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Geotechnical Engineering Report
CARMAX – ELK GROVE
WKA No. 9179.02
July 27, 2011

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Geotechnical Engineering Report

CARMAX – ELK GROVE

Sacramento County, California

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E. Stockton Blvd.
Sacramento County, California
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INTRODUCTION

We have completed a geotechnical engineering investigation for the proposed Carmax automotive dealership to be constructed on the east side of East Stockton Boulevard, north of Calvine Road in Sacramento County, California. The purposes of our work have been to explore the existing site, soil and groundwater conditions across the property, and to provide geotechnical engineering conclusions and recommendations regarding development of the property.

Scope of Work

Our scope of work has included the following tasks:

1. initial site reconnaissance to observe the current condition of the property;
2. review of previous geotechnical reports prepared for projects in the vicinity of the site;
3. review of available geologic and groundwater maps;
4. subsurface exploration, including the drilling and sampling of 33 borings across the property to a maximum depth of approximately 21½ feet below existing site grades;
5. bulk sampling of anticipated pavement subgrade soils;
6. laboratory testing of selected soil samples;
7. engineering analysis; and,
8. preparation of this report.

Previous Investigations

Supplemental information used in the preparation of this report, included review of the following reports prepared by our firm for the adjacent property; and Earthtec Ltd., for a larger property that includes the Carmax site.

- *Geotechnical Engineering Report* (WKA No. 8368.01, dated April 17, 2003) prepared for the existing commercial development located adjacent to the south edge of the subject property.
- *General Geotechnical Study* (Earthtec Ltd. Project No. 104228, dated December 6, 2004) prepared for a proposed commercial development, which included the subject property.

Figures and Attachments

This report contains an overall Vicinity Map as Figure 1; a Site Plan showing approximate boring and bulk sample locations as Figure 2; and, Logs of Soil Borings completed for this project as Figures 3 through 35. An explanation of the symbols and classification system used on the logs is contained on Figure 36. Appendix A contains information of a general nature regarding project concepts, exploratory methods used during the field exploration phase of our investigation, an explanation of laboratory testing accomplished, and further laboratory test results that are not presented on the boring logs. Appendix B contains *Guide Earthwork Specifications* that may be used in the preparation of project plans and specifications. Pavement design calculations for the project are contained in Appendix C.

Proposed Development

Review of the *June 8, 2011, Initial Site Plan*, prepared by Charles J. O-Brien Architects, the project architects, indicates the proposed automotive dealership building will be located near the center of the site. The remainder of the site is identified as supporting asphalt concrete paved access driveways and parking areas for approximately 794 autos. Associated development will include construction of underground utilities, landscaping, exterior flatwork, pole-mounted light standards, and tall entry signs.

We understand the Carmax dealership will consist of a single commercial building containing a sales office, a service department, and a carwash. The planned dealership building will

encompass a total area on the order of 27,185 square feet (sf). We anticipate the building will be a tall, single-story structure constructed of concrete masonry walls with an interior concrete slab-on-grade floor. Based on review of the Carmax Design Criteria, the dealership building will develop structural loads on the order of 120 kips (dead plus live loads) for interior columns, and exterior wall loads on the order of 4.0 kips per lineal foot (dead plus live loads). Interior floor slabs will be subjected to uniform live loads on the order of 300 to 700 pounds per square foot (psf).

Although grading plans were not available at the time of our investigation, we anticipate maximum excavations and fills on the order of one to three feet for development of the site, with deeper excavations expected for the below-grade drainage pit in the proposed carwash.

FINDINGS

Site Description

The irregular-shaped parcel encompasses a total area of approximately eight acres and is located on the east side of East Stockton Boulevard, north of Calvine Road in Sacramento County, California (Figure 1). The property is bounded to the north by fallow, undeveloped land; to the east by existing apartment complexes; to the south by an existing commercial development; and, to the west by East Stockton Boulevard. The topography of the site consists of relatively flat terrain with an average surface elevation of approximately +29 feet relative to mean sea level (msl), based on review of topographic information provided by KASL Consulting Engineering, Inc.

At the time of our field investigation on July 1 and 5, 2011, the site was fallow, undeveloped land. The surface of the site had been recently disced and supported variable concentrations of volunteer weeds and grasses. Utility manholes were observed within the existing utility easement that extends through the northern portion of the property, between Auberry Drive and East Stockton Boulevard. Two stockpiles were observed in the western portion of the site, near East Stockton Boulevard and contained loose soils, concrete rubble, metal debris, and other deleterious debris.

Historical Aerial Photograph Review

Review of available aerial photographs taken in 1937 and 1947, indicates the site is undeveloped fallow land. Highway 99 is visible to the west of the site. Review of 1952 and 1961 aerial photographs indicate the site supported flood irrigated crops and row crops. In 1971, the site appears to be fallow undeveloped land.

Reviews of aerial photographs taken from 1981 through 2006 indicate the site remained relatively unchanged from 1971. Commercial structures similar in size and location to the building observed south of the site become visible in the 2005 photograph.

Site Geology

The site is located in the central portion of the Great Valley geomorphic province of California in the southern portion of the Sacramento Valley. The Great Valley of California is generally considered to be an elongated sedimentary trough, approximately 450 miles long and 50 miles wide. Rock units within the Great Valley geomorphic province consist of Mesozoic to Cenozoic marine and non-marine sedimentary rocks. These sediments have been folded into an asymmetric syncline, the axis of which lies immediately east of the interior Coast Ranges. The sedimentary units on the east side of the Great Valley are minimally deformed and are deposited on basement rocks of the Sierra Nevada geomorphic province. The sedimentary rocks on the west side of the Great Valley are deformed at dip at moderate angles to the east (Norris and Webb, 1990).

Late Pleistocene fluvial and eolian sediments of the lower member of the Riverbank Formation (Qrl) underlie the site. These fluvial and eolian sediments consist primarily of sands and silts (Atwater, 1982). The mapped geology was found to be generally consistent with the subsurface soil conditions encountered within our borings performed across the parcel.

Subsurface Soil Conditions

Results of our test borings indicate the surface and near-surface soils consist of dark brown, silty clays within the upper two to eight feet of the ground surface, underlain by layers of variably cemented, clayey and sandy silts to the maximum depths explored of approximately 21½ feet below existing grades. Borings D27 through D30 did not encounter a layer of silty clay at or near the surface at their locations.

For specific soil conditions at a particular location, please refer to the Logs of Soil Borings, Figures 3 through 35. The approximate elevation of the ground surface at each boring location was obtained topographic information provided by KASL Consulting Engineers, Inc.

Groundwater

Groundwater was not encountered the soil borings performed on the site on July 1 and 5, 2011, at a maximum depth of approximately 21½ feet below existing site grades.

To supplement our groundwater data, we reviewed available groundwater elevation data obtained from a California Department of Water Resources (DWR) monitored well as identified as #07N05E15H001M previously located near the southern boundary of the subject property. The surface elevation at the well location is indicated to be about +28.5 feet msl. The DWR has periodically measured water elevations in this well from June 1952 to March 1988. Based on the available data, the "lowest" measured groundwater elevation at the well occurred on June 23, 1977, at an approximate elevation of -79 feet msl, or approximately 108 feet below existing site grades; the "highest" elevation of -23.3 feet msl occurred on June 11, 1952, or approximately 51 feet below existing site grades. Recent measurements taken over the past 10 years by DWR in nearby groundwater wells indicates the groundwater elevation fluctuating between approximately 50 to 60 feet below existing side grades.

CONCLUSIONS

Bearing Capacity and Anticipated Settlements

The upper one to two feet of existing native soils appear to be disturbed and in a relatively loose condition, partially due to previous agricultural activities. However, based on our field investigation and laboratory test results, it is our opinion the undisturbed native soils and engineered fill, properly placed and compacted in accordance with the recommendations of this report, are capable of supporting the proposed structures and pavements provided the following recommendations regarding site preparation and engineered fill placement are carefully followed.

Specific recommendations to scarify, moisture condition, and recompact the surface soils have been provided in the Site Preparation section of this report.

Foundations constructed in accordance with the recommendations of this report are expected to experience a maximum total settlement less than one inch and maximum differential settlement on the order of ½-inch over a distance of 40 feet, including dry sand seismic settlements.

2010 California Building Code Site Classification

The site is underlain by the lower member of the Riverbank Formation (Qrl), which consists of mid-Quaternary semi-consolidated alluvial deposits consisting of gravel, sand, clay and silt deposited from erosion of the Sierra Nevada Mountains east of the site. In our professional opinion the site is not "vulnerable to potential failure or collapse under seismic loading". Therefore, the site is not considered subject to any of the four categories of Site Class F as defined in the 2010 CBC. The site is not subject to the three criteria of Site Class E, as defined in the 2010 CBC. Review of *"A Site-Conditions Map for California Based on Geology and Shear-Wave Velocity"* prepared by representatives of the CGS and published in the Bulletin of the Seismological Society of America indicate a site classification of C for the Riverbank Formation (Wills et al., 2000). Therefore, based on the information presented Tables 1613.5.2 and 1613.5.5 of the 2010 CBC, we recommend that the site be classified as Site Class C.

2010 California Building Code Seismic Design Parameters

Section 1613 of the 2010 California Building Code (CBC) references Chapter 11 (*Seismic Design Criteria)* of the American Society of Civil Engineers (ASCE) Standard 7-05 for the purposes of seismic design. The ASCE Standard 7-05 seismic parameters were determined based on the site latitude and longitude (Latitude 38.4607°N, Longitude 121.4106°W) using the public domain computer program developed by the United States Geological Survey (Version 5.1.0). The following parameters summarized in the table below may be used for seismic design of the proposed structure per the 2010 CBC.

TABLE 1 2010 CBC SEISMIC DESIGN PARAMETERS				
Latitude: 38.4607° N Longitude: 121.4106° W	ASCE 7-05 Table/Equation	2010 CBC Table/Equation	Factor/ Coefficient	Value
Short-Period MCE at 0.2s	N/A[1]	N/A[1]	S_S	0.585 g
1.0s Period MCE	N/A[1]	N/A[1]	S_1	0.239 g
Site Class	Table 20.3-1	Table 1613.5.2	--	C
Site Coefficient	Table 11.4-1	Table 1613.5.3(1)	F_a	1.166
Site Coefficient	Table 11.4-2	Table 1613.5.3(2)	F_v	1.561
Adjusted MCE Spectral Response Parameters	Equation 11.4-1	Equation 16-36	S_{MS}	0.683 g
	Equation 11.4-2	Equation 16-37	S_{M1}	0.374 g
Design Spectral Acceleration Parameters	Equation 11.4-3	Equation 16-38	S_{DS}	0.455 g
	Equation 11.4-4	Equation 16-39	S_{D1}	0.249 g
Seismic Design Category	Table 11.6-1	Table 1613.5.6(1)	Occupancy I to III	C
	Table 11.6-1	Table 1613.5.6(1)	Occupancy IV	D
	Table 11.6-2	Table 1613.5.6(2)	Occupancy I to IV	D

[1]: USGS Seismic Hazard Calculator version 5.1.0

Based upon the results of our work at the site, the known site, geologic, seismologic, groundwater and soils conditions, it is our opinion that the potential for liquefaction occurring at this site is very low.

Soil Expansion Potential

The surface and near-surface soils consist primarily of silty clays and are considered moderately plastic with a moderate expansion potential when tested in accordance with ASTM D4829 (Figures A2 and A3) and ASTM D4318 (Figure A4). Based on our experience in the area and the results of the laboratory testing, on-site clays are considered capable of exerting significant expansion pressures upon building foundations, and slabs-on-grade concrete (both interior and exterior). Specific recommendations to reduce the effects of expansive soils are presented in later sections of this report.

Pavement Subgrade Qualities

The surface and near-surface soils exhibit poor subgrade qualities for support of asphalt concrete pavements. Laboratory testing of the near-surface soils indicate that these materials possess Resistance ("R") values ranging from 5 to 14. Summaries of the R-value test results are contained on Figure A5.

Our experience indicates clay soils may react well with dolomitic or high-calcium quicklime, with resulting R-values typically greater than 50. Lime-treatment of native clays can be an effective and economical method to increase the capability of the clay soil to support pavements, reduce expansion potential, and to reduce the moisture content of near-saturated soils, enabling construction to proceed during or shortly after the rainy season.

The performance of chemically stabilized soils is very dependent on uniform mixing of the lime into the subgrade soils and providing a proper curing period following compaction. An experienced soil stabilization contractor and a comprehensive quality control program are essential to achieve the best results with lime stabilized subgrades.

On-Site Soil Suitability for Engineered Fill Construction

The native soils are considered suitable for use as engineered fill provided that they are free of significant quantities of organics, rubble and deleterious debris, and are at a suitable moisture content to achieve the recommended compaction. *Native clays will not be suitable for use in the upper 12 inches of building pads or exterior slabs-on-grade unless treated with lime.*

Soil Corrosion Potential

Four samples of near-surface soils were submitted for analysis of soil pH, resistivity, chloride and sulfate concentrations to help evaluate the potential for corrosive attack upon exposed buried metal and reinforced concrete. Results of the corrosion testing are summarized in Table 2; copies of the analytical reports are presented on Figures A7 through A10.

