REFERENCE: R-2566BA

PROJECT: 37512

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2566BA	1	31

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY WATAUGA

PROJECT DESCRIPTION BRIDGE NO. 5 ON -L- (NC 105) OVER WATAUGA RIVER

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
2A	SUPPLEMENTAL LEGEND (GSI)
3	SITE PLAN
4	PROFILE
5-7	CROSS SECTION(S)
8-21	BORE LOGS, CORE LOGS, CORE PHOTOS
22-29	ROCK TEST RESULTS
30	SITE PHOTOS

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.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

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11/29/2018

SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-2566BA	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	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
MATERIAL PASSING #40 LL	—		—	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PI	6 MX		NP	10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
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
GRAIN SIZE 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	- MOIST - (M)	SOLID; AT OR NEAR OPTIMUM MOISTURE
SL — SHRINKAGE LIMIT		
	- 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-550X
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [x] AUTOMATIC
- [ ] MANUAL

CORE SIZE:
- [ ] -B _____
- [ ] -H _____
- [x] -N Q

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: See Note

ELEVATION: FEET

NOTES:

- Collar elevations dervied using GeoPak and the TIN file (R2566BA_ls_tin.tin)
- Cross sections were cut/drawn using GeoPak, the TIN file (R2566BA_ls_tin.tin), and the Microstation DGN file (R-2566BA_2span bridge layout_20180824.dgn). The DGN was supplied by NCDOT Geotechnical Asheville Field Office on October 25, 2018.

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
R-2566BA	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

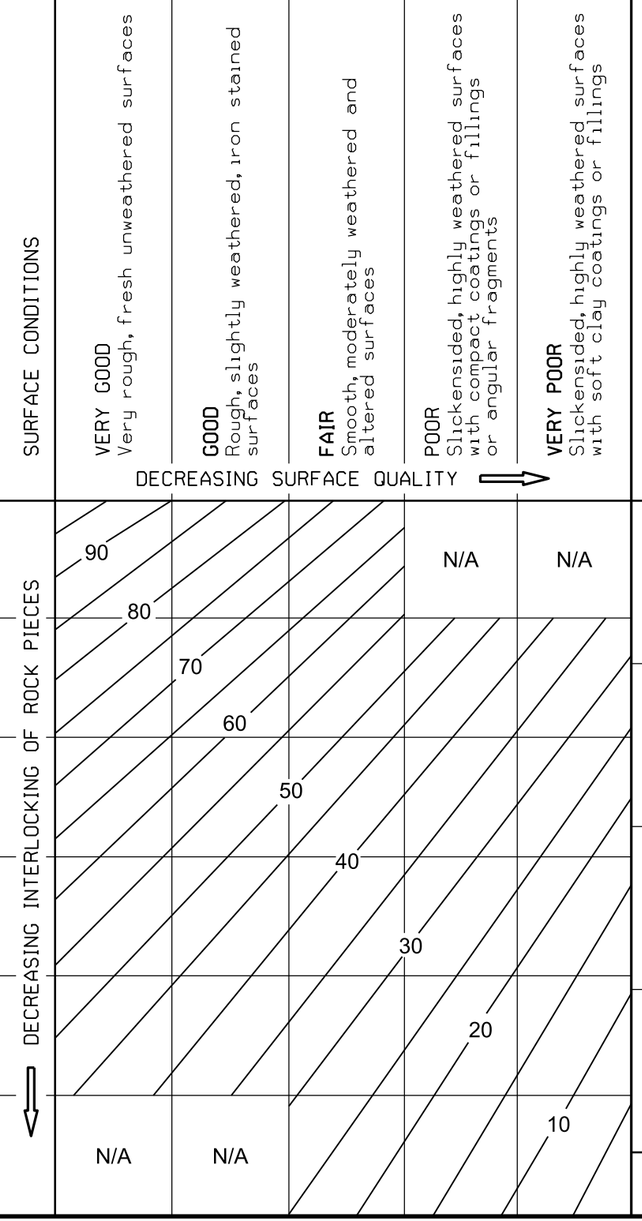
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

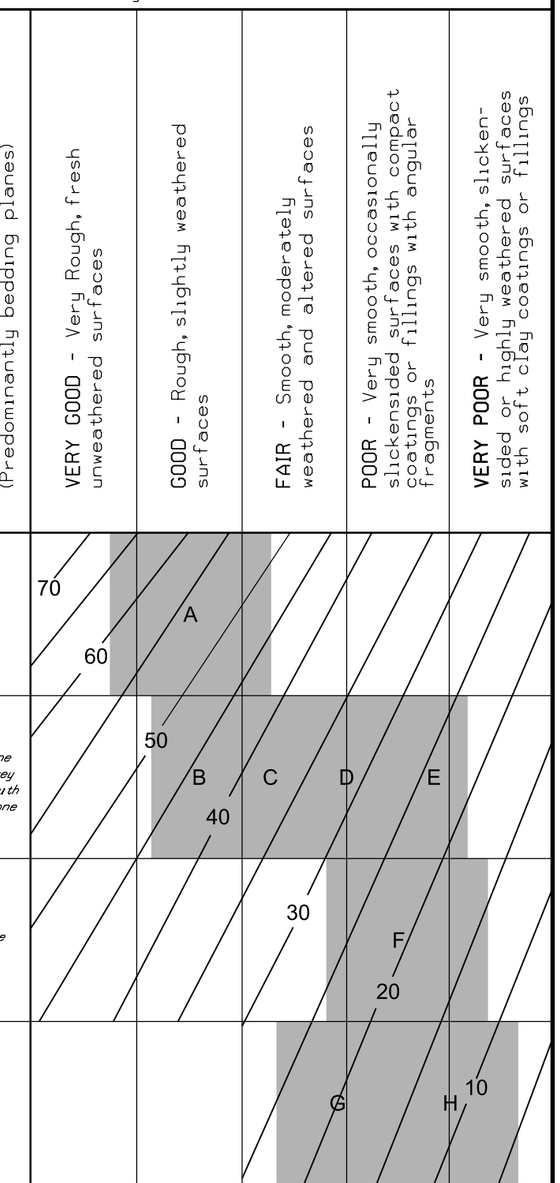


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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

