Geotechnical Engineering Report

DELANO DEPARTMENT OF MOTOR VEHICLES

WKA No. 11743.01P

January 10, 2018

Prepared for:

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DELANO DEPARTMENT OF MOTOR VEHICLES
Dover Parkway
Delano, California
WKA No. 11743.01P
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INTRODUCTION

We have completed a geotechnical engineering study for the Delano Department of Motor Vehicles project to be constructed on the east side of Dover Parkway, approximately 1300 feet north of Woollomes Avenue in Delano, California. The purpose of our study has been to explore the existing site, soil and groundwater conditions, and to provide geotechnical engineering conclusions and recommendations for the design and construction of the planned development. This report presents the results of our study.

Scope of Services

Our scope of services for this project included the following tasks:

1. a site reconnaissance;
2. review of historic United States Geological Survey (USGS) topographic maps, historical aerial photographs, and available groundwater information;
3. subsurface exploration, including the drilling and sampling of four borings to depths of approximately 16½ feet below the existing ground surface;
4. bulk sampling of anticipated pavement subgrade soils;
5. laboratory testing of selected soil samples to determine engineering properties of the soil;
6. engineering analyses; and,
7. preparation of this report.

Figures and Attachments

This report contains a Vicinity Map as Figure 1; a Site Plan showing the boring locations as Figure 2; and, the Logs of Soil Borings as Figures 3 through 6. An explanation of the symbols and classification system used on the boring logs is contained on Figure 7. Appendix A contains general information regarding project concepts, exploratory methods used during our field investigation, and laboratory test results that are not included on the logs. Appendix B contains *Guide Earthwork Specifications* that may be used in the preparation of project plans and specifications.

Proposed Development

We understand the project will consist of the design and construction of a new 10,718-square foot, field office for the Department of Motor Vehicles. We anticipate the single-story field office will be wood-framed or concrete block construction with an interior concrete slab-on-grade floors. Structural loads for the structure are anticipated to be relatively light based on this type of construction. Associated development is anticipated to consist of landscaping, underground utilities, asphalt concrete pavements, perimeter walls, and concrete flatwork improvements. Two small, shallow retention basins are planned to be constructed within the parking lot. We anticipate that these basins will be unlined and allow storm water to naturally percolate into the soil. We anticipate the depth of basins will be on the order of one to three feet.

Grading plans were not available at the time this report was prepared; however, based on existing topography, we anticipate maximum excavations and fills on the order of about one to three feet will be required to establish final site grades.

FINDINGS

Site Description

The subject site is located on the east side of Dover Parkway, approximately 1300 feet north of Woollomes Avenue in Delano, California (Figure 1). The site is bounded to the north, east and south by undeveloped property, and to the west by Dover Parkway. The property is relatively flat with an average surface elevation of about +305 feet mean sea level (msl) based on review of the USGS *7.5-Minute Topographic Map of the Delano East Quadrangle, California*, dated 2015.

At the time of our field exploration on December 13, 2017, the site was vacant and undeveloped. The surface soil across the site was loose and appeared to be recently disced for weed abatement. A sparse growth of volunteer weeds was observed across the property. A fence runs east-west near the northern site boundary, and turns north-south near the western boundary.

Historical Aerial Photograph Review

Review of available historical aerial photographs taken in 1969 indicate the site was vacant and used for agricultural farming. The site appears to have remained essentially unchanged during the period from at least 1993 through 2005.

Soil Conditions

Four exploratory borings were drilled across the property on December 13, 2017 at the approximate location shown on the attached Site Plan (Figure 2). The results of the borings indicate the near surface soils consist of about 16½ feet of light brown to brown, loose to medium dense, clayey sand. Silty sand was encountered below the near-surface clayey sand within Borings D1 and D4 below depths of about 13 and 14 feet respectively. The sands varied in density and amount of fines present.

For detailed soil conditions at a particular location, please refer to the Logs of Soil Borings presented as Figures 3 through 6.

Groundwater

We did not encounter groundwater during our subsurface explorations on December 13, 2017. Review of available groundwater information provided by the California Department of Water Resources indicates that regional groundwater beneath the site is generally present at an elevation of approximately 80 feet msl, or about 225 feet below the existing ground surface. (https://gis.water.ca.gov/app/gicima/).

CONCLUSIONS

Bearing Capacity

In our opinion, the native soils are considered capable of supporting proposed development provided the surface and near-surface soils are properly moisture conditioned and compacted during earthwork operations. Thorough moisture conditioning and recompaction of the upper soils, which have been disturbed by discing, will be important to provide uniform support for the planned structure and pavements.

Our experience also indicates that engineered fills composed of native soils or approved import soils that are placed and compacted in accordance with general engineering practices will be suitable for support of the proposed structure, pavements and other site improvements.

2016 CBC/ASCE 7-10 Seismic Design Criteria

The 2016 edition of the *California Building Code* (CBC) references the American Society of Civil Engineers (ASCE) Standard 7-10 for seismic design. The following seismic parameters provided in Table 1 were determined based on the site latitude and longitude using the public domain computer program developed by the USGS. The seismic design parameters summarized in Table 1 may be used for seismic design of the proposed structure.

TABLE 1
2016 CBC, ASCE 7-10 SEISMIC DESIGN PARAMETERS

Latitude: 35.75184° N Longitude: 119.24959° W	ASCE 7-10 Table/Figure	2016 CBC Table/Figure	Factor/ Coefficient	Value
Short-Period MCE at 0.2 seconds	Figure 22-1	Figure 1613.3.1(1)	S_S	0.760 g
1.0 second Period MCE	Figure 22-2	Figure 1613.3.1(2)	S_1	0.308 g
Soil Class	Table 20.3-1	Section 1613.3.2	Site Class	D
Site Coefficient	Table 11.4-1	Table 1613.3.3(1)	F_a	1.196
Site Coefficient	Table 11.4-2	Table 1613.3.3(2)	F_v	1.784
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-37	S_{MS}	0.909 g
	Equation 11.4-2	Equation 16-38	S_{M1}	0.549 g
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-39	S_{DS}	0.606 g
	Equation 11.4-4	Equation 16-40	S_{D1}	0.366 g
Seismic Design Category	Table 11.6-1	Section 1613.3.5(1)	Risk Category I to IV	D
	Table 11.6-2	Section 1613.3.5(2)	Risk Category I to IV	D

Notes: MCE = Maximum Considered Earthquake
g = gravity

Liquefaction Potential

Based on the results of our subsurface exploration, the known geologic, seismic, groundwater and soil conditions, it is our opinion that the potential for liquefaction occurring at the site during seismic events is very low.

Soil Expansion Potential

Laboratory testing of the near-surface soil indicate these materials possess a low expansion potential when tested in accordance with ASTM D4829 (Figure A2). Based on the soil conditions encountered at the borings and the results of the laboratory testing, deepening of foundations, special reinforcement of foundations or floor slabs, or special moisture conditioning during site grading to resist or control soil expansion pressures, are not considered necessary on this project.

Soil Suitability for Engineered Fill Construction

The on-site native soils encountered in the borings are considered suitable for use in engineered fill construction, provided these materials do not contain significant organics, rubble, and other deleterious debris, and are at moisture contents capable of achieving the desired degree of compaction. Imported materials, if necessary, should be granular and approved by our office prior to importing the materials to the site.

Excavation Conditions

The on-site soils should be readily excavatable with conventional construction equipment. In our opinion, shallow excavations less than five feet in depth will stand at a near-vertical inclination for the short periods of time required for utility construction. However, minor sloughing and "running" conditions could occur if the soils are saturated, or where zones of clean (cohesionless) sands are encountered, especially when subjected to construction vibrations or allowed to dry significantly.

Excavations or trenches exceeding five feet in depth that will be entered by workers should be sloped, braced or shored to conform to current Occupational Safety and Health Administration (OSHA) requirements. The contractor must provide an adequately constructed and braced shoring system in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground.

