Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

CELEBRATING 35 YEARS

February 22, 2022
Project No. 109373001

Mr. Bryce Storm
Santee School District
9880 Riverwalk Drive
Santee, California 92071

Subject: Geotechnical Pavement Evaluation
Carlton Oaks School Hardcourt Pavements
9353 Wethersfield Road
Santee, California

Dear Mr. Storm:

In accordance with your authorization (P.O. No. 12926), we have performed a geotechnical pavement evaluation of the various existing asphalt concrete (AC) paved hardcourt play areas at the Carlton Oaks School campus located at 9353 Wethersfield Road in Santee, California (Figure 1). Our evaluation was focused on the AC paved hardcourt play areas located on the eastern, southern, and western portions of the school campus. For the purpose of this report, these areas have been labeled as the East, South, and West Hardcourts, as shown on Figure 2. The purposes of our services were to evaluate the subgrade soil conditions beneath the existing hardcourt pavements and provide our conclusions regarding the potential cause(s) of the observed pavement cracks, as well as provide recommendations for the replacement or renovation of the hardcourt surfacing.

SCOPE OF SERVICES

Ninyo & Moore's scope of services for this project included the following tasks:

- Reviewing background information including a previous geotechnical report for the school campus prepared by our office, available geologic and topographic maps, and historic aerial photographs.

- Performing a site reconnaissance to document the hardcourt pavement conditions and to locate our exploratory borings for clearance by Underground Service Alert (USA) and school personnel. Selected photographs are included in Attachment A.

- Performing a subsurface exploration consisting of manually excavating, logging, and sampling of four exploratory borings. The existing AC was cored prior to excavating the borings. Bulk samples of the encountered subgrade materials were collected and transported to our in-house laboratory for testing.

- Measuring the existing pavement sections encountered in our borings.
- Evaluating for the presence of paving fabric materials within the existing AC pavement sections at the boring locations.
- Performing geotechnical laboratory testing on representative soil samples to evaluate in-situ moisture content and R-value.
- Compiling and analyzing the data obtained from our background review, subsurface exploration, and laboratory testing.
- Preparing this report providing our findings regarding the subsurface conditions, our laboratory test results, as well as our conclusions regarding the potential cause(s) of the AC cracking and our recommendations for the replacement or renovations of the hardcourt play areas.

SITE DESCRIPTION AND OBSERVATIONS

Our evaluation was focused on the AC paved hardcourt play areas designated the East, South, and West Hardcourts on the school campus (Figure 2). The East Hardcourt (Photographs 1 through 4) is relatively flat with elevations ranging between approximately 379 and 383 feet above mean sea level (MSL) and includes basketball courts, tetherball, and foursquare areas. The South Hardcourt (Photographs 5 and 6) is relatively flat with elevations ranging between approximately 381 and 383 feet above MSL and includes a bike rack enclosure and electrical equipment. The West Hardcourt (Photographs 7 and 8) is relatively flat with an elevation of approximately 386 feet above mean sea level (MSL) and includes tetherball and foursquare areas.

Based on our discussions with you and the observations during our January 13 and 17, 2022 site visits, the existing AC hardcourt pavements have experienced extensive cracking and separation at several locations. Many of those cracks had been previously sealed or repaired and the cracks continue to propagate through the patching.

FIELD EXPLORATION AND SUBSURFACE CONDITIONS

Our field exploration was conducted on January 17, 2022 and consisted of manually excavating, logging, and sampling of four exploratory borings (B-1 through B-4) within the existing AC paved hardcourt areas. Borings B-1 and B-2 were performed in the East Hardcourt, boring B-3 was performed in the South Hardcourt, and boring B-4 was performed in the West Hardcourt. Prior to excavating, the locations were cleared of underground utilities by participating members of USA and the existing AC was cored using an 8-inch diameter core barrel. The exploratory borings were excavated to depths up to approximately 4 feet. Bulk soil samples were obtained from the borings. The samples were then transported to our in-house geotechnical laboratory for testing.

