STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	BP4.R006	1	20

REFERENCE: BP4.R006

PROJECT:

STATE OF NORTH CAROLINA
DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY JOHNSTON

PROJECT DESCRIPTION BRIDGE NO. 173 OVER BUFFALO CREEK ON SR 1700 (COVERED BRIDGE ROAD) BETWEEN SR 1003 AND SR 3519

SITE DESCRIPTION

CONTENTS

CAUTION NOTICE

THE SUBSURFACE INFORMATION AND THE SUBSURFACE INVESTIGATION ON WHICH IT IS BASED WERE MADE FOR THE PURPOSE OF STUDY, PLANNING AND DESIGN, AND NOT FOR CONSTRUCTION OR PAY PURPOSES. THE VARIOUS FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA AVAILABLE MAY BE REVIEWED OR INSPECTED IN RALEIGH BY CONTACTING THE N. C. DEPARTMENT OF TRANSPORTATION, GEOTECHNICAL ENGINEERING UNIT AT (919) 707-6850. THE SUBSURFACE PLANS AND REPORTS, FIELD BORING LOGS, ROCK CORES AND SOIL TEST DATA ARE NOT PART OF THE CONTRACT.

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PERSONNEL

CATLIN ENGINEERS AND SCIENTISTS

INVESTIGATED BY T. PARK

DRAWN BY T. LYNN

CHECKED BY K. BUSSEY

SUBMITTED BY HDR

DATE OCTOBER 2022

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SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

SOIL IS CONSIDERED UNCONSOLIDATED, SEMI-CONSOLIDATED, OR WEATHERED EARTH MATERIALS THAT CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER AND YIELD LESS THAN 100 BLOWS PER FOOT ACCORDING TO THE STANDARD PENETRATION TEST (AASHTO T 206, ASTM D1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM. BASIC DESCRIPTIONS GENERALLY INCLUDE THE FOLLOWING: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. FOR EXAMPLE,
VERY STIFF, GRAY, SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6

SOIL LEGEND AND AASHTO CLASSIFICATION

GENERAL CLASS.	GRANULAR MATERIALS (≤ 35% PASSING #200)							SILT-CLAY MATERIALS (> 35% PASSING #200)				ORGANIC MATERIALS		
GROUP CLASS.	A-1		A-3	A-2				A-4	A-5	A-6	A-7	A-1, A-2 A-3	A-4, A-5 A-6, A-7	
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6			
SYMBOL														
% PASSING #10 #40 #200	50 MX 30 MX 15 MX	50 MX 25 MX	51 MN 10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN	GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
MATERIAL PASSING #40 LL PI	— 6 MX		— NP	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	40 MX 10 MX	41 MN 10 MX	40 MX 11 MN	41 MN 11 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
GROUP INDEX	0		0	0		4 MX		8 MX	12 MX	16 MX	NO MX			
USUAL TYPES OF MAJOR MATERIALS	STONE FRAGS. GRAVEL, AND SAND		FINE SAND	SILTY OR CLAYEY GRAVEL AND SAND				SILTY SOILS		CLAYEY SOILS				
GEN. RATING AS SUBGRADE	EXCELLENT TO GOOD							FAIR TO POOR				FAIR TO POOR	POOR	UNSUITABLE

PI OF A-7-5 SUBGROUP IS ≤ LL - 30 ; PI OF A-7-6 SUBGROUP IS > LL - 30

CONSISTENCY OR DENSENESS

PRIMARY SOIL TYPE	COMPACTNESS OR CONSISTENCY	RANGE OF STANDARD PENETRATION RESISTENCE (N-VALUE)	RANGE OF UNCONFINED COMPRESSIVE STRENGTH ($TONS/FT^2$)
GENERALLY GRANULAR MATERIAL (NON-COHESIVE)	VERY LOOSE LOOSE MEDIUM DENSE DENSE VERY DENSE	< 4 4 TO 10 10 TO 30 30 TO 50 > 50	N/A
GENERALLY SILT-CLAY MATERIAL (COHESIVE)	VERY SOFT SOFT MEDIUM STIFF STIFF VERY STIFF HARD	< 2 2 TO 4 4 TO 8 8 TO 15 15 TO 30 > 30	< 0.25 0.25 TO 0.5 0.5 TO 1.0 1 TO 2 2 TO 4 > 4

TEXTURE OR GRAIN SIZE

U.S. STD. SIEVE SIZE	4	10	40	60	200	270
OPENING (MM)	4.76	2.00	0.42	0.25	0.075	0.053

BOULDER (BLDR.)	COBBLE (COB.)	GRAVEL (GR.)	COARSE SAND (CSE. SD.)	FINE SAND (F SD.)	SILT (SL.)	CLAY (CL.)

GRAIN SIZE	MM	305	75	2.0	0.25	0.05	0.005
	IN.	12	3				

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE SL — SHRINKAGE LIMIT	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
	- DRY - (D)	REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE

PLASTICITY

	PLASTICITY INDEX (PI)	DRY STRENGTH
NON PLASTIC	0-5	VERY LOW
SLIGHTLY PLASTIC	6-15	SLIGHT
MODERATELY PLASTIC	16-25	MEDIUM
HIGHLY PLASTIC	26 OR MORE	HIGH

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-GRAY). MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.

GRADATION

WELL GRADED - INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE.
UNIFORMLY GRADED - INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE.
GAP-GRADED - INDICATES A MIXTURE OF UNIFORM PARTICLE SIZES OF TWO OR MORE SIZES.

ANGULARITY OF GRAINS

THE ANGULARITY OR ROUNDNESS OF SOIL GRAINS IS DESIGNATED BY THE TERMS: ANGULAR, SUBANGULAR, SUBROUNDED, OR ROUNDED.

MINERALOGICAL COMPOSITION

MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHEN THEY ARE CONSIDERED OF SIGNIFICANCE.

COMPRESSIBILITY

SLIGHTLY COMPRESSIBLE	LL < 31
MODERATELY COMPRESSIBLE	LL = 31 - 50
HIGHLY COMPRESSIBLE	LL > 50

PERCENTAGE OF MATERIAL

ORGANIC MATERIAL	GRANULAR SOILS	SILT - CLAY SOILS	OTHER MATERIAL	
TRACE OF ORGANIC MATTER	2 - 3%	3 - 5%	TRACE	1 - 10%
LITTLE ORGANIC MATTER	3 - 5%	5 - 12%	LITTLE	10 - 20%
MODERATELY ORGANIC	5 - 10%	12 - 20%	SOME	20 - 35%
HIGHLY ORGANIC	> 10%	> 20%	HIGHLY	35% AND ABOVE

GROUND WATER

- WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING
- STATIC WATER LEVEL AFTER 24 HOURS
- PW — PERCHED WATER, SATURATED ZONE, OR WATER BEARING STRATA
- SPRING OR SEEP

MISCELLANEOUS SYMBOLS

- ROADWAY EMBANKMENT (RE) WITH SOIL DESCRIPTION
- SOIL SYMBOL
- ARTIFICIAL FILL (AF) OTHER THAN ROADWAY EMBANKMENT
- INFERRED SOIL BOUNDARY
- INFERRED ROCK LINE
- ALLUVIAL SOIL BOUNDARY
- 25/025 — DIP & DIP DIRECTION OF ROCK STRUCTURES
- SPT, DPT, DMT, VST, PMT — TEST BORING
- AUGER BORING
- CORE BORING
- MW — MONITORING WELL
- PIEZOMETER INSTALLATION
- SLOPE INDICATOR INSTALLATION
- CONE PENETROMETER TEST
- SOUNDING ROD
- TEST BORING WITH CORE
- SPT N-VALUE

RECOMMENDATION SYMBOLS

- UNDERCUT
- SHALLOW UNDERCUT
- UNCLASSIFIED EXCAVATION - UNSUITABLE WASTE
- UNCLASSIFIED EXCAVATION - ACCEPTABLE DEGRADABLE ROCK
- UNCLASSIFIED EXCAVATION - ACCEPTABLE, BUT NOT TO BE USED IN THE TOP 3 FEET OF EMBANKMENT OR BACKFILL

ABBREVIATIONS

AR - AUGER REFUSAL
BT - BORING TERMINATED
CL. - CLAY
CPT - CONE PENETRATION TEST
CSE. - COARSE
DMT - DILATOMETER TEST
DPT - DYNAMIC PENETRATION TEST
e - VOID RATIO
F - FINE
FOSS. - FOSSILIFEROUS
FRAC. - FRACTURED, FRACTURES
FRAGS. - FRAGMENTS
HI. - HIGHLY
MED. - MEDIUM
MICA. - MICACEOUS
MOD. - MODERATELY
NP - NON PLASTIC
ORG. - ORGANIC
PMT - PRESSUREMETER TEST
SAP. - SAPROLITIC
SD. - SAND, SANDY
SL. - SILT, SILTY
SLI. - SLIGHTLY
TCR - TRICONE REFUSAL
w - MOISTURE CONTENT
V - VERY
VST - VANE SHEAR TEST
WEA. - WEATHERED
γ - UNIT WEIGHT
γ_d - DRY UNIT WEIGHT

SAMPLE ABBREVIATIONS

S - BULK
SS - SPLIT SPOON
ST - SHELBY TUBE
RS - ROCK
RT - RECOMPACTED TRIAXIAL
CBR - CALIFORNIA BEARING RATIO

EQUIPMENT USED ON SUBJECT PROJECT

DRILL UNITS:
- [ ] CME-45C
- [ ] CME-55
- [X] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

ADVANCING TOOLS:
- [ ] CLAY BITS
- [ ] 6" CONTINUOUS FLIGHT AUGER
- [ ] 8" HOLLOW AUGERS
- [ ] HARD FACED FINGER BITS
- [ ] TUNG.-CARBIDE INSERTS
- [ ] CASING [ ] W/ ADVANCER
- [ ] TRICONE _____" STEEL TEETH
- [ ] TRICONE _____" TUNG.-CARB.
- [X] CORE BIT
- [X] MUD ROTARY

HAMMER TYPE:
- [X] AUTOMATIC [ ] MANUAL

CORE SIZE:
- [ ] -B _____ [ ] -H _____
- [X] -N Q2

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [ ] HAND AUGER
- [ ] SOUNDING ROD
- [ ] VANE SHEAR TEST
- [ ] _____

ROCK DESCRIPTION

HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT REFUSAL IF TESTED. AN INFERRED ROCK LINE INDICATES THE LEVEL AT WHICH NON-COASTAL PLAIN MATERIAL WOULD YIELD SPT REFUSAL. SPT REFUSAL IS PENETRATION BY A SPLIT SPOON SAMPLER EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS IN NON-COASTAL PLAIN MATERIAL, THE TRANSITION BETWEEN SOIL AND ROCK IS OFTEN REPRESENTED BY A ZONE OF WEATHERED ROCK.
ROCK MATERIALS ARE TYPICALLY DIVIDED AS FOLLOWS:

WEATHERED ROCK (WR)	NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.
CRYSTALLINE ROCK (CR)	FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.
NON-CRYSTALLINE ROCK (NCR)	FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YEILD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES PHYLLITE, SLATE, SANDSTONE, ETC.
COASTAL PLAIN SEDIMENTARY ROCK (CP)	COASTAL PLAIN SEDIMENTS CEMENTED INTO ROCK, BUT MAY NOT YIELD SPT REFUSAL. ROCK TYPE INCLUDES LIMESTONE, SANDSTONE, CEMENTED SHELL BEDS, ETC.

