GEOTECHNICAL SUMMARY REPORT FOR:
PROPOSED DOLLAR GENERAL
WESTERN AVENUE
MANCHESTER, MAINE 04351

TO:
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JTC PROJECT NO: 14-15-039

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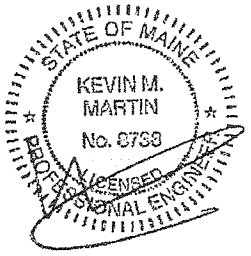

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FROM: Judson Zachar, P.E.
Staff Engineer

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Geotechnical Engineer

DATE: June 16, 2014

RE: **GEOTECHNICAL SUMMARY REPORT**
PROPOSED DOLLAR GENERAL
WESTERN AVENUE
MANCHESTER, MAINE
Project No. 14-15-039

This memorandum serves as a geotechnical report for the referenced project. The contents of this report are subject to the attached ***Limitations***.

SITE & PROJECT DESCRIPTION

The project site is located on a vacant lot. Specifically, the site consists of a cleared, grassed landscape lot with some perimeter woodlands. We were provided with limited *Site Plans* at the time of this study. Specifically, an *Aerial Photo & Plot Plan* with no existing conditions and no grading were provided for our use. The *Plot Plan* does provide the proposed layout of the store and associated parking. JTC has no knowledge of past site work, construction and/or development of the property. The majority of the site is generally level given past grading and filling. It was reported and noticeably evident that fill was necessary to achieve present grade. Steepened embankment slopes (≈1H:1V) are evident along the eastern and southern project limits. These embankment slopes vary from about ≈5-12 ft in height attenuating to the front (north) as shown on the attached Sketch.

The project includes a new retail store. The building is to consist of a single-story building about 9,100 ft² in footprint area. It is intended to support the building on a conventional spread footing foundation with a concrete floor slab-on-grade. We anticipate that maximum wall loads will be in the order of ≈3 kips per linear foot and ≈30 kips for the strip-wall footings and column pads, respectively. Paved parking will be provided to the north and west of the store. Again, *Grading Plans* were not provided at the time of this study. It is expected that shallow cuts or fills (less than ≈1-2 ft) will be necessary to accommodate final grades. The purpose of this study is to provide a preliminary geotechnical evaluation as it pertains to foundation design and associated construction.

SUBSURFACE EXPLORATIONS & LABORATORY TESTING

Test Borings

The subgrade conditions were reviewed with eight (8) test borings completed throughout the site. The test borings (identified as B1 to B8) were advanced to depths of about ≈12-22 ft utilizing 2¼ inch continuous flight hollow stem augers. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2-inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (*Standard Method for Penetration Test and Split-Barrel Sampling of Soils*). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater and other pertinent data are contained on the attached *Test Boring Logs*. The test borings were located by referencing existing site features as shown on the *Test Boring Location Plan*.

Laboratory Testing

Several selected split-spoon samples obtained from the test borings were submitted to our laboratory for sieve analyses and in-situ moisture per ASTM Standards. The purpose of the testing was to assess engineering characteristics for design and to assess the suitability of the site soils for re-use as structural fill on the project. The test results are attached for review.

SUBGRADE CONDITIONS

The subgrade conditions generally include (1) undocumented Fill underlain by (2) by Organic soils then (3) stable Glacial deposits.

A thin Topsoil blankets the site being only a few inches in thickness.

Some deep Fill was encountered throughout the site to depths of about ≈5-10½ ft being deeper towards the rear (south). The limits of the Fill are apparent given the steepened, perimeter embankment slopes. The Fill generally includes a silty Sand with variable gravel. There were pockets of Silt (B1) as well as wood (B4) embedded in the Fill as well as some granular soils. The relative density of the Fill varies from loose to medium dense suggesting uncontrolled placement. There is no engineering documentation regarding the placement, compaction and/or testing of the Fill.

Some buried Organic laden soils were present in most areas below the Fill. These soils include a grey to dark brown, loamy-organic, silty Sand, trace to little gravel. The collective depth of the Fill & Organic laden soils varies from ≈6-13 ft attenuating to the north. This is consistent with the filled embankment slopes.

