EXHIBIT B

SPECIAL PROVISIONS

CITY OF FLAGSTAFF

SHEEP CROSSING FUTS TRAIL

CITY OF FLAGSTAFF PROJECT NO.

03-17001 & ST3305

PREPARED BY

TURNER ENGINEERING INC.
CONSULTING CIVIL ENGINEERING
528 West Aspen Avenue
Flagstaff, Arizona 86001
Ph. 928 779-1814

Project Number 10617
August 28, 2019
Revised January 13, 2020

Registered Professional Engineer (Civil)
CERTIFICATE NO.
16258
PAUL W.
TURNER
Date Signed 1-15-20
ARIZONA U.S.A.

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NEW PART 000
INTRODUCTION

Modifications to the City of Flagstaff Engineering Design and Specifications for New Infrastructure, the MAG Specifications, Arizona Department of Transportation Specifications (A.D.O.T.), and the preceding City of Flagstaff's Amendments to MAG STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION – Amended May, 2019 EDITION (Hereinafter known as Exhibit A) are made in these Special Provisions and take precedence over aforementioned Specifications. Where there is no conflict between MAG Specifications, A.D.O.T. Specifications and the City of Flagstaff's Revisions of MAG Standard Specifications for Public Works Construction and the city of flagstaff engineering design standards and specifications for new infrastructure these Special Provisions are to be construed as being additions or replacements to the Specifications. In cases of conflict between the other Specifications and the Special Provisions, the Special Provisions are to be construed as supplanting only the conflicting portions of the other Specifications.

MAG UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION (2018 EDITION) AND EXHIBIT A ARE HEREBY AMENDED TO INCLUDE THE FOLLOWING:

PART 100
GENERAL CONDITIONS

SECTION 103
AWARD AND EXECUTION OF CONTRACT

103.6 CONTRACTOR'S INSURANCE:

103.6.1 General: (add the following after the first sentence)

No additional payment shall be made for compliance with insurance requirements and certificates.

SECTION 104
SCOPE OF WORK

104.1: WORK TO BE DONE:

104.1.2 Maintenance of Traffic: (add the following)

The Contractor is responsible for preparing, submitting and obtaining approval of a complete traffic control plan satisfactory to the Project Manager. A permit shall not be issued until approval is granted from the City of Flagstaff (Public Improvements Permit at no cost to Contractor) and Arizona Department of Transportation (ADOT), Transportation Departments. Detailed traffic control plans shall include provisions for access to all adjacent properties within the project area. Fort Tuthill points of vehicular and pedestrian ingress/egress shall remain accessible at all times throughout construction – at no time during construction shall access be limited or closed. Traffic Control Plan & Implementation are pursuant to Exhibit A. Finalization of the traffic control plan(s) will be done prior to issuance of the Public Improvements Permit and Encroachment Permit through the City's Transportation Engineering Section, ADOT and Coconino County, respectively.

104.2 ALTERATION OF WORK:

104.2.3 Due to Extra Work: (modify Exhibit A as following)

Delete the last sentence in the first paragraph.

Delete the last paragraph.

SECTION 105
CONTROL OF WORK

105.12 MAINTENANCE DURING CONSRUCTION: (add the following)

Portions of the trail work require working in close proximity of traffic inclusive of vehicular, bicycle and pedestrian. The Contractor shall be responsible to secure the work site for general public safety at all times. The cost of this effort shall be included in the cost of whole project.

SECTION 107
LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

107.9 PROTECTION AND RESTORATION OF PROPERTY AND LANDSCAPE: (add the following)

Survey monuments and property corners shall be identified, protected and not disturbed except as noted on the Plans. All costs associated with protecting or re-establishing disturbed survey monuments and property corners shall be the sole responsibility of the Contractor. Re-establishing all monuments and property corners shall be performed by a currently Licensed Arizona Surveyor pursuant to the Arizona State Board of Technical Registration and all applicable State Statutes. Monuments and property corners shall be in place and visible prior to final acceptance of the Project.

107.9.1 COORDINATION OF SERVICE INTERRUPTION AND HOURS OF OPERATION: (add new sub section)

The work affecting adjacent properties services including emergency services, trash and recycling pick-up and mail delivery shall be coordinated with those property owners, occupants, renters, lessees (herein after called owners) being affected. The Contractor shall notify those owners two weeks prior to any interruption in service. Service interruptions shall be coordinated with the affected owners, primarily Fort Tuthill. This may mean that the Contractor will have to do their work during the night or on a weekend or both. This effort and cost shall be included in work of those items that require service interruption.

107.9.2 Erosion and Sediment Control and SWPPP: (new subsection added)

An erosion and sediment control plan sheet is contained within the Plans. The Contractor is required to follow the instructions for obtaining authorization to discharge stormwater from construction activities under the AZPDES Construction General Permit or the most current revision thereto. For specific information about the program or the permit, visit their website at adeq.gov/node/524. This effort will include, but not be limited to, a Notice of Intent (NOI), preparation and maintenance of the SWPPP and a Notice of Termination (NOT). The cost of this effort shall be paid Lump Sum per the Bid Schedule as NPDES & SWPPP.

107.11 CONTRACTOR'S RESPONSIBILITY FOR UTILITY PROPERTY AND SERVICES: (add the following)

All franchise utilities will be asked to attend the preconstruction meeting. The Contractor shall perform required utility potholes. It shall be the Contractor's responsibility to determine the exact location of the utilities prior to any construction operations and to notify the respective utility and the city's project manager at least two (2) weeks prior to commencing any work near the conflict.

The Contractor shall protect existing water, sewer, electric, gas, telephone, cable TV, and fiber optic lines where construction crosses lines. Main line and electric, telephone, cable TV, other components and service lines may not be shown on the plans or may not be accurately shown on the plans. It is the Contractor's responsibility to determine their location in the field. (Call Arizona 811). Protection or repair of existing main or service lines damaged by the Contractor is incidental to the work causing such damage. In the event that there is a physical conflict between an existing utility main or service line and the work, the Contractor shall immediately notify the Project Manager of the conflict. The Project Manager will make a determination as to how the conflict will be resolved. Any Extra Work required as a result of an unforeseen main or service conflict will be ordered and paid for in accordance with Section 104.2.3 in Exhibit A. Locations of underground utilities shown on the plans are to be regarded as approximately only. The Contractor shall perform utility potholes in advance of the trenching or excavation operations to determine the actual locations of underground utilities which may affect the proposed work as called out on the plans. The Contractor shall contact all utility companies prior to commencing any work and shall be responsible for scheduling and coordinating his work activities accordingly to avoid conflicts and delays with utilities. Delays due to the lack of early coordination with utilities shall not warrant an increase in contract time as determined by the City Project Manager.

107.11.1 Payment: (new subsection)

No additional payment shall be made for the franchise utility coordination and pothole work. This cost shall be included in the price bid for the construction or installation of items to which such measures are incidental or appurtenant.

SECTION 108
COMMENCEMENT, PROSECUTION AND PROGRESS

108.4 CONTRACTOR'S CONSTRUCTION SCHEDULE:

108.4.1 Weekly Construction Meetings: (new subsection added)

The Contractor's Responsible Person-in-Charge shall attend weekly construction meetings and be knowledgeable about daily operations. The Contractor shall update the current schedule to include the past work and the worked planned for the next two weeks. In addition to the schedule, the Contractor shall keep a log of problems, issues, complaints, safety, traffic or pedestrian issues, delays, material testing results, inspection results and notes, any service disruptions and

duration, access disruptions and duration, field orders or changes, or any items related to Project that the Project Manager considers necessary. This log shall be updated weekly and be available for review by the Project Manager at the weekly construction meetings. The Contractor shall prepare meeting agendas and meeting minutes. Meeting agendas shall be distributed to the Project Manager two working days prior to the meeting. Minutes shall be distributed within four working days of the meeting. No separate measurement or payment shall be made for weekly construction meetings, agendas and minutes. Weekly construction meetings shall be considered incidental to the work.

108.5 LIMITATION OF OPERATIONS: (add the following)

Notwithstanding anything to contrary, the Contractor shall be prepared to perform some work during nights, weekends and/or both. This generally applies to work within right-of-ways. It also applies to work in and around roadway intersections or driveways. Night time work is to be considered incidental to those bid items requiring night time work and no additional compensation will be paid to the Contractor. The Contractor is hereby made aware of the additional inspection and testing cost and should include such costs in the bid items requiring night time, weekends and/or both (See Exhibit A, 108.5). Night time work shall be done at the request of the Project Manager and requires the approval of the Project Manager.

