EXHIBIT A

TECHNICAL SPECIFICATIONS

FOR

City of Tempe

SEWER LINE PROJECT-MCKELLIPS ROAD; LA ROSA DRIVE TO CAVALIER DRIVE

Project No. 3221023E

TEMPE, ARIZONA

December 2024

Mayor
Cory D. Woods

Vice Mayor
Doreen Garlid

City Council
Jennifer Adams
Nikki Amberg
Arlene Chin
Randy Keating
Berdetta Hodge

City Manager
Rosa Inchausti

Dibble Project No. 1024018.01

3020 East Camelback Road, Suite 201
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APPENDICES

DOCUMENTS PROVIDED IN ATTACHED APPENDICES ARE FOR REFERENCE ONLY AND NOT PROFESSIONALLY SEALED BY AUTHOR.

SECTION 100 GENERAL CONDITIONS

The "Uniform Standard Specifications for Public Works Construction" which are sponsored and distributed by the Maricopa Association of Governments (MAG), and which are hereinafter referred to as the "MAG Standard Specifications," are hereby adopted as part of these contract documents. Copies of these documents, with the latest revisions, may be obtained at the Maricopa Association of Governments, 302 North 1st Avenue, Phoenix AZ 85003.

SECTION 101 ABBREVIATIONS AND DEFINITIONS

Add the following subsections to the MAG Standard Specifications:

101.2 Definitions and Terms

City:	City of Tempe, Arizona
Contracting Agency:	City of Tempe, Arizona
Consulting Engineer:	Dibble
	3020 East Camelback Road, Suite 201, Phoenix, AZ 85016
Construction Manager:	TBD

SECTION 104 SCOPE OF WORK

Add the following subsections to the MAG Standard Specifications:

104.1 Work to be Done

The project is generally described as follows: installation of new sewer along McKellips Road from La Rosa Drive to the east to Cavalier Drive to the west. The new sewer will connect to existing sanitary sewer manholes both upstream and downstream of project area.

Major elements of the project include construction and installation of the following: sewer pipe, manholes, concrete encasement, sidewalk, valley gutter, and surface restoration.

104.1.1 General

The work shall be as described in the specifications, as shown on the project plans, and in compliance with permit requirements.

The work shall conform to the City's Public Works and Engineering Standards and Details, and MAG Standard Specifications, latest edition. Any section or any sub-section of any Standard Specification included within these Contract Documents by reference only is understood to be made part of these Contract Documents. The Contractor shall have at least one copy of all referenced standard specifications and details at the job site at all times.

Standard Drawings and the manuals referenced in the project contract documents shall be required for construction of this project, insofar as applicable for any work to be performed within the public right-of-way and within the City jurisdictional limits.

- City of Tempe Supplement to the MAG Uniform Standard Details and Specifications for Public Works Construction
- MAG Standard Specifications and Details
- City of Tempe Traffic Barricade Manual, latest edition
- Manual on Uniform Traffic Control Devices (MUTCD), Millennium Edition, latest version

All work mentioned or indicated within the Contract Documents shall be performed by the contractor as part of this Contract unless it is specifically indicated in the Contract Documents that such construction is to be excluded or modified.

SECTION 105 CONTROL OF WORK

Add the following subsections to the MAG Standard Specifications:

105.2 Plans and Shop Drawings

Remove the following paragraphs:

"If the submittal is acceptable, one (1) copy with each page stamped "Furnish as Submitted" will be returned to the Contractor. The Contractor shall submit additional copies (as required) to the Engineer.

If the Engineer determines that the submittal requires corrections or is to be rejected, one (1) copy stamped "Furnish as Noted" or "Revise and Resubmit" will be returned to the Contractor. The Contractor will submit five (5) corrected or new copies.

The copy stamped "Furnish as Submitted," returned to the Contractor, will become a part of the contract documents and will be kept at the job site. Any work done prior to the receipt of this review will be at the Contractor's risk and expense."

Add the following paragraphs:

If the submittal is acceptable, one (1) copy will be stamped "No Exceptions Taken" and will be returned to the Contractor.

If the submittal is acceptable with minor corrections, one (1) copy will be stamped "Make Corrections Noted" and will be returned to Contractor. Contractor shall make the noted corrections, but a shop drawing resubmittal is not required.

If the submittal requires corrections, one (1) copy will be stamped "Amend & Resubmit" and will be returned to the Contractor. If the submittal is stamped "Amend & Resubmit" the Contractor shall submit a corrected or new copy electronically.

If the submittal is rejected, one (1) copy will be stamped "Rejected" and will be returned to the Contractor. The Contractor shall resubmit a corrected or new copy electronically.

The copy stamped "No Exceptions Taken," returned to the Contractor, will become a part of the contract documents and will be kept at the job site. Any work done prior to the receipt of this review will be at the Contractor's risk and expense.

Electronic submittals shall be in PDF format only.

105.6 Cooperation with Utilities

The Contractor shall notify all affected utility companies and Arizona 811 (602-263-1100 or 811) prior to the start of construction and shall ascertain the locations of the various underground utilities either shown on the Design Drawings and/or as may be brought to their attention by the utility companies. The location of underground utilities shall be determined by "potholing" by the Contractor prior to any trenching or excavation operations.

The existing utilities expected to be encountered and their owners are listed below. This list is for guidelines and may not be all inclusive.

Lumen (formerly CenturyLink) – USIC Dispatch Center	(800) 778-9140
Cox Communications – USIC Dispatch Center	(800) 778-9140
Southwest Gas – ELM Locating Dispatch	(623) 780-3350
Southwest Emergency Number	(602) 271-4277
SRP Electric – SRP Blue Stake	(602) 236-8026
City of Tempe Utilities	(480) 350-4311

Section 105.8 Construction Stakes, Lines and Grades
Section 105.8 of the MAG Standard Specifications is replaced with the following:

The Contractor shall furnish all materials, personnel, and equipment necessary to perform all surveying, staking, laying out of control lines and verifications of the accuracy of all existing control points which are delineated in the design drawings and contract documents. The work shall be done under the direction of a Registered Land Surveyor licensed to practice in the State of Arizona.

Staking Outline: Prior to beginning any survey operations, the Contractor shall furnish to the City of Tempe Project Manager, for approval, a written outline detailing the method of staking, interval of stakes, marking of stakes, grade control for various courses of materials, referencing, structure control, and any other procedures and controls necessary for survey completion. A part of this outline shall also be a schedule which will show the sequencing of the survey and layout work, throughout the course of the contract, listing a percentage of completion for each month.

Field Books: The Contractor shall furnish field books to be used for recording survey data and field notes. These books shall be available for inspection by the City at any time and shall become the property of the City upon completion of the work.

Survey Control Verification:
The Contractor shall protect in place the Project Benchmark, described on the cover sheet:

CITY OF TEMPE ALUMINUM CAP FLUSH AT THE INTERSECTION OF COLLEGE AVENUE AND MCKELLIPS ROAD
OBSERVED GROUND NORTHING: 291749.66
OBSERVED GROUND EASTING: 294636.22
PUBLISHED ELEVATION: 1226.56

The Contractor shall be responsible to stake construction elevations tied to the bench mark.

(A) Control Points (horizontal and vertical) – The existence and location of all survey monuments, bench marks and control points shall be verified prior to demolition or construction activity. Immediately notify the City of Tempe Project Manager when location discrepancies greater than two-hundredths (0.02) foot horizontal or one-hundredth (0.01) foot vertical are found. All datum shall be the City of Tempe Vertical Network.

(B) Control Lines – Construction control lines with grade breaks, transition points, horizontal and vertical curves, etc., shall be established and referenced prior to construction.

Construction Stakes: The Contractor shall set construction stakes and marks establishing lines and grades for utilities and necessary appurtenances and other work as indicated in the design drawings and contract documents and shall be responsible for their conformance with the plans and specifications.

The stakes shall be established in accordance with the following guidelines which represent the minimum standard and the Contractor shall provide additional stakes and controls necessary to perform the work. The Contractor shall be held responsible for the preservation of all stakes and marks and will replace, at no additional cost to the City, any construction stakes or marks which have been carelessly or willfully destroyed by any party.

Inspection and Acceptance of Work: The City reserves the right to make inspections and random checks of any portion of the staking and layout work. If, in the City's opinion, the work is not being performed in a manner that will assure proper control and accuracy of the work, the City will order any or all of the staking and layout work redone at no additional cost to the City.

As-Builts: A full size set of project Design Drawings shall be kept on-site and updated on a weekly basis with a red pencil or red ink to reflect any field adjustments, changes, omissions, additions, etc. as they occur on the project. The PM/CM will check site as-builts on a weekly basis to insure all modified project elements have been properly recorded on the field plan set.

The Contractor shall prepare as-builts using the project Design Drawings. Information shall be shown on these design drawings in red opaque ink, depicting the constructed dimensions, elevations, grades and materials including locations of existing underground utilities found during construction. The City and Engineer will be the sole judge in determining whether the as-builts are acceptable.

All work included in the contract documents as well as changes to the contract shall be noted as correct or modified by either checking off the information if it is correct, or by drawing a neat line through the original data and writing in the correct information in red opaque ink if the information is incorrect. Unless noted otherwise below in the minimum as-built requirement section, station/offset measurements will be from construction centerline/monument line both parallel and transverse to roadway; added items or location changes shall be physically drawn at revised or new locations on the as-builts; and all measurements and stations should be to the nearest tenth of a foot.

The minimum requirements for as-built acceptance are as follows:

(1) Project Drawing Quantity Notations: Any project drawing or quantity summary sheet that shows a quantity on it that is incorrect shall be corrected by drawing a neat line through the original quantity and writing in the correct information. When space on the drawing does not allow room to indicate the corrections, a separate table may be drawn on a separate sheet with reference on both plan sheets to the plan sheet that the table refers to or to the sheet where the table is located.

(2) Existing/New Utilities: All underground infrastructure utilities, whether depicted on the project plans or not, shall be verified, corrected or added to the as-builts noting the beginning and ending station/offset location and elevation of utility relative to finished roadway grade or other identifiable ground or permanent roadway/project feature. Any electrical installation work for street lighting or power connection shall be located relative to construction centerline/monument line or relative to back of curb and gutter (whichever is closer) including the depth of the facility.

(3) Removals: Dimensions and/or other volumetric descriptions and station/offset location of all removed items.

(4) Pipelines: When pipeline parallels the construction centerline/monument line, verify or correct the perpendicular distance between the two. When pipeline angles relative to the construction

centerline/monument line or is in a curved roadway section, as-built measured straight pipe run distances, angle points, changes in size, fitting/tee locations tied-in with practical known construction centerline/monument line location or other easily verifiable permanent point. Distances between fittings are from fitting centerline. All project drawing pipeline cross sections and profiles are to be corrected to reflect modified pipeline locations/alignments. Station and offset locations for sewer line laterals are from main line to ROW line with beginning/ending line location tied to a monument or to a property corner. Locations where waterlines cross curb and gutter are to be noted by station. Where waterlines run parallel to curb and gutter, note locations relative to back of curb or construction centerline/monument line (whichever is closer) including angle points and elevation.

The as-built drawings shall be certified by a Registered Land Surveyor licensed to practice in the State of Arizona. As-built drawings shall be delivered to the City of Tempe Contract Administrator within thirty (30) calendar days from the date of final inspection and acceptance by the City of the work completed under this contract. Work under this bid item includes transfer of all information noted by the Contractor on the on-site as-built drawing set described above under Bid Item number 1. Final payment will be made only after submitted as-builts are accepted by the City (see "Measurement and Payment" below).

Measurement and Payment: Construction surveying will be measured as a single complete item of work and paid at the lump sum price indicated on the Schedule of Bid Items, which amount shall be considered full compensation for the work as described herein and required to provide all necessary survey stakes and control. The approved schedule showing the sequencing and percentage of the survey and layout work shall be the basis on which monthly progress payments shall be made. This schedule shall be subject to periodic review, at the request of either party, if the survey and layout work lags or accelerates. If necessary, the schedule will be revised to reflect changes in survey and layout progress. When approved, the revised schedule will become the basis for payment.

Final payment for survey work under this bid item will be made when the City accepts the final as-built. Should the Contractor fail to submit acceptable as-builts within the maximum 30 calendar day period noted above, the City will execute a deductive change order for 1% of the Construction Survey bid item total from the contract (or $5,500.00, whichever is greater) for every 5 working day period that the contractor fails to provide acceptable as-builts (not including City review time). If the Contractor fails to submit acceptable as-builts after the 3rd submittal, the City will deduct 5% from the Construction Survey As-Built bid item total from the contract (or $10,000.00, whichever is greater) and execute a final change order noting the City's justification for penalizing the contractor for unacceptable as-built preparation.

ITEM 001 CONSTRUCTION SURVEY, LAYOUT, & AS-BUILT LUMP SUM

SECTION 106 CONTROL OF MATERIALS

Add the following subsections to the MAG Standard Specifications:

106.2 SAMPLES AND TESTS OF MATERIALS:

The Contractor shall provide material testing and frequency as stated by MAG Specifications. The Contractor shall obtain an independent laboratory or testing company and pay all costs required by the Contract Documents. A copy of all test results shall be furnished to the City's Construction Manager in a Weekly Summary Report submitted at the weekly construction progress meeting (time and date to be set upon contract award) for tests performed from the preceding week. Before final completion, the Contractor shall submit a final testing report containing all testing results which certifies the work complies with the Contract Documents. This testing report shall be sealed by a Professional Civil Engineer, registered in the state of Arizona who was responsible for overseeing the testing and sampling for said company. Payment for material testing shall be considered incidental to the cost of this project.

The City's Construction Manager will provide Quality Assurance testing to supplement the Contractor's above testing requirements. The Contractor shall provide access and coordination to facilitate the testing required by the Construction Manager's testing lab.

SECTION 107 LEGAL REGULATIONS AND RESPONSIBILITY TO PUBLIC

Add the following subsections to the MAG Standard Specifications:

107.2.1 PERMITS

AZPDES:
Contractor shall be responsible for the preparation and implementation of an Arizona Department of Environmental Quality (ADEQ) Arizona Pollutant Discharge Elimination System (AZPDES) Construction General Permit Notice of Intent (NOI), Notice of Termination (NOT) and Stormwater Pollution Prevention Program (SWPPP) along with the preparation and submittal of all supporting applications and documentation.
Contractor shall be responsible for implementing, installing, maintaining, and removing equipment and facilities specified in the SWPPP. This includes, but not limited to the preparation, installation, maintenance, and removal of temporary SWPPP elements, assuring proper operation of the pollution control devices installed, and all maintenance, cleaning, and disposal costs associated with the cleanup and repair following storm events, runoff or releases on the project.

City of Tempe Right-Of-Way Use Permit:
Contractor shall be responsible for the preparation and submittal of all supporting applications, documentation, and fees necessary for obtaining permits and bonding for construction within City of Tempe rights-of-way.

107.2.1.1 Payment:

Payment for AZPDES, and City of Tempe (COT) permits, as completed herein, shall be made incidental to the cost of pipe installation. No separate payment will be made for this work.

SECTION 109 MEASUREMENTS AND PAYMENTS

Add the following subsections to the MAG Standard Specifications:

109.11 Mobilization and Demobilization:

The City of Tempe will compensate the Contractor for one-time, round trip mobilization to begin work and upon completion of the work demobilization of Contractor's personnel, equipment, supplies and incidentals, establishment of offices, buildings and other facilities required for the performance of the work on the project, existing utility coordination and "potholing", as well as preparatory work and operations prior to the commencement of the work on the project site.

