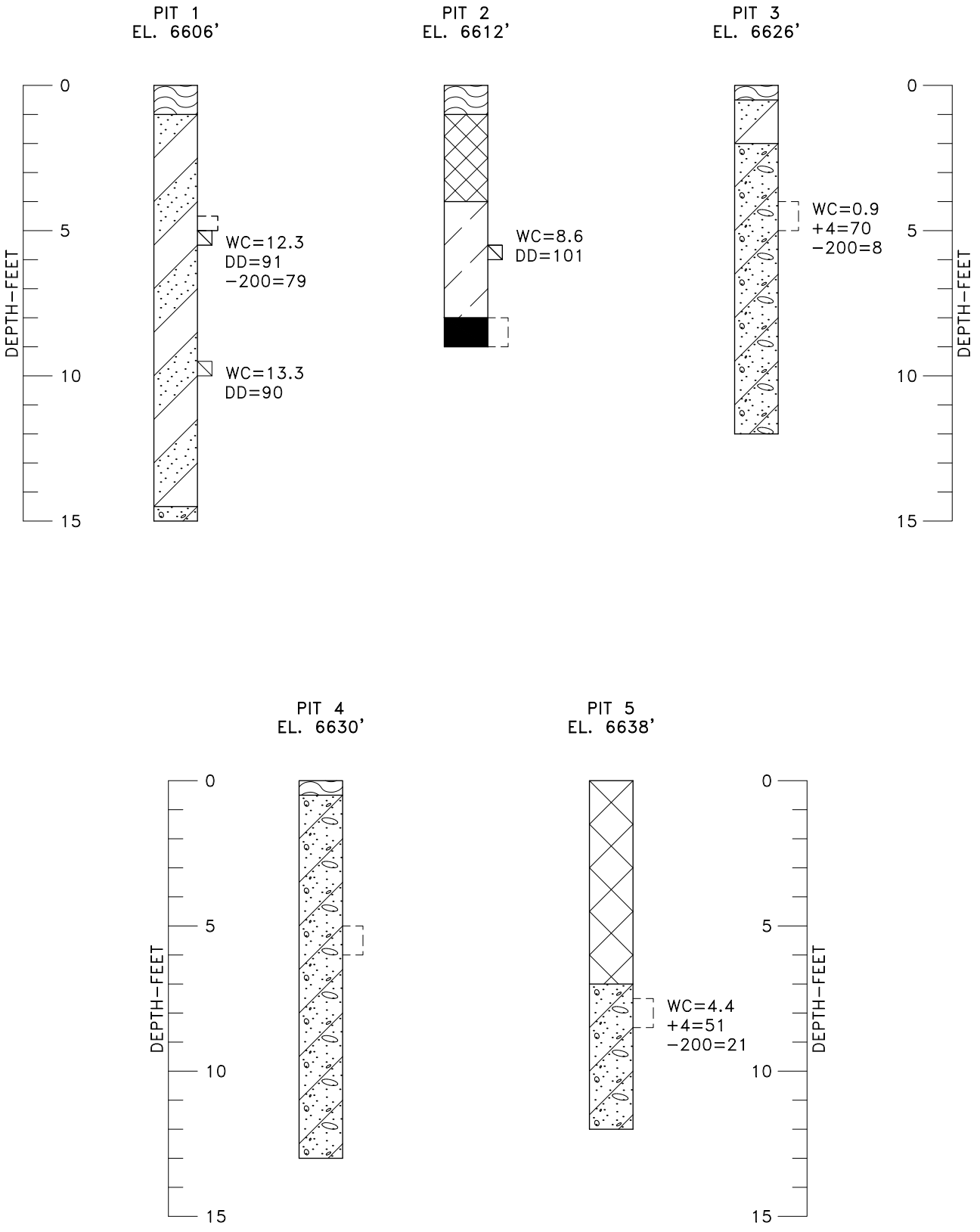
cc: The Dwell Company – Steve Stone – (stone@dwellmountain.com)

LEGEND:

- ■ EXPLORATORY PIT FOR CURRENT STUDY.
- ● EXPLORATORY BORING FOR PRELIMINARY STUDY DATED 12-21-23.



23-7-513	Kumar & Associates	PARCEL 1, RED MOUNTAIN RANCH	LOCATION OF EXPLORATORY PITS	Fig. 1



23-7-513	Kumar & Associates	LOGS OF EXPLORATORY PITS	Fig. 2

LEGEND


TOPSOIL; ORGANIC SANDY SILT AND CLAY, FIRM, SLIGHTLY MOIST, DARK BROWN.