WEATHERING

FRESH	ROCK FRESH, CRYSTALS BRIGHT, FEW JOINTS MAY SHOW SLIGHT STAINING. ROCK RINGS UNDER HAMMER IF CRYSTALLINE.
VERY SLIGHT (V SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED, SOME JOINTS MAY SHOW THIN CLAY COATINGS IF OPEN, CRYSTALS ON A BROKEN SPECIMEN FACE SHINE BRIGHTLY. ROCK RINGS UNDER HAMMER BLOWS IF OF A CRYSTALLINE NATURE.
SLIGHT (SLI.)	ROCK GENERALLY FRESH, JOINTS STAINED AND DISCOLORATION EXTENDS INTO ROCK UP TO 1 INCH. OPEN JOINTS MAY CONTAIN CLAY. IN GRANITOID ROCKS SOME OCCASIONAL FELDSPAR CRYSTALS ARE DULL AND DISCOLORED. CRYSTALLINE ROCKS RING UNDER HAMMER BLOWS.
MODERATE (MOD.)	SIGNIFICANT PORTIONS OF ROCK SHOW DISCOLORATION AND WEATHERING EFFECTS. IN GRANITOID ROCKS, MOST FELDSPARS ARE DULL AND DISCOLORED, SOME SHOW CLAY. ROCK HAS DULL SOUND UNDER HAMMER BLOWS AND SHOWS SIGNIFICANT LOSS OF STRENGTH AS COMPARED WITH FRESH ROCK.
MODERATELY SEVERE (MOD. SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. IN GRANITOID ROCKS, ALL FELDSPARS DULL AND DISCOLORED AND A MAJORITY SHOW KAOLINIZATION. ROCK SHOWS SEVERE LOSS OF STRENGTH AND CAN BE EXCAVATED WITH A GEOLOGIST'S PICK. ROCK GIVES "CLUNK" SOUND WHEN STRUCK. *IF TESTED, WOULD YIELD SPT REFUSAL*
SEVERE (SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC CLEAR AND EVIDENT BUT REDUCED IN STRENGTH TO STRONG SOIL. IN GRANITOID ROCKS ALL FELDSPARS ARE KAOLINIZED TO SOME EXTENT. SOME FRAGMENTS OF STRONG ROCK USUALLY REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES > 100 BPF*
VERY SEVERE (V SEV.)	ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE THAT ONLY MINOR VESTIGES OF ORIGINAL ROCK FABRIC REMAIN. *IF TESTED, WOULD YIELD SPT N VALUES < 100 BPF*
COMPLETE	ROCK REDUCED TO SOIL. ROCK FABRIC NOT DISCERNIBLE, OR DISCERNIBLE ONLY IN SMALL AND SCATTERED CONCENTRATIONS. QUARTZ MAY BE PRESENT AS DIKES OR STRINGERS. SAPROLITE IS ALSO AN EXAMPLE.

ROCK HARDNESS

VERY HARD	CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGIST'S PICK.
HARD	CAN BE SCRATCHED BY KNIFE OR PICK ONLY WITH DIFFICULTY. HARD HAMMER BLOWS REQUIRED TO DETACH HAND SPECIMEN.
MODERATELY HARD	CAN BE SCRATCHED BY KNIFE OR PICK. GOUGES OR GROOVES TO 0.25 INCHES DEEP CAN BE EXCAVATED BY HARD BLOW OF A GEOLOGIST'S PICK. HAND SPECIMENS CAN BE DETACHED BY MODERATE BLOWS.
MEDIUM HARD	CAN BE GROOVED OR GOUGED 0.05 INCHES DEEP BY FIRM PRESSURE OF KNIFE OR PICK POINT. CAN BE EXCAVATED IN SMALL CHIPS TO PEICES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT	CAN BE GROVED OR GOUGED READILY BY KNIFE OR PICK. CAN BE EXCAVATED IN FRAGMENTS FROM CHIPS TO SEVERAL INCHES IN SIZE BY MODERATE BLOWS OF A PICK POINT. SMALL, THIN PIECES CAN BE BROKEN BY FINGER PRESSURE.
VERY SOFT	CAN BE CARVED WITH KNIFE. CAN BE EXCAVATED READILY WITH POINT OF PICK. PIECES 1 INCH OR MORE IN THICKNESS CAN BE BROKEN BY FINGER PRESSURE. CAN BE SCRATCHED READILY BY FINGERNAIL.

FRACTURE SPACING

TERM	SPACING
VERY WIDE	MORE THAN 10 FEET
WIDE	3 TO 10 FEET
MODERATELY CLOSE	1 TO 3 FEET
CLOSE	0.16 TO 1 FOOT
VERY CLOSE	LESS THAN 0.16 FEET

BEDDING

TERM	THICKNESS
VERY THICKLY BEDDED	4 FEET
THICKLY BEDDED	1.5 - 4 FEET
THINLY BEDDED	0.16 - 1.5 FEET
VERY THINLY BEDDED	0.03 - 0.16 FEET
THICKLY LAMINATED	0.008 - 0.03 FEET
THINLY LAMINATED	< 0.008 FEET

INDURATION

FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF MATERIAL BY CEMENTING, HEAT, PRESSURE, ETC.

FRIABLE	RUBBING WITH FINGER FREES NUMEROUS GRAINS; GENTLE BLOW BY HAMMER DISINTEGRATES SAMPLE.
MODERATELY INDURATED	GRAINS CAN BE SEPARATED FROM SAMPLE WITH STEEL PROBE; BREAKS EASILY WHEN HIT WITH HAMMER.
INDURATED	GRAINS ARE DIFFICULT TO SEPARATE WITH STEEL PROBE; DIFFICULT TO BREAK WITH HAMMER.
EXTREMELY INDURATED	SHARP HAMMER BLOWS REQUIRED TO BREAK SAMPLE; SAMPLE BREAKS ACROSS GRAINS.

TERMS AND DEFINITIONS

ALLUVIUM (ALLUV.) - SOILS THAT HAVE BEEN TRANSPORTED BY WATER.

AQUIFER - A WATER BEARING FORMATION OR STRATA.

ARENACEOUS - APPLIED TO ROCKS THAT HAVE BEEN DERIVED FROM SAND OR THAT CONTAIN SAND.

ARGILLACEOUS - APPLIED TO ALL ROCKS OR SUBSTANCES COMPOSED OF CLAY MINERALS, OR HAVING A NOTABLE PROPORTION OF CLAY IN THEIR COMPOSITION, SUCH AS SHALE, SLATE, ETC.

ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IT IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE.

CALCAREOUS (CALC.) - SOILS THAT CONTAIN APPRECIABLE AMOUNTS OF CALCIUM CARBONATE.

COLLUVIUM - ROCK FRAGMENTS MIXED WITH SOIL DEPOSITED BY GRAVITY ON SLOPE OR AT BOTTOM OF SLOPE.

CORE RECOVERY (REC.) - TOTAL LENGTH OF ALL MATERIAL RECOVERED IN THE CORE BARREL DIVIDED BY TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

DIKE - A TABULAR BODY OF IGNEOUS ROCK THAT CUTS ACROSS THE STRUCTURE OF ADJACENT ROCKS OR CUTS MASSIVE ROCK.

DIP - THE ANGLE AT WHICH A STRATUM OR ANY PLANAR FEATURE IS INCLINED FROM THE HORIZONTAL.

DIP DIRECTION (DIP AZIMUTH) - THE DIRECTION OR BEARING OF THE HORIZONTAL TRACE OF THE LINE OF DIP, MEASURED CLOCKWISE FROM NORTH.

FAULT - A FRACTURE OR FRACTURE ZONE ALONG WHICH THERE HAS BEEN DISPLACEMENT OF THE SIDES RELATIVE TO ONE ANOTHER PARALLEL TO THE FRACTURE.

FISSILE - A PROPERTY OF SPLITTING ALONG CLOSELY SPACED PARALLEL PLANES.

FLOAT - ROCK FRAGMENTS ON SURFACE NEAR THEIR ORIGINAL POSITION AND DISLODGED FROM PARENT MATERIAL.

FLOOD PLAIN (FP) - LAND BORDERING A STREAM, BUILT OF SEDIMENTS DEPOSITED BY THE STREAM.

FORMATION (FM.) - A MAPPABLE GEOLOGIC UNIT THAT CAN BE RECOGNIZED AND TRACED IN THE FIELD.

JOINT - FRACTURE IN ROCK ALONG WHICH NO APPRECIABLE MOVEMENT HAS OCCURRED.

LEDGE - A SHELF-LIKE RIDGE OR PROJECTION OF ROCK WHOSE THICKNESS IS SMALL COMPARED TO ITS LATERAL EXTENT.

LENS - A BODY OF SOIL OR ROCK THAT THINS OUT IN ONE OR MORE DIRECTIONS.

MOTTLED (MOT.) - IRREGULARLY MARKED WITH SPOTS OF DIFFERENT COLORS. MOTTLING IN SOILS USUALLY INDICATES POOR AERATION AND LACK OF GOOD DRAINAGE.

PERCHED WATER - WATER MAINTAINED ABOVE THE NORMAL GROUND WATER LEVEL BY THE PRESENCE OF AN INTERVENING IMPERVIOUS STRATUM.