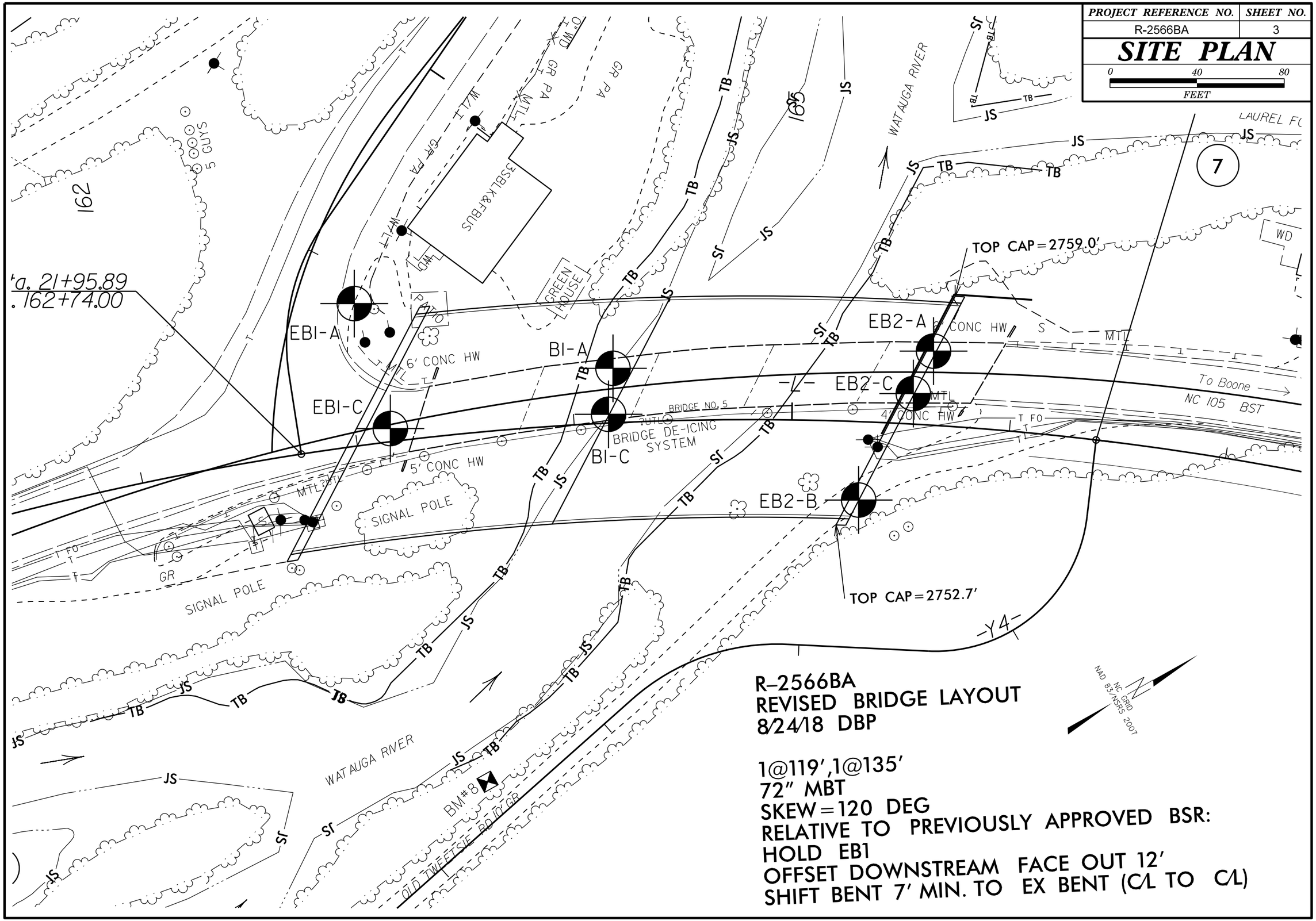


DATE: 8-19-16

PROJECT REFERENCE NO.	SHEET NO.
R-2566BA	3

SITE PLAN

0 40 80
FEET

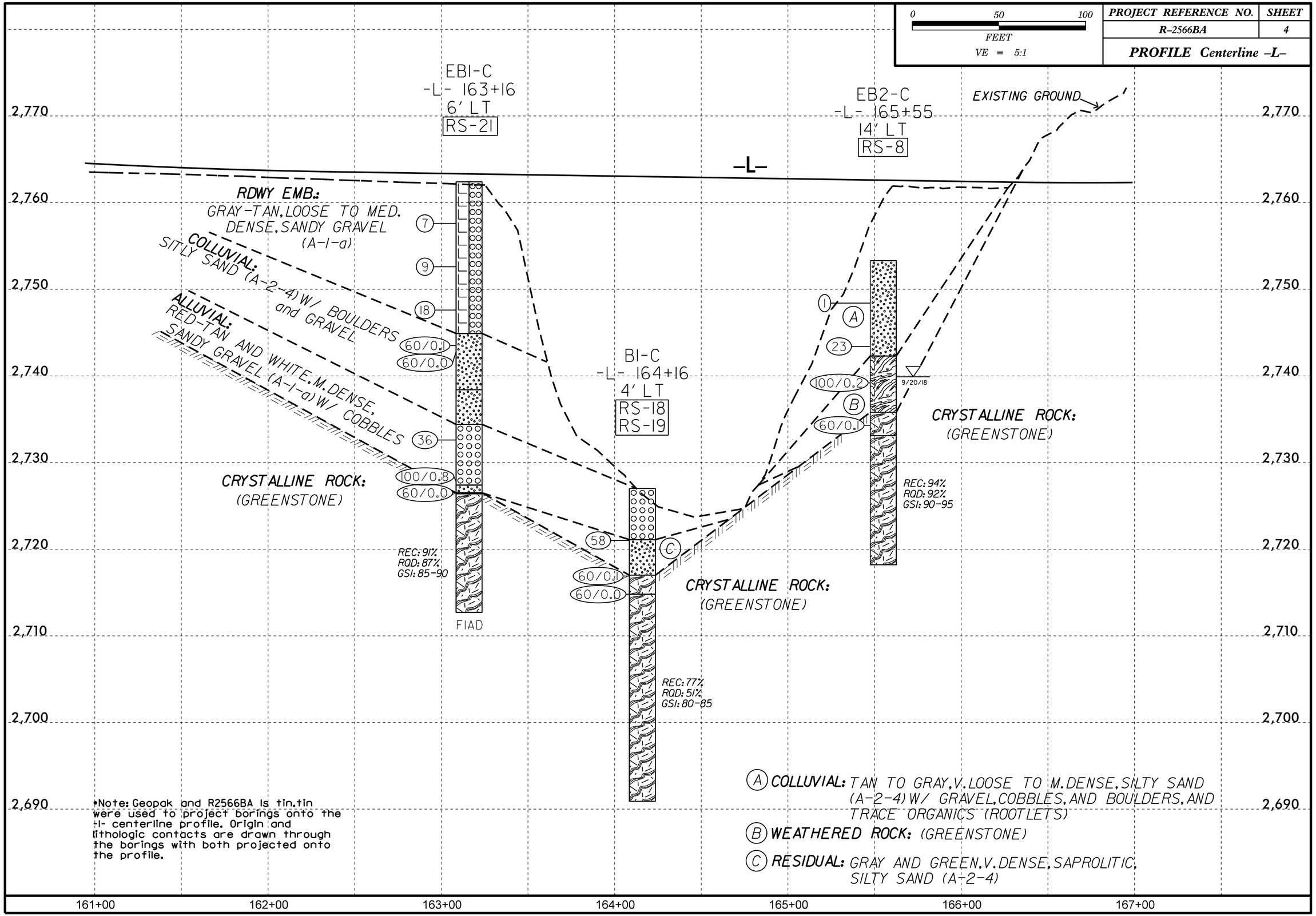


R-2566BA
REVISED BRIDGE LAYOUT
8/24/18 DBP

1@119',1@135'
72" MBT
SKEW = 120 DEG
RELATIVE TO PREVIOUSLY APPROVED BSR:
HOLD EB1
OFFSET DOWNSTREAM FACE OUT 12'
SHIFT BENT 7' MIN. TO EX BENT (C/L TO C/L)

PROJECT REFERENCE NO.	SHEET
R-2566BA	4

PROFILE Centerline -L-



*Note: Geopak and R2566BA ls tin.tin were used to project borings onto the -l- centerline profile. Origin and lithologic contacts are drawn through the borings with both projected onto the profile.

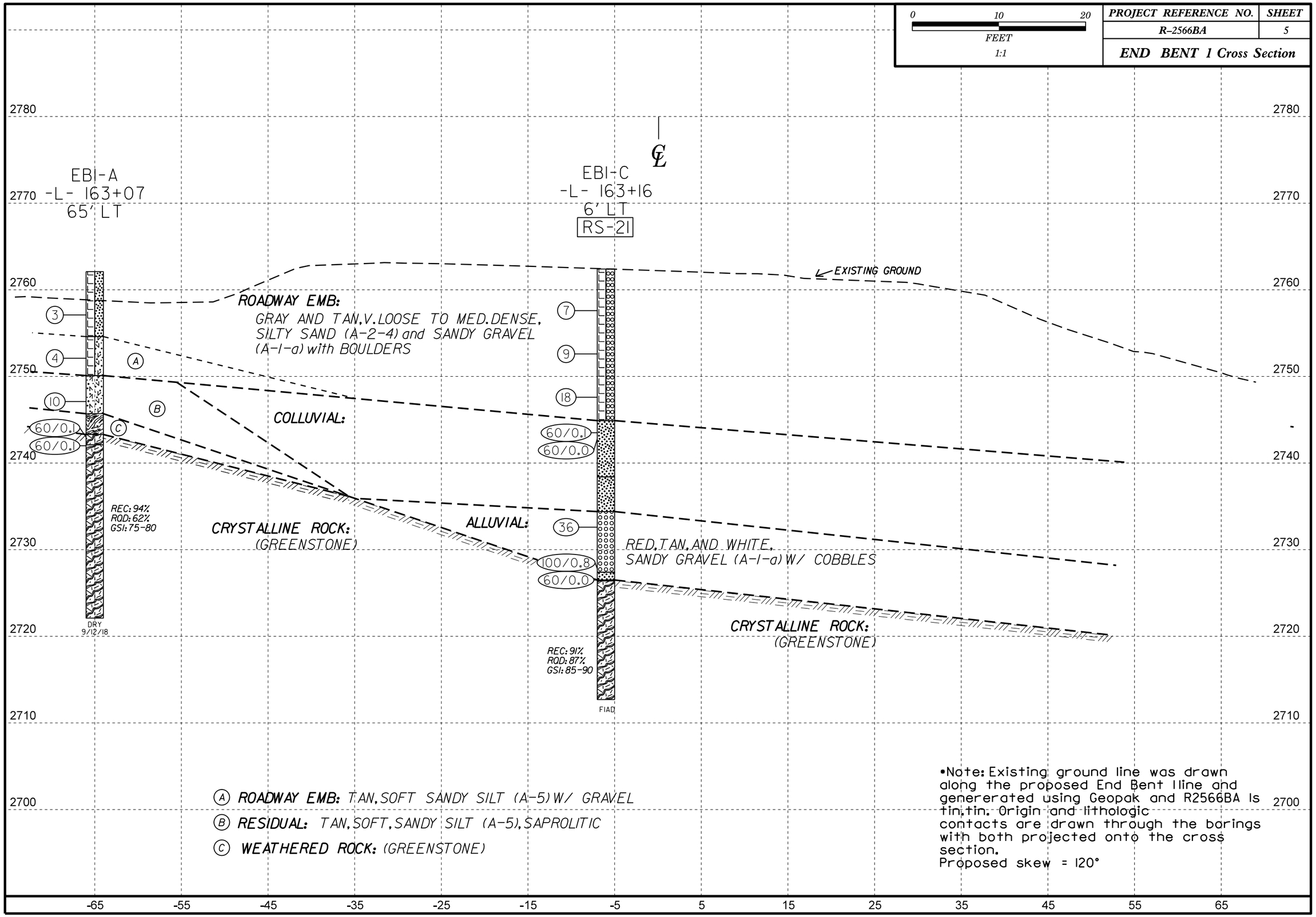
(A) **COLLUVIAL:** TAN TO GRAY, V. LOOSE TO M. DENSE, SILTY SAND (A-2-4) W/ GRAVEL, COBBLES, AND BOULDERS, AND TRACE ORGANICS (ROOTLETS)

(B) **WEATHERED ROCK:** (GREENSTONE)

(C) **RESIDUAL:** GRAY AND GREEN, V. DENSE, SAPROLITIC, SILTY SAND (A-2-4)