FILL; SILTY SANDY GRAVEL, MEDIUM DENSE, SLIGHTLY MOIST, GRAY AND BROWN, ROOT ZONE AT SURFACE.


FILL: MIXED SANDY SILT AND CLAY WITH GRAVEL, SCATTERED COBBLES, FIRM, SLIGHTLY MOIST, MIXED BROWN, ORGANICS.


CLAY (CL); SILTY, SANDY TO VERY SANDY, STIFF, SLIGHTLY MOIST, GRAY–BROWN, LOW PLASTICITY.


SAND (SM–ML); SILTY TO VERY SILTY, SLIGHTLY CLAYEY, SCATTERED GRAVEL, LOOSE, MOIST TO VERY MOIST WITH DEPTH, MIXED BROWN AND RED–BROWN.


GRAVEL AND COBBLES (GM); WITH BOULDERS, SANDY, SILTY TO SLIGHTLY SILTY, DENSE, SLIGHTLY MOIST, LIGHT BROWN.


CLAYSTONE/SILTSTONE BEDROCK; FRACTURED, HARD, SLIGHTLY MOIST, GRAY. EAGLE VALLEY EVAPORITE FORMATION.

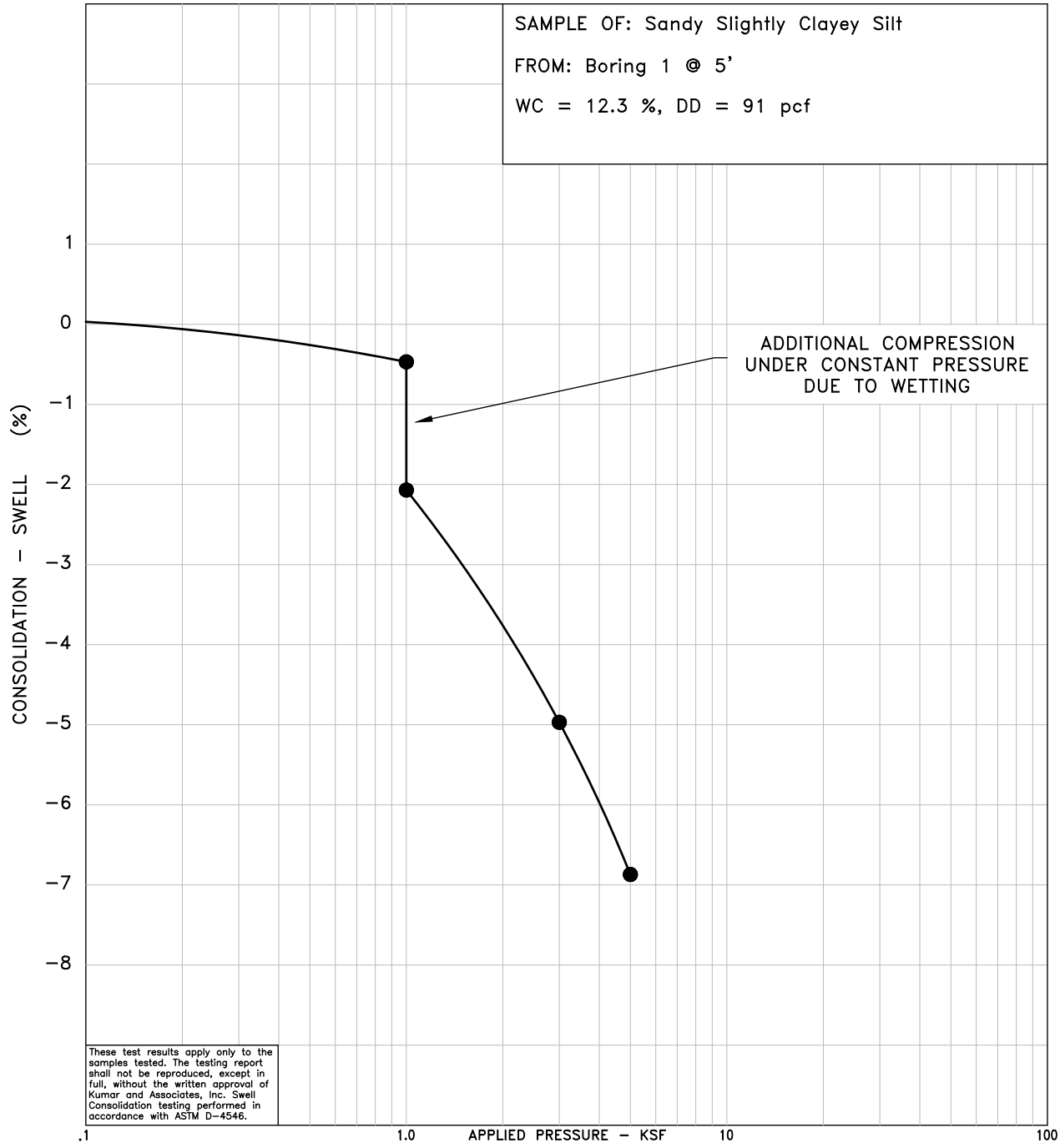

HAND DRIVE SAMPLE.


DISTURBED BULK SAMPLE.