TABLE 2
SOIL CORROSION TEST RESULTS

Analyte	Test Method	Units	Sample Identification			
			D1 (4'-6')	D3 (0'-2')	D24 (0'-3')	D29 (1'-4')
pH	CA DOT 643 Modified*	-	7.72	6.88	7.52	7.39
Min. Resistivity	CA DOT 643 Modified*	Ω-cm	1,020	990	1,340	5,090
Chloride	CA DOT 422	ppm	25.2	18.7	10.1	10.3
Sulfate	CA DOT 417	ppm	50.8	1.9	11.6	16.1

* = Small cell method
Ω-cm = Ohm-centimeters
ppm = Parts per million

Published literature[1] defines a corrosive area as an area where the soil and/or water contains more than 500 ppm of chlorides, more than 2000 ppm of sulfates, or has a pH of less than 5.5. Resistivities of less than 1000 Ω-cm are known to shorten the life of buried metal structures (CT643). The corrosivity test results suggest that the native soils are not highly corrosive to steel reinforcement properly embedded within Portland cement concrete for the samples tested, but would be corrosive to exposed buried metal. Table 4.3.1 – *Requirement for Concrete Exposed to Sulfate-Containing Solutions*, American Concrete Institute (ACI) 318, Section 4.3, as referenced in Section 1904A.5 of the 2010 CBC, indicates the sulfate exposure for the samples tested is *Negligible*. Ordinary Type I-II Portland cement is considered suitable for use on this project, assuming a minimum concrete cover is maintained over the reinforcement.

Wallace-Kuhl & Associates are not corrosion engineers. Therefore, to further define the soil corrosion potential at the site, or to determine the need or design parameters for cathodic protection or grounding systems, a corrosion engineer should be consulted.

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

[1] California Department of Transportation, Division of Engineering Services, Materials Engineering and Testing Services, Corrosion Technology Branch, Corrosion Guidelines, Version 1.0, September 2003.

for the short periods of time required for utility construction. However, minor sloughing and "running" conditions may occur if the soils are saturated, or where zones of clean (cohesionless) sands are encountered, especially when the soils are subjected to construction vibrations or allowed to dry significantly.

Excavations deeper than five feet that will be entered by workers should be sloped, braced or shored in accordance with current OSHA regulations. 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.

Excavated materials should not be stockpiled directly adjacent to the open trench to prevent surcharge loading of the trench sidewalls. Excessive truck and equipment traffic should also be avoided near open trenches. If material is stored or heavy equipment is operated near an excavation, stronger shoring (or flatter slopes) would be needed to resist the additional pressure due to the superimposed loads.

Groundwater

Our borings and review of available groundwater information indicates that permanent groundwater should not be a significant factor in design or construction of the proposed development at this site.

Seasonal Water

During the wet season, infiltrating surface water can create a saturated or perched water condition within the surface soils above the near-surface cemented soils. 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. Furthermore, high soil moisture contents below interior floor slabs and pavements are common during the lifetime of structures due to daily watering of landscaping and poor drainage around completed structures. Therefore, high soil moisture should be expected beneath existing pavements and slabs regardless of the time of year.

RECOMMENDATIONS

The recommendations in this report are based on assumed maximum excavations and fills of one to three feet for development of the Carmax facility. We consider it essential that our office review grading and structural foundation plans to verify the applicability of the following recommendations, and to provide supplemental recommendations, if necessary.

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 drying by aeration or the addition of lime or a similar product. Should the construction schedule require work to continue during the wet months, additional recommendations can be provided, as conditions dictate.

Site Clearing and Site Preparation

Initially, surface debris, rubble, rubbish; trees, shrubs and bushes, including rootballs; and, loose and/or saturated materials, should be removed from the site and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Adequate removal of existing roots may require laborers and hand-picking to clear the subgrade soils to the satisfaction of our representative, prior to further site preparation.

The existing stockpile soils must be completely removed to expose firm undisturbed soil, as determined by our representative. The stockpiled soils may be used as engineered fill, provided they are free of significant organics, concrete rubble, metal debris, clays, rubbish, or other unsuitable materials.

Following clearing operations, the site should be stripped of remaining surface vegetation and organically contaminated topsoil. Strippings may be stockpiled for later use or disposed of off-site. *Strippings should not be used in general fill construction, but may be used in landscaped areas, provided they are kept at least five feet from any structures, including adjacent flatwork, pavements, and are moisture conditioned and compacted.*

Discing of the organics into the surface soils may be a suitable alternate to stripping, depending on the condition and quantity of the organics at the time of grading. *The decision to utilize discing in lieu of stripping should be made by our representative, at the time of earthwork*

construction. Discing operations, if approved, should be observed by the Geotechnical Engineer, or his representative, and be continuous until the organics are adequately mixed into the surface soils to provide a compactable mixture of soil containing minor amounts of organic matter. Pockets or concentrations of organics will not be allowed.

Our representative should be present during clearing and grading operations to verify adequate removal of existing roots and debris and determine the need for additional sub-excavation. Excavations resulting from clearing operations shall be left as shallow dish-shaped depressions for proper location and to allow proper access with compaction equipment during grading operations.

Existing excavations resulting from the clearing operations should be cleaned out to expose firm, undisturbed soil and the excavations backfilled in accordance with the recommendations of this report. During clearing operations the exposed subgrades should be evaluated by our representative. Any other loose, disturbed, soft or otherwise unsuitable materials should be removed to expose a firm base for the support of the fill needed to restore the areas back to the required grades.

Areas designated to receive fill, remain at-grade or achieved by excavation should be scarified to a depth of 12 inches, uniformly moisture conditioned to at least two percent over the optimum moisture content, and compacted to at least 90 percent of the maximum dry density per ASTM D1557 specifications. Compaction should be performed using a heavy, self-propelled sheepsfoot compactor (Caterpillar 815 or equivalent-sized compactor).

Compaction of the existing grade must be performed in the presence of our representative who will evaluate the performance of the subgrade under compactive loads and identify any loose or unstable soil conditions that could require additional excavation. Subgrades must be properly compacted and stable prior to further construction or fill placement.

The site preparation recommendations contained in this section are provided to mitigate potential foundation and slab movements to within the Carmax design criteria and requirements.

Engineered Fill Construction

Engineered fill should be placed in lifts that do not exceed six inches in compacted thickness. Native materials should be thoroughly moisture conditioned to at least two percent over the optimum moisture content and uniformly compacted to at least 90 percent of maximum dry density, as defined above.

If construction begins during the summer or fall, there is a potential that the surface clay soils may be desiccated deeper than the recommended depth of scarification. Should this condition exist, the site should be continuously watered for a sufficient period of time to close the desiccation cracks to within 12 inches of the surface. Prewatering of the site should not be necessary if grading operations begin in the early spring months prior to the soils having a chance to dry significantly.

The upper 12 inches of final building pad subgrades and subgrades supporting exterior slabs-on-grade should consist of select, non-expansive, granular fill uniformly compacted to not less than 90 percent of the maximum dry density, as determined by ASTM D1557, regardless of whether final grade is completed by excavation, filling or left at existing grade. Alternatively, the upper 12 inches of clayey soils may be chemically treated with at least 4½ pounds of quicklime (either dolomitic or high-calcium) per square foot per foot of depth. Lime-treated soils should be compacted to at least 92 percent relative compaction at not less than two percent over the optimum moisture content. The moisture content of lime-treated soils should be maintained by continual wetting until covered by aggregate base or capillary break materials.

If the granular fill option is selected and the existing grades are within 12 inches of final subgrade levels, the clays must be excavated to provide for the 12-inch select fill section. Following excavation, if required, the exposed soils should be moisture conditioned and recompacted, as recommended above.

On-site soils are considered suitable for use in engineered fill construction, if free of significant concentrations of organic materials, rubble or debris. Imported fill materials, if required, should be well graded granular materials with non-plastic fines with a maximum Plasticity Index of 15 or less; an Expansion Index of 20 or less; and, free of particles greater than three-inches in maximum dimension. Imported fill should be free of contamination with proper documentation

and should be observed, tested and approved by the Geotechnical Engineer prior to being transported to the site.

The upper six inches of "untreated" 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, and must be stable under construction traffic prior to placement of aggregate base. Final pavement subgrade processing and compaction should be performed just prior to placement of aggregate base, after construction of underground utilities is complete. The moisture content of the subgrade soils must be maintained until covered by aggregate base.

Permanent excavation and fill slopes should be constructed no steeper than two horizontal to one vertical (2:1), and should be vegetated as soon as practical following grading to minimize erosion. Slopes should be over-built and cutback to design grades and inclinations.

Site preparation should be accomplished in accordance with the recommendations of this section and the *Guide Earthwork Specifications* provided in Appendix B. Our representative 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.

Utility Trench Backfill

Bedding of utilities and initial backfill around and over the pipe should be in accordance with the manufacturer's recommendations for the pipe materials selected, and County of Sacramento requirements. Native soils should be used as intermediate trench backfill within the building and all pavement areas. Utility trench backfill should be placed in maximum six-inch lifts (compacted thickness), moisture conditioned to above the optimum moisture content and mechanically compacted to at least 90 percent of the ASTM D1557 maximum dry density. Within the upper 12 inches of the building and the upper six inches of pavement and sidewalk areas the minimum compaction should be 95 percent of ASTM D1557.

We recommend that underground utility trenches that are aligned nearly parallel with foundations be at least three feet from the outer edge of foundations, wherever possible. As a general rule, trenches should not encroach into the zone extending outward at a 1:1 inclination below the bottom of the foundations. Additionally, trenches parallel to existing foundations

should not remain open longer than 72 hours. 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 Carmax dealership structure may be supported on a continuous perimeter foundation with interior continuous or isolated spread foundations that bear on engineered fill constructed in accordance with the recommendations of this report. Foundations should extend at least 18 inches below the completed building pad soil surface or lowest adjacent compacted soil grade, whichever is lower. Continuous foundations should be at least 12 inches wide; isolated spread foundations should be at least 24 inches in plan dimension. A continuous foundation around the perimeter of the building, including the service bays, is crucial to help minimize moisture variations beneath the structure.

Foundations may be sized for maximum net allowable soil bearing pressures of 2000 pounds per square foot (psf) for a dead load, 3000 psf for a dead plus live load or 4000 psf for total load, including the short-term effects of seismic or wind forces. The weight of foundation concrete extending below grade may be disregarded in sizing computations. Foundations designed with this criteria should experience total settlements less than 1 inch and differential settlements of less than ½ inch over a distance of 40 feet, including seismic settlements.

We recommend that all continuous foundations be reinforced with a minimum of four No. 4 reinforcing bars, placed two each, top and bottom, to allow the foundations the ability to span isolated soil irregularities. Final reinforcement should be determined by the structural engineer based upon anticipated structural loads.

Lateral resistance of foundations may be computed using an allowable friction factor of 0.30, which may be multiplied by the effective vertical load on the foundation. Additional lateral resistance may be assumed to develop against the vertical face of the foundations and may be computed using a "passive" 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 the passive resistance requires some horizontal movement, which significantly diminishes the frictional resistance.

A modulus of vertical subgrade reaction (k_s) of 115 pounds/cu. in.(pci) may be used for design of grade beams or other foundation elements, where applicable.

Uplift resistance of foundations will be provided by the weight of foundation concrete, the weight of backfill overlying the foundation and shearing resistance developed along assumed vertical planes extending upward from the outer edges of foundations to the ground surface. In computations for determining uplift resistance, the unit weight of concrete may be assumed to be 150 pounds per cubic foot (pcf) and the moist unit weight of the backfill may be assumed to be 130 pcf, provided the backfill is placed as engineered fill. An allowable total skin friction of 300 psf may be applied to the sides of the foundation in contact with native soils or engineered fill.

Retaining Wall Design

Retaining walls capable of slight rotation about their base (unrestrained at the top or sides) should be capable of resisting an "active" lateral earth pressure equal to an equivalent fluid pressure of 40 psf per foot of wall backfill for horizontal backfill conditions. Retaining walls that are fixed at the top should be capable of resisting an "at-rest" lateral earth pressure equal to an equivalent fluid pressure of 60 psf per foot for horizontal backfill conditions.

Retaining walls could experience additional surcharge loading if vehicles are parked or at-grade foundations are constructed within a one horizontal to one vertical (1:1) projection from the bottom of the retaining walls. Surcharge loading under these circumstances should be included in the design of the walls.

Retaining wall foundations should extend at least 18 inches below soil grade. Retaining wall foundations may be designed utilizing the parameters provided in the Foundation Design section of this report.

Where storm or irrigation water can enter the wall backfill, the retaining walls should be fully drained to prevent the build-up of hydrostatic pressure behind the wall. Retaining walls should be provided with a drainage blanket (Class 2 permeable material, Caltrans Specification Section 68-1.025) at least one foot wide extending from the base of wall to within one foot of the top of the wall. The top foot above the drainage layer should consist of compacted on-site materials. Weep holes or perforated rigid pipe should be provided near the base of the wall to allow drainage of accumulated water. Drain pipes, if used, should slope to discharge at no less than a

one percent fall to suitable drainage facilities. Open-graded ½-inch to ¾-inch crushed rock may be used in lieu of the Class 2 permeable material, if the rock and drain pipe are completely enveloped in an approved non-woven geotextile filter fabric. Should the area behind the wall be covered with concrete, drainage behind the wall is optional.