PROJECT REFERENCE NO.	SHEET
R-2566BA	5
END BENT 1 Cross Section	

0 10 20
FEET
1:1



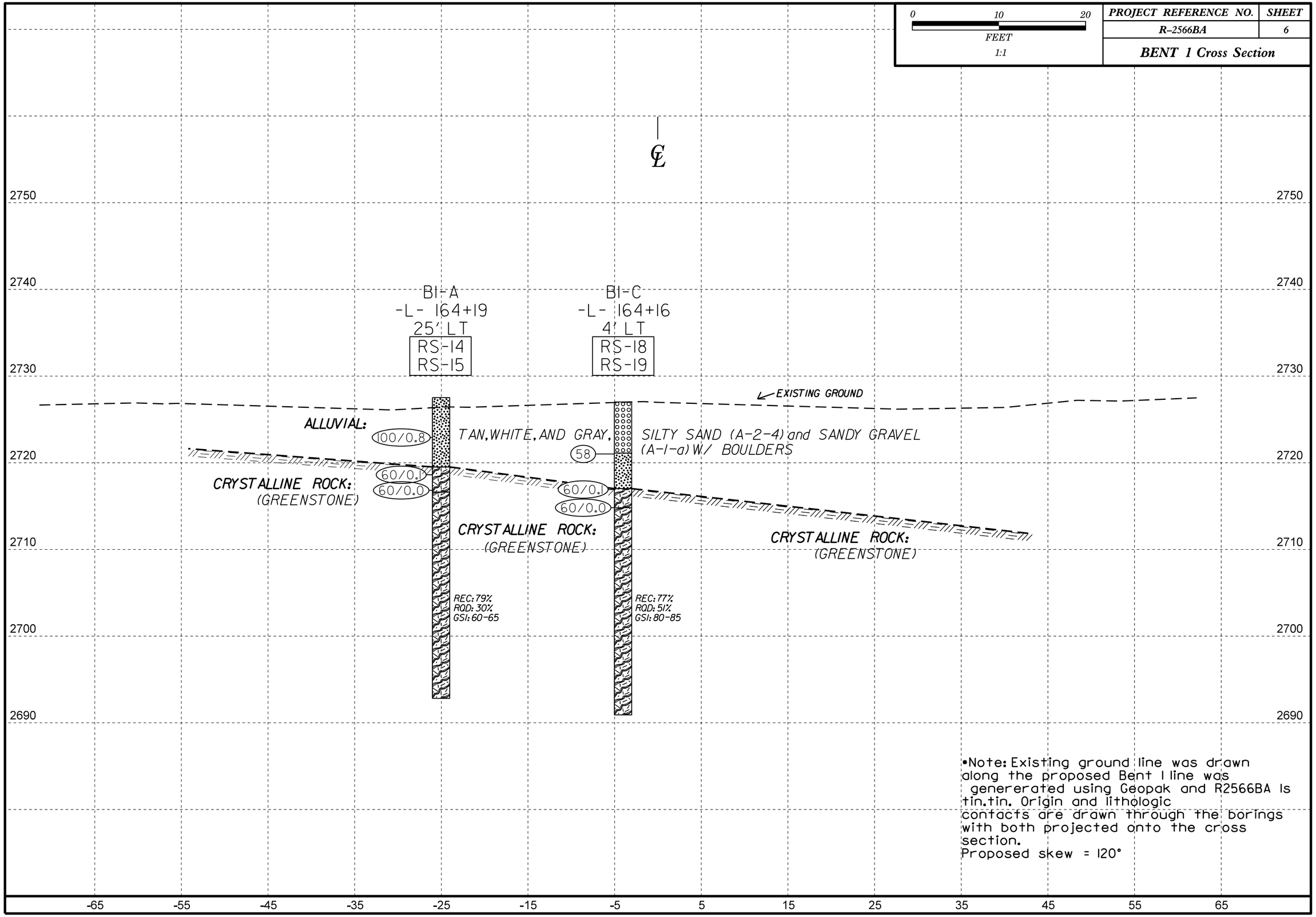
Ⓐ **ROADWAY EMB:** TAN, SOFT SANDY SILT (A-5) W/ GRAVEL

Ⓑ **RESIDUAL:** TAN, SOFT, SANDY SILT (A-5), SAPROLITIC

Ⓒ **WEATHERED ROCK:** (GREENSTONE)

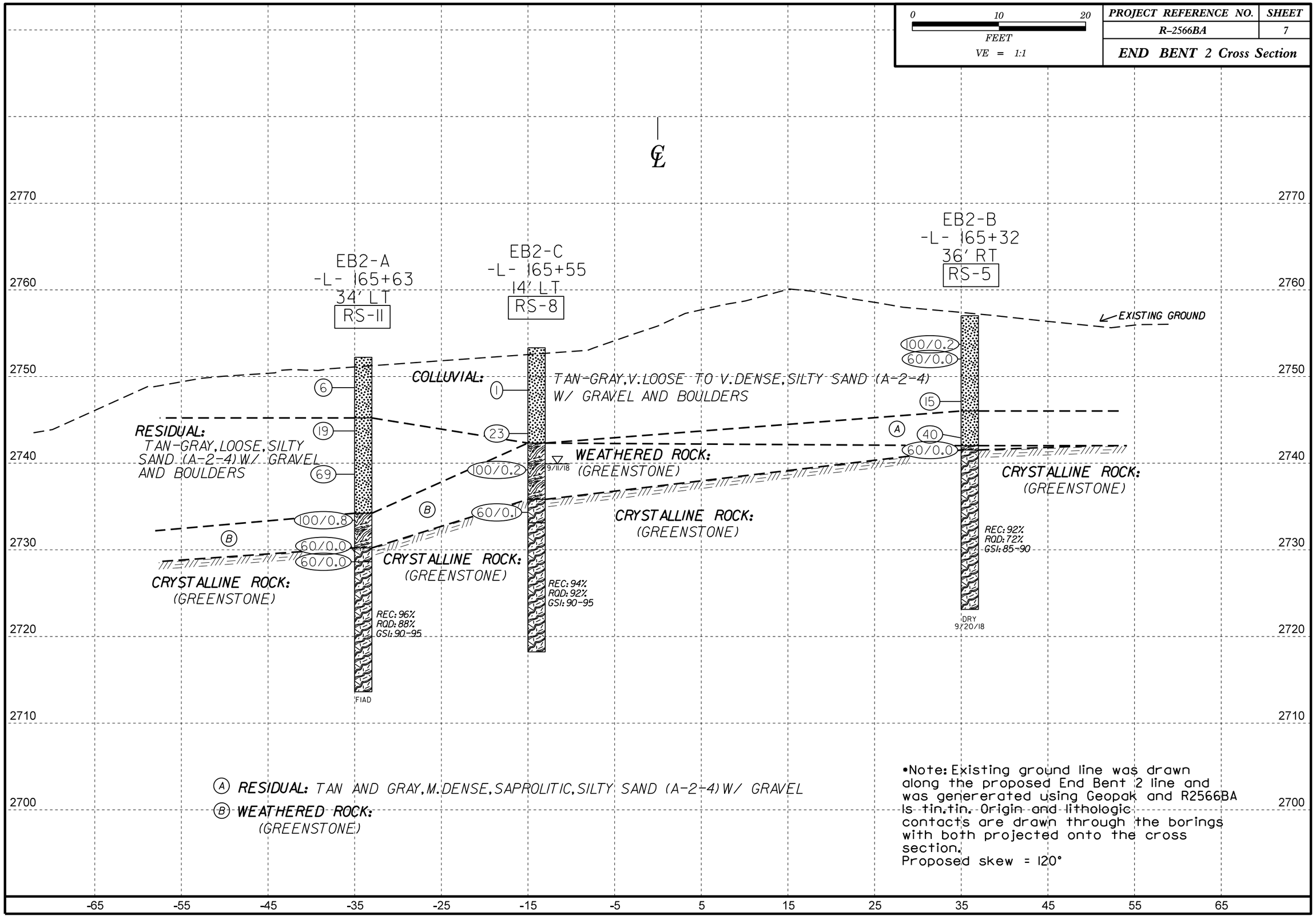
•Note: Existing ground line was drawn along the proposed End Bent 1line and genererated using Geopak and R2566BA Is tin.tin. Origin and lithologic contacts are drawn through the borings with both projected onto the cross section.
Proposed skew = 120°

PROJECT REFERENCE NO.	SHEET
R-2566BA	6
BENT 1 Cross Section	



•Note: Existing ground line was drawn along the proposed Bent 1 line was generated using Geopak and R2566BA Is tin.tin. Origin and lithologic contacts are drawn through the borings with both projected onto the cross section.
Proposed skew = 120°

PROJECT REFERENCE NO.	SHEET
R-2566BA	7
END BENT 2 Cross Section	



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 163+07	**OFFSET** 65 ft LT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,762.1 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 900,702	**EASTING** 1,189,910 / **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/11/18	**COMP. DATE** 09/11/18	**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)
2765											
										2,762.1 GROUND SURFACE	0.0
2760										**ROADWAY EMBANKMENT** Gray and tan, v. loose, Silty SAND (A-2-4), with gravel and BOULDERS	
	2,758.1	4.0	3	2	1	3		W			
2755										2,754.6	7.5
	2,753.1	9.0	1	1	3	4		M		Tan, soft, Sandy SILT (A-5), with gravel	
2750										2,750.1	12.0
	2,748.1	14.0	2	4	6	10		M		**RESIDUAL** Tan, stiff, Sandy SILT (A-5), saprolitic	
2745										2,745.7	16.4
	2,743.1	19.0								**WEATHERED ROCK** (Greenstone) 2,743.3	18.8
	2,742.1	20.0	60/0.1			60/0.1				**CRYSTALLINE ROCK** (Greenstone) 2,742.1	20.0
2740			60/0.1			60/0.1				(Greenstone)	
2735											
2730											
2725											
										2,722.1 Boring Terminated at Elevation 2,722.1 ft in Crystalline Rock (greenstone)	40.0