109.11.1 Payment:

Payment for mobilization and demobilization, measured as provided above, will be made at the contract lump sum price. Payment shall be made in equal one-third portions. The first payment will be paid with Contractor's initial billing. The second payment will be made when the total payments to Contractor for the bid items, exclusive of payments for mobilization/demobilization, equals one-half of the total bid by Contractor, exclusive of mobilization and demobilization. The remaining one-third will be paid as part of the final payment due Contractor.

When other contract items are adjusted as provided in Section 109, and if the costs applicable to such items of work include mobilization costs, such mobilization costs will be considered as recovered by Contractor in the lump sum price paid for mobilization and will be excluded from consideration in determining compensation under Section 109.

ITEM 002	***MOBILIZATION/DEMOBILIZATION***	***LUMP SUM***

PART 300 – STREETS AND RELATED WORK

SECTION 336 PAVEMENT MATCHING AND SURFACE REPLACEMENT

Add the following subsections to the MAG Standard Specifications:

336.5 Payment

Payment for AC pavement replacement will be made at the unit bid price per square yard. Such payment shall constitute full compensation for providing equipment and accomplishing this work complete in place as shown on the construction plans. Striping shall be replaced in kind and shall be considered incidental to pavement replacement.

ITEM 003	***AC PAVEMENT REPLACEMENT (COT STANDARD DETAIL T-450)***	***SQUARE YARD***

No separate payment will be made for typical trench backfill of unpaved ground per the City of Tempe Standard Detail T-450. This work will be made and shall be considered incidental to Section 610 WATER LINE CONSTRUCTION.

SECTION 350 REMOVAL OF EXISTING IMPROVEMENTS

Add the following subsections to the MAG Standard Specifications:

350.1 Description

This work shall consist of removal, disposal, replacement of various existing improvements, such as structures, curbs and gutters, sidewalks, riprap, and other items necessary for the accomplishment of the improvements.

Where the items are identified to be salvaged, the Contractor shall deliver the item to a location to be determined by the City. The location for salvaged item delivery shall not be located more than 4 miles from the project site.

350.4 Payment

Payment for removal and replacement of curbs, gutters, sidewalks, and brick manholes includes all labor, equipment, and materials required and shall constitute full compensation for accomplishing all work associated with the removal and replacement of curbs, gutters, sidewalks, brick manhole, concrete manhole, and connecting new sewer to existing manhole base as described in the special provisions and on the design drawings.

ITEM 004	***REMOVE & REPLACE VERTICAL CURB & GUTTER (MAG STD DET 220, TYPE A)***	***LINEAR FOOT***
ITEM 005	***REMOVE & REPLACE SIDEWALK (MAG STD DET 222, TYPE B)***	***SQUARE FOOT***
ITEM 006	***REMOVE & REPLACE 48-INCH DIAMETER BRICK MANHOLE***	***EACH***
ITEM 007	***REPLACE LANDSCAPING IN KIND***	***LUMP SUM***

PART 400 – TRAFFIC CONTROL, RIGHT-OF-WAY DEVELOPMENT AND INCIDENTALS

SECTION 401 TRAFFIC CONTROL

Add the following subsections to the MAG Standard Specifications:

401.5 General Traffic Regulations

Contractor shall submit traffic control plans to the City of Tempe for approval prior to the start of work in accordance with the City of Tempe Traffic Barricade Manual and City of Phoenix Traffic Barricade Manual. Contractor shall maintain traffic flow along McKellips Road at all times with a minimum of one lane open for each direction.
Off duty officers are required per the City of Tempe approved traffic control plans where excavation occurs within 500-feet of a signalized intersection.

401.6 Measurement

Traffic control devices shall be measured according to Contractor supplied invoices for devices provided. Trench plating and road restriping shall not be considered part of traffic control devices, but as incidental to the project.

401.7 Payment

Traffic control devices shall be paid per approved invoice amounts provided by Contractor. The amount allocated for this ALLOWANCE is **$65,000.00**

ITEM 008 TRAFFIC CONTROL ALLOWANCE

PART 600 – WATER, SEWER, STORM DRAIN AND IRRIGATION

SECTION 615 SANITARY SEWER LINE CONSTRUCTION

Add the following subsection to the MAG Standard Specifications

615.2 Materials

Section 615.2 of the MAG Standard Specifications is replaced with the following:

Sanitary sewer pipe used for sewer line construction including specials, joints, and gaskets shall be extra strength Vitrified Clay Pipe (VCP) in accordance with MAG specification Section 743.

Sanitary sewer pipe shall be installed and tested per MAG Specification sections 615 & 611. In addition to required testing per MAG Specification sections 615 & 611 and prior to surface restoration, the Contractor shall clean and conduct Closed Circuit T.V. (CCTV) Inspection utilizing digital 360 degree view CCTV video equipment to document built conditions. Any defects in the pipe or construction methods found shall be corrected by the Contractor at no additional cost to the City.

615.16 Measurement and Payment

Payment for installation of sanitary sewer pipe will be made at the contract unit price per linear foot, and shall constitute full compensation for furnishing all material, labor, tools and equipment, protecting and/or replacing traffic signal loops and other utilities, and accomplishing all work associated with obtaining and installing the new sewer pipe as described in the special provisions and on the design drawings. The work includes, but is not limited

to trench excavation, bedding, and backfill.

Payment for cleaning and conducting CCTV inspection will be made at the contract unit price per linear foot, and shall constitute full compensation for furnishing all material, labor, tools and equipment, and accomplishing all work associated with completing cleaning and CCTV inspection.

Payment for installation of concrete encasement will be made at the contract unit price per linear foot, and shall constitute full compensation for furnishing all material, labor, tools and equipment, protecting and/or replacing existing utilities and accomplishing all work associated with obtaining and installing the concrete encasement as described in the special provisions and on the design drawings. The work includes, but is not limited to trench excavation, bedding, and backfill.

ITEM 009	***8-INCH VCP SANITARY SEWER PIPE***	***LINEAR FOOT***
ITEM 010	***CLEANING AND CCTV INSPECTION***	***LINEAR FOOT***
ITEM 011	***CONCRETE ENCASEMENT MAG STD DET 404-3***	***LINEAR FOOT***

PART 625 – MANHOLE CONSTRUCTION AND DROP SEWER CONNECTIONS

625.5 Payment

Payment for installation of sanitary sewer access manholes will be made at the each contract unit price, and shall constitute full compensation for furnishing all material, labor, tools, and equipment, accomplishing all work associated with obtaining and installing the new sanitary sewer access manholes, and testing per MAG Specification Section 611.5. The work includes, but is not limited to excavation, proper disposal of excavated material, and bedding.

ITEM 012	***60-INCH DIAMETER CONCRETE MANHOLE***	***EACH***

APPENDIX A

MARICOPA COUNTY ENVIRONMENTAL SERVICES DEPARTMENT –
CERTIFICATE OF APPROVAL TO CONSTRUCT
(1 PAGE)

Environmental Services Department
Water and Waste Management Division
Subdivision, Infrastructure, and Planning Program
301 W. Jefferson St., Suite 170 | Phoenix, Arizona 85003
P: 602.506.1058 | **E:** ENVSubdivision@maricopa.gov
Maricopa.gov

Approval Date: 11/15/2024

MCESD Project No. WWR2400620
SYSTEM: City of Tempe

CERTIFICATE OF APPROVAL TO CONSTRUCT
(WITH STIPULATIONS)
and
PROVISIONAL VERIFICATION OF GENERAL PERMIT CONFORMANCE
SEWAGE DISPOSAL SYSTEM EXTENSION

PROJECT DESCRIPTION: Sewer Line Project - McKellips Road; La Rosa Drive to Cavalier Drive - sanitary sewer collection system of approximately 821 linear feet of 8" with a point of connection to the City of Tempe sewer system.

LOCATION: City of Tempe, Maricopa County
Section 10, T1N, R4E
E McKellips Road

PROJECT OWNER: City of Tempe
31 E Fifth Street
Tempe, AZ 85281

Pursuant to Arizona Administrative Code (AAC) Title 18: Chapter 9, Article 3 and the Maricopa County Environmental Health Code: Chapters II.

Approval to construct the above described facilities as represented in the approved plan documents on file with the Maricopa County Environmental Services Department is hereby given subject to the following stipulations: **1. In addition to obtaining a permit from Maricopa County Environmental Services Department, it may be necessary to obtain a permit from your local municipality or Maricopa County Planning and Development Department – if the property is in the unincorporated County. Please contact these entities for additional information.**

2. Operation of this sewer collection system project shall not begin until an Approval of Construction and Verification of General Permit Conformance is issued by the Maricopa County Environmental Services Department. AOC will require confirmation that wastewater treatment plant capacity and conveyance line capacity are available to service the flows projected and described by this application at the time AOC is sought by the applicant and before AOC will be granted by the County.

WATER AND WASTE MANAGEMENT DIVISION

By _____
Subdivision Infrastructure & Planning Program

From the approval date noted above this certificate will EXPIRE, if construction has not substantially started within one year or if no Approval OF Construction has been received within two years showing verification of completion.

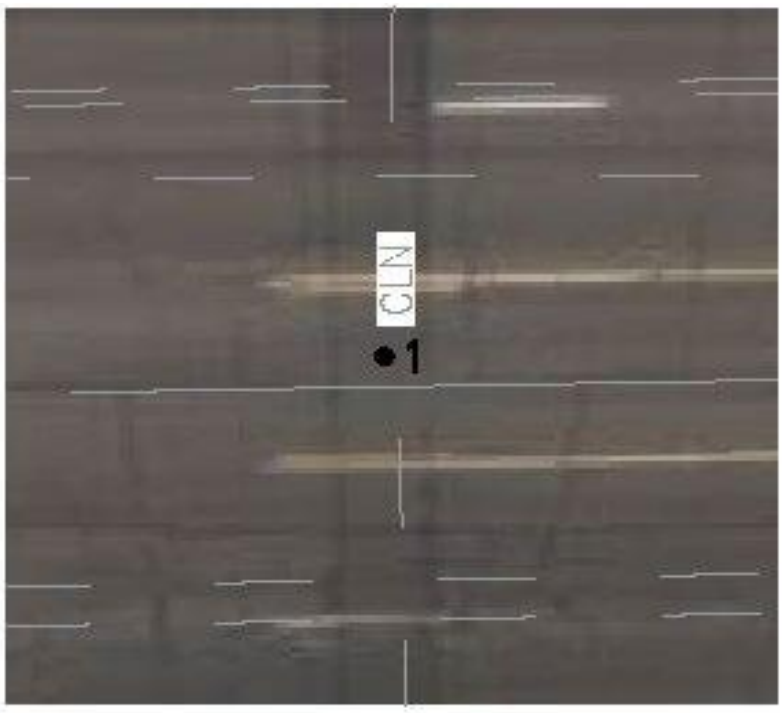
APPENDIX B

UTILITY POTHOLING REPORT
(10 PAGES)

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	1	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & La Rosa Dr		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
55030
DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR Orange

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1221.5	12" x 12" x 45"	
		O.D. (INCHES) 3	
TOP ELEVATION	1218.0	3.5	TOP DEPTH (FEET)
BOTTOM ELEVATION	1217.8	3.8	BOTTOM (FEET)

COORDINATES:	NORTHING	291765.36	EASTING 295345.50
STATIONING:	STATION	0+00.00	OFFSET 0

PAVING THICKNESS (INCHES)	5	PAVING TYPE	Asphalt	SOIL CONDITION	Good Soil
SIZE (INCHES)	3	TYPE (MATERIAL)	HDPE	FACILITY OWNER	Century Link Fiber Optic

COMMENTS:

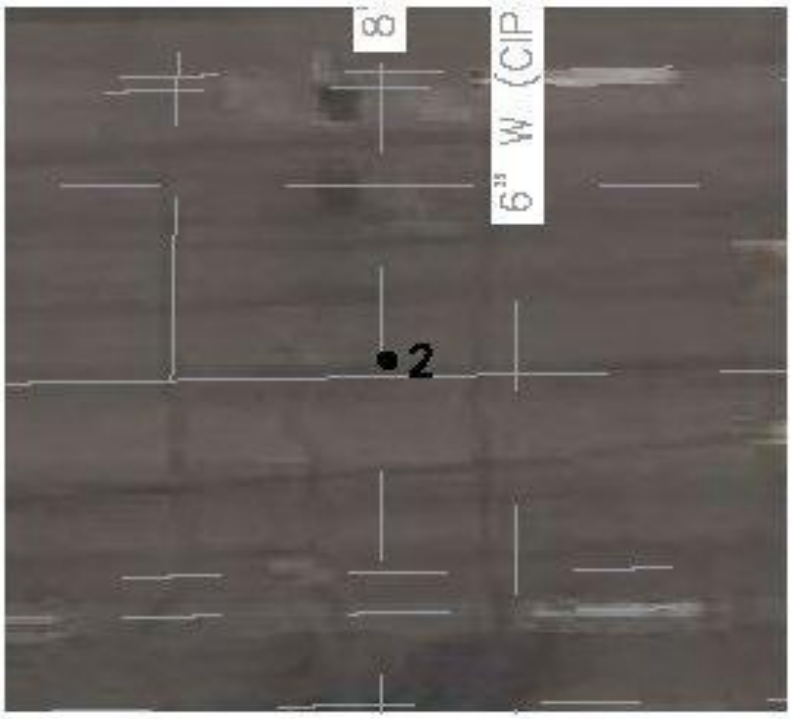
(1) 3" HDPE Century Link Fiber Optic @ 42" Top of Pipe

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	2	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & Normal Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
55030
DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK	CROSS SECTION - NOT TO SCALE
PROJECT BM - BRASS CAP IN HANDHOLE @ COLLEGE AVE & MCKELLIPS RD ELEVATION: 1226.56' (NAVD 88)	FACING: North SURFACE ELEVATION: 1220.3 12" x 12" x 45" O.D. (INCHES): 9.05 TOP ELEVATION: 1216.2 4.0 TOP DEPTH (FEET) BOTTOM ELEVATION: 1215.5 4.8 BOTTOM (FEET)
RIBBON COLOR: Blue	

COORDINATES: NORTHING 291766.37 EASTING 295449.29

STATIONING: STATION 0+00.00 OFFSET 0

PAVING THICKNESS (INCHES) 5 PAVING TYPE Asphalt SOIL CONDITION Good Soil

SIZE (INCHES) 8 TYPE (MATERIAL) D.I.P. FACILITY OWNER City of Tempe Water

COMMENTS:

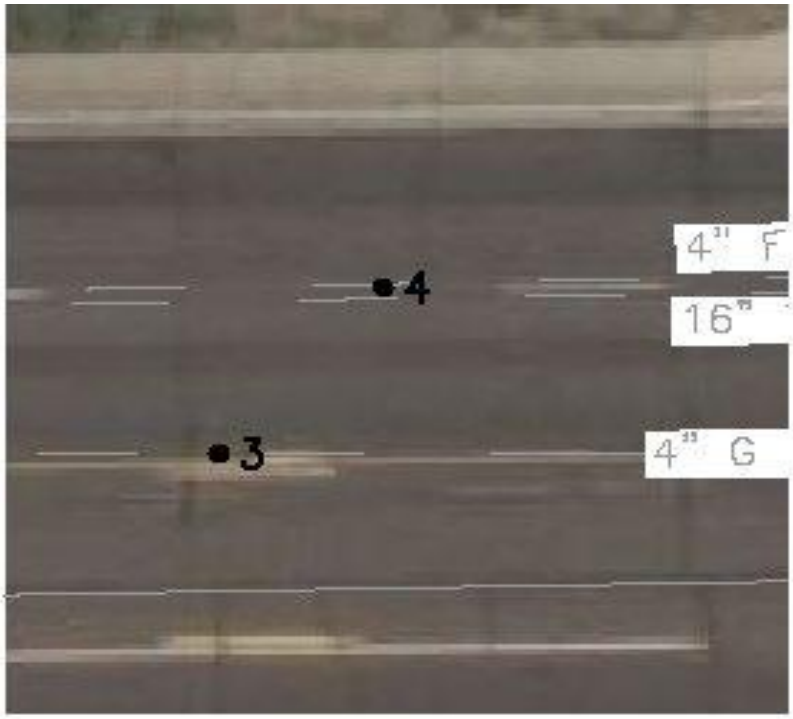
(1) 8" (9.05" O.D.) Ductile Iron City of Tempe Water Line @ 48.48" Top of Pipe

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	3	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & Van Ness Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
55030
DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR: Yellow

CROSS SECTION - NOT TO SCALE

FACING: East

SURFACE ELEVATION	1216.9	12" x 12" x 45"	
		O.D. (INCHES) 4	
TOP ELEVATION	1213.4		3.4 TOP DEPTH (FEET)
BOTTOM ELEVATION	1213.1		3.8 BOTTOM (FEET)

COORDINATES: NORTHING 291778.21 EASTING 295636.78

STATIONING: STATION 0+00.00 OFFSET 0

PAVING THICKNESS (INCHES) 5 PAVING TYPE Asphalt SOIL CONDITION Good Soil

SIZE (INCHES) 4 TYPE (MATERIAL) Steel FACILITY OWNER Southwest Gas

COMMENTS:

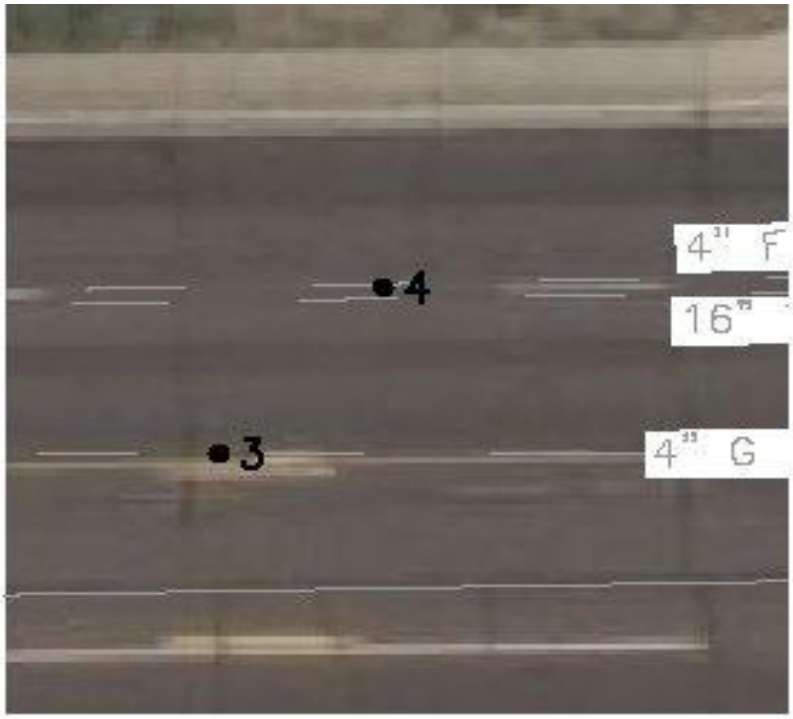
(1) 4" Steel SWG Gas at 41" Top of Pipe

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	4	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & Van Ness Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

REGISTERED LAND SURVEYOR
CERTIFICATE NO.
55030
DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR: Blue

CROSS SECTION - NOT TO SCALE

FACING: East

SURFACE ELEVATION	1216.4	12" x 12" x 45"	
		O.D. (INCHES) 17.4	
TOP ELEVATION	1210.8	5.6	TOP DEPTH (FEET)
BOTTOM ELEVATION	1209.3	7.1	BOTTOM (FEET)

COORDINATES:	NORTHING 291789.53	EASTING 295647.00	
STATIONING:	STATION 0+00.00	OFFSET 0	

PAVING THICKNESS (INCHES)	5	PAVING TYPE	Asphalt	SOIL CONDITION	Good Soil
SIZE (INCHES)	16	TYPE (MATERIAL)	D.I.P.	FACILITY OWNER	City of Tempe Water

COMMENTS:

(1) 16" (17.4" O.D.) Ductile Iron City of Tempe Water Line @ 67.5" Top of Pipe.

PREPARED BY: TL

CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	5	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & Van Ness Ave		

LOCATION PLAN - NOT TO SCALE

See attached associated picture file for corresponding field photos.

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SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR: Orange

CROSS SECTION - NOT TO SCALE

FACING: North

SURFACE ELEVATION	1215.5	12" x 12" x 45"	
		O.D. (INCHES) 2	
TOP ELEVATION	1212.1	3.4	TOP DEPTH (FEET)
BOTTOM ELEVATION	1211.9	3.6	BOTTOM (FEET)

COORDINATES:	NORTHING 291797.97	EASTING 295734.24	
STATIONING:	STATION 0+00.00	OFFSET 0	
PAVING THICKNESS (INCHES)	5	PAVING TYPE: Asphalt	SOIL CONDITION: Good Soil
SIZE (INCHES)	4" x 2"	TYPE (MATERIAL): PVC	FACILITY OWNER: COX Fiber Optic

COMMENTS:

(2) 2" PVC COX Fiber Optic stacked side by side @ 40.5" Top of Pipe

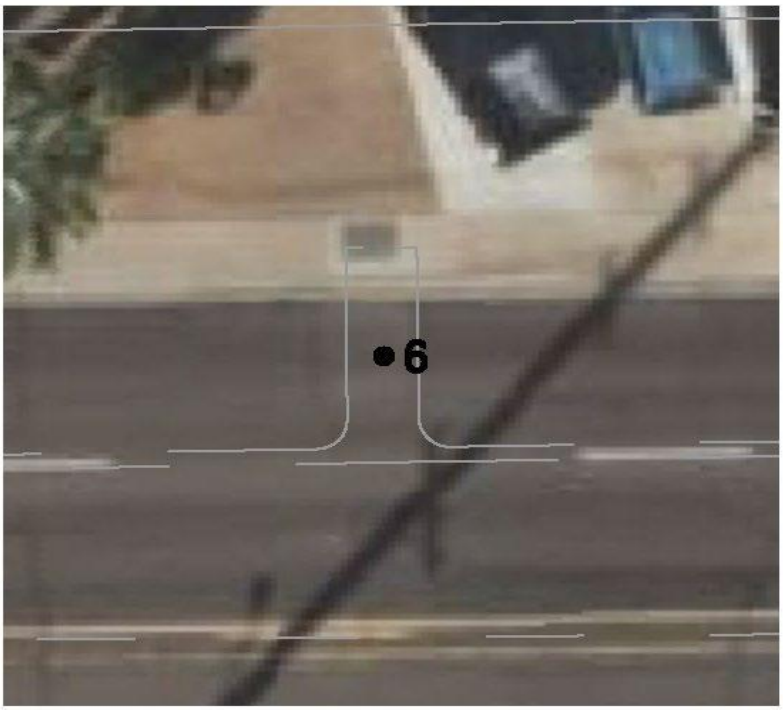
PREPARED BY: TL

CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	6	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & Van Ness Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

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DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

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UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR Orange

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1215.2	12" x 12" x 45"	
		O.D. (INCHES) 4	
TOP ELEVATION	1212.4	2.7	TOP DEPTH (FEET)
BOTTOM ELEVATION	1212.1	3.1	BOTTOM (FEET)

COORDINATES: NORTHING 291798.92 EASTING 295791.20

STATIONING: STATION 0+00.00 OFFSET 0

PAVING THICKNESS (INCHES) 5 PAVING TYPE Asphalt SOIL CONDITION Good Soil

SIZE (INCHES) 18" x 4" TYPE (MATERIAL) PVC FACILITY OWNER Century Link Communication

COMMENTS:

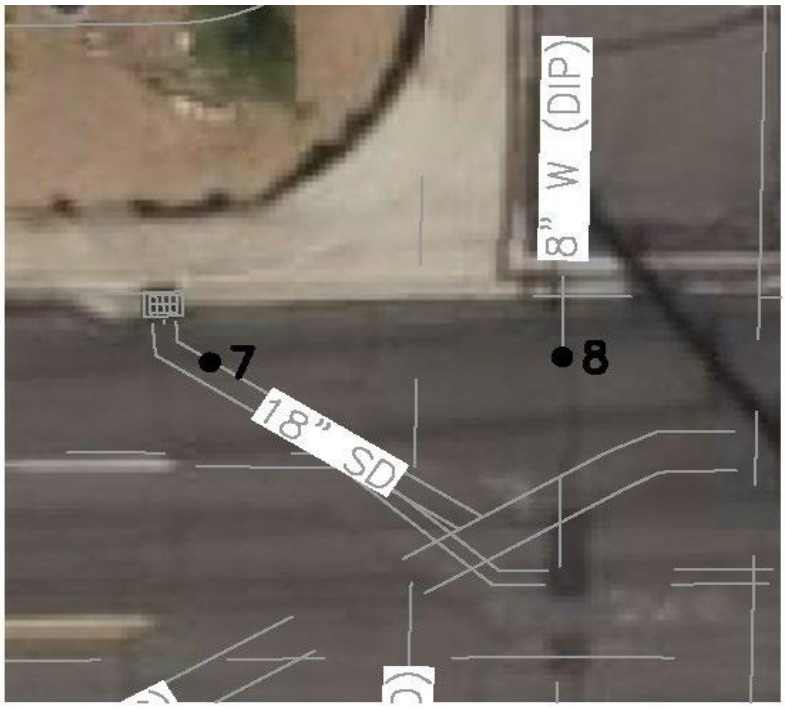
(2) 4" PVC Century Link Communication @ 32.5" Top of Pipe. These pipes are side by side with a 10" gap between them. The data is to the center of the pipes.

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	7	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & McAllister Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

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SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR Green

CROSS SECTION - NOT TO SCALE

FACING Northwest

SURFACE ELEVATION	1213.9	12" x 12" x 45"	
		O.D. (INCHES) 21	
TOP ELEVATION	1212.7	1.2	TOP DEPTH (FEET)
BOTTOM ELEVATION	1210.9	2.9	BOTTOM (FEET)

COORDINATES: NORTHING 291801.12 EASTING 295936.44

STATIONING: STATION 0+00.00 OFFSET 0

PAVING THICKNESS (INCHES) 5 PAVING TYPE Asphalt SOIL CONDITION Good Soil

SIZE (INCHES) 18 TYPE (MATERIAL) Concrete FACILITY OWNER City of Tempe Storm Drain

COMMENTS:

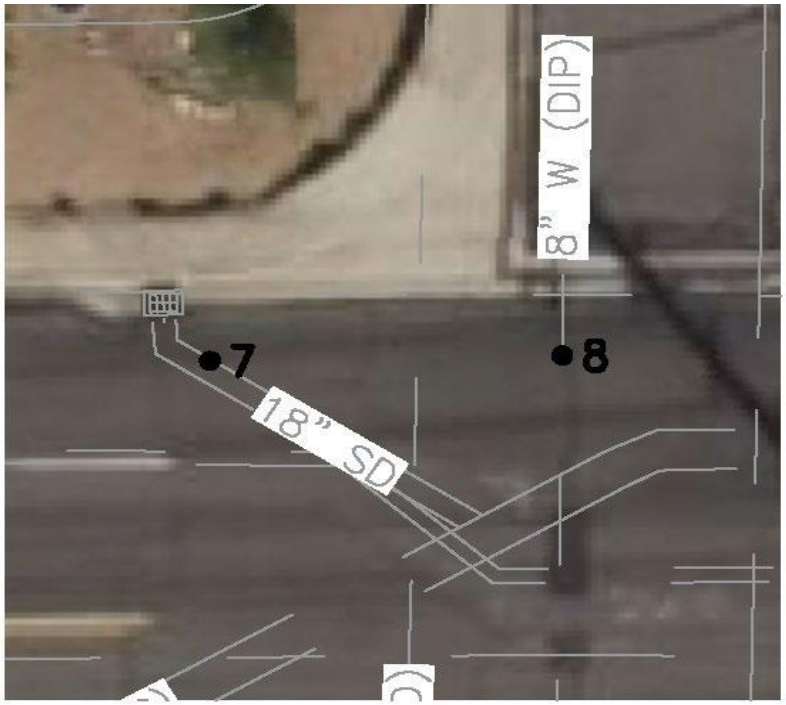
(1) 18" (21" O.D.) Concrete City of Tempe Storm Drain @ 14" Top of Pipe.

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	8	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & McAllister Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

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SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR Blue

CROSS SECTION - NOT TO SCALE

FACING North

SURFACE ELEVATION	1213.7	12" x 12" x 45"	
		O.D. (INCHES) 9.05	
TOP ELEVATION	1209.1	4.6	TOP DEPTH (FEET)
BOTTOM ELEVATION	1208.4	5.3	BOTTOM (FEET)

COORDINATES: NORTHING 291801.51 EASTING 295958.43

STATIONING: STATION 0+00.00 OFFSET 0

PAVING THICKNESS (INCHES) 5 PAVING TYPE Asphalt SOIL CONDITION Good Soil

SIZE (INCHES) 8 TYPE (MATERIAL) D.I.P. FACILITY OWNER City of Tempe Water

COMMENTS:

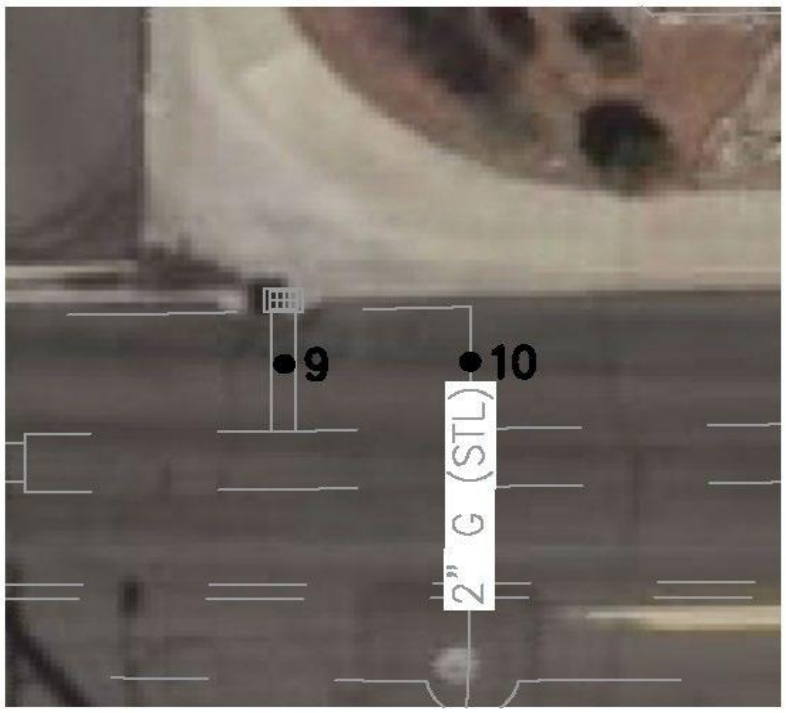
(1) 8" (9.05" O.D.) Ductile Iron City of Tempe Water Line @ 55" Top of Pipe. This point is at a 45° elbow and represents the bottom flange of the elbow. The pipe is getting deeper as it heads to the south from this point at a 45° angle.