Temporarily sloped excavations less than 20 feet in depth should be constructed no steeper than a one horizontal to one vertical (1H:1V) inclination. Temporary slopes likely will stand at this inclination for the short-term duration of construction, provided significant pockets of loose and/or saturated granular soils are not encountered. Flatter slopes would be required if these conditions are encountered.

Excavated materials should not be stockpiled directly adjacent to an open excavation to prevent surcharge loading of the excavation sidewalls. Excessive truck and equipment traffic should be avoided near excavations. If material is stored or heavy equipment is stationed and/or operated near an excavation, a shoring system must be designed to resist the additional pressure due to the superimposed loads.

Pavement Subgrade Quality

Laboratory test results indicate the anticipated pavement subgrade soils are considered poor quality materials for support of asphalt concrete pavements and will require thicker pavement sections to compensate for the lower strength of the soils. Laboratory tests indicate that the anticipated subgrade soils possess a Resistance ("R") value of 14 when tested in accordance with California Test 301 (Figure A3). Based on the recent laboratory test results and the anticipated mixing of soils during earthwork construction, we have used an R-value of 10 for our pavement design.

Soil Corrosion Potential

One sample of near-surface soil was submitted to Sunland Analytical Lab of Rancho Cordova, California, for testing to determine pH, chloride and sulfate concentrations, and minimum resistivity to help evaluate the potential for corrosive attack upon buried concrete. The results of the corrosivity testing are summarized below in Table 2. Copies of the test reports are presented in Figures A4 and A5.

TABLE 2
SOIL CORROSIVITY TESTING

Analyte	Test Method	Sample Identification
		D2 (0'-3')
pH	CA DOT 643 Modified*	7.70
Minimum Resistivity	CA DOT 643 Modified*	1880 Ω-cm
Chloride	CA DOT 422	28.7 ppm
Sulfate	CA DOT 417	31.8 ppm
Sulfate – SO4	ASTM D-516	31.51 mg/kg

Notes: * = Small cell method; Ω-cm = Ohm-centimeters; ppm = Parts per million; mg/kg= milligrams per kilogram

The California Department of Transportation Corrosion and Structural Concrete Field Investigation Branch, 2015 Corrosion Guidelines (Version 2.1), considers a site to be corrosive to foundation elements if one or more of the following conditions exists for the representative soil and/or water samples taken: has a chloride concentration greater than or equal to 500 ppm, sulfate concentration greater than or equal to 2000 ppm, or the pH is 5.5 or less. Based on this criterion, the on-site soils tested are not considered corrosive to steel reinforcement properly embedded within Portland cement concrete (PCC).

Table 19.3.1.1 – Exposure Categories and Classes, of American Concrete Institute (ACI) 318-14, Section 19.3 – Concrete Design and Durability Requirements, as referenced in Section 1904.1 of the 2016 CBC, indicates the severity of sulfate exposure for the sample tested is Exposure Class S0 (water-soluble sulfate concentration in contact with concrete is low and injurious sulfate attack is not a concern). The project structural engineer should evaluate the requirements of ACI 318-14 and determine their applicability to the site.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, if it is desired to further define the soil corrosion potential at the site, a corrosion engineer should be consulted.

Soil Permeability

Review of the *Site Plan* dated September 22, 2017, prepared by Nacht & Lewis, indicates two, shallow storm water retention basins will be constructed in the parking lot area located on the west side of the building. We understand these features will be used to dispose of on-site water prior to its discharge from the site.

Review of the U.S. Department of Agriculture, Soil Conservation Service (SCS) *Soil Survey of Kern County, California, Northwestern Part* indicate the near-surface soils underlying the site consist of the “Wasco Sandy Loam” which is designated hydrologic soil group “A” considered to have relatively high infiltration characteristics. The soil survey indicates the capacity of the most limiting layer to transmit water to have a permeability ranging from about 2 to 6 inches per hour.

Based on the soil conditions encountered at the borings, information contained in the soil survey, and our experience with similar soil types, it is our opinion that an average infiltration rate of about 2 inches per hour is suitable for infiltration design at the site. However, the infiltration rate provided above is for preliminary design purposes only. Permeability testing was beyond the scope of our work for this project.

Groundwater Conditions and Seasonal Moisture

Based upon the absence of groundwater during our field exploration and the published information regarding groundwater elevations in the vicinity, we conclude that a permanent groundwater level should not be a significant factor in the design or construction of the proposed structure and shallow utilities.

During the wet season, infiltrating surface runoff water can create a saturated surface condition. Grading operations attempted following the onset of winter rains and prior to prolonged drying periods will be hampered by high soil moisture contents. Such soils, intended for use as engineered fill, will require considerable aeration and/or drying to reach a moisture content that will permit the soils to be properly compacted.

RECOMMENDATIONS

General

We anticipate maximum excavations and fills on the order of one to three feet to develop the site. The recommendations in this report are based upon this assumption. Also, the recommendations presented below are appropriate for typical construction in the late spring through fall months. The on-site soils likely will be saturated by rainfall in the winter and early spring months, and will not be compactable without aeration or chemical treatment to dry the soils. Should the construction schedule require work during wet conditions, additional recommendations can be provided, as conditions warrant.

Site preparation should be accomplished in accordance with the provisions of this report. A representative of the Geotechnical Engineer should be present during site grading to evaluate compliance with our recommendations. The Geotechnical Engineer of Record referenced herein should be considered the Geotechnical Engineer that is retained to provide geotechnical engineering observation and testing services during construction.

Site Clearing

Initially, the site should be cleared of any surface debris and rubble. Any existing underground utilities designated to be removed or relocated should include all trench backfill. Depressions resulting from clearing operations, as well as any loose, saturated, or organically contaminated soils, as identified by our representative, should be cleaned out to firm, undisturbed soils and widened, as necessary, to allow access with construction equipment. Depressions should be backfilled with engineered fill in accordance with the recommendations in this report.

Subgrade Preparation

Following clearing operations, the remaining surface organics should be removed by stripping. Strippings should not be used in general fill construction, but may be used in landscape areas, provided they are kept at least five feet from the building pad, moisture conditioned and compacted and do not exceed a depth of two feet. Discing of organics may be a suitable alternative to stripping depending upon the quantity and condition of the surface vegetation at the time of grading. Discing will be allowed only with our prior approval and should be observed by our representative. Discing, if approved, must be continuous until organics are adequately mixed with the soil to provide a compactable mixture. Pockets or concentrations of organics will not be allowed.

Areas designated to receive fill, remain at-grade or achieved by excavation, including an area at least five feet horizontally beyond the exterior edge of the structure, should be scarified to a depth of 12 inches, thoroughly moisture conditioned to achieve at least the optimum moisture content, and compacted to at least 90 percent of the ASTM D1557 maximum dry density.

Compaction of the soil subgrade should be achieved using a heavy, self-propelled, sheepsfoot compactor (such as a Caterpillar 815 or equivalent) and must be performed in the presence of our representative who will evaluate the performance of the subgrade under the compaction loads, and identify loose or unstable soil conditions that could require additional excavation. Loose, soft or saturated soil deposits encountered below the depth of scarification during compaction operations should be removed to expose firm undisturbed soils as identified by our representative and backfilled with engineered fill as recommended in this report. Difficulty in achieving subgrade compaction or unusual soil instability may be indications of loose soils associated with past subsurface items such as burn pits or dump pits. Should these conditions exist, the materials should be excavated to check for subsurface structures and the excavations backfilled with engineered fill. We recommend construction bid documents contain a unit price (price per cubic yard) for additional excavation due to unsuitable materials and replacement with engineered fill.

Engineered Fill

On-site soils will be suitable for engineered fill construction in structural areas provided these materials do not contain rubbish, rubble greater than three inches, and significant organic concentrations. Imported fill materials, if required, should be similar to but less expansive than native soil and does not contain particles greater than three inches in maximum dimension. Imported soils should be approved by our office prior to being transported to the site. Also, if import fills are required (other than aggregate base), the contractor must provide appropriate documentation that the import is clean of known contamination and within acceptable corrosion limits.

Engineered fill should be placed in lifts not exceeding six inches in compacted thickness with each lift being thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to not less than 90 percent of the ASTM D1557 maximum dry density.