The approximate locations of the exploratory borings are shown on Figure 2. Table 1 summarizes the encountered hardcourt pavement sections and subgrade materials encountered during our field exploration.

Table 1 – Summary of Encountered Pavement Sections and Subgrade Soils

Boring Location	Boring Depth (feet)	Encountered Asphalt Concrete (AC) Thickness	Encountered Subbase Thickness	Encountered Subgrade Soils
B-1	3	4½ inches (1½-inch top layer over 3-inch bottom layer with a paving fabric in between)	18 inches	Clayey SAND
B-2	3½	3½ inches (1½-inch top layer over 2-inch bottom layer with a paving fabric in between)	20 inches	Sandy Lean CLAY
B-3	2	4½ inches (1-inch top layer over 3½-inch bottom layer with a paving fabric in between)	7 inches	Silty SAND
B-4	4	5½ inches (3-inch top layer over 2½-inch bottom layer)	5 inches	Sandy Lean CLAY

The subbase materials encountered beneath the AC pavements generally consisted of various shades of brown, moist, medium dense, poorly graded sand with silt. Scattered gravel and cobbles were encountered within the subbase materials.

The underlying subgrade soils that were encountered in our borings generally consisted of brown to reddish brown, moist, medium dense, clayey sand, and very stiff, sandy lean clay. Scattered to numerous amounts of gravel and cobbles were encountered within the subgrade soils.

Groundwater was not encountered during our evaluation. However, seepage was encountered in boring B-1 at approximately 2 feet near the contact between the subbase materials and underlying subgrade soils. Perched water may be encountered due to the geologic contacts between the subbase and subgrade materials, as well as the presence of trench backfill and bedding materials for underground utilities, as these materials tend to act as a conduit for perched water conditions. Fluctuations in the groundwater level and perched conditions may occur due to variations in ground surface topography, subsurface geologic conditions and structure, rainfall, irrigation, and other factors.

LABORATORY TESTING

Laboratory testing of the subgrade soils encountered beneath the existing AC hardcourt included an evaluation of the in-situ moisture content in general accordance with ASTM International (ASTM) D 2216 and its R-value in general accordance with California Test (CT) 301. The laboratory tests were performed at our in-house geotechnical laboratory. The results of our testing are summarized in Table 2 and in the preceding section.

Table 2 – Summary of Laboratory Tests

Boring Location	Sample Depth (feet)	Encountered Subgrade Material	In-Situ Moisture Content (%)	R-Value
B-1	2.0-3.0	Clayey SAND	23.5	28
B-2	2.0-3.0	Sandy Lean CLAY	15.5	15
B-4	0.8-2.0	Sandy Lean CLAY	14.9	-
B-4	2.0-4.0	Sandy Lean CLAY	15.0	14

FINDINGS AND CONCLUSIONS

As noted previously, purposes of our services were to measure the existing AC sections, evaluate the subsurface conditions beneath the existing hardcourt play areas, and provide our recommendations for the reconstruction of the hardcourt AC surfacing. Our evaluation has included a review of geotechnical-related background materials, a site reconnaissance, a subsurface exploration program consisting of four exploratory borings, and geotechnical laboratory testing.

Based on our evaluation, we provide the following conclusions for the project:

- The East, South, and West Hardcourts exhibit extensive AC cracking ranging from transverse, longitudinal, joint, alligator, and random cracks
- The encountered pavement sections in the hardcourt areas consisted of approximately 3½ to 5½ inches of AC underlain by approximately 5 to 20 inches of subbase materials. Additionally, a paving fabric was encountered between the AC layers in borings B-1, B-2, and B-3.
- The subgrade soils encountered generally consisted of clayey sand and sandy lean clay to the total depths explored

- Onsite excavations will generate oversized materials that are not suitable for reuse in the engineered subgrade soils. The contractor should anticipate and be prepared perform additional processing of onsite soils that may include rock-picking and/or screening of the material prior to reuse.

