Western Technologies
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GEOTECHNICAL EVALUATION REPORT

WILLCOX HIGH SCHOOL
WRESTLING BUILDING ADDITION AND TRACK PAVING

240 North Bisbee Avenue
Willcox, Arizona
WT Job No. 29-224101-2

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GEOTECHNICAL EVALUATION
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WRESTLING BUILDING ADDITION AND TRACK PAVING
240 NORTH BISBEE AVENUE
WILLCOX, ARIZONA
JOB NO. 29-224101-2

1.0 PURPOSE

This report contains the results of our geotechnical evaluation for a proposed wrestling building addition and track paving to be located in Willcox, Arizona. The purpose of these services is to provide information and recommendations regarding:

- Subsurface conditions
- Foundation design parameters
- Lateral earth pressures
- Earthwork guidelines
- Pavement sections
- Drainage
- Groundwater
- Corrosivity (soil to concrete)
- Slabs-on-grade
- Seismic conditions
- Excavation conditions
- Soil Agronomy

Results of the field exploration, field tests, and laboratory testing program are presented in the Appendices.

2.0 PROJECT DESCRIPTION

We understand the proposed wrestling building addition will be a single-story, slab-on-grade structure using wood-frame and/or masonry construction. Maximum wall and column loads are assumed to be 4 kips per linear foot (klf) and 50 kips, respectively. We anticipate that ground floor level will be within 2 feet of existing site grade and that no extraordinary slab criteria are required. A new asphalt concrete and acrylic surfacing on the track will be included as part of the project. Should this information not be correct, we should be notified immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

One boring was drilled to a depth of about 21.5 feet below existing site grade in the proposed building areas. In addition, two borings were drilled to depths of about 5 feet in the proposed paved track area. Also, one boring was excavated in the football field using hand tools for agronomy testing. The borings were at the approximate locations shown on the attached Boring Location Diagram. A field log was prepared for each boring. These logs contain visual classifications of the materials encountered during drilling as well as interpolation of the subsurface conditions between samples. Final logs, included in Appendix A, represent our interpretation of the field logs and may include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thickness, and the locations where samples were obtained.

The Unified Soil Classification System was used to classify soils. The soil classification symbols appear on the boring logs and are briefly described in Appendix A. Local and regional geologic characteristics were used to estimate the seismic design criteria.

3.2 Laboratory Analyses

Laboratory analyses were performed on representative soil samples to aid in material classification and to estimate pertinent engineering properties of the on-site soils for preparation of this report. Testing was performed in general accordance with applicable standard test methods. The following tests were performed, and the results are presented in Appendix B.

- Water content
- Dry density
- Compression
- Moisture-density relationship (proctor)
- Expansion
- Plasticity
- Minus #200 sieve
- Soil agronomy

3.3 Analyses and Report

This geotechnical engineering report includes a description of the project, a discussion of the field and laboratory testing programs, a discussion of the subsurface conditions, and design recommendations as appropriate to its purpose. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the site, discovery of underground storage tanks or other underground structures, or identification of contaminated or hazardous materials or conditions. If there is concern about the potential for such contamination, other studies should be undertaken. We are available to discuss the scope of such studies with you.

4.0 SITE CONDITIONS

4.1 Surface

Existing site development consisted of the Willcox High school track and field, and the existing wrestling building. Fills or underground facilities such as septic tanks, cesspools, basements, utilities, and dry wells were not observed. The ground surface was relatively flat and vegetation consisted of the landscaped grass in the field area. There was no vegetation in the vicinity of the wrestling building addition area . Site drainage trended to the south as sheet surface flow, although shallow depressions existed.

4.2 Subsurface

As presented on the Boring Logs, surface soils to depths of 15 feet consisted of medium dense to dense Clayey SAND. Near surface soils are of medium to high plasticity. The materials underlying the surface soils and extending to the full depth of exploration consisted of stiff to very stiff Sandy CLAY and Sandy Silty CLAY. No apparent zones of carbonate cementation were encountered. Groundwater was not encountered in any boring at the time of exploration. A detailed description of the soils encountered can be found on the boring logs in Appendix A.

5.0 GEOTECHNICAL PROPERTIES & ANALYSIS

5.1 Laboratory Tests

Laboratory test results (see Appendix B) indicate that on-site subsoils near shallow foundation level exhibit low compressibility at existing water contents. Low additional compression occurs when the water content is increased.

Near-surface soils are of medium to high plasticity. These soils exhibit low to moderate expansion potential when recompacted, confined by loads approximating floor loads and saturated. Slabs-on-grade supported on recompacted on-site soils have a low to medium potential for heaving if the water content of the soil increases.

Chemical tests for soil agronomy were performed on representative samples of on-site soils. The tests were performed by Motzz Laboratories, Inc. and the test results and a soil amendment recommendation letter are presented in Appendix C.

5.2 Field Tests

On-site subsoils near shallow foundation level exhibited medium resistance to penetration using the standard penetration test method (ASTM D1586) and ring-lined barrel sampler (ASTM D3550).

The boring logs included in this report are indicators of subsurface conditions only at the specific location and date noted. Variations from the field conditions represented by the borings may become evident during construction. If variations appear, we should be contacted to re-evaluate our recommendations.

6.0 RECOMMENDATIONS

6.1 General

Recommendations contained in this report are based on our understanding of the project criteria described in Section 2.0 and the assumption that the soil and subsurface conditions are those disclosed by the explorations. Others may change the plans, final elevations, number and type of structures, foundation loads, and floor levels during design or construction. Substantially different subsurface conditions from those described herein may be encountered or become known. Any changes in the project criteria or subsurface conditions shall be brought to our attention in writing. This report does not encompass the effects, if any, of underlying geologic hazards or regional groundwater withdrawal and expresses no opinion regarding their effects on surface movements at the project site.