GEOTECHNICAL BORING REPORT
CORE LOG

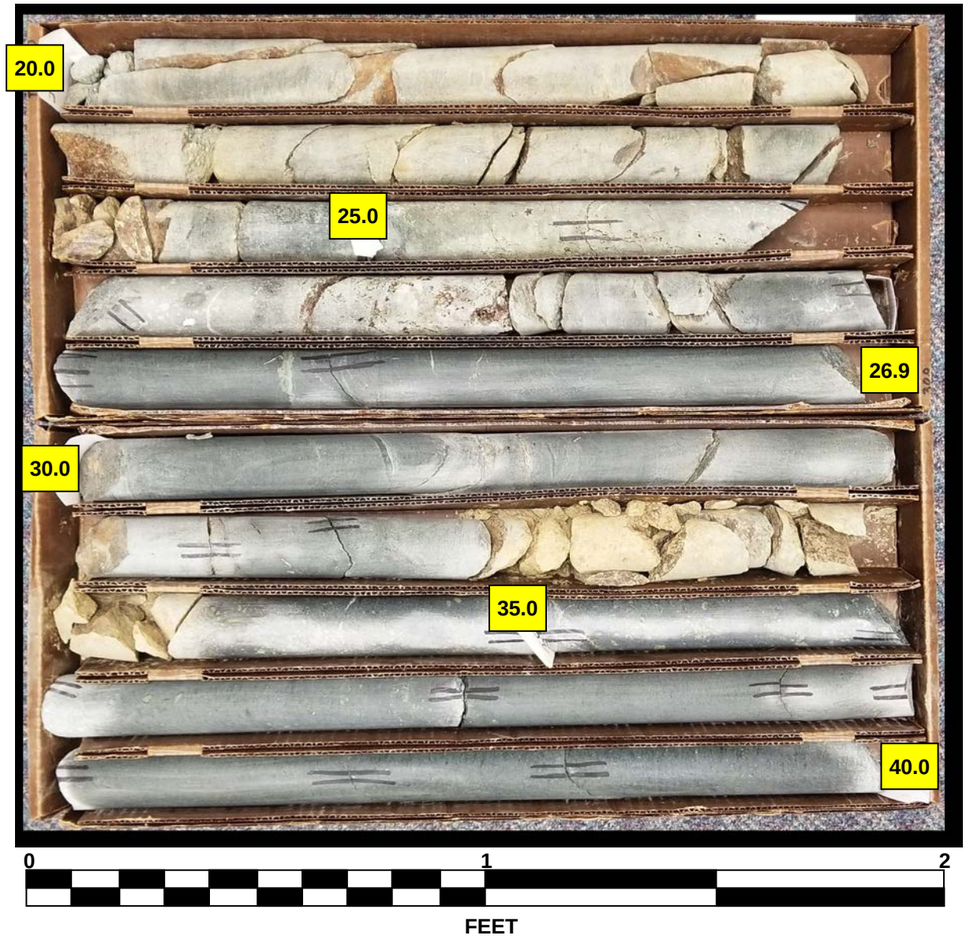
WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB1-A	**STATION** 163+07	**OFFSET** 65 ft LT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,762.1 ft	**TOTAL DEPTH** 40.0 ft	**NORTHING** 900,702	**EASTING** 1,189,910 / **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/11/18	**COMP. DATE** 09/11/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 20.0 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)
2742.1											Begin Coring @ 20.0 ft	
2740	2,742.1	20.0	5.0	04:12/1.0 N=60/0.1 04:12/1.0 05:38/1.0 04:40/1.0 03:38/1.0	(4.4) 88%	(0.0) 0%		(18.7) 94%	(12.3) 62%		2,742.1 Green-tan to green-gray, severely. weathered to fresh, mod. hard to v. hard, v. close- to close-fractured, greenstone GSI = 70-75	20.0
	2,737.1	25.0	5.0	05:33/1.0 07:08/1.0 03:06/1.0 07:34/1.0 06:27/1.0 04:30/1.0	(4.6) 92%	(4.2) 84%						
2735	2,732.1	30.0	5.0	02:52/1.0 03:56/1.0 03:24/1.0 03:53/1.0 06:00/1.0	(4.8) 96%	(3.2) 64%						
2730	2,727.1	35.0	5.0	04:00/1.0 04:25/1.0 04:45/1.0 04:10/1.0 05:24/1.0	(4.9) 98%	(4.9) 98%						
2725	2,722.1	40.0									2,722.1 Boring Terminated at Elevation 2,722.1 ft in Crystalline Rock (greenstone)	40.0

CORE PHOTOGRAPHS

EB1-A

BOXES 1 & 2: 20.0 - 40.0 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 163+16	**OFFSET** 6 ft LT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,762.4 ft	**TOTAL DEPTH** 49.7 ft	**NORTHING** 900,689	**EASTING** 1,189,968 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/03/18	**COMP. DATE** 10/04/18	**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
2765										
										2,762.4 GROUND SURFACE 0.0
2760										**ROADWAY EMBANKMENT** Gray and tan, loose to med. dense, Sandy GRAVEL (A-1-a)
	2,758.6	3.8	9	4	3	7		W		
2755										
	2,753.6	8.8	5	4	5	9		W		
2750										
	2,748.6	13.8	9	11	7	18		M		
2745										2,744.9 17.5
	2,743.6	18.8								**COLLUVIAL** Greenstone, greenschist, and amygdaloidal basalt BOULDERS with Silty SAND (A-2-4) (Advancer refusal at 19.6 feet) (Begin core at 19.8 feet; back into soil at 24.0')
	2,742.8	19.6	60/0.1			60/0.1				
			60/0.0			60/0.0				
2740										
										2,738.4 24.0
										Silty SAND (A-2-4), with gravel
2735										2,734.4 28.0
	2,733.6	28.8	8	10	26	36		Sat.		**ALLUVIAL** Red, tan, and white, med. dense, Sandy GRAVEL (A-1-a), with cobbles
2730										
	2,728.6	33.8	12	88/0.3		100/0.8				
	2,726.5	35.9	60/0.0			60/0.0				2,727.4 35.0
2725										2,726.5 35.9
										2,726.4 36.0
										Tan, med. dense, Silty SAND (A-2-4), with gravel and cobbles (Boulder affected blow count at 33.8 feet drive)
2720							RS-21			**CRYSTALLINE ROCK** (Greenstone) (Casing advancer and SPT refusal at 35.9') (Greenstone)
2715										2,712.7 49.7
										Boring Terminated at Elevation 2,712.7 ft in Crystalline Rock (greenstone)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB1-C	**STATION** 163+16	**OFFSET** 6 ft LT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,762.4 ft	**TOTAL DEPTH** 49.7 ft	**NORTHING** 900,689	**EASTING** 1,189,968 / **24 HR.** FIAD
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/03/18	**COMP. DATE** 10/04/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 23.6 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
2742.6											Begin Coring @ 19.8 ft
2740	2,742.6	19.8	4.9	03:13/0.9 01:24/1.0 02:11/1.0 01:34/1.0 01:04/1.0	(3.3) 67%	(2.3) 47% Colluvial cobbles and boulders					**COLLUVIAL** BOULDERS (Fresh, slightly weatherd to hard, Greenschist and Amygdaloidal Basalt)
	2,737.7	24.7									2,738.4 24.0
											*Note back to colluvial soil at 24.0' *(continued)*
											Silty SAND (A-2-4), with gravel
2735			5.0	00:48/1.0 00:24/1.0 00:39/1.0 00:51/1.0 00:53/1.0 *N=36*	(0.7) 14%	(0.0) 0% Colluvial cobbles and boulders					2,734.4 28.0
	2,732.7	29.7									**ALLUVIAL** Red, tan, and white, med. dense, Sandy GRAVEL (A-1-a), with cobbles
2730											
				N=100/0.8							2,727.4 35.0
	2,726.4	36.0									2,726.5 35.9
2725			3.7	*N=60/0.0* 02:25/0.7 03:47/1.0 03:12/1.0 02:56/1.0	(3.0) 81%	(3.0) 81%		(12.4) 91%	(11.9) 87%		2,726.4 36.0 Tan, med. dense, Silty SAND (A-2-4), with gravel and cobbles (Boulder affected blow count at 33.8 feet drive)
	2,722.7	39.7									**CRYSTALLINE ROCK** Gray Greenstone, some MnO, slightly weathered to fresh, hard to v. hard, close to wide fracture spacing (0.4 feet of core left in ground, unable to retrieve)
2720			5.0	03:26/1.0 02:59/1.0 02:32/1.0 02:44/1.0 02:08/1.0	(4.9) 98%	(4.2) 84%	RS-21				GSI = 85-90
	2,717.7	44.7									
2715			5.0	02:16/1.0 02:36/1.0 02:27/1.0 02:32/1.0 03:52/1.0	(4.5) 90%	(4.0) 80%					
	2,712.7	49.7									2,712.7 49.7
											Boring Terminated at Elevation 2,712.7 ft in Crystalline Rock (greenstone)

CORE PHOTOGRAPHS

EB1-C

BOXES 1 & 2: 19.8 - 49.7 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 164+19	**OFFSET** 25 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 2,727.5 ft	**TOTAL DEPTH** 34.7 ft	**NORTHING** 900,791	**EASTING** 1,189,994 / **24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/01/18	**COMP. DATE** 10/02/18	**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)
2730											
										2,727.5 GROUND SURFACE	0.0
2725										**ALLUVIAL** Tan and gray, alluvial BOULDERS and v. dense Silty SAND (A-2-4) w/ gravel	
	2,723.7	3.8	20	80/0.3		100/0.8		Sat.			
2720										2,719.5	8.0
	2,718.7	8.8	60/0.1			60/0.1				**CRYSTALLINE ROCK** (Greenstone)	
	2,716.8	10.7	60/0.0			60/0.0				2,716.6	10.9
2715										(Advancer refusal at 10.7 feet) (Begin core at 10.9 feet) (Greenstone)	
2710											
2705											
							RS-14				
							RS-15				
2700											
2695											
										2,692.8	34.7
										Boring Terminated at Elevation 2,692.8 ft in Crystalline Rock (greenstone)	