SECTION 109
MEASUREMENTS AND PAYMENTS

109.2 SCOPE OF PAYMENT: (add the following)

The form for submitting pay requests shall be NSPE form C620. The successful Bidder shall be provided this form in Excel© electronic version upon request at no cost. No additional payment will be made to the contractor for using this form An Adobe© copy is attached as Appendix B for reference.

PART 200
EARTHWORK

SECTION 201 - CLEARING AND GRUBBING

201.3 CONSTRUCTION METHODS:

(revise to include the following)

The Contractor shall have the services of an ISA Certified Arborist to prune trees and cut branches. Payment shall be made per the Bid Schedule.

SECTION 205
ROADWAY EXCAVATION

205.1 DESCRIPTION:

(add the following)

FUTS trail shall be classified under ROADWAY EXCAVATION. All excavation, backfill and embankment work shall include the cost of rock excavation, handling rock or disposing of rock in the bid schedule unit cost for excavation (cut), backfill (fill) and embankment and no separate measurement or payment shall be made. Rock shall be defined as any highly cemented or hard material that may require additional efforts to remove, handle, or dispose of. Furthermore Rock as defined herein shall not be classified as unsuitable material. Sink hole remediation shall be pursuant to the new Subsection **240 SINK HOLE REMEDIATION,** below

205.2 UNSUITABLE MATERIAL: (add the following)

It shall be understood that the amount for this item in the proposal is an estimate only and no guarantee is given that the full amount or any portion of it will actually be utilized. It shall not be utilized without specific written authorization by the Project Manager.

240 SINK HOLE REMEDIATION: (add new section)

240.1 DESCRIPTION:

During design a depression in the ground was identified just west of the north box culvert. The area was investigated by Western Technologies, Inc. and identified in their report WT Job No 2528JW011. Refer to this report for a description and remediation methods. Measurement of the volume of earth to be excavated and replaced for remediation is included in the Bid Schedule.

PART 300
STREETS AND RELATED WORK

SECTION 301
SUB-GRADE PREPARATION

301.1 DESCRIPTION: (add the following)

Site preparation, earthwork factors, fill and backfill, utility installation, slabs-on-grade, corrosion protection, and permanent Cut/Fill Slope Limitations shall all be per the Geotechnical Evaluation prepared by Western Technologies, Inc. Project number 2528JW011 dated 4/4/2018. The Geotechnical Evaluation is attached as Appendix A.

301.3 RELATIVE COMPACTION: (add the following paragraph)

Additional compaction requirements and soil treatment shall be per the Geotechnical Evaluation prepared by Western Technologies, Inc. Project number 2528JW011 dated 4/4/2018. The Geotechnical Evaluation is attached as Appendix A.

SECTION 340
CONCRETE CURB, GUTTER, SIDEWALK, SIDEWALK RAMPS, DRIVEWAY AND ALLEY ENTRANCE

340.3 CONSTRUCTION METHODS: (add the following paragraph)

Curb, gutter, sidewalk, driveway aprons, driveways, and handicapped sidewalk ramps shall be constructed on 3" of A.B.C. or as shown on the plans, placed in accordance with M.A.G. Section 310. The cost for the A.B.C. and placement as specified shall be included in the respective bid item. This does not apply to work inside the tunnel nor FUTS Trail.

340.3.4.1 Expansion Joints: (add the following paragraph)

Transverse expansion joints along concrete flatwork (such as the FUTS trail inclusive of this project) shall have flexible modified PVC joint seal as detailed within the plans. Joints shall be placed not more than forty feet. Cost shall be incidental to the work

340.3.4.2 Contraction Joints: (add the following paragraph)

Transverse contraction joints along concrete flatwork (such as the FUTS trail inclusive of this project) shall be filled with elastomeric sealant as detailed within the plans. Cost shall be incidental to the work.

340.3.4.11: (add the following section) **Concrete Colorization on USFS Lands**

New concrete in the area east of the existing concrete tunnel shall be colorized by the "Natina" process. Contact Natina Products, LLC, Casa Grande, AZ; (877) 762-8462. Alternative colorization processes may be allowed but will be subject to prior approval by the Coconino National Forest, which has jurisdiction over the area. Cost of colorization shall be per the Bid Schedule.

PART 600
WATER AND SEWER

SECTION 601
TRENCH EXCAVATION, BACKFILLING AND COMPACTION

601.1 DESCRIPTION: (add the following)

Storm drain pipes shall be included in this PART 600. Furthermore, add, the Contractor shall complete the required excavations in accordance with generally accepted practice and the plans and specifications and these Special Provisions. The Contractor shall complete the work in whatever type of material they encounter. Trench Rock, is measurement and payment is further defined in Exhibit A.

601.2.3 Trench Grade: (add the following)

Elevation stakes are required for all pipes that have grades shown on the Plans.

602.2.11 DEWATERING: (new subsection)

All water encountered, including, but not limited to, during any excavation, trenching or jacking or tunneling operation shall be disposed of by the Contractor in such a manner as will not damage public or private property or create a nuisance or health problem. The cost of furnishing pumps, pipes and equipment for dewatering will be considered incidental to the work and no additional payment will be made.

PART 800
SOUTH TUNNEL
NEW PART

SECTION 800 DESCRIPTION:

The purpose of this new part is to provide additional special considerations and specifications for using the existing box culverts that are under I-17 and Beulah for both drainage and installing a FUTS trail. The north box will continue to convey drainage and the south box will converted into a FUTS trail. Refer to the Plans for more detail.

SECTION 801 CONCRETE:

The new floor of the FUTS trail shall be ADOT Class B concrete and conform to all ADOT specifications.

SECTION 802 PREPARATION AND TREATMENT OF EXISTING SOUTH TUNNEL FOR USE AS FUTS TRAIL:

1. The tunnel shall be clean of all trash and debris and then pressure washed or use another method to clean all sides, top, bottom and both inlet and outlet, for inspection by the Project Manager for potential defects. It is the contractor's responsibility to keep the tunnel clean and dry throughout the duration of the project and until the final inspection and acceptance. This shall be paid per Clean and Prepare Existing Concrete on the Bid Schedule.
2. Any apparent structural defects identified shall be duly noted for further inspection by a geotechnical and/or structural engineer as maybe deemed necessary by the Project Manager. Remedies shall be identified and quantified and shall be paid for as a field order under 104.2.3 in Exhibit A only by prior written approval of the Project Manager.
3. Interior walls and ceiling shall be checked for surfaces where irregularities exceed more than 1/2'" (one-half inch) from a plane to which they are adjacent to. Those areas should be identified (marked) and require inspection by the Project Manager to determine if further treatment is necessary. Further treatment could be grinding smooth the surface of the protruding side or by filling the sub surface side with an approved concrete filler. Contractor shall submit type, method, and any warranty data of the product to the Project Manager prior to doing the work. Throughout this section, the term "PC" includes all of the many types of polymer resins used in mortars, including epoxy resins. The PC can be used for cold weather repairs down to temperatures as low as 15 °F. PC repairs can be accomplished in thicknesses varying from about ¼ inch to several feet if appropriate precautions are taken. Epoxy PC systems must meet the appropriate requirements of ASTM C881 (100-percent solids, Type III, Grade 2, Class B or C). Class B epoxy is used between 40 and 60 °F. Class C epoxy is used above 60 °F up to the highest temperature defined by the epoxy manufacturer. The temperature at time of application shall determine which Class is appropriate. The filled surface shall be feathered out and troweled smooth and be acceptable to the Project Manager. Irregularity repair shall be measured and paid for in the Bid Schedule by Lump Sum. Estimated Linear feet of repair is 400 feet of varying widths. The actual linear feet may vary and will be paid on a pro-rata share of the Lump Sum amount after cleaning and inspection is performed. The total amount paid may be more or less than the Lump Sum.

4. Crack Sealing: Cracks have been identified within the tunnel. After a thorough cleaning as identified in 1. above, a thorough inspection for cracks shall be made by the City Project Manager and Contractor. Crack sealing of existing walls and ceiling of tunnel shall be accomplished with a sealant "Sikaflex" or approved equal. The Contractor shall follow the manufactures recommendations on applying the crack sealant. Crack sealing shall be measured and paid for in the Bid Schedule by the linear foot. The actual linear feet may vary from the Bid Schedule after cleaning and inspection is performed.
5. In the area that is to receive the floor grate the surface of the wall shall be on a true straight plane. This is required due to the fact the supporting angle iron shall be able to support the grate without excessive gaps or fit too tight. Fitting too tight will not allow for expansion and fitting too loose will not allow for contraction.