RESIDUAL (RES.) SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK.

ROCK QUALITY DESIGNATION (RQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF CORE RUN AND EXPRESSED AS A PERCENTAGE.

SAPROLITE (SAP.) - RESIDUAL SOIL THAT RETAINS THE RELIC STRUCTURE OR FABRIC OF THE PARENT ROCK.

SILL - AN INTRUSIVE BODY OF IGNEOUS ROCK OF APPROXIMATELY UNIFORM THICKNESS AND RELATIVELY THIN COMPARED WITH ITS LATERAL EXTENT, THAT HAS BEEN EMPLACED PARALLEL TO THE BEDDING OR SCHISTOSITY OF THE INTRUDED ROCKS.

SLICKENSIDE - POLISHED AND STRIATED SURFACE THAT RESULTS FROM FRICTION ALONG A FAULT OR SLIP PLANE.

STANDARD PENETRATION TEST (PENETRATION RESISTANCE) (SPT) - NUMBER OF BLOWS (N OR BPF) OF A 140 LB. HAMMER FALLING 30 INCHES REQUIRED TO PRODUCE A PENETRATION OF 1 FOOT INTO SOIL WITH A 2 INCH OUTSIDE DIAMETER SPLIT SPOON SAMPLER. SPT REFUSAL IS PENETRATION EQUAL TO OR LESS THAN 0.1 FOOT PER 60 BLOWS.

STRATA CORE RECOVERY (SREC.) - TOTAL LENGTH OF STRATA MATERIAL RECOVERED DIVIDED BY TOTAL LENGTH OF STRATUM AND EXPRESSED AS A PERCENTAGE.

STRATA ROCK QUALITY DESIGNATION (SRQD) - A MEASURE OF ROCK QUALITY DESCRIBED BY TOTAL LENGTH OF ROCK SEGMENTS WITHIN A STRATUM EQUAL TO OR GREATER THAN 4 INCHES DIVIDED BY THE TOTAL LENGTH OF STRATA AND EXPRESSED AS A PERCENTAGE.

TOPSOIL (TS.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.

BENCH MARK: N/A

ELEVATION: FEET

NOTES:

BORING ELEVATIONS OBTAINED FROM SURVEY CONDUCTED BY CATLIN ENGINEERS AND SCIENTISTS

FIAD - FILLED IMMEDIATELY AFTER DRILLING

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	2A

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SUPPLEMENTAL LEGEND, GEOLOGICAL STRENGTH INDEX (GSI) TABLES FROM AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS

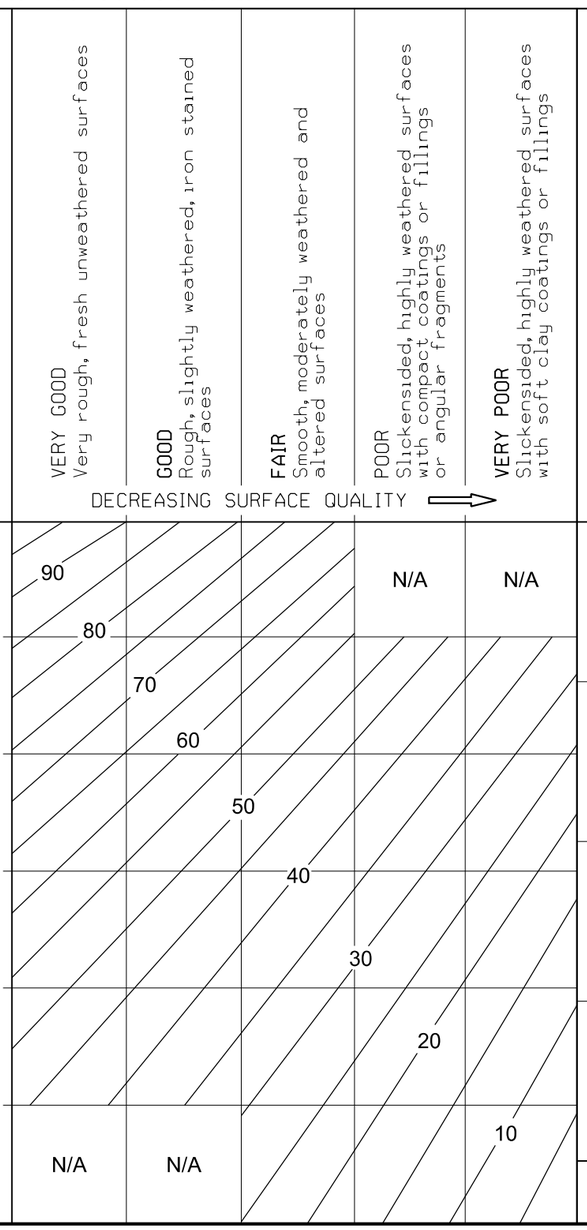
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

GEOLOGICAL STRENGTH INDEX (GSI) FOR JOINTED ROCKS (Hoek and Marinos, 2000)

From the lithology, structure and surface conditions of the discontinuities, estimate the average value of GSI. Do not try to be too precise. Quoting a range from 33 to 37 is more realistic than stating that GSI = 35. Note that the table does not apply to structurally controlled failures. Where weak planar structural planes are present in an unfavorable orientation with respect to the excavation face, these will dominate the rock mass behaviour. The shear strength of surfaces in rocks that are prone to deterioration as a result of changes in moisture content will be reduced if water is present. When working with rocks in the fair to very poor categories, a shift to the right may be made for wet conditions. Water pressure is dealt with by effective stress analysis.

STRUCTURE

- INTACT OR MASSIVE - intact rock specimens or massive in situ rock with few widely spaced discontinuities
- BLOCKY - well interlocked undisturbed rock mass consisting of cubical blocks formed by three intersecting discontinuity sets
- VERY BLOCKY - interlocked, partially disturbed mass with multi-faceted angular blocks formed by 4 or more joint sets
- BLOCKY/DISTURBED/SEAMY - folded with angular blocks formed by many intersecting discontinuity sets. Persistence of bedding planes or schistosity
- DISINTEGRATED - poorly interlocked, heavily broken rock mass with mixture of angular and rounded rock pieces
- LAMINATED/SHEARED - Lack of blockiness due to close spacing of weak schistosity or shear planes

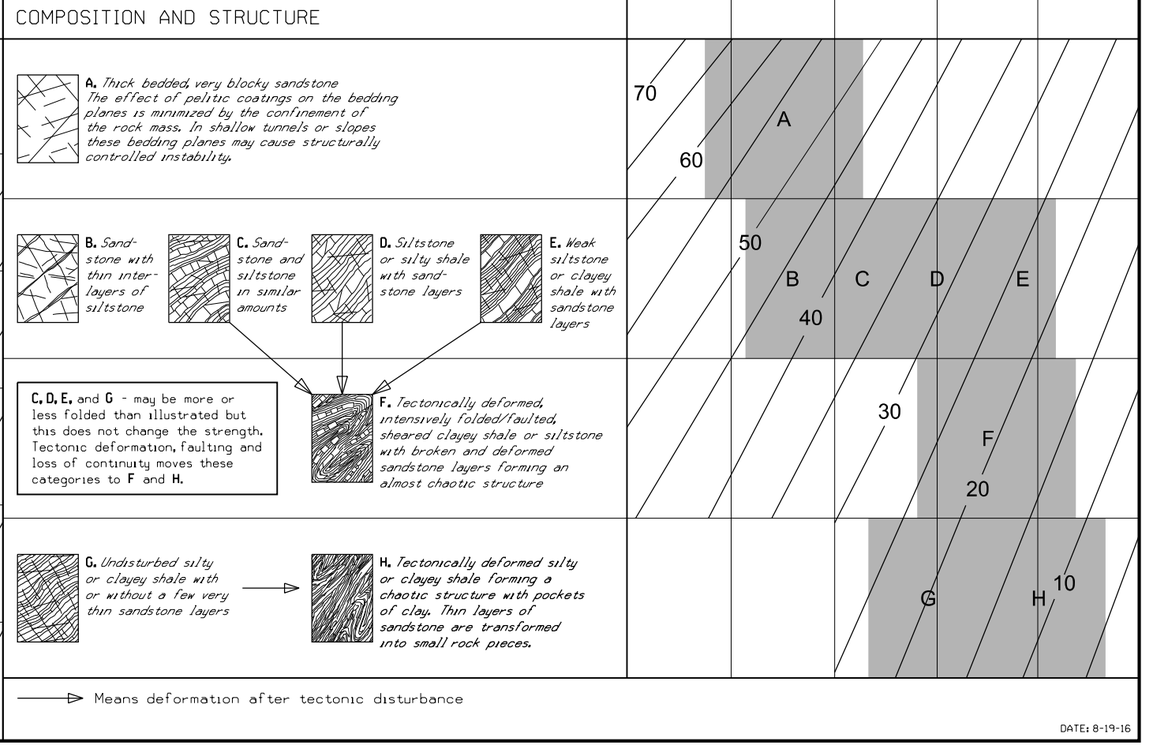


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

GSI FOR HETEROGENEOUS ROCK MASSES SUCH AS FLYSCH (Marinos. P and Hoek E., 2000)

From a description of the lithology, structure and surface conditions (particularly of the bedding planes), choose a box in the chart. Locate the position in the box that corresponds to the condition of the discontinuities and estimate the average value of GSI from the contours. Do not attempt to be too precise. Quoting a range from 33 to 37 is more realistic than giving GSI = 35. Note that the Hoek-Brown criterion does not apply to structurally controlled failures. Where unfavourably oriented continuous weak planar discontinuities are present, these will dominate the behaviour of the rock mass. The strength of some rock masses is reduced by the presence of groundwater and this can be allowed for by a slight shift to the right in the columns for fair, poor and very poor conditions. Water pressure does not change the value of GSI and it is dealt with by using effective stress analysis.