Structural backfill materials for retaining walls, other than the drainage layer, should consist of on-site or imported granular soils free of significant quantities of rubbish, rubble, organics and rock over four inches in size. Structural backfill should be placed in lifts not exceeding 12 inches in compacted thickness, and should be mechanically compacted to at least 90 percent relative compaction per ASTM D1557. The top six inches of backfill in pavement areas should be compacted to not less than 95 percent relative compaction.

We recommend that our office review retaining wall structural plans to verify the applicability of these recommendations and to provide supplemental recommendations, as necessary.

Sound Wall Systems

Sound walls may be supported on conventional foundations or drilled pier foundations bearing on firm, undisturbed ground, engineered fill that is placed and compacted in accordance with the recommendations of our report, or a combination of these materials, as confirmed by the our representative. Conventional foundations for support of sound walls should be designed utilizing the parameters provided in the Foundation Design section of this report. Drilled pier foundations for support of sound walls may be designed utilizing the parameters provided in the Pier Foundations section of this report.

Pier Foundations

Based upon results of our investigation and our experience with similar projects, we anticipate sound walls, pole-mounted lights used near walkways or within parking areas, and pylon entry signs will be supported upon drilled, cast-in-drilled-hole (CIDH) reinforced concrete piers. Piers for support of sound walls and pole-mounted lights should be at least 18 inches in diameter and extend at least six feet below lowest adjacent soil grade. Drilled piers for pylon entry signs should be at least 24 inches in diameter and extend at least 10 feet below lowest adjacent soil grades. Drilled pier foundations should be structurally isolated from any adjacent concrete flatwork by a felt strip or similar material.

Drilled piers may be sized utilizing a maximum allowable vertical bearing capacity of 3000 psf and an allowable skin friction of 300 psf for dead plus live loads, which may be applied over the surface of the pier. Those values may be increased by one-third to include short-term wind or seismic forces. The weight of foundation concrete below grade may be disregarded in sizing computations.

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 300 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.

The upper 12 inches of skin friction should be neglected unless the pier is completely surrounded by slab concrete or pavements for a distance of at least three feet from the edge of the foundation pier.

Sizing of piers to resist lateral loads can be evaluated using Section 1807.1 of the 2010 California Building Code (CBC). A value of 150 pcf for lateral bearing as defined in Table 1806.2 of the CBC may be used for the coefficients S_1 and S_3 for the nonconstrained and constrained conditions, respectively. Per Table 1804.2 of the 2010 CBC, an increase of 1/3 is permitted when using the alternate load combinations in Section 1605.3.2 that include wind or earthquake loads. The upper 12 inches of the subgrade should be neglected for the nonconstrained condition.

Reinforcement and concrete should be placed in the pier excavations as soon as possible after excavation is completed to minimize the chances of sidewall caving into the excavations. Although we do not anticipate excessive sloughing of the sidewalls during pier construction, we recommend that the pier contractor be prepared to case the pier holes if conditions require.

To minimize the amount of sidewall caving, we recommend that a maximum elapsed time of two hours between completion of the pier excavation and the start of concrete placement. The bottom of the pier excavations should be free of loose or disturbed soils prior to placement of the concrete. Cleaning of the bearing surface should be verified by the geotechnical engineer prior to concrete placement. Concrete should be pumped into pier foundations from the bottom up by using a concrete pump equipped with a tremie pipe or other approved device.

We estimate total settlement for drilled pier foundations using the recommended maximum net allowable bearing pressure and skin friction presented above, should be less than one inch. The settlement estimate is based on the available soil information, our experience with similar structures and soil conditions, and field verification of suitable bearing soils during foundation construction.

It is considered essential that our representative be present during pier drilling to verify adequate depth of penetration into competent bearing soils or rock. Concrete reinforcing steel should not be placed in any pier excavation until approved by our representative.

Interior Floor Slab Support

A modulus of subgrade reaction (k_s) of 115 pounds per cubic inch (pci) is considered appropriate for design on interior floor slabs, provided the upper 12 inches of pad subgrade soils are uniformly compacted to 95 percent of the ASTM D1557 maximum dry density. *Temporary loads exerted during construction from vehicle traffic, cranes, forklifts, and storage of palletized construction materials should be considered in the design of the slab-on-grade floor.*

Interior concrete slab-on-grade floors can be supported upon the recommended non-expansive soil subgrade prepared in accordance with the recommendations in this report and maintained in that condition (at least the optimum moisture). Interior concrete slab-on-grade floors should be at least five inches thick and, as a minimum, should contain chaired No. 4 rebar at 24-inches each way in the slab, located at mid-slab depth. This slab thickness and reinforcement is suggested as a guide "minimum" only. Final slab thickness, reinforcement and joint spacing should be determined by the structural engineer. Proper and consistent location of the reinforcement at 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. *Temporary loads exerted during construction from vehicle traffic, cranes, forklifts, and storage of palletized construction materials should be considered in the design of the slab-on-grade floors.*

Slabs that will receive moisture sensitive floor covering should be underlain by a layer of free-draining gravel (or crushed rock) serving as a deterrent to migration of capillary moisture. The rock layer should be at least four inches thick and graded such that 100 percent passes a one-inch sieve and none passes a No. 4 sieve. This detail should not be used for support of vehicles or other significant floor loads.

Slab-on-grade floors that will be used for vehicle support should consist of six inches of Portland Cement Concrete (PCC) overlying six inches of Class 2 aggregate base compacted to 95 percent of ASTM D1557. Reinforcing for crack control, if desired, should consist of No. 4 reinforcing bars placed on maximum 24-inch centers each way throughout the slab. PCC should achieve a minimum compressive strength of 3500 pounds per square inch (psi) at 28 days. Concrete curing and joint spacing and details should conform to current Portland Cement Association (PCA) and American Concrete Institute (ACI) guidelines

Additional moisture protection may be provided by placing a sheet plastic membrane (at least 10-mils thick) directly over the crushed rock or aggregate base. The plastic membrane should meet or exceed the minimum specifications for plastic water vapor retarders as outlined in ASTM E1745 and be installed in strict conformance with the manufacturer's recommendations.

Floor slab construction over the past 20 years or more has included placement of a thin layer of sand over the vapor retarder membrane. The intent of the sand 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. Typically, the sand shifts during concrete placement resulting in an irregular slab thickness and sand pockets in the slab concrete. The slab designer should consider these factors when detailing the slab support layers.

For slabs-on-grade constructed without a vapor barrier membrane, the allowable friction factor between the slab and subslab material may be assumed to be 0.50. With a vapor retarder membrane, the allowable friction factor should be reduced to 0.20.

Interior slab concrete should be designed with the lowest practical water cement ratio, and achieve a 28-day compressive strength of not less than 3000 psi.

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 wet to near-saturated at some time during the life of the structure. This is a certainty when the interior slab is 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 all slabs intended for moisture-sensitive floor coverings or materials, require protection against moisture or moisture vapor penetration. Standard practice includes the gravel and water vapor retarder as suggested above. However, the gravel and plastic membrane offer only a limited, first-line of defense against soil-related moisture. Recommendations contained in this report concerning foundation and floor slab design are presented as *minimum* requirements, only from the geotechnical engineering standpoint.

It is emphasized that the use of sub-slab crushed rock and sheet plastic membrane will not "moisture proof" the slab, nor does it assure that slab moisture transmission levels will be low enough to 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 slab.

Exterior Flatwork (Non-Pavement Areas)

Exterior slab-on-grade concrete (e.g. sidewalks, patios, etc.) should be supported on at least 12 inches of compacted, non-expansive soil or lime-treated native soils. The native soils beneath the non-expansive layer should be uniformly compacted to at least 90 percent relative compaction and thoroughly moisture conditioned to at least two percent above the optimum moisture, and maintained in that moisture condition until covered by the non-expansive soil layer. 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.

Slab reinforcement for crack control, if desired, should consist of No. 3 reinforcing bars at 18-inch centers each way, located at the mid-depth of the concrete.

Consideration should be given to thickening the edges of sidewalks and other exterior flatwork to at least twice the slab thickness. Areas adjacent to new exterior flatwork should be landscaped to maintain more uniform soil moisture conditions adjacent to and under the flatwork. We recommend that final landscaping plans not allow fallow ground adjacent to exterior concrete flatwork.

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

Drainage Pit Excavation

We recommend unsupported excavation slopes be excavated no steeper than a one horizontal to one vertical (1:1) inclination. Temporary vertical excavations will be suitable if bracing or shoring is provided within the excavation for protection of workers.

Drainage Pit Walls

Following are preliminary recommendations for use in the drainage pit wall design. We assume that the walls constructed at the site will retain engineered fill constructed of on-site soil. We should review the grading plans for the project to evaluate the applicability of our recommendations and determine the need for modified recommendations.

The drainage pit walls should be capable or resisting "at-rest" lateral soil pressures equal to an equivalent fluid pressure of 60 psf per foot of retained soil. Foundations for the pit walls may be sized for vertical compressive loads utilizing maximum allowable soil bearing pressures of 3000 psf for dead plus live load, with a ⅓ increase for total load, including the effects of seismic forces. Lateral resistance of retaining wall foundations can be evaluated using the soil parameters contained in the Foundation Design section of this report.

The drainage pit walls could experience additional loading from nearby foundations if the foundations extend within a one horizontal to one vertical (1:1) projection from the bottom of the retaining wall. The increased load will depend on the depth and horizontal distance of the foundation from the wall; therefore, surcharge loading under these circumstances will need to be

evaluated on a case-by-case basis. Surcharge loading of the walls can be avoided by deepening foundations so the bottom of the foundation is beyond the 1:1 projection. Lateral loading on the drainage pit walls due to vehicle loads along the wall may be computed by 0.4q; where "q" is the magnitude of the surcharge load. The surcharge pressure is a rectangular pressure distribution, i.e. constant with depth, and should be applied over the entire height of the wall.

Hydrostatic pressure should not be allowed to buildup behind the wall. If this cannot be accomplished, then the walls will need to be designed for higher at-rest pressures.

Only approved on-site or imported granular soils should be used to backfill drainage pit walls. Backfill should be placed in lifts not exceeding six inches in compacted thickness and compacted by mechanical methods to at least 90 percent of the maximum dry density per current ASTM D1557 specifications. Clay soils should not be used for retaining wall backfill.

Pavement Design

In the State of California, Caltrans has developed it's own design method and not yet adopted the American Association of State Highway and Transportation Officials (AASHTO) design method. Accordingly, this method of pavement design is the standard of practice in California and was used to calculate alternative pavement sections as follows. This method is based on R-value tests (Figure A5) rather than the *California Bearing Ratio* (CBR) tests on the supporting soils.

The anticipated traffic level was characterized in terms of Equivalent Axle Loads (EAL's). For this project we have assumed this is the same as an 18 kip *Equivalent Single Axle Loads* (ESAL). Carmax specifies a 20-year design life, which was converted to a Traffic Index (TI) as used in the California method. Table 3 summarizes the conversion of ESAL to TI for both Light Duty and Heavy Duty Pavements.

TABLE 3
SUMMARY CONVERSION OF ESAL TO TRAFFIC INDICES

Light Duty		Heavy Duty	
ESAL	TI	ESAL	TI
7,500	5.5	75,000	7.0

Using the above TIs, the results of our R-Value testings, and the procedures described within Chapters 600 to 670 of the *California Highway Design Manual*, dated July 1, 2008, we have calculated the following pavement section alternatives for on-site improvements summarized in Table 4. Copies of our pavement design calculations also are provided in Appendix C. The project civil engineer should determine the appropriate traffic index based on anticipated traffic conditions. The pavement sections for chemically treated subgrades presented below are preliminary in nature and included for budgetary purposes only.

TABLE 4
PAVEMENT DESIGN ALTERNATIVES FOR ON-SITE PAVEMENTS

		Untreated Subgrades R-value = 5		Chemically-Treated Subgrades R-value = 50+		Portland Cement Concrete (inches)
Traffic Index (TI)	Traffic Condition	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	Type B Asphalt Concrete (inches)	Class 2 Aggregate Base (inches)	
5.5	Automobile Parking Only	2½	15	2½	6	---
		3*	13	3*	6	---
7.0	Driveways and Areas Subjected to Occasional Truck Traffic	3	19	3	7	---
		4*	17	4*	6	---
		---	---	---	4	6
		---	6	---	---	6

* = Asphalt thickness includes Caltrans Factor of Safety.
(a)= Lime-treated subgrade should be at least 12 inches thick and possess a minimum R-value of 50 when tested in accordance with California Test 301.

We emphasize that the performance of the pavement is highly 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 pavement. Earthwork construction within the limits of the pavement should be performed in accordance with the recommendations contained within this report. All underground utility trenches should be backfilled prior to final preparation of pavement subgrades. Scarification, moisture conditioning and final compaction of pavement subgrades

should be accomplished within 48 hours of aggregate base placement, to prevent degradation of the subgrade. Lime-treated subgrade soils, if selected, should be kept moist until covered by the aggregate base section. If lime-treated soils are removed by underground utility trenches or other excavations, the lime-treated soils should be replaced with compacted aggregate base.