- Seepage was encountered in boring B-1 at a depth of approximately 2 feet. Perched water conditions may be encountered and the contractor should anticipate these conditions. Additionally, the in-situ subgrade soils indicated in-situ moisture contents between 14.9 and 23.5 percent, which is considered to be above the materials optimum moisture content. The contractor should anticipate performing additional aeration and drying of these materials prior to recompaction.

RECOMMENDATIONS

Due to the extensive cracks within the AC pavement, the variable moisture conditions and types of the subgrade soils beneath the existing AC pavements, along with the presence of paving fabrics and crack sealants, we recommend that the AC hardcourt pavements be reconstructed. The proposed reconstruction should be performed in accordance with the recommendations provided herein and the requirements of the applicable governing agencies. Ninyo & Moore should be contacted for questions regarding the recommendations or guidelines presented herein.

Pre-Construction Conference

We recommend that a pre-construction meeting be held prior to commencement of grading. The owner or their representative, the agency representatives, Ninyo & Moore, and the contractor should attend to discuss the plans, the project, and the proposed construction schedule.

Excavation Characteristics

The results of our field exploration program indicate that the project site is underlain by AC pavements, subbase consisting of poorly sand with silt, and subgrade soils consisting of clayey sand and sandy lean clay. Excavation of the onsite materials should be feasible with heavy-duty excavation equipment in good working condition. However, due to the presence of gravel and cobbles in the subbase and subgrade soils, the contractor may encounter difficult conditions when performing excavations.

Additionally, onsite excavations are anticipated to generate oversize material and additional processing and handling of these materials, including screening and/or rock picking, should be anticipated. Oversized materials generated from the earthwork operations should be removed from the project site and disposed of at a legal dumpsite.

Pavement Reconstruction – East Hardcourt

Based on discussions with the client, we understand that the hardcourt pavements are to be designed and constructed to support pedestrian and vehicular traffic. Specifically, the vehicular traffic is anticipated to include maintenance vehicles, delivery trucks, and the occasional piece of construction equipment. Our laboratory testing of near surface soil samples from borings B-1 and B-2 in the East Hardcourt indicated R-values of 28 and 15. Therefore, we have used a Traffic Index (TI) of 6 and an R-value of 15 for the design and construction of the new East Hardcourt pavement. Additionally, these pavement recommendations have been developed to accommodate for potential wet subgrade soil conditions. The recommended preliminary pavement section for the new East Hardcourt pavement is presented in Table 3 below:

Table 3 – Recommended Preliminary Flexible Pavement Section – East Hardcourt

Traffic Index Pavement Usage	Design R-Value	Asphalt Concrete (inches)	Aggregate Base (inches)
6 (Playground/Hard Courts)	15	4	18 (with geogrid reinforcing)

Aggregate base materials should conform to Caltrans Class 2 aggregate base materials as defined in Section 26 of the Caltrans Standard Specifications (2021b), Greenbook (2018) crushed aggregate base, or Greenbook (2018) crushed miscellaneous base. Aggregate base materials should be moisture conditioned to at or slightly above optimum moisture content and should be placed over prepared subgrade materials. We recommend that the aggregate base materials be compacted to a relative compaction of 95 percent of the modified Proctor density in accordance with ASTM D 1557.

The AC materials should consist of a 3/8-inch gradation in accordance with Class D materials as presented in Section 206-6.5.4 of the Greenbook (2018) with a Performance Grade (PG) 70-10 polymer modified (PM) binder. The AC materials should be placed over the aggregate base materials and be compacted to 95 percent relative compaction as compared to the material's Hveem density.

As part of the reconstruction, we recommend that continuous headers be utilized along the portions of the play area perimeter which are adjacent to unpaved surfaces. Also, the AC surface should be placed in such a manner to provide positive drainage so that surface water is not permitted to pond on the surface and is diverted off of and away from the AC materials.