6.2 Foundations

Shallow spread-type footings may be used to support the proposed structure. The foundations should bear on engineered fills achieved by removal and recompaction of the soils below foundations. The depth and lateral extent of the engineered fills is presented in the **EARTHWORK** section of this report.

Alternative footing depths and allowable bearing capacities are presented in the following tabulation:

Footing Depth Below Finished Grade[1] (ft)	Allowable Bearing Capacity[2] (psf)
1.5	2,000
2.0	2,500

We anticipate that total settlement of the proposed structure, supported as recommended, should be less than ¾ inch. Differential settlement is anticipated to be less than ½ inch. Additional foundation movements could occur if water from any source infiltrates the foundation soils. Therefore, proper drainage should be provided in the final design and during construction.

Footings should have minimum widths in accordance with local building codes. The bearing capacities given are net bearing capacities and the weight of the concrete in the footings may be ignored.

We recommend that the geotechnical engineer or his representative observe the footing excavations before reinforcing steel and concrete are placed. This observation is to evaluate whether the soils exposed are similar to those anticipated for support of the footings. Any soft, loose or unacceptable soils should be undercut to suitable materials and backfilled with approved fill materials or lean concrete. Soil backfill should be properly compacted.

6.3 Lateral Design Criteria

Lateral loads may be resisted by concrete interface friction and by passive resistance. For shallow foundations bearing on properly compacted fill at this site, we recommend the following lateral resistance criteria:

---

[1] Finished grade is the lowest adjacent grade for perimeter footings and floor level for interior footings.

[2] Allowable bearing capacities assume fulfillment of **EARTHWORK** recommendations. Pounds per square foot (psf).

- Passive:
  Shallow wall footings...250 psf/ft
  Shallow column footings...400 psf/ft

- Coefficient of base friction (passive)...0.30

Earth retaining structures less than 10 feet in height, above any free water surface, with level backfill and no surcharge loads may be designed using the equivalent fluid pressure method. Recommended active equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

- Active:
  Undisturbed subsoil..40 psf/ft
  Compacted granular backfill ....30 psf/ft
  Compacted site soils...35 psf/ft

- Coefficient of base friction (active)..0.40

Where the design includes restrained elements, the following equivalent fluid pressures are recommended:

- At-rest:
  Undisturbed subsoil..60 psf/ft
  Compacted granular backfill ....55 psf/ft

The equivalent fluid pressures presented herein do not include the lateral pressures arising from the presence of:

- hydrostatic conditions, submergence or partial submergence
- sloping backfill, positively or negatively
- surcharge loading, permanent or temporary
- seismic or dynamic conditions

We recommend a free-draining soil layer or manufactured geosynthetic material be constructed adjacent to the back of any retaining walls. A filter may be required between the soil backfill and drainage layer. This drainage zone should help prevent development of hydrostatic pressure on the wall. This vertical drainage zone should be tied into a gravity drainage system at the base of the wall. It is important that all backfill be properly placed and compacted. Backfill should be mechanically compacted in layers. Flooding or jetting should not be permitted. Care should be taken not to damage the walls when placing the backfill. Backfills should be observed and tested during placement.

Fill against footings, stem walls, and any retaining walls should be compacted to densities specified in **EARTHWORK**. Clayey soils should not be used as backfill against retaining walls. Compaction of each lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Over-compaction may cause excessive lateral earth pressures that could result in wall movements.

6.4 Seismic Considerations

Structures should be designed in accordance with applicable building codes. The seismic design parameters presented in the following table, in accordance with the 2012 International Building Code and ASCE 7-10, are applicable to the project site:

Seismic Design Parameters International Building Code 2012, ASCE 7-10	
Soil Site Class	D
Mapped Spectral Response Acceleration at 0.2 sec period (S_S)	0.248g
Mapped Spectral Response Acceleration at 1.0 sec period (S_1)	0.074g
Site Coefficient for 0.2 sec period (F_a)	1.600
Site Coefficient for 1.0 sec period (F_v)	2.400
Design Spectral Response Acceleration at 0.2 sec period (S_{DS})	0.265g
Design Spectral Response Acceleration at 1.0 sec period (S_{D1})	0.119g

The soil site class is based upon conditions identified in shallow explorations and local knowledge of the soil conditions in the vicinity of the site. Soil conditions extending beyond the depth of our explorations to a depth of 100 feet were assumed for the purposes of providing the information presented in the table.

6.5 Conventional Slab-on-Grade Support

Floor slabs can be supported on properly placed and compacted fill. The slab subgrade should be prepared by the procedures outlined in this report. A minimum 4-inch layer of base course should be provided beneath all slabs to help prevent capillary rise and a damp slab. The modulus of subgrade reaction (k) is estimated to be 250 pounds per cubic inch (pci), based upon a 30-inch diameter plate.

The use of vapor retarders or barriers is desirable for any slab-on-grade where the floor will be covered by products using water based adhesives, wood, vinyl backed carpet, impermeable floor coatings (urethane, epoxy, acrylic terrazzo, etc.) or where the floor will be in contact with moisture sensitive equipment or product. When used, the design and installation should be in accordance with the recommendations given in ACI 302.1R and 302.2R. Final determination on the use of a vapor retarder should be left to the slab designer.

All concrete placement and curing operations should follow the American Concrete Institute manual recommendations. Improper curing techniques and/or high slump (high water-cement ratio) could cause excessive shrinkage, cracking or curling. Concrete slabs should be allowed to cure adequately before placing vinyl or other moisture sensitive floor covering.

6.6 Drainage

The major cause of soil problems in this vicinity is moisture increase in soils below structures. Therefore, it is extremely important that positive drainage be provided during construction and maintained throughout the life of the proposed building. Infiltration of water into utility or foundation excavations must be prevented during construction. It is also important that proper planning and control of any landscape and irrigation practices be performed.