Pavement design alternates for lime-stabilized soil are contingent upon at least 12 inches of the pavement subgrade soils being composed of native soils mixed with a spread rate of at least 4½ pounds of quicklime per cubic foot of amended soil. Lime-treated soil should be moisture conditioned to at least two percent over the optimum moisture content and uniformly compacted to at least 95 percent relative compaction. Untreated pavement subgrades should be compacted to at least 90 percent relative compaction at a moisture content of at least the optimum moisture content.

Aggregate base should be compacted to at 95 percent of the ASTM D1557 maximum dry density. Proof-rolling also should be performed on the completed aggregate base section. Asphalt concrete should be compacted to not less that 95 percent of the maximum density in accordance with current Caltrans requirements. At longitudinal pavement seams, the compaction should not be less than 92 percent of the maximum density. Additionally, the asphalt concrete should be placed in two approximately equal lifts, to conform to Carmax requirements.

In the summer heat, high axle loads coupled with shear stresses induced by sharply turning tire movements can lead to failure in asphalt concrete pavements. Therefore, we recommend that consideration be given to using a Portland cement concrete (PCC) section in areas subjected to concentrated heavy wheel loading, such as entry driveways and in front of trash enclosures. We suggest considering the concrete slabs be constructed with thickened edges in accordance with American Concrete Institute (ACI) design standards. Reinforcing for crack control, if desired, should consist of No. 4 reinforcing bars placed on maximum 24-inch centers each way throughout the slab. Reinforcement must be located at mid-slab depth to be effective. Joint spacing and details should conform with the current PCA or ACI guidelines. Portland cement concrete should achieve a minimum compressive strength of 3500 pounds per square inch at 28 days.

Based on our experience, the native clay soils would likely react well with the addition of quicklime (high-calcium or dolomitic) and could enhance the support characteristics of the

subgrade and allow for a reduction in the aggregate base section. Chemical treatment of subgrade soils as part of the pavement section should be performed in accordance with Chapter 26 of the Caltrans *Standard Specifications*. We recommend a minimum spread rate of at least 4½ pounds of quicklime per square foot of mixing depth. Lime-treated subgrades should be compacted to not less than 95 percent of the ASTM D1557 maximum dry density, at a moisture content of two percent above the optimum moisture content.

We are recommending the use of an aggregate section to act as a rock cushion beneath all pavements, i.e., no pavement directly upon the chemically treated subgrades. Our experience indicates cracking problems usually occur with asphalt concrete placed directly on a treated subgrade. Even when the treated soils are properly cured, cracks tend to develop over time, and without the use of the rock cushion, these cracks propagate up through the asphalt concrete.

Efficient drainage of all surface water to avoid infiltration and saturation of the supporting aggregate base and subgrade soils is important to pavement performance. We suggest considering the use of full-depth curbs where pavements abut landscaped areas to serve as a cut-off against water migrating into the pavement base and subgrade materials. Weep holes also could be provided at drop inlets, located at or slightly below the subgrade-base interface, to allow accumulated water to drain from beneath the pavements.

Materials quality and construction within the structural section of the pavement should conform to the applicable provisions of the latest editions of the *Caltrans Standard Specifications* and applicable City/County Standards, latest editions. The project specifications should provide construction tolerances for placement at asphalt concrete pavements.

Surface Drainage

Performance of building foundations, slabs-on-grade floors and pavement areas is dependent upon proper control of surface water on the site. The ground adjacent to buildings should be sloped away from structures at a gradient no less than two percent for a distance of at least five feet, where possible. All roof drain downspouts either discharge onto paved surfaces leading away from structures or be connected to rigid non-perforated piping directed to an appropriate drainage point away from the structures. Ponding of surface water should not be allowed adjacent to the structures or pavements. Landscape berms, if planned, should not be constructed in such a manner as to promote drainage toward the building.

Geotechnical Engineering Observation and Testing During Earthwork

Site preparation should be accomplished in accordance with the recommendations of this report, the *Guide Earthwork Specifications* provided in Appendix B, and the Carmax Design Criteria. Representatives of Wallace-Kuhl & Associates 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. These services are beyond the scope of work authorized for this investigation.

Many factors can effect the number of tests that should be performed during the course of construction, such as soil type, soil moisture, season of the year and contractor operations/performance. Therefore, it is crucial that the actual number and frequency of testing be determined by the Geotechnical Engineer during construction based on their observations, site conditions, and difficulties encountered. As a preliminary guideline we recommend the following minimum tests:

- mass grading: one test per 500 cubic yards of compacted fill or one per day of work, whichever is greater
- final subgrade preparation: one test per 10,000 square feet
- aggregate base compaction: one test per 10,000 square feet
- utility backfill: one test per foot of backfill for every 200 linear feet of trench
- wall backfill: one test per foot of backfill for ever 100 linear feet of wall

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" should be prepared upon completion of the project.

LIMITATIONS

Our recommendations are based upon the information provided regarding the proposed construction, combined with our analysis of site conditions revealed by the field exploration and laboratory testing programs. We have used prudent 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 relocated 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. This report should not be utilized for construction on any other site. This report is considered valid for the proposed construction for a period of two years following the date of this report. If construction has not started within two years, we must re-evaluate the recommendations of this report and update the report, if necessary.

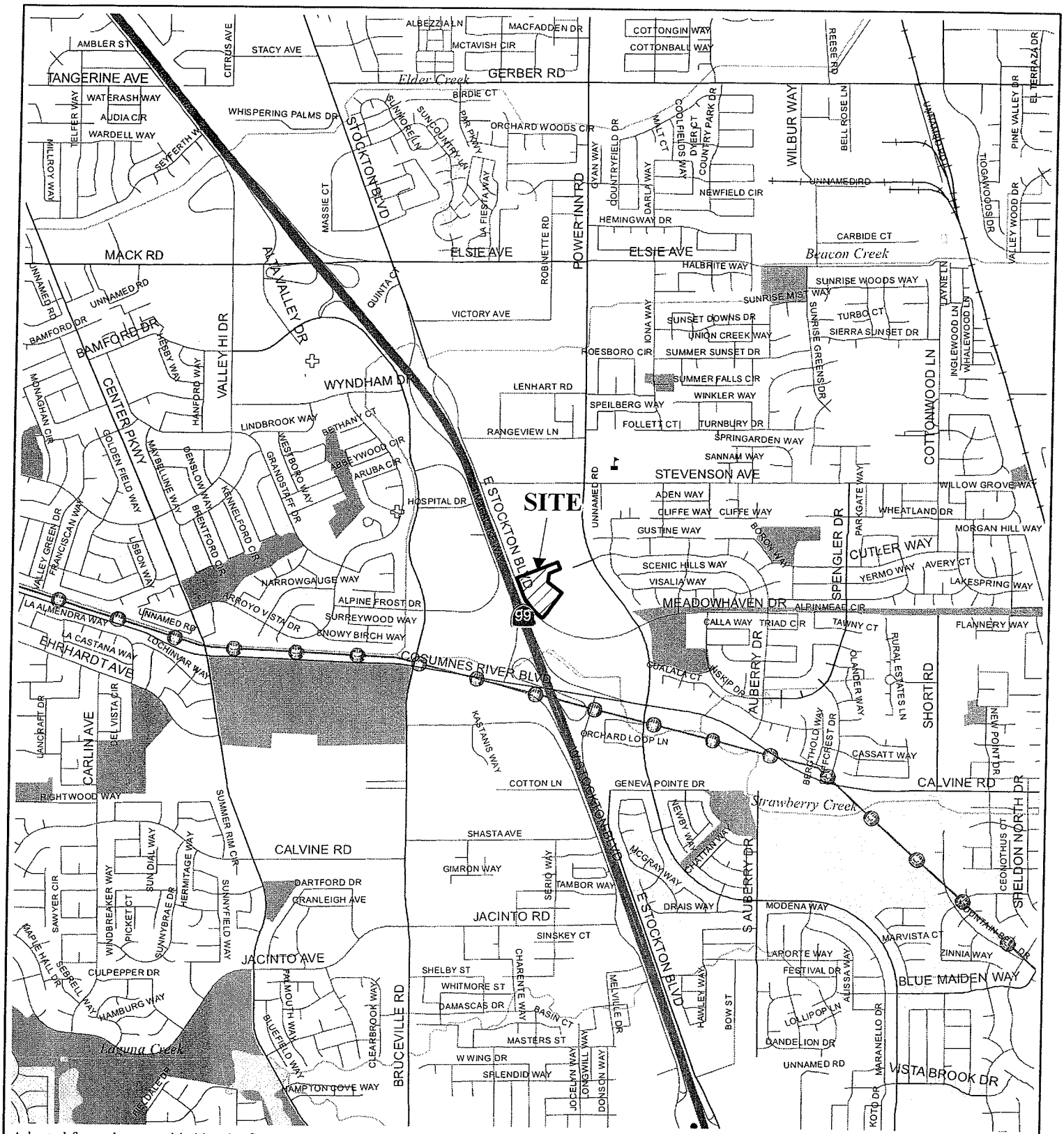
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David R. Gius, Jr.
Senior Engineer



Adapted from data provided by the Sacramento Area Council of Governments, 2008.
Projection: NAD 83, California State Plane, Zone II

Wallace Kuhl & Associates

VICINITY MAP

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	1
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	



Adapted from a drawing provided by KASL Consulting Engineers.
Projection: NAD 83, California State Plane. Zone II

Legend

- Approximate soil boring location
- Approximate bulk sample location

N

0 50 100

Feet

Wallace Kuhl & Associates

SITE PLAN

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	2
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO.	9179.02

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D1

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.2
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
25			Dark brown, moist, very stiff, silty clay (CL-CH)		D1-1I	25	16.6	106	
	5		Brown, moist, very stiff, weakly cemented, clayey silt (ML)		D1-2I	30			
20									
	10		less clayey		D1-3I	50/4"			
15									
	15				D1-4I	75			
10									
	20		sandy silt		D1-5I	27			

BORING LOG 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/20/11 2:26 PM

Wallace Kuhl & ASSOCIATES

FIGURE 3

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D2

Sheet 1 of 1

Date(s) Drilled: 7/1/11	Logged By: MLC	Checked By: DJP
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drillling	Total Depth of Drill Hole: 21.5 feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6"	Approx. Surface Elevation, ft MSL: 27.5
Groundwater Depth [Elevation], feet: Not Encountered []	Sampling Method(s): California Modified	Drill Hole Backfill: soil cuttings
Remarks		Driving Method and Drop: 140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25					D2-1I	18			
			Light brown, moist, hard, cemented, clayey silt (ML)						
	5								
					D2-2I	55	22.8	91	
20									
	10		weakly cemented		D2-3I	35			
15									
	15		sandy silt		D2-4I	41			
10									
	20				D2-5I	35			

BORING LOG 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/20/11 2:27 PM

Wallace Kuhl & ASSOCIATES

FIGURE 4

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D3

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.8
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)						
					D3-1I	20			
25									
	5		Brown, moist, very stiff, fine sandy silt (ML)						
					D3-2I	19			
20									
	10		cemented; slightly clayey		D3-3I	51	37.0	83	
15									
	15				D3-4I	50			
10			sandy silt						
	20				D3-5I	41			

BORING LOG 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/20/11 2:27 PM

Wallace Kuhl & ASSOCIATES

FIGURE 5

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D4

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)						
					D4-1I	28			
25	5		brown						
					D4-2I	17	25.3	90	
			Light brown, moist, hard, cemented, clayey, sandy silt (ML)						
20	10				D4-3I	43			
15	15				D4-4I	50/6"			
10	20				D4-5I	51			

BORING LOG 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/20/11 2:27 PM

Wallace Kuhl & ASSOCIATES

FIGURE 6

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D5

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.9
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)		D5-1I	24	19.6	89	
25	5		Reddish / Grayish brown, moist, dense, clayey, sandy silt (ML)		D5-2I	18			
20	10		brown		D5-3I	19			
15	15				D5-4I	50			
10	20				D5-5I	45			

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FIGURE 7

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D6

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25					D6-1I	14			
	5		Light brown, moist, very dense, clayey, sandy silt (ML)						
					D6-2I	42	24.7	90	
20									
	10		brown; cemented		D6-3I	50/6"			
15									
	15				D6-4I	62			
10									
	20				D6-5I	41			

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FIGURE 8

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D7

Sheet 1 of 1

Date(s) Drilled: 7/1/11	Logged By: MLC	Checked By: DJP
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drillling	Total Depth of Drill Hole: 21.5 feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6"	Approx. Surface Elevation, ft MSL: 28.4
Groundwater Depth [Elevation], feet: Not Encountered []	Sampling Method(s): California Modified	Drill Hole Backfill: soil cuttings
Remarks		Driving Method and Drop: 140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25				■	D7-1I	17			
	5		Light brown, moist, hard, clayey silt (ML)						
				■	D7-2I	54	23.3	94	
20									
	10		cemented; sandy silt	■	D7-3I	79			
15									
	15			■	D7-4I	71			
10									
	20			■	D7-5I	34			