PREPARED BY: TL CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	9	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & McAllister Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

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DOUGLAS B.
TONEY
Date Signed 7/25/24
ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR: Green

CROSS SECTION - NOT TO SCALE

FACING: North

SURFACE ELEVATION	1213.4	12" x 12" x 45"	
		O.D. (INCHES) 21	
TOP ELEVATION	1211.5	1.9	TOP DEPTH (FEET)
BOTTOM ELEVATION	1209.7	3.7	BOTTOM (FEET)

COORDINATES:	NORTHING 291802.08	EASTING 295998.15	
STATIONING:	STATION 0+00.00	OFFSET 0	
PAVING THICKNESS (INCHES)	5	PAVING TYPE: Asphalt	SOIL CONDITION: Good Soil
SIZE (INCHES)	18	TYPE (MATERIAL): Concrete	FACILITY OWNER: City of Tempe Storm Drain

COMMENTS:

(1) 18" (21" O.D.) Concrete City of Tempe Storm Drain @ 23" Top of Pipe.

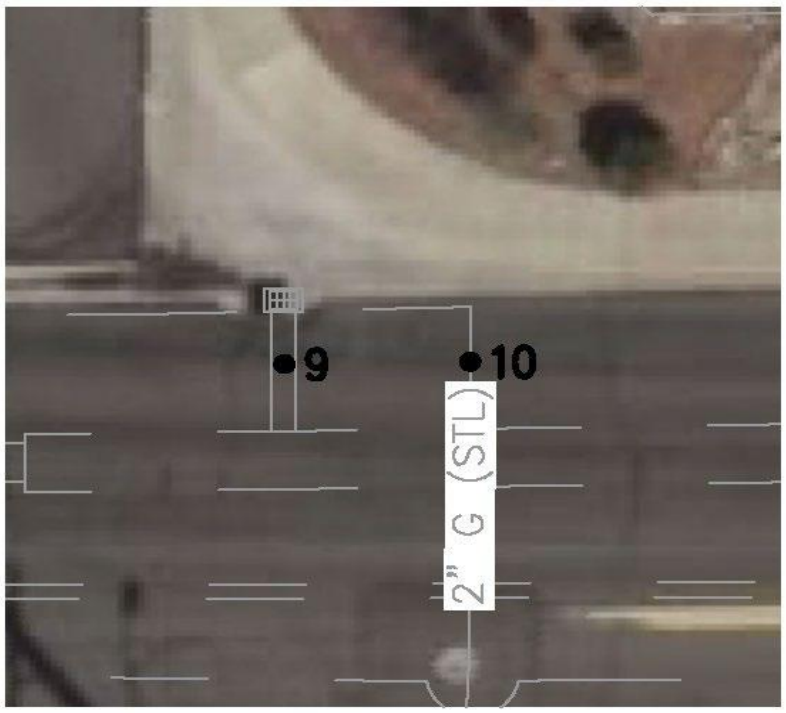
PREPARED BY: TL

CHECKED BY: DT

SUE LOCATION REPORT - QUALITY LEVEL A

Test Hole #	10	SUE Crew	GRACO
Date Dug	7/23/2024	Truck #	
Project #	N/A	City	Tempe
Project Name	Mckellips Sewer Potholes	County	Maricopa
Location	McKellips Rd & McAllister Ave		

LOCATION PLAN - NOT TO SCALE



See attached associated picture file for corresponding field photos.

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ARIZONA, U.S.A.

SUMMIT ULC
UTILITY LOCATING & CONSULTING

SITE BENCHMARK

PROJECT BM - BRASS CAP IN HANDHOLE @
COLLEGE AVE & MCKELLIPS RD
ELEVATION: 1226.56' (NAVD 88)

RIBBON COLOR: Yellow

CROSS SECTION - NOT TO SCALE

FACING: North

SURFACE ELEVATION	1213.3	12" x 12" x 45"	
		O.D. (INCHES) 2	
TOP ELEVATION	1210.7	2.6	TOP DEPTH (FEET)
BOTTOM ELEVATION	1210.5	2.8	BOTTOM (FEET)

COORDINATES:	NORTHING 291802.27	EASTING 296009.78	
STATIONING:	STATION 0+00.00	OFFSET 0	
PAVING THICKNESS (INCHES)	5	PAVING TYPE: Asphalt	SOIL CONDITION: Good Soil
SIZE (INCHES)	2	TYPE (MATERIAL): Steel	FACILITY OWNER: Southwest Gas

COMMENTS:

(1) 2" Steel SWG Gas at 31.5" Top of Pipe

PREPARED BY: TL

CHECKED BY: DT

APPENDIX C

GEOTECHNICAL REPORT
(41 PAGES)

GEOTECHNICAL STUDY
McKellips Sewer Alignment
La Rosa Drive & McKellips Drive
Tempe, Arizona

PREPARED FOR:

Dibble
3020 East Camelback Road,
Suite 201
Phoenix, Arizona 85016

PREPARED BY:

Smith & Annala Engineering Co.
5861 South Kyrene Road,
Suite 5
Tempe, Arizona 85283
(480) 659-4101

SMITH & ANNALA
ENGINEERING CO.
SAECO

August 10, 2024
SAECO Project No. 44.24.2328

August 10, 2024

SMITH & ANNALA ENGINEERING CO.
SAECO

Attention: Alaric Fradenburg

Dibble
3020 East Camelback Road
Suite 201
Phoenix, Arizona 85016
Phone: (970) 423-9701
Email: alaric.fradenburg@dibblecorp.com

Subject: Geotechnical Engineering Study
McKellips Sewer Alignment
La Rosa Drive & McKellips Drive
Tempe, Arizona
SAECO Project No. 44.24.2328

We are pleased to submit this report of our geotechnical study for the project. This study was performed in general accordance with our proposal PG29.24.008, Revision 2, dated February 26, 2024, and your authorization. The report's goal is to provide geotechnical engineering recommendations for project design and construction. The recommendations provided are based on subsurface explorations, laboratory testing, academic publications, and our judgement based on experience with similar projects and similar subsurface conditions.

From a geotechnical standpoint and provided the recommendations contained in the report are followed, we believe the site is suitable for the proposed construction. A summary of our findings and a summary of the recommendations we have provided in the full report are outlined below.

Significant conditions encountered from our investigation at the site include:

- Near surface materials generally consist of clayey sand with gravel.
- Field penetration testing indicates soils are dense to very dense throughout the depths explored.
- Relative shallow refusal was encountered at the east side of the alignment at 11.9 feet below current grade due to oversized gravel and cobbles.
- Testing on remolded samples indicates the near surface soils have low expansion potential.
- Based on our laboratory testing, the on-site soils appear to have low contents of soluble sulfate and should have negligible effect on concrete.

The following summary of the recommendations in our report are based on the findings from our field investigation:

- Bedding and foundations (manholes, vaults, etc.) generally may bear on relatively undisturbed dense native soils.
- On-site soils generally appear suitable for re-use as trench backfill material, however some screening or selective use may be necessary.
- Given the dense to very dense nature of the site soils, we anticipate open-cut methods may be used for construction.

The recommendations presented in this report are based on the assumed type of construction, structural loading, and grading concepts as presented in Section 1.1 of this report. If any of these items change significantly, we should be contacted to determine if revisions to our recommendations are necessary.

We appreciate the opportunity to be of service to you during this phase of the project.

Sincerely,
SMITH & ANNALA ENGINEERING CO.

Aaron J. Spreiser, E.I.T.
Staff Professional

Jonathan K. Alexander, P.E.
Principal

Distribution: (1) Addressee (via e-mail)

Appendices

Geotechnical Study

In accordance with our proposal dated February 26, 2024, and your authorization, we have performed a geotechnical evaluation for the McKellips Sewer Alignment located on McKellips Drive between La Rosa Drive and N. Cavalier Drive in Tempe, Arizona (Figure A-1 Appendix A). The purpose of this study was to examine the geotechnical profile at the site to evaluate the subsurface soils and their engineering properties. This information was used to develop geotechnical engineering recommendations for project design and construction. A description of the project, the scope of our geotechnical services, a description of our findings and our recommendations are presented in the following sections.

1.0 PROJECT UNDERSTANDING

The project consists of the design and construction of an 8-inch-diameter sanitary sewer line on East McKellips Road between La Rosa Drive and Cavalier Drive, at a depth of approximately 7-9 feet below the current ground surface.

2.0 SCOPE OF WORK

The scope of our services for this study included the following major task items:

- Reviewing readily available aerial photographs and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Coordinating our subsurface investigation activities with Dibble and the City of Tempe.
- Notifying Arizona 811 of the proposed exploration locations prior to performing our field explorations.
- Obtaining dry utility and Right-Of-Way permits with the City of Tempe.
- Drilling, logging, and sampling 8-inch-diameter exploratory borings at 2 locations. Details of this task and a log of the explorations can be found in Appendix B.
- Subcontracting roadway asphalt patch work to comply with city requirements.
- Performing laboratory testing on selected samples obtained from the exploratory borings. The details of the laboratory testing and the results are included in Appendix C.
- Preparing this report of our study presenting our findings, and recommendations.

Our scope of services for this study did not include environmental consulting services with respect to the identification or assessment of any hazardous environmental or biological materials that may be, or may not be, present at the site. A detailed scope of services and estimated fee related to the investigation of the presence or impact of pollution, contamination, or hazardous materials related to this site can be provided upon request.

3.0 FINDINGS

This section contains the results of our evaluation of the site as determined by the scope described in Section 2.0.

3.1 Current Site Conditions

The project site is located on East McKellips Road, between North La Rosa Drive and North Cavalier Drive, in Tempe, Arizona. At the time of our site investigation McKellips Road consisted of two west bound and two east bound lanes, with a center turn lane. The asphalt was recently resealed with repainted roadway markings. Residential streets can be found along McKellips Road to the north and south leading to residential communities. The site slopes gently down from west to east. Based on publicly available elevation data, the project site is situated on the order of 1,210 feet relative to mean sea level.

3.2 Past Site Conditions

Aerial photographs from public sources were reviewed for this project. The following table lists our observations made. The oldest photo we could obtain was taken in 1953.

Year of Photo	Site Description
1953	The alignment of McKellips Rd. appears similar to present day. Land north and south of McKellips Rd. appears to be a mix of undeveloped and developed land used for agriculture. No buildings appear to be constructed near the site.
1961	Residential home construction appears to begin along McKellips Rd.
1979	Nearly all the area north and southwest of McKellips Rd. has been completely developed with residential homes.
1987-2021	Site development appears similar to present day.

3.3 Subsurface Conditions

The following generalized description of the subsurface profile at the site is based upon the conditions we observed in a relatively few, widely spaced explorations. The thickness of strata described should be considered approximate and is inferred from changes observed between recovered samples or observed drilling conditions (changes in drilling effort, or from cuttings generated from auger advancement). Conditions could vary significantly between exploration locations. And although we did not observe evidence of or encounter buried structures such as underground utilities, septic tanks, dry wells, or fill materials during our site reconnaissance or within our explorations, such materials could be encountered during construction. Should different conditions be discovered during construction, when earthwork operations expose larger areas of the site, SAECO should be notified to allow revised recommendations to be provided.

- The pavement encountered consists of 5 to 5-½-inches of asphalt over 7 to 7-½-inches of aggregate base course. The asphalt has been recently sealed with nearby unsealed asphalt in fair to poor condition, with block cracking, alligator cracking and utility patches.
- The native soils encountered from below the pavement section extended to the total depths explored. These soils consist of medium plastic clayey sand with gravel, are light brown in color, moist to touch, dense to very dense in relative density, and have no to weak cementation.
- Practical auger refusal due to oversized particles was encountered at 11.9 feet below ground surface (bgs) in exploration B-2.

3.4 Groundwater

Groundwater was not encountered in any of our explorations during the field exploration. We did not perform long term monitoring of groundwater levels at the site and the observations reported in the report and on the log of explorations should be considered to only represent the groundwater conditions at the time and location of our explorations. Based on well data from the Arizona Department of Water Resources, the depth to regional groundwater has historically been measured between approximately 60 to 150 feet below the surface near the site 15 wells within 1-mile of the site with groundwater depths reported from 1992 to 2021. Groundwater levels may fluctuate due to seasonal variations in precipitation, irrigation, groundwater withdrawal, and other factors. Shallow perched groundwater zones are sometimes encountered near leaking utility lines or near stormwater retention basins.

Groundwater seepage could occur within excavations that approach the bedrock surface. Pumping from sumps may be utilized to control water within the excavations. A more complete dewatering plan and additional efforts will be required for significant groundwater flow, or where excavations penetrate groundwater to a significant depth.

3.5 Geologic Setting

Arizona can generally be divided into three geological provinces; the Colorado Plateau in the north, the Basin and Range in the deserts of the south and west, and a Transition Zone in between. This site lies within the Basin and Range Province.

The Basin and Range Physiographic Province is dominated by extensional tectonics, typified by broad alluvial valleys separated by steep, discontinuous, sub-parallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with variable thickness extending up to several thousands of feet. Intermittent volcanic activity also occurred within this region.

The Phoenix Metropolitan Area covers an area of about 9,000 square miles in a topographic basin bounded by the Transition Provence Bradshaw and Usary Mountains to the north, the McDowell and Superstitions Mountains to the east, South Mountain to the south, the Sierra Estrella Mountains to the southwest, and the White Tank Mountains to the west. The Phoenix Mountains form a predominant range near the center of The City. Rocks found in the ranges include andesitic volcanics, limestone and sandstone sedimentary rocks, granites, and metamorphics (predominately granitic parent-rock). As is typical of the Basin and Range Province, these ranges have broad piedmont surfaces extending at fairly uniform slopes of 5 to 20 miles away from much steeper mountain fronts (bajadas). The bajadas may be erosional bedrock surfaces, called pediments, or they may be mantled by fan gravels and dissected by deep washes. The ephemeral streams of the piedmont areas convey water and sediment from the mountain fronts to the valley floors in the basin during occasional, but often intense rainstorms. Coarser gravel and boulders are deposited mainly on the piedmont, while the finer fraction of the load, including sand, silt, and clay, are conveyed to the valley floors, where significant fills, up to 9,000-feet-thick, have built up.

The floor of the basin is generally a broad and flat plain. The principal watercourses in this basin (The Salt River, Gila River, New River, Agua Fria River, and Hassayampa River) collect drainage principally off the Mogollon Rim and eastern Arizona and from within this basin, ultimately outletting the basin to the southwest. Meanders, downcutting, and flood events have left numerous terrace features and relatively unconsolidated deposits of boulders, cobbles, gravels, sands, silts and clays adjacent to the banks of the watercourses.