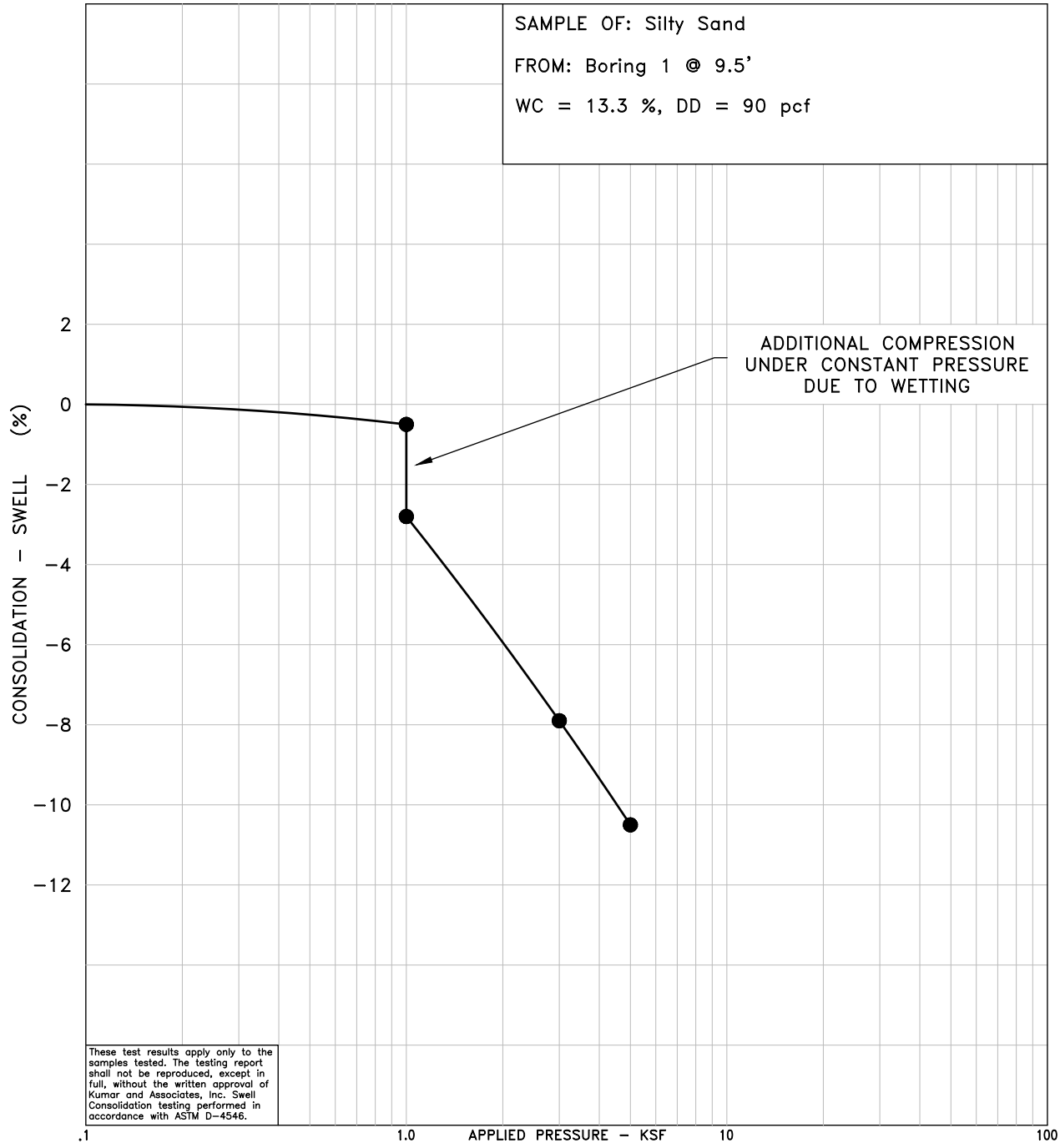
NOTES

1. THE EXPLORATORY PITS WERE EXCAVATED WITH A BACKHOE ON AUGUST 7, 2024.
2. THE LOCATIONS OF THE EXPLORATORY PITS WERE LOCATED AND DUG BY THE CLIENT.
3. THE ELEVATIONS OF THE EXPLORATORY PITS WERE OBTAINED BY INTERPOLATION BETWEEN CONTOURS ON THE SITE PLAN PROVIDED.
4. THE EXPLORATORY PIT LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.
5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY PIT LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.