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FIGURE 9

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D8

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25					D8-1I	14	22.6	98	
	5		Light brown, moist, hard, silty fine sand (SM)						
					D8-2I	68			GR
20			Brown, moist, very hard, fine sandy silt (ML)						
	10				D8-3I	50/6"			
15									
	15				D8-4I	68			
10									
	20				D8-5I	37			

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FIGURE 10

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D9

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.2
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25	5				D9-1I	15	21.4	98	
					D9-2I	22			
20			Brown, moist, very dense, clayey, sandy silt (ML)						
	10		cemented		D9-3I	54			
15									
	15				D9-4I	50/5"			
10									
	20				D9-5I	53			

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FIGURE 11

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D10

Sheet 1 of 1

Date(s) Drilled: 7/1/11	Logged By: MLC	Checked By: DJP
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drillling	Total Depth of Drill Hole: 21.5 feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6"	Approx. Surface Elevation, ft MSL: 28.2
Groundwater Depth [Elevation], feet: Not Encountered []	Sampling Method(s): California Modified	Drill Hole Backfill: soil cuttings
Remarks		Driving Method and Drop: 140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0		Dark brown, moist, very stiff, silty clay (CL-CH)						
25			light brown		D10-1I	22			
	5		Light brown, moist, hard, cemented, fine sandy silt (ML)		D10-2I	62			TR
20									
	10				D10-3I	55			
15									
	15				D10-4I	68			
10									
	20				D10-5I	44			

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FIGURE 12

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D11

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.6
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D11-1I	17	23.4	96	
25	5		brown		D11-2I	15	24.3	87	
			Light brown, moist, hard, cemented, fine sandy silt (ML)						
20	10				D11-3I	48			
15	15		weakly cemented		D11-4I	50			
10	20				D11-5I	52			

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FIGURE 13

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D12

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D12-1I	15			
25	5		light brown; very silty		D12-2I	16			
			Light brown, moist, hard, fine sandy silt (ML)						
20	10				D12-3I	52			
15	15				D12-4I	47			
10	20				D12-5I	51			

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FIGURE 14

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D13

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.2
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25					D13-1I	19			
	5		Light brown, moist, hard, cemented, fine sandy silt (ML)						
					D13-2I	56	23.4	96	
20									
	10				D13-3I	50/5"			
15									
	15				D13-4I	46			
10									
	20				D13-5I	30			

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FIGURE 15

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D14

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.7
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)						
25			brown		D14-1I	24			
	5		Light brown, moist, very hard, cemented, fine sandy silt (ML)		D14-2I	50/6"			
20									
	10				D14-3I	77	29.2	91	
15									
	15				D14-4I	45			
10									
	20				D14-5I	41			

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FIGURE 16

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D15

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.9
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D15-1I	15	24.3	92	UCC 2.3 (tsf)
25									
	5		Light brown, moist, very hard, cemented, fine sandy silt (ML)						
					D15-2I	50/5"	35.7	72	UCC 1.6 (tsf)
20									
	10				D15-3I	50/6"			
15									
	15				D15-4I	71			
10									
	20				D15-5I	51			

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FIGURE 17

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D16

Sheet 1 of 1

Date(s) Drilled	7/1/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.3
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25			Light brown, moist, stiff, weakly cemented, fine sandy silt (ML)		D16-1I	33	23.7	90	
	5				D16-2I	50/6"			
20									
	10				D16-3I	50/6"			GR
15									
	15				D16-4I	70			
10									
	20				D16-5I	31			

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FIGURE 18

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D17

Sheet 1 of 1

Date(s) Drilled: 7/1/11	Logged By: MLC	Checked By: DJP
Drilling Method: Solid Flight Augers	Drilling Contractor: V&W Drillling	Total Depth of Drill Hole: 21.5 feet
Drill Rig Type: CME-55	Diameter(s) of Hole, inches: 6"	Approx. Surface Elevation, ft MSL: 28.5
Groundwater Depth [Elevation], feet: Not Encountered []	Sampling Method(s): California Modified	Drill Hole Backfill: soil cuttings
Remarks		Driving Method and Drop: 140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D17-1I	17	17.2	104	UCC 2.7 (tsf)
25									
	5		Light brown, moist, very hard, cemented, fine sandy silt (ML)						
					D17-2I	50/5"	17.2	109	
20									
	10				D17-3I	72			
15									
	15				D17-4I	51			
10									
	20				D17-5I	30			

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FIGURE 19

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D18

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.6
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
	0		Dark brown, moist, stiff, silty clay (CL-CH)						
			Light brown, moist, hard, cemented, fine sandy, clayey silt (ML)						
25	5				D18-1I	69	30.2	86	
					D18-2I	50/6"			
20	10		reddish / grayish brown		D18-3I	50/6"			
15	15				D18-4I	70			
10	20		sandy silt		D18-5I	56			

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FIGURE 20

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D19

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.9
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D19-1I	50/2"	17.4	97	UCC 0.7 (tsf)
			Light brown, moist, very hard, cemented, fine sandy, clayey silt (ML)						
25	5				D19-2I	50/6"			
20	10		reddish / grayish brown		D19-3I	63	27.4	87	
15	15				D19-4I	48			
10	20		sandy silt		D19-5I	35			

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FIGURE 21

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D20

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.1
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
			Light brown, moist, hard, cemented, fine sandy, clayey silt (ML)						
25	5				D20-1I	58			
					D20-2I	54	30.7	82	
20	10		reddish / grayish brown		D20-3I	64			
15	15				D20-4I	47			
10	20		sandy silt		D20-5I	29			

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FIGURE 22

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D21

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.0
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D21-1I	16	23.2	96	
25			Light brown, moist, very hard, cemented, fine sandy, clayey silt (ML)						
	5				D21-2I	50/6			
20									
	10		reddish / grayish brown		D21-3I	57			
15									
	15				D21-4I	35			
10									
	20		sandy silt		D21-5I	49			

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FIGURE 23

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D22

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)						
				■	D22-1I	26	16.2	101	
			Light brown, moist, very hard, cemented, fine sandy, clayey silt (ML)						
25	5			■	D22-2I	50/6"			
			Brown, moist, very dense, silty fine sand (SM)						
20	10			■	D22-3I	53			GR
			Reddish / Grayish brown, moist, dense, fine sandy silt (ML)						
15	15			■	D22-4I	34			
10	20			■	D22-5I	41			

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FIGURE 24

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D23

Sheet 1 of 1

Date(s) Drilled: **7/5/11**	Logged By: **MLC**	Checked By: **DJP**
Drilling Method: **Solid Flight Augers**	Drilling Contractor: **V&W Drillling**	Total Depth of Drill Hole: **21.5 feet**
Drill Rig Type: **CME-55**	Diameter(s) of Hole, inches: **6"**	Approx. Surface Elevation, ft MSL: **29.9**
Groundwater Depth [Elevation], feet: **Not Encountered []**	Sampling Method(s): **California Modified**	Drill Hole Backfill: **soil cuttings**
Remarks		Driving Method and Drop: **140-lb automatic hammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D23-1I	18			
			Light brown, moist, hard, weakly cemented, fine sandy, clayey silt (ML)						
25	5				D23-2I	50			
20	10		reddish / grayish brown		D23-3I	45			
15	15				D23-4I	36	36.3	83	
10	20		sandy silt		D23-5I	46			

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FIGURE 25

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D24

Sheet 1 of 1

Date(s) Drilled: **7/5/11**	Logged By: **MLC**	Checked By: **DJP**
Drilling Method: **Solid Flight Augers**	Drilling Contractor: **V&W Drillling**	Total Depth of Drill Hole: **21.5 feet**
Drill Rig Type: **CME-55**	Diameter(s) of Hole, inches: **6"**	Approx. Surface Elevation, ft MSL: **28.6**
Groundwater Depth [Elevation], feet: **Not Encountered []**	Sampling Method(s): **California Modified**	Drill Hole Backfill: **soil cuttings**
Remarks		Driving Method and Drop: **140-lb automatic hammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
25	0		Dark brown, moist, very stiff, silty clay (CL-CH)						
				■	D24-1I	23			
	5		Light brown, moist, very hard, cemented, fine sandy, clayey silt (ML)						
				■	D24-2I	50/6"	19.3	95	
20									
	10		reddish / grayish brown	■	D24-3I	48			
15									
	15			■	D24-4I	34			
10									
	20		sandy silt	■	D24-5I	66			

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FIGURE 26

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D25

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.8
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, very stiff, silty clay (CL-CH)	■	D25-1I	23			
25	5		Light brown, moist, very hard, cemented, fine sandy, clayey silt (ML)	■	D25-2I	50/6"	19.5	97	
20	10		reddish / grayish brown	■	D25-3I	55			
15	15			■	D25-4I	50			
10	20		sandy silt	■	D25-5I	36			

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FIGURE 27

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D26

Sheet 1 of 1

Date(s) Drilled: **7/5/11**	Logged By: **MLC**	Checked By: **DJP**
Drilling Method: **Solid Flight Augers**	Drilling Contractor: **V&W Drillling**	Total Depth of Drill Hole: **21.5 feet**
Drill Rig Type: **CME-55**	Diameter(s) of Hole, inches: **6"**	Approx. Surface Elevation, ft MSL: **28.7**
Groundwater Depth [Elevation], feet: **Not Encountered []**	Sampling Method(s): **California Modified**	Drill Hole Backfill: **soil cuttings**
Remarks		Driving Method and Drop: **140-lb automatic hammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
25	5		Light brown, moist, hard, cemented, fine sandy, clayey silt (ML)		D26-1I	36	31.6	78	
					D26-2I	50/6"			
20	10		reddish / grayish brown		D26-3I	51			
15	15				D26-4I	44			
10	20		sandy silt		D26-5I	45			

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FIGURE 28

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D27

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.5
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Light brown, moist, hard, clayey silt (ML)						
25	5				D27-1I	69			
					D27-2I	58	18.5	105	
20	10		reddish / grayish brown		D27-3I	60			
15	15				D27-4I	36			
10	20				D27-5I	35			

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FIGURE 29

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D28

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.5
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Light brown, moist, hard, fine sandy, clayey silt (ML)						
				■	D28-1I	54			
25									
	5		cemented	■	D28-2I	50/3"			
20									
	10		reddish / grayish brown; weakly cemented	■	D28-3I	53	35.6	80	
15									
	15			■	D28-4I	50/5"			
10									
	20		sandy silt	■	D28-5I	45			

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FIGURE 30

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D29

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.3
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Light brown, moist, very hard, cemented, fine sandy, silt (ML)						
25					D29-1I	50/6"	19.8	97	
	5				D29-2I	50/6"			
20									
	10		reddish / grayish brown		D29-3I	76			
15									
	15				D29-4I	50/4"			
10									
	20		weakly cemented		D29-5I	30			

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FIGURE 31

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D30

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	28.9
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Light brown, moist, hard, cemented, fine sandy silt (ML)						
					D30-1I	67			
25	5								
					D30-2I	50/6"	21.5	94	
20	10		brown		D30-3I	50/6"			
15	15				D30-4I	37			
10	20				D30-5I	54			

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FIGURE 32

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D31

Sheet 1 of 1

Date(s) Drilled: **7/5/11**	Logged By: **MLC**	Checked By: **DJP**
Drilling Method: **Solid Flight Augers**	Drilling Contractor: **V&W Drillling**	Total Depth of Drill Hole: **21.5 feet**
Drill Rig Type: **CME-55**	Diameter(s) of Hole, inches: **6"**	Approx. Surface Elevation, ft MSL: **28.6**
Groundwater Depth [Elevation], feet: **Not Encountered []**	Sampling Method(s): **California Modified**	Drill Hole Backfill: **soil cuttings**
Remarks		Driving Method and Drop: **140-lb automatic hammer**

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
			Brown, moist, very hard, cemented, fine sandy silt (ML)		D31-1I	50/4"	12.8	106	
25	5		brown		D31-2I	50/5"			
20	10		weakly cemented		D31-3I	50/5"			
15	15		not cemented		D31-4I	33			
10	20				D31-5I	42			

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FIGURE 33

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D32

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-55	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.4
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
			Dark brown, moist, very hard, cemented, clayey silt (ML)		D32-1I	50/5"			
25	5				D32-2I	50/3"			
20	10		not cemented		D32-3I	54			
15	15		reddish / grayish brown		D32-4I	39			
10	20		sandy silt		D32-5I	56			

BORING LOG 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/20/11 2:27 PM

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FIGURE 34

Project: CarMax - Elk Grove
Project Location: Sacramento County, California
WKA Number: 9179.02

LOG OF SOIL BORING D33

Sheet 1 of 1

Date(s) Drilled	7/5/11	Logged By	MLC	Checked By	DJP
Drilling Method	Solid Flight Augers	Drilling Contractor	V&W Drillling	Total Depth of Drill Hole	21.5 feet
Drill Rig Type	CME-75	Diameter(s) of Hole, inches	6"	Approx. Surface Elevation, ft MSL	29.2
Groundwater Depth [Elevation], feet	Not Encountered []	Sampling Method(s)	California Modified	Drill Hole Backfill	soil cuttings
Remarks				Driving Method and Drop	140-lb automatic hammer