In areas where sidewalks or paving do not immediately adjoin the structure, protective slopes should be provided with an outfall of 5 percent for at least 10 feet from perimeter walls. Scuppers and drainpipes should be designed to provide drainage away from the structure for a minimum of 10 feet. Backfill against footings, exterior walls, and in utility and sprinkler line trenches should be well compacted and free of all construction debris to minimize the possibility of moisture infiltration.

Water and sewer utility lines should be properly installed to avoid possible sources for subsurface saturation. It is important that all utility trenches be properly backfilled. If practicable, planters and/or landscaping should not be constructed adjacent to or near structure. If planters and/or landscaping are adjacent to or near the structure, we recommend the following:

- Planters should be sealed
- Grades should slope away from the building
- Only shallow rooted landscaping should be used
- Watering should be kept to a minimum

It should be understood that these recommendations will help reduce the potential for soil movement and resulting distress but will not eliminate this potential.

6.7 Corrosivity to Concrete

In order to be consistent with standard local practice and for reasons of material availability, we recommend a Type II portland cement be used for all concrete on and below grade.

6.8 Pavements

It is understood that the existing track pavement section consists of 1½ to 2 inches of asphalt concrete. It is recommended that the asphalt concrete should be pulverized to their full depth. The resulting asphalt concrete millings may be used as part of the aggregate base course below the new pavements, discarded, or used as fill in another area of the site. The following minimum athletic pavement section is recommended:

Traffic Area	Asphalt Concrete Pavement (inches)	Base Course (inches)
Athletic Track Alternative 1[3]	2½	4
Athletic Track Alternative 2[3]	2	6

Given the proximity of the existing track to an irrigated athletic field, a significant potential exists for some of the pavement supporting soils to be wet and unstable. Furthermore, the supporting soils may exhibit instability when the existing asphalt concrete is removed. If wet or unstable subgrade soils are encountered, they should be addressed using one of the methods outlined in Section 7.6 **Wet/Unstable Subgrade Soils**.

[3] A rubberized or acrylic athletic track surface layer may be placed on top of and in addition to the recommended section.

Base course and asphalt concrete should conform to *MAG (*Maricopa Association of Governments) *Standard Specifications for Public Improvements*, Current Edition. Bituminous surfacing should be constructed of dense-graded, central plant-mix, asphalt concrete. Asphalt concrete should conform to the specification requirements for “½-inch” Marshall Mix of the MAG specifications. An alternative low-volume asphalt mix that includes terminal rubber binder is also acceptable and may have a better long-term performance for an athletic track.

Material and compaction requirements should conform to recommendations presented under **EARTHWORK**. The gradient of paved surfaces should ensure positive drainage. Water should not pond in areas directly adjoining paved sections. The on-site clayey subgrade soils may soften and lose stability if subjected to conditions that result in an increase in water content.

The "design life" (20 years) of a pavement is defined as the expected life at the end of which reconstruction of the pavement will need to occur. Normal maintenance, including crack sealing, slurry sealing, and/or chip sealing, should be performed during the life of the pavement.

7.0 EARTHWORK

7.1 General

The conclusions contained in this report for the proposed construction are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance that occurs after completion of the earthwork must be backfilled, compacted and tested in accordance with the recommendations contained herein. It is not reasonable to rely upon our conclusions and recommendations if any future unobserved and untested trenching, earthwork activities or backfilling occurs.

Although fills or underground facilities such as septic tanks, cesspools, basements, utilities, and dry wells were not observed, such features might be encountered during construction. These features should be demolished in accordance with the recommendations of the geotechnical engineer. Any loose or disturbed soils resulting from demolition should be removed or recompacted as engineered fill and any excavations should be backfilled in accordance with recommendations presented herein.

7.2 Site Clearing

Strip and remove any existing fill material, vegetation, debris, and any other deleterious materials from the building and pavement areas. The building area is defined as that area within the building footprint plus 5 feet beyond the perimeter of that footprint. All exposed surfaces should be free of mounds and depressions that could prevent uniform compaction.

7.3 Excavation

We anticipate that excavations for shallow foundations and utility trenches for the proposed construction can be accomplished with conventional equipment.

On-site soils may pump or become unworkable at high water contents. Workability may be improved by scarifying and drying. Over-excavation of wet zones and replacement with granular materials may be necessary. The use of lightweight excavation and compaction equipment may be required to minimize subgrade pumping.

The soils to be penetrated by the proposed excavations may vary significantly across the site. Our soil classifications are based solely on the materials encountered in widely spaced exploratory test borings. The contractor should verify that similar conditions exist throughout the proposed area of excavation. If different subsurface conditions are found at the time of construction, we should be contacted immediately to evaluate the conditions encountered.

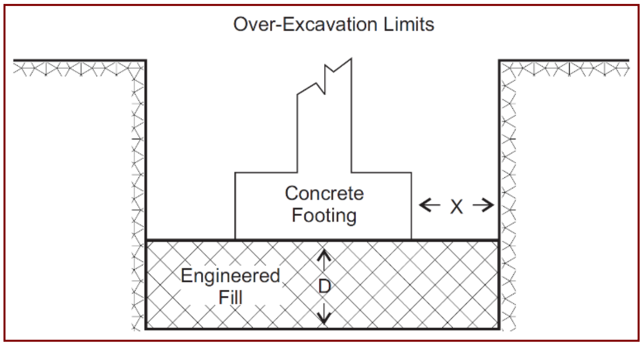
7.3.1 Temporary Excavations and Slopes

Temporary, non-surcharged construction excavations should be sloped or shored. The individual contractor should be made responsible for designing and constructing stable, temporary excavations as required to maintain stability of both the excavation sides and bottom. All excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. OSHA recommends a maximum slope inclination of ¾:1 (horizontal:vertical) for Type A soils, 1:1 for Type B soils, and 1½:1 for Type C soils.

