GeoProfessional
Innovation.

August 19, 2021
File: PU21001A

Mrs. Caren Johnson
Richland School District
c/o Mike Melling
Associate Director
Construction Services Group
104 Clover Island Dr., Ste. 202
Kennewick, WA 99336

RE: **Geotechnical Transmittal**
Fran Rish Stadium Improvements
1350 Lee Boulevard
Richland, Washington

Greetings, Caren and Mike.

GeoProfessional Innovation Corporation (GPI) is pleased to provide this final geotechnical deliverable for the proposed improvements for the Fran Rish Stadium in Richland, Washington. We continue to follow up with your project team as design is finalized, specifically to evaluate any questions regarding our geotechnical work and interface with the Building Official on our geotechnical design as necessary. The remainder of this transmittal letter provides you, the owner, and the design/construction management team information on how to correctly interpret and apply our deliverable. It further outlines the variability of subsurface conditions and other pitfalls of changing geology, which can commonly occur through incorrect applications or expectations of our work. This information is partially adapted from *GBA, the GeoProfessional Business Association*, of which GPI is a member.

YOUR GEOTECHNICAL DELIVERABLE

These documents include GPI's geotechnical design, soil engineering characteristics, recommendations, and earthwork construction criteria. This information was specifically prepared for Richland School District (District) and your retained design consultants for the project, description, and location described in the *Project Understanding* section in the geotechnical (GT) plans for this project. Please read, understand, and implement the geotechnical recommendations and requirements in their entirety. Do not read or rely on select elements only. Design continuity across disciplines will be enhanced through regular consultation and incremental plan document reviews to verify the geotechnical design is understood and properly incorporated into final project design; ultimately realized during construction.

GPI's Deliverables are Based on a Unique Set of Project-Specific Factors

GPI considers a number of unique, project-specific factors when establishing the scope of our geotechnical services. Typical factors include your goals, objectives, and risk management preferences; the general nature of the structures involved, their size and configuration, and the location of structures on the site. Occasionally between the time our deliverable is published and final design is complete, project concepts change that require modification to our deliverable for it to remain accurate and applicable.

As a general rule, *always* inform GPI of project changes – even minor ones – and request an assessment of their impact. If our *Project Understanding*, as outlined in the attached documents, is not correct, please notify us immediately. *GPI cannot accept responsibility or liability for problems that occur because our documents do not consider developments of which we were not informed.* During our evaluation, we relied on and reference the following documents provided by the design team:

- Site Overview and Ticket Booth Plan provided by Design West Architects, dated June 17, 2021.
- McCue and Associates Record Drawings, dated March 21, 1980 and revised April 22, 1980.
- Grandstand Accessibility & Structural Analysis, provided by Design West Architects, Date January 15, 2021.
- Civil Plan Sheets C.101 and C.102 provided by J-U-B Engineers, Inc., dated July 8, 2021.

Subsurface Conditions Can Change

We observed 12 soil borings advanced with a G2400 trailer-mounted drill rig. Infiltration testing was performed in borings B-21001A-11 and B-21001A-12. Additionally, we accomplished 2 Cone Penetration Testing (CPT) soundings with a truck-mounted CPT exploration rig. Approximate exploration locations can be seen on *Exploration Map,* located in Section 11 on plan sheet GT5 of the appended geotechnical plans. Prior to exploration, GPI retained Geophysical Northwest, LLC to perform ground penetrating radar in and around the existing athletic facility to avoid private utilities. This data has been shared with the project's Civil Engineer, (PBS Consultants) and was provided to the team once completed with our exploration summary.

Unknown or unanticipated subsurface conditions are a principal cause of construction delays, cost overruns, and disputes. The information contained herein is provided to help you manage your risk associated with subsurface conditions. The project site has previously been developed with the existing stadium. By definition, that development disturbed the near surface geology. Given the existing facility's performance, it is reasonable to assume that immediately below existing structures, the disturbance was corrected through normal construction practices that compacted and provided a uniform substrate. However, soil backfill along existing stem walls, in landscape areas, or other similar site components may not have been compacted to today's structural fill requirements. Therefore, this site has unique conditions and associated risks of variable fill in the existing facility's footprint.

Site exploration identifies only a small portion of the site's subsurface conditions, which can change significantly between exploration locations. GPI performed borings and CPT soundings as outlined above, and relied on the field and laboratory data to apply our professional judgment rendering an opinion about the subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those identified from exploration and in our documents. Retaining GPI to provide construction observation is part of the geotechnical design process and one of the most widely recognized and effective methods of managing the risks associated with unanticipated or changed site conditions exposed during construction.

The project concept changed after exploration. We reviewed the location of the newly envisioned ticket booth and concession stand and confirmed that boring B-21001A-1 is proximate to the planned building location. We used that data, as well as other information collected from our work, for geotechnical evaluation of the planned structure.

Design Iterations and Alternatives Analyzed

Subsequent to exploration and initial interaction with the project team, GPI considered a variety of geotechnical design concepts in support of project civil and structural design. Original design concepts considered entirely demolishing and replacing the grandstand structure. However, the existing grandstand structure was evaluated for ADA accessibility and structural integrity by Design West Architects and Structural Forte, Inc., and was found to meet accessibility requirements. Additionally, the overall structural frame and foundation elements of the grandstands appear to be in good condition. Therefore, Richland School District has elected to leave the existing structure in place with only minor structural modifications and negligible new structural loading. Therefore, substantial modification of the structure's foundation elements or new foundation elements are not part of the rehabilitation plan for the grandstands.

The existing site soil conditions are such that structures are susceptible to liquefaction settlement induced by a significant seismic event. Additionally, the existing grandstand structure was originally designed and constructed in the 1980's without a deep foundation system, and design codes have changed significantly since then. A similar structure constructed today would likely require accounting for liquefaction with a more progressive foundation approach. However, as the project consists of renovating an existing structure, we understand the *International Existing Building Code* (IEBC) applies to the grandstand modifications. We further understand that when the existing foundation and structural frame will not realize changes to the applied loads by more than 5 percent from the original loading, the IEBC allows the code used for original design to be applied to the current modifications. The proposed improvements and structural design will maintain loading within these limits. Therefore, underpinning the existing foundations is not necessary to reduce the potential for liquefaction beneath the existing grandstand.

The District plans to construct a new restroom, concessions, and ticket booth structure to the east of the existing track and grandstands. The new structure will be a single-story, wood-framed structure, built on a relatively level part of this site. The building will be used temporarily during short-duration public events. Conventional foundations are planned for this structure. While we estimate 3 to 5 inches of seismically induced settlement is possible during a 2,475-year seismic event (estimated magnitude 6.0 earthquake), the probability of realizing this magnitude of earthquake is extremely low in general. The predicted settlement is not at a magnitude where structural collapse is expected, if realized. When considering the life of the structure and its occasional planned use, the probability of realizing such a seismic event is unlikely. Combined with the site being level, thereby precluding the potential for lateral spreading, our opinion is that conventional foundations are applicable for the restroom, concessions, and ticket booth structure.

The planned improvements for the remainder of the site consist of a rubberized track and synthetic field. Performance for these facilities is a function of uniform subgrade condition. The subsurface conditions include fill beneath existing track and field facilities. Based on our observations of the condition of the existing facilities, exploration results, and laboratory testing, our opinion is the existing fill soil is sufficient to support the planned track and field improvements, provided it is processed and compacted to *Structural Fill* requirements outlined in Section 6 on plan sheet GT3. In our opinion, complete removal of fill would significantly increase cost without significant performance improvement. If building structures are planned now or in the future above fill, it should be removed, processed, and placed as structural fill.

Civil grading plans are not complete at this time. However, we presume that surface stormwater from the track and field will be directed to a herringbone or grid system of subsurface drain pipes and will be disposed on site via infiltration. Site grading should direct stormwater away from new and existing foundations.

GPI's Deliverables Can Be Subject to Misinterpretation

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, bid documents should clearly delineate how you intend the design team and contractors rely on the geotechnical engineering deliverable. You can also lower the risk of costly problems from misinterpretation by having GPI confer with appropriate members of the project team during the entire design and construction process. We look forward to providing our review of pertinent final aspects of the plans and specifications. Contractors can also misinterpret a geotechnical engineering deliverable. Again, this risk can be reduced by having GPI participate in pre-bid, preconstruction, and pre-installation conferences, and by providing construction observation performed by the geotechnical engineer-of-record, GPI.

Geotechnical Recommendations Are Not Final

The design and resulting construction requirements are not final, because GPI engineers develop them principally from judgment and opinion. Construction continuity is a requirement and a critical element of the geotechnical design process. GPI can confirm our recommendations only by observing actual subsurface conditions revealed during construction. If for some reason a firm or individual other than GPI is retained to observe, test, or interpret actual field conditions, they are assuming the role of geotechnical engineer-of-record and responsible for implementing design. It is important to notify this entity of their role and responsibility.

Read Responsibility Provisions Closely

Geotechnical engineering is a far less exact science than other engineering disciplines. Geology does not behave uniformly or linearly and is subject to change based on various factors beyond anyone's control. This lack of understanding and the presumption that geotechnical design can be administered similar to structural and civil design has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, GPI includes an *Evaluation Limitations* section herein to indicate where GPI's responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions.* Ask questions; GPI will respond fully and frankly.

GEOTECHNICAL DESIGN CONTINUITY

We base the information contained in these deliverables on existing site conditions, project data supplied by project team members as noted in the *Project Understanding* and *Geotechnical Design Basis* sections, and the currently planned school improvement projects. Changes to the project configurations, loading, or stormwater disposal plans may require additional analyses specific to the actual anticipated construction conditions and final grading configuration. We understand GPI is retained to provide geotechnical continuity through the final planning, design, and construction for the project. This includes aiding Design West Architects in plan and specification review of appropriate portions of structural, civil, and grading for the project.

EVALUATION LIMITATIONS

The attached geotechnical deliverable is prepared to assist in the planning, design, and construction of the Fran Rish Stadium improvement projects in Richland, Washington. Our services comprise professional opinions and recommendations made in accordance with generally accepted geotechnical engineering principles and practices, as they exist at the time and in the area of this deliverable. GPI's scope does not include stormwater design, structural evaluation, deep foundation, underpinning, or structural concrete design, erosion control, shoring, or an environmental site assessment.

The geotechnical design recommendations and construction requirements provided herein are based on the premise that GPI will conduct an adequate program of tests and observations during construction in order to verify compliance with our recommendations and to confirm conditions between exploration locations. This acknowledgment is in lieu of all express or implied warranties.

CLOSING

We appreciate the opportunity to continue our professional relationship with the Richland School District. If you have any questions regarding this deliverable or need more information, please contact us.

Sincerely,
GPI Corporation

Amanda Carlson, E.I.
Staff Engineer

Travis J. Wambeke, P.E.
Principal Engineer

TJW/mg

Attachments: Plan Sheets GT1 through GT8 – *Fran Rish Stadium*

FRAN RISH STADIUM

Reference Google 2020, No scale intended.

2 REFERENCES

The geotechnical evaluation herein is based on the authorized geotechnical scope dated December 17, 2020, and the latest versions of the ASTM International (ASTM) standards, Washington State Department of Transportation (WSDOT), American Society of Agronomy (ASA), and other reference standards listed below:

Field Exploration

- ASTM D 420 - Guide to site characterization for engineering, design, and construction
- ASTM D 2487 - Test method for classification of soils for engineering purposes (USCS)
- ASTM D 2488 - Practice for description & identification of soil (Visual-manual procedure)
- Stormwater Management Manual for Eastern Washington September 2004 Publication No. 04-10-076 Appendix 6B.3 Recommended Field Test Procedures

Laboratory Investigation

- ASTM D 2216 - Test method for laboratory determination of water content of soil and rock
- ASTM D 1557 - Test method for laboratory compaction characteristics of soil, modified method (Modified Proctor)
- ASTM D 6913 - Test method for particle-size distribution (Gradation) of Soil Using Sieve Analysis
- ASTM D 1883 - Test method for California Bearing Ratio (CBR) of laboratory compacted soils
- Electrode, ASA 12-2.6 - Test method for measuring pH of soil for use in corrosion testing
- Conductivity Meter ASA 10-3.3 - Test method for electrical conductivity for soil resistivity measurements
- Western States Standard Methods Manual - Ion Chromatography (IC) test method for measuring sulfate content of soil.

1 PROJECT UNDERSTANDING

Exiting Site Conditions

The existing Fran Rish Stadium comprises a 10-lane track surrounding a football infield area. The existing field is grass. Large grandstands to the east (home) and west (visitor) of the track and infield currently provide fan and patron sports viewing. A concession and restroom structure is situated northeast of the existing track. A large utility corridor exists to the east of the existing home grandstands.

Planned Construction

The District plans to improve the Fran Rish Stadium track and field complex by increasing the infield size while maintaining a new 10-lane track. The track will comprise asphalt pavement overlain by rubberized track surfacing. The track section will be specified by the track material supplier and/or applicator with input from D.A. Hogan, the project's sports facility consultant. The field itself will comprise synthetic turf.

Structural Forte has evaluated the existing east side (home side) grandstands for structural integrity, referencing the International Existing Building Code (IEBC). The existing structure is reportedly in good structural condition and will remain in place with minor aesthetic improvements. The interior of the underlying reinforced concrete and concrete masonry unit (CMU) structure will be almost entirely demolished and rehabilitated. The majority of floor slabs and non-bearing walls will be removed and reconfigured with updated plumbing. Existing CMU shear walls will remain, likely at the north and south end walls and the west wall fronting onto the track. New slabs-on-grade will provide at grade floor systems. The new roof will slope west, though not as steep as the grandstand slope. Design West Architects is programming this facility to be revitalized with new locker rooms, offices, physical therapy areas, storage, and other sports support functions. The District plans to also construct a new bathroom and ticket booth structure to the east of the track and field. The new structure will likely comprise a wood-framed, single-story facility that will bear on conventional spread footings. The structural loads for the ticket booth and restroom structure will be 2 to 3 kips per linear foot for continuous footings and less than 50 kips per column.

