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SUBSOIL STUDY
FOR FOUNDATION DESIGN
PROPOSED MIDTOWN VILLAGE
US HIGHWAY 24
MINTURN, COLORADO

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Project No. 22-7-293

JULY 25, 2022

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SUMMARY

1. The subsurface conditions at the site were evaluated by drilling a total of 15 exploratory borings as shown on Figure 1. Subsoils encountered in the borings consisted of about 1½ to 7 feet of mixed clayey silty sand, gravel and cobble fill and up to 2 to 5 feet of natural sandy clay and silty sand down to about 3 to 10 feet and underlain by slightly silty to silty sand, gravel and cobbles with possible boulders to the boring depths of 10 to 25 feet.

2. Groundwater was encountered in the borings at depths of about 14 to 19 feet at the time of drilling. The upper soils were slightly moist to very moist and wet with depth.

3. The existing fill materials are generally not suitable for support of building foundations, floor slabs, concrete flatwork, and asphalt or concrete pavement. The underlying natural sandy clay and silty sand soils can be used for support of lightly loaded spread footings and floor slabs. Shallow foundations bearing on compacted structural fill placed on the natural soils and natural clay and sand soils designed for an allowable bearing pressure of 2,000 pounds per square foot (psf) can be used for building support. Alternately, spread footings which extend down through the existing fill, clay and sand soils and into the underlying dense, sandy gravel and cobble soils can be designed for an allowable bearing pressure of 4,000 psf. Detailed discussions of geotechnical recommendations are presented in the body of this report.

4. The following recommended pavement section thicknesses were based on an assumed traffic loading of 5 Equivalent Daily Load Applications (EDLA) for parking areas (Standard Duty), and 20 EDLA for drive lanes (Heavy Duty).

Location	Asphalt Over Aggregate Base Course (Inches)	Concrete Over Aggregate Base Course (inches)
Standard Duty	3 over 8	6 over 4
Heavy Duty	4 over 8	7 over 4

We recommend trash pickup areas, delivery truck lanes, and other areas where truck turning movements are concentrated be paved with portland cement concrete.

PURPOSE AND SCOPE OF STUDY

This report presents the results of a geotechnical engineering study for the proposed Midtown Village, US Highway 24 in Minturn, Colorado. The project site is shown on Figure 1. The study was conducted in general accordance with our Proposal No. P7-22-108, dated January 14, 2022 for the purpose of providing geotechnical engineering recommendations, pavement thickness sections and site grading criteria for the project.

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

PROPOSED CONSTRUCTION

The project consists of a mixed-use development located in the 900 block of Minturn between US Highway 24 and the valley side as shown on Figure 1. Most existing development on the property will be razed except for a commercial building and adjacent small residence in the south-central part of the project site. New proposed development includes single-family and multi-unit residential in the central and northern parts, a commercial building in the northwest corner and an apartment building with an underground parking level in the southeast part of the property. Foundation loadings are assumed to be relatively light to moderate and carried mainly by continuous foundation walls. Grading for the proposed development will be relatively minor in the valley bottom area and moderate along the south side with cut depths up to around 10 to 15 feet into the hillside.

If the proposed construction varies significantly from that described above, we should be notified to reevaluate our recommendations.

SITE CONDITIONS

The site is located mainly in relatively flat, valley bottom terrain between US Highway 24 and the steep valley side with various existing buildings as shown on Figure 1. The site slopes gently down to the northwest with around 5 feet of elevation difference in the valley bottom development area. Along the southwest side, the grade abruptly steepens with about 5 to 10 feet elevation rise within the property limits as indicated by the contour lines shown on Figure 1. The property is typically vegetated with grass, weeds and brush in developed areas and an aspen and evergreen tree forest on the hillside with debris and fill piles scattered across the property.

SUBSURFACE CONDITIONS

The subsurface conditions were evaluated by drilling 15 exploratory borings at the approximate locations shown on Figure 1. The boring logs are shown on Figures 2 and 3. Swell-consolidation test results, shown on Figures 5 and 6, indicated the sandy clay and silty sand soils have low to moderate compressibility under conditions of loading and wetting. Results of gradation analyses performed on small diameter drive samples of the granular soils (minus 1½-inch size fraction) are presented on Figures 7 through 12. The laboratory test results are summarized Table 1.

The following subsurface descriptions are of a generalized nature to highlight the major stratification features and groundwater conditions encountered in the borings. The boring logs should be referenced for more detailed information at the immediate location of the borings. Subsoils encountered in the borings consisted of about 1½ to 7 feet of mixed clayey silty sand, gravel and cobble fill and up to 2 to 5 feet of natural sandy clay and silty sand down to about 3 to 10 feet and underlain by relatively dense, slightly silty to silty sand, gravel and cobbles with possible boulders to the boring depths of 10 to 25 feet. Drilling in the coarse granular soils was difficult due to the cobbles and boulders and practical auger refusal was encountered in several of the borings.

Groundwater was encountered in the borings at depths of about 14 to 19 feet at the time of drilling. The upper soils were slightly moist to very moist and wet with depth. The groundwater levels can be expected to seasonally fluctuate.

GEOTECHNICAL ENGINEERING CONSIDERATIONS

The subsurface conditions encountered in the borings were evaluated to develop geotechnical engineering recommendations for the proposed development. The following discussion addresses building foundations, slabs-on-grade, surface and subsurface drainage, site grading, and pavement sections, which should be considered during project planning, design and construction.

The existing fill materials are generally not suitable for support of building foundations, floor slabs, concrete flatwork, and asphalt or concrete pavement. The underlying natural sandy clay and silty sand soils and compacted structural fill placed on the natural soils can be used for support of lightly loaded spread footings and floor slabs. Alternately, spread footings which extend down through the existing fill soils and natural clay and sand soils and into the underlying dense, sandy gravel and cobble soils can be used for support of moderately loaded spread footings and floor slabs with low settlement potential. If a deep foundation such as piles or piers is proposed, we should be contacted for additional analysis and recommendations.

FOUNDATION RECOMMENDATIONS

Shallow Foundations: Considering the subsoil conditions encountered in the exploratory borings, shallow footings are suitable for support of the proposed buildings that bearing on the natural soils or on properly compacted structural fill placed on the natural soils. Existing fill and debris from previous construction at the site or topsoil if encountered, should be removed from development areas. The excavation should be adequately dewatered, relatively dry, and stable prior to placement of structural fill. The natural clay soils will tend to soften under construction traffic and precautions should be taken to maintain a stable subgrade. Excavations should be evaluated for suitable subgrade conditions by a representative of Kumar & Associates prior to placing structural fill and for suitability of natural soils for bearing prior to forming footings.

Footing Foundations: 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 properly compacted structural fill or on the underlying natural clay and sand soils should be designed for an allowable soil bearing pressure of 2,000 pounds per square foot (psf). Based on experience, we expect initial settlement of footings designed and constructed as discussed in this section will be about 1 inch or less with additional settlement of around 1 inch from long term compression of the natural soils or structural fill. Footings placed on the underlying natural dense, sandy gravel and cobble soils should be designed for an allowable soil bearing pressure of 4,000 psf. Settlements are expected to be about 1 inch or less.
2. Continuous footings should be at least 18 inches wide and isolated pads should be at least 24 inches wide.
3. Exterior footings and footings beneath unheated areas should be provided with adequate soil cover above their bearing elevation for frost protection. Placement of foundations at least 42 inches below the exterior grade is recommended for this area.
4. Continuous foundation walls should be heavily reinforced top and bottom to span an unsupported length of at least 12 feet.
5. Earthwork recommendations for spread footing foundations are presented in the "Earthwork and Site Grading" section of this report.
6. A representative of the geotechnical engineer should observe the overall excavation prior to placing structural fill and footing areas prior to concrete placement.

RETAINING AND FOUNDATION WALLS

Lateral Earth Pressures: Below-grade foundation walls and retaining structures, should be designed for the lateral earth pressure generated by the backfill, which is a function of the degree of rigidity of the wall and the type of backfill material used. Foundation walls and retaining structures that are laterally supported and can be expected to undergo only a slight amount of deflection should be designed for earth pressures based on the following equivalent fluid densities:

Granular backfill with < 5% passing No. 200 sieve .... 40 pcf
CDOT Class 1 backfill (<20% passing No. 200 sieve) .... 45 pcf
On-site granular backfill... 50 pcf

Cantilevered retaining structures that can be expected to deflect sufficiently to mobilize the full active earth pressure condition should be designed for earth pressures based on the following equivalent fluid densities:

Granular backfill with < 5% passing No. 200 sieve .... 35 pcf
CDOT Class 1 backfill (<20% passing No. 200 sieve) .... 40 pcf
On-site granular backfill .... 40 pcf

The equivalent fluid density values recommended above assume drained conditions behind the walls and retaining structures, and a horizontal backfill surface. The buildup of water behind a wall or retaining structure, or an upward sloping backfill surface, will increase the lateral earth pressure imposed on the wall or retaining structure. Below-grade walls and retaining structures should also be designed for appropriate surcharge pressures due to adjacent structures, vehicle traffic, and construction activities.

Backfill should be placed in uniform lifts and compacted to at least 95% of the maximum Proctor dry density (ASTM D 698). The backfill should be compacted at moisture contents within 2 percentage points of optimum. Care should be taken not to over-compact the backfill since this could cause excessive lateral pressure on the walls. Hand compaction procedures, if necessary, should be used to prevent lateral pressures from exceeding the design values. Settlement of deep wall backfills can occur even if the fill is properly placed and compacted.

The lateral resistance of footings will be a combination of the sliding resistance of the footing on the bearing materials and passive earth pressure against the side of the footing. Resistance to sliding at the bottoms of the footings can be calculated based on a coefficient of friction of 0.40 for clay or sand soils and 0.50 for dense gravel soils. Passive pressure of compacted backfill against the sides of the footings can be calculated using an equivalent fluid unit weight of 400 pcf. The coefficient of friction and passive pressure values recommended above assume ultimate soil strength. Suitable factors of safety should be included in the design to limit the strain which will occur at the ultimate strength, particularly in the case of passive resistance. Fill placed against the sides of the footings to resist lateral loads should be a granular material compacted to at least 95% of the maximum standard Proctor dry density at a moisture content near optimum.