Final Subgrade Preparation

The upper 12 inches of final building pad subgrade should be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to 90 percent of the maximum dry density regardless of whether final grade is left at the existing grade or is completed by excavation or filling.

The upper six inches of pavement subgrades should be uniformly compacted to at least 95 percent of the ASTM D1557 maximum dry density at a moisture content of at least the optimum moisture content, regardless of whether final grade is completed by excavation, filling or left at existing grade. Final subgrade compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete. The compacted subgrade should be kept in a moist condition until the placement of the aggregate base. If subgrade soils are disturbed or allowed to dry they must be re-moisture conditioned and compacted before the aggregate base is placed.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2H:1V) and should be vegetated as soon as practical following grading to minimize erosion. As a minimum, the following erosion control measures should be considered: placement of straw bale sediment barriers or construction of silt filter fences in areas where surface run-off may be concentrated. The final decision of erosion control measures should be made by the Project Stormwater Pollution Prevention Plan (SWPPP) Engineer.

Site preparation should be accomplished in accordance with the recommendations of this section and the *Guide Earthwork Specifications* provided in Appendix B. We recommend that a representative from our office be present during site clearing and preparation and grading operations to observe and test the fill to verify compliance with these recommendations.

Utility Trench Backfill

Bedding of utilities and initial backfill should be in accordance with the manufacturer's recommendations for the pipe materials selected and Kern County standards, latest edition. Utility trench backfill should be placed in thin lifts, thoroughly moisture conditioned to the optimum moisture content and mechanically compacted to at least 90 percent of the ASTM D1557 maximum dry density. The thickness of each lift will depend on the type of compaction equipment used. Utility trench backfill should be continuously observed and tested during construction.

Trench backfill materials and compaction within street right-of-ways should conform to the applicable portions of the current Kern County standards, latest edition. The upper six inches of utility trench backfill within pavement areas should be uniformly compacted to at least 95 percent of the ASTM D1557 maximum dry density.

Underground utility trenches, which are aligned nearly parallel with foundations, should be at least three feet from the outer edge of foundations. Trenches should not encroach into the zone extending outward at a 1H:1V inclination below the bottom of the foundations. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Additionally, trenches near foundations should not remain open longer than 72 hours to prevent drying of the soils. The intent of these recommendations is to prevent loss of both lateral and vertical support of foundations, resulting in possible settlement.

Foundation Design

The proposed single-story structure may be supported upon continuous and/or isolated spread foundations extending at least 12 inches below lowest adjacent soil grade. Lowest adjacent soil grade is defined as the grade upon which the capillary break material is placed or exterior soil grade, whichever is lower. All continuous foundations should maintain a minimum width of 12 inches; isolated spread foundations should be at least 18 inches in plan dimension. Foundations should be continuous around the perimeter of the building to help minimize moisture variations beneath the structure.

Foundations bearing on undisturbed or re-compacted native soils, engineered fill, or a combination of those materials may be sized for maximum allowable “net” soil bearing pressure of 3000 pounds per square foot (psf) for dead plus live load; this bearing value may be increased by one-third to include the effects of seismic or wind forces. The weight of the foundation concrete extending below lowest adjacent soil grade may be disregarded in sizing computations.

We recommend that all foundations be adequately reinforced to provide structural continuity, mitigate cracking and permit spanning of local soil irregularities. The structural engineer or civil engineering consultant should determine final foundation reinforcing requirements.

Resistance to lateral foundation displacement may be computed using an allowable friction factor of 0.30, which may be multiplied by the effective vertical load on each foundation. Additional lateral resistance may be computed using an allowable passive lateral earth pressure against the vertical projection of foundations equal to an equivalent fluid pressure of 300 psf per foot of depth. These two modes of resistance should not be added unless the frictional component is reduced by 50 percent since full mobilization of these resistances may occur at different degrees of horizontal movement.

Interior Floor Slab Support

Interior concrete slab-on-grade floors can be supported upon the soil subgrade prepared in accordance with the recommendations in this report. Slabs-on-grade should be at least four inches thick, and final thickness, reinforcement and joint spacing should be determined by the slab designer. Proper and consistent location of the reinforcement near mid-slab is essential to its performance. The risk of uncontrolled shrinkage cracking is increased if the reinforcement is not properly located within the slab.

Floor slabs should be underlain by a layer of free-draining crushed rock, serving as a deterrent to migration of capillary moisture. The crushed rock layer should be at least four inches thick and graded such that 100 percent passes a one-inch sieve and no appreciable amount passes a No. 4 sieve. Additional moisture protection may be provided by placing a vapor retarder membrane (at least 10-mils thick) directly over the crushed rock. The membrane should meet or exceed the minimum specifications as outlined in ASTM E1745 and be installed in strict conformance with the manufacturer’s recommendations.

Floor slab construction over the past 30 years or more has included placement of a thin layer of sand or pea gravel over the vapor retarder membrane. The intent of the sand/pea gravel is to aid in the proper curing of the slab concrete. However, recent debate over excessive moisture vapor emissions from floor slabs includes concern for water trapped within the sand/pea gravel. As a consequence, we consider the use of the sand/pea gravel layer as optional. The concrete curing benefits should be weighed against efforts to reduce slab moisture vapor transmission.

The recommendations presented above are intended to mitigate any significant soils-related cracking of the slab-on-grade floors. More important to the performance and appearance of a Portland cement concrete slab is the quality of the concrete, the workmanship of the concrete contractor, the curing techniques utilized, and the spacing of control joints.

Floor Slab Moisture Penetration Resistance

It is considered likely that floor slab subgrade soils will become saturated at some time during the life of the structure. This is a certainty when slabs are constructed during the wet season or when constantly wet ground or poor drainage conditions exist adjacent to the structure. For this reason, it should be assumed that interior slabs, particularly those intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the rock and vapor retarder membrane suggested above. However, the rock and membrane offer only a limited, first line of defense against soil-related moisture. Recommendations contained in this report concerning floor slab design are presented as *minimum* requirements only from the geotechnical engineering standpoint.

It is emphasized that the use of sub-slab gravel and vapor retarder membrane will not "moisture proof" the slab, nor does it assure that slab moisture transmission levels will prevent damage to floor coverings or other building components. If increased protection against moisture vapor penetration of slabs is desired, a concrete moisture protection specialist should be consulted. The design team should consider all available measures for slab moisture protection. It is commonly accepted that maintaining the lowest practical water-cement ratio in the slab concrete is one of the most effective ways to reduce future moisture vapor penetration of the completed slabs.

Exterior Flatwork

Soil subgrades supporting exterior concrete flatwork (i.e., sidewalks, patios, etc.) should be brought to at least the optimum moisture content and uniformly compacted prior to the placement of the concrete. Proper moisture conditioning of the subgrade soils is considered important to the performance of exterior flatwork. Expansion joints should be provided to allow for minor vertical movement of the flatwork. Exterior flatwork should be constructed independent of the perimeter building foundation and isolated column foundations by the placement of a layer of felt material between the flatwork and the foundation.

Sidewalks and other concrete flatwork should be at least four inches thick and may be constructed directly on the prepared subgrade. The subgrade should be uniformly moisture conditioned to at least the optimum moisture content, and compacted to at least 95 percent of the maximum dry density just prior to concrete placement.

Consideration should be given to thickening the edges of sidewalks and patios to at least twice the slab thickness. Flatwork reinforcement for crack control, if desired, should be determined by the structural engineer.

Practices recommended by the Portland Cement Association (PCA) for proper placement, curing, joint depth and spacing, construction, and placement of concrete should be followed during exterior concrete flatwork construction.

Areas adjacent to new exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and beneath flatwork. We recommend final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

Perimeter Sound Walls

If perimeter sound walls (i.e. Proto II walls) will be constructed, the walls may be supported upon conventional foundations utilizing the design parameters provided in the Foundation Design section of this report, or drilled, cast-in-place reinforced concrete piers (drilled piers). Piers for support of sound walls should be at least 12 inches in diameter and extend at least five feet below lowest adjacent soil grade.