CITY OF FLAGSTAFF ENGINEERING DESIGN STANDARDS AND SPECIFICATIONS FOR NEW INFRASTRUCTURE (2017 EDITION) ARE HEREBY AMENDED AS FOLLOWS:

Division 13-17-002

NATIVE SEEDING

Section 13-17-002-0003 Materials

Paragraph B. Replace as follows:

B. Seed. Seed shall be fresh, clean and latest season's crop. Legume seed shall be inoculated with appropriate bacteria cultures in accordance with the manufacturer's instructions. Manufacturer's preinoculated seed with protective coating may be used. Contractor inoculated seed that is not sown within eight (8) hours shall be inoculated again. Seed rates are expressed as pounds of pure live seed (PLS) per one acre. The seed mix shall consist of the following grass species mix:

Grasses		**% of Total Mix 25**	**#/Acres**
Arizona Fescue	*Festuca arizonica*	11.3	2.8
Bottlebush Squireltail	Elymus elymoides	22.7	5.7
Western wheatgrass	Pascopyrum smithii	31.8	8.0
Blue grama	Bouteloua gracilis	13.6	3.4

Little bluestem	Schizachyrium scoparium	20.5	5.1

25# Total/Acre

Division 13-17-004

(New Section)

Invasive Weed Management

Section 13-17-004-0001 General

The contractor shall be responsible for establishing weed management practices that prevent the enhancement, spread or introduction of nonnative weed species within disturbance areas of the project. In all areas of the project, the contractor shall be aware of problem species and high density weed areas within the work area as identified within the approved Weed Management Plan for this project. In areas of grading and earthwork, weeds may be removed and buried by mechanical and/or hand methods to prevent germination or regrowth.

In staging areas, weeds shall be removed prior to entering the construction area. Once weeds have been removed, spread a layer of clean (weed-free) soil or gravel, 3 to 6 inches deep to minimize weed growth. The contractor shall avoid creating staging and storage areas in areas infested with weeds to limit traffic to/from these areas. Upon completion of weed management activities in areas of concern, the contractor shall maintain said area in a weed-free condition. Other areas not directly scheduled for disturbance within the overall project limits may be marked as off limits to travel to prevent spread of weed seed.

Any ground disturbing activities such as parking and staging must occur within the construction project footprint or as approved by the City Inspector.

Section 13-17-004-0002 Equipment Management

Avoid or minimize all types of travel through weed-infested areas, or restrict travel to those periods when spread of seed or propagules is least likely.

Equipment Wash Station: Equipment and vehicles must be washed prior to entering and exiting the project site to remove any traces of noxious or other undesired weeds and plants. This

practice should reduce the level of re-infestation of noxious weeds, and thus, herbicides used to control these species.

Preferably, equipment and vehicles will be cleaned at an off-site, commercial facility prior to entering the construction zone. Temporary locations for washing vehicles and equipment shall be designated within the staging area(s). The horizontal dimensions of the washing areas will be determined by the contractor based on site access needs, number of vehicles being washed at any one time, etc. They must have a filter system, for example at least 6 inches of large cinder or gravel spread over an area 10ft x 30ft. Filter cloth may be used for temporary stations. The area will be a perched drainage to allow excess moisture to drain after being filtered and must be at least 200 feet from a natural drainage to avoid contamination.

Remove mud, dirt, and plant parts from project equipment before moving it into the specific construction area. Determine the need for, and when appropriate, identify sites where equipment can be cleaned. In all cases, cleaning areas are to be located outside of USFS controlled lands. This practice does not apply to service vehicles traveling frequently in and out of the project area that will remain on a clean roadway. Seeds and plant parts accumulated in the cleaning area shall be collected when practical and disposed of in deep fill or by incineration at approved site.

If operating in areas infested with weeds, clean all equipment before leaving the project site. To minimize time spent cleaning equipment, time all work in infested areas last and concurrently, designate a "contaminated" parking lot where project vehicles working in the infested area may be parked for the duration of the project. Seeds and plant parts shall be collected when practical and incinerated.

Section 13-17-004-0003 Measurement and Payment

Invasive Weed Management: Invasive weed management, including weed management and equipment management will be paid as one lump sum for the project as a whole per the Bid Schedule.

AENDMENTS TO ARIZONA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR ROAD AND BRIDGE CONSTRUCTION (2008 EDITION)

SECTION 902 CHAIN LINK FENCE

SECTION 902-1 Description (add the following paragraph)

New chain link fence in the area east of the existing concrete tunnel shall be colorized by the "Natina" process. Fence fabric, fence posts, and all other components shall be colorized. Contact Natina Products, LLC, Casa Grande, AZ; (877) 762-8462. Alternative colorization processes may be possible but will be subject to prior approval by the Coconino National Forest, which has jurisdiction over the area. Payment for colorization of new chain link fence shall be per the Bid Schedule.

Western Technologies Inc.

GEOTECHNICAL EVALUATION REPORT

FUTS I-17 UNDERPASS
Flagstaff, Arizona
WT Reference No. 2528JW011

PREPARED FOR:
Turner Engineering
528 West Aspen Avenue
Flagstaff, Arizona 86001
Attn: Mr. Mike Kearly, P.E.

April 4, 2018

Craig P. Wiedeman, P.E.
Senior Geotechnical Engineer

Reviewed By: Bruce M. MacIlroy, P.E.
Senior Geotechnical Engineer

Western Technologies Inc.
The Quality People
Since 1955

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Flagstaff, Arizona 86004-8934
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April 4, 2018

Turner Engineering
528 West Aspen Avenue
Flagstaff, Arizona 86001

Attn: Mr. Mike Kearly, P.E.

Re: Geotechnical Evaluation
FUTS I-17 Underpass
Flagstaff, Arizona

Job No. 2528JW011

Western Technologies Inc. has completed the geotechnical evaluation for the proposed FUTS Interstate 17 underpass and sinkhole evaluation located near Flagstaff, Arizona. This study was performed in general accordance with our proposal number 2527PW155 dated August 28, 2017. The results of our study, including the boring location diagram, laboratory test results, boring logs, and the geotechnical recommendations are attached.

We have appreciated being of service to you in the geotechnical engineering phase of this project and are prepared to assist you during the construction phases as well. If design conditions change, or if you have any questions concerning this report or any of our testing, inspection, design and consulting services, please do not hesitate to contact us. We look forward to working with you on future projects.

Sincerely,
WESTERN TECHNOLOGIES, INC.
Geotechnical Engineering Services

Craig P. Wiedeman, P.E.
Senior Geotechnical Engineer

Copies to: Addressee (emailed)

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GEOTECHNICAL EVALUATION
FUTS I-17 UNDERPASS
FLAGSTAFF, ARIZONA
JOB NO. 2528JW011

1.0 PURPOSE

This report contains the results of our geotechnical evaluation for the proposed FUTS Interstate 17 underpass and sinkhole evaluation located near Flagstaff, Arizona. The purpose of these services is to provide information and recommendations regarding:

- retaining wall foundation design parameters
- lateral earth pressures
- earthwork
- sinkhole remediation
- drainage
- corrosivity to concrete

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

2.0 PROJECT DESCRIPTION

Based on information provided by Mr. Michael Kearly, P.E., the proposed project will consist of converting an existing stormwater box culvert approximately 300 feet long below Interstate 17 into an underpass for the Flagstaff Urban Trail System. Included is an evaluation of a sinkhole located on the western side of Highway 89A. Additional retaining walls will be added as part of the box culvert conversion. Maximum retaining wall heights are anticipated to be about 5 feet. Should any of our information or assumptions not be correct, we request that the Client notify WT immediately.

3.0 SCOPE OF SERVICES

3.1 Field Exploration

Four borings were drilled to depths ranging from about 8 to 28 feet below existing site grades at the approximate locations shown on the attached boring location diagram. Logs of the borings are presented in Appendix A. Subsoils encountered during drilling were examined visually and sampled at selected depth intervals.

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 include modifications based on laboratory observations and tests of the field samples. The final logs describe the materials encountered, their thicknesses, 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.

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 ASTM and Arizona methods. The following tests were performed and the results are presented in Appendix B.

- Water content
- Dry density
- Compression
- Direct shear
- Expansion
- Gradation
- Plasticity
- Soluble salts and sulfates

Test results were utilized in the development of the recommendations contained in this report.

3.3 Analyses and Report

This geotechnical evaluation 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 required to satisfy the purpose previously described.