COMPOSITION AND STRUCTURE



DATE: 8-19-16

HDR Engineering, Inc. of the Carolinas
555 Fayetteville St, Suite 900 Raleigh, N.C. 27601
N.C.B.E.L.S. License Number: F-0116

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	3

SITE PLAN

0 50 100
FEET

NAD 83/NA 2011

15+00

18+00

BRIDGE NO.173

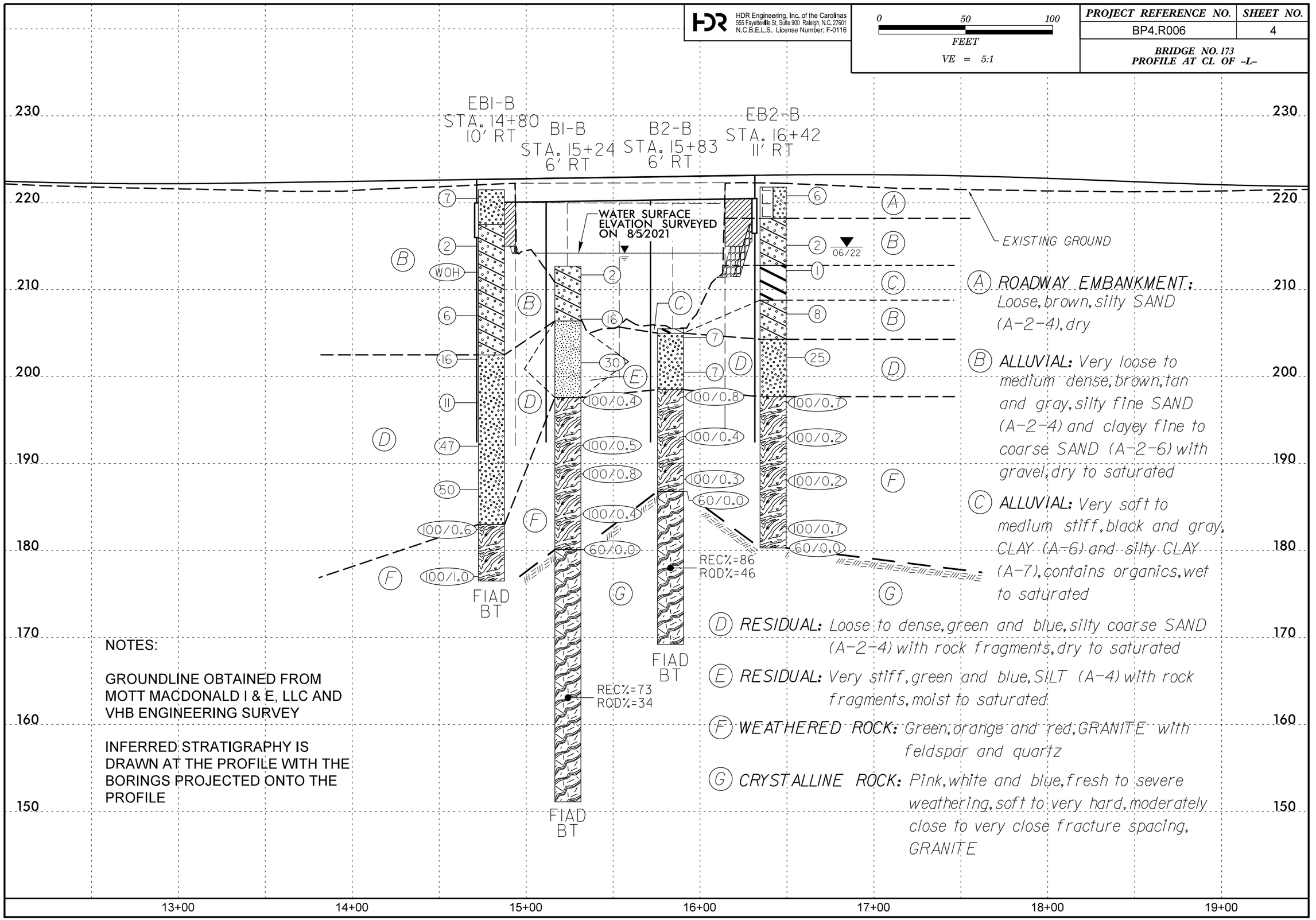
BRIDGE ON SR 1700
OVER BUFFALO CREEK
SKEW: 60°

HDR Engineering, Inc. of the Carolinas
555 Fayetteville St, Suite 900 Raleigh, N.C. 27601
N.C.B.E.L.S. License Number: F-0116

0 50 100
FEET
VE = 5:1

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	4

BRIDGE NO. 173
PROFILE AT CL OF –L–



NOTES:

GROUNDLINE OBTAINED FROM MOTT MACDONALD I & E, LLC AND VHB ENGINEERING SURVEY

INFERRED STRATIGRAPHY IS DRAWN AT THE PROFILE WITH THE BORINGS PROJECTED ONTO THE PROFILE

(A) *ROADWAY EMBANKMENT:* Loose, brown, silty SAND (A-2-4), dry

(B) *ALLUVIAL:* Very loose to medium dense, brown, tan and gray, silty fine SAND (A-2-4) and clayey fine to coarse SAND (A-2-6) with gravel, dry to saturated

(C) *ALLUVIAL:* Very soft to medium stiff, black and gray, CLAY (A-6) and silty CLAY (A-7), contains organics, wet to saturated

(D) *RESIDUAL:* Loose to dense, green and blue, silty coarse SAND (A-2-4) with rock fragments, dry to saturated

(E) *RESIDUAL:* Very stiff, green and blue, SILT (A-4) with rock fragments, moist to saturated

(F) *WEATHERED ROCK:* Green, orange and red, GRANITE with feldspar and quartz

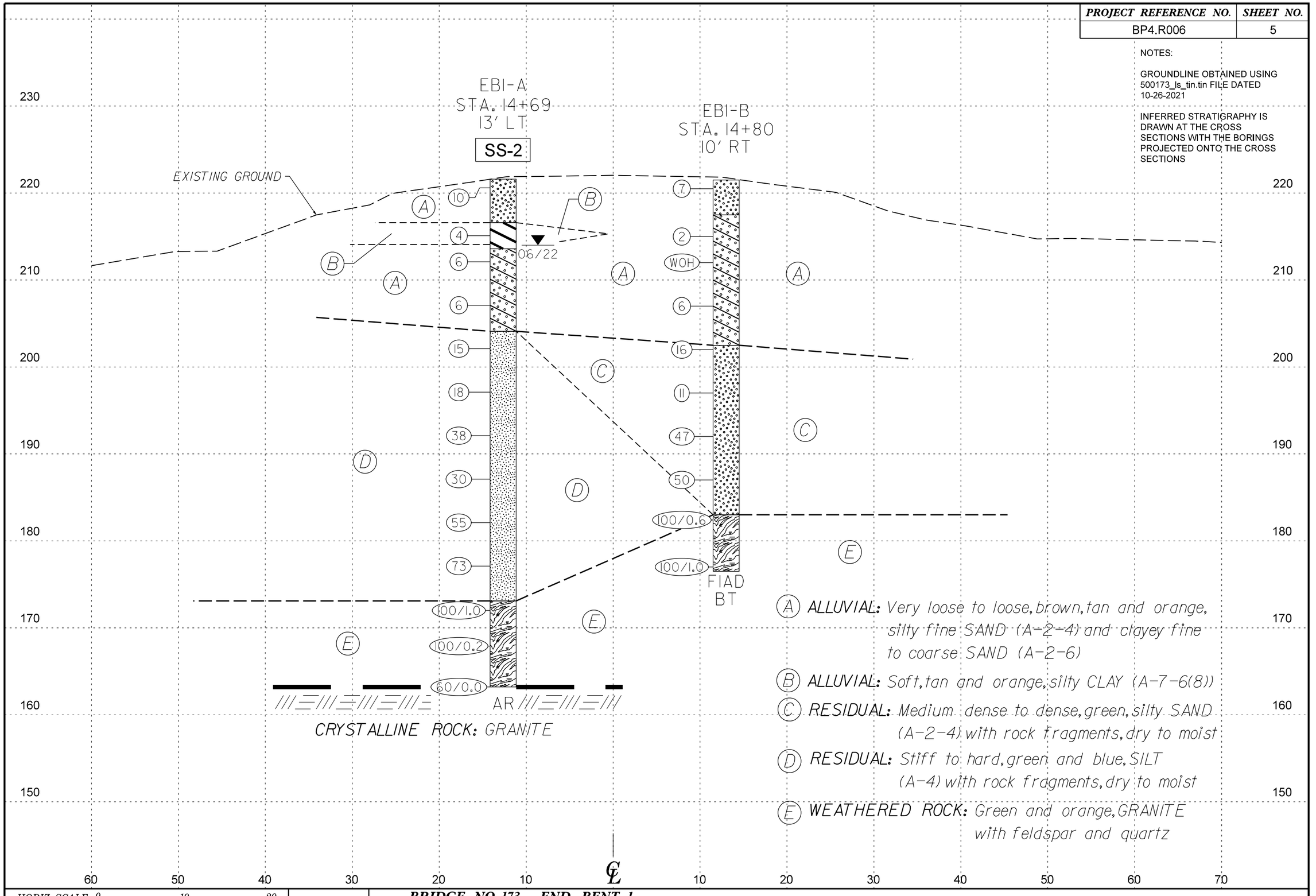
(G) *CRYSTALLINE ROCK:* Pink, white and blue, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	5

NOTES:

GROUNDLINE OBTAINED USING 500173_ls_tin.tin FILE DATED 10-26-2021

INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS



HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

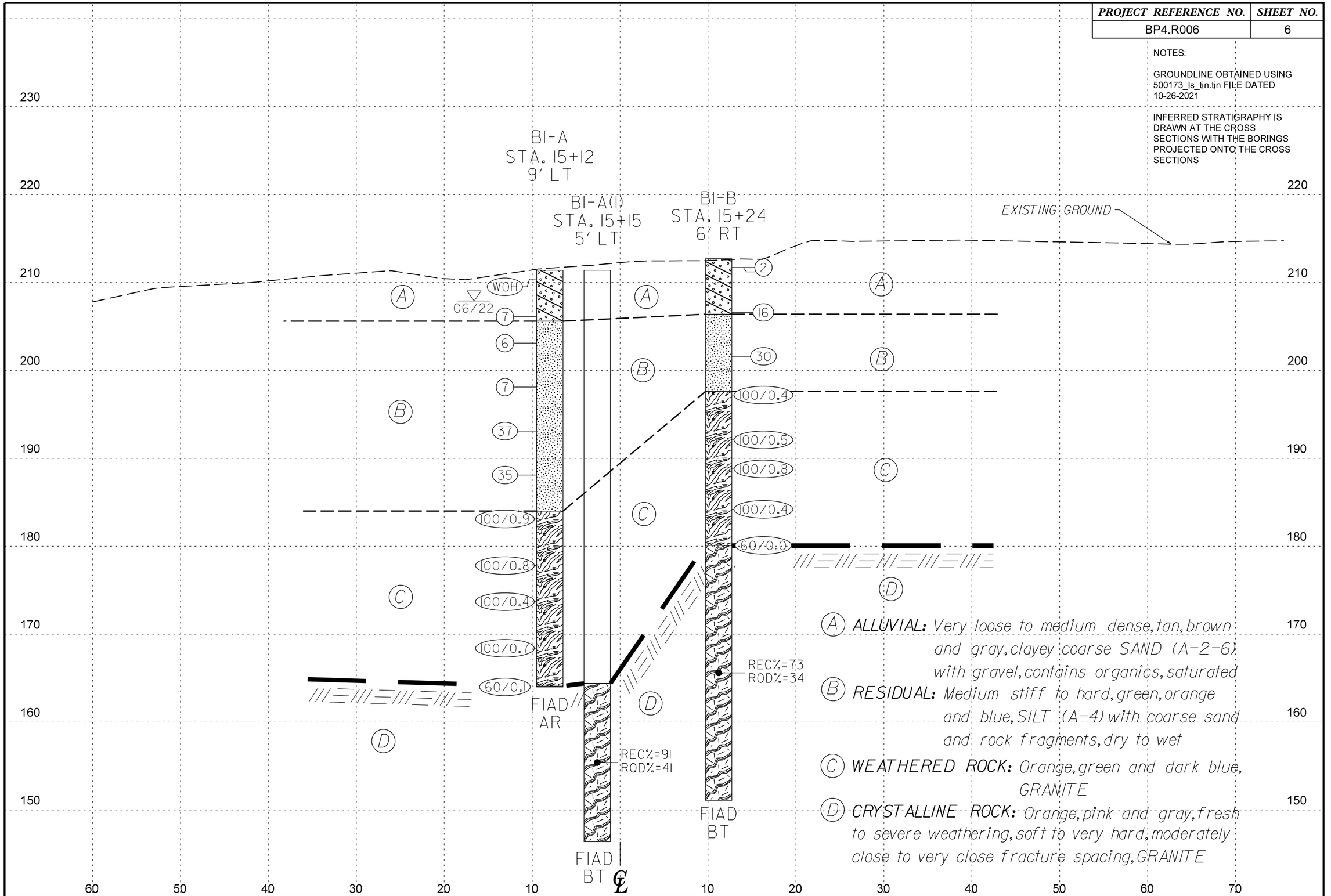
BRIDGE NO. 173 – END BENT 1
–L– STA. 14+71.50 – 60° SKEW

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	6

NOTES:

GROUNDLINE OBTAINED USING 500173_ls_tin.tin FILE DATED 10-26-2021

INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS



(A) **ALLUVIAL:** *Very loose to medium dense, tan, brown and gray, clayey coarse SAND (A-2-6) with gravel, contains organics, saturated*

(B) **RESIDUAL:** *Medium stiff to hard, green, orange and blue, SILT (A-4) with coarse sand and rock fragments, dry to wet*

(C) **WEATHERED ROCK:** *Orange, green and dark blue, GRANITE*

(D) **CRYSTALLINE ROCK:** *Orange, pink and gray, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE*

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

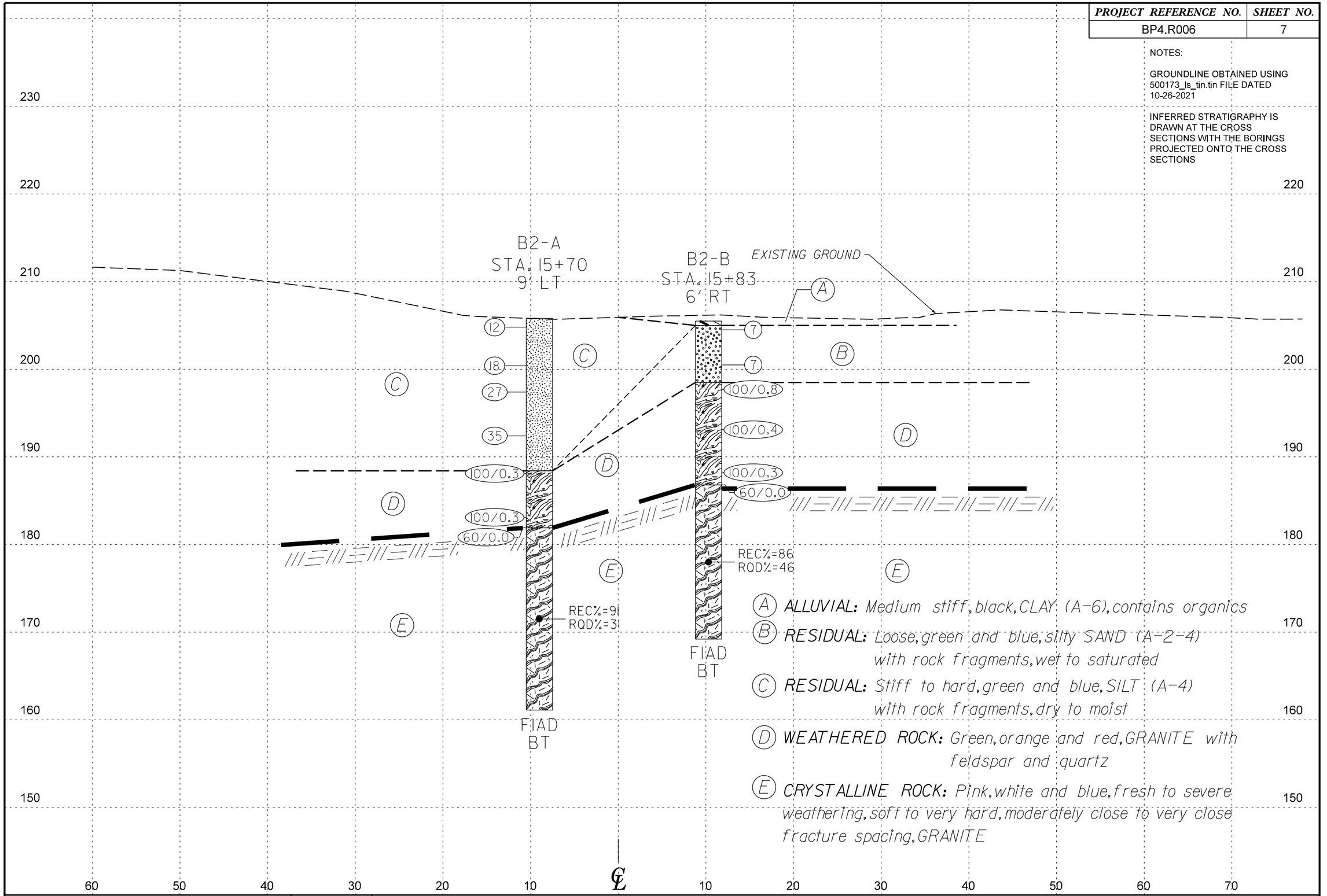
BRIDGE NO. 173 – BENT 1
–L– STA. 15+11.50 – 60° SKEW

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	7

NOTES:

GROUNDLINE OBTAINED USING 500173_ls_tin.tin FILE DATED 10-26-2021

INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS



(A) **ALLUVIAL:** *Medium stiff, black, CLAY (A-6), contains organics*

(B) **RESIDUAL:** *Loose, green and blue, silty SAND (A-2-4) with rock fragments, wet to saturated*

(C) **RESIDUAL:** *Stiff to hard, green and blue, SILT (A-4) with rock fragments, dry to moist*

(D) **WEATHERED ROCK:** *Green, orange and red, GRANITE with feldspar and quartz*

(E) **CRYSTALLINE ROCK:** *Pink, white and blue, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE*

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

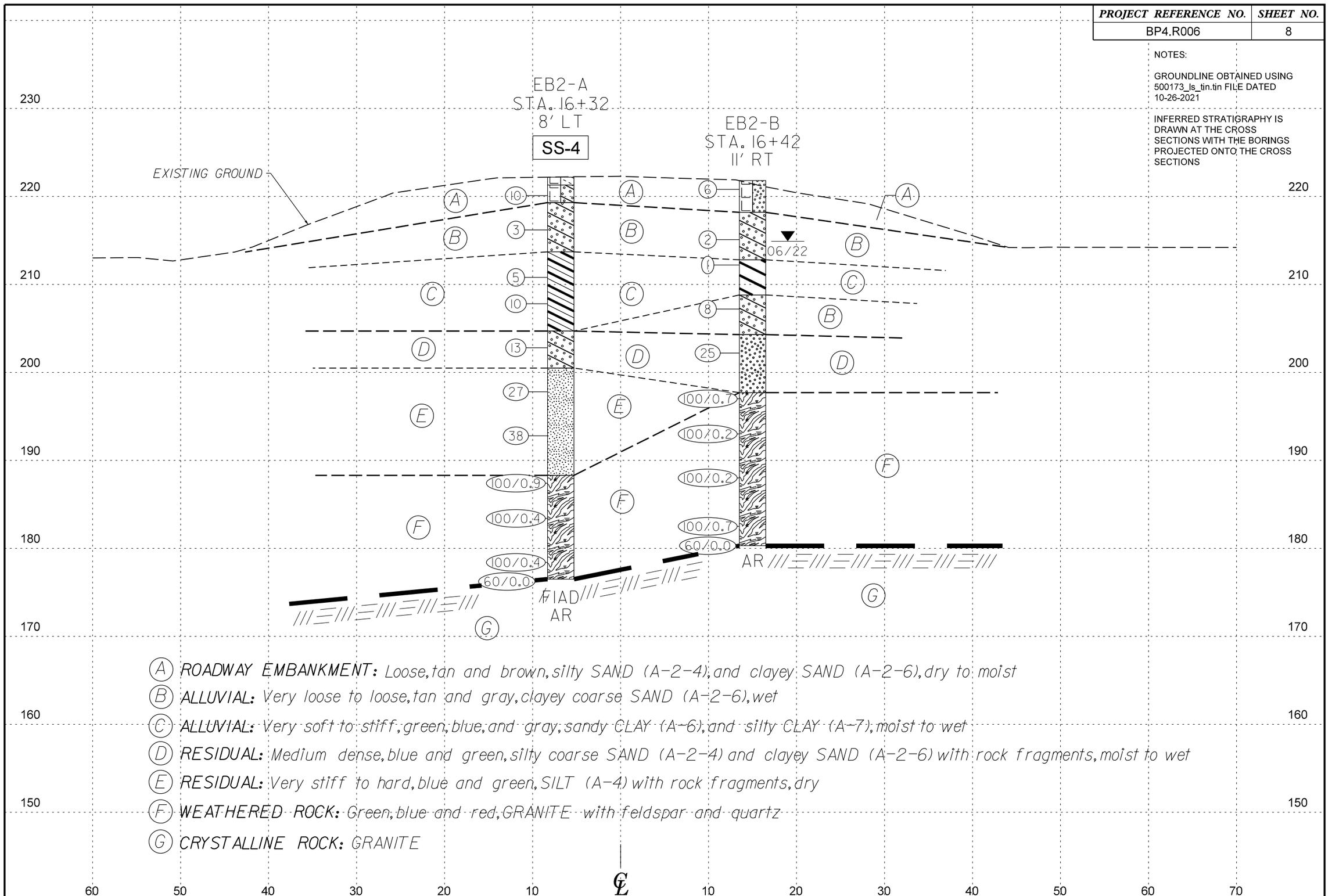
BRIDGE NO. 173 – BENT 2
–L– STA. 15+71.50 – 60° SKEW