Drilled piers extending at least five feet below the ground surface may be sized utilizing a maximum allowable vertical “net” bearing capacity of 4000 psf or an allowable skin friction of 250 psf for dead plus live loads, which may be applied over the surface of the pier. The upper 12 inches of skin friction should be disregarded unless the pier is completely surrounded by concrete or pavements for a distance of at least three feet from the edge of the foundation pier. These values may be increased by one-third to include the short-term wind or seismic forces. The weight of foundation concrete below grade may be disregarded in sizing computations for the end-bearing condition.

Uplift resistance of pier foundations may be computed using the following resisting forces, where applicable: 1) weight of the pier concrete (150 pounds per cubic foot), and 2) the allowable skin friction of 250 psf applied over the shaft area of the pier. Increased uplift resistance can be achieved by increasing the diameter of the pier or increasing the depth. Lateral resistance of pier foundations may be evaluated by applying a passive lateral earth pressure of equivalent to a fluid pressure of 300 psf per foot of depth.

Pavement Design

The following pavement sections provided in Table 3 have been calculated based on the results of R-value testing, and the procedures contained within Chapters 600 to 670 of the California Highway Design Manual, 6th edition, utilizing design Traffic Indices (TI) considered appropriate for the proposed development. The project civil engineer should determine the appropriate traffic index based on anticipated traffic conditions. We can provide alternative pavement sections based on other traffic indices, upon request.

TABLE 3
PAVEMENT DESIGN ALTERNATIVES

Traffic Index (TI)	Pavement Use	Pavement Subgrade R-value = 14	
		Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)
4.5	Automobile Parking and Drive Areas	2½*	8
		3	7
6.5	Drive Aisles, Moderate Truck Traffic and Entry/Exit Drive	3	15
		4*	13

Note: * = Asphalt concrete thickness includes the Caltrans Safety Factor.

We emphasize that the performance of pavements is critically dependent upon uniform and adequate compaction of the soil subgrade, as well as all engineered fill and utility trench backfill within the limits of the pavements. We recommend that pavement subgrade preparation, (i.e. scarification, moisture conditioning and compaction), be performed after underground utility construction is completed and just prior to aggregate base placement. The upper six inches of pavement subgrade soils should be compacted to at least 95 percent relative compaction at no less than the optimum moisture content. All aggregate base should be compacted to at least 95 percent of the ASTM D1557 maximum dry density. Materials quality and construction of the structural section should conform to the applicable provisions of the Caltrans Standard Specifications and Kern County Standards, latest editions.

We recommend consideration be given to using the Portland cement concrete pavements in areas subjected to concentrated heavy wheel loading, such as at truck loading/unloading areas and in front of trash enclosures. Portland cement concrete pavements, where used should be at least six inches thick over at least six inches of Class 2 aggregate base. We suggest that concrete slabs be constructed with thickened edges at least two inches plus the slab thickness and at least 36 inches wide in accordance with ACI design standards. Reinforcing for crack control, if desired, should consist of No. 3 reinforcing bars placed on maximum 18-inch centers each way throughout the slab. Reinforcement must be located at mid-slab depth to be effective. Portland cement concrete should achieve a minimum compressive strength of 3500 psi at 28 days. Concrete curing and joint spacing and details should conform with current PCA and ACI guidelines.

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to pavement performance. Weep holes could be provided at drainage inlets, located at the subgrade-base interface, to allow accumulated water to drain from beneath the pavements.

Consideration should be given to using full-depth curbs between landscaped areas and pavements to serve as a cut off for water that could migrate into the pavement base materials or subgrade soils, especially in area adjacent to the on-site drainage systems.

Site Drainage

Final site grading should be accomplished to provide positive drainage of surface water away from the building and prevent ponding of water adjacent to foundations, slabs and pavements. The grades adjacent to the building should be sloped away from foundations at a minimum two percent slope for a distance of at least five feet, where possible. Roof gutter downspouts and surface drains should drain onto pavements or be connected to rigid, non-perforated piping directed to an appropriate drainage point away from the building. Ponding of surface water should not be allowed adjacent to the building or pavements.

Geotechnical Engineering Construction Observation Services

Site preparation should be accomplished in accordance with the recommendations of this report. Representatives of the Geotechnical Engineer should be present during site preparation and all grading operations to observe and test the fill to verify compliance with our recommendations and the job specifications. Testing frequency will depend on how the site is graded and should be determined during the rough grading operations. These services are beyond the scope of work authorized for this investigation.

In the event that Wallace-Kuhl & Associates is not retained to provide geotechnical engineering observation and testing services during construction, the Geotechnical Engineer retained to provide these services should indicate in writing that they agree with the recommendations of this report, or prepare supplemental recommendations as necessary. A final report by the Geotechnical Engineer providing construction testing services should be prepared upon completion of the project.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed project, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used our engineering judgment based upon the information provided and the data generated from our investigation. This report has been prepared in substantial compliance with generally accepted geotechnical engineering practices that exist in the area of the project at the time the report was prepared. No warranty, either express or implied, is provided.

If the proposed construction is modified or re-sited; or, if it is found during construction that subsurface conditions differ from those we encountered at the boring locations, we should be afforded the opportunity to review the new information or changed conditions to determine if our conclusions and recommendations must be modified.

We emphasize that this report is applicable only to the proposed construction and the investigated site, and should not be utilized for construction on any other site.

The conclusions and recommendations of this report are considered valid for a period of three years. If design is not completed and construction has not started within three years of the date of this report, the report must be reviewed and updated if necessary.

Wallace - Kuhl & Associates

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Michael M. Watari
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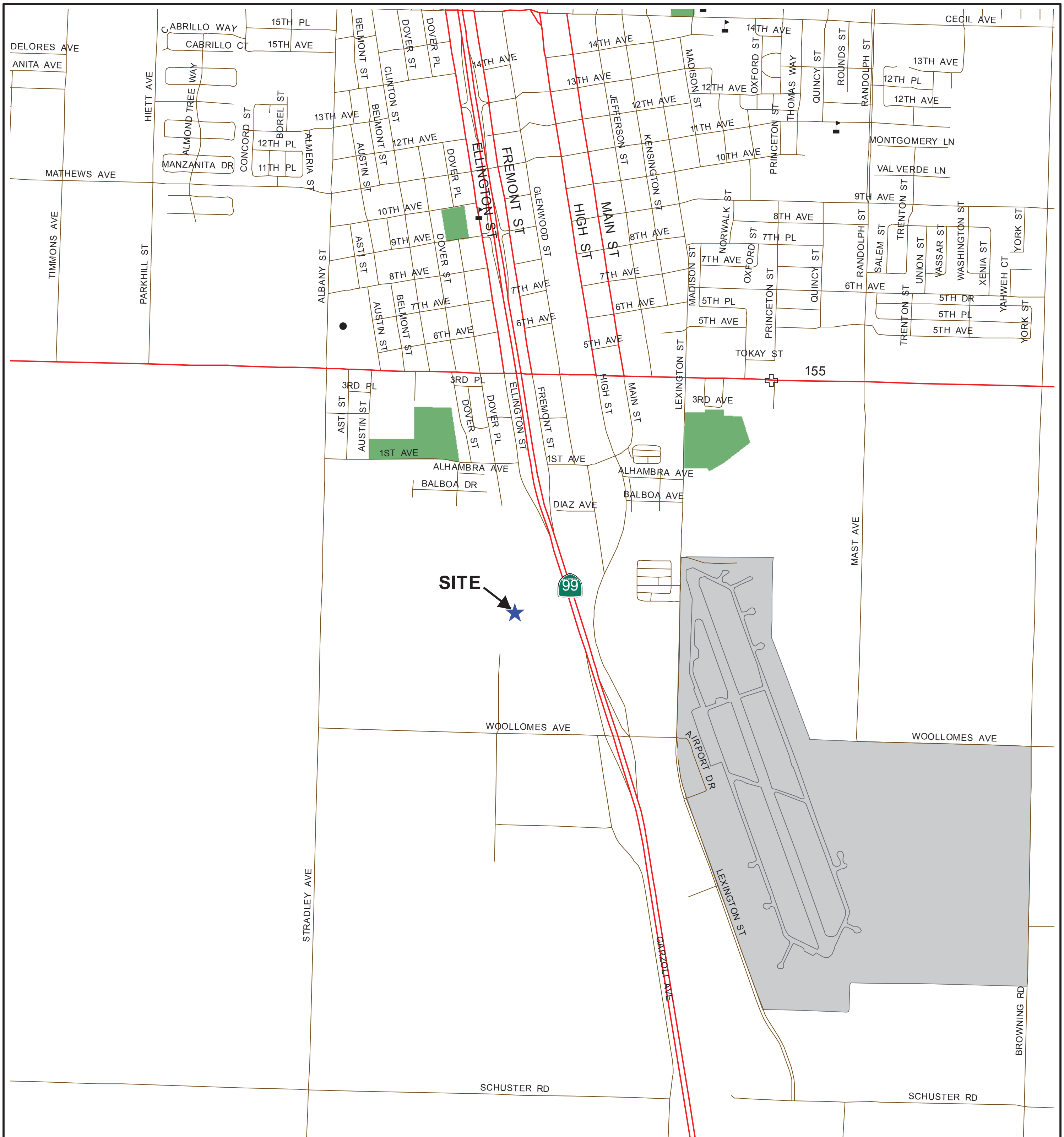
1/10/18