This report is for the exclusive purpose of providing geotechnical engineering and/or testing information and recommendations. The scope of services for this project does not include, either specifically or by implication, any environmental assessment of the Site or identification of contaminated or hazardous materials or conditions. If the owner is concerned 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

The Site is an approximate east-west oriented double box concrete culvert running below Interstate 17 and Highway 89A. Each box opening is approximately 10 feet wide and 10 feet tall. Sloped concrete wingwalls are located at both ends of the culvert. The culvert was bordered on both sides by undeveloped land. The sinkhole is located approximately 10 feet west of the western end of the culvert. At the time of our field exploration, the surface expression of the sinkhole was about 12 feet long, 6.5 feet wide and 6 inches deep. The sinkhole had been filled with soil. A previous photo from August, 2016 shows a roughly circular surface expression about 2 feet in diameter and 4 feet deep. The ground surface near both ends of the box culvert was rocky, and contained embedded limestone cobbles and boulders. The ground surface sloped gently down toward both ends of the box culvert. Some minor ponding was present in the box culvert and along the eastern entrance. Evidence of previous ponding was present along the western entrance to the box. Site surface drainage appeared to be poor by means of sheet flow toward both ends of the box culvert. Vegetation in areas adjacent to the culvert consisted of a sparse to moderate growth of native grasses and weeds, with pine trees east and west of the culvert location.

4.2 Subsurface

As presented on the boring logs, Silty SAND fill soil was encountered to a depth of about 5 feet in Boring 1. This soil had been used to fill the deeper surface expression of the sinkhole from earlier. Below the fill was medium dense Silty, Clayey SAND with gravel that extended to a depth of about 20 feet. An approximate 1 foot thick LIMESTONE ledge was encountered at a depth of about 12 feet. Very loose to loose Silty SAND was then found from a depth of about 20 feet and extended to about 28 feet, where auger refusal occurred on hard LIMESTONE.

Boring 2 was located about 10 feet southwest of Boring 1. In Boring 2, surface and near-surface soils to a depth of about 6 feet were found to be medium dense to very dense Silty, Clayey SANDS with gravel and low plasticity fines. The materials underlying the surficial soils and extending to the full depth of exploration consisted of lightly to moderately weathered, thickly bedded, hard LIMESTONE with relatively close fracture spacing. Refusal to auger penetration occurred on hard LIMESTONE at a depth of about 8 feet in Boring 2.

Boring 3 was located about 10 feet northwest of Boring 1. Surface and subsoils extending to the full depth of exploration in Boring 3 were found to be very stiff to hard, non-plastic Sandy SILTS with variable amount of gravel. An approximate 1 foot thick LIMESTONE ledge was encountered at a depth of about 8 feet. Boring 3 was stopped at a depth of about 21 feet on highly weathered LIMESTONE.

Boring 4 was located on the east side of the culvert. Surface and subsoils extending to the full depth of exploration (21 feet) in Boring 4 consisted of loose to dense, Clayey SANDS with variable amounts of gravel and near-high plasticity fines. An approximate 1 foot thick LIMESTONE ledge was encountered at a depth of about 8 feet.

Soil moisture contents in all the borings ranged from slightly damp to moist. Free groundwater was not encountered in any boring at the time of exploration. The logs in Appendix A show details of the subsurface conditions encountered during the field exploration.

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.

5.0 GEOTECHNICAL PROPERTIES

5.1 Laboratory Tests

Laboratory test results indicate that native subsoils exhibit moderate to moderately high compressibility at existing water contents. Low additional compression occurs when the water content is increased. When water is added to compacted near-surface silty, clayey sand soils, low expansion occurs. When water is added to compacted near-surface clayey sand soils, relatively high expansion occurs. The site soils exhibited moderate to relatively high shear strengths at water contents approaching saturation.

5.2 Field Tests

Native subsoils located outside of the sinkhole area exhibited generally moderate to high resistance to penetration using the standard penetration test method (ASTM D1586) and test method ASTM D3550. Penetration resistances in the sinkhole area were low to moderate and varied significantly with depth.

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, **PROJECT DESCRIPTION**, and the assumption that the soil and subsurface conditions are those disclosed by the borings. Others may change the plans, number and type of structures, and finished grades 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.

6.2 Retaining Wall Foundations

If the recommendations contained in this report are followed, the proposed retaining wall structures can be supported by conventional, continuous spread footings bearing on a minimum thickness of 2 feet of site soils removed and recompacted as engineered fill or on 2 feet of lean mix (2-sack) concrete backfill. The depth and lateral extents of the engineered fill/concrete backfill is presented in the **EARTHWORK** section of this report.

The retaining wall footings should bear at least 2.5 feet below the lowest adjacent finished grade. For any portions of the walls that are located on the existing slopes, this depth should be measured from the toe of the retaining wall footing. The footings may be designed to impose a maximum dead plus live-load pressure of up to 2500 pounds per square foot.

We anticipate that total and differential settlement of the proposed retaining wall structures, supported as recommended, should be less than 1 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.

The design bearing capacity applies to dead loads plus design live load conditions. The recommended minimum width of continuous wall footings is 24 inches. The bearing value given is a net bearing value and the weight of the concrete in the footing may be ignored. All footings, stem walls and retaining walls should be reinforced to reduce the potential for distress caused by differential foundation movements.

Site preparation procedures and foundation excavations should be observed by the geotechnical engineer to assess that adequate bearing conditions exist and that recompaction of site soils and/or placement of engineered fill/concrete backfill has been performed satisfactorily. If the soil conditions encountered differ significantly from those presented in this report, supplemental recommendations will be required.

6.3 Lateral Design Criteria

For abutments and wingwalls located above any free water surface with no surcharge loads, recommended equivalent fluid pressures and coefficients of base friction for unrestrained elements are:

Level backfill behind wall:

- Active:
  Existing site soils .....36 psf/ft
  Compacted granular backfill .....30 psf/ft
  Compacted site soils .....36 psf/ft

2:1 (horizontal:vertical) sloping backfill behind wall:

- Active:
  Undisturbed subsoil: .....50 psf/ft
  Compacted granular backfill .....45 psf/ft
  Compacted site soils .....50 psf/ft

3:1 (horizontal:vertical) sloping backfill behind wall:

- Active:
  Undisturbed subsoil .....45 psf/ft
  Compacted granular backfill .....40 psf/ft
  Compacted site soils .....45 psf/ft

- Passive:
  Shallow wall footings .....225 psf/ft

- Coefficient of base friction..... 0.35*

* The coefficient of base friction should be reduced to 0.25 when used in conjunction with passive pressure.

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

- At-rest:
  Existing site soils .....64 psf/ft
  Compacted granular backfill .....55 psf/ft

These lateral earth pressures are not applicable for submerged soils. We should be consulted for additional recommendations if such conditions are to be included in the design. Any surcharge from adjacent loadings must also be considered.

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 inspected and tested during placement.

Fill against walls should be compacted to densities specified in **EARTHWORK**. Medium to high plasticity clay soils should not be used as backfill against walls. Compaction of each

lift adjacent to walls should be accomplished with hand-operated tampers or other lightweight compactors. Overcompaction may cause excessive lateral earth pressures which could result in wall movements.

6.4 Corrosivity to Concrete

The chemical test results indicate that the site soils are negligibly corrosive to concrete. However, in order to be consistent with standard local practice and for reasons of material availability, we recommend that Type II portland cement be used for all concrete on and below grade.

6.5 Sinkhole Remediation

The geologic unit that underlies the surface and subsoils on the Site is the Kaibab Formation that is comprised of interbedded limestones and sandstones. There are numerous accounts of sinkholes developing in highly fractured limestone members within the Kaibab Formation, including several in the Flagstaff area. The sinkhole on this Site was explored using auger drilling techniques. Boring 1 was drilled near the center of the current surface expression of the sinkhole. Boring 2 was drilled about 10 feet southwest of Boring 1, and Boring 3 was drilled approximately 10 feet northwest of Boring 1. Using test method ASTM D3550, drive samples were obtained at 5 foot intervals in all borings, and blow counts were compared. Low blow counts were recorded in Boring 1, and highly weathered limestone was obtained in the samples. Auger refusal was encountered in Boring 2 at a depth of about 8 feet below the existing site grade on hard limestone. Blow counts recorded in Boring 3 were similar to those recorded in Boring 4, which are assumed to represent native soil conditions unaffected by sinkhole activity.

The sinkhole on this Site is likely the result of a collapsed karst feature, as represented by the low resistance to penetration and moderate to moderately high compressibility results obtained on the samples tested. The maximum lateral extent of the area affected by the collapse of the karst is estimated to be an approximate 10 to 15-foot radius from the center of the surface expression of the sinkhole. However, the extent of the affected area could be greater on the eastern side of the sinkhole, as exploration access was limited in that area by the existing 89A development.

The following procedures are recommended to repair the surface distress in the existing sinkhole area:

- Excavate the existing sinkhole surface expression to a minimum depth of 5 feet below the design finished grade in this area. Widen the excavation, as necessary, until dense soils are encountered on all sides of the excavation.

- Remove all previously placed fill, and all loose and disturbed materials from the bottom and sides of the excavation.

- Backfill the excavation with properly compacted, engineered fill material. The fill material should consist of site soils or imported, low expansive engineered fill with a high percentage of fines.