FLOOR SLABS

Existing fill, topsoil and organic matter are not suitable for support of floor slabs and flatwork and should be removed essentially down to the natural soils and replaced with properly compacted structural fill. To reduce the effects of some differential movement, floor slabs should be separated from all bearing walls and columns with expansion joints which allow unrestrained vertical movement. Floor slab control joints should be used to reduce damage due to shrinkage cracking. The joint spacing and slab reinforcement should be established by the designer based on experience in concrete floor slab design using criteria such as that of the Portland Cement Association or American Concrete Institute. A perimeter foundation drain should not be needed for slab-at-grade construction.

In occupied areas of the building, we recommend vapor retarders conform to at least the minimum requirements of ASTM E1745 Class C material. Certain floor types are more sensitive to water vapor transmission than others. For floor slabs bearing on angular gravel or where flooring system sensitive to water vapor transmission are utilized, we recommend a vapor barrier be utilized conforming to the minimum requirements of ASTM E1745 Class A material. The vapor retarder/barrier should be installed in accordance with the manufacturers' recommendations and ASTM E1643.

EARTHWORK AND SITE GRADING

We recommend the following criteria be used when preparing the site grading plans:

Removal and Replacement Requirement: Existing fill and other unsuitable materials related to the previous property development, should be removed from within the proposed building footprint and pavement areas to a minimum 1:1 horizontal to vertical projection beyond development edges and replaced with properly compacted structural fill.

Fill Material Specifications: The following material specifications are presented for fills on the project site.

1. *Foundation and Pavement Subgrade and Backfill*: The on-site granular soils should be suitable for reuse throughout the site including under foundations and as foundation backfill or pavement subgrade, following screening to remove unsuitable materials and moisture conditioning. Construction debris or other unsuitable materials may be present as remnants of prior site development. These materials should be removed from the excavated soils before placement and compaction. Imported fill should consist of a minus 6-inch non-expansive soil having less than 25 percent passing the No. 200 sieve, a liquid limit less than 30, and a plasticity index less than 15.
2. *Utility Trench Backfill*: Screened materials from onsite excavations can be used for trench backfill above the pipe zone fill provided they do not contain unsuitable material such as construction debris or particles larger than 4 inches.
3. *Material Suitability*: All structural fill material should be non-expansive and free of vegetation, brush, sod and other deleterious substances and should not contain rocks or lumps having a diameter of more than 6 inches. The geotechnical engineer should evaluate the suitability of all proposed fill materials prior to placement. A fill material should be considered non-expansive if the swell potential when remolded to the required compaction in the table below at the optimum moisture content under a 200 psf surcharge pressure does not exceed ½ percent.
4. *Subgrade Preparation*: The ground surface should be stripped of existing fill, vegetation/ organics, loose soils, or any other deleterious materials prior to fill placement. The resulting ground surface should be scarified to a depth of 8 inches, moisture conditioned as necessary, and compacted in a manner specified below for the subsequent layers of fill. Loose or unstable soils should be removed and replaced to provide a stable platform prior to placement of fill.

Compaction Requirements: A representative of the geotechnical engineer should observe fill placement operations on a regular basis. We recommend the following minimum compaction criteria be used on the project.

Area	Percentage of Standard Proctor Maximum Dry Density (ASTM D 698)
Below Foundation Elements	98%
Floor Slab Subgrade and Foundation Wall Backfill	95%
Beneath Pavement areas / Flatwork/Utility Trenches	95%
Landscape and Other Misc. Overlot Fill Areas	90%
For compaction of onsite or import soils, a moisture content within 2 percent of optimum should be maintained during placement and compaction.	

EXCAVATION CONSIDERATIONS

In our opinion, it is anticipated that the on-site soils encountered in the exploratory borings drilled for this study can be excavated with conventional duty construction equipment. All excavations should be in accordance with OSHA, state and local requirements. The contractor should follow appropriate safety precautions. In accordance with OSHA guidelines, the upper soils will likely classify as a Type B material. If materials different from those indicated in this report are encountered, the OSHA soil type may vary and need to be adjusted. The contractor's competent person should make decisions regarding cut slopes. Per OSHA criteria, unless excavations are shored, temporary dry excavations in Type B soils shall have slopes no steeper than 1 horizontal to 1 vertical. The underlying sandy gravel and cobbles soil will likely classify as a Type C material with temporary dry slopes of 1½ Horizontal to 1 Vertical or flatter. Shoring will be required where excavated slopes cannot be accommodated. OSHA regulations require that excavations greater than 20 feet in depth and excavations that extend below the ground water level be designed by a professional engineer.

Groundwater was encountered in the borings below the expected excavation depths but may be encountered during construction as seasonal perched water or rise in the groundwater level. If water seepage is encountered, flatter slopes will be required. Dewatering during construction can likely be handled by the use of trenches and sumps for shallow drawdown. Surface drainage should be diverted away from all temporary cut slopes in order to reduce the potential for slope erosion and instability.

SURFACE DRAINAGE

Proper surface drainage is very important for acceptable performance of the facilities during construction and after construction has been completed. Drainage recommendations provided by local, state and national entities should be followed based on the intended use of the structure. The following recommendations should be used as guidelines and changes should be made only after consultation with the geotechnical engineer.

1. Excessive wetting of the foundation and slab subgrades should be avoided during construction.
2. Exterior backfill should be compacted according to the "Earthwork and Site Grading" section of this report.

3. Care should be taken when compacting around the foundation walls and underground structures to avoid damage to the structure. Hand compaction procedures, if necessary, should be used to prevent lateral pressures from exceeding the design values.
4. The ground surface surrounding the exterior of the building 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 in unpaved areas. Site drainage beyond the 10-foot zone should be designed to promote runoff and reduce infiltration. A minimum slope of 2 inches in the first 10 feet is recommended in the paved areas. These slopes may be changed as required for handicap access points in accordance with the Americans with Disabilities Act.
5. Ponding of water should not be allowed in backfill material or in a zone within 10 feet of the foundation walls, whichever is greater.
6. Backfill material should meet the requirements stated in the "Earthwork and Site Grading" section of the report.
7. Roof downspouts and drains should discharge well beyond the limits of all backfill.

PAVEMENT DESIGN

Subgrade Materials: The subgrade materials encountered at the site are variable and generally classified as A-4 in accordance with the American Association of State Highway Transportation Officials (AASHTO) classification. Based on the soil classification and our experience with similar projects, an Hveem R-value of 15 was assumed for design of flexible pavements and a corrected subgrade modulus of 75 pounds per cubic inch (pci) was assumed for rigid pavements.

Design Traffic: Traffic loading information was not available at the time of report preparation. Based on our experience, we assumed an equivalent 18-kip daily load application (EDLA) of 5 for standard duty areas (parking areas restricted to automobile traffic) and an EDLA of 20 for the heavy-duty areas (drive lanes and areas with auto and truck traffic, including occasional delivery trucks, and fire trucks with HS20 loading). If it is determined that actual traffic is significantly different from that assumed, we should be contacted to reevaluate the pavement thickness design.

Pavement Sections: The recommended sections were determined using an in-house spreadsheet based on the 1993 AASHTO pavement design procedures. Based on the subgrade conditions encountered and the traffic information provided, we recommend the following pavement sections:

Location	Asphalt Over Aggregate Base Course (inches)	Concrete Over Aggregate Base Course (inches)
Standard Duty	3 over 8	6 over 4
Heavy Duty	4 over 8	7 over 4

We recommend trash pickup areas and other areas where truck turning movements are concentrated be paved with Portland cement concrete.

Pavement Materials: Asphalt should consist of a mixture of aggregate, filler and asphalt cement established by a qualified engineer. Aggregate Base Course (ABC) should conform to the requirements of AASHTO M147 and to Section 703.03 of the CDOT Standard Specifications for Road and Bridge Construction. The ABC should meet Class 6 grading and quality as defined by the CDOT specifications. The ABC should have a minimum R-value of 77 and a minimum dry unit weight of 120 pcf when placed at the required compaction. The ABC must also meet all other appropriate CDOT specifications.

Concrete pavement should meet the requirements of a Class P Mix, per Section 601 of the CDOT Standard. Specifications, and should be based on a mix design established by a qualified engineer. Concrete joint spacing should be established by a qualified engineer. Concrete should be cured by protecting against loss of moisture, rapid temperature changes and mechanical injury for at least three days after placement. The concrete sections presented above are assumed to be unreinforced. Providing dowels at construction joints would help reduce the risk of differential movements between panel sections. Providing a grid mat of deformed rebar or welded wire mesh within the concrete pavement section would assist in mitigating corner breaks and differential panel movements. If a rebar mat is installed, we recommend that the bars be placed in the lower half of the pavement section. Also, if reinforcing is used, we have commonly seen No. 4 rebar placed at 24-inch center in each direction, however, we recommend that a structural engineer evaluate the placement and spacing of rebar if needed. Concrete pavement will be more sensitive to settlement or heave-related movements than asphalt pavement.

Subgrade Preparation: The existing fill soils should be removed and replaced with structural fill to design subgrade level. Prior to placing the pavement section, the entire subgrade area should be thoroughly scarified and well-mixed to a minimum depth of 8 inches, and adjusted to the moisture content and compaction criteria presented in the “Earthwork and Site Grading” section of the report. Following scarification and compaction, the pavement subgrade should be proof rolled with a heavily loaded pneumatic-tired vehicle. The vehicle should have a gross weight of at least 50,000 lbs., with a single loaded axel weight of 18,000 lbs., and a tire pressure of 100 psi.

Pavement design procedures assume a stable subgrade. Areas that deform excessively under heavy wheel loads are not stable and should be removed and replaced to achieve a stable subgrade prior to paving.

Drainage: The collection and diversion of surface drainage away from paved areas is extremely important to the satisfactory performance of the pavement. Drainage design should provide for the removal of water from paved areas and prevent the wetting of the subgrade soils.

Maintenance: Periodic maintenance of paved areas is critical to achieve the design pavement life. Crack sealing should be performed annually as new cracks appear. Joint seals in concrete should be replaced as they deteriorate. Chip seals, fog seals, or slurry seals applied at approximate intervals of 3 to 5 years are usually necessary for asphalt. As conditions warrant, it may be necessary to perform patching and structural overlays at approximate 10-year intervals.

DESIGN AND SUPPORT SERVICES

Kumar & Associates, Inc. should be retained to review the project plans and specifications for conformance with the recommendations provided in our report. We are also available to assist the design team in preparing specifications for geotechnical aspects of the project, and performing additional studies if necessary to accommodate possible changes in the proposed construction.