3.6 Subsidence and Earth Fissures

Land subsidence and earth fissures are present in numerous alluvial basins in southern Arizona. Due to historic pumping of large volumes of groundwater at rates far exceeding recharge, the alluvium has undergone consolidation, resulting in large areas of land subsidence. The primary geologic hazard associated with subsidence is the formation of earth fissures, related to tensional stress caused by differential consolidation of the alluvial materials. This differential consolidation is often related to the presence of irregular buried bedrock surfaces and/or buried bedrock ridges or pinnacles.

Beginning in the early 1990's, ADWR has performed regular mapping of 18 land subsidence features in alluvial basins across the state of Arizona using remote sensing techniques. This site is not located in an area that ADWR has monitored for land subsidence.

Based on our review of published references (Arizona Geological Survey, 2024) and based on our site reconnaissance, there are no known or documented earth fissures on the subject site. The closest documented earth fissures, based on our research, were located approximately 10.4 miles to the northwest of the project site. If groundwater withdrawal continues, further subsidence and the formation of new fissures or the extension of existing fissures is possible. Prediction of future earth fissure locations is not possible. However, in our opinion, land subsidence and earth fissures are not anticipated to be a design or construction issue for this project.

3.7 Faulting and Seismicity

The site lies within the Sonoran Zone, which is a relatively stable tectonic block located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico. This nearly stable block is bounded by tectonically active regions to the northeast and southwest. This zone is characterized by sparse seismicity and few Quaternary faults (Euge et al., 1992).

The nearest fault consists of the Carefree fault zone, located 22 miles northeast of the site. Less than 3 m (9.84 feet) of displacement has occurred along this fault within upper to middle Pleistocene deposits (150,000 to 750,000 years) (Pearthree, 1995).

Seismic design considerations are presented in Section 4.6 of this report.

3.8 Liquefaction

Based on the lack of near surface water, the low ground motion hazard (relatively low seismic ground accelerations), and the consistency/relative density of the surface soils, the likelihood or potential for liquefaction is considered negligible at this site.

3.9 Hydrocompactive Soils

Hydrocompactive (collapsible) soils generally exhibit low to moderate compressibility at existing low moisture contents. However, under increasing moisture content (such as from improper site drainage, excessive irrigation, and leaking utilities) and foundation loading, these soils can "collapse" (experience significant and rapid volume reduction when wetted). This occurs primarily as a result of the breakdown of the soil structure as light calcium carbonate cementation or bonding between sand particles softens or weakens under increased moisture content. Wetting and loading history of the soil influence the collapse potential, and a soil may collapse under even relatively low loads, such as that imposed by pavement structures or small embankments, when the soil moisture content exceeds past levels. Often, the placement of a new structure changes the drainage or evapotranspiration regime of the soil, increasing the likelihood of a collapse event (Houston, et al., 2002). Empirical identification of soils with collapse potential include some or all the following conditions (adapted from Beckwith, 1979):

- Plasticity Index (PI) less than 10
- Dry density less than 95 pounds per cubic foot (pcf)
- Moisture content less than 8 percent
- SPT N-value less than 15 blows per foot

Collapsible soils can also be identified using 1-dimensional consolidation testing (as generally described by ASTM D2435) in the laboratory. In this test, relatively undisturbed samples (typically collected from driven ring-lined samplers) are axially loaded to typical foundation stresses and then submerged in water, activating the potential collapse mechanism.

Based on the information collected from our site investigation it appears the near surface soils have a low potential for collapse. It is possible that zones of collapsible soils are present on the site and we recommend a geotechnical professional or their representative perform additional observations of the site during construction activity.

3.10 Expansive Soils

The soils encountered in our explorations consist of clayey sand with medium plasticity that exhibits low swell potential (less than 1.5 percent swell) when compacted and inundated with water while subject to light loading similar to a floor-slab. On-site soils generally appear suitable for use and engineered fill at the site, additional details concerning the use of on-site soils as fill material are provided in Section 4.5.6.

4.0 RECOMMENDATIONS

From a geotechnical standpoint, we believe the site is suitable for the proposed construction provided the recommendations provided are followed. Some general geotechnical considerations for site design and construction include:

- Dense to very dense on-site soils should be suitable for open-cut methods.
- Manholes or other structures may bear on relatively undisturbed native soils.
- Native soils are suitable for re-use as engineered fill.
- Difficult excavation conditions may be encountered below 7 feet.

The following sections provide our recommendations for the design and construction of the project. We should be contacted for additional recommendations if the proposed construction or anticipated foundation loads are changed from the project description in Section 1.0 of this report, or if significant changes occur at the site with respect to the site conditions described in Section 3.1 of this report.

4.1 Pipeline Design and Construction

This section contains the information for the design and construction of buried rigid and flexible pipelines. We have assumed the pipelines will be constructed using open trench methods.

4.1.1 Soil Loads on Buried Rigid Pipelines

Soil loads on buried rigid pipes, such as clay, and reinforced concrete, can be determined using the following formula:

$$W_c = C_d \gamma_w {B_d}^2$$

Where:

W_c	Stress on pipe from trench backfill
C_d	Load Coefficient
γ_w	Moist Unit Weight of Soil (pcf)
B_d	Width of trench at top of pipe (ft)

The load coefficient C_d is affected by the type of backfill, the degree of backfill compaction, the trench width, and pipe installation depth. Where the ratio of backfill depth above the top of the pipe (H/B_d) is at least 1, and the trench width at the top of the pipe is less than 3 times the pipe diameter, the load coefficient C_d can be determined from the following:

$$C_d = \frac{1 - e^{-K_{\mu'}(\frac{H}{B_d})}}{2K_{\mu'}}$$

Where:

K	Active Earth Pressure coefficient
μ'	Friction Coefficient between backfill and trench walls
H	Height of backfill above the top of the pipe (ft)
B_d	Width of trench at top of pipe (ft)

The product $K_{\mu'}$ can generally be estimated as follows based on soil type:

Soil Type (USCS)	Maximum recommended value of $K_{\mu'}$
Granular materials without cohesion	0.190
Sand and gravel	0.165
Saturated topsoil	0.150
Ordinary clay	0.130
Saturated Clay	0.110

Based on the information we collected for this study we recommend using a value of 0.150 for $K_{\mu'}$ and a soil backfill density of 125 pcf (moist unit weight).

The soil loads on the pipeline as determined using this method do not include live loads from vehicle traffic. Loading imposed from vehicle and other concentrated surface loads may be analyzed using the information from Section **Error! Reference source not found.**.

4.1.2 Soil Loads on Buried Flexible Pipelines

Generally the deflection of buried flexible pipes (including pipe made of welded steel, and most plastics) from loading may be determined using Spangler's Iowa Deflection Formula:

$$\Delta x = \frac{kWr^3}{EI + 0.061E'r^3}$$

Where:

Δx	Horizontal deflection of the pipe (in)
k	Bedding constant (recommend using 0.1)
W	Load per unit length of pipe (lbs/linear-in)
r	Pipe radius (in)
E	Pipe wall elastic modulus (psi)
I	Pipe wall moment of inertia (in^4/in)
E'	Modulus of soil reaction (psi)

The bedding constant (k) relates the depth of "pipe seating" into the bedding materials beneath the pipe. The soil load (W) in the above equation may be determined as follows:

$$W = C_P(D_{Load} + P_L)$$

Where:

C_P	Load transfer coefficient (recommend using 0.8)
D_{Load}	Soil overburden pressure (psi)
P_L	Vehicle live load (see section 4.3.3)

The modulus of soil reaction (E') relates to the stiffness of the soil surrounding the pipeline. The modulus is affected by trench width, pipe diameter, modulus of the backfill, and modulus of the trench walls. We recommend the following table be used for determining E' for this project:

Depth to pipe springline (ft)	E' (psi)
Less than 7	700
7 to less than 15	1,500

4.1.3 Vehicle Live Loads

Vehicle loads may be analyzed as follows:

$$P_L = \frac{3I_f W_L H^3}{2\pi R^5}$$

Where:

P_L	Soil stress imposed on pipe from surface load (psf)
I_f	Impact factor
W_L	Live load (lbs)
H	Height of backfill above top of pipe
R	Distance from load to the top of the pipe (ft)

The impact load I_f can be estimated as follows:

Value of H (ft)	I_f
Less than 1	1.3
From 1 to less than 2	1.2
From 2 to less than 3	1.1
3 or greater	1.0

4.1.4 Thrust Blocks

The soil reaction for thrust blocks for buried pipelines and pipe jacking can be considered using the following:

$$R_p = \frac{300(D_2^2 - D_1^2)}{F.S.}$$

Where:

R_p	Block Reaction (lbs)
D_2	Depth from ground surface to bottom of block (ft)
D_1	Depth from ground surface to top of block (ft)
F.S.	Factor of Safety (1.5 is recommended)

4.2 Bearing Capacity Recommendations

Recommendations for the design of foundations for manholes, vaults, and valve structures with respect to bearing capacity, estimated settlement, and other geotechnical considerations are provided in this section of the report. The parameters provided below are contingent on following the earthwork recommendations provided in the Section 4.5.3. If conditions are encountered during construction that significantly differ from what is described in Section 1.0, SAECO should be notified to provide additional recommendations.

Recommended bearing pressures are presented in the following table. The average footing bearing pressure should not exceed the allowable equivalent uniform bearing pressure presented below. However, peak edge stresses may exceed this value provided the resultant passes through the middle third of the footing base. Continuous footings should have a minimum width of 16 inches, and isolated column footings should have a minimum width of 24 inches. The allowable soil bearing pressures may be increased by one-third when considering total loads including loads of short duration such as wind or seismic forces.

Footing Depth Below Finished Grade[1] (ft)	Bearing Material	Allowable Equivalent Uniform Bearing Pressure (psf)
1.5 (Min.)	Undisturbed Native Soils	2,500
4	Undisturbed Native Soils	4,000
5	Undisturbed Native Soils	5,000
7 or Greater	Undisturbed Native Soils	6,000

Notes:

1. Finished grade is defined as the lowest point within, and 5 feet beyond, the structure's footprint (not including pipe penetrations).

Total foundation settlements for the expected structural loading conditions are estimated to be less than about 1-inch, provided foundation bearing soils remain at their present, natural moisture conditions. Differential foundation settlements should be on the order of about ½-inch or less for these estimated total settlements.

4.3 Lateral Earth Pressures

Based on the information observed during our field investigation and laboratory testing, the following soil properties may be considered for permanent and temporary structures affected by lateral earth pressures:

Stratum	Depth (ft)	Material Description	Effective Unit Weight (pcf)	Effective Cohesion[1] (psf)	Friction Angle φ (degrees)
Stratum 1	0-7	Dense Clayey Sands with Gravel	125	100	34
Stratum 2	7-16.5	Very Dense Clayey Sands with Gravel and Cobbles	135	100	36

Notes:
1. For permanent structures, we recommend ignoring the soil strength contribution from cohesion

The following ultimate lateral earth pressures may be considered for design of structures subject to lateral loading:

Equivalent Fluid Lateral Earth Pressure[1]

Material	Type	PSF per linear foot of wall or foundation
Undisturbed Clayey sand with Gravel	Active	35
	Passive	450
	At-Rest	55
Compacted On-Site Materials	Active	45
	Passive	400
	At-Rest	55

Note:
1. The recommended lateral earth pressures are suitable for unsaturated soils, level backfill behind and in front of retaining walls, and properly compacted backfill.

The ultimate lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed one-half of the total ultimate resistance. The passive resistance may be increased by one-third when considering loads of short duration, such as wind, or seismic forces. Where conditions include restrained structures the at-rest pressure provided should be considered as acting on the walls. Where foundations are designed to resist lateral loading, they should preferably be proportioned such that the resultant force from total loads, including lateral loading, falls within the kern (i.e., middle one-third of the footing base).

4.4 Excavation Conditions

The excavation conditions described in this section are based on our sub-surface explorations performed at the site, a review of other published geologic information, and our professional experience. It may not be possible for others to duplicate our interpretation of the site characteristics. Those using the information provided in this report should keep in mind that our interpretations are based primarily on data collected from the site from a relatively small area of investigation.

Hollow-stem auger drilling methods were used to advance borings. One exploration was advanced to its proposed depth of 15 feet, and the other encountered refusal on oversize materials at a depth of 11.9 feet below the current ground surface. Because of the relative density of the soils and presence of oversize material, potential difficult excavation conditions may exist.

Given the dense nature of the near surface soils, we anticipate that open cut construction methods will not experience significant caving and sloughing. If areas of looser soils are encountered, additional efforts may need to be provided to prevent damage to pavements and other infrastructure located adjacent to proposed trenches.

Those involved with the construction of this site should review this report along with appropriate performance charts prepared by the manufacturer of the planned excavation equipment. This information can be used to assist in the selection of appropriate equipment that will be required to excavate the material anticipated to be encountered at this site. However, those using the interpretation of the site conditions contained in this report for any reason do so at their own risk.

4.5 Trench Construction

4.5.1 Minimum and Maximum Dimensions

The maximum trench width for pipeline placement should conform to the dimensions provided in the *MAG Uniform Standard Specification for Public Works*, Section 601.2.2 *Trench Widths*. The constraint on trench width should extend at least 1 pipe-diameter above the top of the pipe; above this zone the trench may be widened, for example to meet OSHA excavation guidelines.

Exceeding the maximum trench widths provided in the table could lead to increased pipeline stresses from soil backfill. If trench widths are exceeded the excess areas will require backfill with approved shading material to provide proper pipeline support.

We do not anticipate a significant potential for caving and sloughing using cut-and-cover construction methods along the alignment. If areas of looser soils are encountered during construction, shoring or other methods of trench stabilization may be required to maintain proper trench dimensions for pipeline construction.

4.5.2 Pipeline Foundation

Based on the information collected from explorations we anticipate undisturbed native soils will be suitable for pipeline foundation.

4.5.3 Subgrade Preparation for Other Structures

In general, manhole structures, valves, thrust blocks, and vault structures may bear on undisturbed soils (provided they are free of oversize particles) encountered at planned invert elevation (deeper than 7-feet below the current pavement surface).

If oversize materials are encountered, soils should be removed to a depth of 1 foot below the proposed foundation bottom elevation and replaced with compacted engineered fill with a maximum particle size of 3 inches.

If zones of loose material are encountered, these should be removed and replaced with compacted engineered fill.

4.5.4 Material Placement and Compaction

Foundation materials, pipe bedding, haunching and shading, and trench backfill with on-site soils and/or select imported soils should be placed in accordance with Section 601.3 *Foundation, Bedding, Backfilling, and Compaction* of the *MAG Uniform Standard Specification for Public Works.*

4.5.5 Other Trench Construction Considerations

All involved with the construction should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

Near-surface soils consist predominantly of dense clayey sands with gravel overlying very dense clayey sands with significant gravel content and some cobbles. These soils could be considered Type C soil when applying the OSHA regulations. For this soil type OSHA recommends a maximum temporary slope inclination of 1.5:1 (H:V) or flatter for excavations 20 feet or less in depth. Steeper cut slopes may be utilized for excavations less than 5 feet deep depending on the strength, moisture content, and homogeneity of the soils as observed in the field. Flatter slopes and/or trench shields may also be required depending on conditions encountered along the slope face. Actual safe slope conditions should be determined and monitored in the field at the time of construction by an OSHA-qualified “competent person.”

Excavations encountering seepage should be evaluated on a case-by-case basis. Where the stability of structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Arizona. In general, heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within 1/3 the slope height from the top of any excavation, unless incorporated into the engineered design.