The field and track will have a stormwater drainage system that facilitates surface runoff and subsurface infiltration collection and conveyance to disposal helping to maintain a functional and safe play surface. Infield subsurface drainage will likely be accomplished by a herringbone or grid system of subsurface drain pipes. The track will have a premanufactured edge drainage system positioned on the inboard edge. Both field and track drainage systems will convey water to near surface biofiltration and ultimately, to subsurface disposal. The exact disposal points and methodology will be determined during civil design by PBS (civil consultant) in conjunction with D.A. Hogan. Franchise and public utilities will extend from existing connections to the revitalized facility. The existing parking area is adequate and has good surface conditions with remaining design life. However, some asphalt pavement patching and infill will occur in conjunction with track pavement. Existing sports field lighting will be maintained.

Subsurface Conditions

Subsurface exploration was accomplished via 18 soil borings advanced with a G2400 drill and 2 Cone Penetration Test (CPT) soundings. CPT soundings included testing for pore water pressure dissipation and seismic shear wave velocity. Boring and CPT locations are shown on sheet GT5 and individual logs on GT5 through GT7. Topsoil containing vegetation and organics was observed in borings B-21001A-4, B-21001A-6 through B-21001A-8, B-21001A-11, and B-21001A-12 comprising silty sand that was brown, loose, and moist. In the remaining exploration locations, borings penetrated asphalt that was 1.0- to 5.0-inches-thick atop approximately 3.0- to 6.0-inches of poorly-graded gravel base that was gray, dense, and moist. In most locations, asphalt was surfaced with approximately 1.0 inch of rubberized track surfacing. Beneath topsoil and asphalt sections, the following subsurface soil units were encountered:

Undocumented Fill

The fill encountered is believed to have been placed during previous site development; grading and leveling of the field and parking areas.

- Silty Sand (SM): Brown, loose to medium dense, and moist. Silty sand fill was encountered beneath asphalt in borings B-21001A-1 and B-21001A-2 extending 1.5 to 3.0 feet below the ground surface. Crushed asphalt debris was encountered in the fill unit. Fill is likely associated with original site development.

Alluvium

- Silty Sand (SM): Brown, loose to medium dense, and damp. Alluvial silty sand was encountered in borings B-21001A-2 through B-21001A-5, B-21001A-7, B-21001A-8, B-21001A-10, and B-21001A-12 beneath asphalt sections or topsoil and extending 5.0- to 34.0-feet in borings B-21001A-2, B-21001A-4 and B-21001A-5, and to boring termination in other locations.
- Silt with varying amounts of Sand (ML): Brown, loose, and moist. Alluvial silt with sand was encountered beneath topsoil, fill, or silty sand in borings B-21001A-1, and B-21001A-4 through B-21001A-6 extending to 30.0-feet below the ground surface in boring B-21001A-1 and to boring termination in other locations.
- Poorly-graded Sand with varying amounts of Silt and Gravel (SP-SM): Brown, very loose to dense, and moist to saturated. Alluvial sand was encountered in borings B-21001A-1, B-21001A-2, B-21001A-4, B-21001A-9, and B-21001A-11 extending to 9.0-feet in boring B-21001A-4, to 46.0-feet in boring B-21001A-1, to 51.0-feet in boring B-21001A-2, and to boring termination in other locations.
- Poorly-graded Gravel with Sand (GP): Brown, very dense to hard, saturated. Alluvial gravel was encountered in borings B-21001A-1 and B-21001A-2 beneath poorly-graded sand and extending to boring termination at 46.5- and 51.5-feet below the surface respectively. The hollow stem auger and sampling equipment were refused in this soil unit in borings B-21001A-1 and B-21001A-2.

Bedrock was not encountered in the locations or depths explored. Groundwater was encountered in borings B-21001A-1 and B-21001A-2 between 20- and 21-feet below the ground surface.

3 GEOTECHNICAL DESIGN BASIS

General

- International Existing Building Code (IEBC)
- International Building Code (IBC), 2018
  - o IBC Chapters 16 and 18

GPI's field exploration, reference sheets GT5 through GT7
  - o Borings and CPT advanced on February 1 and 2, 2021
- Laboratory testing, reference sheet GT8
- Foundation frost depth - 2.0-feet
- Estimated structural loads (**to be verified by structural design**):
  - o Total isolated maximum column load: 50 kips
  - o Total conventional maximum strip footing load: 2-3 klf
  - o Existing grandstand foundation loading: < 5% change
- Seismic Site Class D (Reference IBC Section 1613 and ASCE 7).
- Structural settlement tolerances (**to be verified by structural design**):
  - o Maximum footing settlement: 1.0 inch total
  - o Maximum slab and footing differential settlement: 0.75 inches (30-ft span)
- Bearing capacity failure, factor of safety (FOS) = 3 or greater
- Settlement estimates are unfactored
- AASHTO Guide for Design of Pavement Structures (1993)

Documents

- Design West Architectural Plan Sheet F1.00 - *Site Overview*, dated June 10, 2021 and *Ticket Booth Plan*, dated June 17, 2021
- McCue & Associates - *Record Drawings* - dated March 21, 1980, revised April 22, 1980
- *Grandstand Accessibility & Structural Analysis*, provided by Design West, dated January 15, 2021
- *Schematic Design Booklet*, provided by Design West, dated July 2021
- J-U-B Engineers Civil Plan Sheets C.101 and C.102, dated July 8, 2021

ISSUED FOR
☒ DESIGN USE
☒ PRELIMINARY REVIEW
☒ YOUR APPROVAL
☒ REFERENCE
☐ CONSTRUCTION
☐ DESTROY PREVIOUS PRINTS

REV	DATE	DESCRIPTION
1	3/5/2021	30% DRAFT
2	8/5/2021	90% DRAFT
3	8/18/2021	FINAL

CHECK: TJW
FILE: PU21001
PROJECT:
FRAN RISH STADIUM
GEOTECHNICAL
ENGINEERING EVALUATION
1350 LEE BOULEVARD
RICHLAND, WA

DRAWN: AMC
DESIGN: TJW
PREPARED FOR:
RICHLAND SCHOOL DISTRICT
C/O CONSTRUCTION SERVICE GROUP
104 CLOVER ISLAND DRIVE,
SUITE 202
KENNEWICK, WA, 99336
ATTN: MR. MIKE MELLING

RICHLAND School District

TRAVIS J. WAMBECK

GeoProfessional Innovation®
GPI 6 O'Donnell Road Pullman, WA 99163 509.339.2000

GT1 of 8 3

4 EARTHWORK

Site Stripping

1. Remove topsoil containing vegetation and organics from proposed new track and field area, new pavement, and stormwater improvements.
2. Contractors shall budget for a surface-stripping depth of 0.5-feet below the existing ground surface.
3. Isolated thicker topsoil or landscaping material deposits are possible and must also be removed during site stripping operations. Budget a 15 cubic yard contingency unit rate for variance in topsoil quantities.

Demolition

1. Demolition activities shall remove existing asphalt, utilities, slabs, and any building features designated to be demolished to the subgrade elevations and expose native soil to be verified by the project geotechnical engineer-of-record (GER) retained for construction.
2. Demolishing existing structures such as slabs, thrust blocks, curbs, and utilities requires equipment with “breakers,” “rippers” or pneumatic hammers.
3. Where designated for demolition, remove all concrete (stemwalls, foundations, or other) to at least 2 feet below new concrete bearing surfaces (foundations, slabs, etc.). Remnant concrete to remain below grade shall be authorized by Construction Services Group (CSG) and the GER retained for construction.
4. Remediate depressions caused by removing demolished site features by placing *General Structural Fill*.
5. Place suitable structural fill products according to Table G3.1 and G3.2 over native soil subgrade prepared per the *Subgrading* section.

Undocumented/Uncontrolled Fill

1. Undocumented fill was encountered in isolated exploration locations in the focused area. Additional fill deposits may be encountered during construction that were not identified by exploration. Specifically, fill will be encountered within and adjacent the footprints of the existing stuctures during/following demolition.
2. Excavate existing stemwall backfill to existing and proposed foundation bearing grades, extending at least 5-feet laterally away from the building. Reference Figure G2.1.
3. Moisture condition and compact fill beneath the planned improvements to *Structural Fill* requirements, Section 6, GT3.
4. Expose and compact site soil below slabs and new foundations to *Structural Fill* requirements, Section 6, GT3.
5. The project GER retained for construction shall observe demolition excavations and fill over-excavations prior to placing *Structural Fill* and concrete.

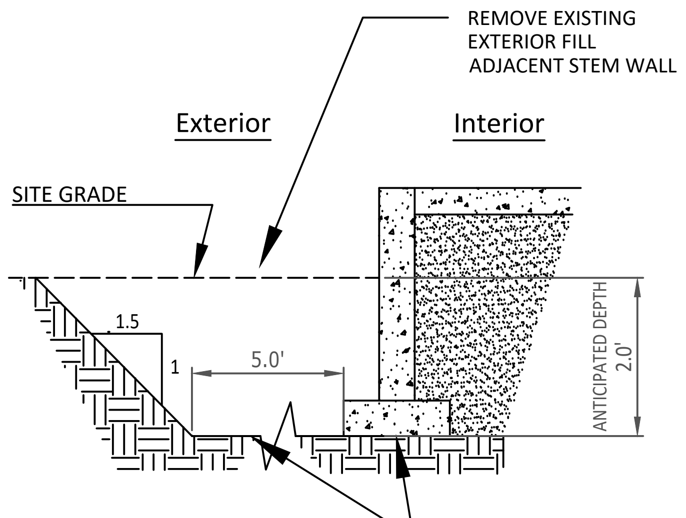

Figure G2.1: Stemwall Backfill Excavation

Subgrading

1. Project subgrades are defined as follows:
   - Base of any depression created by topsoil, root zone removal, or demolition.
   - Base of any utility trench.
   - Slab, synthetic fields, and pavement section subgrades.
   - Foundation subgrade.
   - Any in-situ soil surface to receive *Structural Fill*.
2. Once topsoil stripping and excavation to achieve building, pavement, and hardscape subgrades is complete, prepare subgrades by scarifying and moisture conditioning the exposed site soil a minimum of 0.7-feet and compact the subgrade to the *Structural Fill,* Section 6 requirements.
3. The GER retained for construction shall review site preparations, subgrading efforts, and over-excavations prior to *Structural Fill* placement to verify design requirements.
4. After achieving subgrade, the contractor shall protect the subgrade from becoming disturbed, saturated, or frozen. Control prepared areas by limiting construction traffic and reducing the subgrade's exposure to precipitation, water, and freezing conditions.
5. Grade subgrades to direct surface water away from construction areas to avoid infiltration.

Over-Excavation

1. Beyond fill removal, excavation to remove unsuitable soil may be required after attempting moisture conditioning.
2. Soft, loose, wet, pumping, or rutting areas that cannot achieve compaction following adequate moisture conditioning must be removed to medium dense, unyielding native soil at the direction of the GER, CSG, and the District. Replace these over-excavations with *Granular Structural Fill* (SF-2) as described in *Structural Fill,* Section 6, GT3.
3. Soft/loose soil over-excavation criteria shall be determined during construction with the GER, the contractor, and the District, but shall extend at least 1 foot below the subgrade and laterally 1/2 the depth.

Excavation Characteristics

1. Site soil is expected to be excavatable using conventional excavation techniques and equipment.
2. Temporarily excavate, slope, shore, or brace excavations in accordance with Washington Industrial Safety and Health Act (WISHA) and Washington Administrative Code (WAC) guidelines. Regulations outlined in WAC Section 296-155 provide temporary construction slope requirements for various soil types.
3. Site soil is classified as Type C soil referencing WAC Section 296-155, and must be temporarily sloped back at least 1.5H:1V.
4. Construction vibrations, seepage, or surface loading can cause excavations to slough or cave and should be avoided.
5. Ultimately, the contractor is solely responsible for site safety, excavation configurations, and maintaining WISHA-approved personnel for excavation monitoring.
6. Plan excavations carefully, allowing water collection points and utilizing conventional sumps and pumps to remove nuisance water from runoff, seeps, springs, or precipitation.
7. Excavation adjacent to existing foundations shall be sloped at 1H:1V or flatter, to avoid undermining existing footings. Reference Figure G2.2.
8. Coordinate construction activities and excavation backfilling as rapidly as possible following excavation to reduce the potential for subgrades to degrade under construction traffic.
9. Maintain dewatering systems during wet weather to facilitate good drainage and reduced over-excavation.
10. Discharge collected construction water into temporary stormwater and sediment facilities established as part of contractor's stormwater management plan.

Wet Weather/Wet Soil Construction

1. Ideally, perform earthwork construction during dry weather conditions. Turn off irrigation in the improvement areas at least 1-month prior to construction.
2. If earthwork occurs during wet periods, accomplish work at or near final subgrade with equipment that imparts low bearing pressures, track-mounted, and low tire pressure equipment. Using high ground-contact pressure equipment such as dump trucks and loaders can readily pump and rut the subgrade or existing asphalt and their application should be carefully considered.
3. Leave existing asphalt in place as long as possible.
4. Stage construction, specifically excavation and backfilling, to avoid traffic on subgrades.
5. Depending on precipitation, runoff, and perched groundwater conditions, the site soil may be over optimum moisture content. Contractors shall expect these conditions and be prepared to install runoff management facilities and to replace wet or disturbed soil with *Granular Structural Fill* (SF-2) (see Table G3.1) after moisture conditioning.