- Backfill should be placed in horizontal lifts with a maximum uncompacted lift thickness of 8 inches. Backfill should be compacted to a minimum of 95 percent of the maximum density as determined by ASTM D698 at a compaction moisture content of optimum plus or minus 3 percent.

- Improve surface drainage, as existing grades allow, for more positive flow throughout the path alignment so that water does not pond in this area. Scarifying and recompacting the bottom and sides of the path both up and down gradient of this area would help to improve surface flow characteristics and reduce infiltration of surface water.

7.0 EARTHWORK

7.1 General

The conclusions contained in this report for the proposed construction and sinkhole remediation are contingent upon compliance with recommendations presented in this section. Any excavating, trenching, or disturbance which 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, grading or backfilling occurs.

7.2 Site Clearing

Strip and remove existing vegetation, organic topsoils, debris, and any other deleterious materials from the retaining wall areas. All exposed surfaces should be free of mounds and depressions which could prevent uniform compaction.

7.3 Excavation

We anticipate that excavations into the site soils for the proposed construction can be accomplished with conventional equipment. Any excavations encountering large boulders may require the use of heavy-duty, specialized equipment, possibly together with large pneumatic hammers, to facilitate rock break up and removal.

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

7.4 Retaining Wall Foundation Preparation

In retaining wall footing areas, remove existing soils to a minimum depth of 2 feet below the bottom of the footing. If engineered fill is used below the footing, removal should extend a minimum of 1 foot horizontally beyond the footing edges. If lean mix (2-sack) concrete backfill is used below the footing, removal may extend straight down along the sides of the footing. Replace the removed soil with properly compacted, engineered fill material or with lean mix (2-sack) concrete backfill.

7.5 Materials

a. Clean, on-site native soils with a maximum dimension of 6 inches or imported materials may be used as fill material for the following:

- retaining wall foundation areas
- trail areas
- sinkhole backfill

b. The more highly expansive clayey sand soils, as encountered in Boring 4, are not recommended for use as retaining wall backfill.

c. Frozen soils should not be used as fill or backfill.

d. Lean mix (2-sack) concrete backfill should consist of aggregate base course material combined with 2 sacks of cement per cubic yard. A minimum 28-day compressive strength of 400 pounds per square inch is recommended.

e. 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 (%)* 1.5

- Maximum soluble sulfates (%) 0.10

* 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.

f. Base course should conform to City of Flagstaff specifications.

7.6 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 fill lifts should not exceed 8 inches.

c. No fill should be placed over frozen ground.

d. Materials should be compacted to the following:

Material Compaction (ASTM D698)	Minimum Percent
• On-site and imported soil, reworked and fill:	
Below footings	95
Trail areas	95
• Aggregate base	95
• Backfill	95

e. The on-site clayey sand soils should be compacted with a moisture content in the range of 1 percent below to 3 percent above optimum. On-site and imported soils with low expansive potential and aggregate base course materials should be compacted with a moisture content in the range of 3 percent below to 3 percent above optimum.

7.7 Compliance

Recommendations for retaining wall foundations and other structural elements 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 Section 2.0. 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, contact WT 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 borings. 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 borings, 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 until the earlier of one year from the date of issuance, a change in circumstances, or discovered variations. After expiration, no person or entity shall have any right to 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 borings, 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 warranty, express or implied, is made.

Not to Scale

Approximate Test Boring Location

FUTS I-17 UNDERPASS	
Boring Location Diagram	
Western Technologies Inc.	
Job No.: 2528JW011	Plate: 1

Geotechnical
Environmental
Inspections
Materials

Western Technologies Inc.
The Quality People
Since 1955

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

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.

"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). A double vertical line within the symbol indicates no sample recovery.

"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. A double vertical line within the symbol indicates no sample recovery. A circle within the symbol indicates sample disturbance.

"SAMPLE TYPE" refers to the form of sample recovery, in which **N** = Split-barrel sample, **R** = Ring-lined sample, **G** = Grab sample.

"DRY DENSITY (LBS/CU FT)" refers to the laboratory-determined dry density in pounds per cubic foot.

"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.

DATE DRILLED: **3-6-18**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 1

EQUIPMENT TYPE: **CME-75**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **G. Burr**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
						SM		Silty SAND (FILL); black, damp
10.4	118	R		12	5	SC-SM		Silty, Clayey SAND; with gravel, yellow/brown, medium dense, damp to moist
								increased moisture with depth
25.3	90	R		18	10			
								limestone lense from 12 to 13 feet
								decreased moisture with depth
17.1	90	R		14	15			
12.1	86	R		2	20	SM		Silty SAND; light brown, very loose to loose, damp
11.7	94	R		8	25			
		G						
		R		refusal				**Auger Refusal at 28 Feet on LIMESTONE**
					30			

N- STANDARD PENETRATION TEST
R- RING SAMPLE
CA- CALIFORNIA MODIFIED SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**
Boring located near surface extension of sinkhole

WESTERN TECHNOLOGIES INC.
2400 Huntington Drive
Flagstaff, AZ 86004-8934

PROJECT: **FUTS I-17 UNDERPASS**
PROJECT NO.: **2528JW011**

PLATE **A-4**

BORING LOG

DATE DRILLED: **3-6-18**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 2

EQUIPMENT TYPE: **CME-75**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **G. Burr**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
		G				SC-SM		Silty, Clayey SAND; with gravel, brown, medium dense to very dense, moist to damp
20.5	105	R		19				
								decreased moisture with depth
12.3	111	R		50/6"	5			
								LIMESTONE; lightly to moderately weathered, close fracture spacing, thickly bedded, hard
		N		refusal				**Auger Refusal at 8 Feet on LIMESTONE**
					10			
					15			
					20			
					25			
					30			

N- STANDARD PENETRATION TEST
R- RING SAMPLE
CA- CALIFORNIA MODIFIED SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**
Boring located approximately 10 feet SW of TB1

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

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PROJECT: **FUTS I-17 UNDERPASS**
PROJECT NO.: **2528JW011**

PLATE **A-5**

BORING LOG

DATE DRILLED: **3-6-18**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 3

EQUIPMENT TYPE: **CME-75**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **G. Burr**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
		G				ML		Sandy SILT; trace to some gravel, brown, hard to very stiff, slightly damp to moist
11.2	122	R		30				
9.6	107	R		50/4"	5			
								limestone lense from 8 to 9 feet
6.5	103	R		50/9"	10			
21.4	85	R		50	15			
16.8	95	R		21	20			
								Boring Stopped at 21 Feet on Highly Weathered LIMESTONE
					25			
					30			

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

N- STANDARD PENETRATION TEST
R- RING SAMPLE
CA- CALIFORNIA MODIFIED SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**
Boring located approximately 10 feet NW of TB1

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Flagstaff, AZ 86004-8934

PROJECT: **FUTS I-17 UNDERPASS**
PROJECT NO.: **2528JW011**

PLATE **A-6**

BORING LOG

DATE DRILLED: **3-6-18**
LOCATION: **See Location Diagram**
ELEVATION: **Not Determined**

BORING NO. 4

EQUIPMENT TYPE: **CME-75**
DRILLING TYPE: **7"HSA**
FIELD ENGINEER: **G. Burr**

MOISTURE CONTENT (% OF DRY WT.)	DRY DENSITY (LBS/CU FT)	SAMPLE TYPE	SAMPLE	BLOWS/FT.	DEPTH (FEET)	USCS	GRAPHIC	SOIL DESCRIPTION
		G				SC		Clayey SAND; trace to some gravel, brown/yellow, loose to dense, moist to slightly damp
26.9	85	R		14				
16.9		R		28	5			
28.4	94	R		10	10			
16.7	122	R		50	15			
8.3	108	R		38	20			
					25			**Boring Stopped at 21 Feet**
					30			

THIS SUMMARY APPLIES ONLY AT THIS LOCATION AND AT THE TIME OF LOGGING. CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH TIME. DATA PRESENTED IS A SIMPLIFICATION.