Additionally, concrete and AC materials generated from the demolition of the existing improvements may be crushed or pulverized and reused as aggregate base materials, provided they are free from painted surfaces and rebar. These materials are considered suitable, provided they are processed and meet the criteria of Caltrans Class 2 aggregate base materials or Greenbook crushed miscellaneous base.

Site Preparation – East Hardcourt

For areas to receive new pavements, site preparation activities should begin by clearing and removing existing AC, deleterious materials, including organics (such as roots), and oversize materials. As noted previously, our exploratory borings encountered a layer of paving fabric within the encountered AC surfacing. Underground utilities within the proposed limits of the replacement should be located prior to the commencement of earthwork operations.

Subgrade Preparation and Aggregate Base Placement– East Hardcourt

For the East Hardcourt, subsequent to cutting to finished subgrade elevation, the resulting removal surface should then be smoothed and dressed with a low ground pressure bulldozer or excavator to fill in ruts and level the surface, as necessary. A layer of geogrid (Tensar TX 130S or equivalent) should be placed on the proof rolled subgrade soils prior to placement of the aggregate base materials. The geogrid should overlap 3 feet, be placed in a taut condition, and extend laterally a distance of 2 feet beyond the horizontal limits of the new AC pavement sections, where feasible. Once the geogrid has been placed, the aggregate base materials should be placed and compacted in lifts. Aggregate base materials should consist of Caltrans Class 2 aggregate base, Greenbook crushed aggregate base, Greenbook crushed miscellaneous base, or Greenbook (2018) processed miscellaneous base. Aggregate base materials should be moisture conditioned to at or slightly above optimum moisture content and should be placed over prepared subgrade materials. We recommend that the aggregate base materials be compacted to a relative compaction of 95 percent of the modified Proctor density in accordance with ASTM D 1557.

After the subgrade preparation and aggregate base placement has been performed in accordance with the recommendations provided above for the East Hardcourt, the new AC pavement section should be constructed in accordance with the previous recommendations of this report.

Pavement Reconstruction – South Hardcourt

As noted earlier, we understand that the hardcourt pavements are to be designed and constructed to support pedestrian and vehicular traffic. Our laboratory testing of near surface soil samples at the project site indicated R-values of 14, 15, and 28. Therefore, we have used a TI of 6 and an R-value of 14 for the design and construction of the new South Hardcourt pavement. The recommended preliminary pavement section for the new South Hardcourt pavement is presented in Table 4 below:

Table 4 – Recommended Preliminary Flexible Pavement Section – South Hardcourt

Traffic Index Pavement Usage	Design R-Value	Asphalt Concrete (inches)	Aggregate Base (inches)
6 (Playground/Hard Courts)	14	3½	10½

Aggregate base materials should conform to Caltrans Class 2 aggregate base materials as defined in Section 26 of the Caltrans Standard Specifications (2021b), Greenbook (2018) crushed aggregate base, or Greenbook (2018) crushed miscellaneous base. Aggregate base materials should be moisture conditioned to at or slightly above optimum moisture content and should be placed over prepared subgrade materials. We recommend that the aggregate base materials be compacted to a relative compaction of 95 percent of the modified Proctor density in accordance with ASTM D 1557.

The AC materials should consist of a $^{3}/_{8}$-inch gradation in accordance with Class D materials as presented in Section 206-6.5.4 of the Greenbook (2018) with a Performance Grade (PG) 70-10 polymer modified (PM) binder. The AC materials should be placed over the aggregate base materials and be compacted to 95 percent relative compaction as compared to the material's Hveem density.

As part of the reconstruction, we recommend that continuous headers be utilized along the portions of the play area perimeter which are adjacent to unpaved surfaces. Also, the AC surface should be placed in such a manner to provide positive drainage so that surface water is not permitted to pond on the surface and is diverted off of and away from the AC materials.