Earthwork Testing

The firm retained to verify subgrade conditions, soil bearing units, and compaction shall become the GER for construction. At a minimum the following earthwork testing frequencies shall be implemented.

1. Demolition excavation and final subgrades must be observed by the GER retained for construction or the GER's representative prior to placing *Structural Fill,* concrete, or asphalt pavement. GER shall verify subgrade design criteria.
2. Demolition Excavation Backfill – One compaction test every 1,000 square feet (sf), or a minimum of 4 tests per area.
3. Mass Grading/Structural Fill Placement – One compaction test every 2,500 sf, per fill lift, minimum 3 tests per testing event.
4. Interior and Exterior (hardscapes) Slab Subgrade – One compaction test every 1,000 sf or 4 tests per slab area (subgrade and support aggregate), whichever results in the greater number of tests, per fill lift.
5. Field/Track Subgrade - One compaction test every 10,000 sf, minimum 3 tests per testing event.
6. Foundation Bearing Surfaces - Reviewed by an experienced geotechnical engineer to confirm design bearing unit and at least 1 compaction test every 100 lf of continuous foundations (+2 per column) or a minimum of 4 tests per alignment/area.
7. Foundation Wall Backfill – One compaction test every 100 linear foot (lf) of wall or minimum 3 tests per wall line (interior and exterior sides), whichever results in the greater number of tests, per fill lift.
8. Utility Trench Backfill – One compaction test every 100 lf of trench and minimum 3 tests per utility alignment, whichever results in the greater number of tests, per each fill lift. Field drain trenches are not expected to require compaction testing.
9. Pavement Base Course - One compaction test every 1,000 sf or 100 lf, a minimum of 4 tests per alignment/area.
10. Asphalt Pavement Construction – One compaction test every 100 lf per paving lift, minimum 3 tests per testing event. 1 laboratory test suite on a bulk sample of hot asphalt mix per each day's paving, including oil content, gradation, and maximum theoretical (RICE) specific gravity.

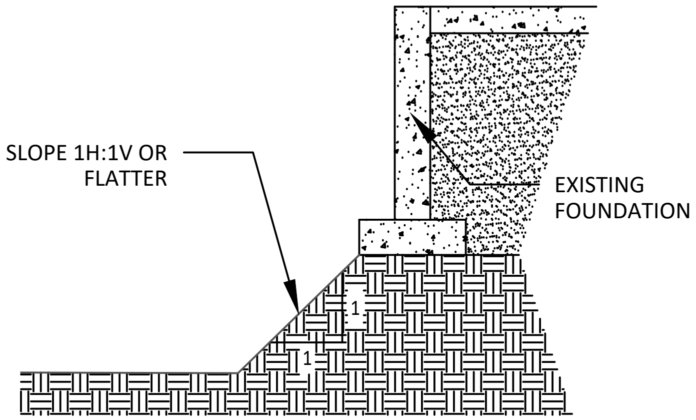

Figure G2.1: Excavation Schematic

5 GEOSYNTHETICS

Where required, apply geosynthetics to the following material and placement requirements:

Table G2.1: Geosynthetic Specifications

Geosynthetic Type	Use	Material Specifications
Non-Woven Stabilization Fabric	Over-excavations, soft or wet soil	- Must meet Soil Stabilization – WSDOT Standards Section 9-33.2(1). Table 3. - Min. 200 pound grab tensile strength (ASTM D 4632) - Min. 180 pound seam breaking strength (ASTM D4632) - Min. 430 pound puncture resistance (ASTM D 6241) - Min. 79 pound tear strength (ASTM D4533)
Biaxial or Triaxial Geogrid	Extremely soft subgrade conditions	- 93 percent junction efficiency (GRI-GG2-05) - 6.5 m-N/degree Torsional Rigidity at 20 kg-cm (GRI-GG9) - Punched and drawn polypropylene Minimum Radial Stiffness of 15,400 lb/ft at 0.5% Strain (ASTM D6637)

Geosynthetics

1. Geosynthetic fabrics that do not meet the requirements in Table G2.1 above may be used only if approved by the GER, CSG, or the District.
2. Geosynthetic fabrics are applicable when constructing on soft or wet soil as separation and stabilization fabrics.
3. Where required for pavement section support, to aid construction, or increase long-term performance, apply geosynthetics directly on approved subgrades, taut, free of wrinkles, and over-lapping at least 1.0-foot.
4. Consult GPI to review geosynthetic applications or other subgrade improvement alternatives.
5. Geosynthetics are not expected to be required to meet geotechnical design unless extremely soft subgrades develop during construction due to unusually high soil moisture or construction during wet seasons. However, geosynthetics are required for catch basins and other site drainage features per civil drainage design.

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CHECK: TJW
FILE: PU21001
PROJECT:
FRAN RISH STADIUM
GEOTECHNICAL
ENGINEERING EVALUATION
1350 LEE BOULEVARD
RICHLAND,WA

DRAWN: AMC
DESIGN: TJW
PREPARED FOR:
RICHLAND SCHOOL DISTRICT
C/O CONSTRUCTION SERVICE GROUP
104 CLOVER ISLAND DRIVE,
SUITE 202
KENNEWICK, WA, 99336
ATTN: MR. MIKE MELLING

GeoProfessional Innovation
GPI 6 O'Donnell Road Pullman, WA 99163 509.339.2000

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6 STRUCTURAL FILL

Material Requirements

1. On site soil may be used as *General Structural Fill* (SF-1) so long as it meets the requirements provided in Table G3.1, below.
2. Material requirements for structural fill reference the 2020 WSDOT Standards.
3. Project structural fill products are described in Table G3.1 below.

Table G3.1: Structural Fill Specifications and Allowable Use

NSF	Non-Structural Fill (Landscape or Topsoil)	- Any area that will not support pavements, foundations or other improvements, (typically landscape areas)	- Soil classified as GW, GM, GP, GC, SM, SW, SP, SC, or ML according to the USCS. - Soil may not contain particles larger than 1.0-foot in median diameter. - Soil must be reasonably free from deleterious substances such as wood, metal, plastic, waste, etc.
SF-1	General Structural Fill*	- Stem wall backfill - Utility trench backfill - General site grading greater than 1-foot below subgrade	- Soil classified as GW, GP, GM, SP, SM, or SW according to the USCS. - Soil must contain less than 3 percent (by weight) of organics, vegetation, wood, metal, plastic, or other deleterious substances. - Soil may not contain particles larger than 0.7-feet in diameter. - Coarse granular soil locally know as "shotrock" or "pitrun" may also be used as SF-1.
SF-2	Granular Structural Fill	- Over-excavations - greater than 0.5-feet below the bottom of concrete bearing	- Soil meeting requirements stated in Section 9-03.14(2) - Select Borrow - Ground asphalt or concrete may be used as SF-2 where not placed beneath structures
CS-1	Crushed Surfacing	- Slab & pavement support aggregate - SF-2 applications - Granular soil improvements	- Soil meeting requirements stated in Section 9-03.9(3) - Crushed Surfacing - Includes Top Course and Base Course
PB	Pipe Bedding	- Utility pipe bedding within 0.5-feet of the pipe invert & 1-foot over the pipe	- Soil meeting requirements stated in Section 9-03.12(3) - Gravel Backfill for Pipe Zone Bedding
DA	Drainage Aggregate	- Drain pipe aggregate	- Soil meeting requirements stated in Section 9-03.12(2)

*Demolished asphalt pavement and concrete meeting the requirements in Table G3.1 may only reused as General Structural Fill outside the building footprint.

1. Structural fill shall not contain particles of frozen soil, mud, snow, or ice. Structural fill shall not be placed on frozen subgrades.
2. Moisture conditioned structural fill products to near optimum moisture content, place and compact in maximum 0.7-foot-thick, loose lifts, providing compaction equipment weighs a minimum of 5 tons. If smaller or lighter compaction equipment is provided, reduce the lift thickness to meet the compaction requirements presented herein.

Required Compaction

Backfill supporting any structure or improvement must be compacted to structural fill requirements presented in Table G3.2 below.

Table G3.2: Required Structural Fill Products for Designated Project Areas

Project Area	Required Structural Fill Product	Compaction Requirement^{A}
Soil subgrades	Native Soil or SF-1	92%
Utility trench backfill, general site grading	SF-1, SF-2^{B}, CS-1	95%
Structural fill placed beneath footings	SF-2, CS-1	95%
Pavement, slab-on-grade support sections, field support section	CS-1	95%
Landscape areas outside of swales and sloped flatter than 5H:1V per the SWPPP	Landscape Fill, Topsoil	Per Landscape Architect or 85%

Table G3.2 Notes:

A. Relative compaction requirement compared to the maximum dry density of the soil as estimated by Modified Proctor.

B. Imported or site coarse soil with greater than 30% retained on the 3/4-inch sieve should be compacted to the *Coarse Fill* section requirements.

Coarse Fill

1. Any material with greater than 30 percent retained above the ¾-inch sieve is too coarse for Modified Proctor density testing, but may be used as SF-1 and SF-2. Coarse fill must be compacted using a "method specification" developed during construction that is based on the material characteristics and the contractor's means and methods.
2. Develop method specifications during construction with the GER and specific to the materials, compaction equipment, and conditions encountered.
3. At a minimum, place all oversize material in maximum 1.5-foot lifts and compact with 5 complete passes of a minimum 10-ton, vibratory or grid roller.
4. Vibratory rollers shall have a dynamic force of at least 30,000 pounds per impact per vibration and at least 1,000 vibrations per minute. Coarse fill must be compacted to a dense, interlocking, and unyielding surface. Vibratory rollers can negatively impact nearby structures and must be used with caution.

Utility/Drain Trench Backfill

1. Remove all saturated, loose, and/or disturbed soil from the bottom of the utility and drain trenches prior to placing pipe bedding.
2. Accomplish bedding for pipes in drain and utility trenches in accordance with WSDOT standards.
3. Backfill the remainder of the utility trenches in accordance with the *Structural Fill* specifications.

7 SITE DRAINAGE

Exterior Grading

1. Site grading design and construction must allow for positive drainage of surface runoff water away from the structures and not be allowed to infiltrate new or existing foundation and slab subgrades.
2. Convey runoff or water migrating along the ground surface away from structures, and track and field surfaces by an appropriately designed series of ditches, hardscapes, swales, trench drains or other surface water management procedures.
3. Per IBC Section 1804.4, slope all surfaces within 10 feet of the structure away at 5 percent except where the *American Disabilities Act of 1990* (ADA) requirements must be met. Where IBC or IEBC standards cannot be met, slope ground as aggressively as possible to direct water away from the building's perimeter.
4. Slope the remaining sidewalks and paved surfaces per civil design away from the structures. This reduces the risk of subsurface soil near the foundation becoming saturated due to water ponding near structures or pavement edges.
5. Provide roof drains to collect and direct water away from foundations.
6. Provide and connect roof downspouts to a solid pipe placed around the concession and restroom structures perimeter and do not allow water to infiltrate into the soil underlying the new or existings structures. New stormwater conveyance can be connected to existing stormwater conveyance where grades allow. Do not disrupt existing stormwater systems.
7. Avoid landscaping that requires irrigation adjacent to grandstands and other structures.

Foundations/Walls

1. Install drains on new ticket booth and existing grandstand foundations and slope to gravity drain and dispose of collected water in a stormwater system away from structures, reference Figure G4.1.
2. Never connect foundation drains to roof drains.
3. Divert water collected in foundation and roof drains to the stormwater disposal system designed and specified by the civil designer.

Stormwater Infiltration

1. Stormwater will be collected via a new subdrainage system beneath the track and disposed of via new and existing infiltration facilities. Divert stormwater to the new or existing disposal systems as specified by site civil design.
2. For existing drywells, thoroughly clean and verify working condition as a part of construction.
3. Design new stormwater disposal facilities in accordance with the WDOE (Eastern Regional Stormwater Management) manual and the City of Richland requirements.
4. The soil profile encountered in explorations is classified under the USCS as silt, silty sand, and poorly-graded sand.
5. Referencing Table 5.6.1 of the Eastern Washington Stormwater Management Manual, the vadose zone treatment capacity of the silty sand and poorly-graded sand is classified as "Medium".
6. GPI performed infiltration tests in 2 site locations (borings B-21001A-11 and B-21001A-12). The infiltration tests for these locations were within the poorly-graded sand and silty sand soil units, respectively.
   - The poorly-graded sand alluvium yielded an estimated unfactored falling head infiltration rate of 10.1 inches per hour at 3.0-feet below the existing ground surface.
   - The silty sand alluvium yielded estimated unfactored falling head infiltration rates of 19.0 inches per hour at 4.0-feet below the existing ground surface.
   - Cation Exchange Capacity = 8.9 meq/100g (Silty Sand)
   - From these tests, drywell outflow rates are provided in Table G3.3 for single and double depth drywells.
   - The infiltration rates may also be used for other subsurface drainage systems such as trench drains, Stormtech® systems, etc.
6. Line subsurface drainage excavations with geosynthetic filter fabric to avoid fine soil migration.
7. Apply a prescriptive safety factor of 3 to infiltration rates or based on the civil designer's ultimate disposal point and experience with stormwater disposal in Richland. Note that vertical infiltration can be impacted by freezing conditions. Vertical infiltration may be limited by fine-grained alluvial silt encountered borings B-21001A-1, B-21001A-4, and B-21001A-6. Alluvial silt extended to 30-feet below the ground surface in boring B-21001A-1 and to boring termination in borings B-21001A-4 and B-21001A-6.
8. Factor groundwater elevations into stormwater design in order to meet the WDOE stormwater disposal to groundwater separation requirements. Groundwater was enountered at 20.0- to 21.0-feet below the ground surface during exploration. The observed groundwater level is consistent with groundwater levels recorded in WDOE well log data in the project vicinity.
9. Avoid aggressive landscaping and irrigation within 10 feet of buildings.
10. Dispose stormwater in new treatment areas at least 30 feet from the new and existing structures, down gradient from adjoining properties and foundations.
11. If Civil Design or other issues will not allow appropriate collection and disposal points set away from structures or neighboring properties, the design team shall evaluate alternate stormwater disposal plans.