We recommend that Kumar & Associates, Inc. be retained to provide construction observation and testing services to document that the intent of this report and the requirements of the plans and specifications are being followed during construction. This will allow us to identify possible variations in subsurface conditions from those encountered during this study and to allow us to re-evaluate our recommendations, if needed. We will not be responsible for implementation of the recommendations presented in this report by others, if we are not retained to provide construction observation and testing services.

LIMITATIONS

This study has been conducted to develop geotechnical related design and construction criteria for the project. The conclusions and recommendations submitted in this report are based upon the data obtained from the exploratory borings at the locations indicated on Fig. 1 and the proposed type of construction. Our findings include interpolation and extrapolation of the subsurface conditions identified at the exploratory borings and variations in the subsurface conditions may not become evident until excavation is performed. If conditions encountered during construction appear different from those described in this report, we should be notified so that re-evaluation of the recommendations may be made. 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 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.

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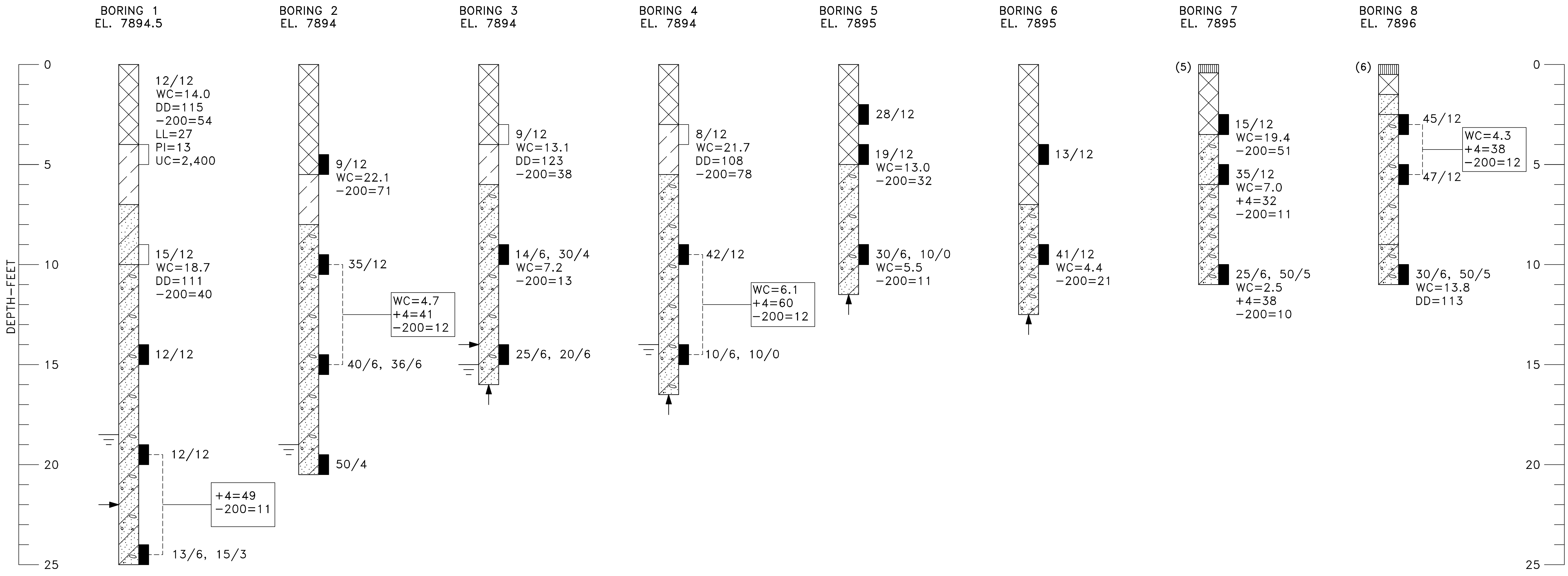
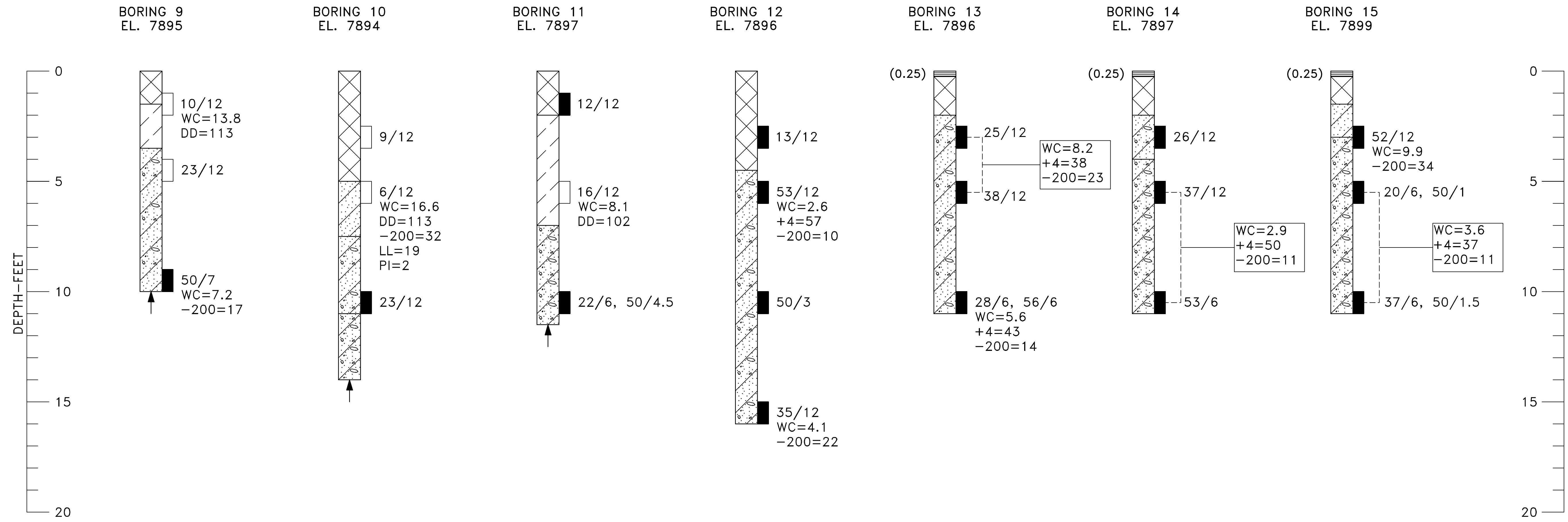
22–7–293	Kumar & Associates	MIDTOWN VILLAGE, MINTURN	LOCATION OF EXPLORATORY BORINGS	Fig. 1



22-7-293	Kumar & Associates	MIDTOWN VILLAGE, MINTURN	LOGS OF EXPLORATORY BORINGS	Fig. 2



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22-7-293	Kumar & Associates	MIDTOWN VILLAGE, MINTURN	LOGS OF EXPLORATORY BORINGS	Fig. 3

LEGEND

(0.25) ASPHALT, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

(5) CONCRETE, THICKNESS IN INCHES SHOWN IN PARENTHESES TO LEFT OF THE LOG.

FILL: SILTY TO CLAYEY SAND AND GRAVEL, COBBLES, SOME ORGANICS, LOOSE, MOIST, BROWN TO BLACK.

CLAY (CL); SILTY, SANDY, MEDIUM STIFF TO STIFF, MOIST, BROWN, LOW PLASTICITY.

SAND (SM); SILTY, SLIGHTLY CLAYEY, GRAVELLY, LOOSE TO MEDIUM DENSE, MOIST, BROWN.

SAND AND GRAVEL (SM-GM); SILTY, COBBLES WITH DEPTH, MEDIUM DENSE TO DENSE, MOIST TO WET WITH DEPTH, BROWN.

GRAVEL (GM); SILTY, SANDY, COBBLES, POSSIBLE BOULDERS, MEDIUM DENSE TO DENSE, MOIST TO WET WITH DEPTH, BROWN.

DRIVE SAMPLE, 2-INCH I.D. CALIFORNIA LINER SAMPLE.

DRIVE SAMPLE, 1 3/8-INCH I.D. SPLIT SPOON STANDARD PENETRATION TEST.

10/12 DRIVE SAMPLE BLOW COUNT. INDICATES THAT 10 BLOWS OF A 140-POUND HAMMER FALLING 30 INCHES WERE REQUIRED TO DRIVE THE SAMPLER 12 INCHES.

DEPTH TO WATER LEVEL ENCOUNTERED AT THE TIME OF DRILLING.

DEPTH AT WHICH BORING CAVED.

PRACTICAL AUGER REFUSAL.

NOTES

1. THE EXPLORATORY BORINGS WERE DRILLED ON MAY 31, 2022 WITH A 4-INCH DIAMETER CONTINUOUS-FLIGHT POWER AUGER.

2. THE LOCATIONS OF THE EXPLORATORY BORINGS WERE MEASURED APPROXIMATELY BY PACING FROM FEATURES SHOWN ON THE SITE PLAN PROVIDED.