DMB:MMW:/dmb



Street data courtesy of Kern County.
Hydrography courtesy of the U.S. Geological Survey
acquired from the GIS Data Depot, December, 2007
Projection: NAD 83, California State Plane, Zone V

N

0 1,000 2,000
Feet

WallaceKuhl & ASSOCIATES

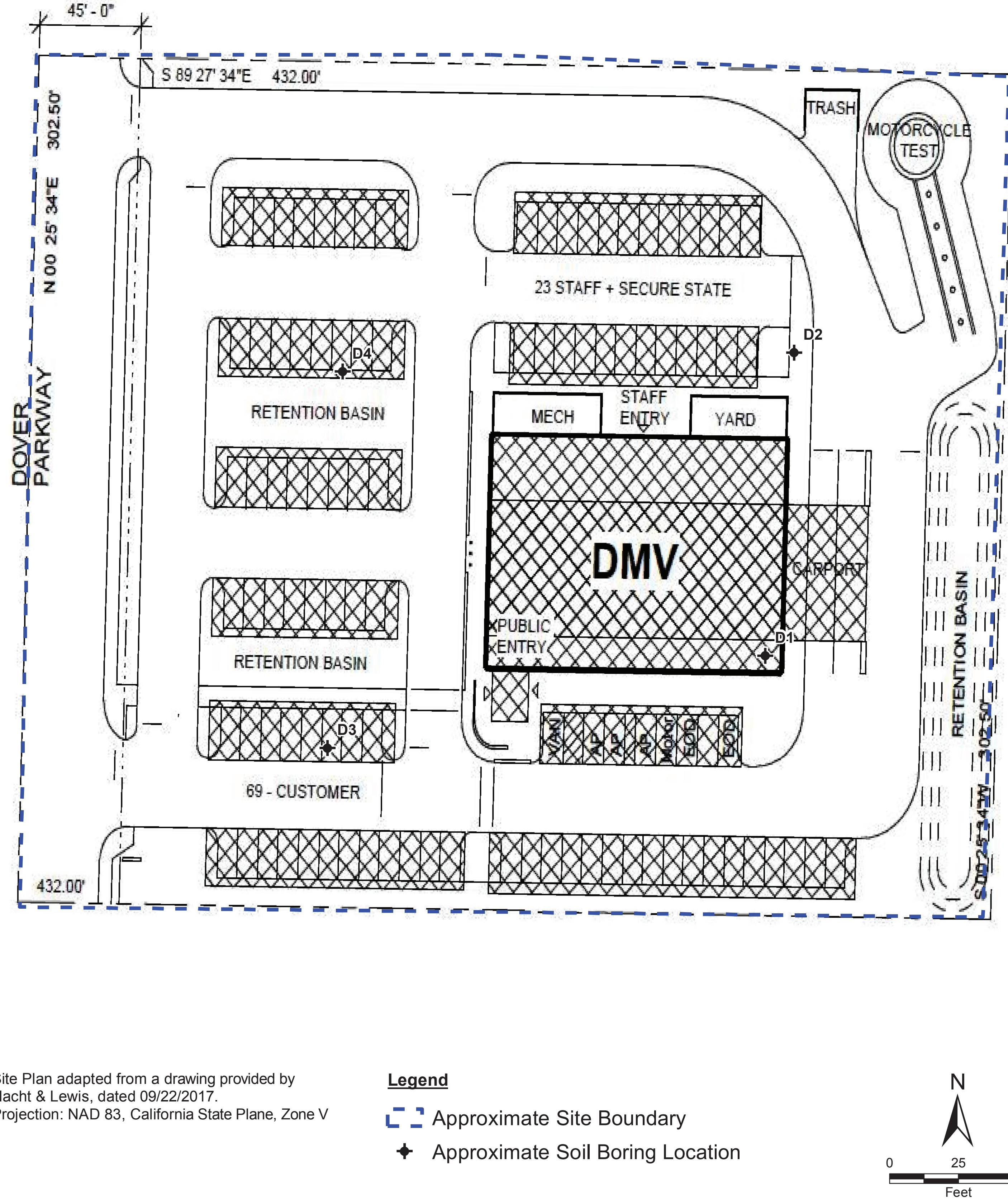
VICINITY MAP

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	1
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18

WKA NO. 11743.01P



Site Plan adapted from a drawing provided by Nacht & Lewis, dated 09/22/2017.
Projection: NAD 83, California State Plane, Zone V

Legend

Approximate Site Boundary

Approximate Soil Boring Location

WallaceKuhl & ASSOCIATES

SITE PLAN

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	2
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO.11743.01P	

Project: Delano DMV Project Location: Delano, California WKA Number: 11743.01P	# LOG OF SOIL BORING D1 Sheet 1 of 1

Date(s) Drilled	12/13/17	Logged By	DB	Checked By	MMW
Drilling Method	Solid Flight Auger	Drilling Contractor	V&W Drilling, Inc.	Total Depth of Drill Hole	16.5 feet
Drill Rig Type	CME 55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	Modified California	Drill Hole Backfill	Soil Cuttings
Remarks			Driving Method and Drop	140-lb automatic hammer, 30-inch drop	

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
		SC	Light brown, moist, loose, clayey fine SAND with varying amount of fines (SC).						
				X	D1-1	6			
	5			X	D1-2	7	15.0	93	
	10		Medium dense.	X	D1-3	30	10.4	99	
		SM	Light brown, moist, dense, silty fine SAND (SM).						
	15			X	D1-4	44			
			Boring terminated at 16.5 feet below existing site grade. Groundwater was not encountered.						

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FIGURE 3

Project: Delano DMV
Project Location: Delano, California
WKA Number: 11743.01P

LOG OF SOIL BORING D2

Date(s) Drilled	**12/13/17**	Logged By	**DB**	Checked By	**MMW**
Drilling Method	**Solid Flight Auger**	Drilling Contractor	**V&W Drilling, Inc.**	Total Depth of Drill Hole	**16.5 feet**
Drill Rig Type	**CME 55**	Diameter(s) of Hole, inches	**6"**	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	**Modified California**	Drill Hole Backfill	**Soil Cuttings**
Remarks				Driving Method and Drop	**140-lb automatic hammer, 30-inch drop**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		Light brown, moist, medium dense, clayey fine SAND (SC).						
					D2-1	15	6.0	96	
	5				D2-2	18			
	10		Dense.		D2-3	49	6.4	110	
	15				D2-4	47			
			Boring terminated at 16.5 feet below existing site grade. Groundwater was not encountered.						