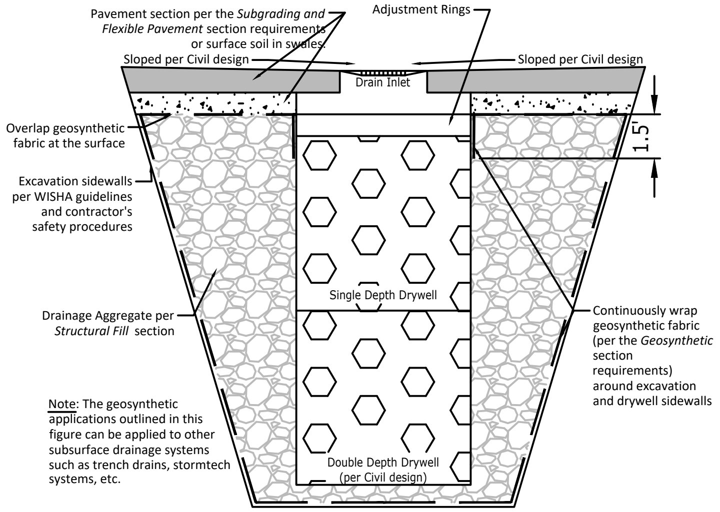

Figure G3.1: Dry Well Schematic

Table G3.3: Drywell/Excavation Outflow Rates (cfs)

Test Location	Test Depth (ft)	Soil Type	Unfactored Outflow Rates (cfs)		Factored Outflow Rates (cfs)	
			Single Drywell	Double Drywell	Single Drywell	Double Drywell
B-21001A-11	3.0	Poorly-graded Sand with Silt	0.015	0.026	0.004	0.008
B-21001A-12	4.0	Silty Sand	0.028	0.050	0.007	0.015

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8 FOUNDATION DESIGN

Foundation design criteria is based on the estimated structural loads as outlined on GT1. Bear foundations on compacted native soil subgrades prepared per the *Subgrading* section requirements on sheet GT2. The following bullets provide foundation design criteria:

1. Maximum allowable bearing pressure: 3,000 psf
    - Maximum 33 percent increase allowed for short term load increases such as wind or seismic.
    - Requires foundations bear on native soil or compacted *Structural Fill*.
2. Estimated foundation vertical settlement beneath new foundations:
    - Total settlement: up to 1.0 inch
    - Differential settlement: Up to 0.75 inches in 30-foot horizontal span.
3. Lateral load resistance:
    - Foundation base friction coefficient:
        - 0.35 for foundations cast directly on compacted native soil or *Structural Fill*
        - Reduce friction coefficient by 1/3 for precast concrete
    - Passive soil resistance on foundation sides:
        - Equivalent fluid pressure: 280 pcf (Site soil used as SF-1)
        - Requires 3/4-inch lateral movement to mobilize full resistance
4. Exterior footings must extend at least 2-feet below the final, exterior ground surface to help protect against frost action.
5. Interior foundations must bear at least 1.5-feet below finish slab elevations and maintain at least 0.5-feet of CS-1 between top of the footing and the bottom of the concrete slab.
6. Avoid thickened footings due to their propensity for reflective cracking.
7. GPI, an experienced geotechnical engineer, or geologist retained by the District as the GER for construction shall observe foundation and slab subgrade preparations to verify vegetation, organics, and significant debris have been removed to the required elevation, and excavations are accomplished according to these requirements and foundation preparations.
8. Design criteria require maintaining drained conditions at the foundation subgrade.

Soil Corrosivity

1. pH = 7.6 - slightly alkaline
2. Resistivity = 4,350 ohm-cm, moderately corrosive
3. Sulfates = 40.8 ppm
4. Account for the soil's moderate corrosion potential in reinforcing steel spacing. Wherever possible, place steel with maximum clearances established through structural design.
5. Based on these corrosion parameters, special cathodic protection or other methods of corrosion protection for buried structures will not extend their practical useful life.
6. Applicable for Type I/II cement.

Figures G4.1 and G4.2 illustrate the foundation construction process. Stem wall height will vary. Figures G4.1 and G4.2 are not structural details.

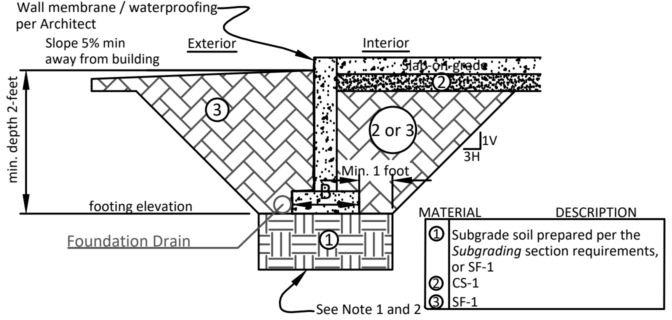

Figure G4.1: Perimeter Foundation Schematic

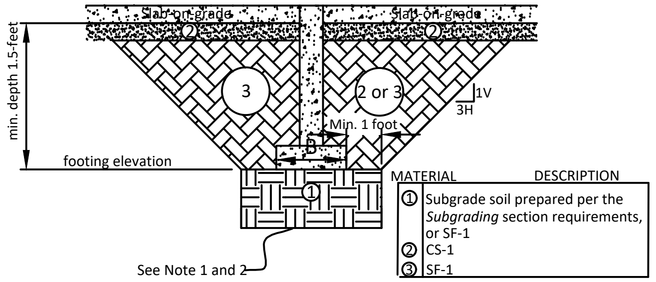

Figure G4.2: Interior Foundation Schematic

Notes:
1. Extend foundation excavations exposing native soil and preparing the exposed soil subgrade per the *Subgrading* section requirements.
2. Compact the resulting subgrade to *Structural Fill* requirements.

Seismic Activity Research

1. The seismic site soil profile is Class D.
2. Seismic design shall reference the parameters provided in Table G4.1. based on the soil conditions and project location.
3. The risk-targeted maximum considered earthquake (MCER) spectral response acceleration parameters provided have modified from standard parameters to parameters for Site Class D.
4. The design spectral acceleration parameters provided in Table G4.1 are equal to 67 percent of the Risk Targets MCER acceleration parameters.

Table G4.1: Seismic Response Criteria (ASCE 7-10)

Period (seconds)	Standard Acceleration Coefficients (g)[2]	Site Factor for Site Class D	MCER Spectral Acceleration Parameters for Site Class D (g)[3]	Design Spectral Acceleration Parameters for Site Class D (g)
0.0 (Peak)	PGA = 0.184	F_{PGA} = 1.431	PGA_M = 0.264 ($PGA*F_{PGA}$)	- -
0.2 (Short)	S_S= 0.415	F_a = 1.468	S_{MS} = 0.610 (F_a*S_S)	S_{DS} = 0.406 (⅔ S_{MS})
1.0	S_1= 0.159	F_v = 2.282	S_{M1} = 0.363 (F_V*S_1)	S_{D1} = 0.242 (⅔ S_{M1})

1. Values for location Latitude 46.275874 °N, Longitude 119.286069 °W
2. Acceleration based on 2% probability of exceedance in 50 years.
3. Coefficient based on 1% probability of exceenance in 50 years.
4. Values for an ASCE Risk Category I/II/III.

Liquefaction Potential

1. The subsurface geology exhibited low $N_{1,60}$ blowcounts and relatively low CPT resistence (correlating to low in-place density) along with relatively high fines content in most soil layers.
2. CPT cone tip resistance data was used to calculate safety factors against liquefaction within the depths explored. Factors of safety were calculated to be between 0.5 and 1.7 during the 2,475-year seismic event (estimated 6.0 magnitude earthquake).
3. Safety factors above 1.0 meet the standard of care for public infrastructure. The safety factor against liquefaction does not consistently exceed 1.0.
4. Based on these conditions, liquefaction potential is relatively high at the project site.
5. Seismically induced settlement is likely to occur on the magnitude of 3 to 5 inches during a 2,475-year seismic event.
6. The potential for lateral spreading on the relatively flat site is low.
7. Because grandstand foundations will not be modified, liquefaction reducing measures will not be applied.
8. The ticket booth and restroom structure is intermittently used by the public and collapse due to liquefaction is not probable for this structure. Liquefaction mitigating measures will not be applied to this structure.

9 SLAB-ON-GRADE FLOORS

Slab Substrate

1. Support concrete slab-on-grade floors with at least 0.5-feet of CS-1 meeting Table G2.1 requirements, placed over compacted subgrades prepared per the *Earthwork* section requirements.
2. Subgrade areas that become soft, wet, or disturbed during slab subgrade preparations must be moisture conditioned and recompacted, or over-excavated to native soil and replaced with CS-1.
3. Compact CS-1 below slabs to *Structural Fill* requirements.
4. The slab's supporting subgrade, CS-1 layer, and any vapor retarders must be constructed once the majority of underslab plumbing and utilities are completed.
5. Floor slabs and supporting base section thicknesses must be structurally designed for the anticipated use and equipment or storage loading conditions.
6. Concrete slab design may utilize an allowable modulus of subgrade reaction (k) of 220 pounds per cubic inch (pci) (Figure G4.3) for slab sections constructed over compacted subgrade soil and at least 0.5-feet of compacted CS-1.

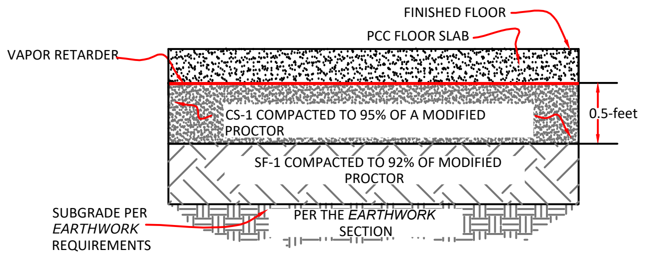

Figure G4.3: Floor Slab Schematic

Vapor Retarder

1. Interior floor slabs may be susceptible to moisture migration caused by subsurface capillary action and vapor pressure. Moisture migration through floor slabs can break down a floor covering, its adhesive, or cause various other floor covering performance problems.
2. Vapor retarders shall consist of thick, puncture proof polyethylene sheeting; an example of this material is Stego Wrap™, a 15-mil retarder.
3. The American Concrete Institute (ACI) recommends, and this project will place retarders immediately below the floor slab.
4. Form stakes or other sub-slab penetrations must never be allowed to puncture the vapor retarder.
5. Plumbing penetrations and foundation edges are notoriously problematic for under-slab vapor protection.
6. Carefully design and construct vapor retarder penetrations to reduce vapor transport through any penetrations.
7. Even when vapor retarders are used, water vapor migration through the concrete floor slab is still possible.
8. Selected floor covering accordingly. Strictly follow floor covering manufacturer's installation requirements.
9. Where vapor retarders are utilized, the flooring and concrete slab contractors, as well as the plastic sheeting manufacturer, must be consulted regarding additional slab cure time requirements and/or the potential for slab curling.