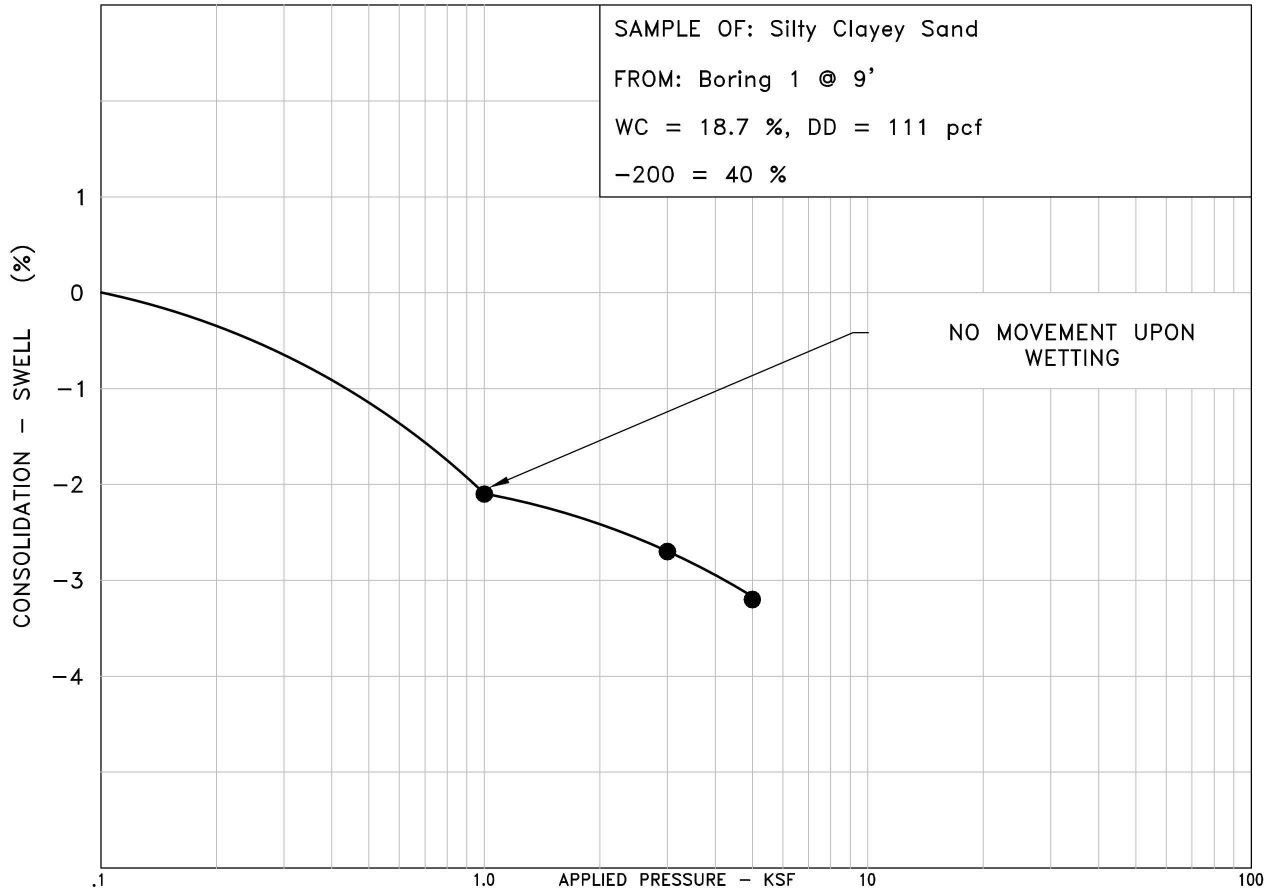
3. THE ELEVATIONS OF THE EXPLORATORY BORINGS WERE OBTAINED BY INTERPOLATION BETWEEN CONTOURS ON THE SITE PLAN PROVIDED.

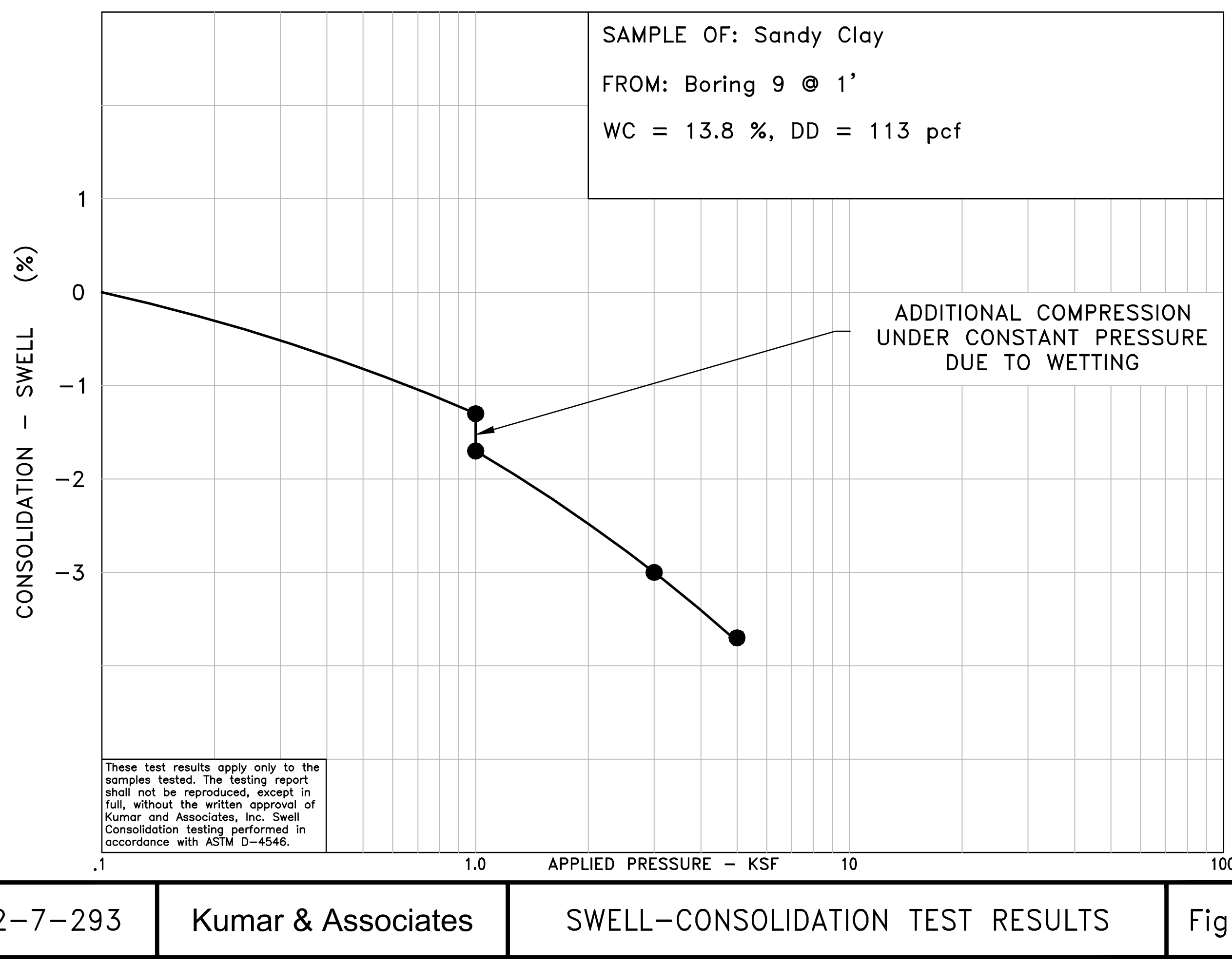
4. THE EXPLORATORY BORING LOCATIONS AND ELEVATIONS SHOULD BE CONSIDERED ACCURATE ONLY TO THE DEGREE IMPLIED BY THE METHOD USED.

5. THE LINES BETWEEN MATERIALS SHOWN ON THE EXPLORATORY BORING LOGS REPRESENT THE APPROXIMATE BOUNDARIES BETWEEN MATERIAL TYPES AND THE TRANSITIONS MAY BE GRADUAL.

6. GROUNDWATER LEVELS SHOWN ON THE LOGS WERE MEASURED AT THE TIME AND UNDER CONDITIONS INDICATED. FLUCTUATIONS IN THE WATER LEVEL MAY OCCUR WITH TIME.

7. LABORATORY TEST RESULTS:
   WC = WATER CONTENT (%) (ASTM D2216);
   DD = DRY DENSITY (pcf) (ASTM D2216);
   +4 = PERCENTAGE RETAINED ON NO. 4 SIEVE (ASTM D6913);
   -200= PERCENTAGE PASSING NO. 200 SIEVE (ASTM D1140);
   LL = LIQUID LIMIT (ASTM D4318);
   PI = PLASTICITY INDEX (ASTM D4318);
   UC = UNCONFINED COMPRESSIVE STRENGTH (psf) (ASTM D 2166);