As a safety measure, it is recommended that all vehicles and soil piles be kept a minimum lateral distance back from the crest of the slope at least equal to the slope height. The exposed slope face should be protected against the elements.

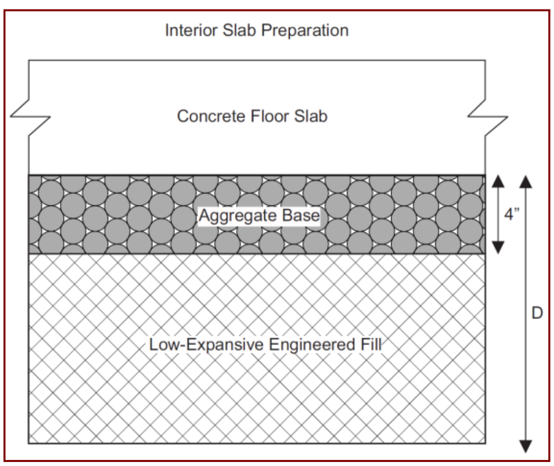
7.4 Foundation Preparation

In footing areas, remove existing soils as required to a minimum depth of 2 feet below the bottom of the footing (depth D in the diagram below) or 2 feet below existing site grade, whichever is deeper. Removal should extend a minimum of 2 feet beyond the footing edges (length X in the diagram below). Replace with engineered fill material.



7.5 Conventional Interior Slab Preparation

Slabs-on-grade should be founded on engineered fill material. Remove existing soils to a minimum depth of 12 inches below the bottom of the slab (depth D in the diagram below). Replace with properly compacted, low- or non-expansive, fill material. The aggregate base course below the slab may be included as part of the low- or non-expansive engineered fill.



7.6 Wet/Unstable Subgrade Soils

If site soils become excessively wet, pumping and instability should be anticipated. If wet, unstable subgrade soils are encountered during construction, there are several alternatives to mitigate them. The alternatives vary in cost and time to implement, so the alternatives should be evaluated and compared in order to decide which one is most beneficial for the project.

1. The wet, unstable subgrade may be scarified and/or partially removed in order to allow the excess moisture to evaporate. The soils should be periodically blended to allow uniform drying to occur. When the soils are near optimum moisture content, they should be compacted in accordance with project requirements.

2. The wet, unstable subgrade may be removed and replaced with drier, granular soil and/or aggregate base course. The depth of removal necessary will vary depending on the conditions in each unstable area. It may be best to remove a uniform thickness of 2 feet in each area. Although the wet, unstable soils may extend to a depth greater than 2 feet, the granular material should bridge over these deeper wet soils. Removal should be performed with an excavator or similar piece of equipment so that underlying wet soils will not be adversely affected by wheel loads and thereby become more unstable. The first foot of granular backfill should be placed at near-optimum moisture content and compacted using static (non-vibrating) equipment to at least 90 percent of the maximum dry density. The second foot of granular material may then be placed and compacted in accordance with project requirements.

3. Geogrid and aggregate base course may be used to bridge over wet subgrade soils. Wet, unstable subgrade should be removed to a depth of at least 1 foot and to a distance at least 2 feet beyond the edge of the unstable area. Removal should be performed with an excavator or similar piece of equipment so that underlying wet soils will not be adversely affected by wheel loads and thereby become unstable. Geogrid should consist of Tensar Type 3, HX165, NX750 or equivalent and should be installed in accordance with the manufacturer's installation instructions. The geogrid should extend at least 2 feet beyond the edge of the unstable area. Aggregate base course (not just granular soil) should be placed over the geogrid and compacted in accordance with project requirements.

4. Wet, unstable subgrade soils at the site may be mixed with dry portland cement or hydrated lime. For cost-estimating purposes, it may be assumed that 5 percent by dry weight of the soil will be required to stabilize the site soils and that treatment to a depth of 1 foot will be required to bridge over the unstable areas. The depth of treatment and quantity of cement or lime may be modified during

construction depending on the results achieved. It should be noted that the portland cement will not chemically react with the clay component of the soil; however, the cement will dry the soil and will provide cementation of the coarse-grained particles in the soil. Since the dry cement will react with the excess moisture in the subgrade soils, additional water will need to be added to achieve moisture contents near optimum prior to compaction of the soils. The blended soil should be compacted and tested in accordance with project requirements.

The extent of the unstable areas to be treated may be identified by proof rolling the exposed materials with a 20-ton, tandem-axle, dual-wheel water truck or dump truck loaded to the legal limit with tires inflated to 100 psi. Areas where soil movement is observed more than 6 inches away from the truck's rear tires should be considered unstable.

7.7 Athletic Track Pavement Preparation

It is recommended that the existing asphalt concrete should be removed completely or pulverized on-site. If the asphalt is pulverized, the resulting asphalt concrete millings may be used as part of the aggregate base course below the new pavements. Prior to placement of fill and/or base course or pavement materials the exposed subgrade soils should be proof-rolled and observed by the geotechnical engineer or his qualified representative to verify that stable subgrade conditions exist. The proof-roll should be conducted using a fully loaded, single axle water truck or other vehicle that will provide sufficient weight on the subgrade. Any loose, soft, disturbed, or otherwise unsuitable materials should be over-excavated and replaced with engineered fill.

7.8 Materials

Clean on-site soils with low expansive potentials and maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- Foundation areas
- Interior slab areas
- Pavement areas
- Backfill

Imported soils should conform to the following:

- Gradation (ASTM C136): percent finer by weight

  6" 100
  4" 85-100
  ¾" 70-100
  No. 4 Sieve 50-100
  No. 200 Sieve ....40 (max)

- Maximum expansive potential (%)[4] 1.5

- Maximum soluble sulfates (%) 0.10

Base course should conform to the *Maricopa Association of Governments Uniform Standard Specifications and Details for Public Works Construction* (MAG) or other local government specifications.