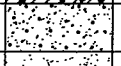
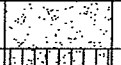
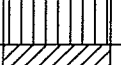
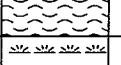
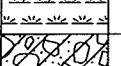
ELEVATION, feet	DEPTH, feet	GRAPHIC LOG	ENGINEERING CLASSIFICATION AND DESCRIPTION	SAMPLE DATA: SAMPLE	SAMPLE NUMBER	NUMBER OF BLOWS	TEST DATA: MOISTURE CONTENT, %	DRY UNIT WEIGHT, pcf	ADDITIONAL TESTS
			Dark brown, moist, stiff, silty clay (CL-CH)						
					D33-1I	22			
25			Light brown, moist, hard, weakly cemented, fine sandy, clayey silt (ML)						
	5				D33-2I	50			
20									
	10		brown		D33-3I	66			
15									
	15		reddish / grayish brown		D33-4I	56			
10									
	20		sandy silt		D33-5I	60			

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FIGURE 35

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS		SYMBOL	CODE	TYPICAL NAMES
COARSE GRAINED SOILS (More than 50% of soil > no. 200 sieve size)	GRAVELS (More than 50% of coarse fraction > no. 4 sieve size)	GW		Well graded gravels or gravel - sand mixtures, little or no fines
		GP		Poorly graded gravels or gravel - sand mixtures, little or no fines
		GM		Silty gravels, gravel - sand - silt mixtures
		GC		Clayey gravels, gravel - sand - clay mixtures
	SANDS (50% or more of coarse fraction < no. 4 sieve size)	SW		Well graded sands or gravelly sands, little or no fines
		SP		Poorly graded sands or gravelly sands, little or no fines
		SM		Silty sands, sand - silt mixtures
		SC		Clayey sands, sand - clay mixtures
FINE GRAINED SOILS (50% or more of soil < no. 200 sieve size)	SILTS & CLAYS LL < 50	ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
		CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL		Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS LL ≥ 50	MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH		Inorganic clays of high plasticity, fat clays
		OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt		Peat and other highly organic soils
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

PI = Plasticity Index

EI = Expansion Index

UCC = Unconfined Compression Test

TR = Triaxial Compression Test

GR = Gradational Analysis (Sieve)

K = Permeability Test

GRAIN SIZE CLASSIFICATION

CLASSIFICATION	RANGE OF GRAIN SIZES	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL coarse (c) fine (f)	3" to No. 4 3" to 3/4" 3/4" to No. 4	76.2 to 4.76 76.2 to 19.1 19.1 to 4.76
SAND coarse (c) medium (m) fine (f)	No. 4 to No. 200 No. 4 to No. 10 No. 10 to No. 40 No. 40 to No. 200	4.76 to 0.074 4.76 to 2.00 2.00 to 0.420 0.420 to 0.074
SILT & CLAY	Below No. 200	Below 0.074

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UNIFIED SOIL CLASSIFICATION SYSTEM

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	36
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

APPENDICES

APPENDIX A
General Information, Field and Laboratory Testing

APPENDIX A

A. GENERAL INFORMATION

The performance of a geotechnical engineering investigation at the site for the proposed Carmax automotive dealership, located on the east side of East Stockton Boulevard, north of Calvine Road in Sacramento County, California, was authorized on June 23, 2011, by Mr. Greg Toler. Authorization was for an investigation as described in our proposal letter dated June 22, 2011, sent to our client Centerpoint Integrated Solutions, LLC, whose mailing address is 1240 Bergen Parkway, Suite A-250, Evergreen, Colorado 80439; telephone (303) 679-6960; facsimilie (303) 670-4172.

The project civil engineering consultant is KASL Consulting Engineers, Inc., whose mailing address is 7777 Greenback Lane, Suite 104, Citrus Heights, California 95610; telephone (916) 722-1800; facsimile (916) 722-4595.

In preparing this report, we made reference to a June 2011 *Carmax Boring Location Number Key*, prepared by KASL Consulting Engineers, Inc., and the June 8, 2011, 1"=100' *Initial Site Plan*, prepared by Charles J. O-Brien Architects.

B. FIELD EXPLORATION

A total of 33 borings were drilled on July 1 and July 5, 2011, at the approximate locations indicated on Figure 2 to a maximum depth of approximately 21½ feet below existing site grades, utilizing a CME-55 truck-mounted drill rig equipped with six-inch diameter solid stem augers. At various intervals, relatively undisturbed soil samples were recovered with a 2½-inch O.D., 2-inch I.D., modified California sampler (ASTM D3550) 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 actual blow counts recorded with the sampler are presented on the boring logs.

The samples obtained with the modified California sampler were retained in 2-inch diameter by 6-inch long, thin-walled brass tubes contained within the sampler. Immediately after recovery, the field engineer visually classified the soil in the tubes and the ends of the tubes were sealed to preserve the natural moisture contents. Soil samples were taken to our laboratory for additional classification (ASTM D2488) and selection of samples for testing.

The Logs of Soil Borings, Figures 3 through 35, contain descriptions of the soils encountered in each boring. A Legend explaining the Unified Soil Classification System and the symbols used on the logs is contained on Figure 36.

C. LABORATORY TESTING

Selected undisturbed soil samples were tested to determine dry unit weight (ASTM D2937) and natural moisture content (ASTM D4643). The results of these tests are included on the boring logs at the depth each sample was obtained.

One relatively undisturbed sample was subjected to triaxial shear strength testing ASTM D4767). The results of these tests are presented on Figure A1.

Two representative samples of the anticipated building pad subgrade soils were subjected to Expansion Index testing (ASTM D4829). One of the samples was also subjected to a Plasticity Index test (ASTM D4318). The test results are presented on Figures A2 through A4.

Two bulk samples of anticipated pavement subgrade soils were subjected to Resistance Value Tests (California Test 301). The results of these tests, which were used in pavement design, are presented on Figures A5. A copy of the pavement design calculations is provided in Appendix C.

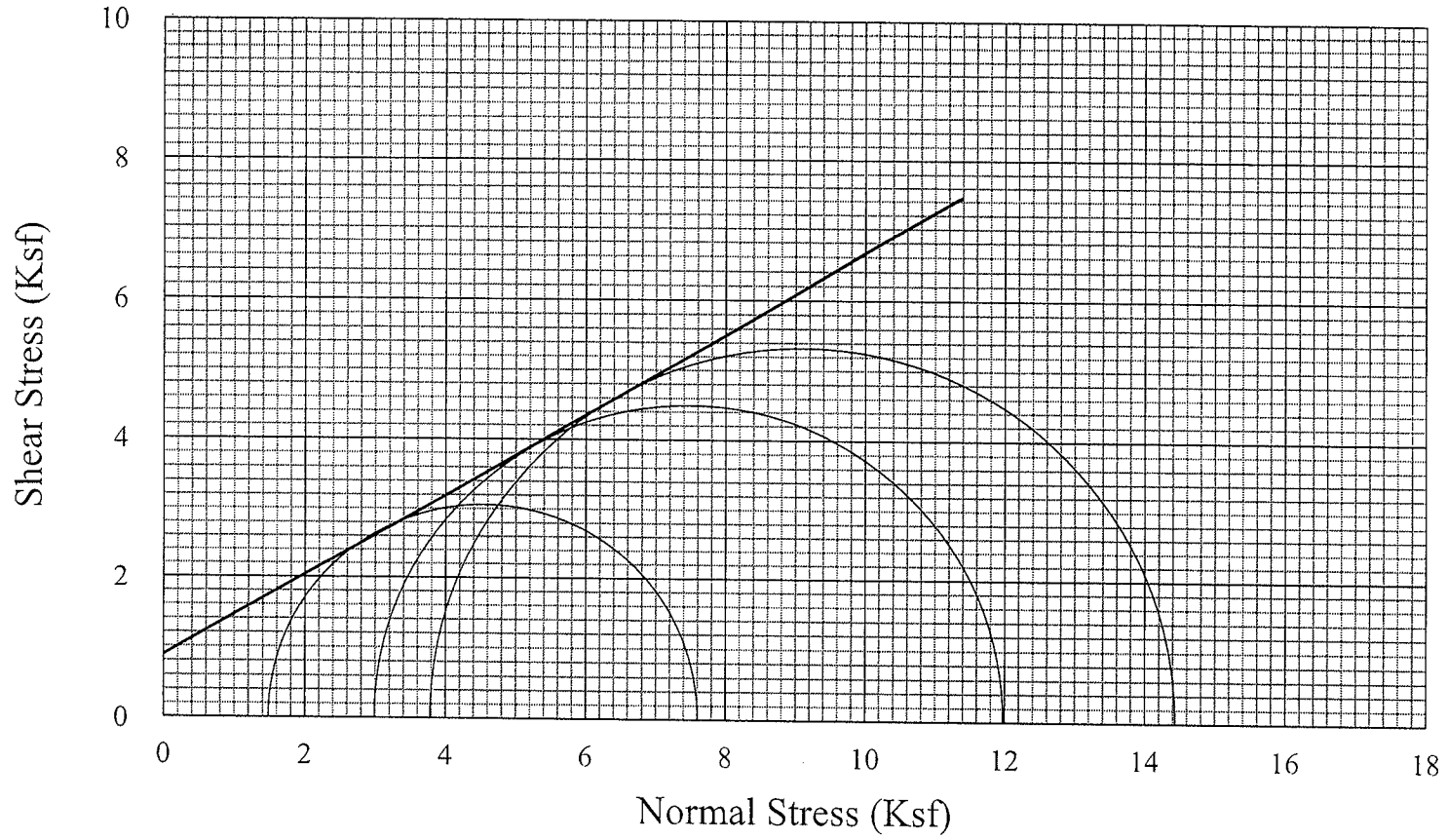
Three representative samples of near-surface soils were tested for grain-size distribution (ASTM C136). The results of the gradation (grain-size) tests are contained on Figure A6.

Four samples of near-surface soils were submitted to Sunland Analytical to determine the soil pH and minimum resistivity (CT 643), sulfate concentration (CT 417) and chloride concentration (CT 422). Results from these tests are included on Figures A7 through A10.

/

TRIAXIAL COMPRESSION TEST

ASTM D4767



SAMPLE NO. :	D10-2I
SAMPLE CONDITION :	Undisturbed
SAMPLE DESCRIPTION :	Brown, fine sandy silt

DRY DENSITY (PCF) :	106
INITIAL MOISTURE (%) :	17.3
FINAL MOISTURE (%) :	21.6
ANGLE OF INTERNAL FRICTION (ø) :	30°
COHESION (PSF) :	885

Wallace Kuhl & Associates

TRIAXIAL COMPRESSION TEST RESULTS

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A1
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Brown, sandy, silty clay

LOCATION: D10

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
2'-4'	16.6	34.8	87.8	**73**

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 TEST RESULTS

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A2
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

EXPANSION INDEX TEST RESULTS

ASTM D4829

MATERIAL DESCRIPTION: Tan brown, clayey silt/silty clay

LOCATION: D28

Sample Depth	Pre-Test Moisture (%)	Post-Test Moisture (%)	Dry Density (pcf)	Expansion Index
0'-3'	13.5	27.4	98.6	**60**

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 TEST RESULTS

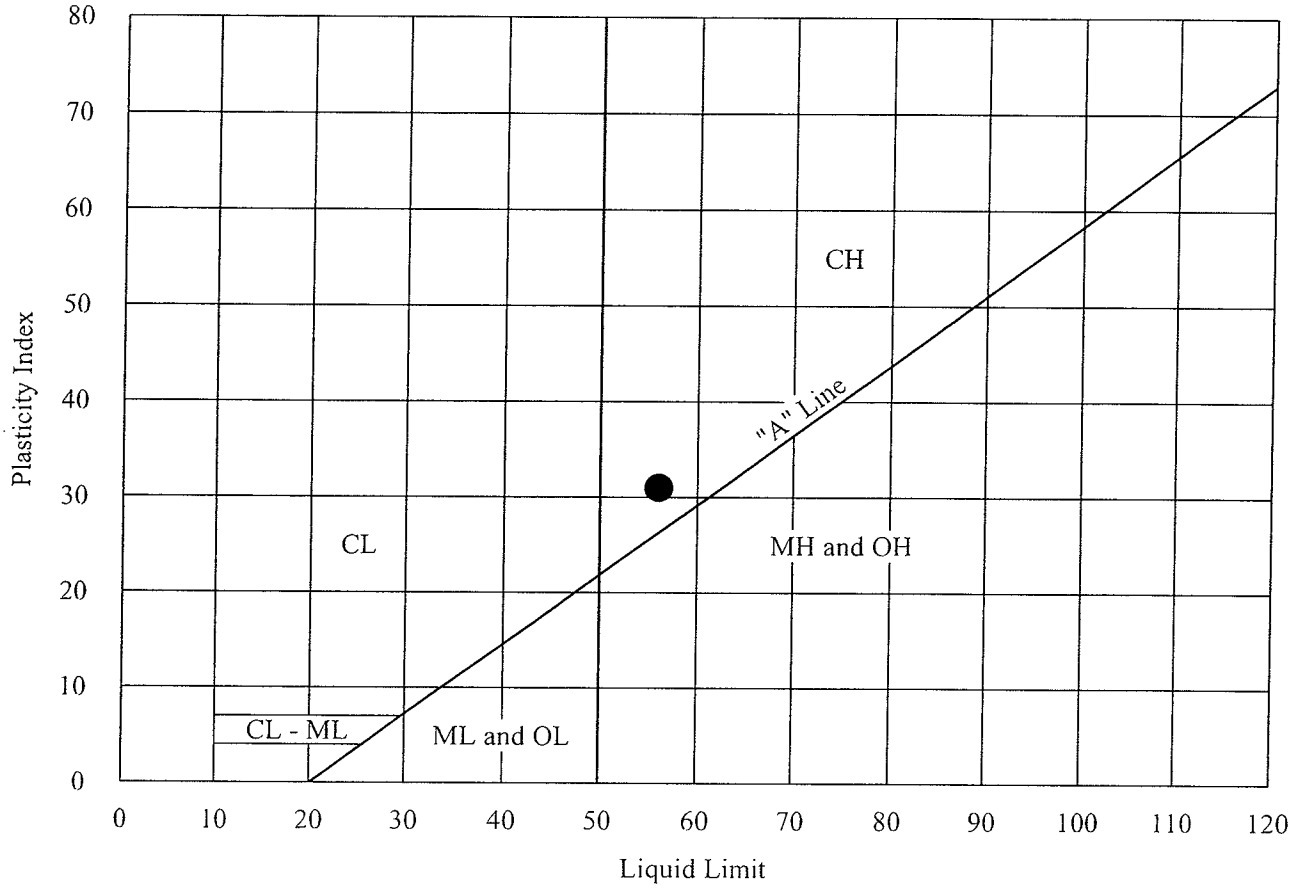
CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A3
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