PROJECT REFERENCE NO.	SHEET NO.
BP4.R006	8

NOTES:

GROUNDLINE OBTAINED USING 500173_ls_tin.tin FILE DATED 10-26-2021

INFERRED STRATIGRAPHY IS DRAWN AT THE CROSS SECTIONS WITH THE BORINGS PROJECTED ONTO THE CROSS SECTIONS



(A) ROADWAY EMBANKMENT: Loose, tan and brown, silty SAND (A-2-4), and clayey SAND (A-2-6), dry to moist

(B) ALLUVIAL: Very loose to loose, tan and gray, clayey coarse SAND (A-2-6), wet

(C) ALLUVIAL: Very soft to stiff, green, blue, and gray, sandy CLAY (A-6), and silty CLAY (A-7), moist to wet

(D) RESIDUAL: Medium dense, blue and green, silty coarse SAND (A-2-4) and clayey SAND (A-2-6) with rock fragments, moist to wet

(E) RESIDUAL: Very stiff to hard, blue and green, SILT (A-4) with rock fragments, dry

(F) WEATHERED ROCK: Green, blue and red, GRANITE with feldspar and quartz

(G) CRYSTALLINE ROCK: GRANITE

℄

HORIZ. SCALE (FEET) 0 10 20

VE = 1:1

BRIDGE NO. 173 – END BENT 2
–L– STA. 16+31.50 – 60° SKEW

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 14+69	**OFFSET** 13 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 221.6 ft	**TOTAL DEPTH** 58.4 ft	**NORTHING** 709,048	**EASTING** 2,194,738	**24 HR.** 7.6
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/07/22	**COMP. DATE** 06/08/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
225										
	221.6	0.0	4	5	5	10		M		221.6 GROUND SURFACE 0.0 **ALLUVIAL** Loose, tan and orange, silty SAND (A-2-4)
220										
	216.1	5.5	1	2	2	4	SS-2	31%		216.6 5.0 Soft, tan and orange, silty CLAY (A-7-6(8))
215	213.1	8.5	2	3	3	6		W		213.6 8.0 Loose, tan, clayey coarse SAND (A-2-6)
210	208.1	13.5	2	3	3	6		Sat.		
205	203.1	18.5	4	6	9	15		M		204.1 17.5 **RESIDUAL** Stiff to hard, green and blue, SILT (A-4) with rock fragments
200	198.1	23.5	8	8	10	18		M		
195	193.1	28.5	11	17	21	38		D		
190	188.1	33.5	10	13	17	30				
185	183.1	38.5	15	22	33	55		D		
180	178.1	43.5	29	36	37	73		D		
175	173.1	48.5	49	51/0.5		100/1.0				173.1 48.5 **WEATHERED ROCK** Green and orange, GRANITE with feldspar and quartz
170	168.1	53.5	100/0.2			100/0.2				
165	163.2	58.4	60/0.0			60/0.0				163.2 58.4 Boring Terminated with Standard Penetration Test Refusal at Elevation 163.2 ft on Crystalline Rock (GRANITE)

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. EB1-B	**STATION** 14+80	**OFFSET** 10 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 221.5 ft	**TOTAL DEPTH** 45.0 ft	**NORTHING** 709,025	**EASTING** 2,194,750	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/15/22	**COMP. DATE** 06/15/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
225										
	221.5	0.0	3	4	3	7		D		221.5 GROUND SURFACE 0.0 **ALLUVIAL** Loose, brown, silty fine SAND (A-2-4)
220										217.5 4.0
	216.0	5.5	1	1	1	2		Sat.		Very loose to loose, tan and orange, clayey fine to coarse SAND (A-2-6)
215	213.0	8.5	1	1	WOH	1		Sat.		
210	208.0	13.5	3	2	4	6		W		
205	203.0	18.5	6	7	9	16		M		202.5 19.0 **RESIDUAL** Medium dense to dense, green, silty SAND (A-2-4) with rock fragments
200	198.0	23.5	7	6	5	11		D		
195	193.0	28.5	23	24	23	47		D		
190	188.0	33.5	21	22	28	50		M		
185	183.0	38.5	58	42/0.1		100/0.6				183.0 38.5 **WEATHERED ROCK** Green, GRANITE with feldspar and quartz
180	178.0	43.5	15	50	50/0.5	100/1.0				176.5 45.0
										Boring Terminated at Elevation 176.5 ft in Weathered Rock (GRANITE)

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 15+12	**OFFSET** 9 ft LT	**ALIGNMENT** -L-	**0 HR.** 3.5
COLLAR ELEV. 211.4 ft	**TOTAL DEPTH** 47.4 ft	**NORTHING** 709,045	**EASTING** 2,194,781	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary		**HAMMER TYPE** Automatic
DRILLER P. McCain	**START DATE** 06/08/22	**COMP. DATE** 06/08/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
215										
	211.4	0.0	WOH	WOH	WOH	0		Sat.		211.4 GROUND SURFACE 0.0
210										**ALLUVIAL** Very loose to loose, tan and brown, clayey SAND (A-2-6), contains organics
	207.1	4.3	7	4	3	7		Sat.		
205										205.6 5.8
	204.1	7.3	2	3	3	6		W		**RESIDUAL** Medium stiff to hard, green and orange, sandy SILT (A-4) with rock fragments
200										
	199.1	12.3	3	3	4	7		W		
195										
	194.1	17.3	11	13	24	37		D		
190										
	189.1	22.3	13	15	20	35		D		
185										
	184.0	27.4	55	45/0.4		100/0.9				184.0 27.4 **WEATHERED ROCK** Orange and green, GRANITE
180										
	179.1	32.3	19	49	51/0.3	100/0.8				
175										
	174.1	37.3	100/0.4			100/0.4				
170										
	169.1	42.3	39	61/0.2		100/0.7				
165										
	164.1	47.3	60/0.1			60/0.1				164.1 47.3 164.0 47.4 **CRYSTALLINE ROCK** Green, GRANITE Boring Terminated with Standard Penetration Test Refusal at Elevation 164.0 ft in Crystalline Rock (GRANITE)

NCDOT BORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 10/10/22

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B1-A(1)	**STATION** 15+15	**OFFSET** 5 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 211.4 ft	**TOTAL DEPTH** 65.0 ft	**NORTHING** 709,041	**EASTING** 2,194,784	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/08/22	**COMP. DATE** 06/08/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
215										
										211.4 GROUND SURFACE 0.0
210										See bore log for B1-A for soil descriptions
205										
200										
195										
190										
185										
180										
175										
170										
165										
160										164.4 47.0
155										**CRYSTALLINE ROCK** Pink, blue, and dark gray, GRANITE with feldspar and quartz
150										146.4 65.0
										Boring Terminated at Elevation 146.4 ft in Crystalline Rock (GRANITE)

NCDOT BORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 9/21/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B1-A(1)	**STATION** 15+15	**OFFSET** 5 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 211.4 ft	**TOTAL DEPTH** 65.0 ft	**NORTHING** 709,041	**EASTING** 2,194,784	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/08/22	**COMP. DATE** 06/08/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 18.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
164.4											Begin Coring @ 47.0 ft
	164.4	47.0	1.0	2:30	(1.0) 100%	(0.0) 0%		(16.4) 91%	(7.3) 41%		164.4 **CRYSTALLINE ROCK** 47.0
	163.4	48.0		1:36							Pink, blue, and dark gray, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE with feldspar and quartz
	161.9	49.5	1.5	1:20/0.5	(1.5) 100%	(0.0) 0%					
160	161.4	50.0	0.5	0:43/0.5							GSI = 30-40
			4.0	0:56							
				1:09	(0.5) 100%	(0.0) 0%					
	157.4	54.0		0:35							
	156.4	55.0	1.0	1:29	(3.4) 85%	(0.0) 0%					
155			5.0	2:15							
				1:36							
				1:21	(0.5) 50%	(0.0) 0%					
				1:17							
				1:19							
	151.4	60.0		1:20	(5.0) 100%	(2.3) 46%					
150			5.0	1:22							
				1:20	(5.0) 100%	(5.0) 100%					
				1:28							
				1:39							
	146.4	65.0		1:40							146.4 65.0
											Boring Terminated at Elevation 146.4 ft in Crystalline Rock (GRANITE)