7.9 Placement and Compaction

a. Place and compact fill in horizontal lifts, using equipment and procedures that will produce recommended water contents and densities throughout the lift.

b. Uncompacted lift thickness should not exceed 10 inches.

c. Materials should be compacted to the following:

[4] Measured on a sample compacted to approximately 95 percent of the ASTM D698 maximum dry density at about 3 percent below optimum water content. The sample is confined under a 100 psf surcharge and submerged.

Material	Minimum Percent Compaction (ASTM D698)
On-site or imported soil, reworked and fill:	
Below footings	95
Below slabs-on-grade	95
Below pavement	95
Base course below slabs-on-grade and foundations	95
Aggregate base below pavement	95
Nonstructural backfill	90

On-site clayey soils should be compacted within a water content range of 1 percent below to 3 percent above optimum. Imported and on-site granular soils with low expansion potential should be compacted within a water content range of 3 percent below to 3 percent above optimum.

7.10 Compliance

Recommendations for foundations, slabs-on-grade, and pavements supported on compacted fills or prepared subgrade depend upon compliance with the **EARTHWORK** recommendations. To assess compliance, observation and testing should be performed under the direction of a WT geotechnical engineer. Please contact us to provide these observation and testing services.

8.0 ADDITIONAL SERVICES

The recommendations provided in this report are based on the assumption that a sufficient schedule of tests and observations will be performed during construction to verify compliance. At a minimum, these tests and observations should be comprised of the following:

- Observations and testing during site preparation and earthwork,
- Observation of foundation excavations, and
- Consultation as may be required during construction.

Retaining the geotechnical engineer who developed your report to provide construction observation is the best way to verify compliance and to help you manage the risks associated with unanticipated conditions.

9.0 LIMITATIONS

This report has been prepared assuming the project criteria described in **2.0 PROJECT DESCRIPTION**. If changes in the project criteria occur, or if different subsurface conditions are encountered or become known, the conclusions and recommendations presented herein shall become invalid. In any such event, WT should be contacted in order to assess the effect that such variations may have on our conclusions and recommendations. If WT is not retained for the construction observation and testing services to determine compliance with this report, our professional responsibility is accordingly limited.

The recommendations presented are based entirely upon data derived from a limited number of samples obtained from widely spaced explorations. The attached logs are indicators of subsurface conditions only at the specific locations and times noted. This report assumes the uniformity of the geology and soil structure between explorations, however variations can and often do exist. Whenever any deviation, difference, or change is encountered or becomes known, WT should be contacted.

This report is for the exclusive benefit of our client alone. There are no intended third-party beneficiaries of our contract with the client or this report, and nothing contained in the contract or this report shall create any express or implied contractual or any other relationship with, or claim or cause of action for, any third party against WT.

This report is valid for the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall rely on this report without the express written authorization of WT.

10.0 CLOSURE

We prepared this report as an aid to the designers of the proposed project. The comments, statements, recommendations and conclusions set forth in this report reflect the opinions of the authors. These opinions are based upon data obtained at the location of the explorations, and from laboratory tests. Work on your project was performed in accordance with generally accepted standards and practices utilized by professionals providing similar services in this locality. No other warranty, express or implied, is made.

LEGEND

APPROXIMATE BORING LOCATION

NOT TO SCALE: FOR REFERENCE ONLY

NORTH

Western Technologies
An RMA Company

PROJECT: WILLCOX HIGH SCHOOL
WRESTLING ADDITION AND TRACK PAVING
JOB NO.: 29-224101-2

PLATE
1

BORING LOCATION DIAGRAM

Allowable Soil Bearing Capacity	The recommended maximum contact stress developed at the interface of the foundation element and the supporting material.
Backfill	A specified material placed and compacted in a confined area.
Base Course	A layer of specified aggregate material placed on a subgrade or subbase.
Base Course Grade	Top of base course.
Bench	A horizontal surface in a sloped deposit.
Caisson/Drilled Shaft	A concrete foundation element cast in a circular excavation which may have an enlarged base (or belled caisson).
Concrete Slabs-On-Grade	A concrete surface layer cast directly upon base course, subbase or subgrade.
Crushed Rock Base Course	A base course composed of crushed rock of a specified gradation.
Differential Settlement	Unequal settlement between or within foundation elements of a structure.
Engineered Fill	Specified soil or aggregate material placed and compacted to specified density and/or moisture conditions under observations of a representative of a soil engineer.
Existing Fill	Materials deposited through the action of man prior to exploration of the site.
Existing Grade	The ground surface at the time of field exploration.
Expansive Potential	The potential of a soil to expand (increase in volume) due to absorption of moisture.
Fill	Materials deposited by the actions of man.
Finished Grade	The final grade created as a part of the project.
Gravel Base Course	A base course composed of naturally occurring gravel with a specified gradation.
Heave	Upward movement.
Native Grade	The naturally occurring ground surface.
Native Soil	Naturally occurring on-site soil.
Rock	A natural aggregate of mineral grains connected by strong and permanent cohesive forces. Usually requires drilling, wedging, blasting or other methods of extraordinary force for excavation.
Sand and Gravel Base Course	A base course of sand and gravel of a specified gradation.
Sand Base Course	A base course composed primarily of sand of a specified gradation.
Scarify	To mechanically loosen soil or break down existing soil structure.
Settlement	Downward movement.
Soil	Any unconsolidated material composed of discrete solid particles, derived from the physical and/or chemical disintegration of vegetable or mineral matter, which can be separated by gentle mechanical means such as agitation in water.
Strip	To remove from present location.
Subbase	A layer of specified material placed to form a layer between the subgrade and base course.
Subbase Grade	Top of subbase.
Subgrade	Prepared native soil surface.