The parent site soils typically include stable Glacial deposits. These soils include a grey, well-graded, fine to medium Sand & Gravel, some silt with layers of silty Sand and/or sandy Silt. These soils are stable, dense and compact.

Groundwater was encountered at depths of ≈6-18 ft. The shallower wet soils may be reflective of perched or trapped water in the loose Fill. Wet soils were encountered below these depths. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature and other factors differing from the time of the measurements. This study was completed at a time of seasonally normal to high groundwater.

FOUNDATION SUBGRADE RECOMMENDATIONS

The subgrade conditions warrant concern for supporting the proposed building on a conventional spread footing foundation with a concrete floor slab-on-grade. There is deep, loose Fill with buried Organic soils extending ≈8-13 ft below grade in the building pad. There is no engineering documentation regarding the Fill placement and compaction (as required by Code). Relying on the Fill & Organic soils will likely translate intolerable settlement to the foundation. It is therefore recommended the Fill, Organic laden soils and other questionable matter be fully removed from the building pad including the *Footing Zone of Influence* (*FZOI*) to expose the parent subgrade. The *FZOI* is defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay (up to ≈4 ft beyond the edge of footing). Structural Fill necessary to achieve foundation grade should conform to the *Specifications* (Table 1). A ≈1 inch minus crushed stone (or graded stone) may be used for Fill in wet conditions.

The parent subgrade soils should be exposed in the foundation areas prior to casting the footings or placing structural fill. Deep excavations (≈8-13 ft) and potential groundwater encroachment will be necessary to fully remove the Fill & Organic soils. Wet conditions (groundwater, storm water, perched water, etc) shall be temporarily maintained at least ≈1 ft below construction grade to provide a dry and stable excavation. Dewatering is expected to be controlled with temporary sumps and pumps together with a base of crushed stone. The sumps shall extend at least ≈2 ft below grade and be protected with stone. A minimum ≈18 inch base of ¾-inch minus crushed stone should be placed atop the subgrade if wet conditions are present. The sumps and pumps shall be in operation prior to foundation excavation. The stone should be *immediately* placed atop the undisturbed subgrade then tamped with a plate compactor exhibiting stable conditions. Extended exposure of the Silty subgrade will likely result in disturbance and excess seepage. The purpose of the stone base is to protect the wet subgrade, facilitate construction dewatering, aid in the placement of Structural Fill in semi-wet conditions and to provide a dry/stable base upon which to progress construction. Wet subgrade conditions are generally more problematic if construction occurs during the winter or spring seasons. The drier summer months are more

favorable for water control. We recommend budgeting stone for subgrade protection especially if site construction occurs during the winter to spring season. The Contractor should ultimately be responsible for the means and methods of temporary dewatering and subgrade protection. Proper groundwater control and storm water management are also necessary to maintain site stability.

The bearing subgrade should ultimately be stable, dewatered, protected from frost and compact throughout construction. It will be necessary to remove weakened or unstable soils and replace with a Structural Fill or crushed stone as necessary. An Engineer from JTC should be scheduled to review the foundation subgrade conditions and preparation during construction.

FOUNDATION DESIGN RECOMMENDATIONS

The footings are expected to gain bearing support atop the parent site soils and/or compacted Structural Fill (Table 1). Footings may be designed using an allowable bearing capacity of 3 ksf (FS=3). The allowable bearing capacity may be increased a third (⅓) when considering transient loads such as wind or seismic. The bearing capacity is contingent upon the perimeter strip footings and isolated column footings being no less than 2 ft and 3 ft in width respectively. For footings less than 3 ft in lateral dimension, the allowable bearing capacity should be reduced to one-third and multiplied by the least lateral footing dimension in feet. As such, the allowable bearing capacity for a 2 ft footing should be reduced to 2 ksf. Foundation settlement should be less than 1 inch with differential settlement less than ½ inch. The settlement should be elastic and occur during construction. Exterior footings shall be provided with at least 5 ft of frost protection. Proper frost protection should be necessary during winter construction.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the *International Building Code (2012)*. Based on the relative density of the site soils, the site does not appear susceptible to liquefaction (complete loss of shear resistance) in the event of an earthquake. Based on interpretation of the *Building Code* together with the project and site conditions, the *Site Classification* (Table 1615.1.1) is "D" (Stable Soil Profile).