Structures and utilities located adjacent to excavations may require additional support (under-pinned), or the excavation may need to be shored, to reduce the potential for damage. In general, structures or excavations will require additional support if any portion of the excavation enters a zone that extends down and away from the base of the structures at a 45-degree angle.

Excavations that enter the BNSF railroad right of way will need to be designed in accordance with *UPRR and BNSF Guidelines for Temporary Shoring*, (2021). The railroad has restrictions on where excavations can occur within their right of way, requires all excavation be shored, prescribes additional surcharge loading on the shoring systems, and has strict deflection limits that may not be exceeded.

A pre-construction inspection, and vibration monitoring during construction, could be considered to reduce potential claims arising from construction activity adjacent to existing structures.

4.5.6 Fill Materials

On-site and imported soils that exhibit low expansive potential when compacted are generally suitable for re-use as fill in all areas, provided they are free of debris and organic material, and all particles are less than 3 inches in size. Ideally fill materials placed to support structures will be placed in a fairly uniform thickness beneath the structure in order to reduce the potential of differential settlement, if this cannot be accomplished due to site constraints, abrupt changes in fill thickness should be minimized.

- **On-Site Soils**
  The on-site soils tested in the laboratory exhibit low swell potential and generally appear suitable for use as engineered fill material below structures and slabs, provided any oversize materials (particles greater than 3 inches) encountered are screened out to prevent point loading.

- **Imported Soils**
  Soils imported from off-site sources for use in new fills below structures or rigid concrete pavements should meet the requirements listed in the following table:

Property	Specification	Remarks
Maximum Particle Size	3 inches	None
Percent Passing No. 4 Sieve	30-100	None
Percent Passing No. 200 Sieve	2-50	None
Maximum Plasticity Index	15	None
Maximum Swell Potential	1.5%	Based on a laboratory sample compacted to 95% of the maximum density at 3% below optimum moisture content as determined by the Standard Proctor (ASTM D698)

The geotechnical consultant should evaluate any imported materials and details of their placement prior to importation.

- **Aggregate Base Course**
  Aggregate base course used beneath pavement structures should meet the requirements of MAG 702

4.5.7 Bedding/Shading Sand

We recommend bedding/shading sand for pipelines conform to the ASTM C 33, fine aggregate standard specification for concrete aggregates with the following gradation when tested in accordance with ASTM C136 and C117:

Sieve Size	Percent Passing
3/8-inch	100
No. 4	95-100
No. 8	80-100
No. 16	50-85
No. 30	25-60
No. 50	10-30
No. 100	2-10

Bedding/shading shall be moisture conditioned and placed in maximum 8-inch loose lifts. Consolidation should be achieved by hand operated vibrating plate compactors or other compaction equipment suitable for the application.

At the discretion of the Owner and/or Engineer, a 3/8-inch pea gravel or CLSM may be substituted for the pipe bedding and shading material.

Where pipelines penetrate structures, CLSM material should be used as backfill from pipeline foundation to finish grade extending from the perimeter of the structure to a distance away from the structure equal to the depth of the trench.

CLSM should generally consist of 1-sack of portland cement per cubic yard concrete aggregate. The 28-day compressive strength of the material should range between 250 and 1000 psi.

4.5.8 Compaction

We recommend subgrade, fill, backfill, subbase fill, or base material be prepared and placed to the relative compaction and moisture content provided below. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized but should generally be placed in lifts not exceeding 10 inches in loose thickness. Fills should be moisture conditioned and compacted by appropriate mechanical methods.

Recommendations for Compaction of On-Site and Imported Soils

Material / Location	Percent Compaction (ASTM D698)	Moisture Content Range (ASTM D698)
Below Foundations	95 min.	Opt. -3 to Opt. +3 percent
Above Foundation Level and Below Concrete Slabs or Flatwork	90 min.	Opt. -3 to Opt. +3 percent[1]
Trench backfill, not deeper than 4 ft. below finished grade	95 min.	Opt. -3 to Opt. +3 percent
Trench backfill, 4 ft. or deeper below finished grade	95 min.	Opt. -3 to Opt. +3 percent
Base Course	100 min.	Opt. -3 to Opt. +3 percent[1]
Miscellaneous Backfill (other backfill areas not used for foundation, pavement, or utility line support)	90 min.	Opt. -3 to Opt. +3 percent

Notes:

1. Maintain in a moist condition until overlying structures, slabs, or pavements are constructed

4.5.9 Workability

If site grading is performed during or after wet weather, or if ponding or leaking utilities are present, then near-surface site soils may be above optimum moisture content. This could make it difficult to achieve specified compaction, material pumping, and equipment maneuverability problems. If this occurs, disking for aeration followed by sufficient drying time (possibly several days depending upon the weather), chemical treatment, replacement with drier material, stabilization with a geotextile fabric or grid, or other methods may be implemented to reduce excessive soil moisture or otherwise facilitate earthwork operations.

4.5.10 Excavation Conditions

Hollow-stem auger drilling methods were used to advance both borings, each of which encountered relatively difficult conditions during advancement. Exploration B-2 encountered practical auger refusal on apparent dense gravel and cobbles.

We believe the excavation conditions encountered in our borings generally represent the conditions to be expected across the site; however, excavation conditions are dependent on many factors including: variability of cementation, presence and size of cobbles and boulders, variability of relative soil density, excavation size, excavation equipment, operator experience, and operator effort. It may not be possible to correlate all the potential variables with the results of what we experienced during our exploration advancement in terms of the actual excavation conditions that could be encountered. Those involved with the construction of this site should use the information provided in this report as a guideline for the conditions that generally exist only at each boring location. Those using this report should understand the limitations of the methods used to obtain the data and should use the information with caution and only as a guideline.

Those involved with the construction of this site should review this report along with appropriate performance charts prepared by the manufacturer of the planned excavation equipment. This information can be used to assist in the selection of appropriate equipment that will be required to excavate the material anticipated to be encountered at this site. However, those using the interpretation of the site conditions contained in this report for any reason do so at their own risk.

Prospective contractors should exercise caution and assume the associated risks if the information provided within this report is used to determine the suitability of any equipment used for construction of the proposed project.

4.5.11 Temporary Excavations

Those involved with the construction of this project should be aware that slope height, slope inclination, or excavation depths (including utility trench excavations) should in no case exceed those specified in local, state, and/or federal safety regulations (e.g., OSHA Health and Safety Standards for Excavations, 29 CFR Part 1926, or successor regulations). Such regulations are strictly enforced and, if they are not followed, the Owner, Contractor, and/or earthwork and utility subcontractors could be liable for substantial penalties.

Trenches over 20 feet deep (if needed) should be designed by the contractor's engineer based on alignment-specific soil properties and settlement-sensitive features. Excavations encountering seepage, if any, should be evaluated on a case-by-case basis. Where the stability of structures is endangered by excavation operations, support systems such as shoring, bracing, or underpinning may be required to provide structural stability and to protect personnel working within the excavation. Shoring, bracing, or underpinning required for the project (if any) should be designed by a professional engineer registered in the State of Arizona. In general, heavy construction equipment, building materials, excavated soil, and vehicular traffic should not be allowed within 1/3 the slope height from the top of any excavation, unless incorporated into the engineered design.

4.6 Seismic Design Considerations

Building structural response to seismic events is based on the structure's Seismic Design Category, which is partially dependent on the Seismic Site Classification. The seismic site classification is based on the soil properties within 100 feet of the surface and the methods outlined in the International Building Code and American Society of Civil Engineers publication ASCE-7. We recommend this site be classified as Site Class C.

The classification is based on a weighted average of the standard penetration testing performed at the site and our experience at similar sites in the region.

The proposed improvements should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. The following table presents the seismic design parameters

for the site in accordance with Minimum Design Loads for Buildings and Other Structures (American Society of Civil Engineers ASCE/SEI 7-16) guidelines and mapped spectral acceleration parameters (United States Geological Survey [USGS], 2011):

Seismic Design Factors	Value
Site Class	C
F_a, Site Coefficient	1.3
F_v, Site Coefficient	1.5
S_s, Mapped Spectral Acceleration at 0.2-second Period	0.185 g
S_1, Mapped Spectral Acceleration at 1.0-second Period	0.066 g
S_{MS}, Spectral Acceleration at 0.2-second Period Adjusted for Site Class	0.241 g
S_{M1}, Spectral Acceleration at 1.0-second Period Adjusted for Site Class	0.099 g
S_{DS}, Design Spectral Response Acceleration at 0.2-second Period	0.161 g
S_{D1}, Design Spectral Response Acceleration at 1.0-second Period	0.066 g

Notes:
1. Site soil classification has been estimated using a combination of the soils encountered in the explorations and our understanding of the geological conditions at the site.

4.7 Soil Corrosion and Concrete Exposure

SAECO performed laboratory testing for parameters that commonly affect the corrosion of buried metal elements. Details of the test methods used to determine the parameters and the results are presented in Appendix B. The effect of these properties on buried metal elements is complex and other factors we have not tested for may also be present at the site. The test results we have provided should be used to assist others in determining the type and degree of corrosion protection that may be required. We recommend a certified corrosion specialist be consulted to assist you with the specific needs of your project.

Laboratory chemical tests performed on samples of the on-site soils indicated sulfate contents of up to 3 parts per million. Based on the American Concrete Institute (ACI) 318 Building Code, the potential for sulfate attack is negligible for water-soluble sulfate contents in soils ranging from 0 percent to 0.10 percent by weight (0 ppm to 1,000 ppm). We recommend the use of Type II cement for construction of concrete structures in contact with soil at this site. The structural engineer should select the concrete design strength, water-cement ratio, slump at placement, etc., based on the project specific conditions and also based on the recommendations presented in ACI.

4.8 Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, the civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

5.0 LIMITATIONS

Some variations in the soil conditions are anticipated between the points explored. The nature and extent of variations may not be evident until construction occurs. If any conditions are encountered at this site that are different from those described in this report, our firm should be immediately notified so that we may make any necessary revisions to the recommendations contained in this report. In addition, if the scope of the proposed construction changes from that described in this report, our firm should also be notified.

The exploration, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report.

This report may be used only by the client and only for the purposes stated within a reasonable time from its issuance, but in no event later than one year from the date of the report. Land or facility use, on and off-site conditions, regulations, or other factors may change over time, and additional work may be required with the passage of time. Similarly, future irrigation, broken water or sewer pipelines, or other factors may adversely influence the project. Any party other than the client who wishes to use this report shall notify SAECO of such intended use. SAECO may require that additional work be performed and that an updated report be issued. Non- compliance with any of these requirements by the client or anyone else will release SAECO from any liability resulting from the use of this report by any unauthorized party and client agrees to defend, indemnify, and hold harmless SAECO from any claim or liability associated with such unauthorized use or non-compliance.

6.0 REFERENCES

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Smith & Annala Engineering Co., In-house proprietary information.

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ENGINEERING CO.
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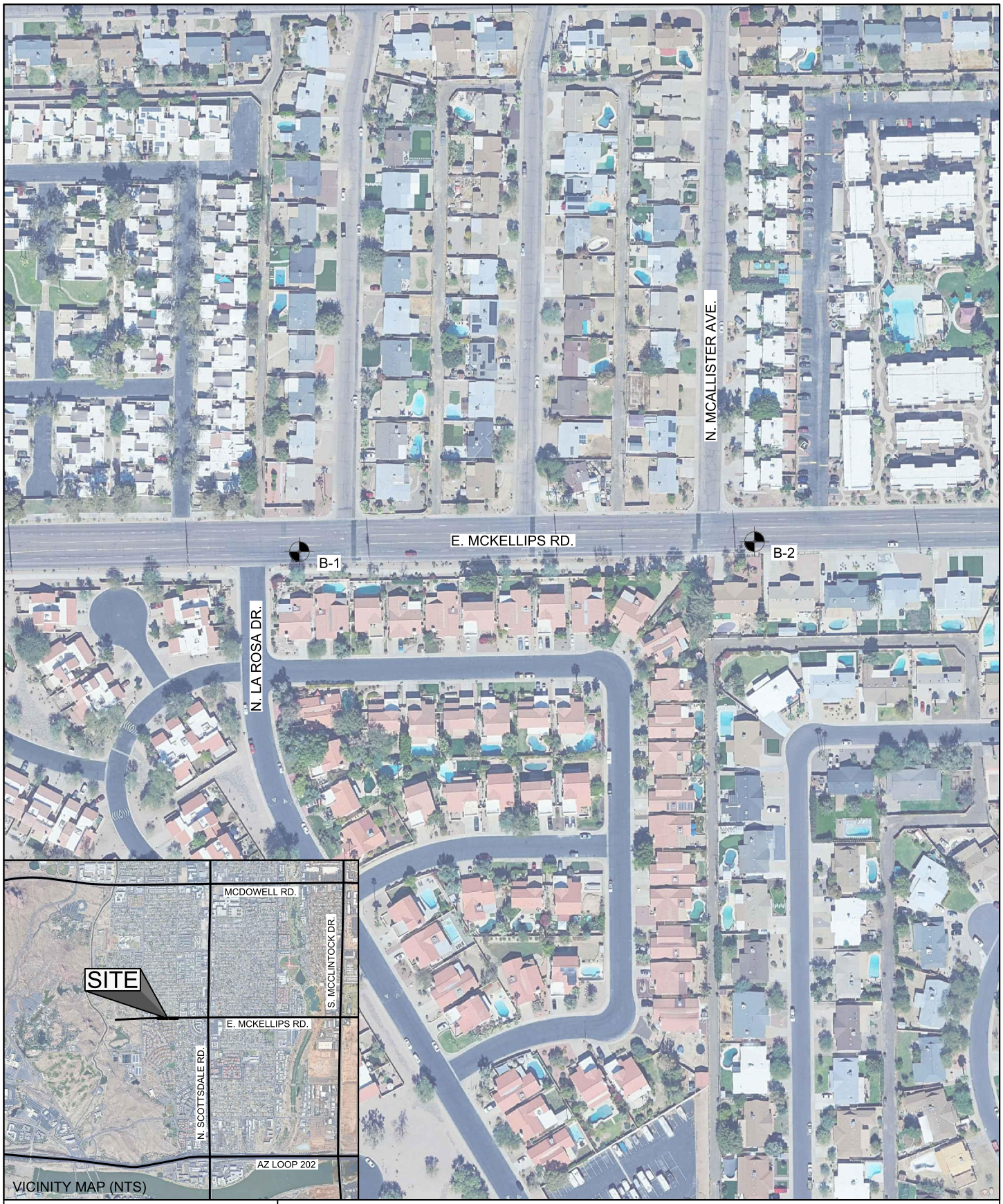
APPENDIX A



MCKELLIPS SEWER ALIGNMENT
MCKELLIPS ROAD & LA ROSA DR.
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GEOTECHNICAL ENGINEERING • CONSTRUCTION QA/QC • ENVIRONMENTAL SERVICES

MAP KEY
APPROXIMATE BORING LOCATION

0 INCHES 1
0 FEET 200

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DRAWN BY:	CHECKED BY:	PROJECT NUMBER:
AJS	JKA	44.24.2328

CLIENT:	DATE:	SCALE:	FIGURE TITLE:	FIGURE NO.:
DIBBLE ENGINEERING	08/08/2024	1" = 200'	EXPLORATION MAP	A-1

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APPENDIX B

APPENDIX B
FIELD INVESTIGATION

Our field investigation was performed on July 22, 2024. During the field investigation a representative from SAECO:

- Noted the current site conditions from cursory observations
- Sited the explorations in the field by estimating bearings and distances from site features shown on aerial photographs, locations marked by the client, the use of a hand-held global positioning device.
- Estimated surface elevations at the explorations using a builder's-level referencing a temporary benchmark (shown on the site plan), a benchmark with an elevation referenced to mean sea level, estimating from topographic maps, etc...
- Directed the exploration subcontractor with respect to total depth of exploration and the type and depth of any sampling performed.
- Visually classified the subsurface materials exposed during the advancement of the explorations. In general accordance with ASTM D2487 (Visual Manual Procedure) with some modifications from SAECO.
- Created a log of the explorations, including subsurface materials encountered, results of field testing performed, and a record of any samples collected.
- Appropriately labeled and packaged the samples collected for transport to the SAECO laboratory.