22-7-293	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 5

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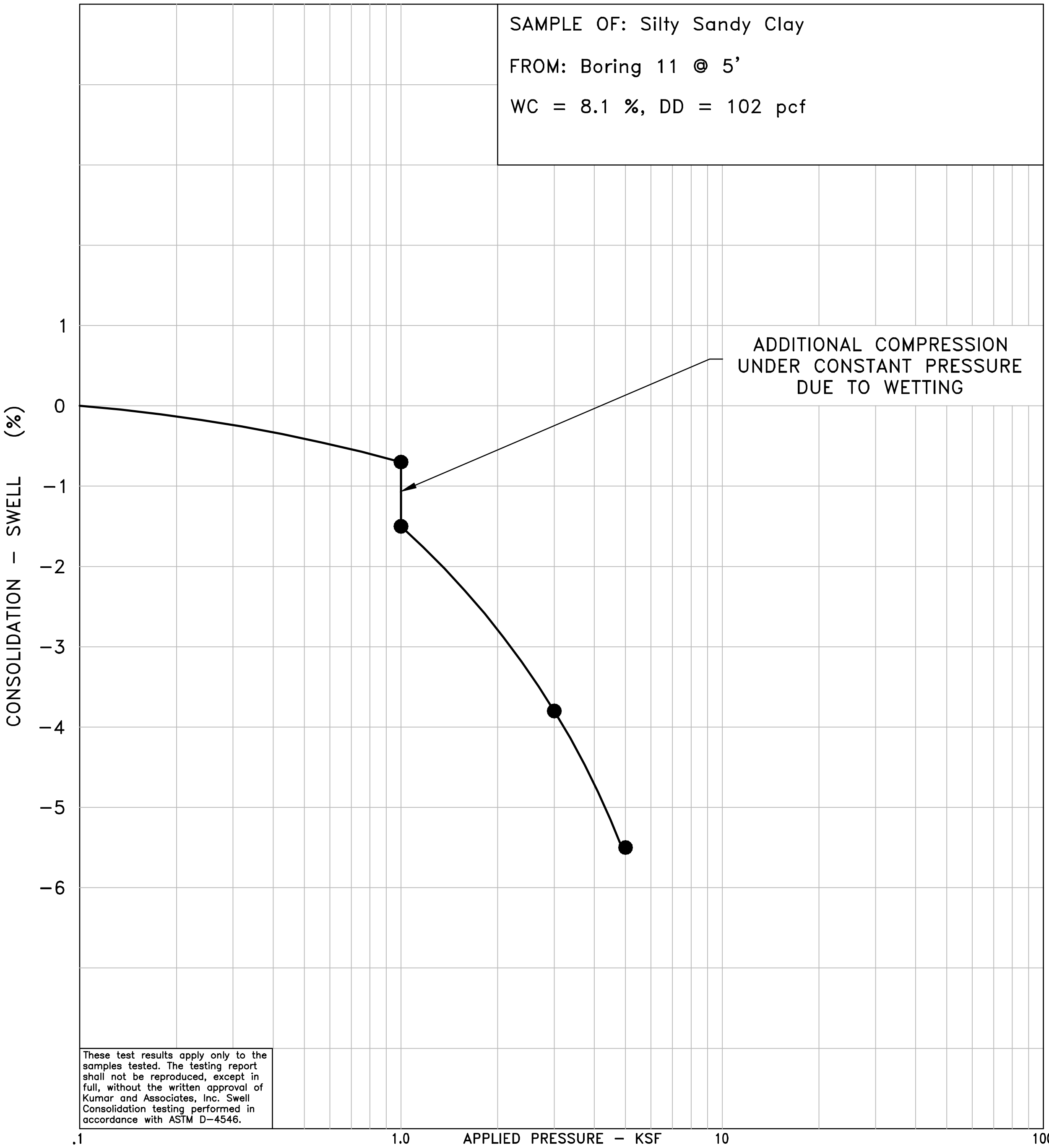
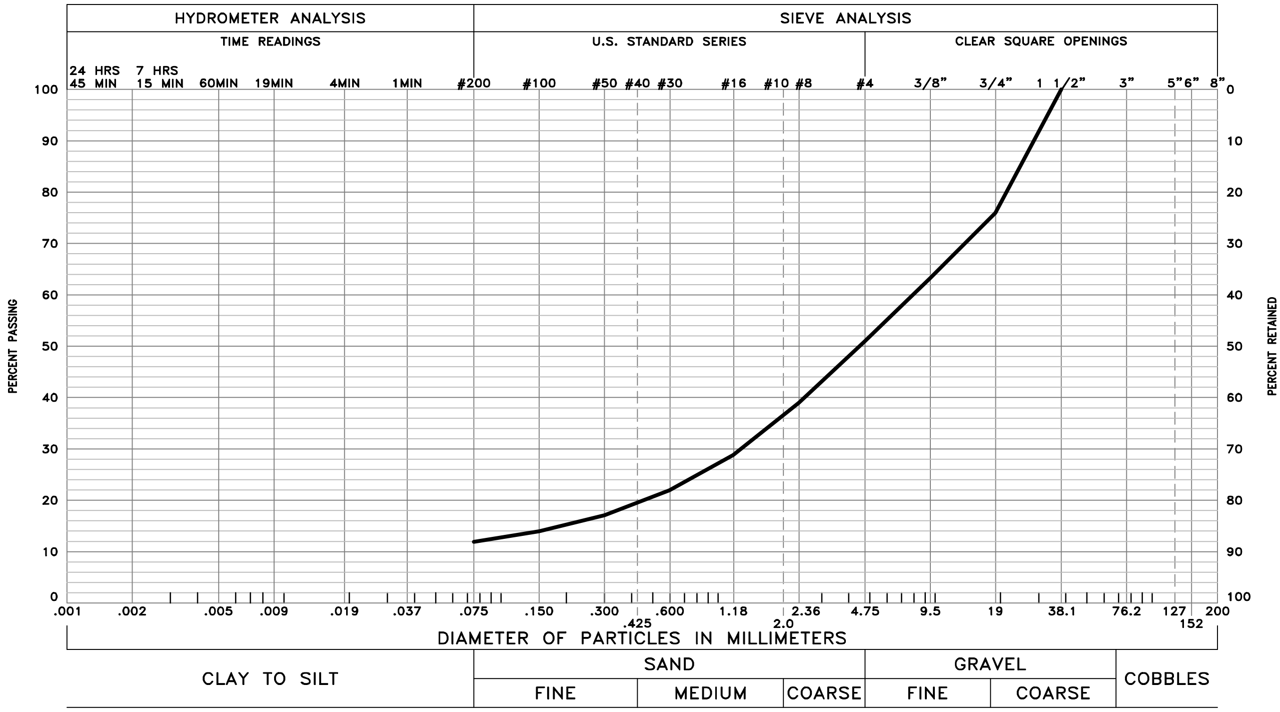


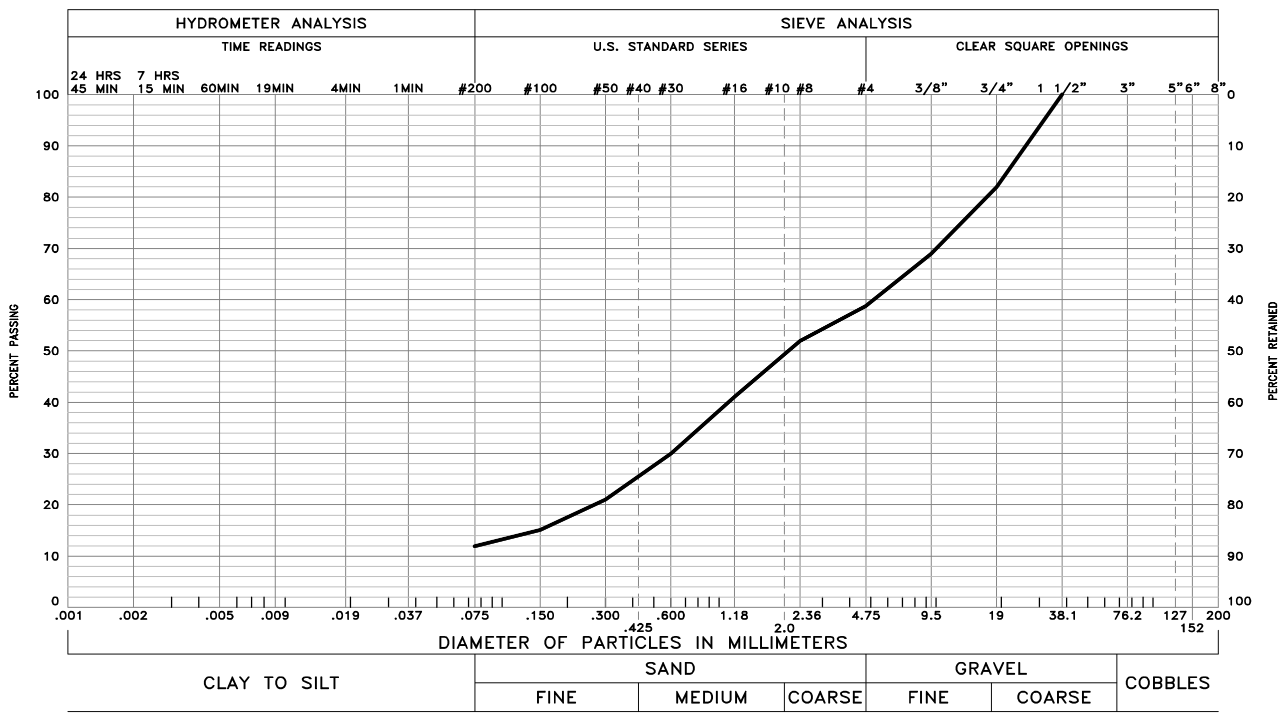
22-7-293	Kumar & Associates	SWELL-CONSOLIDATION TEST RESULTS	Fig. 6



GRAVEL 49 % SAND 40 % SILT AND CLAY 11 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy Gravel FROM: Boring 1 @ 19' & 24 (Combined)



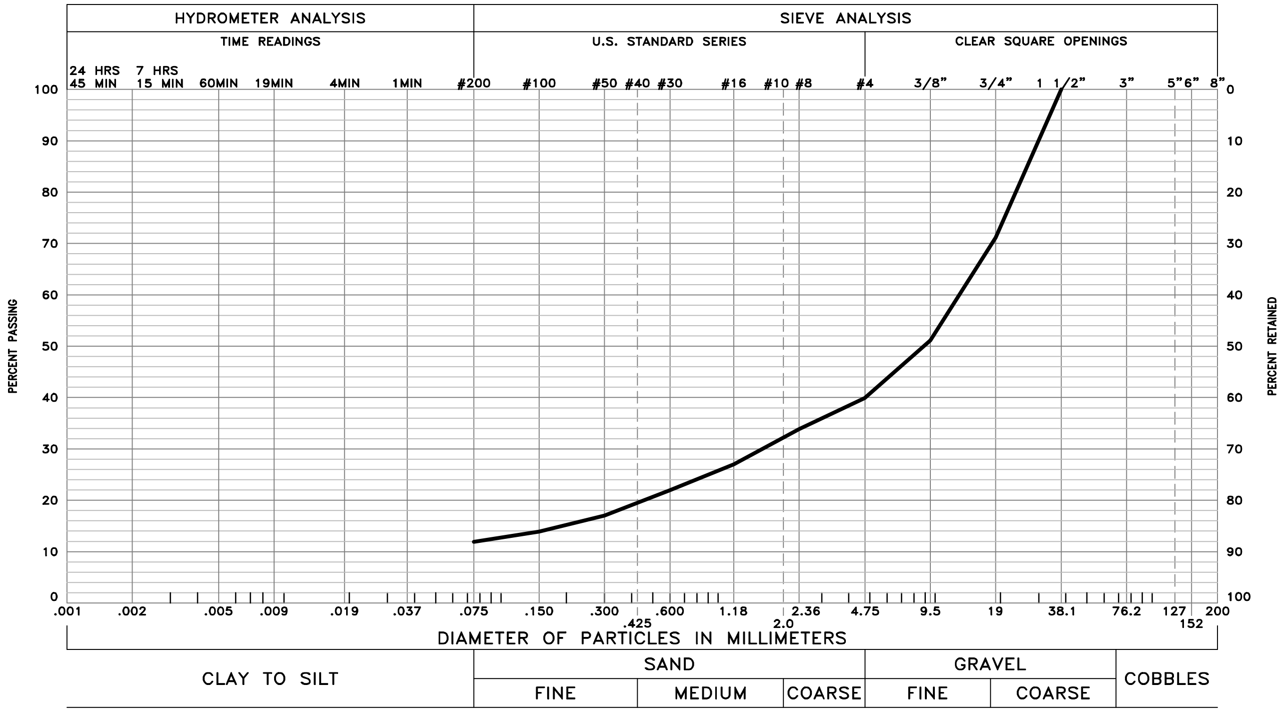
GRAVEL 41 % SAND 47 % SILT AND CLAY 12 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand and Gravel FROM: Boring 2 @ 9.5 & 14.5 (Combined)