N- STANDARD PENETRATION TEST
R- RING SAMPLE
CA- CALIFORNIA MODIFIED SAMPLER
G- GRAB SAMPLE
B- BUCKET SAMPLE

NOTES: **Groundwater Not Encountered**

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Flagstaff, AZ 86004-8934

PROJECT: **FUTS I-17 UNDERPASS**
PROJECT NO.: **2528JW011**

BORING LOG

PLATE
A-7

Boring No.	Depth (ft)	USCS Class.	Particle Size Distribution (%) Passing by Weight							Atterberg Limits		Laboratory Compaction Characteristics			Remarks
			3"	¾"	#4	#10	#40	#200	2μ	LL	PI	Dry Density (pcf)	Optimum Moisture (%)	Method	
2	0-5	SC-SM	100	99	76	68	57	40.8		23	5				2
3	0-5	ML		100	94	88	81	54.7			NP				2
4	0-5	SC		100	92	84	74	49.4		42	23				2

NOTE: NP = Non-plastic
μ = microns (2μ = 0.002mm)

REMARKS

Classification / Particle Size / Moisture-Density Relationship

1. Visual
2. Laboratory Tested
3. Minus #200 Only
4. Test Method ASTM D698/AASHTO T99
5. Test Method ASTM D1557/AASHTO T180
6. From the ADOT Family of Curves

Geotechnical Environmental Inspections Materials
Western Technologies Inc.
The Quality People
Since 1955
wt-us.com

PROJECT: FUTS I-17 UNDERPASS
JOB NO.: 2528JW011

SOIL PROPERTIES

PLATE
B-1

Boring No.	Depth (ft.)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Compression Properties			Expansion Properties		Plasticity		Percent Passing #200	Soluble		Remarks
					Surcharge (ksf)	Total Compression (%)		Surcharge (ksf)	Expansion (%)	LL	PI		Salts (ppm)	Sulfate (ppm)	
						In-Situ	After Saturation								
2	0-5	SC-SM	115.7	11.9				0.1	0.1						1,2
4	0-5	SC	111.2	13.5				0.1	5.9						1,2

Notes: Initial Dry Density and Initial Water Content are remolded.

Remarks

1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.

Geotechnical Environmental Inspections Materials

Western Technologies Inc.
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PROJECT: FUTS I-17 UNDERPASS
JOB #: 2528JW011

SOIL PROPERTIES

PLATE
B-2

MOTZZ LABORATORY, INC.

Soil Analysis Report

Western Technologies - Flagstaff
Crockett Saline
2400 East Huntington
Flagstaff, AZ 86004-8934

Project: 2528JW011
Date Received: 3/19/2018
Date Reported: 3/21/2018
PO Number: 2858PO020

Lab Number: 924186-1 **2 (0-5)**

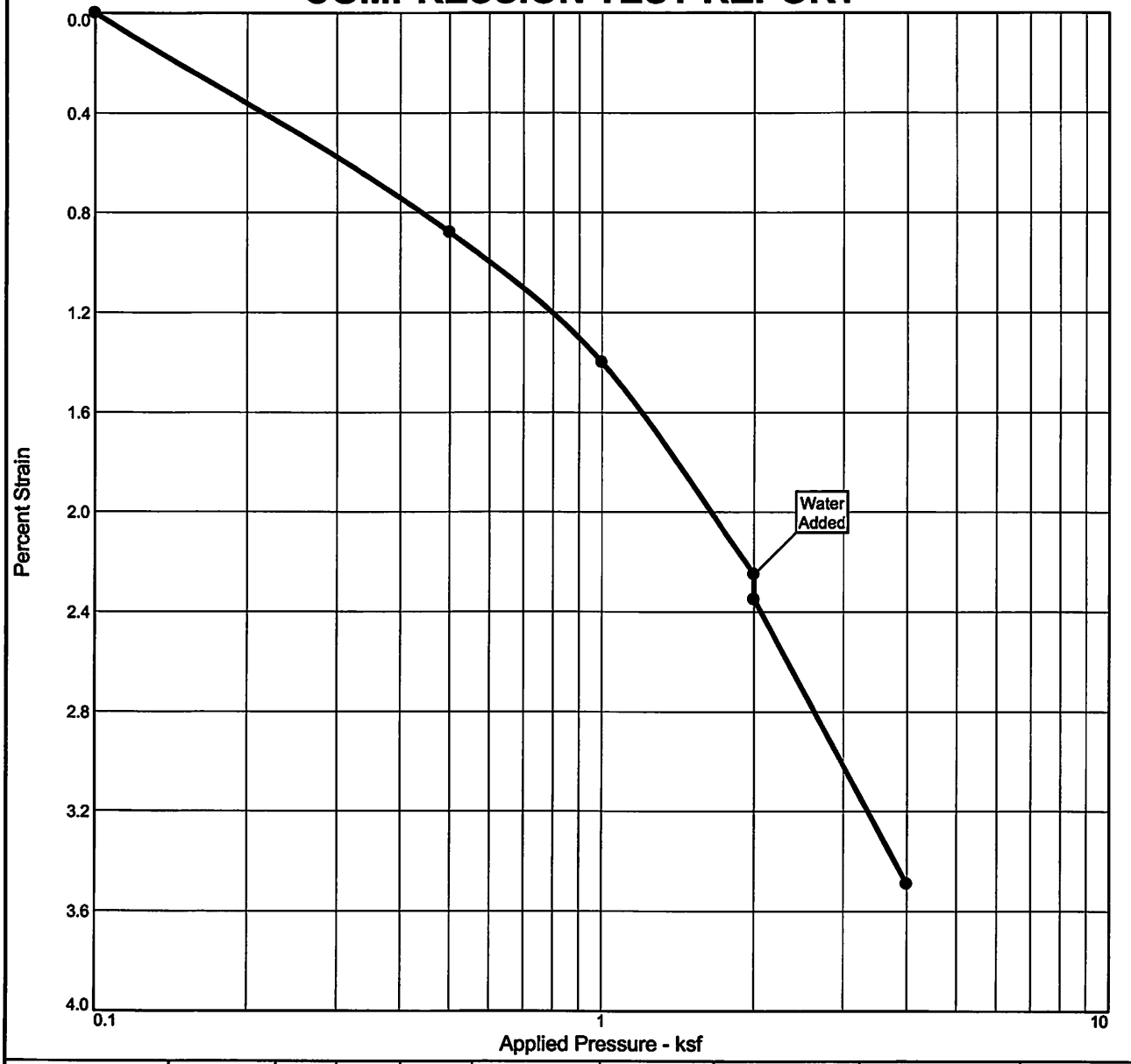
Soluble Salts, Sulfate & Chloride	Method	Result	Units	Levels
Soluble Salts	ARIZ 237b SS	359	ppm	
Sulfate, SO4	ARIZ 733	37	ppm	
Chloride, Cl	ARIZ 736	24	ppm	

Lab Number: 924186-2 **4 (0-5)**

Soluble Salts, Sulfate & Chloride	Method	Result	Units	Levels
Soluble Salts	ARIZ 237b SS	870	ppm	
Sulfate, SO4	ARIZ 733	26	ppm	
Chloride, Cl	ARIZ 736	60	ppm	

3540 E Corona Ave., Phoenix AZ 85040 602-454-2376 (Phone) 602-454-9243 (Fax)

COMPRESSION TEST REPORT



Natural		Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
Sat.	Moist.									
67.5 %	10.4 %	117.5			2.65		0.408		0.1	

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY, CLAYEY SAND WITH GRAVEL	SC-SM	