6. GROUNDWATER WAS NOT ENCOUNTERED IN THE PITS AT THE TIME OF EXCAVATION. PITS WERE BACKFILLED SUBSEQUENT TO SAMPLING.
7. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D 2216);
   DD = DRY DENSITY (pcf) (ASTM D 2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D 422);
   −200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D 1140).

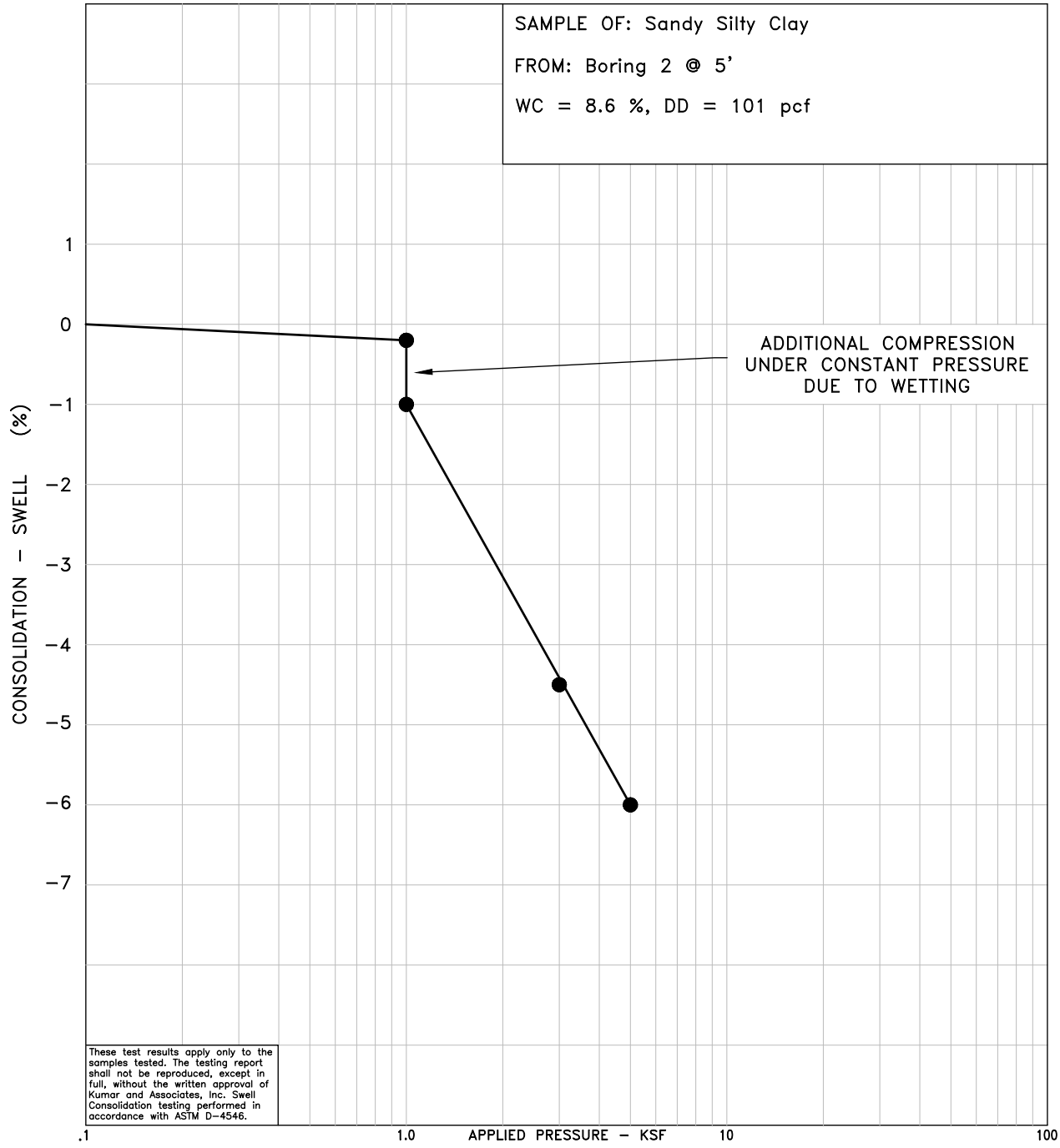
23-7-513	Kumar & Associates	LEGEND AND NOTES	Fig. 3