GEOTECHNICAL BORING REPORT
CORE LOG

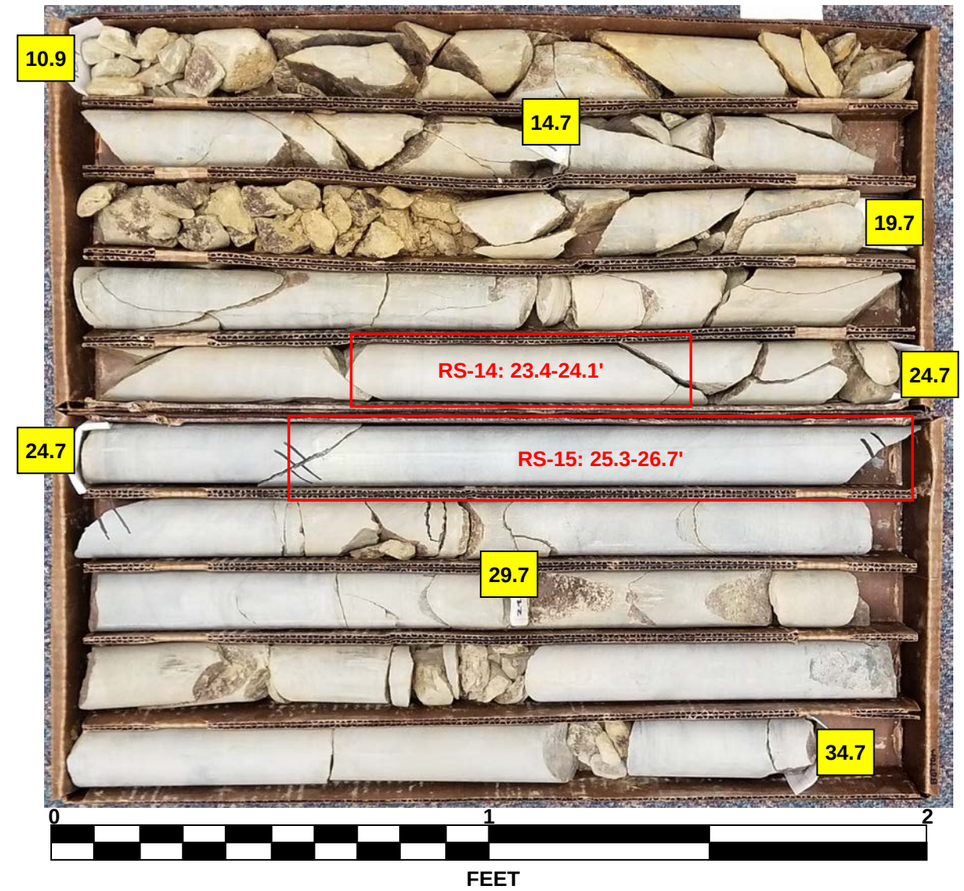
WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. B1-A	**STATION** 164+19	**OFFSET** 25 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 2,727.5 ft	**TOTAL DEPTH** 34.7 ft	**NORTHING** 900,791	**EASTING** 1,189,994 / **24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/01/18	**COMP. DATE** 10/02/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 23.8 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)
2716.6											Continued from previous page	
2715	2,716.6	10.9	3.8	02:25/0.8 04:05/1.0 03:11/1.0 04:13/1.0	(3.1) 82%	(0.4) 11%		(18.9) 79%	(7.2) 30%		2,716.6 Gray, Greenstone with MnO in fractures, severely weathered to fresh with complete weathering from 15.5 to 18.5 feet, med. hard to hard, v. close to mod. close fracture spacing	10.9
	2,712.8	14.7	5.0	03:17/1.0 01:30/1.0 01:19/1.0 01:40/1.0 05:11/1.0	(2.6) 52%	(0.0) 0%					GSI = 60-65	
2710	2,707.8	19.7	5.0	02:24/1.0 00:50/1.0 03:40/1.0 03:48/1.0 03:23/1.0	(3.9) 78%	(1.1) 22%						
2705	2,702.8	24.7	5.0	02:42/1.0 03:04/1.0 03:10/1.0 03:07/1.0 03:07/1.0	(4.7) 94%	(3.4) 68%	RS-14 / RS-15					
2700	2,697.8	29.7	5.0	02:19/1.0 02:29/1.0 02:49/1.0 03:04/1.0 03:28/1.0	(4.6) 92%	(2.3) 46%						
2695	2,692.8	34.7									2,692.8	34.7
											Boring Terminated at Elevation 2,692.8 ft in Crystalline Rock (greenstone)	

CORE PHOTOGRAPHS

B1-A

BOXES 1 & 2: 10.9 - 34.7 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 164+16	**OFFSET** 4 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 2,727.0 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 900,779	**EASTING** 1,190,012 / **24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/02/18	**COMP. DATE** 10/03/18	**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	
2730											
										2,727.0 GROUND SURFACE	0.0
2725										**ALLUVIAL** White and tan, alluvial BOULDERS with sandy gravel (A-1-a)	
	2,722.0	5.0	18	26	32	58		Sat.		2,721.1	5.9
2720										**RESIDUAL** Gray and green, v. dense, Silty SAND (A-2-4), saprolitic (Can see relict epidote porphyroblasts and foliation)	
	2,717.0	10.0	60/0.1			60/0.1				2,717.0	10.0
2715	2,714.8	12.2	60/0.0			60/0.0				**CRYSTALLINE ROCK** (Greenstone) (Advancer refusal at 12.2 feet) (Begin core at 12.2 feet) (Greenstone)	2,714.8 12.2
2710											
2705											
2700							RS-18				
2695							RS-19				
										2,690.9	36.1
										Boring Terminated at Elevation 2,690.9 ft in Crystalline Rock (greenstone)	

GEOTECHNICAL BORING REPORT
CORE LOG

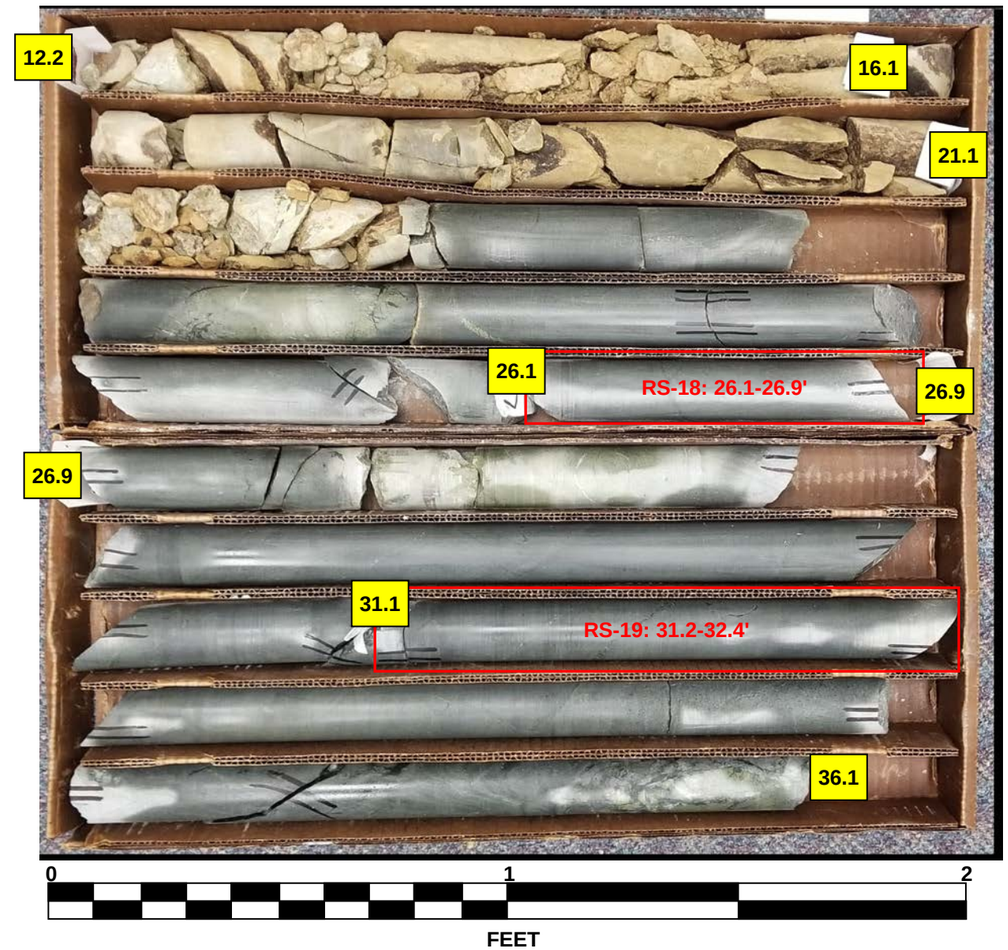
WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. B1-C	**STATION** 164+16	**OFFSET** 4 ft LT	**ALIGNMENT** -L- / **0 HR.** N/A
COLLAR ELEV. 2,727.0 ft	**TOTAL DEPTH** 36.1 ft	**NORTHING** 900,779	**EASTING** 1,190,012 / **24 HR.** N/A
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 10/02/18	**COMP. DATE** 10/03/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 23.9 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
2714.8											Continued from previous page
	2,714.8	12.2	3.9	*N=60/0.0* 01:59/0.9 02:07/1.0 02:42/1.0 03:21/1.0	(1.8) 46%	(0.0) 0%		(18.3) 77%	(12.2) 51%		2,714.8 (FROM 12.2 TO 22.4 FEET) 12.2 Tan and gray, complete to mod. severe weathering, Greenstone, v. soft to med. hard, v. close to close fracture spacing
2710	2,710.9	16.1	5.0	04:14/1.0 02:35/1.0 03:12/1.0 00:45/1.0 01:36/1.0	(2.2) 44%	(0.0) 0%					(FROM 22.4 TO 36.1 FEET) Gray and green, Greenstone, fresh, v. hard, mod. close to wide fracture spacing
2705	2,705.9	21.1	5.0	02:55/1.0 03:01/1.0 02:10/1.0 02:21/1.0 02:55/1.0	(4.5) 90%	(3.0) 60%					GSI = 80-85
2700	2,700.9	26.1	5.0	02:49/1.0 03:48/1.0 04:35/1.0 03:46/1.0 04:10/1.0	(4.9) 98%	(4.4) 88%	RS-18				
2695	2,695.9	31.1	5.0	02:57/1.0 03:05/1.0 02:50/1.0 03:15/1.0 03:17/1.0	(4.9) 98%	(4.8) 96%	RS-19				
	2,690.9	36.1									2,690.9 36.1
											Boring Terminated at Elevation 2,690.9 ft in Crystalline Rock (greenstone)