Additionally, concrete and AC materials generated from the demolition of the existing improvements may be crushed or pulverized and reused as aggregate base materials, provided they are free from painted surfaces and rebar. These materials are considered suitable, provided they are processed and meet the criteria of Caltrans Class 2 aggregate base materials or Greenbook crushed miscellaneous base.

Site Preparation – South Hardcourt

For areas to receive new pavements, site preparation activities should begin by clearing and removing existing AC, deleterious materials, including organics (such as roots), and oversize materials. As noted previously, our exploratory borings encountered a layer of paving fabric within the encountered AC surfacing. Underground utilities within the proposed limits of the replacement should be located prior to the commencement of earthwork operations.

Subgrade Preparation – South Hardcourt

For the South Hardcourt, we recommend that the subgrade soils be scarified to a depth of 8 inches, rock picked, moisture conditioned to at or slightly above optimum moisture content, and recompacted to a relative compaction of 95 percent as evaluated by ASTM D 1557. After the subgrade preparation has been performed in accordance with the recommendations provided above for South Hardcourt, the new AC pavement sections, including aggregate base materials, should be constructed in accordance with the previous recommendations of this report.

In general, subgrade soils should not contain rocks or lumps over approximately 3 inches in diameter, and not more than approximately 30 percent larger than ¾-inch.

Pavement Reconstruction – West Hardcourt

As noted earlier, we understand that the hardcourt pavements are to be designed and constructed to support pedestrian and vehicular traffic. Our laboratory testing of a near surface soil samples from boring B-4 in the West Hardcourt indicated an R-value of 14. That R-value, along with a TI of 6 has been used for the design and construction of the new West Hardcourt pavement. The recommended preliminary pavement section for the new West Hardcourt pavement is presented in Table 5 below:

Table 5 – Recommended Preliminary Flexible Pavement Section – West Hardcourt

Traffic Index Pavement Usage	Design R-Value	Asphalt Concrete (inches)	Aggregate Base (inches)
6 (Playground/Hard Courts)	14	3½	10½

Aggregate base materials should conform to Caltrans Class 2 aggregate base materials as defined in Section 26 of the Caltrans Standard Specifications (2021b), Greenbook (2018) crushed aggregate base, or Greenbook (2018) crushed miscellaneous base. Aggregate base materials should be moisture conditioned to at or slightly above optimum moisture content and should be placed over prepared subgrade materials. We recommend that the aggregate base materials be compacted to a relative compaction of 95 percent of the modified Proctor density in accordance with ASTM D 1557.

The AC materials should consist of a $^{3}/_{8}$-inch gradation in accordance with Class D materials as presented in Section 206-6.5.4 of the Greenbook (2018) with a Performance Grade (PG) 70-10 polymer modified (PM) binder. The AC materials should be placed over the aggregate base materials and be compacted to 95 percent relative compaction as compared to the material's Hveem density.

As part of the reconstruction, we recommend that continuous headers be utilized along the portions of the play area perimeter which are adjacent to unpaved surfaces. Also, the AC surface should be placed in such a manner to provide positive drainage so that surface water is not permitted to pond on the surface and is diverted off of and away from the AC materials.

Additionally, concrete and AC materials generated from the demolition of the existing improvements may be crushed or pulverized and reused as aggregate base materials, provided they are free from painted surfaces and rebar. These materials are considered suitable, provided they are processed and meet the criteria of Caltrans Class 2 aggregate base materials or Greenbook crushed miscellaneous base.

Site Preparation – West Hardcourt

For areas to receive new pavements, site preparation activities should begin by clearing and removing existing AC, deleterious materials, including organics (such as roots), and oversize materials. As noted previously, our exploratory borings encountered a layer of paving fabric within the encountered AC surfacing. Underground utilities within the proposed limits of the replacement should be located prior to the commencement of earthwork operations.