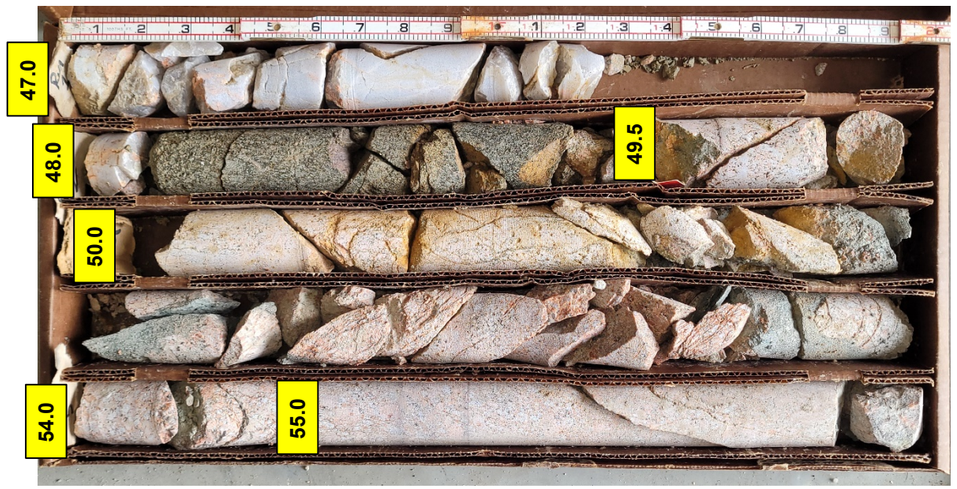
NCDOT CORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 10/10/22

CORE PHOTOGRAPHIC RECORD

BP4.R006

Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)

B1-A(1)
Box 1 of 2: 47.0 – 55.0 ft



B1-A(1)
Box 2 of 2: 55.0 – 65.0 ft

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 15+24	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 212.7 ft	**TOTAL DEPTH** 61.6 ft	**NORTHING** 709,030	**EASTING** 2,194,793	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/10/22	**COMP. DATE** 06/14/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
215										
	212.7	0.0	WOH	1	1	2		Sat.		212.7 0.0 GROUND SURFACE
210										**ALLUVIAL** Very loose to medium dense, tan and gray, clayey coarse SAND (A-2-6) with gravel
	207.6	5.1	5	6	10	16		W		206.4 6.3 **RESIDUAL** Very stiff, green and blue, SILT (A-4) with rock fragments
205										
	202.6	10.1	12	15	15	30		M		
200										
	197.6	15.1	100/0.4			100/0.4				197.6 15.1 **WEATHERED ROCK** Dark blue, GRANITE
195										
	192.6	20.1	100/0.5			100/0.5				
190										
	189.6	23.1	16	84/0.3		100/0.8				
185										
	184.6	28.1	100/0.4			100/0.4				
180	180.1	32.6	60/0.0			60/0.0	RS-1			180.1 32.6 **CRYSTALLINE ROCK** Pink, tan, and gray, GRANITE
175										
170										
165										
160										
155										151.1 61.6 Boring Terminated at Elevation 151.1 ft in Crystalline Rock (GRANITE)

NCDOT BORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 10/10/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B1-B	**STATION** 15+24	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 212.7 ft	**TOTAL DEPTH** 61.6 ft	**NORTHING** 709,030	**EASTING** 2,194,793	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/10/22	**COMP. DATE** 06/14/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 29.0 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
180											Begin Coring @ 32.6 ft
	180.1	32.6	5.0	0:31 0:43 1:25 1:23 1:53	(3.0) 60%	(0.0) 0%		(21.3) 73%	(9.8) 34%		180.1 32.6 **CRYSTALLINE ROCK** Pink, tan, and gray, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE with feldspar and quartz
175	175.1	37.6									GSI = 30-40
	172.3	40.4	2.8	1:28 1:30 3:00/0.8	(0.6) 21%	(0.0) 0%					
170	170.1	42.6	2.2	1:54/1.2 3:03	(0.5) 23%	(0.0) 0%					
	166.4	46.3	3.7	2:23 2:10 2:23 2:00/0.7	(1.8) 49%	(0.0) 0%					
165	165.1	47.6	1.3	2:50/1.3	(0.4) 31%	(0.0) 0%					
			5.0	3:53 1:24 1:45 2:18 2:21	(5.0) 100%	(4.0) 80%					Qu = 5,460 psi
160	160.1	52.6					RS-1				
			5.0	2:46 3:27 3:47 4:07 4:33	(5.0) 100%	(3.9) 78%					
155	155.1	57.6									
			4.0	4:50 6:05 4:16 5:36	(5.0) 125%	(1.9) 48%					
	151.1	61.6									151.1 61.6 Boring Terminated at Elevation 151.1 ft in Crystalline Rock (GRANITE)

NCDOT CORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 10/10/22

CORE PHOTOGRAPHIC RECORD

BP4.R006

Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)

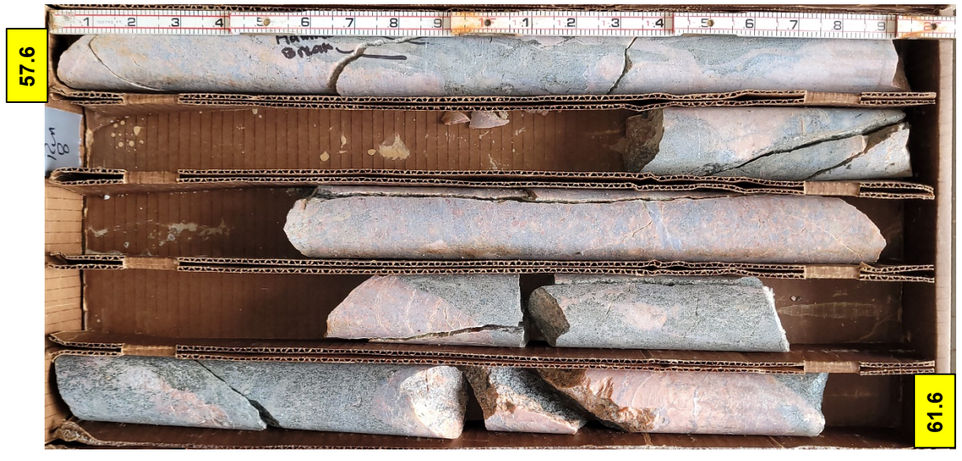
B1-B
Box 1 of 3: 32.6 – 45.3 ft

0.0 1.0 2.0
FEET

B1-B
Box 2 of 3: 45.3 – 56.6 ft

0.0 1.0 2.0
FEET

B1-B
Box 3 of 3: 56.6 – 61.6 ft



0.0 1.0 2.0
FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 15+70	**OFFSET** 9 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 205.8 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 709,047	**EASTING** 2,194,839	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/07/22	**COMP. DATE** 06/07/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION ELEV. (ft)	DEPTH (ft)
210											
	205.8	0.0	2	6	6	12				205.8 GROUND SURFACE	0.0
205										**RESIDUAL** Stiff to hard, green and blue, SILT (A-4) with rock fragments, saprolitic	
	201.4	4.4	5	8	10	18		M			
200	198.4	7.4									
			10	12	15	27		D			
195	193.4	12.4									
			6	12	23	35		D			
190	188.4	17.4								188.4	17.4
			100/0.3			100/0.3				**WEATHERED ROCK** Dark green, GRANITE with feldspar and quartz	
185	183.4	22.4									
	181.9	23.9	100/0.3			100/0.3				181.9	23.9
180			60/0.0			60/0.0				**CRYSTALLINE ROCK** Pink, white, and blue, GRANITE	
175											
170											
165							RS-2			161.1	44.7
										Boring Terminated at Elevation 161.1 ft in Crystalline Rock (GRANITE)	

NCDOT BORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 9/21/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B2-A	**STATION** 15+70	**OFFSET** 9 ft LT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 205.8 ft	**TOTAL DEPTH** 44.7 ft	**NORTHING** 709,047	**EASTING** 2,194,839	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/07/22	**COMP. DATE** 06/07/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 20.8 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS ELEV. (ft)	DEPTH (ft)
181.9												
	181.9	23.9	0.8	2:15/0.8	(0.8)	(0.0)		(19.0)	(6.4)		Begin Coring @ 23.9 ft	
180	181.1	24.7	5.0	1:24	100%	0%		91%	31%		181.9 **CRYSTALLINE ROCK**	23.9
				1:38	(3.2)	(0.0)					Pink, white, and blue, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE with feldspar and quartz	
	176.1	29.7		3:01	64%	0%						
175			5.0	4:07	(5.0)	(1.3)					GSI = 30-40	
				2:14								
				2:26	100%	25%						
	171.1	34.7		2:32								
170			5.0	2:51	(5.0)	(2.3)						
				5:50	100%	45%						
				3:30			RS-2				Qu = 4,840 psi	
	166.1	39.7		3:33								
165			5.0	2:43	(5.0)	(2.8)						
				3:29	100%	56%						
				2:38								
	161.1	44.7		3:18							161.1	44.7
				3:36							Boring Terminated at Elevation 161.1 ft in Crystalline Rock (GRANITE)	
				2:46								
				3:39								
				3:19								
				3:44								

NCDOT CORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 10/5/22

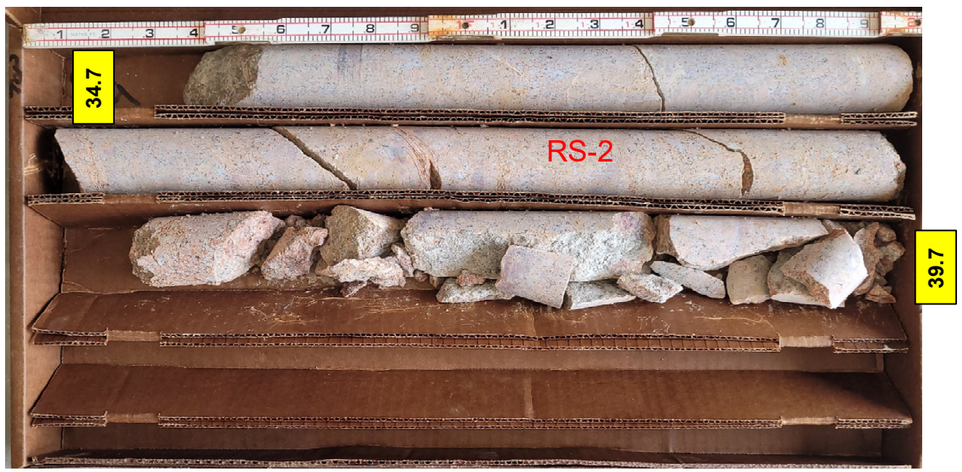
CORE PHOTOGRAPHIC RECORD

BP4.R006

Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)