Soil Borings: Soil borings performed as part of the investigation were extended using a Dietrich Model D-120 Central Mine Equipment, Model CME-75 truck mounted drill-rig utilizing 8-inch (OD) diameter hollow-stem auger operated by Southlands Engineering. Upon completion the borings were backfilled with cuttings derived from auger advancement and asphalt patched utilizing the City of Phoenix high volume C- ¾", 5.0% design.

Descriptions of the types of samples obtained during the field exploration are presented below:

Bulk Samples: Bulk samples are typically bags of loose soil or rock material obtained from auger cuttings of borings or from the walls or bottom of a test trench.

Ring Samples: Relatively undisturbed samples were obtained with a modified ring-lined split barrel sampler. It was driven into the bottom of the borehole at selected depths with a 140-pound hammer free-falling from a height of 30 inches, in general accordance with ASTM D1586. The sampler had an external diameter of 3.0 inches and was lined with a stack of 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The ring-lined samples were removed from the sample barrel, sealed in plastic bags, and placed in protective plastic sleeves with end caps.

Standard Penetration Test (SPT) Samples: Disturbed samples were obtained with a Standard Penetration Test sampler. The sampler had an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. It was driven into the bottom of the borehole at selected depths with a 140-pound hammer

free-falling from a height of 30 inches, in general accordance with ASTM D1586. The blow counts reported on the logs are those for the last 12 inches of penetration. The soil samples were removed from the sampler and sealed in plastic bags.

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KEY TO SYMBOLS

Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona

LITHOLOGIC SYMBOLS
(Unified Soil Classification System)


ABC: Aggregate Base Course


ASPHALT: Asphalt


SC: USCS Clayey Sand

SAMPLER SYMBOLS


Bulk Sample


Split-barrel ring-lined sampler, 2.4-inch I.D.


Standard Penetration Test

WELL CONSTRUCTION SYMBOLS

ABBREVIATIONS

LL - LIQUID LIMIT (%)
PI - PLASTIC INDEX (%)
W - MOISTURE CONTENT (%)
DD - DRY DENSITY (PCF)
NP - NON PLASTIC
-200 - PERCENT PASSING NO. 200 SIEVE
PP - POCKET PENETROMETER (TSF)

TV - TORVANE
PID - PHOTOIONIZATION DETECTOR
UC - UNCONFINED COMPRESSION
ppm - PARTS PER MILLION


Water Level at Time Drilling, or as Shown


Water Level at End of Drilling, or as Shown


Water Level After 24 Hours, or as Shown

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KEY TO SOIL SYMBOLS AND TERMS

Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona

UNIFIED SOIL CLASSIFICATION (ASTM D-2487)

MATERIAL TYPES	CRITERIA FOR ASSIGNING SOIL GROUP NAMES			GROUP SYMBOL	SOIL GROUP NAMES & LEGEND
COARSE-GRAINED SOILS >50% RETAINED ON NO. 200 SIEVE	GRAVELS >50% OF COARSE FRACTION RETAINED ON NO 4. SIEVE	CLEAN GRAVELS <5% FINES	C_u >= 4 AND 1 <= C_c <= 3	GW	WELL-GRADED GRAVEL
			C_u < 4 AND/OR 1 > C_c > 3	GP	POORLY-GRADED GRAVEL
		GRAVELS WITH FINES >12% FINES	FINES CLASSIFY AS ML OR CL	GM	SILTY GRAVEL
			FINES CLASSIFY AS CL OR CH	GC	CLAYEY GRAVEL
	SANDS >50% OF COARSE FRACTION PASSES ON NO 4. SIEVE	CLEAN SANDS <5% FINES	C_u >= 6 AND 1 <= C_c <= 3	SW	WELL-GRADED SAND
			C_u < 6 AND/OR 1 > C_c > 3	SP	POORLY-GRADED SAND
		SANDS AND FINES >12% FINES	FINES CLASSIFY AS ML OR MH	SM	SILTY SAND
			FINES CLASSIFY AS CL OR CH	SC	CLAYEY SAND
FINE-GRAINED SOILS >50% PASSES NO. 200 SIEVE	SILTS AND CLAYS LIQUID LIMIT<50	INORGANIC	PI>7 AND PLOTS>"A" LINE	CL	LEAN CLAY
			PI>4 AND PLOTS<"A" LINE	ML	SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OL	ORGANIC CLAY OR SILT
	SILTS AND CLAYS LIQUID LIMIT>50	INORGANIC	PI PLOTS >"A" LINE	CH	FAT CLAY
			PI PLOTS <"A" LINE	MH	ELASTIC SILT
		ORGANIC	LL (oven dried)/LL (not dried)<0.75	OH	ORGANIC CLAY OR SILT
HIGHLY ORGANIC SOILS		PRIMARILY ORGANIC MATTER, DARK IN COLOR, AND ORGANIC ODOR		PT	PEAT

PARTICLE SIZE DEFINITION FOR SANDS AND GRAVELS

SOIL FRACTION	GRAIN SIZE
Boulders	12 inches +
Cobbles	12 inches to 3 inches
Gravel	
Coarse	3 inches to 3/4 inches
Fine	3/4 inches to #4 Sieve
Sand	
Coarse	#4 to #10 Sieve
Medium	#10 to #40 Sieve
Fine	#40 to #200 Sieve

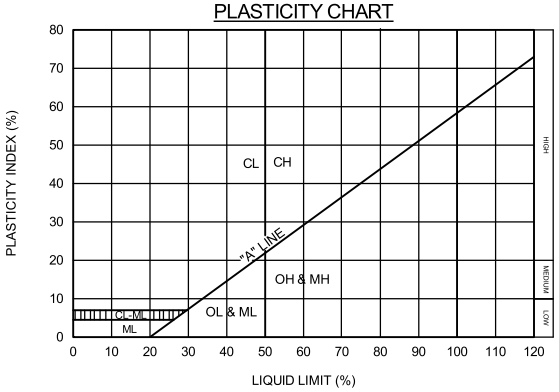
SAMPLE TYPES

- SPT - Standard Penetration Test
- RC - Rock Core, HQ3 Core Barrel
- RING - Ring-lined Sampler
- BULK - Bulk Sample
- UD - Undisturbed Sample

OTHER TESTS OR COMMENTS

(NR)	NO RECOVERY	pH	pH OF SOIL
CN	CONSOLIDATION	RES	MINIMUM ELECTRICAL RESISTIVITY
DS	DIRECT SHEAR	CHLOR	CHORIDE CONTENT
SW	SWELL	SULF	SULFATE CONTENT
UC	UNCONFINED COMPRESSION	THRM	THERMAL RESISTIVITY
RV	R-VALUE	HSA	HOLLOW STEM AUGER
CBR	CALIFORNIA BEARING RATIO	REC	SAMPLE RECOVERY (%)
EI	EXPANSION INDEX	RQD	ROCK QUALITY DESIGNATION
PP	POCKET PENETROMETER (TSF)		

PLASTICITY CHART



CONSISTENCY / RELATIVE DENSITY DEFINITIONS

PENETRATION RESISTANCE (RECORDED AS BLOWS / FT)				
SAND & GRAVEL		COHESIVE SOILS		
RELATIVE DENSITY	N-VALUE BLOWS/FOOT*	CONSISTENCY	N-VALUE BLOWS/FOOT*	UNCONFINED COMPRESSIVE STRENGTH (TSF) **
VERY LOOSE	0 - 4	VERY SOFT	0 - 2	0 - 0.25
LOOSE	4 - 10	SOFT	2 - 4	0.25 - 0.50
MEDIUM DENSE	10 - 30	FIRM	4 - 8	0.50 - 1.0
DENSE	30 - 50	STIFF	8 - 15	1.0 - 2.0
VERY DENSE	OVER 50	VERY STIFF	15 - 30	2.0 - 4.0
		HARD	OVER 30	OVER 4.0

* NUMBER OF BLOWS OF 140 LB HAMMER FALLING 30 INCHES TO DRIVE A 2 INCH O.D. (1-3/8 INCH I.D.) SPLIT-BARREL SAMPLER THE LAST 12 INCHES OF AN 18-INCH DRIVE (ASTM-1586 STANDARD PENETRATION TEST).

** VERY APPROXIMATE

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BORING NUMBER B-1

Client: Dibble
Project Name: McKellips Sewer Alignment
Project Number: 44.24.2328
Project Location: Tempe, Arizona
Date Started: 7/22/24 Completed: 7/22/24
Ground Elevation: 1219 ft Hole Size: 8 inches
Drilling Contractor: Southlands
Ground Water Levels:
Drilling Method: Hollow Stem Auger
At time of Drilling: Not Encountered
Logged By: EDM Checked By: JKA
At end of Drilling: Not Encountered
Notes:
After Drilling: Not Encountered

Elevation (ft)	Depth (ft)	Bullnose Pen. (blows / ft)	Sample type/Interval	Blows per 6 in.	N-value (blows / ft)	Dry Unit Wt. (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing No. 4 Sieve (%)	Passing No. 200 Sieve (%)	Other Tests or Comments	Graphic Log	USCS Classification	MATERIAL DESCRIPTION
															Asphalt, 5.0-inches
														SC	Aggregate Base Course, 7.0-inches
															CLAYEY SAND, light brown, moist, dense, medium plasticity, no cementation
				21 25	(46)	132	6	42	18	59	15	SW, pH, RES, CHLOR, SULF			
1215															
	5			10 36	(46)	119	9								
				34 50/5"	100+										Very dense
1210															
	10			32 50/5"	100+										
1205															
	15			26 27 50/5"	100+										

Bottom of borehole at 16.4 feet.

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BORING NUMBER B-2

Client: Dibble
Project Name: McKellips Sewer Alignment
Project Number: 44.24.2328
Project Location: Tempe, Arizona
Date Started: 7/22/24 Completed: 7/22/24
Ground Elevation: 1216 ft Hole Size: 8 inches
Drilling Contractor: Southlands
Ground Water Levels:
Drilling Method: Hollow Stem Auger
At time of Drilling: Not Encountered
Logged By: EDM Checked By: JKA
At end of Drilling: Not Encountered
Notes:
After Drilling: Not Encountered

Elevation (ft)	Depth (ft)	Bullnose Pen. (blows / ft)	Sample type/Interval	Blows per 6 in.	N-value (blows / ft)	Dry Unit Wt. (pcf)	Moisture Content (%)	Liquid Limit	Plasticity Index	Passing No. 4 Sieve (%)	Passing No. 200 Sieve (%)	Other Tests or Comments	Graphic Log	USCS Classification	MATERIAL DESCRIPTION
1215															Asphalt, 5.5-inches
															Aggregate Base Course, 7.5-inches
														SC	CLAYEY SAND, light brown, moist, dense to very dense, medium plasticity, no cementation
				32 50/4"	(50+)										
	5														
1210				15 12 21	33										
				21 50/3"	(50+)		5					CHLOR, SULF			
	10														
				50/5"	100+										
1205				36 35 50/5"	100+										Weak cementation

Refusal at 11.9 feet. Gravel.

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APPENDIX C

APPENDIX C
LABORATORY TESTING

In-Place Moisture and Density Tests

The moisture contents of samples obtained from the field exploration were evaluated in general accordance with ASTM Test Method D 2216; dry unit weight was evaluated using procedures similar to ASTM Test Method D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

Gradation

Gradation tests were utilized to aid in soil classification. Gradation testing was performed on selected representative soil samples in general accordance with ASTM D422. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System (USCS).

Atterberg Limits

Atterberg Limits tests were utilized to evaluate the plasticity characteristics of the soil, aid in soil classification, and to correlate with engineering properties such as shrink-swell potential. Tests were performed on selected representative soil samples in general accordance with ASTM D4318.

Swell Potential

Swell tests were performed in general accordance with ASTM D4546, Method B. The specimens were prepared by compacting a moisture conditioned sample to approximately 95% of the maximum density and at approximately 3% below the optimum moisture content as determined by ASTM D698 (Standard Proctor). The specimens were loaded with a surcharge load of approximately 100 pounds per square foot before inundation.

Resistivity and pH

Resistivity and pH tests were performed to evaluate the corrosive potential of the site soils. Tests were performed in general accordance with ADOT Test Method 236.

Sulfate and Chloride

Sulfate and Chloride tests were performed to evaluate the corrosive potential of site soils toward portland cement concrete and ferrous metals. Tests were performed in general accordance with Arizona Test Method 733 and 736, respectively.

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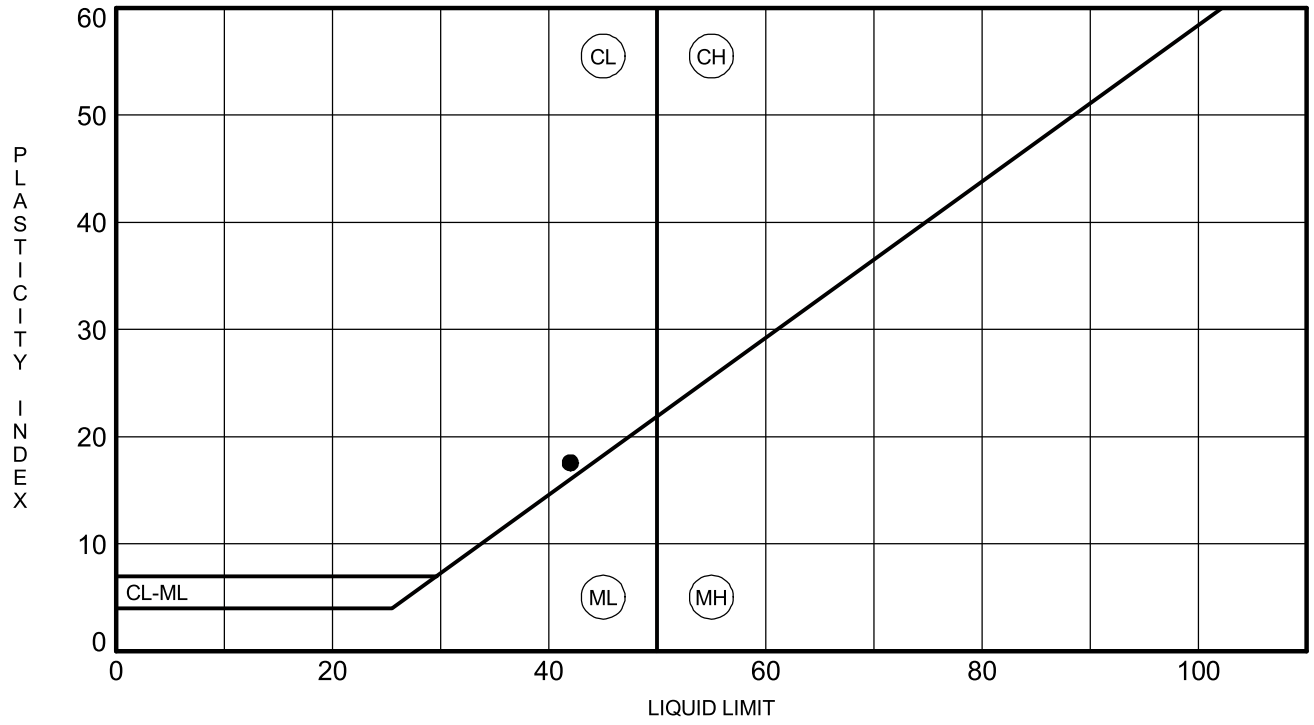
ATTERBERG LIMITS' RESULTS

Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona



	Borehole	Depth (ft)	LL	PL	PI	Fines (%)	Classification
●	**B-1**	**1.0-5.0**	**42**	**24**	**18**	**15**	**CLAYEY SAND with GRAVEL(SC)**

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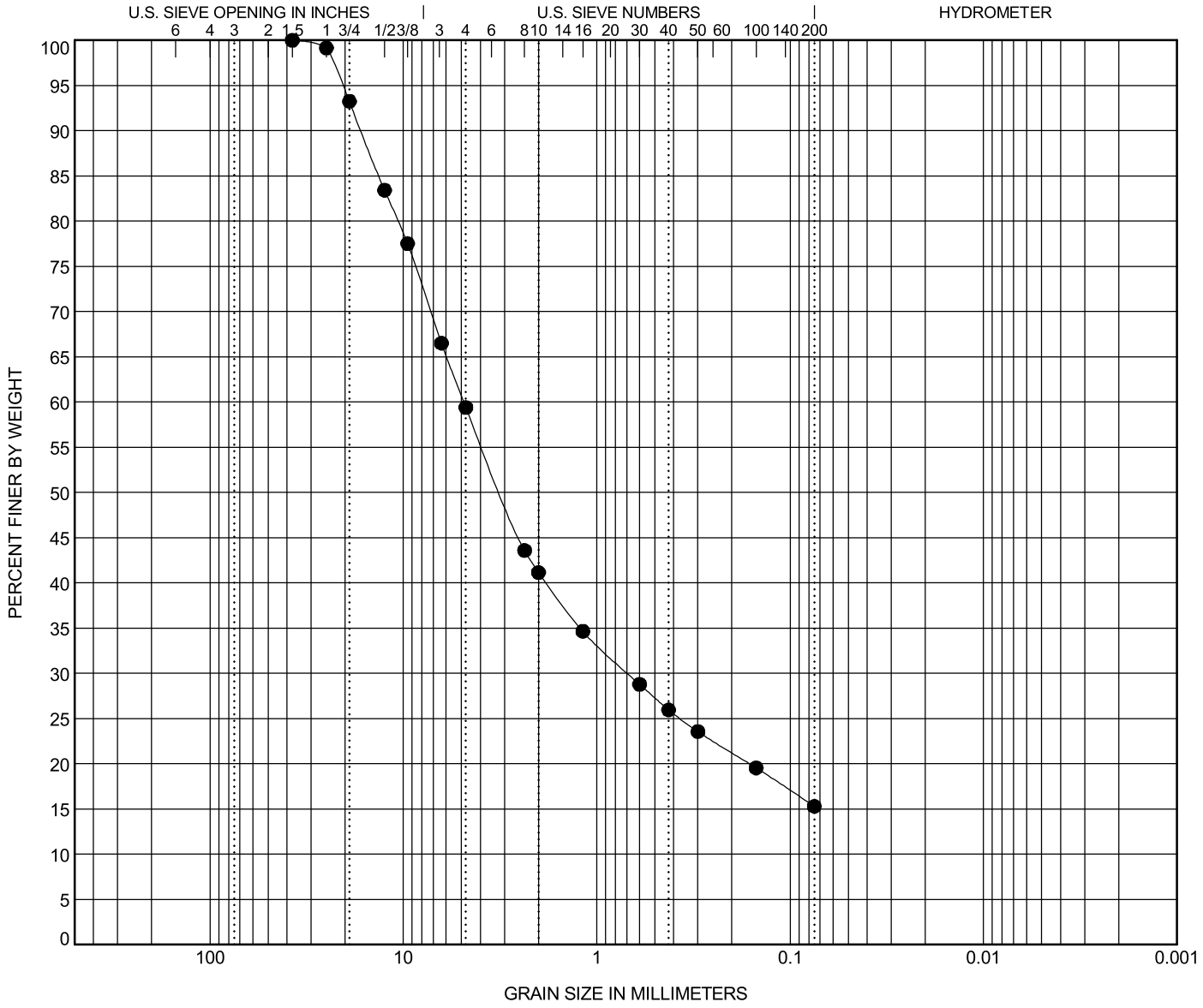
GRAIN SIZE DISTRIBUTION

Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Borehole	Depth (ft)	Classification	LL	PL	PI	Cc	Cu
● **B-1**	**1.0-5.0**	**CLAYEY SAND with GRAVEL(SC)**	**42**	**24**	**18**		

Borehole	Depth (ft)	D100 (mm)	D60 (mm)	D30 (mm)	D10 (mm)	%Gravel	%Sand	%Silt	%Clay
● **B-1**	**1.0-5.0**	**37.5**	**4.867**	**0.69**		**40.6**	**44.1**	**15.3**	

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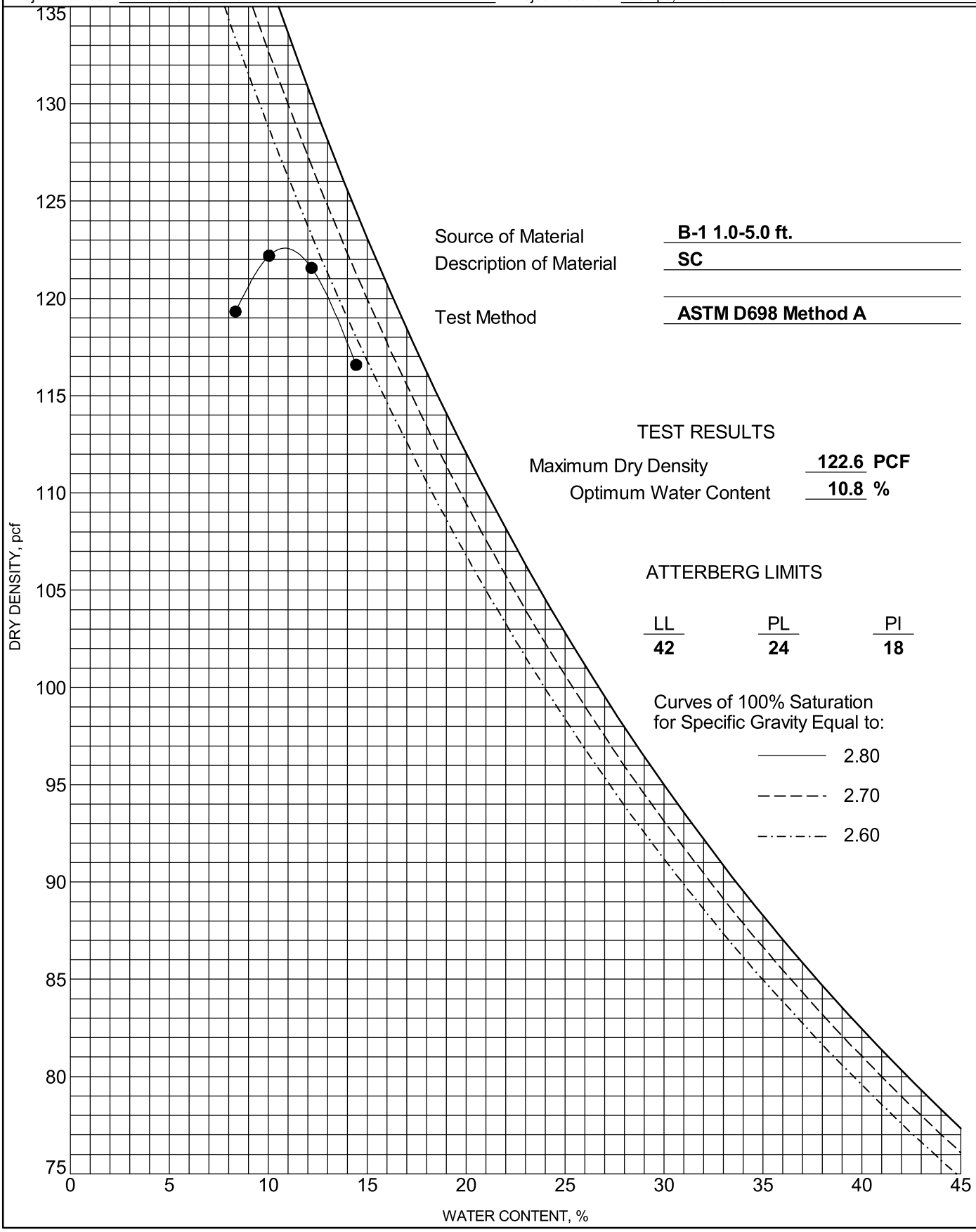
MOISTURE-DENSITY RELATIONSHIP

Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona



Source of Material: **B-1 1.0-5.0 ft.**

Description of Material: **SC**

Test Method: **ASTM D698 Method A**

TEST RESULTS

Maximum Dry Density: **122.6** **PCF**

Optimum Water Content: **10.8** **%**

ATTERBERG LIMITS

LL	PL	PI
42	**24**	**18**

Curves of 100% Saturation for Specific Gravity Equal to:

——— 2.80

– – – – 2.70

–·–·–·– 2.60

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REMOLDED SWELL TEST

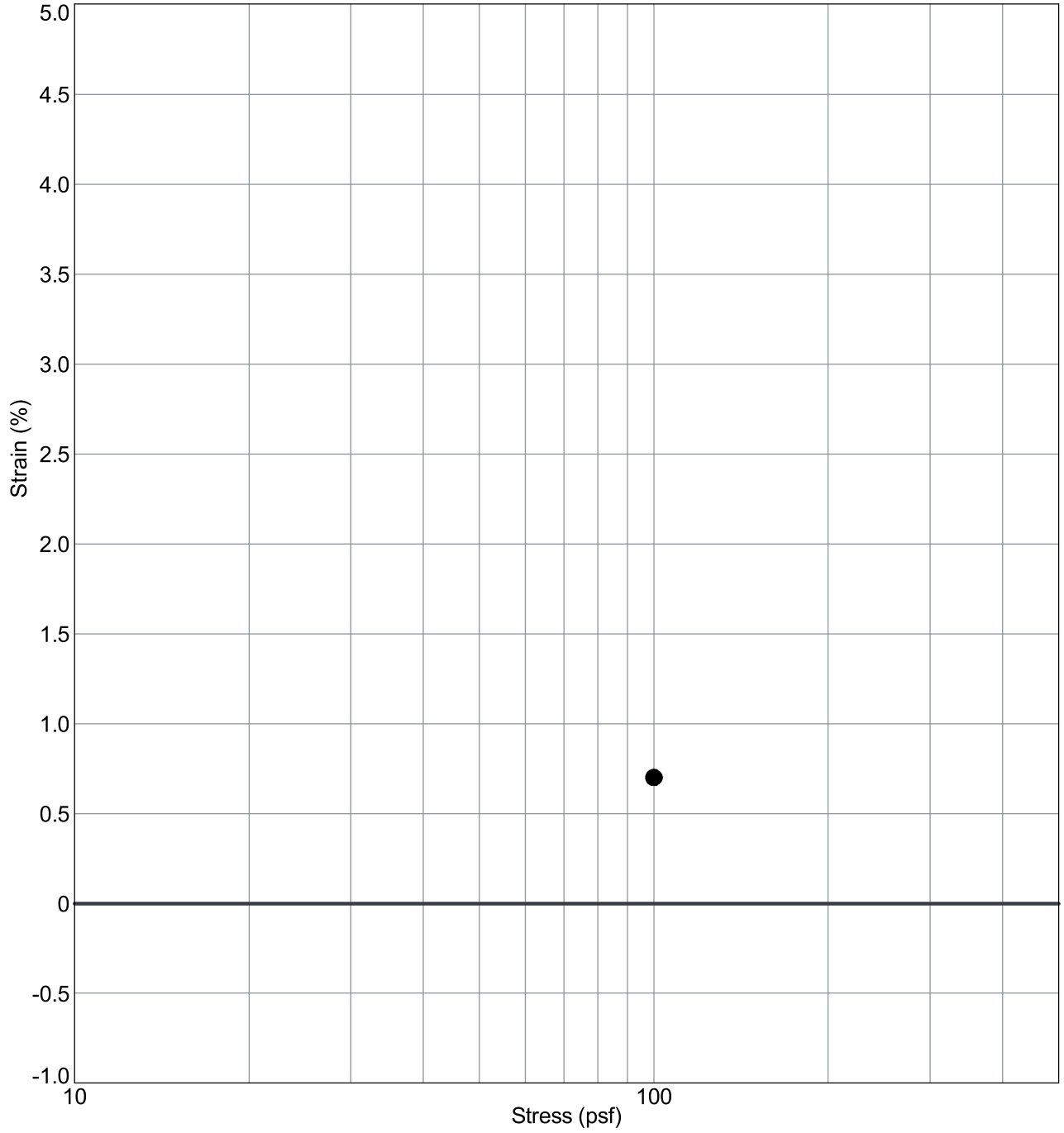
Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona

Samples remolded to 95% of maximum dry density and 3% below optimum moisture content as determined by ASTM D698, or AZ232b



	Borehole	Depth (ft)	Description of Materials	Rmld. DD	Rmld. WC	SWELL
●	**B-1**	**1.0-5.0**	**CLAYEY SAND with GRAVEL(SC)**	**116.5 PCF**	**7.8 %**	**0.7 %**

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SUMMARY OF LABORATORY RESULTS

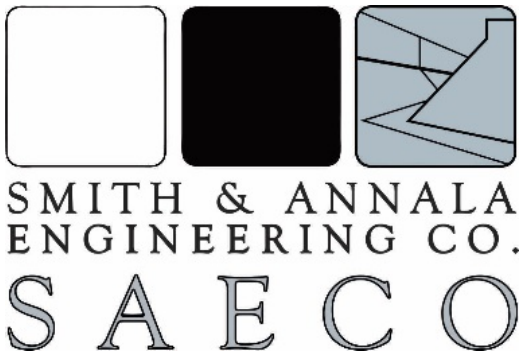
Client: Dibble

Project Name: McKellips Sewer Alignment

Project Number: 44.24.2328

Project Location: Tempe, Arizona

Borehole	Depth (ft)	USCS Group Symbol	Liquid Limit	Plastic Limit	Plasticity Index	%>#4 Sieve	%<#200 Sieve	Water Content (%)	Dry Density (pcf)	Consol(-)/ Swell(+) (%)	pH	Minimum Resistivity (Ohm-cm)	Sulfate (ppm)	Chloride (ppm)
B-1	**1.0-5.0**	**SC**	**42**	**24**	**18**	**41**	**15**			**+0.7**	**7.9**	**6000**	**3**	**5**
B-1	**2.5-3.5**	**SC**						**6.1**	**131.5**					
B-1	**5.0-6.0**	**SC**						**9.3**	**119.0**					
B-2	**7.5-8.3**	**SC**						**5.3**					**3**	**10**



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