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FIGURE 4

Project: Delano DMV
Project Location: Delano, California
WKA Number: 11743.01P

LOG OF SOIL BORING D3

Date(s) Drilled	12/13/17	Logged By	DB	Checked By	MMW
Drilling Method	Solid Flight Auger	Drilling Contractor	V&W Drilling, Inc.	Total Depth of Drill Hole	16.5 feet
Drill Rig Type	CME 55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	Modified California	Drill Hole Backfill	Soil Cuttings
Remarks		Driving Method and Drop	140-lb automatic hammer, 30-inch drop		

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE DATA: SAMPLE NUMBER	SAMPLE DATA: NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	TEST DATA: DRY UNIT WEIGHT, pcf	TEST DATA: ADDITIONAL TESTS
	0		Light brown, moist, loose, clayey fine SAND with varying amount of fines (SC).						
					D3-1	12	6.8	90	
	5		Medium dense.		D3-2	16			
	10				D3-3	32			
	15		Very dense.		D3-4	50/6"	10.0	97	
			Boring terminated at 16.5 feet below existing site grade. Groundwater was not encountered.						

BORING LOG 11743.01P - DELANO DMV.GPJ WKA.GDT 1/5/18 10:16 AM

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FIGURE 5

Project: Delano DMV
Project Location: Delano, California
WKA Number: 11743.01P

LOG OF SOIL BORING D4

Date(s) Drilled	12/13/17	Logged By	DB	Checked By	MMW
Drilling Method	Solid Flight Auger	Drilling Contractor	V&W Drilling, Inc.	Total Depth of Drill Hole	16.5 feet
Drill Rig Type	CME 55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	
Groundwater Depth [Elevation], feet		Sampling Method(s)	Modified California	Drill Hole Backfill	Soil Cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer, 30-inch drop

ELEVATION, feet	DEPTH, feet	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE NUMBER	NUMBER OF BLOWS	MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0	Light brown, moist, medium dense, clayey fine SAND with varying amount of fines (SC).					
			D4-1	21			
	5		D4-2	20	15.8	84	
	10	Dense.	D4-3	48			
	14	Light tan, moist, medium dense, fine to medium SAND .					
	15		D4-4	27	1.9	87	

Boring terminated at 16.5 feet below existing site grade. Groundwater was not encountered.

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FIGURE 6

UNIFIED SOIL CLASSIFICATION SYSTEM (ASTM D2487)

MAJOR DIVISIONS		USCS[4]	CODE	CHARACTERISTICS
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS[1] (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well-graded gravels or gravel - sand mixtures, trace or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, trace or no fines
		GM		Silty gravels, gravel - sand - silt mixtures, containing little to some fines[2]
		GC		Clayey gravels, gravel - sand - clay mixtures, containing little to some fines[2]
	SANDS[1] (50% or more of coarse fraction < no. 4 sieve size)	SW		Well-graded sands or sand - gravel mixtures, trace or no fines
		SP		Poorly graded sands or sand - gravel mixtures, trace or no fines
		SM		Silty sands, sand - gravel - silt mixtures, containing little to some fines[2]
		SC		Clayey sands, sand - gravel - clay mixtures, containing little to some fines[2]
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts, gravely silts, and sandy silts that are non-plastic or with low plasticity
		CL		Inorganic lean clays, gravelly lean clays, sandy lean clays of low to medium plasticity[3]
		OL		Organic silts, organic lean clays, and organic silty clays
	SILTS & CLAYS LL ≥ 50	MH		Inorganic elastic silts, gravelly elastic silts, and sandy elastic silts
		CH		Inorganic fat clays, gravelly fat clays, sandy fat clays of medium to high plasticity
		OH		Organic fat clays, gravelly fat clays, sandy fat clays of medium to high plasticity
HIGHLY ORGANIC SOILS		PT		Peat
ROCK		RX		Rocks, weathered to fresh
FILL		FILL		Artificially placed fill material

OTHER SYMBOLS

= Drive Sample: 2-1/2" O.D. Modified California sampler

= Drive Sampler: no recovery

= SPT Sampler

= Initial Water Level

= Final Water Level

— — — = Estimated or gradational material change line

———— = Observed material change line

Laboratory Tests

- CR = Corrosion
- PI = Plasticity Index
- EI = Expansion Index
- UCC = Unconfined Compression Test (TSF)
- TR = Triaxial Compression Test
- GR = Gradational Analysis (Sieve/Hydro)
- FC = Wash (Fines Content)
- PP = Pocket Penetrometer Test (TSF)
- PID = Photo Ionization Detector Test (PPM)
- RV = Resistance ("R") Value

REF = Refusal (>50 blows in 6 inches)

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS (b)	Above 12"	Above 300
COBBLES (c)	12" to 3"	300 to 75
GRAVEL (g) coarse fine	3" to No. 4 3" to 3/4" 3/4" to No. 4	75 to 4.75 75 to 19 19 to 4.75
SAND coarse medium fine	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.75 to 0.075 4.75 to 2.00 2.00 to 0.425 0.425 to 0.075
SILT & CLAY	Below No. 200	Below 0.075

Trace - Less than 5 percent
Few - 5 to 10 percent
Little - 15 to 25 percent
Some - 35 to 45 percent
Mostly - 50 to 100 percent

* Percents as given in ASTM D2488

NOTES:

1. Coarse grained soils containing 5% to 12% fines, use dual classification symbol (ex. SP-SM).
2. If fines classify as CL-ML (4<PI<7), use dual symbol (ex. SC-SM).
3. Silty Clays, use dual symbol (CL-ML).
4. Borderline soils with uncertain classification list both classifications (ex. CL/ML).

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UNIFIED SOIL CLASSIFICATION SYSTEM

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	7
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO. 11743.01P	

APPENDICES

APPENDIX A
General Information, Field and Laboratory Testing

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering study for the proposed Delano Department of Motor Vehicles project to be constructed approximately 1300 feet north of Woollomes Avenue on the east side of Dover Parkway in Delano, California, was authorized by Nacht & Lewis Architects, Inc. on November 9, 2017. Authorization was for an investigation as described in our proposal letter dated November 19, 2015, sent to our client Nacht & Lewis, Inc., whose address is 600 Q Street, Sacramento, California; telephone (916) 329-4000.

In performing this investigation, we referenced a Site *Plan* prepared by Nacht & Lewis Architects, Inc., dated September 22, 2017.

B. FIELD EXPLORATION

Four borings were drilled across the site on December 13, 2017, at the approximate locations indicated in Figure 2 utilizing a CME-75 truck-mounted drill rig. The borings were drilled to depths of about 16½ feet below existing site grades using six-inch diameter, solid-flight helical augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., modified California sampler driven by an automatic 140-pound hammer freely falling 30 inches. The number of blows of the hammer required to drive the 18-inch long sampler each 6-inch interval was recorded. The sum of the blows required to drive the sampler the lower 12-inch interval, or portion thereof, is designated the penetration resistance or "blow count" for that particular drive.

The samples were retained in 2-inch diameter by 6-inch long thin-walled brass tubes contained within the sampler. Immediately after recovery, the soils in the tubes were visually classified by the field engineer and the ends of the tubes were sealed to preserve the natural moisture contents. All samples were taken to our laboratory for additional soil classification and selection of samples for testing.

The Boring Logs, Figures 3 through 6, contain descriptions of the soils encountered at each boring location. A Boring Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 7.

C. LABORATORY TESTING

Selected undisturbed samples of the soils were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D2216). The results of these tests are included on the Logs of Borings.

A relatively undisturbed sample was tested for shear strength by triaxial strength testing (ASTM D4767). The results of the triaxial shear strength testing are presented in Figure A1.