Project No. 2528JW011 **Client:** TURNER ENGINEERING

Project: FUTS I-17 UNDERPASS

Source: RING SAMPLE **Depth:** 5-6 FEET **Sample No.:** BORING 1

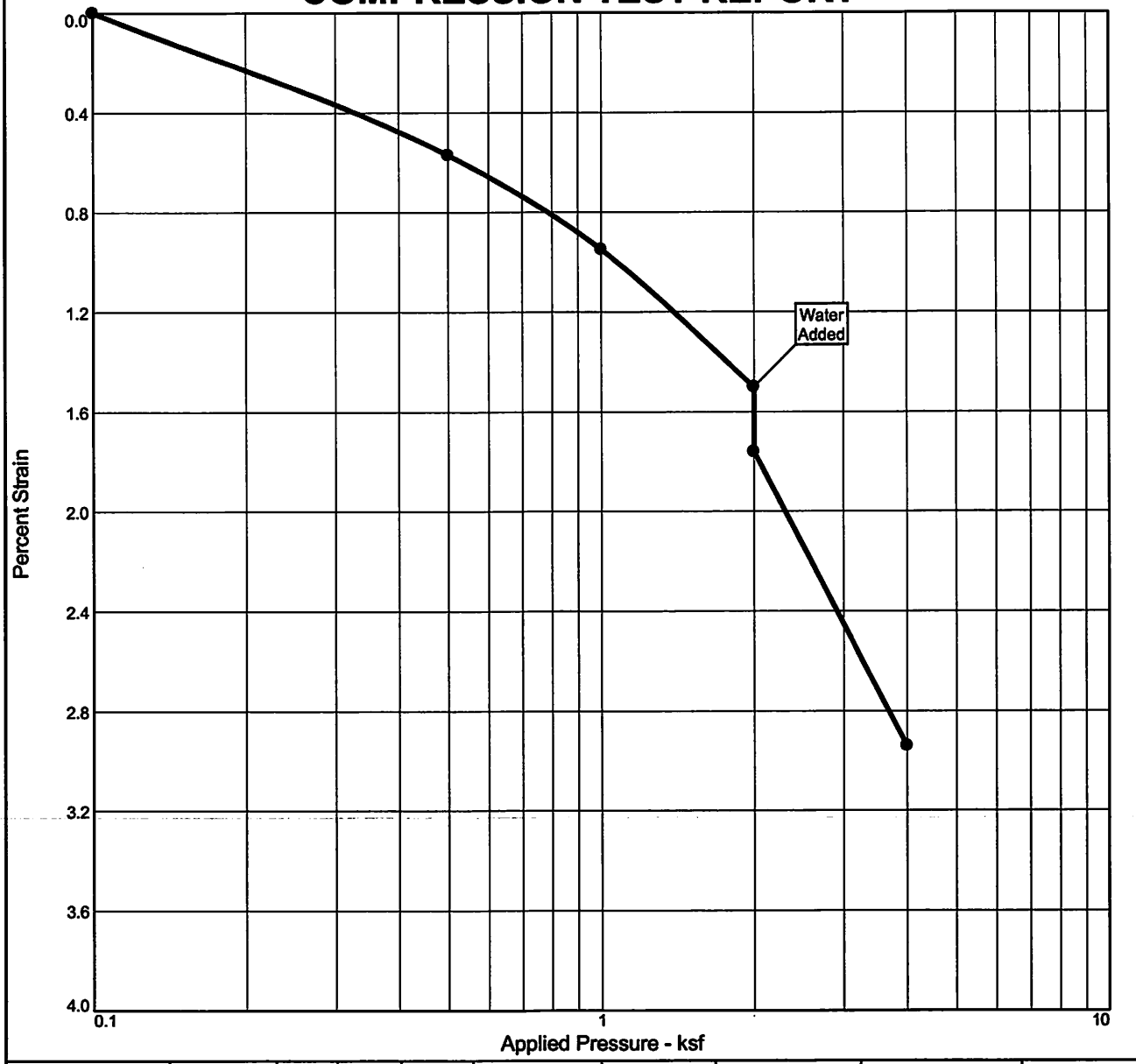
Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-4

COMPRESSION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
34.2 %	12.1 %	85.5			2.65		0.934		0.3	

MATERIAL DESCRIPTION	USCS	AASHTO
SILTY SAND	SM	

Project No. 2528JW011 **Client:** TURNER ENGINEERING

Project: FUTS I-17 UNDERPASS

Source: RING SAMPLE **Depth:** 20-21 FEET **Sample No.:** BORING 1

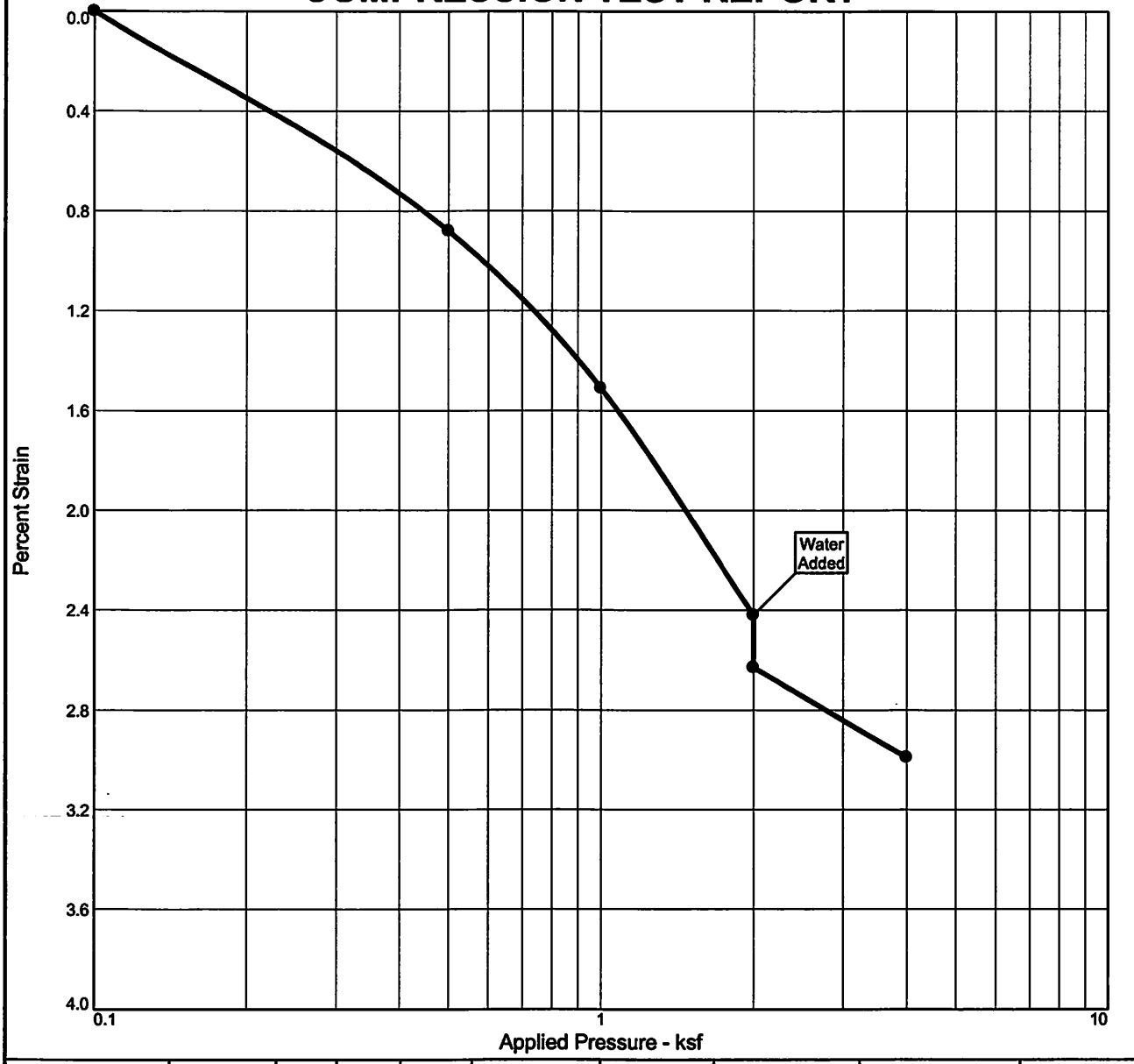
Western Technologies, Inc.

Flagstaff, AZ

Remarks:

Plate B-5

COMPRESSION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
84.4 %	11.2 %	122.4			2.65		0.351		0.2	