COARSE-GRAINED SOILS

LESS THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
GW	WELL-GRADED GRAVEL OR WELL-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	GRAVELS MORE THAN HALF OF COARSE FRACTION IS LARGER THAN NO. 4 SIEVE SIZE
GP	POORLY-GRADED GRAVEL OR POORLY-GRADED GRAVEL WITH SAND, LESS THAN 5% FINES	
GM	SILTY GRAVEL OR SILTY GRAVEL WITH SAND, MORE THAN 12% FINES	
GC	CLAYEY GRAVEL OR CLAYEY GRAVEL WITH SAND, MORE THAN 12% FINES	
SW	WELL-GRADED SAND OR WELL-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	SANDS MORE THAN HALF OF COARSE FRACTION IS SMALLER THAN NO. 4 SIEVE SIZE
SP	POORLY-GRADED SAND OR POORLY-GRADED SAND WITH GRAVEL, LESS THAN 5% FINES	
SM	SILTY SAND OR SILTY SAND WITH GRAVEL, MORE THAN 12% FINES	
SC	CLAYEY SAND OR CLAYEY SAND WITH GRAVEL, MORE THAN 12% FINES	

NOTE: Coarse-grained soils receive dual symbols if they contain 5% to 12% fines (e.g., SW-SM, GP-GC).

FINE-GRAINED SOILS

MORE THAN 50% FINES

GROUP SYMBOLS	DESCRIPTION	MAJOR DIVISIONS
ML	SILT, SILT WITH SAND OR GRAVEL, SANDY SILT, OR GRAVELLY SILT	SILTS AND CLAYS LIQUID LIMIT LESS THAN 50
CL	LEAN CLAY OF LOW TO MEDIUM PLASTICITY, SANDY CLAY, OR GRAVELLY CLAY	
OL	ORGANIC SILT OR ORGANIC CLAY OF LOW TO MEDIUM PLASTICITY	
MH	ELASTIC SILT, SANDY ELASTIC SILT, OR GRAVELLY ELASTIC SILT	SILTS AND CLAYS LIQUID LIMIT MORE THAN 50
CH	FAT CLAY OF HIGH PLASTICITY, SANDY FAT CLAY, OR GRAVELLY FAT CLAY	
OH	ORGANIC SILT OR ORGANIC CLAY OF HIGH PLASTICITY	
PT	PEAT AND OTHER HIGHLY ORGANIC SOILS	HIGHLY ORGANIC SOILS

NOTE: Fine-grained soils may receive dual classification based upon plasticity characteristics (e.g. CL-ML).

SOIL SIZES

COMPONENT	SIZE RANGE
BOULDERS	Above 12 in.
COBBLES	3 in. – 12 in.
GRAVEL	No. 4 – 3 in.
Coarse	¾ in. – 3 in.
Fine	No. 4 – ¾ in.
SAND	No. 200 – No. 4
Coarse	No. 10 – No. 4
Medium	No. 40 – No. 10
Fine	No. 200 – No. 40
Fines (Silt or Clay)	Below No. 200

NOTE: Only sizes smaller than three inches are used to classify soils

CONSISTENCY

CLAYS & SILTS	BLOWS PER FOOT
VERY SOFT	0 – 2
SOFT	3 – 4
FIRM	5 – 8
STIFF	9 – 15
VERY STIFF	16 – 30
HARD	OVER 30

RELATIVE DENSITY

SANDS & GRAVELS	BLOWS PER FOOT
VERY LOOSE	0 – 4
LOOSE	5 – 10
MEDIUM DENSE	11 – 30
DENSE	31 – 50
VERY DENSE	OVER 50

NOTE: Number of blows using 140-pound hammer falling 30 inches to drive a 2-inch-OD (1⅜-inch ID) split-barrel sampler (ASTM D1586).

PLASTICITY OF FINE GRAINED SOILS

PLASTICITY INDEX	TERM
0	NON-PLASTIC
1 – 7	LOW
8 – 20	MEDIUM
Over 20	HIGH

DEFINITION OF WATER CONTENT

DRY
SLIGHTLY DAMP
DAMP
MOIST
WET
SATURATED

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METHOD OF CLASSIFICATION

PLATE

A-2

The number shown in **"BORING NO."** refers to the approximate location of the same number indicated on the "Boring Location Diagram" as positioned in the field by pacing or measurement from property lines and/or existing features, or through the use of Global Positioning System (GPS) devices. The accuracy of GPS devices is somewhat variable.

"DRILLING TYPE" refers to the exploratory equipment used in the boring wherein **HSA = hollow stem auger**, and the dimension presented is the outside diameter of the HSA used.

"N" in "BLOW COUNTS" refers to a 2-inch outside diameter split-barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows, or "blow count", of the hammer is recorded for each of three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2^{nd} and 3^{rd} increments) is defined as the Standard Penetration Test (SPT) "**N**"-Value. Refusal to penetration is considered more than 50 blows per 6 inches. (Ref. ASTM D1586).

"R" in "BLOW COUNTS" refers to a 3-inch outside diameter ring-lined split barrel sampler driven into the ground with a 140 pound drop-hammer dropped 30 inches repeatedly until a penetration of 12 inches is achieved or until refusal. The number of blows required to advance the sampler 12 inches is defined as the "**R**" blow count. The "**R**" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows per foot. (Ref. ASTM D3550).