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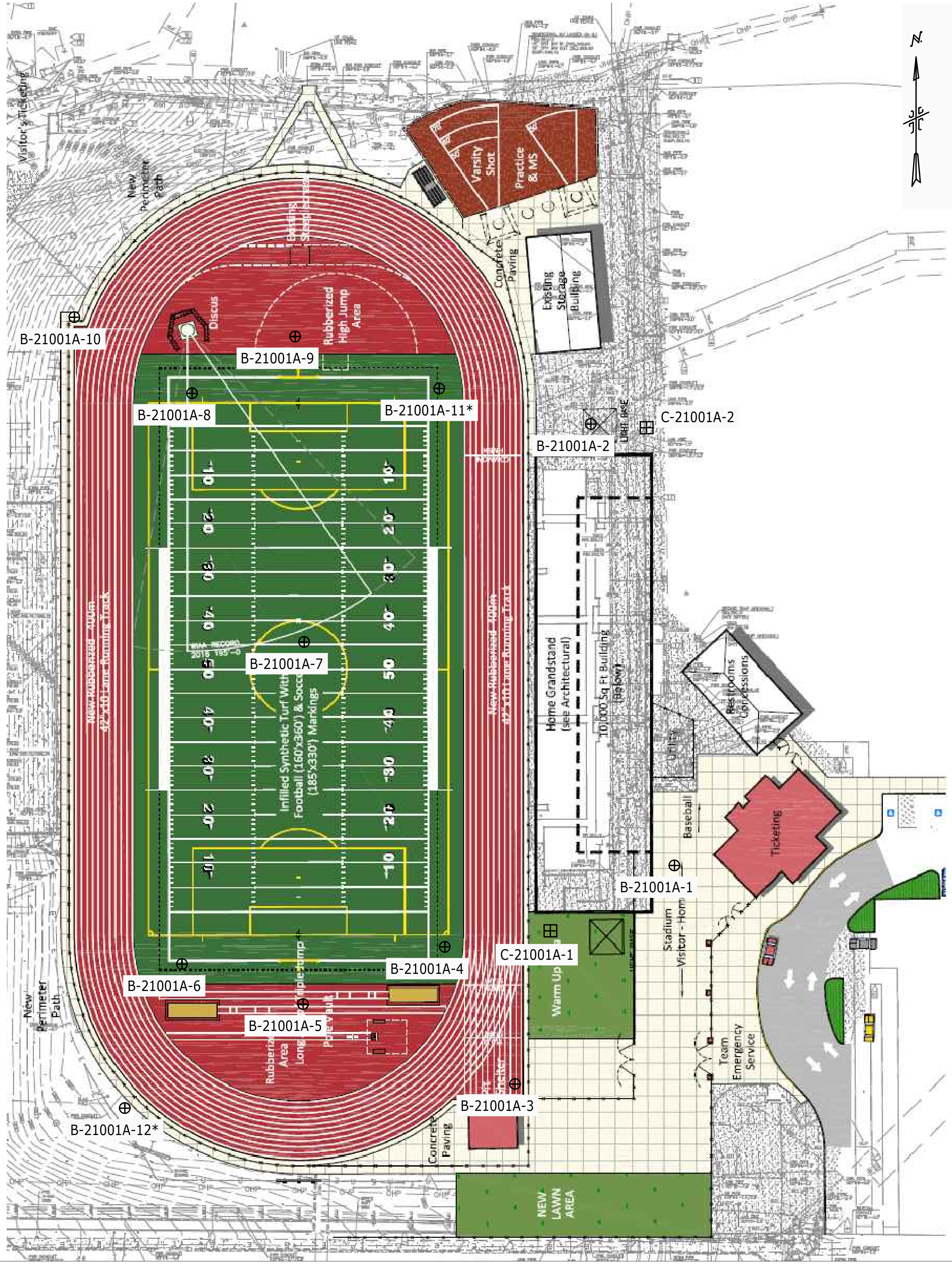
⑩ EXPLORATION MAP



Legend

⊕ Exploration boring location as observed by GPI on 2/1/2021 and 2/2/2021.

⊞ CPT location as observed on 2/1/2021

* Infiltration test location.

Reference: Base image provided by Design West Architects. No scale intended.

⑪ EXPLORATION LOGS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE GRAINED SOIL	GRAVEL	CLEAN GRAVEL	▨	GW	WELL-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
			▨	GP	POORLY-GRADED GRAVEL, GRAVEL-SAND MIXTURES.
		GRAVEL WITH FINES	▨	GM	SILTY GRAVEL, GRAVEL-SAND-SILT MIXTURES.
			▨	GC	CLAYEY GRAVEL, GRAVEL-SAND-CLAY MIXTURES.
	SAND	CLEAN SAND	▨	SW	WELL-GRADED SAND, GRAVELLY SAND.
			▨	SP	POORLY-GRADED SAND, GRAVELLY SAND.
		SAND WITH FINES	▨	SM	SILTY SAND, SAND-SILT MIXTURES.
			▨	SC	CLAYEY SAND, SAND-CLAY MIXTURES.
FINE GRAINED SOIL	SILT AND CLAY LIQUID LIMIT LESS THAN 50%		▨	ML	INORGANIC SILT, SANDY OR CLAYEY SILT.
			▨	CL	INORGANIC CLAY OF LOW TO MEDIUM PLASTICITY, SANDY OR SILTY CLAY.
			▨	CL-ML	INORGANIC MIXED CLAY AND SILT.
			▨	OL	ORGANIC SILT AND CLAY OF LOW PLASTICITY.
	SILT AND CLAY LIQUID LIMIT GREATER THAN 50%		▨	MH	INORGANIC SILT, MICA- CEOUS SILT, PLASTIC SILT.
			▨	CH	INORGANIC CLAY OF HIGH PLASTICITY, FAT CLAY.
			▨	OH	ORGANIC CLAY OF MEDIUM TO HIGH PLASTICITY.
			▨	PT	PEAT, MUCK AND OTHER HIGHLY ORGANIC SOILS.

BORING LOG SYMBOLS

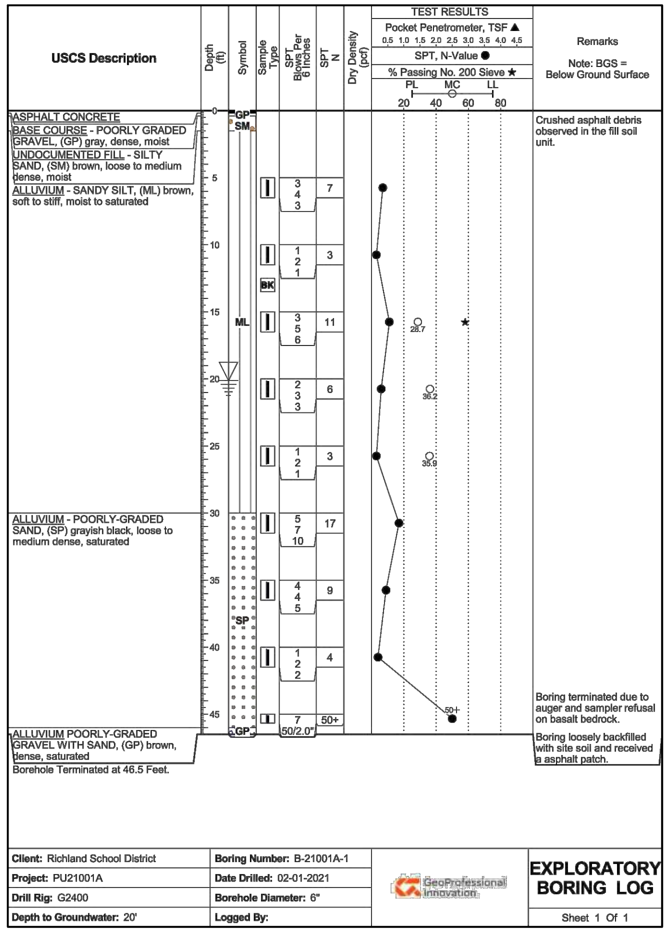
- STANDARD 2 INCH OD SPLIT SPOON SAMPLE
- CALIFORNIA MODIFIED 3 INCH OD SPLIT SPOON SAMPLE
- ROCK CORE
- SHELBY TUBE 3 INCH OD UNDISTURBED SAMPLE

TEST PIT LOG SYMBOLS

- GRAB BAG SAMPLE BG
- BULK SAMPLE BK
- RING SAMPLE RG

GROUNDWATER SYMBOLS

- ▼ GROUNDWATER AFTER 24 HOURS
- ▽ GROUNDWATER AT TIME OF EXPLORATION
- GROUNDWATER AT THE END OF EXPLORATION



USCS Description	Depth (ft)	SPT Blows Per 6 Inches	SPT N	Remarks (Note: BGS = Below Ground Surface)
ASPHALT CONCRETE BASE COURSE - POORLY GRADED GRAVEL, (GP) gray, dense, moist UNDOCUMENTED FILL - SILTY SAND, (SM) brown, loose to medium dense, moist	0			Crushed asphalt debris observed in the fill soil unit.
ALLUVIUM - SANDY SILT, (ML) brown, soft to stiff, moist to saturated	5	3 4 3	7	
	10	1 2 1	3	
	15	3 5 6	11	
	20	2 3 3	6	
	25	1 2 1	3	
ALLUVIUM - POORLY-GRADED SAND, (SP) grayish black, loose to medium dense, saturated	30	5 7 10	17	
	35	4 4 5	9	
	40	1 2 2	4	
	45	7 50/2.0"	50+	Boring terminated due to auger and sampler refusal on basalt bedrock.
ALLUVIUM POORLY-GRADED GRAVEL WITH SAND, (GP) brown, dense, saturated Borehole Terminated at 46.5 Feet.				Boring loosely backfilled with site soil and received a asphalt patch.

Client: Richland School District
Project: PU21001A
Drill Rig: G2400
Depth to Groundwater: 20'
Boring Number: B-21001A-1
Date Drilled: 02-01-2021
Borehole Diameter: 6"
Logged By:

GeoProfessional Innovation

EXPLORATORY BORING LOG

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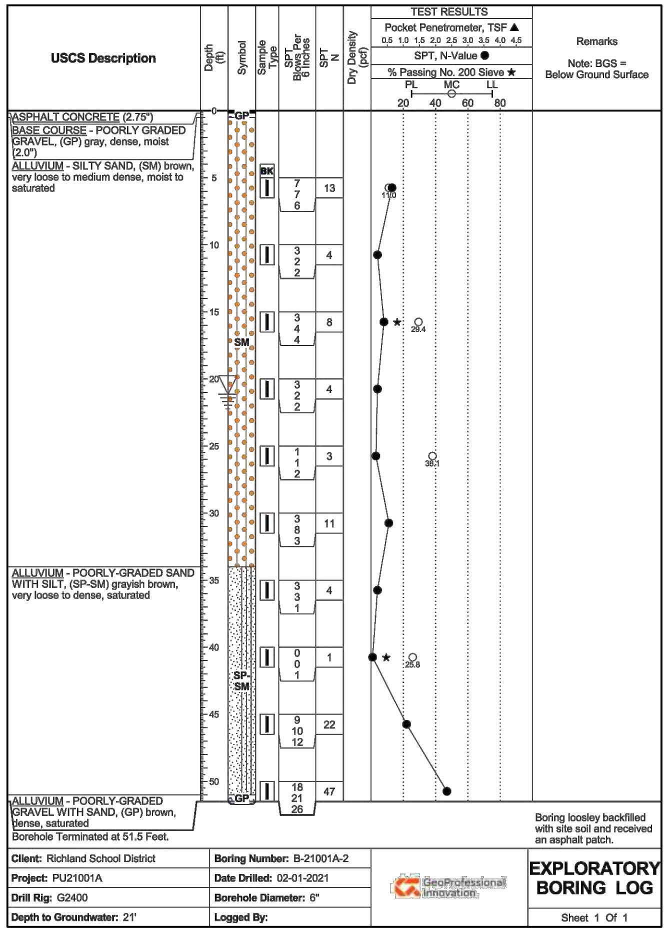
EXPLORATION LOGS



ASPHALT CONCRETE (2.75")

BASE COURSE - POORLY GRADED GRAVEL, (GP) gray, dense, moist (2.0")

ALLUVIUM - SILTY SAND, (SM) brown, very loose to medium dense, moist to saturated

ALLUVIUM - POORLY-GRADED SAND WITH SILT, (SP-SM) grayish brown, very loose to dense, saturated

ALLUVIUM - POORLY-GRADED GRAVEL WITH SAND, (GP) brown, dense, saturated

Borehole Terminated at 51.5 Feet.

SPT Blows Per 6 Inches	SPT N
7 7 6	13
3 2 2	4
3 4 4	8
3 2 2	4
1 1 2	3
3 8 3	11
3 3 1	4
0 0 1	1
9 10 12	22
18 21 26	47

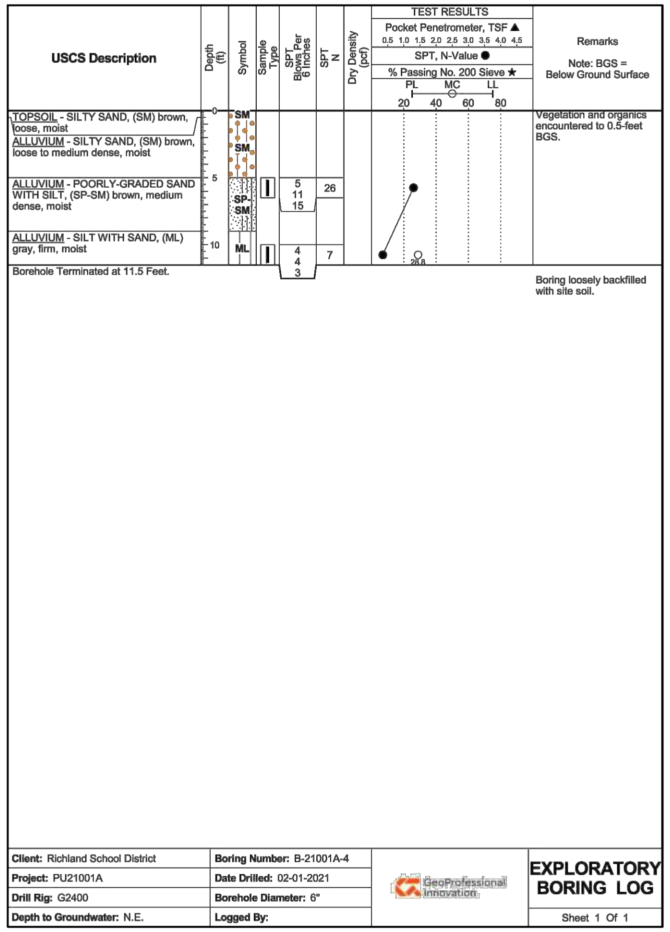
Boring loosley backfilled with site soil and received an asphalt patch.

Client: Richland School District	**Boring Number:** B-21001A-2
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: 21'	**Logged By:**

GeoProfessional Innovation

EXPLORATORY BORING LOG

Sheet 1 Of 1



TOPSOIL - SILTY SAND, (SM) brown, loose, moist

ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist

ALLUVIUM - POORLY-GRADED SAND WITH SILT, (SP-SM) brown, medium dense, moist

ALLUVIUM - SILT WITH SAND, (ML) gray, firm, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
5 11 15	26
4 4 3	7

Vegetation and organics encountered to 0.5-feet BGS.