It is recommended that a minimum 8-inch base of *Clean Granular Fill* (Table 1) be placed below the concrete floor slab for moisture and frost control. The gravel base shall be increased to no less than 12 inches for exterior concrete slabs exposed to frost (20 inches at the entrance and ramps). A subgrade modulus of 175 pci may be used for design of the floor slab. A vapor retarder should be used below the floor slab dependent upon the floor treatment. A vapor barrier should be specified by others per ACI Standards. A typical vapor retarder may include 10 mil polyethylene sheeting or StegoWrap™ lapped 8 inches at seams. A vapor retarder appears necessary given the public use of the building. Structural fill necessary within and below the foundation should also conform to the attached *Specifications* (Table 1). The existing Fill is generally suitable for re-use as Structural Fill or foundation backfill. The Fill will need to segregated from the organic soils and screened of large stones. The Fill will need to be compacted within ±2% of optimum moisture content per the Modified Proctor Test. The Fill will likely be wet and require some aeration for proper stability.

SITE DEVELOPMENT CONSIDERATIONS

Bituminous Pavement Structures

The flexible pavement recommendations are based on our experience with similar pavement structures and reference to the *AASHTO Guide for Design of Pavement Structures*. The thickness of each course is a function of the subgrade strength, traffic intensity, design life, drainage, and frost/regional conditions.

Based on the foregoing, the following is a summary of our minimum pavement structure recommendations for a 15 year design life:

Pavement Course	*Heavy Duty Traffic Conditions*	*Light Duty Traffic Conditions*
Bituminous Concrete Top Course, ME DOT	1½ inch	1½ inch
Bituminous Concrete Binder Course, ME DOT	2½ inch	1½ inch
Crushed Gravel (Base Course) ME DOT	16 inch	14 inch
TOTAL:	**20 inches**	**17 inches**

NOTES:

Heavy duty pavement areas are associated with access drives, entrances, main roadways, loading bays, etc. whereas light duty pavements are strictly for vehicular parking.

The above recommendations are based on a stable, granular subgrade that is free of organic and other weak material The subgrade should be proof rolled with a minimum 10 ton vibratory roller making at least four coverages across the pavement subgrade. Areas exhibiting unstable/weaving conditions should be over-excavated and replaced with compacted structural fill. The subgrade should ultimately be granular, stable and compact being free of organic and weak material.

The pavement recommendations recognize variable subgrade conditions with fill, granular soils, poor-draining soils, organic laden soils, etc. Additional gravel may be considered to prolong the service life of the pavement and provide additional frost protection. An additional 6 inches of Crushed Gravel would be considered beneficiary to the project and increase the service life of the pavement to ≈20 years. Periodic maintenance should still be expected with any pavement structure given the variable and undocumented subgrade.

The Crushed Gravel Base Course should be placed in controlled lifts and compacted to at least 95 percent relative compaction as determined by the Modified Proctor Test (ASTM-D1557). The adequacy of the compaction efforts should be verified by field density testing.

The pavement structure recommendations should not be construed for adequate support of haul roads, staging areas and other construction traffic. The design and maintenance of such temporary construction roads shall be reviewed by the contractor.

Bituminous concrete should be placed in accordance with the ***ME-DPW Standard Specifications for Bridge and Highway Construction***. In particular, bituminous concrete should be compacted to at least 95 percent of Marshall density per ASTM6927 within the specified temperature range (or at least 92.5 percent of Theoretical Maximum Density per ASTM D2041 or AASHTO T209). Placement temperatures of bituminous concrete mixes, in general, range between 270 and 310 degrees Fahrenheit.

A tack coat shall be placed between successive layers of the bituminous concrete. Specifically, a tack coat shall be placed atop the binder course pavement prior to placing the wearing course.

The groundwater table shall be permanently maintained at least 3 ft below final grade.