ATTERBERG LIMITS

ASTM D4318



KEY SYMBOL	LOCATION	SAMPLE DEPTH	NATURAL WATER CONTENT (%)	ATTERBERG LIMITS		PASSING No. 200 SIEVE (%)	UNIFIED SOIL CLASSIFI-CATION SYMBOL
				LIQUID LIMIT (%)	PLACTICITY INDEX (%)		
●	D10	2' - 4'	---	56	31	---	CH

Wallace Kuhl & Associates

ATTERBERG LIMITS

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A4
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

RESISTANCE VALUE TEST RESULTS
(California Test 301)

MATERIAL DESCRIPTION: Brown, sandy, silty clay

LOCATION: D5 (1'-2')

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial)	Expansion Pressure (psf)	R Value
1	110	19.2	758	--	593	
2						
3						

Sample extruded, therefore R-Value = 5

MATERIAL DESCRIPTION: Brown, fine sandy silt

LOCATION: B1 (6"-12")

Specimen No.	Dry Unit Weight (pcf)	Moisture @ Compaction (%)	Exudation Pressure (psi)	Expansion Pressure (dial)	Expansion Pressure (psf)	R Value
1	115	13.0	235	17	74	11
2	117	12.3	335	23	100	17
3	120	11.5	508	33	143	49

R-Value at 300 psi exudation pressure = 14

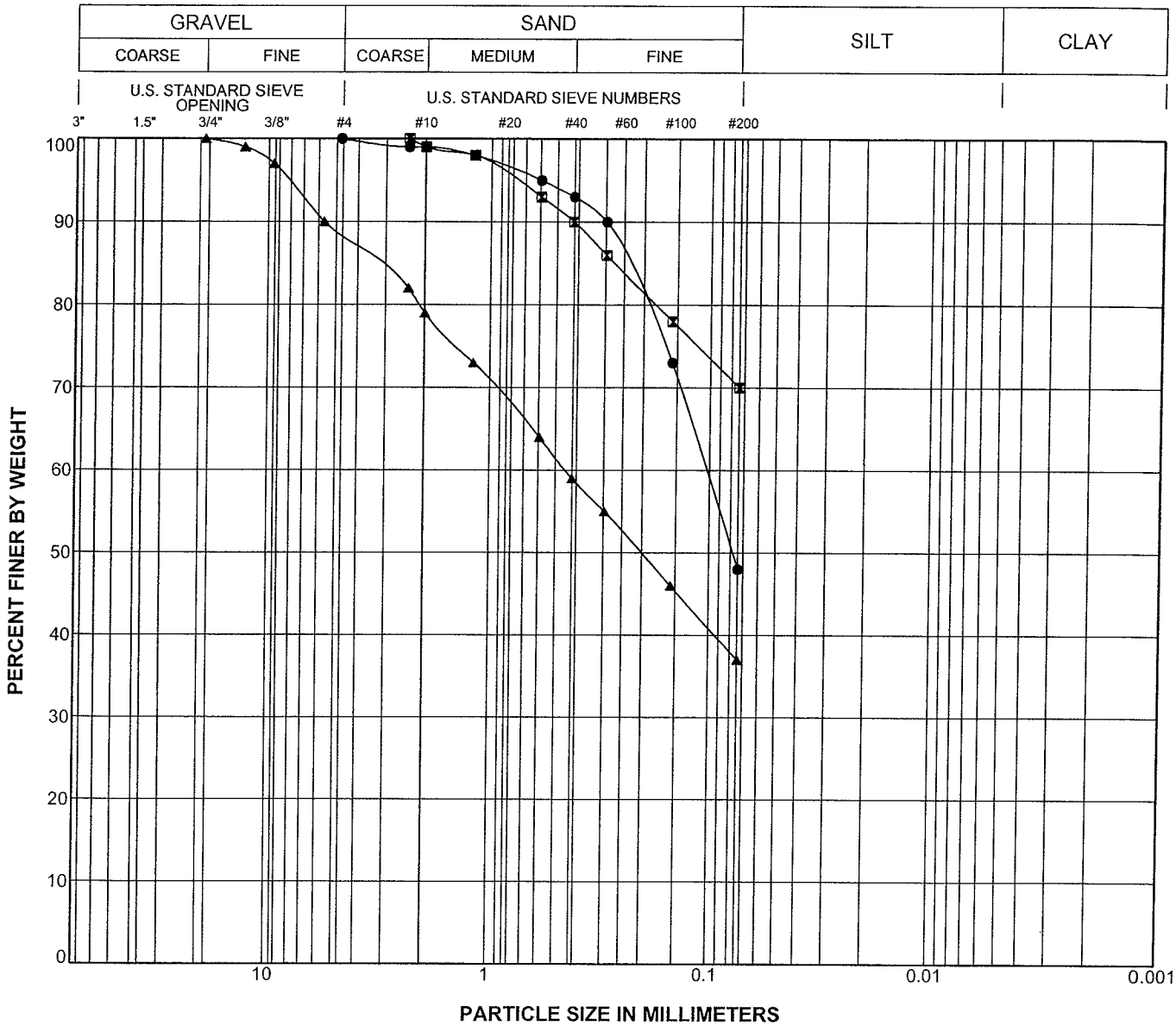
Wallace Kuhl & Associates

RESISTANCE VALUE TEST RESULTS

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A5
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	



Boring Number	Sample Number	USCS	Depth (feet)	Symbol	LL	PI	Classification
D16	D16-3I	ML	11.0	●			Light brown, fine sandy silt
D22	D22-3I	SM	11.0	⊠			Brown, silty fine sand
D8	D8-2I	SM	6.0	▲			Light brown, silty fine sand

PARTICLE SIZE DISTRIBUTION

Project: CarMax - Elk Grove
WKA No. 9179.02

FIGURE A6

Wallace Kuhl & ASSOCIATES

GRAIN SIZE 9179.02 - CARMAX - ELK GROVE.GPJ WKA.GDT 7/27/11 1:22 PM

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/13/2011
Date Submitted 07/07/2011

To: Dominic Potestio
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 : 9179.01 CARMAX ELK G Site ID : D1 4-6'.
Your purchase order number is 2181.
Thank you for your business.

* For future reference to this analysis please use SUN # 60438-123670.

EVALUATION FOR SOIL CORROSION

Soil pH	7.72		
Minimum Resistivity	1.02 ohm-cm (x1000)		
Chloride	25.2 ppm	00.00252	%
Sulfate	50.8 ppm	00.00508	%

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

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A7
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/13/2011
Date Submitted 07/07/2011

To: Dominic Potestio
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 : 9179.01 CARMAX ELK G Site ID : D3 0-2'.
Your purchase order number is 2181.
Thank you for your business.

* For future reference to this analysis please use SUN # 60438-123671.

EVALUATION FOR SOIL CORROSION

Soil pH	6.88		
Minimum Resistivity	0.99 ohm-cm (x1000)		
Chloride	18.7 ppm	00.00187	%
Sulfate	1.9 ppm	00.00019	%

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

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A8
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/13/2011
Date Submitted 07/07/2011

To: Dominic Potestio
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 : 9179.01 CARMAX ELK G Site ID : D24 0-3'.
Your purchase order number is 2181.
Thank you for your business.

* For future reference to this analysis please use SUN # 60438-123672.

EVALUATION FOR SOIL CORROSION

Soil pH	7.52	
Minimum Resistivity	1.34 ohm-cm (x1000)	
Chloride	10.1 ppm	00.00101 %
Sulfate	11.6 ppm	00.00116 %

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

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A9
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11

WKA NO. 9179.02

Sunland Analytical

11353 Pyrites Way, Suite 4
Rancho Cordova, CA 95670
(916) 852-8557

Date Reported 07/13/2011
Date Submitted 07/07/2011

To: Dominic Potestio
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 : 9179.01 CARMAX ELK G Site ID : D29 1-4'.
Your purchase order number is 2181.
Thank you for your business.

* For future reference to this analysis please use SUN # 60438-123673.

EVALUATION FOR SOIL CORROSION

Soil pH	7.39		
Minimum Resistivity	5.09 ohm-cm (x1000)		
Chloride	10.3 ppm	00.00103	%
Sulfate	16.1 ppm	00.00161	%

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

CARMAX - ELK GROVE

Sacramento County, California

FIGURE	A10
DRAWN BY	TJC
CHECKED BY	DJP
PROJECT MGR	SLF
DATE	7/11
WKA NO. 9179.02	

APPENDIX B
Guide Earthwork Specifications

APPENDIX B

GUIDE EARTHWORK SPECIFICATIONS

CARMAX – ELK GROVE

East Stockton Boulevard

Sacramento County, California

WKA No. 9179.02

PART 1: GENERAL

1.1 SCOPE

A. General Description

This item shall include all clearing of vegetation, existing stockpiles, rubbish, rubble and associated items; 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 building, exterior flatwork, and pavement areas to conform with the lines, grades and slopes as shown on the accepted Drawings.

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 him or his representative.

1.2 PROTECTION

A. Adequate protection measures shall be provided to protect workers and passers-by at 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, dirt 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 GEOTECHNICAL REPORT

A. A Geotechnical Engineering Report (WKA No. 9179.02; dated July 27, 2011) has been prepared for this site by Wallace - Kuhl & Associates, Geotechnical Engineers of West Sacramento, California. 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 they may draw from this report. Should the Contractor prefer not to assume such risk, they should employ their own experts to analyze available information and/or to make additional borings upon which to base their conclusions, all at no cost to the Owner.

1.4 EXISTING SITE CONDITIONS

The Contractor shall be 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 Contractor's operations subsequent to the discovery of such unshown utilities.

1.5 SEASONAL LIMITS

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.

PART 2: PRODUCTS

2.1 MATERIALS

A. All fill shall be of approved local materials from required excavations, supplemented by imported fill, if necessary. Approved local materials are defined as local granular soils, which are free from significant quantities of rubble, rubbish and vegetation, and having been tested and approved by the Geotechnical Engineer prior to use. Clods, rocks or hard lumps exceeding four inches (4") in final size shall not be allowed in the upper two feet (2') of any fill supporting pavements and the building.

B. Imported fill materials shall be granular materials with non-plastic fines having a Plasticity Index not exceeding fifteen (15); shall have an Expansion Index less than twenty (20); shall be free of particles greater than three-inch (3") in maximum dimension. Import soil shall be free of contamination with the proper documentation provided by the contractor, and shall be approved by the Geotechnical Engineer prior to being transported to the site.

C. Capillary break 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 latest edition of the State of California (Caltrans) Standard Specifications and applicable City/County Standards, latest editions.

PART 3: EXECUTION

3.1 LAYOUT AND PREPARATION

Lay out 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 PADS AND PAVEMENT AREAS

A. All existing surface debris, rubble, rubbish; trees, shrubs and bushes; and, loose and/or saturated materials shall be removed and disposed of so as to leave the areas that have been disturbed with a neat and finished appearance, free from unsightly debris. Excavations and depressions resulting from the removal of such items, as well as any existing excavations or loose soil deposits, as determined by the Geotechnical Engineer, shall be cleaned out to firm, undisturbed soil and backfilled with suitable materials in accordance with these specifications. Adequate removal of existing rubble and roots may require laborers and hand-picking to clear the subgrade soils to the satisfaction of the Geotechnical Engineer, prior to further site preparation.