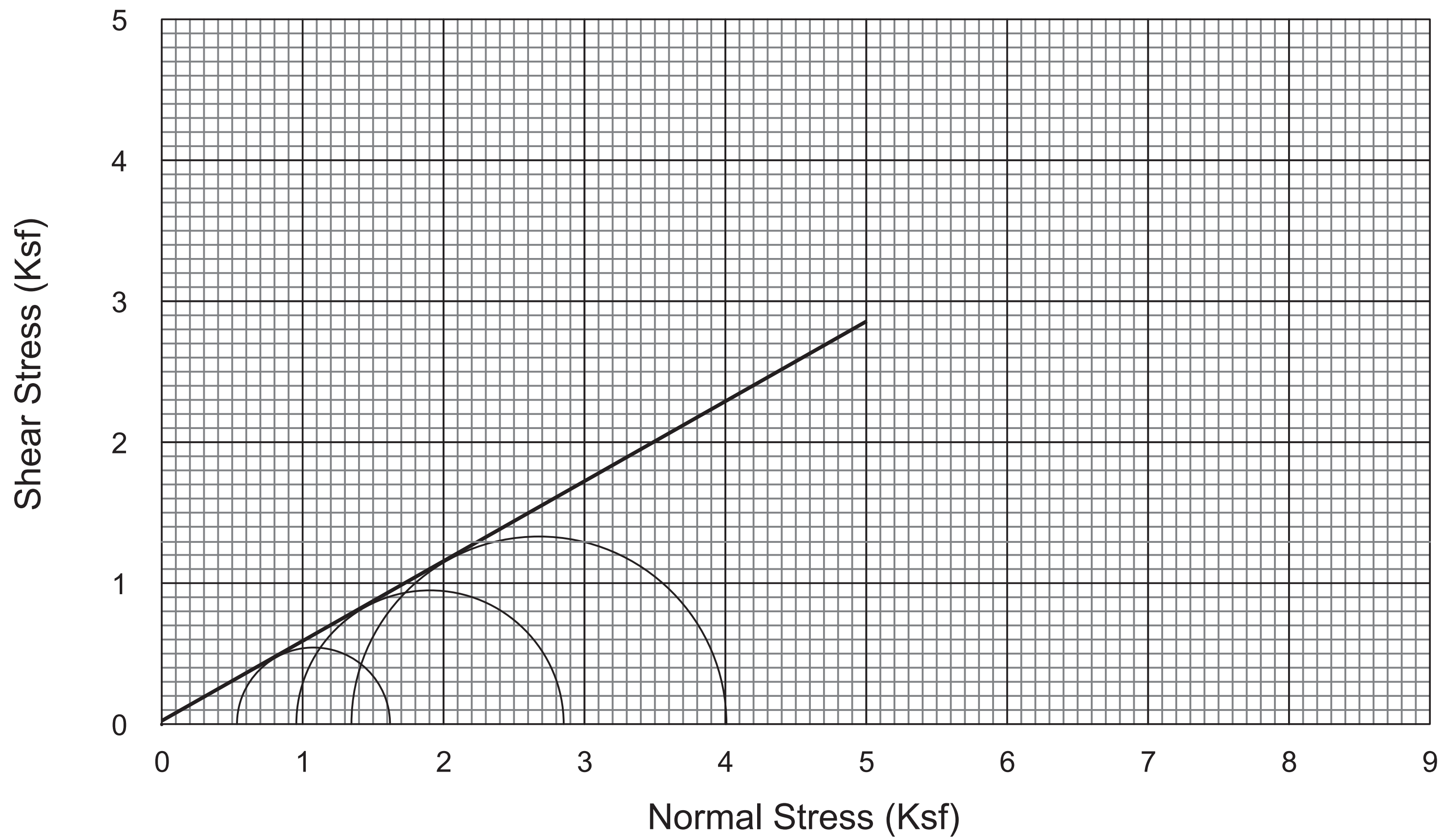
A representative sample of the near-surface soil was subjected to Expansion Index testing (ASTM D4829); the results of the test are presented on Figure A2.

One bulk sample of anticipated pavement subgrade soil was subjected to Resistance-value ("R-value") testing in accordance with California Test 301. The results of the R-value test, which were used in the pavement design, are presented in Figure A3.

One sample of near-surface soil was submitted to Sunland Analytical for corrosivity testing in accordance with California Test (CT) No. 643 (Modified Small Cell), CT 417, CT 422, and ASTM D516. Copies of the analytical results are presented in Figures A4 and A5.

TRIAXIAL COMPRESSION TEST

ASTM D4767



SAMPLE NO. : D1-1I

SAMPLE CONDITION : Undisturbed

SAMPLE DESCRIPTION : Light brown, clayey fine sand

DRY DENSITY (PCF) : 107
INITIAL MOISTURE (%) : 6.7
FINAL MOISTURE (%) : 16.4

ANGLE OF INTERNAL FRICTION (ø) : 29.5°
COHESION (PSF) : 17.3

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TRIAXIAL COMPRESSION TEST RESULTS

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	A1
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO. 11743.01P	

EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Light brown, clayey fine sand

LOCATION: D4

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
0' - 5'	8.0	14.3	118	**23**

CLASSIFICATION OF EXPANSIVE SOIL *

EXPANSION INDEX	POTENTIAL EXPANSION
0 - 20	Very Low
21 - 50	**Low**
51 - 90	Medium
91 - 130	High
Above 130	Very High

* From ASTM D4829, Table 1

Wallace Kuhl & ASSOCIATES

EXPANSION INDEX

DELANO DEPARTMENT OF MOTOR VEHICLES
Delano, California

FIGURE	A2
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO.	11743.01P

RESISTANCE VALUE TEST RESULTS

(California Test 301)

MATERIAL DESCRIPTION: Brown, clayey silty sand

LOCATION: D2 (0' - 5')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion (dial, inches x 1000)	Expansion (psf)	R Value
G	126	11.2	643	56	242	48
I	122	12.1	364	18	78	20
20	122	12.8	263	12	52	10

R-Value at 300 psi exudation pressure = **14**

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RESISTANCE VALUE TEST RESULTS

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	A3
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18

WKA NO. 11743.01P

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 12/20/2017
Date Submitted 12/15/2017

To: Derek Bays
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following location:
Location : 11743.01P Site ID : BULK D2.
Thank you for your business.

* For future reference to this analysis please use SUN # 75831-158187.

EVALUATION FOR SOIL CORROSION

Soil pH	7.70		
Minimum Resistivity	1.88	ohm-cm (x1000)	
Chloride	28.7 ppm	00.00287 %	
Sulfate	31.8 ppm	00.00318 %	

METHODS
pH and Min.Resistivity CA DOT Test #643
Sulfate CA DOT Test #417, Chloride CA DOT Test #422

Wallace Kuhl & ASSOCIATES

CORROSION TEST RESULTS
DELANO DEPARTMENT OF MOTOR VEHICLES
Delano, California

FIGURE	A4
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO.	11743.01P

Sunland Analytical
11419 Sunrise Gold Circle, #10
Rancho Cordova, CA 95742
(916) 852-8557

Date Reported 12/20/2017
Date Submitted 12/15/2017

To: Derek Bays
Wallace-Kuhl & Assoc.
3050 Industrial Blvd
West Sacramento, CA 95691

From: Gene Oliphant, Ph.D. \ Randy Horney
General Manager \ Lab Manager

The reported analysis was requested for the following:
Location : 11743.01P Site ID : BULK D2.
Thank you for your business.

* For future reference to this analysis please use SUN # 75831-158188.

Extractable Sulfate in Water

TYPE OF TEST	RESULTS	UNITS
Sulfate-SO4	31.51	mg/kg

ASTM D-516 from sat.paste extract-reported based on dry wt.

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CORROSION TEST RESULTS

DELANO DEPARTMENT OF MOTOR VEHICLES

Delano, California

FIGURE	A5
DRAWN BY	RWO
CHECKED BY	DMB
PROJECT MGR	MMW
DATE	01/18
WKA NO.	11743.01P

APPENDIX B
Guide Earthwork Specifications

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

DELANO DEPARTMENT OF MOTOR VEHICLES

Dover Parkway

Delano, California

WKA No. 11743.01P

PART I: GENERAL

1.1 SCOPE

a. General Description

This item shall include all clearing of on-site rubble and debris; preparation of surfaces to be filled, filling, spreading, compaction, observation and testing of the fill; and all subsidiary work necessary to complete the grading of the site to conform with the lines, grades and slopes as shown on the accepted Drawings.

b. Related Work Specified Elsewhere

(1) Trenching and backfilling for sanitary sewer system: Section ___.