Subgrade Preparation – West Hardcourt

For the West Hardcourt, we recommend that the subgrade soils be scarified to a depth of 8 inches, rock picked, moisture conditioned to at or slightly above optimum moisture content, and recompacted to a relative compaction of 95 percent as evaluated by ASTM D 1557. After the subgrade preparation has been performed in accordance with the recommendations provided above for West Hardcourt, the new AC pavement sections, including aggregate base materials, should be constructed in accordance with the previous recommendations of this report.

In general, subgrade soils should not contain rocks or lumps over approximately 3 inches in diameter, and not more than approximately 30 percent larger than ¾-inch.

LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

Respectfully submitted,
NINYO & MOORE

Christine M. Kuhns, PE
Project Engineer

Jeffrey T. Kent, PE, GE
Principal Engineer

CMK/JTK/gg

Attachments: References
Figure 1 – Site Location
Figure 2 – Boring Locations
Attachment A – Photographs

REFERENCES

Building News, 2018, “Greenbook,” Standard Specifications for Public Works Construction: BNI Publications.

California Department of Transportation (Caltrans), 2021a, Highway Design Manual.

California Department of Transportation (Caltrans), 2021b, Standard Specifications.

City of San Diego, 1960, Topographic Survey, Sheet 246-1761.

City of San Diego, 1973, Orthotopographic Survey, Sheet 246-1761

Google, Inc., 2022, www.googleearth.com.

Historic Aerials, 2022, www.historicaerials.com/viewer.

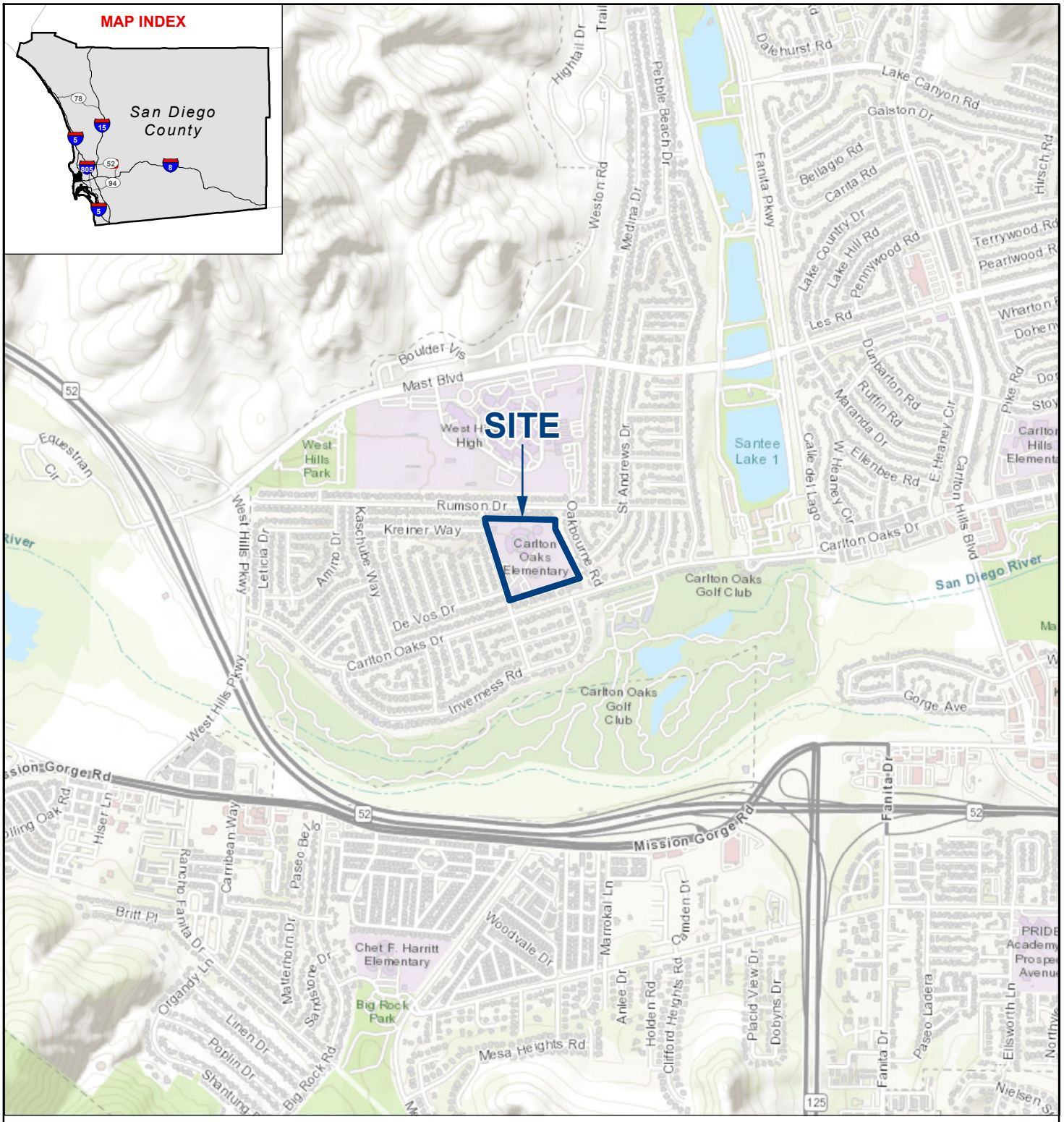
Kennedy and Tan, 2008, Geologic Map of San Diego 30’ x 60’ Quadrangle, California, Scale 1:100,000.