B. All fill to be constructed that will be below the depth of lime treatment shall be constructed in accordance with Section 3.3 of these specifications and the surfaces receiving fill shall be prepared in accordance with the following paragraphs in this section: Section 3.2.

C. If the surface soils are dry and desiccated, the exposed subgrades shall be repeatedly watered for a period of not less than three days and shall continue until the Geotechnical Engineer verifies that saturation of the subgrades has been

adequate to close the deep desiccation cracks. The subgrades shall then be reworked by blading or discing to achieve a uniform moisture content.

D. The surfaces upon which fill is to be placed shall be plowed or scarified to a depth of at least twelve inches (12"), until the surface is free from ruts, hummocks or other uneven features which would tend to prevent uniform compaction by the selected equipment.

E. When the moisture content of the subgrade is less than two percent (2%) above the optimum moisture content, as defined by the ASTM D1557 test method, water shall be added until the proper moisture content is achieved.

F. When the moisture content of the subgrade is too high to permit the specified compaction to be achieved, the subgrade shall be aerated by blading or other methods until the moisture content is satisfactory for compaction.

G. After the foundations for fill have been cleared, plowed or scarified, they shall be disced or bladed until uniform and free from large clods, brought to the proper moisture content and compacted to not less than ninety percent (90%) of the maximum dry density as determined by the ASTM D1557 Test Method. Compaction operations shall be performed in the presence of the Geotechnical Engineer who will evaluate the performance of the materials under compactive load. Loose, soft and saturated soils and unstable soil deposits, as determined by the Geotechnical Engineer, shall be excavated to expose a firm base and grades restored with engineered fill in accordance with these specifications. Compaction operations shall be performed with a heavy, self-propelled sheepsfoot compactor (Caterpillar 815 or equivalent-sized compactor).

H. The building pad areas shall be defined as extending at least five feet (5') beyond the proposed building lines. The pavement areas shall be defined as extending at least two feet (2') beyond the edges of pavement.

3.3 CONSTRUCTION OF UNTREATED SUBGRADES

A. The selected soil fill material shall be placed in layers which, when compacted, do not exceed six inches (6") in thickness. Each layer shall be spread evenly and

shall be thoroughly mixed during the spreading to promote uniformity of material in each layer. Clay soils shall not be used in fills within the upper twelve inches (12") of building pads and subgrades support exterior flatwork unless lime treated.

B. When the moisture content of fill material is less than two percent (2%) above the optimum moisture content, as defined by the ASTM D1557 test method, 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 the specified degree of compaction to be achieved, the fill material shall be aerated by blading or other methods until the moisture content is satisfactory.

D. After each layer has been placed, mixed and spread evenly, it shall be uniformly compacted to not less than ninety percent (90%) of maximum dry density as determined by the ASTM D1557 test method. Compaction shall be undertaken with equipment capable of achieving the specified density and shall be accomplished while the fill material is at the required moisture content. Each layer shall be compacted over its entire area until the desired density has been obtained.

E. The fill operations shall be continued until the fills have been brought to the slopes and grades shown on the accepted Drawings.

3.4 LIME-STABILIZED SUBGRADE CONSTRUCTION

A. Placing Material

The material to be treated shall be placed at a moisture content at least two percent (2%) over optimum moisture as defined by the ASTM D1557 test method.

B. Preparing Material

Material to be treated shall be scarified and thoroughly broken up to the full depth and width to be stabilized. The material to be treated shall contain no rocks or solids larger than one and one-half inches (1½") in maximum dimension.

C. Mixing

1) Lime shall be added to the material to be treated at a rate of four and one half pounds (4½ lbs.) per cubic foot of soil treated.

2) Lime shall be spread by equipment that will uniformly distribute the required amount of lime for the full width of the prepared material. The rate of spread per linear foot of blanket shall not vary more than five percent (5%) from the designated rate.

3) The spread lime shall be prevented from blowing by suitable means selected by the Contractor. Quicklime shall not be used to make lime slurry. The spreading operations shall be conducted in such a manner that a hazard is not present to construction personnel or the public. All lime spread shall be thoroughly mixed into the soil the same day lime spreading operations are performed.

4) The distance which lime may be spread upon the prepared material ahead of the mixing operation shall be determined by the Contractor.

5) No traffic other than the mixing equipment shall be allowed to pass over the spread lime until after the completion of mixing.

6) Mixing equipment shall be equipped with a visual depth indicator showing mixing depth, an odometer or footmeter to indicate travel speed and a controllable water additive system for regulating water added to the mixture.

7) Mixing equipment shall be of the type that can mix the full depth of the treatment specified and leave a relatively smooth bottom of the treated section. Mixing and re-mixing, regardless of equipment used, shall continue until the material is uniformly mixed (free of streaks or pockets of lime), moisture is at approximately two percent (2%) over optimum and the mixture complies with the following requirements:

Minimum Sieve Size	Percent Passing
1-1/2"	100
1"	95
No. 4	60

8) Non-uniformity of color reaction when the treated material, exclusive of one inch or larger clods, as tested with the standard phenolphthalein alcohol indicator, shall be considered evidence of inadequate mixing.

9) Lime-treated material shall not be mixed or spread while the atmospheric temperature is below thirty-five degrees Fahrenheit (35°F). The entire mixing operation shall be completed within seventy-two (72) hours of the initial spreading of lime, unless otherwise permitted by the Geotechnical Engineer.

D. Spreading and Compacting

1) The treated mixture shall be spread to the required width, grade and cross-section. The maximum compacted thickness of a single layer may be determined by the Contractor provided he can demonstrate to the Geotechnical Engineer that his equipment and method of operation will provide uniform distribution of the lime and the required compacted density throughout the layer. If the Contractor is unable to achieve uniformity and density throughout the thickness selected, he shall rework the affected area using thinner lifts until a satisfactory treated subgrade meeting the distribution and density requirements is attained, as determined by the Geotechnical Engineer, at no additional cost to the Owner.

2) The finished thickness of the lime-treated material shall not vary more than one-tenth foot (0.1') from the planned thickness at any point.

3) The lime-treated soils within building pad subgrades shall be compacted to a relative compaction of not less than ninety-two percent (92%) as determined by the ASTM D1557 test method. Lime-treated soils within pavement subgrades shall be compacted to a relative compaction of not less than ninety-five percent (95%) as determined by the ASTM D1557 test method.

4) Initial compaction shall be performed by means of a sheepsfoot or segmented wheel roller. Final rolling shall be by means of steel-tired or pneumatic-tired rollers.

5) Areas inaccessible to rollers shall be compacted to meet the minimum compaction requirement by other means satisfactory to the Geotechnical Engineer.

6) Final compaction shall be completed within thirty-six (36) hours of final mixing. The surface of the finished lime-treated material shall be the grading plane and at any point shall not vary more than eight one hundredths of a foot (0.08') foot above or below the grade established by the Civil Engineer except that

when the lime-treated material is to be covered by material which is paid for by the cubic yard the surface of the finished lime-treated material shall not extend above the grade established by the Civil Engineer.

7) Before final compaction, if the treated material is above the grade tolerance specified in this section, uncompacted excess material may be removed and used in areas inaccessible to mixing equipment. After final compaction and trimming, excess material shall be removed and disposed of. The trimmed and completed surface shall be rolled with steel or pneumatic-tired rollers. Minor indentations may remain in the surface of the finished material so long as no loose material remains in the indentations.

8) At the end of each day's work, a construction joint shall be made in thoroughly compacted material and with a vertical face. After a part-width section has been completed, the longitudinal joint against which additional material is to be placed shall be trimmed approximately three inches (3") into treated material, to the neat line of the section, with a vertical edge. The material so trimmed shall be incorporated into the adjacent material to be treated.

9) An acceptable alternate to the above construction joints, if the treatment is performed with cross shaft rotary mixers, is to actually mix three inches (3") into the previous day's work to assure a good bond to the adjacent work.

3.5 FINAL SUBGRADE PREPARATION USING UNTREATED SOILS

A. The upper twelve inches (12") of building pad subgrades and subgrades supporting exterior flatwork shall consist of select granular soils and shall be brought to a uniform moisture content not less the optimum moisture content and shall be uniformly compacted to not less than ninety percent (90%) of the ASTM D1557 test method.

B. The upper six inches (6") of any untreated pavement subgrades shall be brought to at least the optimum moisture content and uniformly compacted to at least ninety-five (95%) percent of the ASTM D1557 test method, regardless of whether the subgrade is attained by filling, excavation or is left at existing grade.

3.6 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 tests 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, he 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 specifications shall be made except upon written approval of the Geotechnical Engineer or Architect/Engineer.

/

APPENDIX C
Pavement Design Calculations

WALLACE · KUHL & ASSOCIATES

By DJP Date 7/27/11 Project Name: Carmax - Elk Grove Proj. No. 9179.02
Chkd. By DRG Date _____ Sheet No. 1 of 3

Heavy Duty Pavements 75,000 EAL's 20yr design life
Light Duty Pavements 7,500 EAL's

Light Duty Pavements:

$$TI = 9.0\left(\frac{ESAL}{10^6}\right)^{0.119} = 9.0\left(\frac{7500}{10^6}\right)^{0.119} = 5.03 \Rightarrow 5.5$$

Heavy Duty Pavements:

$$TI = 9.0\left(\frac{ESAL}{10^6}\right)^{0.119} = 9.0\left(\frac{75000}{10^6}\right)^{0.119} = 6.61 \Rightarrow 7.0$$

TI = 5.5
R-Value = 5

Light Duty Pavements

AC G_f = 2.32
AB G_f = 1.1

Overall: $GE = 0.0032(TI)(100-R)$
$0.0032(5.5)(100-5) = 1.67' = 20.06"$

AC (No F.S.): $GE = 0.0032(5.5)(100-78) = .387'$ $.387'/2.32 = .167' = 2.0"$ (use 2.5" as minimum)

AC (w F.S.): $GE = .387 + 0.2 = .587$ $.587/2.32 = .253' = 3.0"$

AB (No F.S.): $1.67' - \frac{2.5}{12}(2.32) = 1.67 - .483' = 1.187' = 14.24" \Rightarrow 15"$

AB (w F.S.): $1.67' - \frac{3}{12}(2.32) = 1.67 - .58 = 1.09' = 13.1" \Rightarrow 13"$

Light Duty Pavements

$\frac{2\frac{1}{2}"\ AC}{15"\ AB}$ or $\frac{3"\ AC}{13"\ AB}$

WALLACE · KUHL & ASSOCIATES

By DJP Date 7/27/11 Project Name: Carmax - Elk Grove Proj. No. 9179.02
Chkd. By DRG Date _____ Sheet No. 2 of 3

Heavy Duty

TI = 7.0
R-Value = 5

AC G_f = 2.14
AB G_f = 1.1

Overall: $GE = 0.0032(7.0)(100-5) = 2.13'' = 25.5''$

AC (No F.S.): $GE = 0.0032(7.0)(100-78) = .493'$

$.493/2.14 = .23' \Rightarrow 2.8''$ (Say 3")

AC (W F.S.): $GE = .493 + .2 = .693$ $.693/2.14 = .324' = 3.89'' \Rightarrow 4''$

AB (No F.S.): $2.13 - \frac{3}{12}(2.14) = 1.6 = 19''$

AB (w F.S.): $2.13 - \frac{4}{12}(2.14) = 1.42 = 17''$

Heavy Duty Pavements

3" AC / 19" AB or 4" AC / 17" AB

WALLACE · KUHL & ASSOCIATES

By DJP Date 7/27/11 Project Name: Carmax - Elk Grove Proj. No. 9179.02
Chkd. By DRG Date _____ Sheet No. 3 of 3

Light Duty - Lime Treated

TI = 5.5
Assumed R-Value = 50

AC G_f = 2.32
AB G_f = 1.1

Overall: $GE = 0.0032(TI)(100-R)$
$0.0032(5.5)(100-50) = 0.88' = 10.56"$

AC (No F.S.): GE = .387 $.387/2.32 = .167' = 2.0"$ (use 2.5" as minimum)

AC (w/ F.S.): GE = .587 $.587/2.32 = .253' = 3.0"$

AB (No F.S.): $GE = 0.88 - \frac{2.5}{12}(2.32) = 0.4' = 4.76"$ (say 6")

AB (w/ F.S.): $GE = 0.88 - \frac{3}{12}(2.32) = 0.3' = 3.6"$ (say 6")

Light Duty - Lime Treated
2½" AC / 6" AB or 3" AC / 6" AB

Heavy Duty - Lime Treated

TI = 7.0
Assumed R-Value = 50

AC G_f = 2.14
AB G_f = 1.1

Overall: $GE = 0.0032(7.0)(50) = 1.12' = 13.44"$

AC (No F.S.): GE = .493 $.493/2.14 = .23' = 2.8"$ (say 3")

AC (w/ F.S.): GE = .693 $.693/2.14 = .324' = 3.89"$ (say 4")

AB (No F.S.): $1.12 - \frac{3}{12}(2.14) = .585' = 7.0"$

AB (w/ F.S.): $1.12 - \frac{4}{12}(2.14) = .407 = 4.88"$ say 6"

Heavy Duty - Lime Treated
3" AC / 7" AB or 4" AC / 6" AB