MATERIAL DESCRIPTION	USCS	AASHTO
SANDY SILT	SM	

Project No. 2528JW011 **Client:** TURNER ENGINEERING

Project: FUTS I-17 UNDERPASS

Source: RING SAMPLE **Depth:** 2-3 FEET **Sample No.:** BORING 3

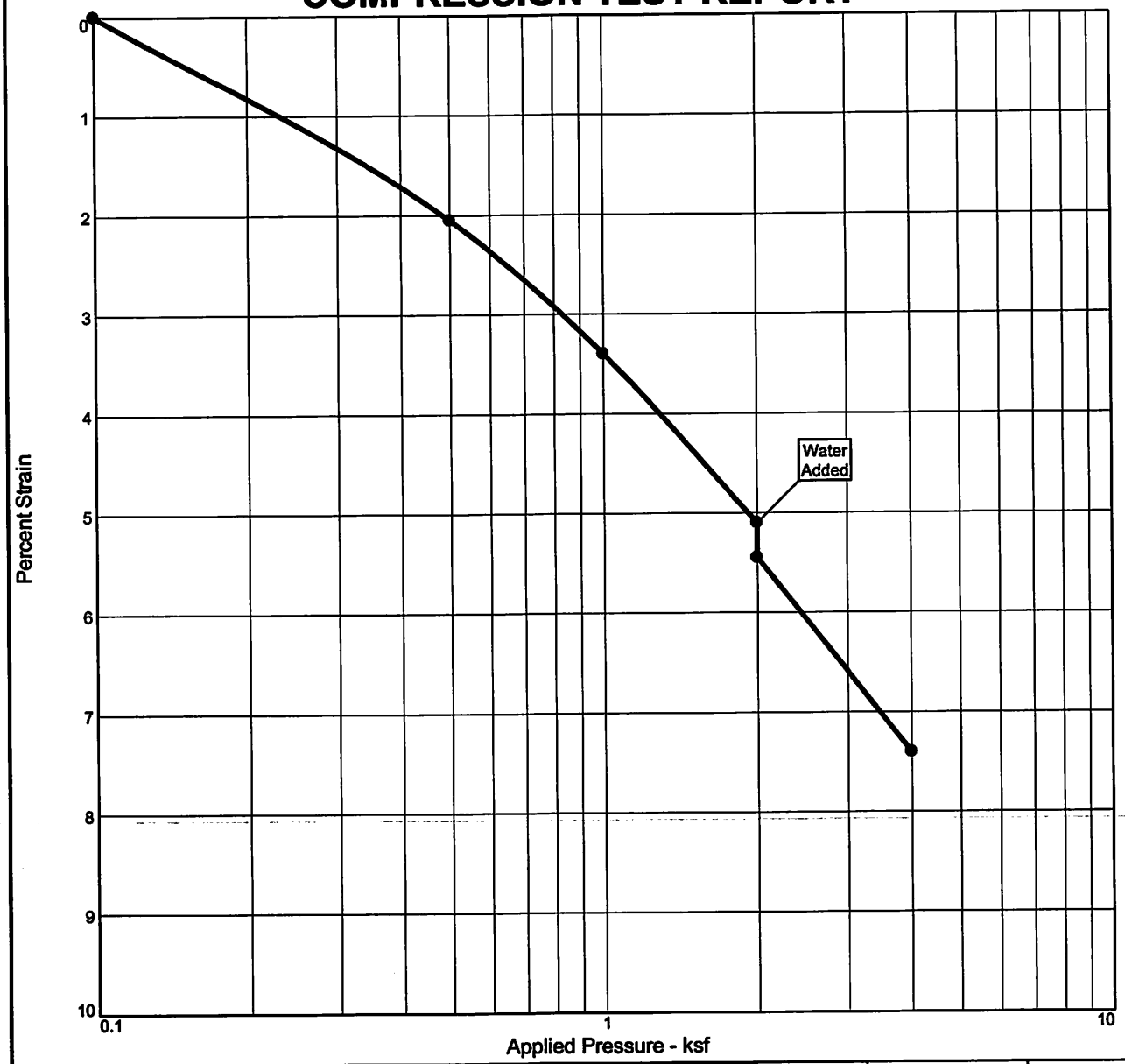
Western Technologies, Inc.

Flagstaff, AZ

Remarks:

Plate B-6

COMPRESSION TEST REPORT



Natural Sat.	Natural Moist.	Dry Dens. (pcf)	LL	PI	Sp. Gr.	Overburden (ksf)	e_o	Swell Press. (ksf)	Clpse. %	C_r
76.0 %	26.9 %	85.4			2.65		0.938		0.4	

MATERIAL DESCRIPTION	USCS	AASHTO
CLAYEY SAND	SC	

Project No. 2528JW011 **Client:** TURNER ENGINEERING

Project: FUTS I-17 UNDERPASS

Source: RING SAMPLE **Depth:** 2-3 FEET **Sample No.:** BORING 4

Remarks:

Western Technologies, Inc.

Flagstaff, AZ

Plate B-7

Boring No.	Depth (ft.)	USCS Class.	Initial Dry Density (pcf)	Initial Water Content (%)	Compression Properties			Direct Shear		Plasticity		Percent Passing #200	Soluble Salts (ppm)	Remarks
					Surcharge (ksf)	Total Compression (%)		Cohesion (ksf)	Φ Angle (deg.)	Liquid Limit	Plasticity Index			
						In-Situ	After Saturation							
2	2-3	SC-SM	104.5	20.5				1.2	37					2,5
4	5-6	SC		16.9										4
4	10-11	SC	93.8	28.4				0.7	20					2,5

Note: Initial Dry Density and Initial Water Content are in-situ values unless otherwise noted.
NP = Non-Plastic

Remarks

1. Compacted density (approx. 95% of ASTM D698 max. density at moisture content slightly below optimum.)
2. Submerged to approximate saturation.
3. Slight rebound after saturation.
4. Sample disturbance observed.
5. ASTM D3080 Procedure

Geotechnical Environmental Inspections Materials

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PROJECT: FUTS I-17 UNDERPASS
JOB NO.: 2528JW011

SOIL PROPERTIES

PLATE
B-8

Appendix B

Contractor's Application for Payment

Owner:		**Owner's Project No.:**	
Engineer:		**Engineer's Project No.:**	
Contractor:		**Contractor's Project No.:**	
Project:			
Contract:			
Application No.:		**Application Date:**	
Application Period:	**From**	**to**	

1. Original Contract Price	$ -
2. Net change by Change Orders	$ -
3. Current Contract Price (Line 1 + Line 2)	$ -
4. Total Work completed and materials stored to date (Sum of Column G Lump Sum Total and Column J Unit Price Total)	$ -
5. Retainage	
a. _____ X $ - Work Completed	$ -
b. _____ X $ - Stored Materials	$ -
c. Total Retainage (Line 5.a + Line 5.b)	$ -
6. Amount eligible to date (Line 4 - Line 5.c)	$ -
7. Less previous payments (Line 6 from prior application)	
8. Amount due this application	$ -
9. Balance to finish, including retainage (Line 3 - Line 4)	$ -

Contractor's Certification

The undersigned Contractor certifies, to the best of its knowledge, the following:

(1) All previous progress payments received from Owner on account of Work done under the Contract have been applied on account to discharge Contractor's legitimate obligations incurred in connection with the Work covered by prior Applications for Payment;

(2) Title to all Work, materials and equipment incorporated in said Work, or otherwise listed in or covered by this Application for Payment, will pass to Owner at time of payment free and clear of all liens, security interests, and encumbrances (except such as are covered by a bond acceptable to Owner indemnifying Owner against any such liens, security interest, or encumbrances); and

(3) All the Work covered by this Application for Payment is in accordance with the Contract Documents and is not defective.

Contractor: _____

Signature: _____ **Date:** _____

Recommended by Engineer		**Approved by Owner**	
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	
Approved by Funding Agency			
By:		**By:**	
Title:		**Title:**	
Date:		**Date:**	

Progress Estimate - Unit Price Work | **Contractor's Application for Payment**

Owner: ______________________ **Owner's Project No.:** __________
Engineer: ______________________ **Engineer's Project No.:** __________
Contractor: ______________________ **Contractor's Project No.:** __________
Project: ______________________
Contract: ______________________

Application No.: __________ **Application Period:** **From** __________ **to** __________ **Application Date:** __________

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
				Original Contract							
					-		-		-		-
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					-		-		-		-
				Original Contract Totals	$ -		$ -	$ -	$ -		$ -

Progress Estimate - Unit Price Work

Contractor's Application for Payment

Owner: ____________________
Engineer: ____________________
Contractor: ____________________
Project: ____________________
Contract: ____________________

Owner's Project No.: ________
Engineer's Project No.: ________
Contractor's Project No.: ________

Application No.: ________ Application Period: From ________ to ________ Application Date: ________

A	B	C	D	E	F	G	H	I	J	K	L
		Contract Information				Work Completed					
Bid Item No.	Description	Item Quantity	Units	Unit Price ($)	Value of Bid Item (C X E) ($)	Estimated Quantity Incorporated in the Work	Value of Work Completed to Date (E X G) ($)	Materials Currently Stored (not in G) ($)	Work Completed and Materials Stored to Date (H + I) ($)	% of Value of Item (J / F) (%)	Balance to Finish (F - J) ($)
Change Orders											
					-		-		-		-
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				Change Order Totals	$ -		$ -	$ -	$ -		$ -
Original Contract and Change Orders											
				Project Totals	$ -		$ -	$ -	$ -		$ -

EJCDC C-620 Contractor's Application for Payment

Stored Materials Summary

Contractor's Application for Payment

Owner: ______
Engineer: ______
Contractor: ______
Project: ______
Contract: ______

Owner's Project No.: ______
Engineer's Project No.: ______
Contractor's Project No.: ______

Application No.: ______ Application Period: From ______ to ______ Application Date: ______

A	B	C	D	E	F	G	H	I	J	K	L	M
						Materials Stored			Incorporated in Work			
Item No. (Lump Sum Tab) or Bid Item No. (Unit Price Tab)	Supplier Invoice No.	Submittal No. (with Specification Section No.)	Description of Materials or Equipment Stored	Storage Location	Application No. When Materials Placed in Storage	Previous Amount Stored ($)	Amount Stored this Period ($)	Amount Stored to Date (G+H) ($)	Amount Previously Incorporated in the Work ($)	Amount Incorporated in the Work this Period ($)	Total Amount Incorporated in the Work (J+K) ($)	Materials Remaining in Storage (I-L) ($)
								-			-	-
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								-			-	-
					Totals	$ -	$ -	$ -	$ -	$ -	$ -	$ -

EJCDC C-620 Contractor's Application for Payment