Ninyo & Moore, 2007, Geotechnical Evaluation, Carlton Oaks School, Santee, California, Project No. 106114001: dated July 12.

Ninyo & Moore, 2021, Proposal for Geotechnical Pavement Evaluation, Hardcourt Pavements, Carlton Oaks School, 9353 Wethersfield Road, Santee, California, Proposal No. 02-02630: dated November 24.

United States Department of Agriculture (USDA), 1953, Flight AXN-10M, Numbers 16 and 17: dated April 14.

FIGURES



NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: ESRI WORLD TOPO, 2022

1_109373001_SL.mxd 2/8/2022 AOB

FIGURE 1

SITE LOCATION

CARLTON OAKS SCHOOL HARDCOURT PAVEMENTS
9353 WETHERSFIELD ROAD, SANTEE, CALIFORNIA

109373001 | 2/22

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

LEGEND

SITE BOUNDARY

B-4 TD=4.0 BORING
TD=TOTAL DEPTH IN FEET

N

FEET
0 100 200

NOTE: DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE. | SOURCE: GOOGLE EARTH, 2021

2_109373001_BL.mxd 2/8/2022 AOB

FIGURE 2

BORING LOCATIONS

CARLTON OAKS SCHOOL HARDCOURT PAVEMENTS
9353 WETHERSFIELD ROAD, SANTEE, CALIFORNIA

109373001 | 2/22

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants

ATTACHMENT A

Photographs

Photograph 1: **View of East Hardcourt play area looking north. Note the several patched and unpatched AC cracks running in the north-south and east-west orientations.**

Photograph 2: **View of East Hardcourt play area looking south. Note the several AC cracks running in the north-south and east-west orientations.**

Photograph 3: View of several alligator cracks in the AC pavement for the East Hardcourt play area looking north.

Photograph 4: View of several random oriented cracks in the AC with various cracks that have previously been patched and have reopened.

Photograph 5: View of South Hardcourt play area looking east. Note the several patched and unpatched AC cracks running in the north-south and east-west orientations.

Photograph 6: View of South Hardcourt play area looking east. Note the several patched and unpatched AC cracks running in the north-south and east-west orientations.

Photograph 7: **View of West Hardcourt play area looking west. Note the several patched and unpatched AC cracks running in the north-south and east-west orientations.**

Photograph 8: **Close-up view of an AC crack approximately ½-inch wide.**