"CS" in "BLOWS/FT." refers to a 2½-in. outside diameter California style split-barrel sampler, lined with brass sleeves, driven into the ground with a 140-pound hammer dropped 30 inches repeatedly until a penetration of 18 inches is achieved or until refusal. The number of blows of the hammer is recorded for each of the three 6-inch increments totaling 18 inches. The number of blows required for advancing the sampler for the last 12 inches (2^{nd} and 3^{rd} increments) is defined as the "CS" blow count. The "CS" blow count requires an engineered conversion to an equivalent SPT N-Value. Refusal to penetration is considered more than 50 blows for a 6-inch increment. (Ref. ASTM D 3550)

"SAMPLE TYPE" refers to the form of sample recovery, in which **N** = Split-barrel sample, **R** = Ring-lined sample, **"CS"** = California style split-barrel sample, **G** = Grab sample, **B** = Bucket sample, **C** = Core sample (ex. diamond bit rock coring).

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot. The symbol **"NR"** indicates that no sample was recovered.

"WATER (MOISTURE) CONTENT" (% of Dry Wt.) refers to the laboratory-determined water content in percent using the standard test method ASTM D2216.

"USCS" refers to the "Unified Soil Classification System" Group Symbol for the soil type as defined by ASTM D2487 and D2488. The soils were classified visually in the field, and where appropriate, classifications were modified by visual examination of samples in the laboratory and/or by appropriate tests.

These notes and boring logs are intended for use in conjunction with the purposes of our services defined in the text. Boring log data should not be construed as part of the construction plans nor as defining construction conditions.

Boring logs depict our interpretations of subsurface conditions at the locations and on the date(s) noted. Variations in subsurface conditions and characteristics may occur between borings. Groundwater levels may fluctuate due to seasonal variations and other factors.

The stratification lines shown on the boring logs represent our interpretation of the approximate boundary between soil or rock types based upon visual field classification at the boring location. The transition between materials is approximate and may be more or less gradual than indicated.

Project: WILLCOX HIGH SCHOOL WRESTLING ADDITION AND TRACK PAVING Project Number: 29-224101-2	# BORING NO. 1	Western Technologies An RMA Company

Date(s) Drilled **8/16/2024**	Logged By **T. DOMINGUEZ**	Checked By **J. HEINECKE**
Drilling Method **HSA**	Drill Bit Size/Type **7"**	Total Depth of Borehole **21.5 FT**
Drill Rig Type **CME-75**	Drilling Contractor **GSI**	Approximate Surface Elevation **NOT DETERMINED**
Groundwater Level and Date Measured **NOT ENCOUNTERED**	Sampling Method(s) **Bulk, Ring, SPT**	Hammer Data **140-LB AUTOHAMMER**
Borehole Backfill **AUGER CUTTINGS**	Location **SEE LOCATION DIAGRAM**	

DEPTH (FEET)	MOISTURE CONTENT	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	BLOW COUNTS	USCS	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0			G		SC	Clayey SAND; gray-brown, medium dense, moist	
	22.9	82	R	35			
5	24.3	99	R	29			
10			N	18 13 18		becomes brown, dense	
15			N	4 4 6	CL	Sandy CLAY; light brown, stiff, moist	
20			N	7 10 8	CL-ML	Sandy Silty CLAY; gray-brown, very stiff, moist	
						BORING STOPPED AT 21.5 FEET	
25							

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BORING NO. 2

Project: WILLCOX HIGH SCHOOL WRESTLING ADDITION AND TRACK PAVING
Project Number: 29-224101-2

Western Technologies — An RMA Company

Date(s) Drilled	**8/16/2024**	Logged By	**T. DOMINGUEZ**	Checked By	**J. HEINECKE**
Drilling Method	**HSA**	Drill Bit Size/Type	**7"**	Total Depth of Borehole	**5 FT**
Drill Rig Type	**CME-75**	Drilling Contractor	**GSI**	Approximate Surface Elevation	**NOT DETERMINED**
Groundwater Level and Date Measured	**NOT ENCOUNTERED**	Sampling Method(s)		Hammer Data	**140-LB AUTOHAMMER**
Borehole Backfill	**AUGER CUTTINGS**	Location	**SEE LOCATION DIAGRAM**		

DEPTH (FEET)	MOISTURE CONTENT	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOW COUNTS	USCS	GRAPHIC	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0						Asphalt		1-1/2" Asphalt Concrete on 0" Aggregate Base Course	
			G			SC		Clayey SAND; with gravel, dark gray-brown, medium dense, moist	
5								BORING STOPPED AT 5 FEET	
10									
15									
20									
25									

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Project: WILLCOX HIGH SCHOOL WRESTLING ADDITION AND TRACK PAVING Project Number: 29-224101-2	BORING NO. 3	Western Technologies An RMA Company

Date(s) Drilled **8/16/2024**	Logged By **T. DOMINGUEZ**	Checked By **J. HEINECKE**
Drilling Method **HSA**	Drill Bit Size/Type **7"**	Total Depth of Borehole **5 FT**
Drill Rig Type **CME-75**	Drilling Contractor **GSI**	Approximate Surface Elevation **NOT DETERMINED**
Groundwater Level and Date Measured **NOT ENCOUNTERED**	Sampling Method(s)	Hammer Data **140-LB AUTOHAMMER**
Borehole Backfill **AUGER CUTTINGS**	Location **SEE LOCATION DIAGRAM**	

DEPTH (FEET)	MOISTURE CONTENT	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOW COUNTS	USCS	GRAPHIC	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0						Asphalt		2" Asphalt Concrete on 0" Aggregate Base Course	
			G			SC		Clayey SAND; trace gravel, gray-brown, medium dense, moist	
5								BORING STOPPED AT 5 FEET	
10									
15									
20									
25									