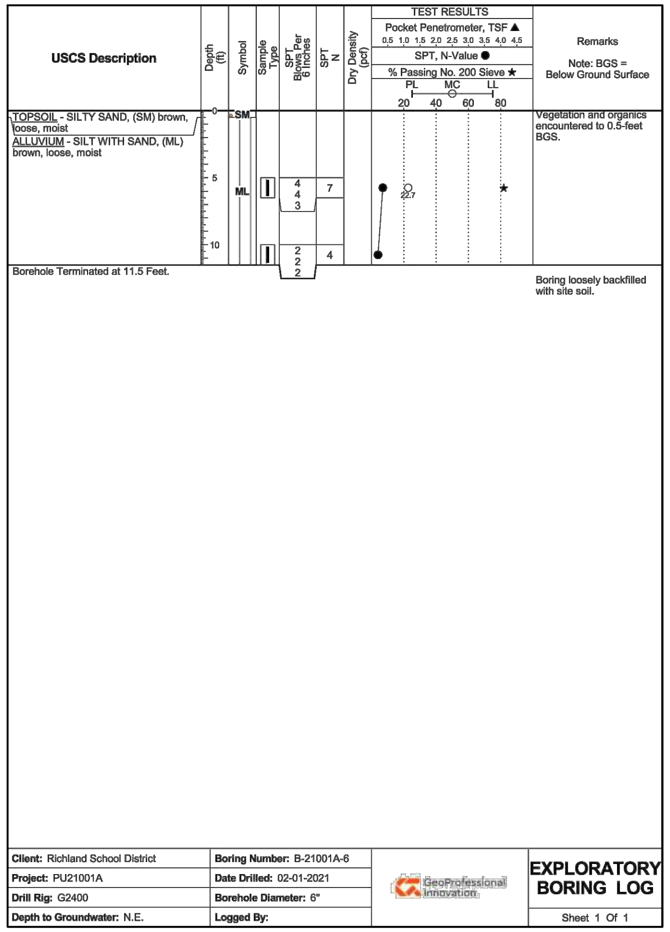
Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-4
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

GeoProfessional Innovation

EXPLORATORY BORING LOG

Sheet 1 Of 1



TOPSOIL - SILTY SAND, (SM) brown, loose, moist

ALLUVIUM - SILT WITH SAND, (ML) brown, loose, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
4 4 3	7
2 2 2	4

Vegetation and organics encountered to 0.5-feet BGS.

Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-6
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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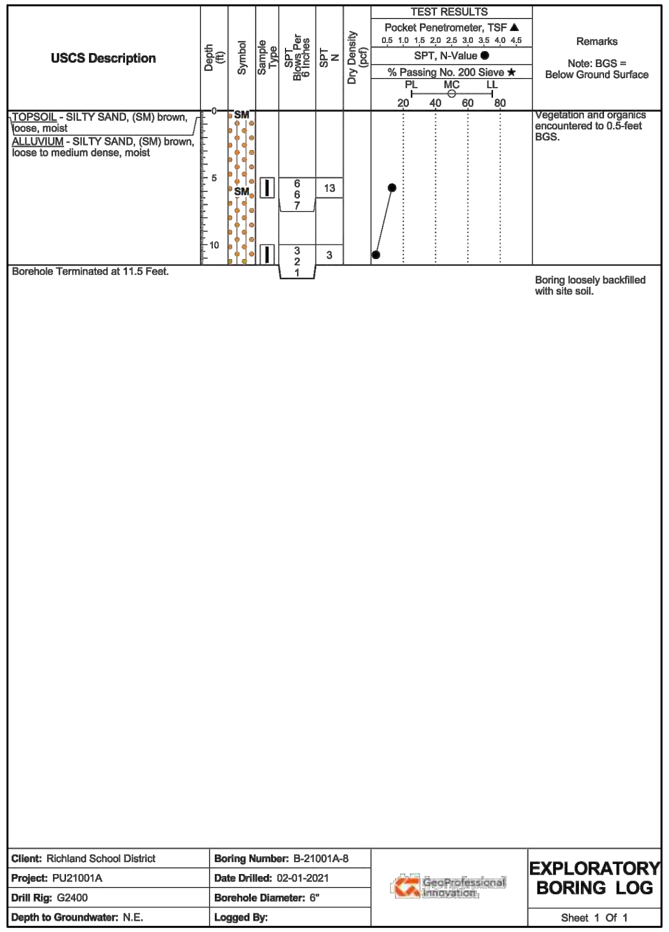
EXPLORATORY BORING LOG

Sheet 1 Of 1



TOPSOIL - SILTY SAND, (SM) brown, loose, moist

ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
6 6 7	13
3 2 1	3

Vegetation and organics encountered to 0.5-feet BGS.

Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-8
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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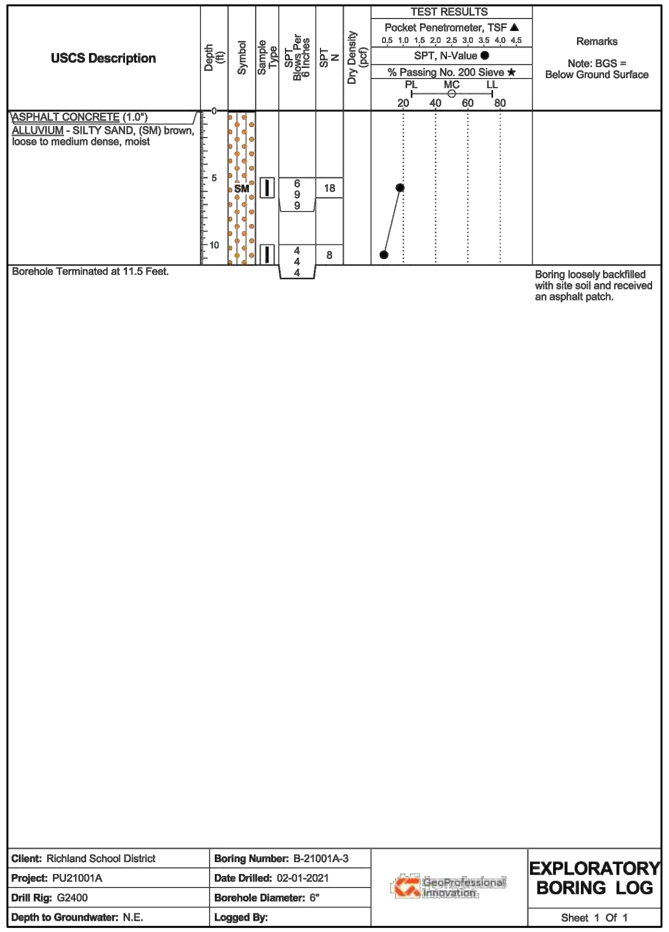
EXPLORATORY BORING LOG

Sheet 1 Of 1



ASPHALT CONCRETE (1.0")

ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
6 9 9	18
4 4 4	8

Boring loosely backfilled with site soil and received an asphalt patch.

Client: Richland School District	**Boring Number:** B-21001A-3
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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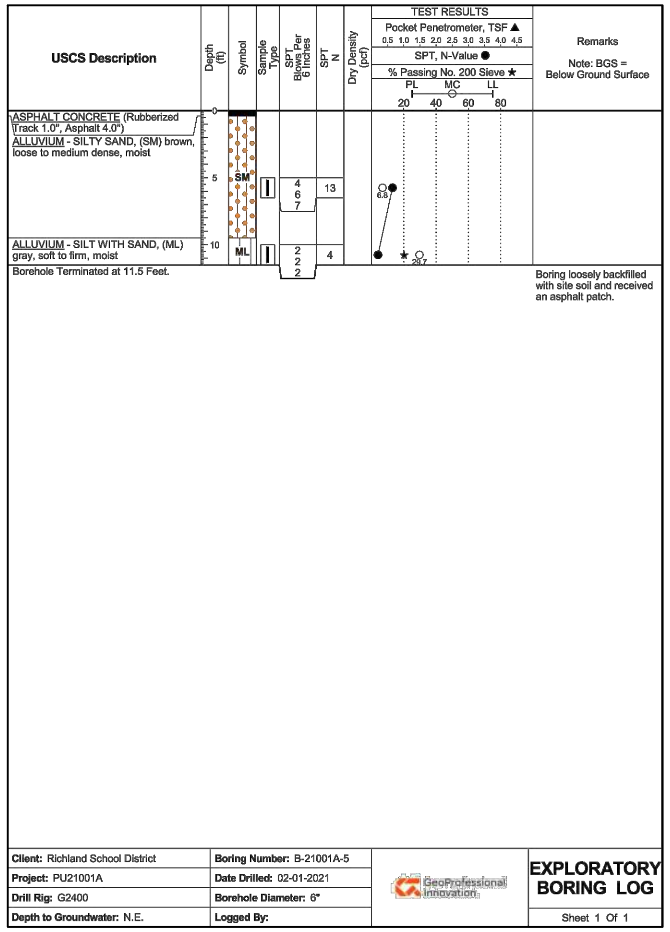
EXPLORATORY BORING LOG

Sheet 1 Of 1



ASPHALT CONCRETE (Rubberized Track 1.0", Asphalt 4.0")

ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist

ALLUVIUM - SILT WITH SAND, (ML) gray, soft to firm, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
4 6 7	13
2 2 2	4

Boring loosely backfilled with site soil and received an asphalt patch.

Client: Richland School District	**Boring Number:** B-21001A-5
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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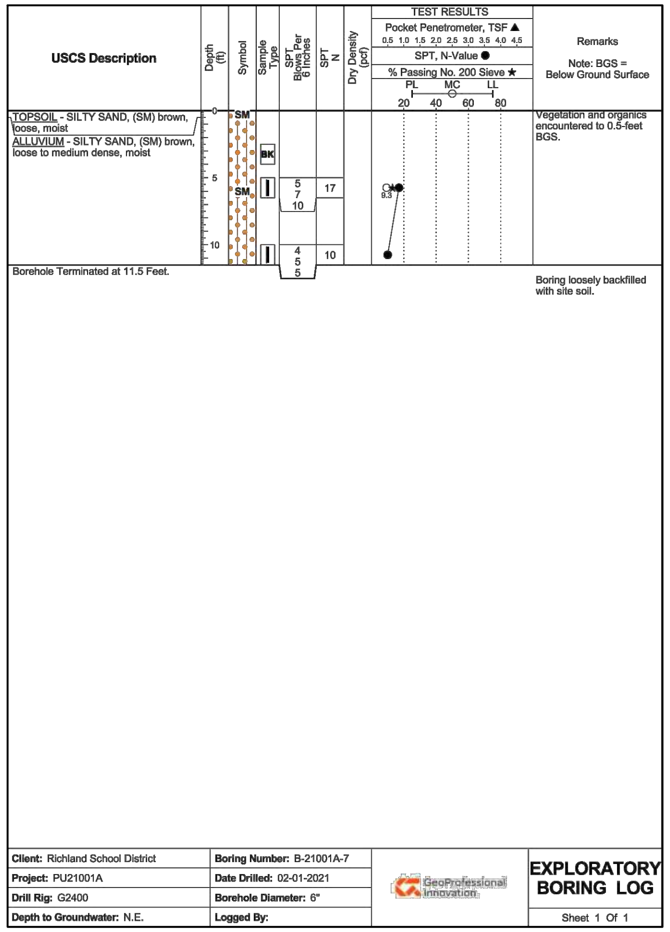
EXPLORATORY BORING LOG

Sheet 1 Of 1



TOPSOIL - SILTY SAND, (SM) brown, loose, moist

ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
5 7 10	17
4 5 5	10

Vegetation and organics encountered to 0.5-feet BGS.

Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-7
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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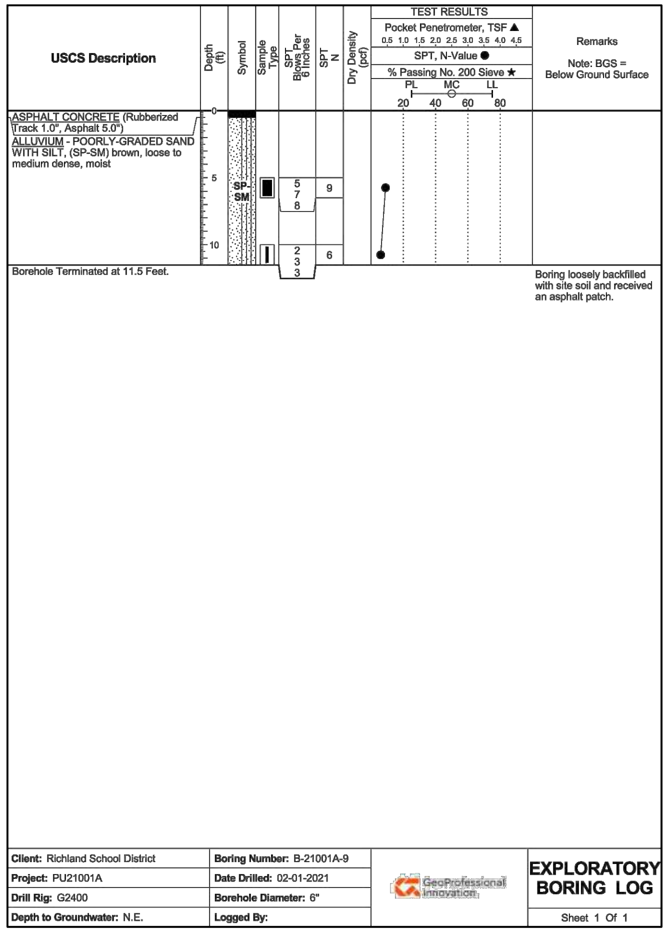
EXPLORATORY BORING LOG

Sheet 1 Of 1



ASPHALT CONCRETE (Rubberized Track 1.0", Asphalt 5.0")

ALLUVIUM - POORLY-GRADED SAND WITH SILT, (SP-SM) brown, loose to medium dense, moist

Borehole Terminated at 11.5 Feet.