CORE PHOTOGRAPHS

B1-C

BOXES 1 & 2: 12.2 - 36.1 FEET



GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 165+63	**OFFSET** 34 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 2,752.2 ft	**TOTAL DEPTH** 38.6 ft	**NORTHING** 900,924	**EASTING** 1,190,059
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/25/18	**COMP. DATE** 09/26/18	**SURFACE WATER DEPTH** N/A

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	FIAD

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)
2755											
										2,752.2 GROUND SURFACE	0.0
2750	2,749.7	2.5								**COLLUVIAL** Tan, loose, Silty SAND (A-2-4), with gravel and boulders	
			3	3	3	6		W			
2745	2,744.7	7.5								2,745.2	7.0
			7	8	11	19		W		**RESIDUAL** Tan and gray, med. dense to v. dense, Silty SAND (A-2-4), with gravel, saprolitic	
2740	2,739.7	12.5									
			7	16	53	69		M			
2735	2,734.7	17.5								2,734.2	18.0
			19	15	85/0.3	100/0.8				**WEATHERED ROCK** (Greenstone)	
2730	2,729.7	22.5								2,730.2	22.0
	2,728.6	23.6	60/0.0			60/0.0				**CRYSTALLINE ROCK** (Greenstone)	
			60/0.0			60/0.0	RS-11			2,728.6	23.6
2725										(SPT and Casing Advancer refusal at 23.6') (Begin core at 23.6') (Greenstone)	
2720											
2715											
										2,713.6	38.6
										Boring Terminated at Elevation 2,713.6 ft in Crystalline Rock (greenstone) *Deck to datum distance: 11.0 ft to embankment surface	

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-A	**STATION** 165+63	**OFFSET** 34 ft LT	**ALIGNMENT** -L-
COLLAR ELEV. 2,752.2 ft	**TOTAL DEPTH** 38.6 ft	**NORTHING** 900,924	**EASTING** 1,190,059
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/25/18	**COMP. DATE** 09/26/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 15.0 ft		

GROUND WTR (ft)	
0 HR.	Dry
24 HR.	FIAD

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)
2728.6											Continued from previous page	
	2,728.6	23.6	5.0	*N=60/0.0* 03:02/1.0 03:24/1.0 04:45/1.0 03:06/1.0 03:44/1.0	(4.4) 88%	(3.2) 64%	RS-11	(14.4) 96%	(13.2) 88%		2,728.6 Gray and green greenstone, generally massive with quartz-epidote phenocrysts, slightly weathered to fresh, hard to v. hard, close to wide fracture spacing GSI = 90-95	23.6
2725												
	2,723.6	28.6	5.0	02:47/1.0 03:15/1.0 03:33/1.0 03:34/1.0 03:27/1.0	(5.0) 100%	(5.0) 100%						
2720												
	2,718.6	33.6	5.0	05:52/1.0 05:14/1.0 03:46/1.0 03:47/1.0 04:01/1.0	(5.0) 100%	(5.0) 100%						
2715												
	2,713.6	38.6									2,713.6	38.6
											Boring Terminated at Elevation 2,713.6 ft in Crystalline Rock (greenstone) *Deck to datum distance: 11.0 ft to embankment surface	

CORE PHOTOGRAPHS

EB2-A

BOXES 1 & 2: 23.6 - 38.6 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 165+32	**OFFSET** 36 ft RT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,757.0 ft	**TOTAL DEPTH** 33.9 ft	**NORTHING** 900,860	**EASTING** 1,190,102 / **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/18/18	**COMP. DATE** 09/18/18	**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
2760										
										2,757.0 GROUND SURFACE 0.0
2755										**COLLUVIAL** Tan and gray, med. dense to v. dense, Silty SAND (A-2-4), with boulders (Advancer refusal at 4.0 feet) (Begin core at 4.0 feet, return to soil, continue with casing advancer at 8.9 feet)
	2,753.9	3.1	100/0.2			100/0.2				
	2,752.0	5.0	60/0.0			60/0.0				
2750										
	2,748.1	8.9	3	3	12	15		M		
2745										2,746.0 11.0 **RESIDUAL** Tan and gray, med. dense, Silty SAND (A-2-4), with gravel, saprolitic
	2,743.9	13.1	3	2	38	40		M		
	2,741.5	15.5	60/0.0							2,742.0 15.0 / 2,741.5 15.5 **WEATHERED ROCK** (Greenstone) (SPT and Casing Advancer refusal at 15.5') (Begin core at 15.5')
2740										
2735							RS-5			**CRYSTALLINE ROCK** (Greenstone)
2730										
2725										2,723.1 33.9 Boring Terminated at Elevation 2,723.1 ft in Crystalline Rock (greenstone)

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-B	**STATION** 165+32	**OFFSET** 36 ft RT	**ALIGNMENT** -L- / **0 HR.** Dry
COLLAR ELEV. 2,757.0 ft	**TOTAL DEPTH** 33.9 ft	**NORTHING** 900,860	**EASTING** 1,190,102 / **24 HR.** Dry
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/18/18	**COMP. DATE** 09/18/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 23.3 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
2753											Continued from previous page
2750	2,753.0	4.0	4.9	03:23/0.9 00:42/1.0 *N=60/0.0* 00:42/1.0 00:27/1.0 00:26/1.0	(0.0) 0%	(0.0) 0%					**COLLUVIAL** Tan, med. dense, Silty SAND (A-2-4), with boulders *(continued)*
	2,748.1	8.9		*N=15*							2,746.0 11.0 **RESIDUAL**
2745				*N=40*							
	2,741.5	15.5	3.4	*N=60/0.0* 04:35/1.0 03:52/1.0 03:21/1.0 00:51/0.4	(3.2) 94%	(3.2) 94%		(17.0) 92%	(13.3) 72%		2,742.0 15.0 / 2,741.5 15.5 **WEATHERED ROCK** (Greenstone)
2740	2,738.1	18.9	5.0	02:47/1.0 02:10/1.0 02:39/1.0 04:00/1.0 03:35/1.0	(4.3) 86%	(1.1) 22%					**CRYSTALLINE ROCK** Gray greenstone, some epidote, otherwise massive, fresh, mod. hard to v. hard, close to wide fracture spacing GSI = 85-90
2735	2,733.1	23.9	5.0	03:05/1.0 03:04/1.0 02:40/1.0 02:42/1.0 02:31/1.0	(4.5) 90%	(4.0) 80%	RS-5				
2730	2,728.1	28.9	5.0	03:05/1.0 02:57/1.0 03:01/1.0 02:50/1.0 02:42/1.0	(5.0) 100%	(5.0) 100%					
2725	2,723.1	33.9									2,723.1 33.9 Boring Terminated at Elevation 2,723.1 ft in Crystalline Rock (greenstone)

CORE PHOTOGRAPHS

EB2-B

BOXES 1 & 2: 15.5 - 33.9 FEET

GEOTECHNICAL BORING REPORT
BORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 165+55	**OFFSET** 14 ft LT	**ALIGNMENT** -L- / **0 HR.** 13.4
COLLAR ELEV. 2,753.3 ft	**TOTAL DEPTH** 35.1 ft	**NORTHING** 900,906	**EASTING** 1,190,072 / **24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/20/18	**COMP. DATE** 09/21/18	**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))
2755										2,753.3 GROUND SURFACE 0.0
2750	2,749.4	3.9	WOH	1	0	1		M		**COLLUVIAL** Tan to gray, v. loose to med. dense, Silty SAND (A-2-4), with gravel and cobbles and boulders, trace organics (rootlets)
2745	2,744.4	8.9	5	10	13	23		D		2,742.3 11.0
2740	2,739.4	13.9	100/0.2			100/0.2				**WEATHERED ROCK** (Greenstone)
2735	2,734.4	18.9	60/0.1			60/0.1	RS-8			2,735.8 17.5 **CRYSTALLINE ROCK** (Greenstone) 2,733.1 20.2 (SPT and Casing Advancer refusal at 20.0' in CR) (Begin core at 20.2') (Greenstone)
2730										
2725										
2720										2,718.2 35.1 Boring Terminated at Elevation 2,718.2 ft in Crystalline Rock (greenstone) *Deck to datum distance: 9.65 ft

NCDOT BORE DOUBLE R2566BA_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 11/14/18

GEOTECHNICAL BORING REPORT
CORE LOG

WBS 37512.1.4	**TIP** R-2566BA	**COUNTY** WATAUGA	**GEOLOGIST** Gross, A.
SITE DESCRIPTION Bridge No. 5 on -L- (NC 105) over Watauga River			**GROUND WTR (ft)**
BORING NO. EB2-C	**STATION** 165+55	**OFFSET** 14 ft LT	**ALIGNMENT** -L- / **0 HR.** 13.4
COLLAR ELEV. 2,753.3 ft	**TOTAL DEPTH** 35.1 ft	**NORTHING** 900,906	**EASTING** 1,190,072 / **24 HR.** Caved
DRILL RIG/HAMMER EFF./DATE SUM3123 CME-550X 95% 11/30/2017		**DRILL METHOD** NW Casing W/SPT & Core	**HAMMER TYPE** Automatic
DRILLER Gonzalez-Castillo, L.	**START DATE** 09/20/18	**COMP. DATE** 09/21/18	**SURFACE WATER DEPTH** N/A
CORE SIZE NQ2	**TOTAL RUN** 14.9 ft		