B2-A
Box 1 of 3: 23.9 – 34.7 ft

B2-A
Box 2 of 3: 34.7 – 39.7 ft



B2-A
Box 3 of 3: 39.7 – 44.7 ft

GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 15+83	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 205.5 ft	**TOTAL DEPTH** 36.3 ft	**NORTHING** 709,033	**EASTING** 2,194,852	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/15/22	**COMP. DATE** 06/15/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
										ELEV. (ft) DEPTH (ft)
210										
205	205.5	0.0	3	4	3	7		Sat.		205.5 0.0 GROUND SURFACE
										205.0 0.5 **ALLUVIAL** Medium stiff, black, CLAY (A-6), contains organics
	201.5	4.0	3	3	4	7		W		**RESIDUAL** Loose, green, and blue, silty SAND (A-2-4) with rock fragments
200	198.5	7.0	49	51/0.3		100/0.8				198.5 7.0 **WEATHERED ROCK** Green, orange, and red, GRANITE with feldspar
195	193.5	12.0	100/0.4			100/0.4				
190	188.5	17.0	100/0.3			100/0.3				
	186.8	18.7	60/0.0			60/0.0				186.8 18.7 **CRYSTALLINE ROCK** Pink, white, and blue, GRANITE
185										
180										
175										
170										169.2 36.3 Boring Terminated at Elevation 169.2 ft in Crystalline Rock (GRANITE)

NCDOT BORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 9/21/22

GEOTECHNICAL BORING REPORT
CORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. B2-B	**STATION** 15+83	**OFFSET** 6 ft RT	**ALIGNMENT** -L-	**0 HR.** N/A
COLLAR ELEV. 205.5 ft	**TOTAL DEPTH** 36.3 ft	**NORTHING** 709,033	**EASTING** 2,194,852	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/15/22	**COMP. DATE** 06/15/22	**SURFACE WATER DEPTH** N/A	
CORE SIZE NQ2	**TOTAL RUN** 17.6 ft			

ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS
											ELEV. (ft) DEPTH (ft)
186.8											Begin Coring @ 18.7 ft
185	186.8	18.7	2.6	0:37/0.6 2:37 4:49	(1.9) 73%	(0.0) 0%		(15.2) 86%	(8.1) 46%	186.8	**CRYSTALLINE ROCK** 18.7 Pink, white, and blue, fresh to severe weathering, soft to very hard, moderately close to very close fracture spacing, GRANITE with feldspar and quartz
	184.2	21.3	5.0	2:24 2:24 2:10 1:58 1:49	(4.7) 94%	(2.8) 56%					GSI = 30-40
180	179.2	26.3	5.0	1:56 3:01 2:20 2:32 2:09	(4.2) 84%	(2.9) 58%					
175	174.2	31.3	5.0	2:44 2:18 1:45 2:10 1:38	(4.4) 88%	(2.4) 48%					
170	169.2	36.3								169.2	36.3 Boring Terminated at Elevation 169.2 ft in Crystalline Rock (GRANITE)

NCDOT CORE DOUBLE 500173_GEO.GPJ NC_DOT.GDT 9/21/22

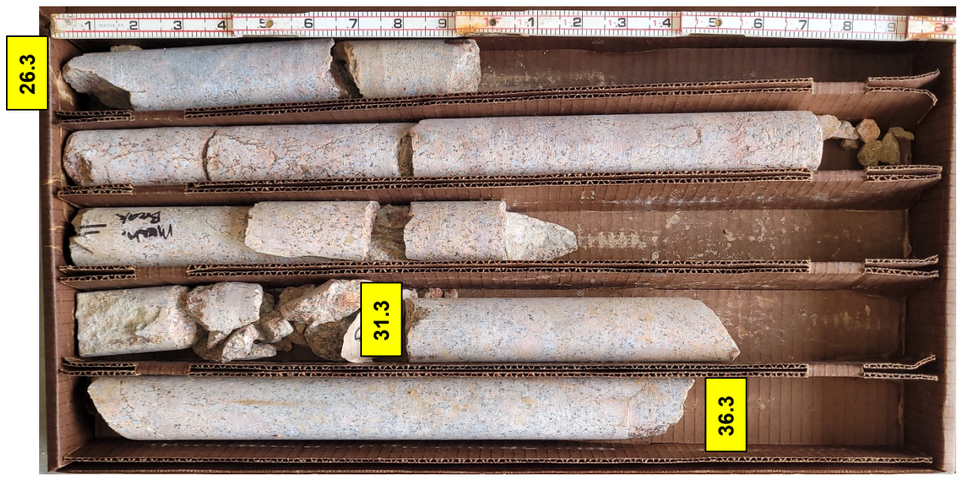
CORE PHOTOGRAPHIC RECORD

BP4.R006

Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)

B2-B
Box 1 of 2: 18.7 – 26.3 ft

B2-B
Box 2 of 2: 26.3 – 36.3 ft



GEOTECHNICAL BORING REPORT
BORE LOG

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 16+32	**OFFSET** 8 ft LT	**ALIGNMENT** -L-	**0 HR.** Dry
COLLAR ELEV. 222.2 ft	**TOTAL DEPTH** 45.7 ft	**NORTHING** 709,048	**EASTING** 2,194,902	**24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/06/22	**COMP. DATE** 06/06/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION (ELEV. (ft) / DEPTH (ft))
225										
										222.2 GROUND SURFACE 0.0
	221.1	1.1	4	6	4	10				221.3 0.9' ASPHALT 0.9
220								M		**ROADWAY EMBANKMENT**
	217.2	5.0	1	2	1	3				219.3 Loose, tan, clayey SAND (A-2-6) 2.9
215								W		**ALLUVIAL** Very loose, tan, clayey SAND (A-2-6), contains tree root from 2.9'-4.0'
	211.8	10.4	2	2	3	5				213.7 Medium stiff to stiff, green and blue, sandy CLAY (A-6(4)) 8.5
210								M		
	208.8	13.4	3	3	7	10	SS-4	28%		
205										204.7 **RESIDUAL** Medium dense, blue and green, clayey SAND (A-2-6) with rock fragments 17.5
	203.8	18.4	6	9	4	13		W		
200										200.5 Very stiff to hard, blue and green, SILT (A-4) with rock fragments 21.7
	198.8	23.4	11	12	15	27				
195								D		
	193.8	28.4	16	22	16	38				
190										188.3 **WEATHERED ROCK** Dark green, blue, and red, GRANITE 33.9
	188.8	33.4	20	40	60/0.4	100/0.9				
185										
	183.8	38.4	100/0.4			100/0.4				
180										
	178.8	43.4	100/0.4			100/0.4				
	176.5	45.7	60/0.0			60/0.0		D		176.5 Boring Terminated with Standard Penetration Test Refusal at Elevation 176.5 ft on Crystalline Rock (GRANITE) 45.7

WBS BP4.R006	**TIP** BP4.R006	**COUNTY** JOHNSTON	**GEOLOGIST** T. Park	
SITE DESCRIPTION Bridge No. 173 over Buffalo Creek on SR 1700 (Covered Bridge Road)				**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 16+42	**OFFSET** 11 ft RT	**ALIGNMENT** -L-	**0 HR.** 6.3
COLLAR ELEV. 221.8 ft	**TOTAL DEPTH** 41.5 ft	**NORTHING** 709,029	**EASTING** 2,194,912	**24 HR.** 6.9
DRILL RIG/HAMMER EFF./DATE CAT1303 CME-550 92% 02/03/2022		**DRILL METHOD** Mud Rotary	**HAMMER TYPE** Automatic	
DRILLER P. McCain	**START DATE** 06/15/22	**COMP. DATE** 06/15/22	**SURFACE WATER DEPTH** N/A	

ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT 0.5ft	0.5ft	0.5ft	BLOWS PER FOOT 0 25 50 75 100	SAMP. NO.	MOI	LOG	SOIL AND ROCK DESCRIPTION
225										
	221.8	0.0								221.8 GROUND SURFACE 0.0
220			3	4	2	6		D		**ROADWAY EMBANKMENT** Loose, brown, silty SAND (A-2-4)
	216.1	5.7	1	1	1	2				218.2 **ALLUVIAL** Very loose, tan, clayey SAND (A-2-6) 3.6
215										
	213.2	8.6	1	WOH	1	1		W		212.8 Very soft, gray, silty CLAY (A-7) 9.0
210										
	208.2	13.6	3	4	4	8		W		208.8 Loose, gray, clayey coarse SAND (A-2-6) 13.0
205										
	203.2	18.6	8	11	14	25		M		204.3 **RESIDUAL** Medium dense, green, silty coarse SAND (A-2-4) with rock fragments 17.5
200										
	198.2	23.6	27	61	39/0.2	100/0.7				197.7 **WEATHERED ROCK** Green, GRANITE with feldspar and quartz 24.1
195										
	193.2	28.6	100/0.2			100/0.2				
190										
	188.2	33.6	100/0.2			100/0.2				
185										
	183.2	38.6	73	27/0.2		100/0.7				
	180.3	41.5	60/0.0			60/0.0				180.3 Boring Terminated with Standard Penetration Test Refusal at Elevation 180.3 ft on Crystalline Rock (GRANITE) 41.5

PROJECT NO.	BP4.R006	SHEET 20

SOIL TEST RESULTS

SAMPLE NO.	BORING	STATION	OFFSET	LINE	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	C. SAND	F. SAND	SILT	CLAY	% PASSING SIEVES 10	40	200	% Moisture	% ORGANIC
SS-2	EB1-A	14+69	13' LT	-L-	5.5-7.0	A-7-6 (8)	44	19	23.9	23.0	22.0	31.2	96.2	82.0	53.6	30.8	-
SS-4	EB2-A	16+32	8' LT	-L-	13.4-14.9	A-6 (4)	31	15	10.5	30.8	22.5	36.2	99.8	95.9	63.6	28.0	-

LABORATORY SUMMARY FOR ROCK CORE

SAMPLE NO.	BORING	STATION	OFFSET	LINE	DEPTH INTERVAL	ROCK TYPE	GEOLOGIC MAP UNIT	RUN REC	RUN RQD	RUN LENGTH (FT)	DIAMETER (IN)	UNIT WEIGHT (PCF)	UNCONFINED COMPRESSIVE STRENGTH (PSI)	YOUNG'S MODULUS (PSI)	REMARKS
RS-1	B1-B	15+24	6' RT	-L-	51.8-52.5'	GRANITE	PPmg	100%	78%	5.0	1.96	168.8	5,460	-	-
RS-2	B2-A	15+70	9' LT	-L-	37.2-37.8'	GRANITE	PPmg	100%	45%	5.0	1.98	161.7	4,840	-	-