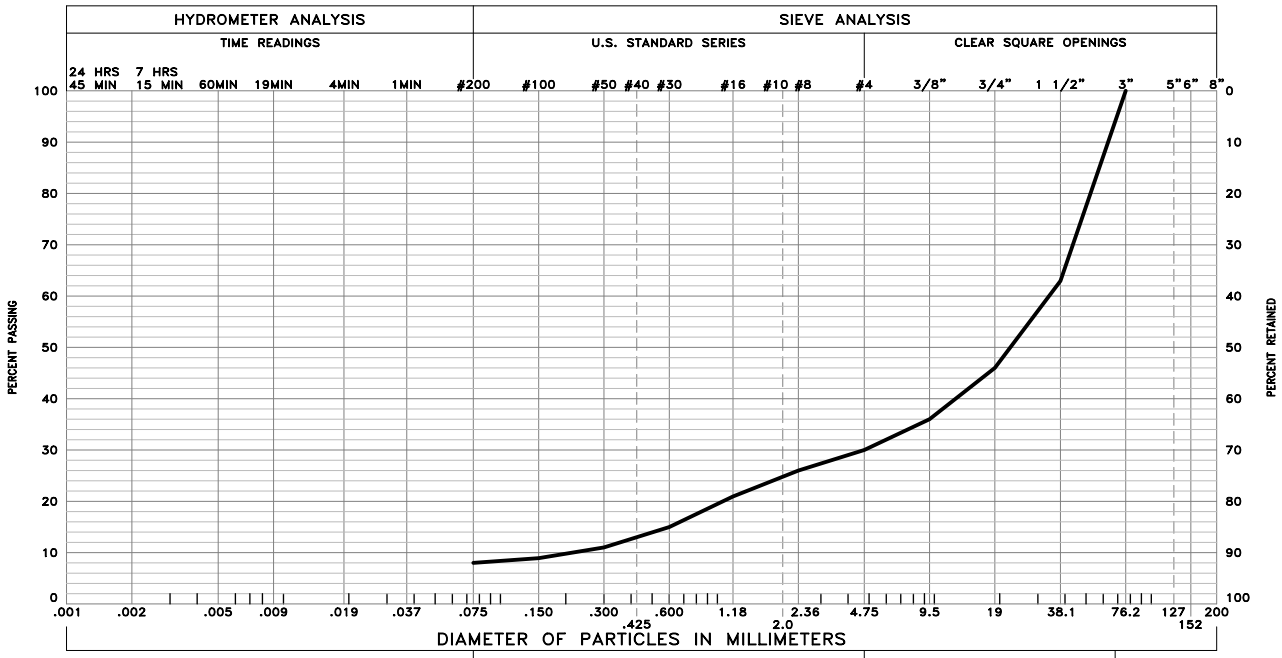
23-7-513	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 4



23-7-513	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 5



23-7-513	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 6



GRAVEL 70 % SAND 22 % SILT AND CLAY 8 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Slightly Silty Sandy Gravel FROM: Pit 3 @ 4'–5'

GRAVEL 51 % SAND 28 % SILT AND CLAY 21 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy gravel FROM: Pit 5 @ 6.5'–7.5'

23–7–513	Kumar & Associates	GRADATION TEST RESULTS	Fig. 7

Kumar & Associates, Inc.®
Geotechnical and Materials Engineers
and Environmental Scientists

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

Project No. 23-7-513

SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY DENSITY	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH	SOIL TYPE
PIT	DEPTH (ft)	(%)	(pcf)	GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)	(psf)	
1	5	12.3	91			79				Sandy Slightly Clayey Silt
	9½	13.3	90							Silty Sand
2	5	8.6	101							Very Sandy Silty Clay
3	4 - 5	0.9		70	22	8				Slightly Silty Sandy Gravel
5	6½ - 7½	4.4		51	28	21				Silty Sandy Gravel