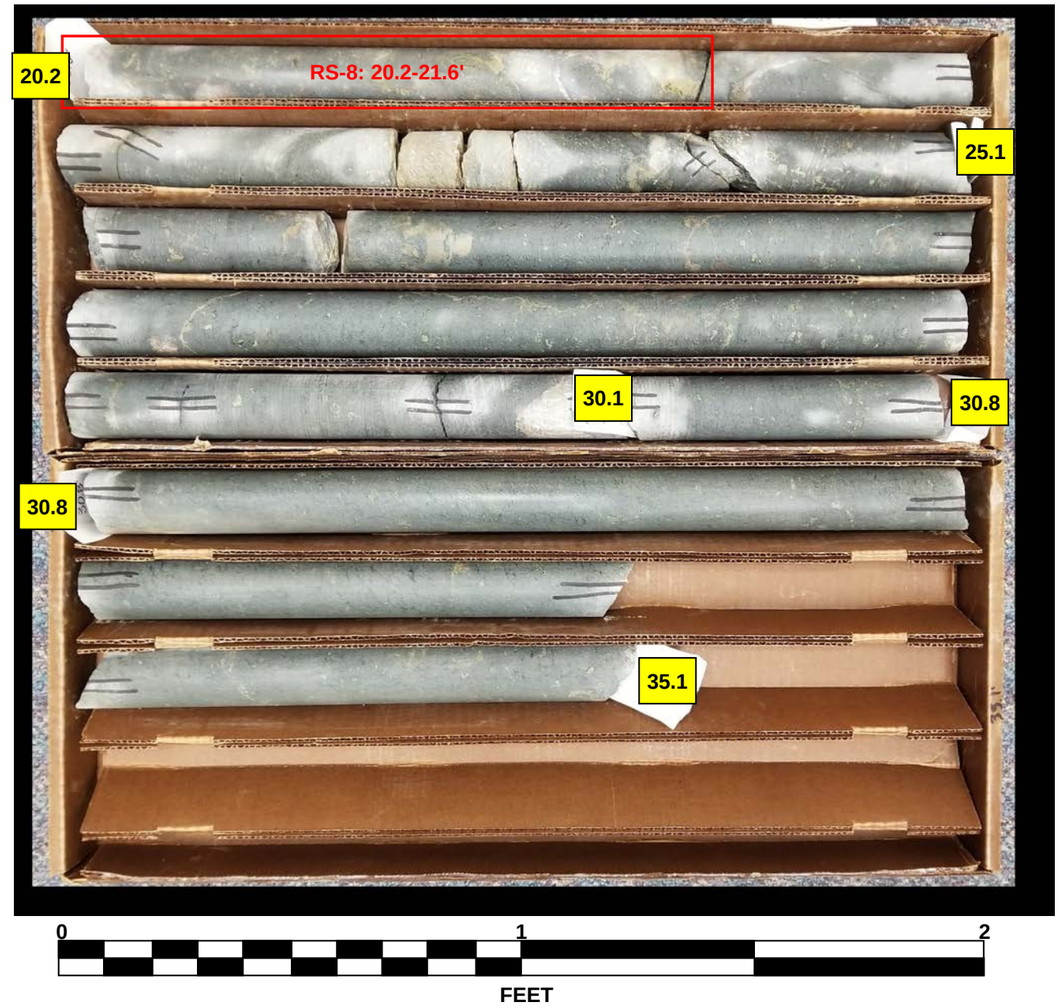
ELEV (ft)	RUN ELEV (ft)	DEPTH (ft)	RUN (ft)	DRILL RATE (Min/ft)	RUN REC. (ft) %	RUN RQD (ft) %	SAMP. NO.	STRATA REC. (ft) %	STRATA RQD (ft) %	LOG	DESCRIPTION AND REMARKS (ELEV. (ft) / DEPTH (ft))
2733.1											Continued from previous page
	2,733.1	20.2	4.9	03:04/0.9 03:21/1.0 03:00/1.0 01:59/1.0 02:42/1.0	(4.0) 82%	(3.7) 76%	RS-8	(14.0) 94%	(13.7) 92%		2,733.1 Gray, greenstone with epidote, generally massive, fresh, v. hard, mod. close to v. wide fracture spacing 20.2 GSI = 90-95
2730	2,728.2	25.1	5.0	02:44/1.0 03:04/1.0 02:36/1.0 03:02/1.0 03:03/1.0	(5.0) 100%	(5.0) 100%					
2725	2,723.2	30.1	5.0	03:04/1.0 03:14/1.0 02:30/1.0 02:59/1.0 02:37/1.0	(5.0) 100%	(5.0) 100%					
2720	2,718.2	35.1									2,718.2 35.1 Boring Terminated at Elevation 2,718.2 ft in Crystalline Rock (greenstone) *Deck to datum distance: 9.65 ft

NCDOT CORE DOUBLE R2566BA_GEO_BRDG_SUMMIT_GINT.GPJ NC_DOT.GDT 11/14/18

CORE PHOTOGRAPHS

EB2-C

BOXES 1 & 2: 20.2 - 35.1 FEET



UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

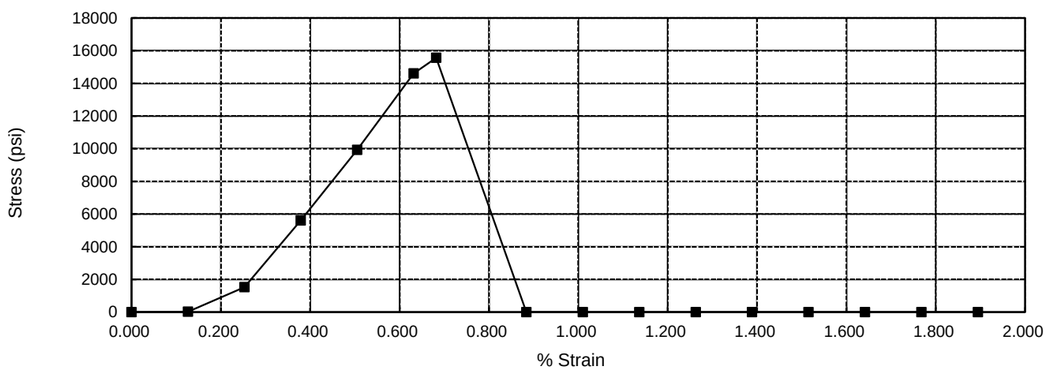
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-21
Location: EB1-C
Depth (ft): 40.4 - 41.8

Length (in.): 3.96
Diameter (in.): 1.98
Area (in²): 3.076
L/D 2.00
Unit Weight (pcf): 186.8

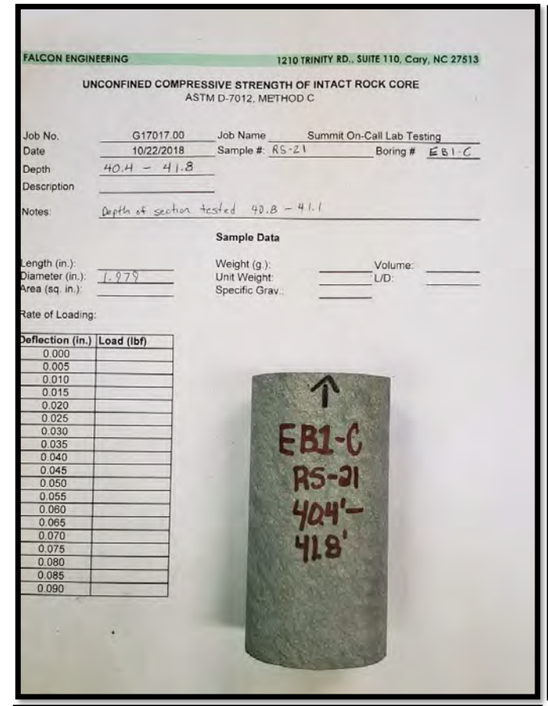
Compressive Strength (psi): 15560
Time to Failure, mins:sec: 4:26

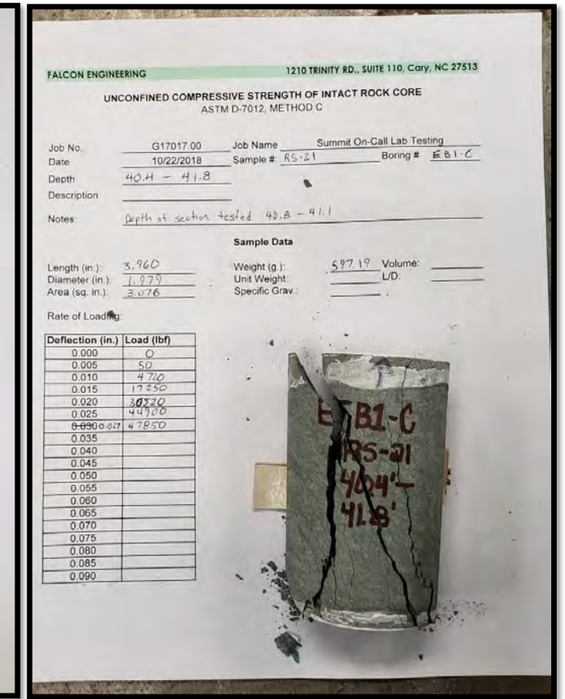
Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.126	50	20	15,840
0.010	0.253	4720	1530	605,880
0.015	0.379	17250	5610	1,481,040
0.020	0.505	30520	9920	1,964,160
0.025	0.631	44900	14600	2,312,640
0.027	0.682	47850	15560	2,282,133
0.035	0.884		0	0
0.040	1.010		0	0
0.045	1.136		0	0
0.050	1.263		0	0
0.055	1.389		0	0
0.060	1.515		0	0
0.065	1.641		0	0
0.070	1.768		0	0
0.075	1.894		0	0