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

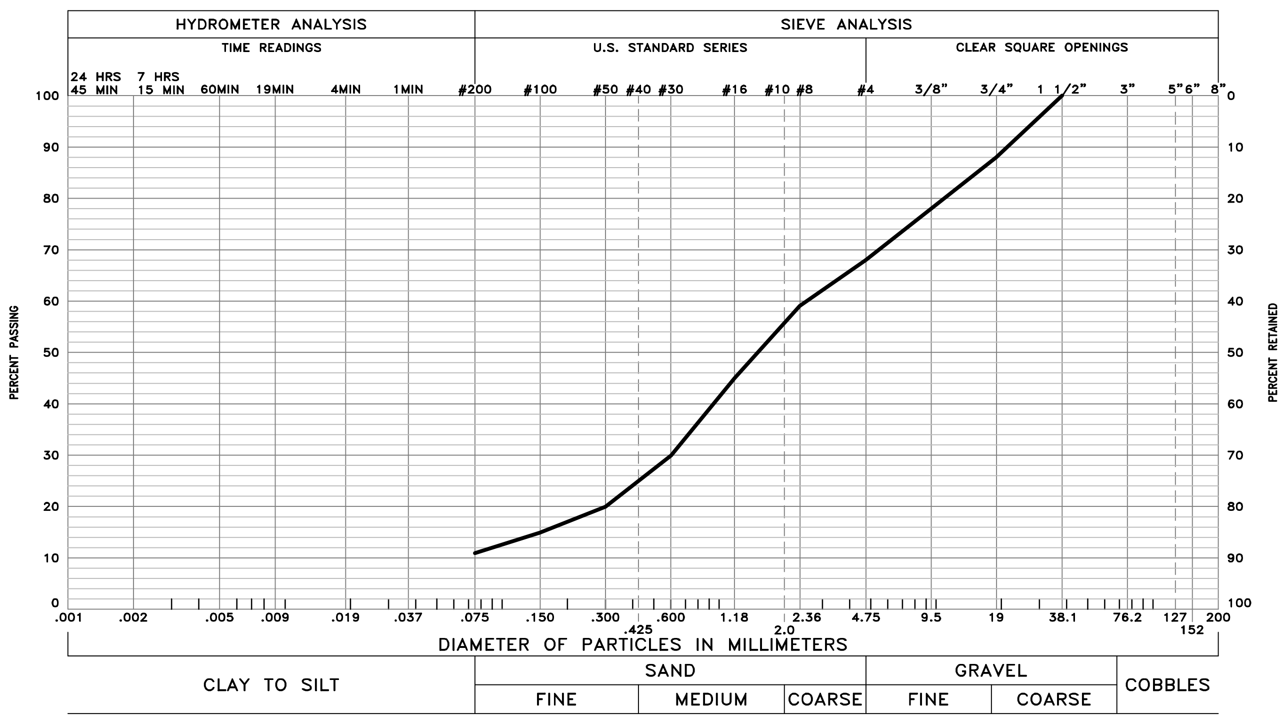
July 25, 2022 – 06:37am
V:\Projects\2022\22-7-293 Proposed Midtown Village\Drafting\227293 07 to 12.dwg



GRAVEL 60 % SAND 28 % SILT AND CLAY 12 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy Gravel FROM: Boring 4 @ 9' & 14' (Combined)

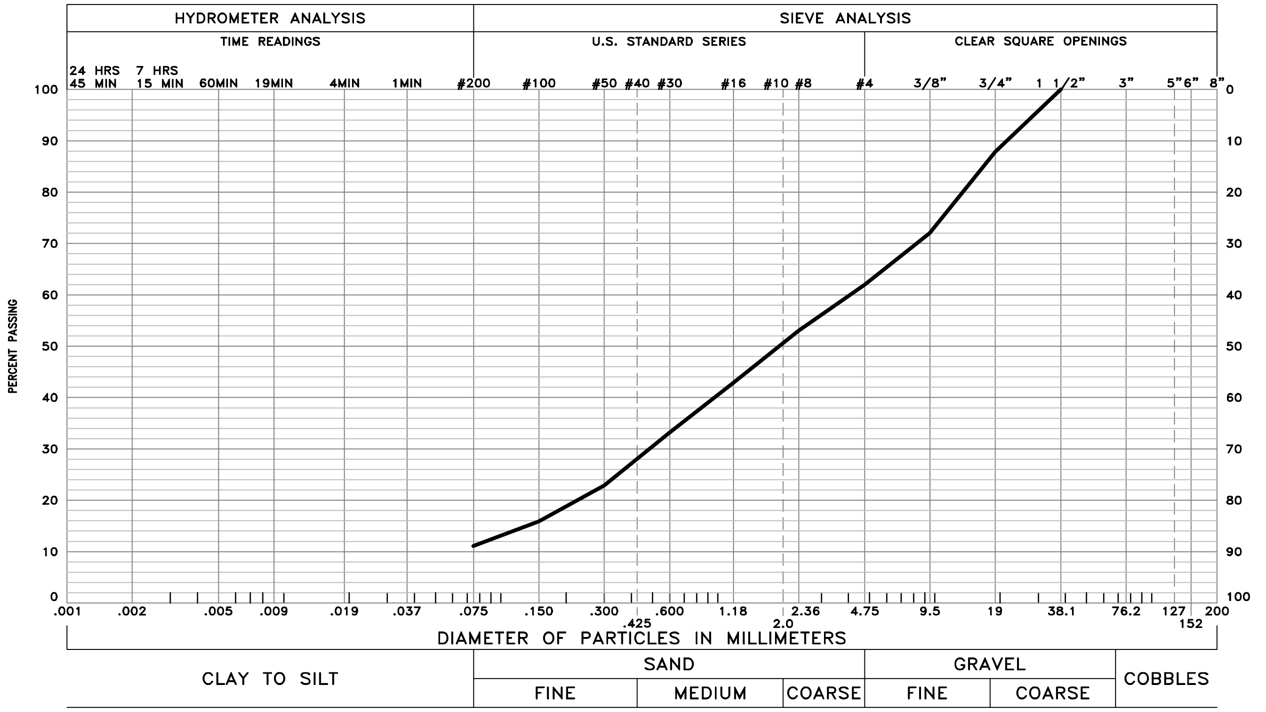


GRAVEL 32 % SAND 57 % SILT AND CLAY 11 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand with Gravel FROM: Boring 7 @ 5'

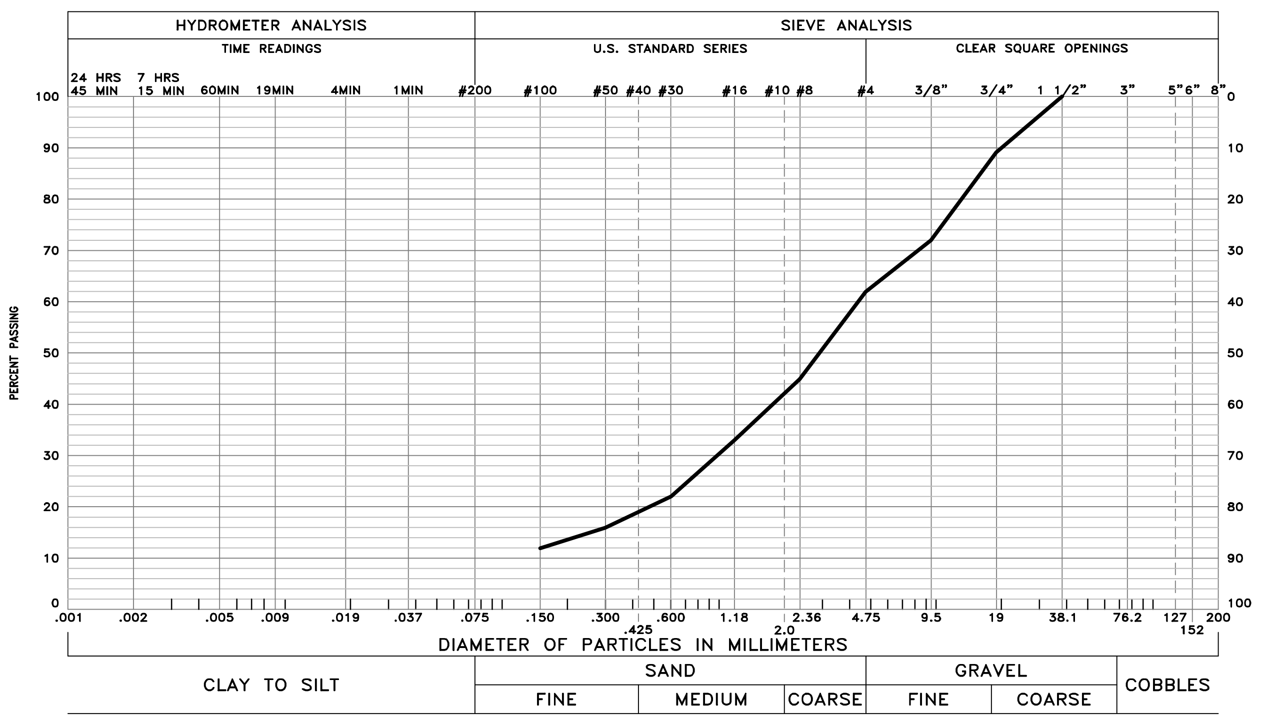
These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



GRAVEL 38 % SAND 52 % SILT AND CLAY 10 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand and Gravel FROM: Boring 7 @ 10'