SPT Blows Per 6 Inches	SPT N
5 7 8	9
2 3 3	6

Boring loosely backfilled with site soil and received an asphalt patch.

Client: Richland School District	**Boring Number:** B-21001A-9
Project: PU21001A	**Date Drilled:** 02-01-2021
Drill Rig: G2400	**Borehole Diameter:** 6"
Depth to Groundwater: N.E.	**Logged By:**

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EXPLORATORY BORING LOG

Sheet 1 Of 1

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☒ PRELIMINARY REVIEW
☒ YOUR APPROVAL
☒ REFERENCE
☐ CONSTRUCTION
☐ DESTROY PREVIOUS PRINTS

REV	DATE	DESCRIPTION
1	3/5/2021	30% DRAFT
2	8/5/2021	90% DRAFT
3	8/18/2021	FINAL

CHECK: TJW
FILE: PU21001
PROJECT:
FRAN RISH STADIUM
GEOTECHNICAL
ENGINEERING EVALUATION
1350 LEE BOULEVARD
RICHLAND,WA

DRAWN: AMC
DESIGN: TJW
PREPARED FOR:
RICHLAND SCHOOL DISTRICT
C/O CONSTRUCTION SERVICE
GROUP
104 CLOVER ISLAND DRIVE,
SUITE 202
KENNEWICK, WA, 99336

ATTN: MR. MIKE MELLING

RICHLAND
School District

TRAVIS J. WAMBEKE

GeoProfessional
Innovation®

GPI 6 O'Donnell Road Pullman, WA 99163 509.339.2000

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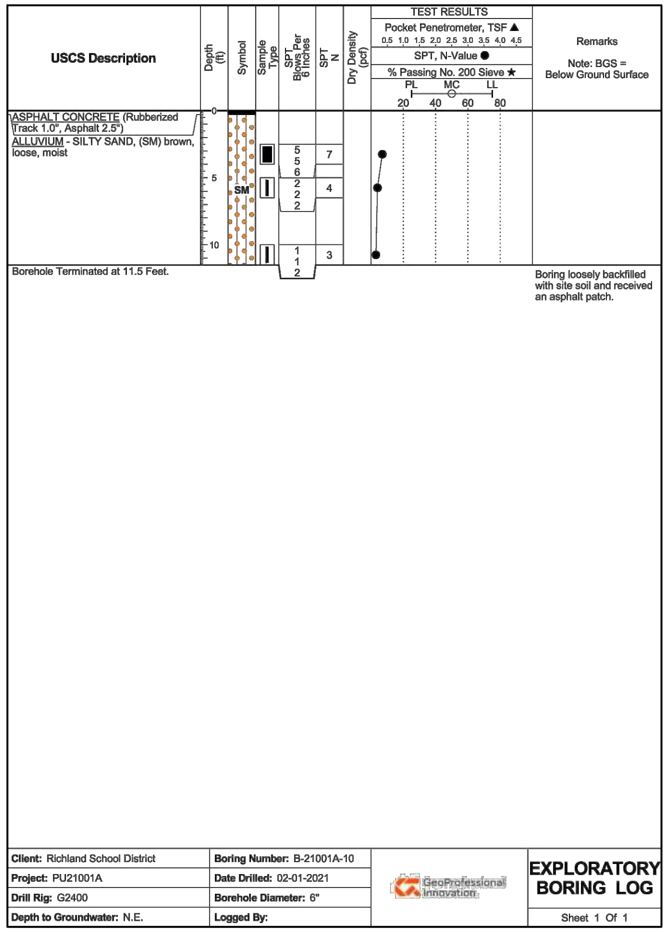
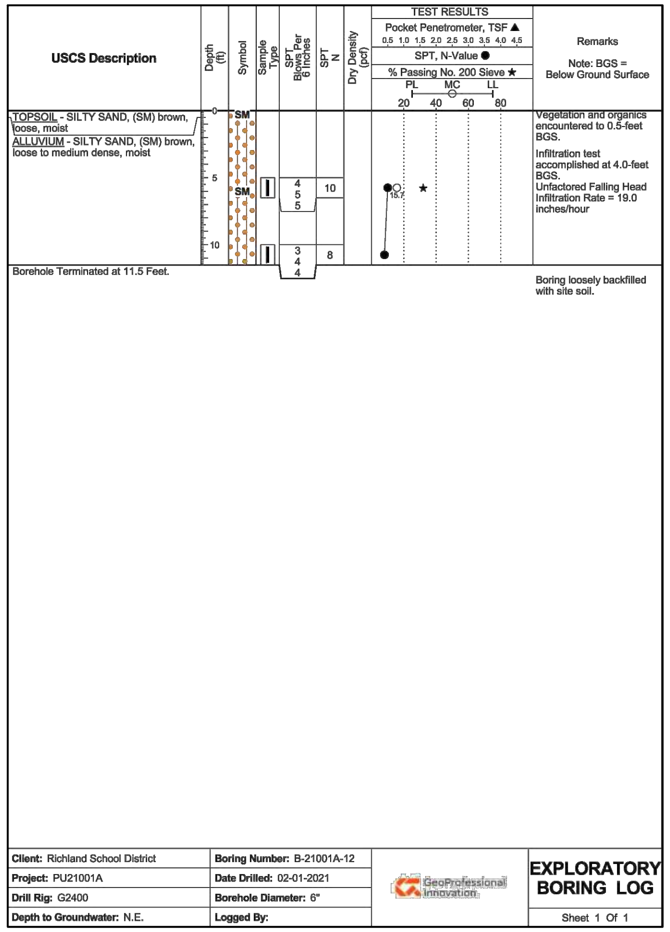
EXPLORATION LOGS



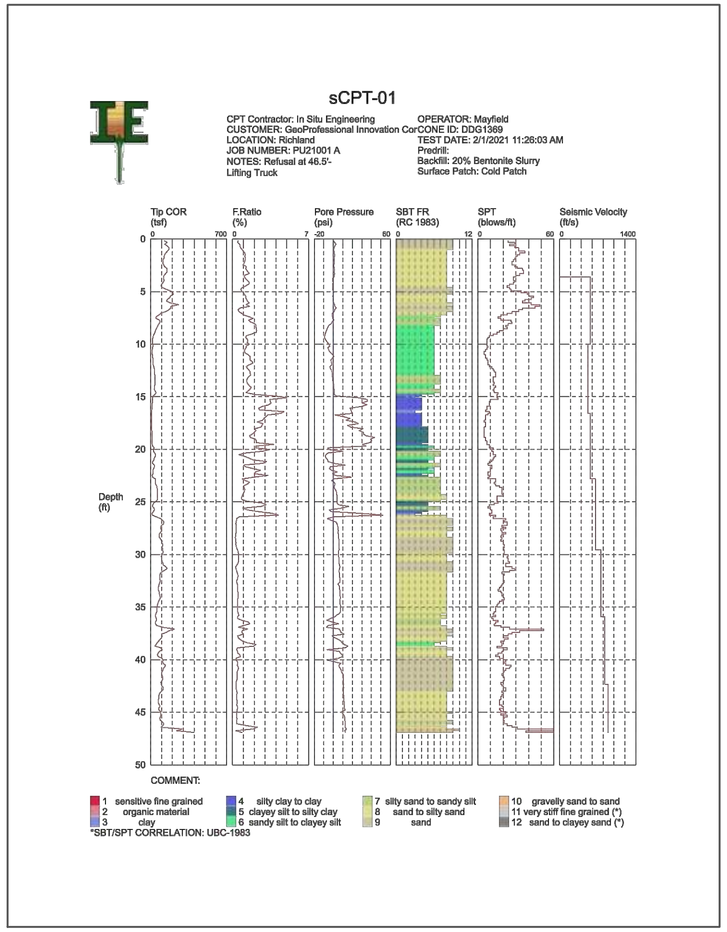
USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks Note: BGS = Below Ground Surface
ASPHALT CONCRETE (Rubberized Track 1.0", Asphalt 2.5") ALLUVIUM - SILTY SAND, (SM) brown, loose, moist	0	SM		5 5 6	7			
	5			2 2 2	4			
	10			1 1 2	3			
Borehole Terminated at 11.5 Feet.								Boring loosely backfilled with site soil and received an asphalt patch.

Client: Richland School District	**Boring Number:** B-21001A-10		EXPLORATORY BORING LOG
Project: PU21001A	**Date Drilled:** 02-01-2021		
Drill Rig: G2400	**Borehole Diameter:** 6"		
Depth to Groundwater: N.E.	**Logged By:**		Sheet 1 Of 1



USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks Note: BGS = Below Ground Surface
TOPSOIL - SILTY SAND, (SM) brown, loose, moist ALLUVIUM - SILTY SAND, (SM) brown, loose to medium dense, moist	0	SM						Vegetation and organics encountered to 0.5-feet BGS. Infiltration test accomplished at 4.0-feet BGS. Unfactored Falling Head Infiltration Rate = 19.0 inches/hour
	5	SM		4 5 5	10		15.7	
	10			3 4 4	8			
Borehole Terminated at 11.5 Feet.								Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-12		EXPLORATORY BORING LOG
Project: PU21001A	**Date Drilled:** 02-01-2021		
Drill Rig: G2400	**Borehole Diameter:** 6"		
Depth to Groundwater: N.E.	**Logged By:**		Sheet 1 Of 1



sCPT-01

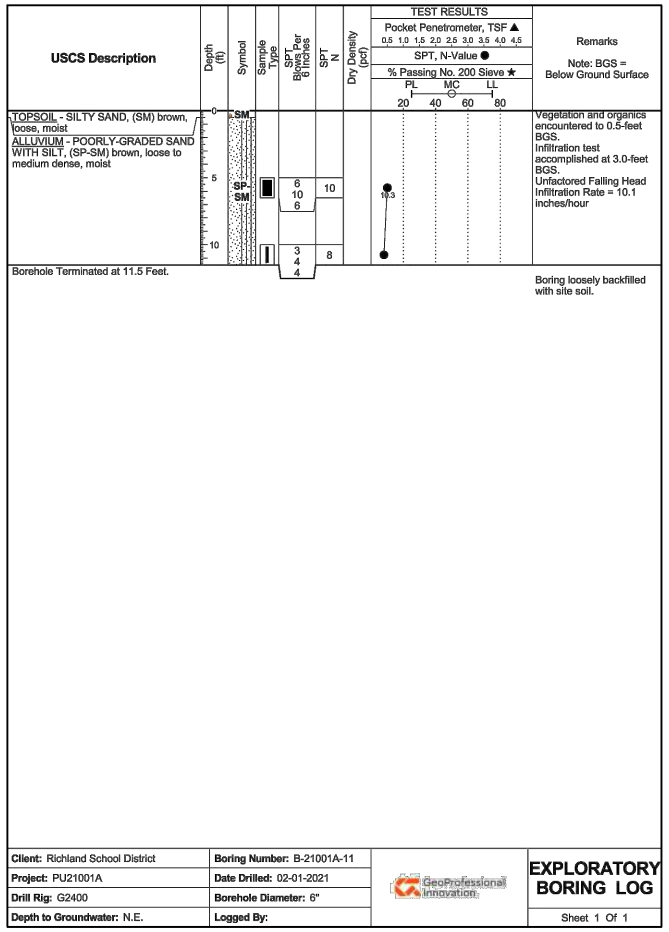
CPT Contractor: In Situ Engineering
CUSTOMER: GeoProfessional Innovation Cor
LOCATION: Richland
JOB NUMBER: PU21001 A
NOTES: Refusal at 46.5'-
Lifting Truck

OPERATOR: Mayfield
CONE ID: DDG1369
TEST DATE: 2/1/2021 11:26:03 AM
Predrill:
Backfill: 20% Bentonite Slurry
Surface Patch: Cold Patch

COMMENT:

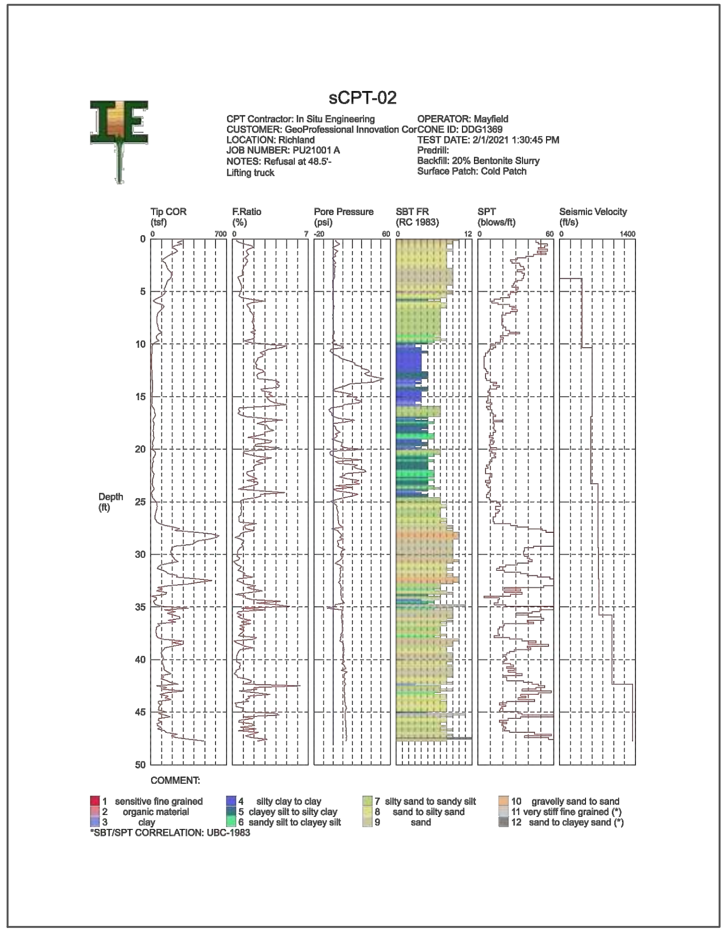
1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983



USCS Description	Depth (ft)	Symbol	Sample Type	SPT Blows Per 6 Inches	SPT N	Dry Density (pcf)	TEST RESULTS	Remarks Note: BGS = Below Ground Surface
TOPSOIL - SILTY SAND, (SM) brown, loose, moist ALLUVIUM - POORLY-GRADED SAND WITH SILT, (SP-SM) brown, loose to medium dense, moist	0	SM						Vegetation and organics encountered to 0.5-feet BGS. Infiltration test accomplished at 3.0-feet BGS. Unfactored Falling Head Infiltration Rate = 10.1 inches/hour
	5	SP-SM		6 10 6	10		10.3	
	10			3 4 4	8			
Borehole Terminated at 11.5 Feet.								Boring loosely backfilled with site soil.