CONSTRUCTION CONCERNS

The contractor should be required to maintain stable-dewatered subgrades for foundations, pavements and other concerned areas during construction. Subgrade disturbance may be influenced by excavation methods, moisture, precipitation, groundwater control and construction activities. The site soils are considered highly vulnerable to disturbance when exposed to wet conditions and construction activities. The fine-grained composition of the soils (≈20-50% fines that passes the No. 200 sieve) impedes drainage and retains moisture. The presence of perched water or wet soils will further impact subgrade stability. The contractor should be aware of the moisture concerns and take precautions to reduce subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling footings as soon as practicable, and maintaining an effective dewatering program. Soils exhibiting weaving or instability should be over-excavated to a competent bearing soil and replaced with a crushed stone or gravel. The moisture concerns are typically more problematic if construction takes place during the winter to spring season or other periods of inclement weather. A protective base of ¾-inch minus crushed stone may be placed at least ≈12 inches below and laterally beyond the footing limits. The stone base is to protect the site soils, facilitate necessary dewatering and provide a dry/stable base upon which to progress foundation construction. The stone base shall be tamped with a plate compactor and exhibit stable and compact conditions. The Contractor shall ultimately be responsible for the means and methods to protect the subgrade during construction. We recommend a contingency budget for stone given the fine-grained, wet and poor-draining soils.

Groundwater Control

Adequate dewatering and storm water management are also necessary for maintaining the competency of the site soils. Groundwater or ponded storm water should be continuously maintained at least one foot below construction grade. The groundwater is expected to be controlled with conventional filtered sumps and pumps together with a base of crushed stone.

The footing trenches should have a positive slope towards the sumps. The sumps shall extend at least ≈2 ft below construction grade and be protected with filter stone. The sumps and pumps shall be in operation prior to foundation excavation. The stone should be *immediately* placed atop the undisturbed subgrade then tamped with a plate compactor exhibiting stable conditions. The Contractor should ultimately be responsible for the means and methods of temporary dewatering and subgrade protection.

Soils which become softened/disturbed during construction will be rendered unsuitable for structural bearing support. The foundation subgrades should ultimately be stable, dewatered, protected from frost and compact throughout construction. An Engineer from JTC should be scheduled to review the subgrade conditions and preparation.

CONSTRUCTION MONITORING

It is recommended that a qualified engineer or representative be retained to review earthwork activities such as the preparation of the foundation bearing subgrade and the placement/compaction of Structural Fill. It is recommended that JTC be retained to provide construction monitoring services. This is to observe compliance with the design concepts presented herein.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

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LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by John Turner Consulting, Inc.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of GBT Realty Corporation in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by John Turner Consulting, Inc. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations.

TABLE 1

Dollar General
Western Avenue
Manchester, ME

Recommended Soil Gradation & Compaction Specifications

Clean Granular Fill
(Select Gravel Fill)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3 inch	100
3/4 inch	60-90
No. 4	20-70
No. 200	2-8

NOTE: For minimum 8-inch base below Concrete Floor Slab-on-Grade
For minimum 12-inch base for exterior concrete slabs exposed to frost
For minimum 20-inch base at ramps and entrances
Compact to at least 95% relative compaction per ASTM D1557

Structural Fill
(Gravelly SAND, little Silt)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5 inch	100
3/4 inch	60-100
No. 4	20-80
No. 200	0-15

NOTE: For use as structural load support below the foundations
For use as backfill behind unbalanced foundation/retaining walls
A ¾-inch crushed stone may be used in wet conditions
Compact to at least 95% relative compaction per ASTM D1557

TABLE 1

Dollar General
Western Avenue
Manchester, ME

Recommended Soil Gradation & Compaction Specifications

Common Fill
(Silty SAND, little Gravel)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
6-8 inch	100
3/4 inch	60-100
No. 4	20-85
No. 200	0-30

NOTE: For use as roadway embankment fill is deep pavement areas.
Maximum stone size should be ⅔ the maximum lift thickness
Compact to at least 92% relative compaction per ASTM D1557

Structural Fill placed beneath the foundation should include the *Footing Zone of Influence* which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1H:1V splay. Structural Fill should be placed in loose lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors. All Structural Fill should be compacted to at least 95 percent of maximum dry density as determined by the Modified Proctor Test (ASTM-D1557). The Clean Granular Fill and Structural Fill should be compacted within ±3% of optimum moisture content. The adequacy of the compaction efforts should be verified by field density testing which is also a requirement of the *State Building Code*.