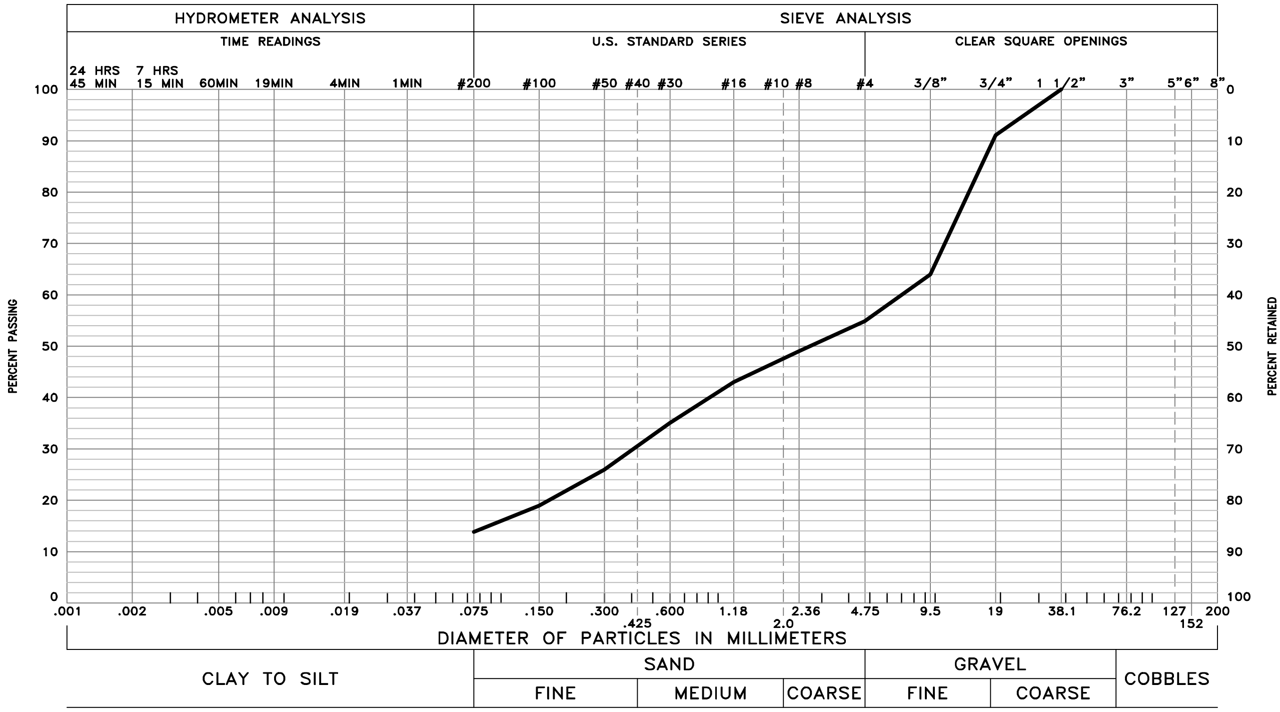
GRAVEL 38 % SAND 50 % SILT AND CLAY 12 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand with Gravel FROM: Boring 8 @ 2.5' & 5 ' (Combined)

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

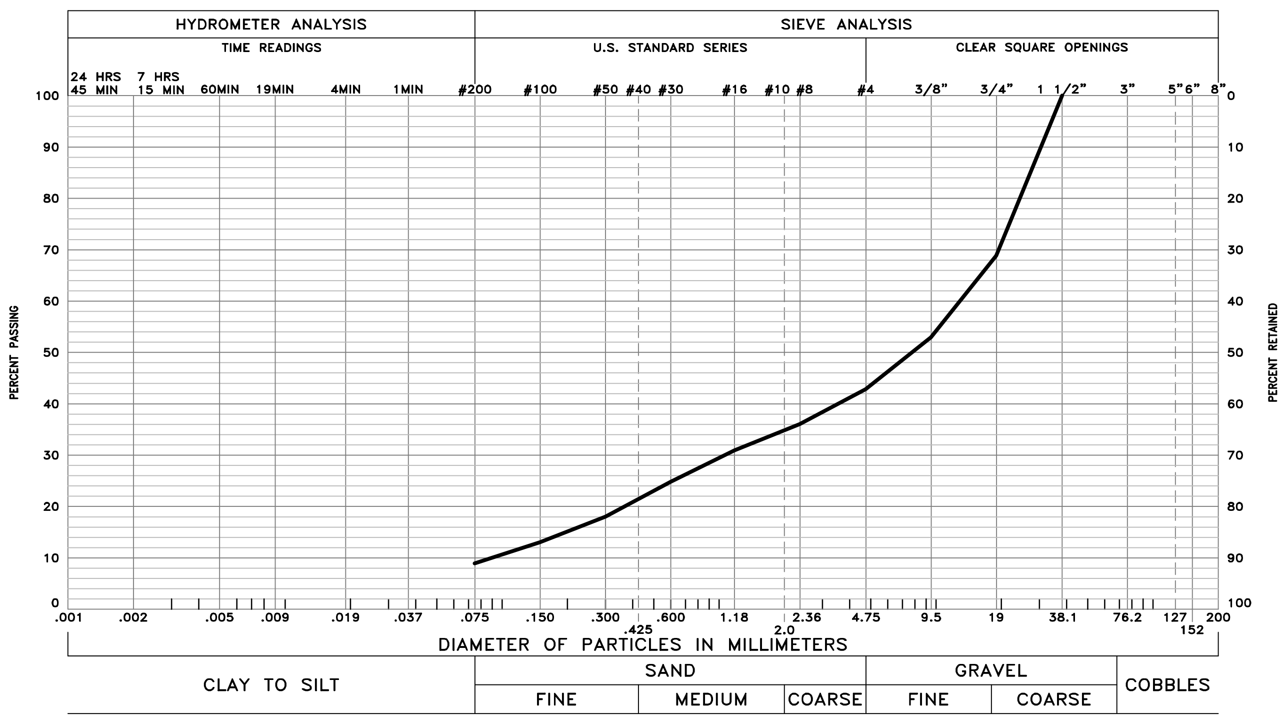
22-7-293	Kumar & Associates	GRADATION TEST RESULTS	Fig. 9



GRAVEL 45 % SAND 42 % SILT AND CLAY 13 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy Gravel FROM: Boring 8 @ 10'

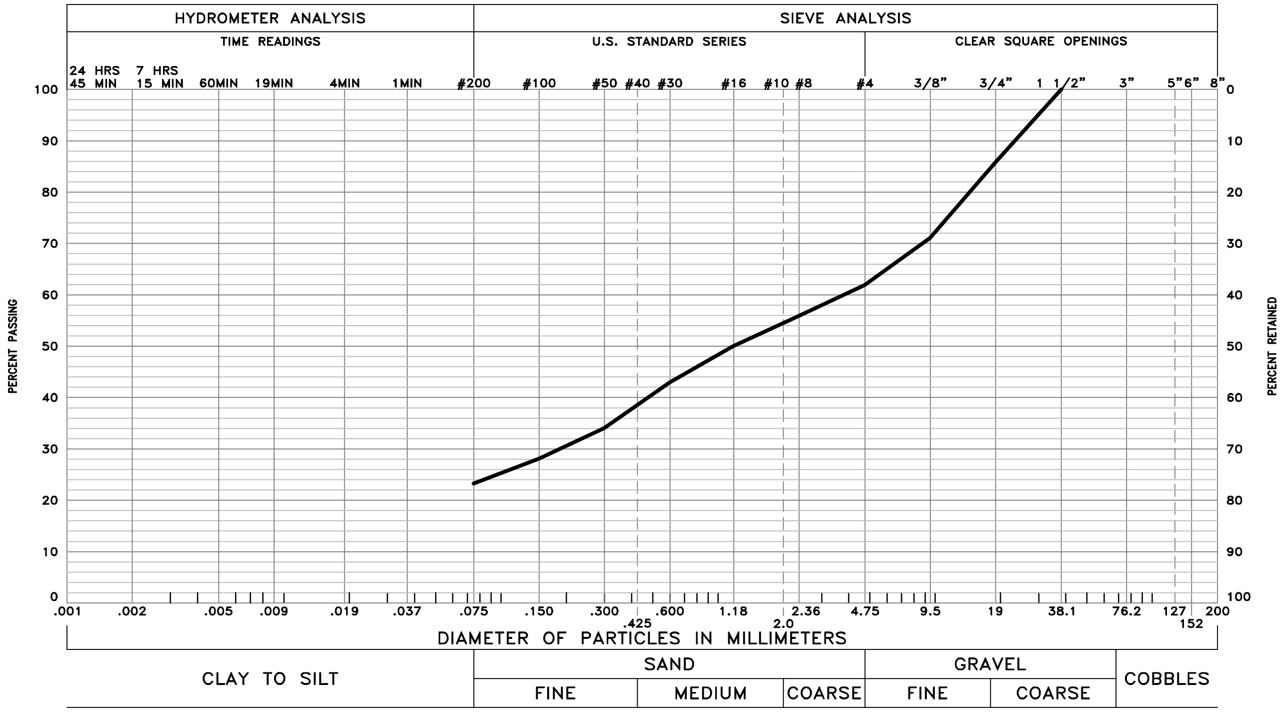


GRAVEL 57 % SAND 33 % SILT AND CLAY 10 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy Gravel FROM: Bring 12 @ 5'

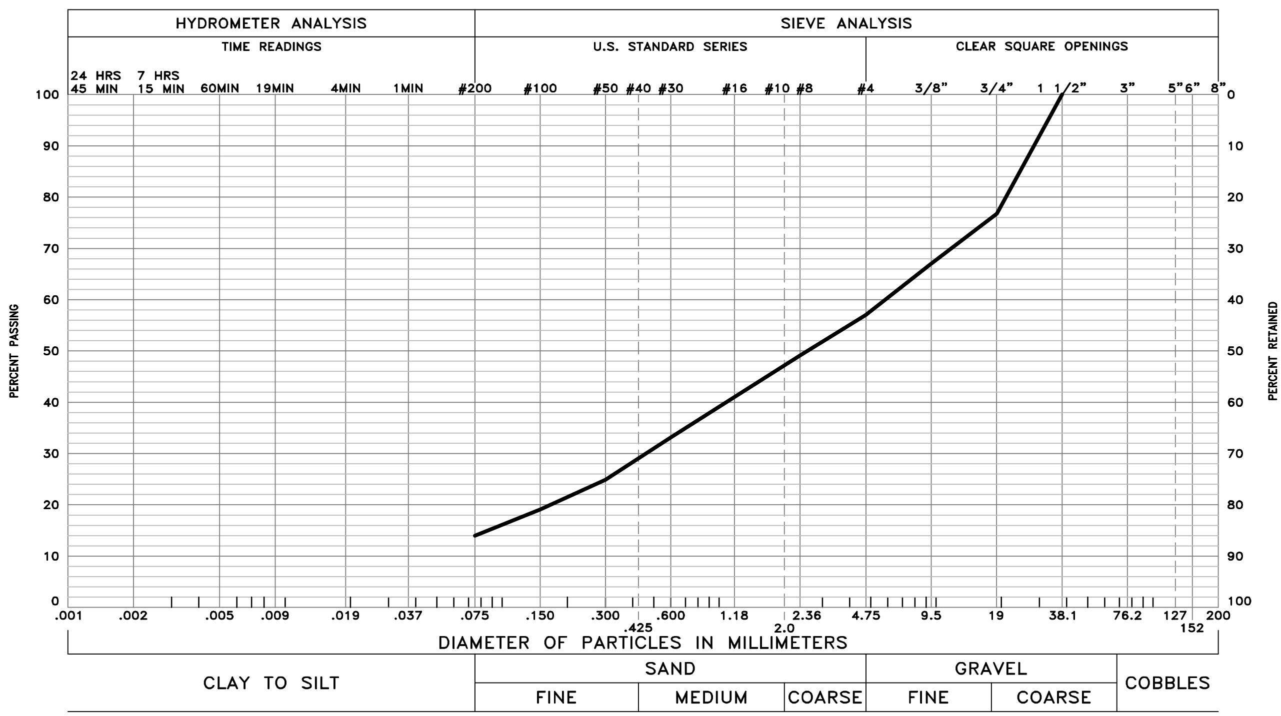
These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