(2) Trenching and backfilling for storm drain system: Section ___.

(3) Trenching and backfilling for underground water, natural gas, and electric supplies: Section ___.

c. Geotechnical Engineer

Where specific reference is made to "Geotechnical Engineer" this designation shall be understood to include either the Geotechnical Engineer or a representative of the Geotechnical Engineer.

1.2 PROTECTION

a. Adequate protection measures shall be provided to protect workers and passers-by the site. Streets and adjacent property shall be fully protected throughout the operations.

b. In accordance with generally accepted construction practices, the Contractor shall be solely and completely responsible for working conditions at the job site, including safety of all persons and property during performance of the work. This requirement shall apply continuously and shall not be limited to normal working hours.

c. Any construction review of the Contractor's performance conducted by the Geotechnical Engineer is not intended to include review of the adequacy of the Contractor's safety measures, in, on or near the construction site.

d. Adjacent streets and sidewalks shall be kept free of mud, loose soil, or similar nuisances resulting from earthwork operations.

e. Surface drainage provisions shall be made during the period of construction in a manner to avoid creating a nuisance to adjacent areas.

f. The site and adjacent influenced areas shall be watered as required to suppress dust nuisance.

1.3 <u>GEOTECHNICAL REPORT</u>

a. A Geotechnical Engineering Report (WKA No. 11743.01P; dated January 10, 2018) has been prepared for this site by Wallace - Kuhl & Associates, Geotechnical Engineers of West Sacramento, California [(916) 372-1434]. A copy is available for review at the office of Wallace - Kuhl & Associates.

b. The information contained in this report was obtained for design purposes only. The Contractor is responsible for any conclusions the Contractor may draw from this report; should the Contractor prefer not to assume such risk, the Contractor should employ experts to analyze available information and/or to make additional explorations upon which to base conclusions, all at no cost to the Owner.

1.4 <u>EXISTING SITE CONDITIONS</u>

The Contractor shall become acquainted with all site conditions. If unshown active utilities are encountered during the work, the Architect shall be promptly notified for instructions. Failure to notify will make the Contractor liable for damage to these utilities arising from the Contractor’s operations subsequent to the Contractor’s discovery of such unshown utilities.

1.5 <u>SEASONAL LIMITS</u>

Fill material shall not be placed, spread or rolled during unfavorable weather conditions. When the work is interrupted by heavy rains, fill operations shall not be resumed until field tests indicate that the moisture contents of the subgrade and fill materials are satisfactory.

<u>PART II:</u> <u>PRODUCTS</u>

2.1 <u>MATERIALS</u>

a. On-site soils will be suitable for engineered fill construction in structural areas provided these materials do not contain rubbish, rubble greater than three inches (3”), and significant organic concentrations. Imported fill materials, if required, shall be similar to but less expansive than native soil and does not contain particles greater than three inches (3”) in maximum dimension. Imported soils should be approved by our office prior to being transported to the site. Also, if import fills are required (other than aggregate base), the contractor shall provide appropriate documentation that the import is clean of known contamination and within acceptable corrosion limits.

c. Capillary barrier material under floor slabs shall be provided to the thickness shown on the Drawings. This material shall be clean crushed rock of one-inch (1”) maximum size, with no material passing a Number four (#4) sieve.

d. Asphalt concrete, aggregate base and other paving products shall comply with the appropriate provisions of the most recent edition of the State of California (Caltrans) Standard Specifications.

PART III: EXECUTION

3.1 LAYOUT AND PREPARATION

Layout all work, establish grades, locate existing underground utilities, set markers and stakes, set up and maintain barricades and protection of utilities--all prior to beginning actual earthwork operations.

3.2 CLEARING, GRUBBING AND PREPARING BUILDING PAD AND PAVEMENT AREAS

a. Initially, the site shall be cleared of any surface debris and rubble. Any existing underground utilities designated to be removed or relocated shall include all trench backfill. Depressions resulting from clearing operations, as well as any loose, saturated, or organically contaminated soils, as identified by our representative, shall be cleaned out to firm, undisturbed soils and widened, as necessary, to allow access with construction equipment. Depressions shall be backfilled with engineered fill in accordance with the recommendations in this report.

b. Following clearing operations, the remaining surface organics shall be removed by stripping. Strippings shall not be used in general fill construction, but may be used in landscape areas, provided they are kept at least five feet (5’) from the building pad, moisture conditioned and compacted and do not exceed a depth of two feet (2’). Discing of organics may be a suitable alternative to stripping depending upon the quantity and condition of the surface vegetation at the time of grading. Discing will be allowed only with our prior approval and should be observed by our representative. Discing, if approved, must be continuous until organics are adequately mixed with the soil to provide a compactable mixture. Pockets or concentrations of organics shall not be allowed.

c. Areas designated to receive fill, remain at-grade or achieved by excavation, including an area at least five feet (5') horizontally beyond the exterior edge of the structure, shall be scarified to a depth of twelve inches (12"), thoroughly moisture conditioned to achieve at least the optimum moisture content, and uniformly compacted to at least ninety percent (90%) of the ASTM D1557 maximum dry density. Compaction shall be performed using a Caterpillar 815 (or equivalent-sized sheepsfoot compactor). Loose, soft or saturated soils encountered below the depth of scarification during compaction operations shall be removed to expose firm undisturbed soils as identified by our representative and backfilled with engineered fill.

d. When the moisture content of the subgrade is below that required to achieve adequate compaction, water shall be added until the proper moisture content is achieved.

e. When the moisture content of the subgrade is too high to permit adequate compaction to be achieved, the subgrade shall be allowed to dry until the moisture content is satisfactory for compaction.

f. Compaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to a firm base and grades restored with engineered fill in accordance with these specifications.

3.3 PLACING, SPREADING AND COMPACTING FILL MATERIAL

a. Engineered fill shall be placed in lifts not exceeding six inches (6") in compacted thickness with each lift being uniformly moisture conditioned to at least the optimum moisture content and compacted to not less than ninety percent (90%) of the ASTM D1557 maximum dry density.

b. When the moisture content of the fill material is below that required to achieve adequate compaction, water shall be added until the proper moisture content is achieved.

c. When the moisture content of the fill material is too high to permit adequate compaction to be achieved, the fill material shall be allowed to dry until the moisture content is satisfactory.

d. The filling operations shall be continued until the fills have been brought to the finished slopes and grades as shown on the accepted Drawings.

3.4 FINAL SUBGRADE PREPARATION

a. The upper twelve inches (12”) of final building pad subgrade shall be thoroughly moisture conditioned to at least the optimum moisture content and uniformly compacted to ninety percent (90%) of the maximum dry density regardless of whether final grade is left at the existing grade or is completed by excavation or filling.

b. The upper six inches (6”) of pavement subgrades shall be uniformly compacted to at least ninety-five percent (95%) of the ASTM D1557 maximum dry density at a moisture content of at least the optimum moisture content, regardless of whether final grade is completed by excavation, filling or left at existing grade. Final subgrade compaction shall be performed just prior to placement of aggregate base, after construction of underground utilities is complete. The compacted subgrade shall be kept in a moist condition until the placement of the aggregate base. If subgrade soils are disturbed or allowed to dry they must be re-moisture conditioned and compacted before the aggregate base is placed.

3.5 TESTING AND OBSERVATION

a. All grading operations, including lime-treatment of the subgrades, shall be tested and observed by the Geotechnical Engineer, serving as the representative of the Owner.

b. Field density test shall be made by the Geotechnical Engineer after compaction of each layer of fill. Additional layers of fill shall not be spread until the field density tests indicate that the minimum specified density has been obtained.

c. Earthwork shall not be performed without the notification or approval of the Geotechnical Engineer. The Contractor shall notify the Geotechnical Engineer at least two (2) working days prior to commencement of any aspect of the site earthwork.

d. If the Contractor should fail to meet the technical or design requirements embodied in this document and on the applicable plans, the Contractor shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer and the Architect/Engineer. No deviations from the specification shall be made except upon written approval of the Geotechnical Engineer or Architect/Engineer.

/