Client: Richland School District	**Boring Number:** B-21001A-11		EXPLORATORY BORING LOG
Project: PU21001A	**Date Drilled:** 02-01-2021		
Drill Rig: G2400	**Borehole Diameter:** 6"		
Depth to Groundwater: N.E.	**Logged By:**		Sheet 1 Of 1



sCPT-02

CPT Contractor: In Situ Engineering
CUSTOMER: GeoProfessional Innovation Cor
LOCATION: Richland
JOB NUMBER: PU21001 A
NOTES: Refusal at 48.5'-
Lifting truck

OPERATOR: Mayfield
CONE ID: DDG1369
TEST DATE: 2/1/2021 1:30:45 PM
Predrill:
Backfill: 20% Bentonite Slurry
Surface Patch: Cold Patch

COMMENT:

1 sensitive fine grained	4 silty clay to clay	7 silty sand to sandy silt	10 gravelly sand to sand
2 organic material	5 clayey silt to silty clay	8 sand to silty sand	11 very stiff fine grained (*)
3 clay	6 sandy silt to clayey silt	9 sand	12 sand to clayey sand (*)

*SBT/SPT CORRELATION: UBC-1983

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☐ CONSTRUCTION
☐ DESTROY PREVIOUS PRINTS

REV	DATE	DESCRIPTION
1	3/5/2021	30% DRAFT
2	8/5/2021	90% DRAFT
3	8/18/2021	FINAL

CHECK: TJW
FILE: PU21001
PROJECT:
FRAN RISH STADIUM
GEOTECHNICAL
ENGINEERING EVALUATION
1350 LEE BOULEVARD
RICHLAND, WA

DRAWN: AMC
DESIGN: TJW
PREPARED FOR:
RICHLAND SCHOOL DISTRICT
C/O CONSTRUCTION SERVICE
GROUP
104 CLOVER ISLAND DRIVE,
SUITE 202
KENNEWICK, WA, 99336

ATTN: MR. MIKE MELLING

RICHLAND
School District

GeoProfessional Innovation®
GPI 6 O'Donnell Road Pullman, WA 99163 509.339.2000

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LABORATORY TEST RESULTS

Test Results Summary

Boring/Test Pit B/TP	Depth (feet)	Description (U.S.C.S. Classification)	In situ Moisture, %	Max Dry Density, pcf	Optimum Moisture, %	#200 Sieve Passing, %	Oroganic Matter %	Cation Exchange Capacity meq/100g	pH	Resistivity Ω·cm	Sulfates ppm
B-21001A-6	5.0-6.5	Silt (ML)	22.7	-	-	81.9	-	-	-	-	-
B-21001A-5	10.0-11.5	Silt with Sand (ML)	29.7	-	-	20.2	-	-	-	-	-
B-21001A-7	5.0-6.5	Silty Sand (SM)	9.3	-	-	13.0	-	-	-	-	-
B-21001A-1	15.0-16.5	Sandy Silt (ML)	28.7	-	-	58.0	-	-	-	-	-
B-21001A-5	5.0-6.5	Silty Sand (SM)	6.8	-	-	-	-	-	-	-	-
B-21001A-4	10.0-11.5	Silt with Sand (ML)	28.8	-	-	-	-	-	-	-	-
B-21001A-1	25.0-26.5	Sandy Silt (ML)	35.9	-	-	-	-	-	-	-	-
B-21001A-7	2.5-4.0	Silty Sand (SM)	10.3	127.0	11.5	-	-	-	-	-	-
B-21001A-8	5.0-6.5	Silty Sand (SM)	-	-	-	-	1.91	8.9	7.6	4350	40.8
B-21001A-11	5.0-6.5	Poorly-graded Sand with Silt (SP-SM)	10.3	-	-	10.0	-	-	-	-	-
B-21001A-12	5.0-6.5	Silty Sand (SM)	15.7	-	-	32.0	-	-	-	-	-
B-21001A-2	15.0-16.5	Silty Sand (SM)	29.4	-	-	16.2	-	-	-	-	-
B-21001A-2	40.0-41.5	Poorly-graded Sand with Silt (SP-SM)	25.8	-	-	9.4	-	-	-	-	-
B-21001A-2	25.0-26.5	Silty Sand (SM)	38.1	-	-	-	-	-	-	-	-
B-21001A-2	5.0-6.5	Silty Sand (SM)	11.0	-	-	-	-	-	-	-	-

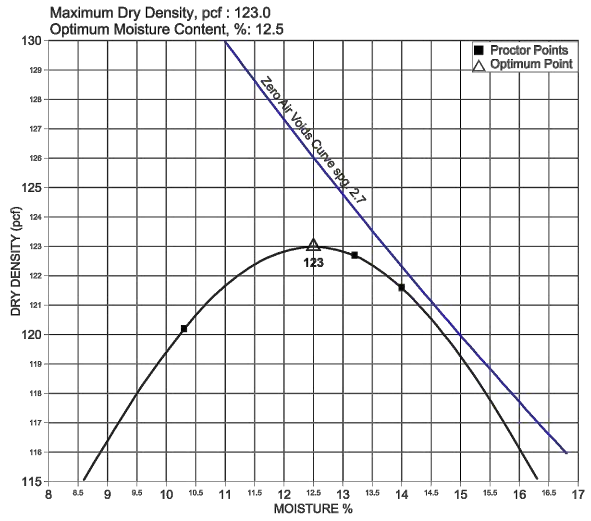
MOISTURE-DENSITY RELATIONSHIP CURVE
ASTM D 1557
Method C

GRADING ANALYSIS

SCREEN SIZE	% PASSING	AS TESTED
3/4 Inch	100	100
3/8 Inch	100	100
No. 4	99	99

Project: Fran Rish Stadium
Client: Richland School District
File Name: PU21001A
Sample Location: B-21001A-7 @ 2.5 - 4.0 feet BGS
Sample Classification: Silty Sand (SM)
Date Tested: 2/2/2021 By: MP
Rammer Type: Manual

Maximum Dry Density, pcf : 123.0
Optimum Moisture Content, %: 12.5

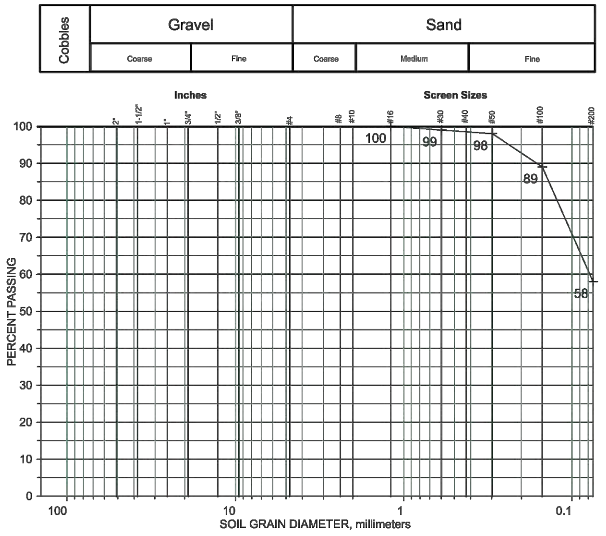


Reviewed By:

GeoProfessional Innovation.

GRADATION ANALYSIS
ASTM D6913

Project: Fran Rish Stadium
Client: Richland School District
File: PU21001A
Sample Location: B-21001A-1 @ 15.0-16.5 feet BGS
Description: Sandy Silt (ML)
Date tested: 2/2/2021 By: BC

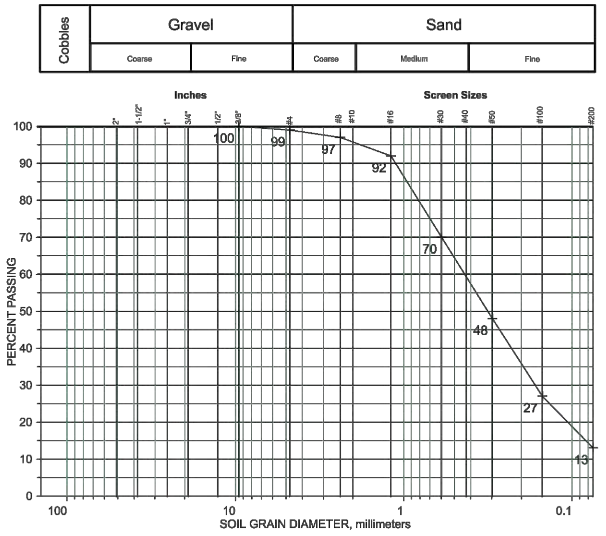


Reviewed by:

GeoProfessional Innovation.

GRADATION ANALYSIS
ASTM D6913

Project: Fran Rish Stadium
Client: Richland School District
File: PU21001A
Sample Location: B-21001A-7 @ 5.0-6.5 feet BGS
Description: Silty Sand (SM)
Date tested: 2/2/2021 By: BC

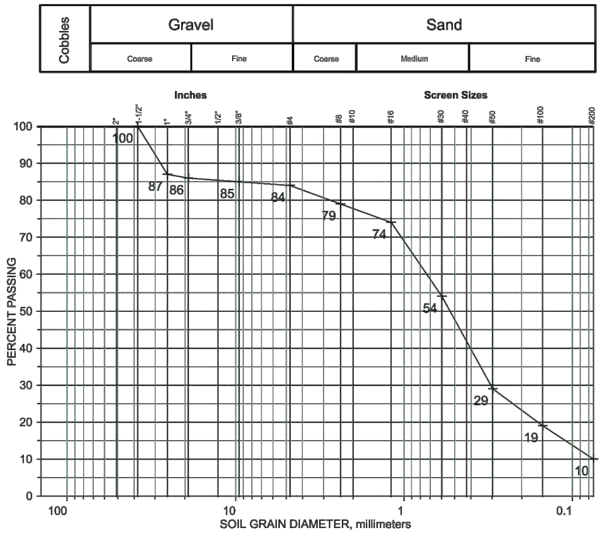


Reviewed by:

GeoProfessional Innovation.

GRADATION ANALYSIS
ASTM D6913

Project: Fran Rish Stadium
Client: Richland School District
File: PU21001A
Sample Location: B-21001-11 @ 5.0-6.5 feet BGS
Description: Poorly-graded Sand with Silt and Gravel (SM)
Date tested: 2/2/2021 By: BC

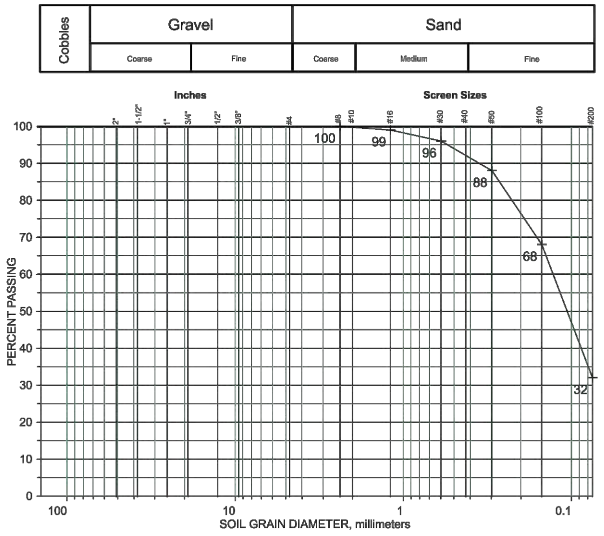


Reviewed by:

GeoProfessional Innovation.

GRADATION ANALYSIS
ASTM D6913

Project: Fran Rish Stadium
Client: Richland School District
File: PU21001A
Sample Location: B-21001A-12 @ 5.0-6.5 feet BGS
Description: Silty Sand (SM)
Date tested: 2/2/2021 By: BC



Reviewed by:

GeoProfessional Innovation.

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REV	DATE	DESCRIPTION
1	3/5/2021	30% DRAFT
2	8/5/2021	90% DRAFT
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CHECK: TJW
FILE: PU21001

PROJECT:
FRAN RISH STADIUM
GEOTECHNICAL
ENGINEERING EVALUATION
1350 LEE BOULEVARD
RICHLAND,WA

DRAWN: AMC
DESIGN: TJW

PREPARED FOR:
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104 CLOVER ISLAND DRIVE,
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ATTN: MR. MIKE MELLING

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GPI 6 O'Donnell Road Pullman, WA 99163 509.339.2000

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