GRAVEL 38 % SAND 39 % SILT AND CLAY 23 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand and Gravel FROM: Boring 13 @ 2.5' & 5' (Combined)

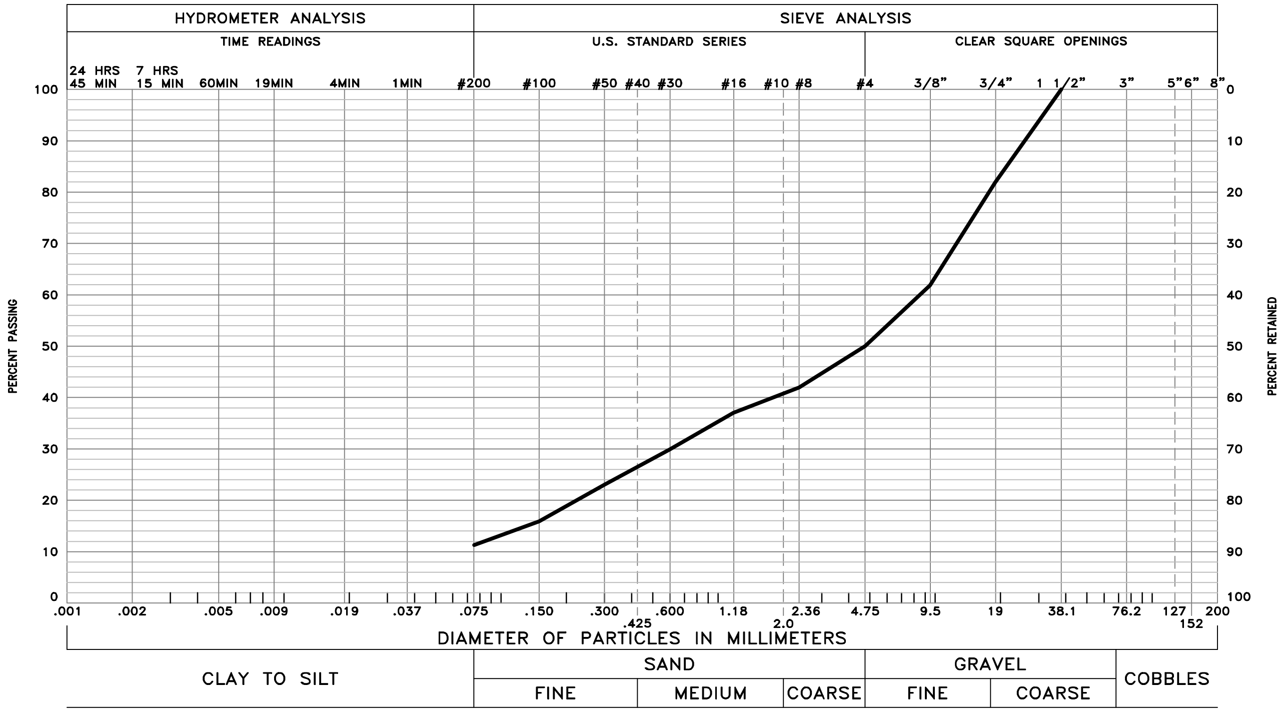


GRAVEL 43 % SAND 43 % SILT AND CLAY 14 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand and Gravel FROM: Boring 13 @ 10'

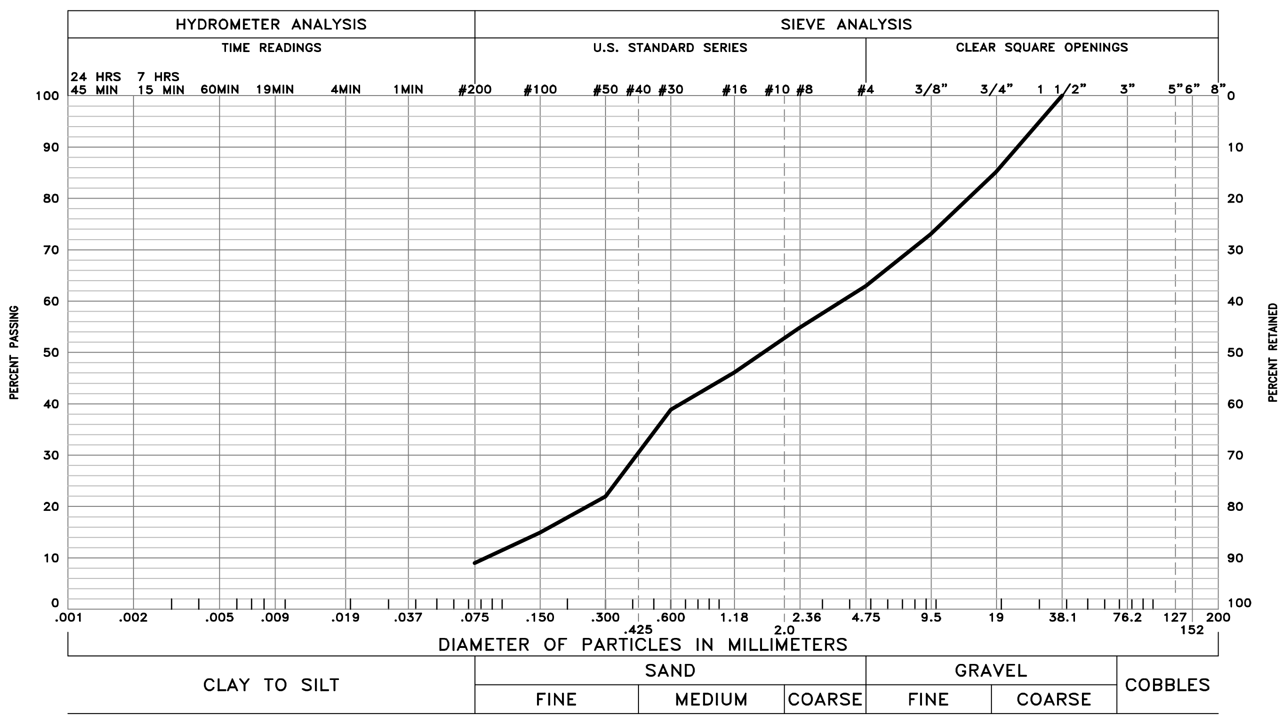
Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.



GRAVEL 50 % SAND 39 % SILT AND CLAY 11 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sandy Gravel FROM: Boring 14 @ 5' & 10' (Combined)



GRAVEL 37 % SAND 52 % SILT AND CLAY 11 %

LIQUID LIMIT – PLASTICITY INDEX –

SAMPLE OF: Silty Sand and Gravel FROM: Boring 15 @ 5' & 10' (Combined)

These test results apply only to the samples which were tested. The testing report shall not be reproduced, except in full, without the written approval of Kumar & Associates, Inc. Sieve analysis testing is performed in accordance with ASTM D6913, ASTM D7928, ASTM C136 and/or ASTM D1140.

22-7-293	Kumar & Associates	GRADATION TEST RESULTS	Fig. 12

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

TABLE 1
SUMMARY OF LABORATORY TEST RESULTS

SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY DENSITY	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH		SOIL TYPE
BORING	DEPTH (ft)	(%)	(pcf)	GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)	(psf)		
1	4	14.0	115			54	27	13	2,400		Sandy Silty Clay
	9	18.7	111			40					Silty Clayey Sand
	19 and 24 combined			49	40	11					Silty Sandy Gravel
2	4½	22.1				71					Sandy Silty Clay (Fill)
	9½ & 14½ combined	4.7		41	47	12					Silty Sand and Gravel
3	3	13.1	123			38					Clayey Sand and Gravel (Fill)
	9	7.2				13					Silty Sand and Gravel
4	3	21.7	108			78					Sandy Silty Clay
	9 and 14 combined	6.1		60	28	12					Silty Sandy Gravel

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and Environmental Scientists

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SUMMARY OF LABORATORY TEST RESULTS

Project No. 22-7-293

SAMPLE LOCATION		NATURAL MOISTURE CONTENT	NATURAL DRY DENSITY	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH		SOIL TYPE
BORING	DEPTH (ft)	(%)	(pcf)	GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)	(psf)		
5	4	13.0				32					Silty Gravelly Sand (Fill)
	9	5.5				11					Silty Sand and Gravel
6	9	4.4				21					Silty Sand and Gravel
7	2½	19.4				51					Very Sandy Clay (Fill)
	5	7.0		32	57	11					Silty Sand with Gravel
	10	2.5		38	52	10					Silty Sand and Gravel
8	2½ and 5 combined	4.3		38	50	12					Silty Sand with Gravel
	10	4.2		45	42	13					Silty Sandy Gravel
9	1	13.8	113								Sandy Clay
	9	7.2				17					Silty Sand and Gravel

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Project No. 22-7-293

SAMPLE LOCATION		NATURAL MOISTURE CONTENT (%)	NATURAL DRY DENSITY (pcf)	GRADATION		PERCENT PASSING NO. 200 SIEVE	ATTERBERG LIMITS		UNCONFINED COMPRESSIVE STRENGTH (psf)		SOIL TYPE
BORING	DEPTH (ft)			GRAVEL (%)	SAND (%)		LIQUID LIMIT (%)	PLASTIC INDEX (%)			
10	5	16.6	113			32	19	2			Silty Clayey Sand
11	5	8.1	102								Silty Sandy Clay
12	5	2.6		57	33	10					Silty Sandy Gravel
	15	4.1				22					Silty Sand and Gravel
13	2½ and 5 combined	8.2		38	39	23					Silty Sand and Gravel
	10	5.6		43	43	14					Silty Sand and Gravel
14	5 and 10 combined	2.9		50	39	11					Silty Sandy Gravel
15	2½	9.9				34					Silty Clayey Sand with Gravel
	5 and 10 combined	3.6		37	52	11					Silty Sand and Gravel