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Project: WILLCOX HIGH SCHOOL WRESTLING ADDITION AND TRACK PAVING Project Number: 29-224101-2	# BORING NO. 4	Western Technologies An RMA Company
Date(s) Drilled **8/16/2024**	Logged By **T. DOMINGUEZ**	Checked By **J. HEINECKE**
Drilling Method **HAND EQUIPMENT**	Drill Bit Size/Type **HAND AUGER**	Total Depth of Borehole **2 FT**
Drill Rig Type **CME-75**	Drilling Contractor **GSI**	Approximate Surface Elevation **NOT DETERMINED**
Groundwater Level and Date Measured **NOT ENCOUNTERED**	Sampling Method(s) **Bulk**	Hammer Data **140-LB AUTOHAMMER**
Borehole Backfill **EXCAVATED SOILS**	Location **SEE LOCATION DIAGRAM**	

DEPTH (FEET)	MOISTURE CONTENT	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOW COUNTS	USCS	GRAPHIC	SOIL DESCRIPTION	REMARKS AND OTHER TESTS
0			G			SC		Clayey SAND; brown, medium dense, moist	
2								BORING STOPPED AT 2 FEET	
5									
10									
15									
20									
25									

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Boring No.	Sample Depth (ft)	USCS Class.	Percent Passing #200	Atterberg Limits		Initial Dry Density (pcf)	Initial Water Content (%)	Compression Properties			Moisture-Density Relationship			Expansion Properties			Soluble Sulfates (ppm)	Soluble Chlorides (ppm)	Remarks
				LL	PI			Surcharge (ksf)	Total Compression (%) In-Situ	Total Compression (%) After Saturation	Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Method	Surcharge (ksf)	Expansion (%)	Expansion Index (EI)			
1	0-5	SC	35	27	11	*105.2*	*12.0*				113.1	12.9	A	0.1	1.2				1,2,10,12
1	2-3	SC				82	22.9	1.0	1.6										
								2.0	2.3	2.9									2
								4.0		4.5									2
1	5-6	SC				99	24.3												11
2	0-5	SC	23	43	29														12
3	0-5	SC	37	38	24														12

Remarks

1. Compacted density is approximately 95% of ASTM D698 maximum density at a moisture content slightly below optimum.
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.
5. Expansion Index (EI) test in accordance with ASTM D4829.
6. Chloride (ARIZ 736a) by Motzz Laboratory Inc.
7. Sulfate (ARIZ 733a) by Motzz Laboratory Inc.
8. pH (ARIZ 237b).
9. Minimum Resistivity (ARIZ 236c).
10. Test Method ASTM D698 / AASHTO T99.
11. Field Visual Classification (ASTM D 2488).
12. Laboratory Soil Classification (ASTM D 2487).
13. Test Method ASTM D1557 / AASHTO T180.
14. From the ADOT Family of Curves for Maricopa County.
15. See Corrosion Plate.
16. Initial Dry Density and Initial Water Content from Remolded Swell.

Notes: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic **NV =** No Value

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PROJECT: **WILLCOX HIGH SCHOOL WRESTLING BUILDING ADDITION AND TRACK PAVING**

JOB NO.: **29-224101-2**

SOIL PROPERTIES

PLATE B-1

MOTZZ LABORATORY, INC.

Report: 952285
Reported: 9/5/2024
Received: 8/28/2024
PO: 292241010

Laboratory Analysis Report

Western Technology, Inc - Tucson
Justin Heinecke
3480 S. Dodge Blvd
Tucson, AZ 85713

Project: 29-224101-0

Lab Number	Sample ID	Crop Info
952285-1	4 (0-2')	Landscape

Soil Complete Test

Test	*Method*	*Result*	*Units*	*Levels*
pH	1:1	8.3	SU	High
Electrical Conductivity, EC	1:1	0.50	dS/m	Medium
Calcium, Ca	NH4OAc (pH 8.5)	2500	ppm	High
Magnesium, Mg	NH4OAc (pH 8.5)	210	ppm	High
Sodium, Na	NH4OAc (pH 8.5)	390	ppm	Very High
Potassium, K	NH4OAc (pH 8.5)	220	ppm	Medium
Zinc, Zn	DTPA	0.39	ppm	Low
Iron, Fe	DTPA	8.3	ppm	High
Manganese, Mn	DTPA	6.6	ppm	Medium
Copper, Cu	DTPA	0.82	ppm	High
Nickel, Ni	DTPA	0.22	ppm	
Nitrate-N, NO3-N	Cd-Reduction	2.3	ppm	Low
Phosphate-P, PO4-P	Olsen	9.0	ppm	Low
Sulfate-S, SO4-S	Hot Water	18	ppm	High
Boron, B	Hot Water	1.5	ppm	Medium
Free Lime, FL	Acid Test	High		
ESP	Calculated	10.3	%	
CEC	Calculated	16.5	meq/100g	

Victoria Normandin, LLC
Email: vicn@cox.net
602-799-7248

Date: 9/07/2024
Report:952285
Information provided by the laboratory: Landscape.

The pH of soil is on the high side at 8.3.
EC or soluble salt is moderately at .5 dS/m.
Till in or topically apply 10 lbs. Sulfur/1000 sq.ft. to lower pH. After applying sulfur, irrigate heavily.

Nitrate-N is very low, and Phosphate-P is moderately low. Apply 1.0-1.5 lb. N/1000 sq.ft. and 1 lb. P_2O_5/1000 sq.ft. Potassium is adequate but an additional 1 lb. K_2O/1000 sq.ft. can be applied if using an N-P-K fertilizer.

The Ca:Mg ratio is OK at 11:1.
Micronutrients, Fe, Zn, Mn, Cu, B, are adequate and in good proportion to each other. Zinc is on the low side. Lowering pH with Sulfur will help increase the availability of zinc. Also, a blended fertilizer that contains a minor amount of zinc can be used.

Thank you,

Victoria Normandin

Victoria Normandin, CPAg

Note: Soil Nutrient interpretations and recommendations are based on the Soil Complete/Standard Analysis Report provided Motzz Laboratory.