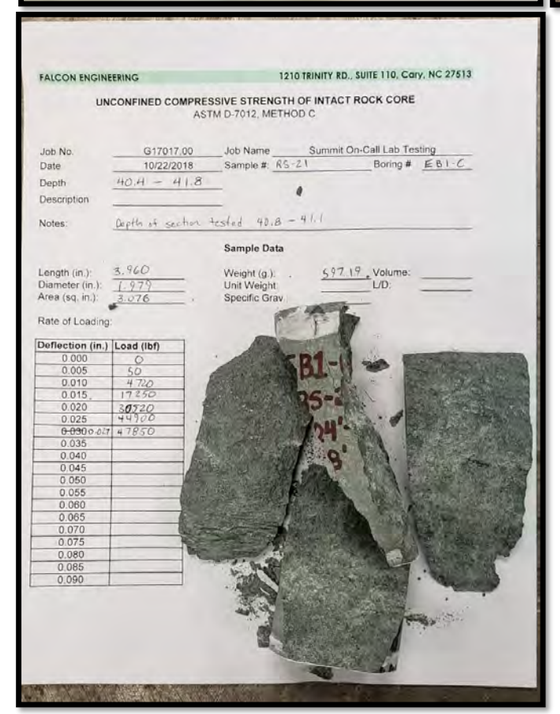


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803







UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

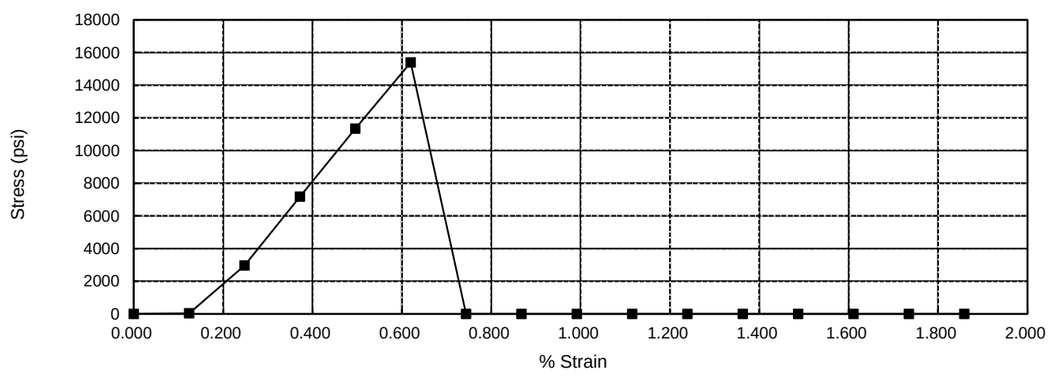
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-14
Location: B1-A
Depth (ft): 23.4 - 24.1

Length (in.): 4.04
Diameter (in.): 1.98
Area (in²): 3.082
L/D 2.04
Unit Weight (pcf): 187.6

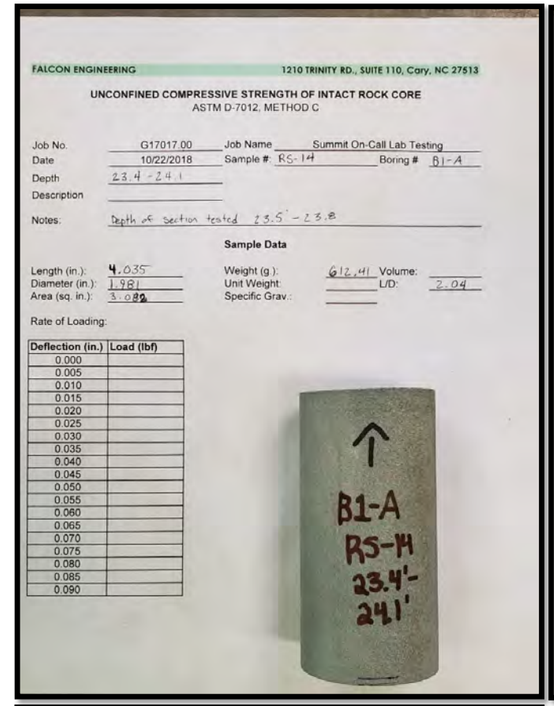
Compressive Strength (psi): 15390
Time to Failure, mins:sec: 4:24

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.124	110	40	32,280
0.010	0.248	9130	2960	1,194,360
0.015	0.372	22100	7170	1,928,730
0.020	0.496	34950	11340	2,287,845
0.025	0.620	47430	15390	2,483,946
0.030	0.743		0	0
0.035	0.867		0	0
0.040	0.991		0	0
0.045	1.115		0	0
0.050	1.239		0	0
0.055	1.363		0	0
0.060	1.487		0	0
0.065	1.611		0	0
0.070	1.735		0	0
0.075	1.859		0	0

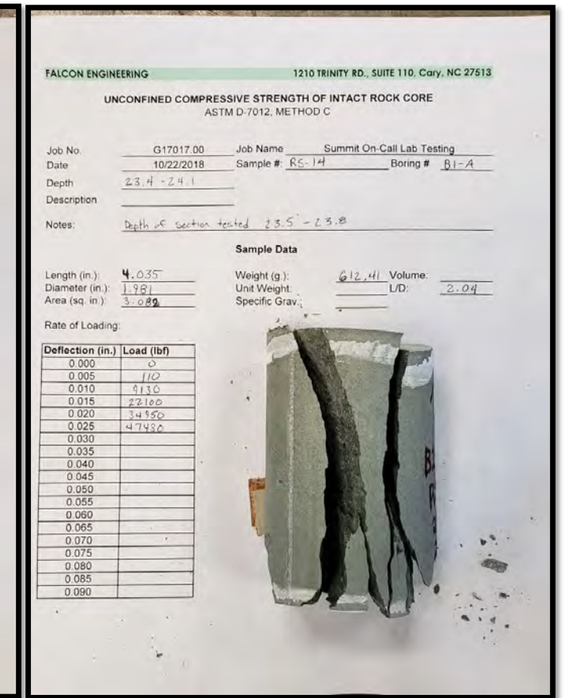


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

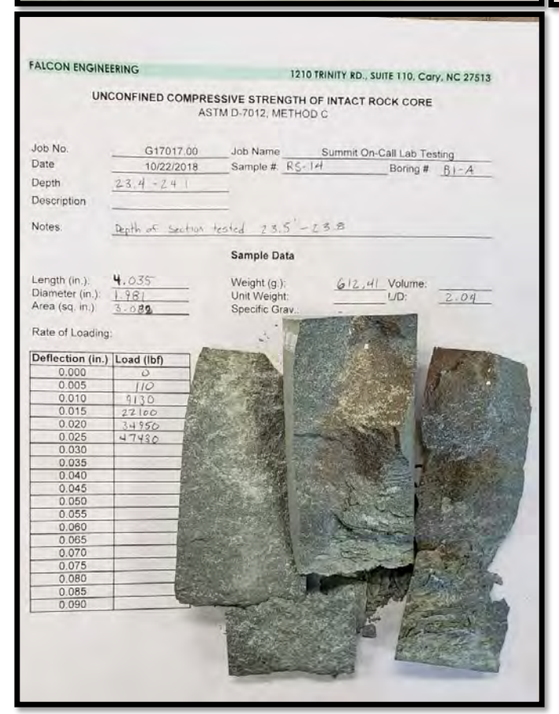
Technician: M. Bauer
NCDOT CERT.# 105-02-0803


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-14 Boring # B1-A
Depth 23.4 - 24.1
Description
Notes: Depth of section tested 23.5' - 23.8
Sample Data
Length (in.): 4.035 Weight (g.): 612.41 Volume:
Diameter (in.): 1.981 Unit Weight: L/D: 2.04
Area (sq. in.): 3.082 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	
0.005	
0.010	
0.015	
0.020	
0.025	
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-14 Boring # B1-A
Depth 23.4 - 24.1
Description
Notes: Depth of section tested 23.5' - 23.8
Sample Data
Length (in.): 4.035 Weight (g.): 612.41 Volume:
Diameter (in.): 1.981 Unit Weight: L/D: 2.04
Area (sq. in.): 3.082 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	110
0.010	9130
0.015	22100
0.020	34950
0.025	47430
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-14 Boring # B1-A
Depth 23.4 - 24.1
Description
Notes: Depth of section tested 23.5' - 23.8
Sample Data
Length (in.): 4.035 Weight (g.): 612.41 Volume:
Diameter (in.): 1.981 Unit Weight: L/D: 2.04
Area (sq. in.): 3.082 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	110
0.010	9130
0.015	22100
0.020	34950
0.025	47430
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

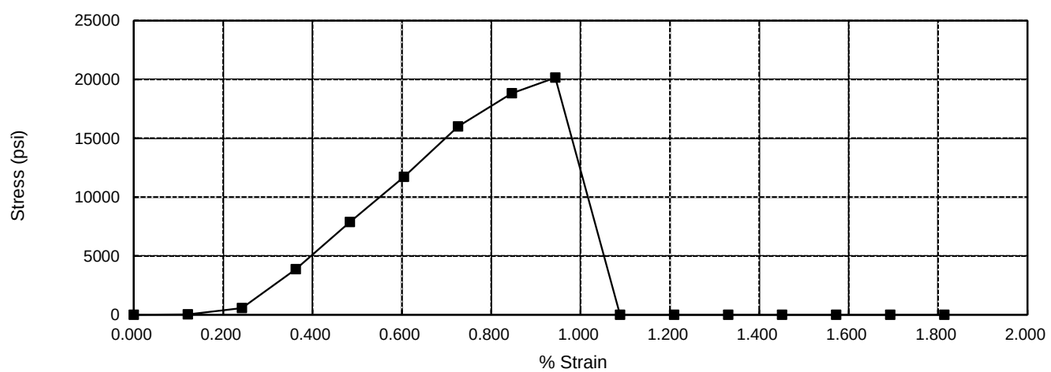
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-15
Location: B1-A
Depth (ft): 25.3 - 26.6

Length (in.): 4.14
Diameter (in.): 1.98
Area (in²): 3.082
L/D 2.09
Unit Weight (pcf): 187.6

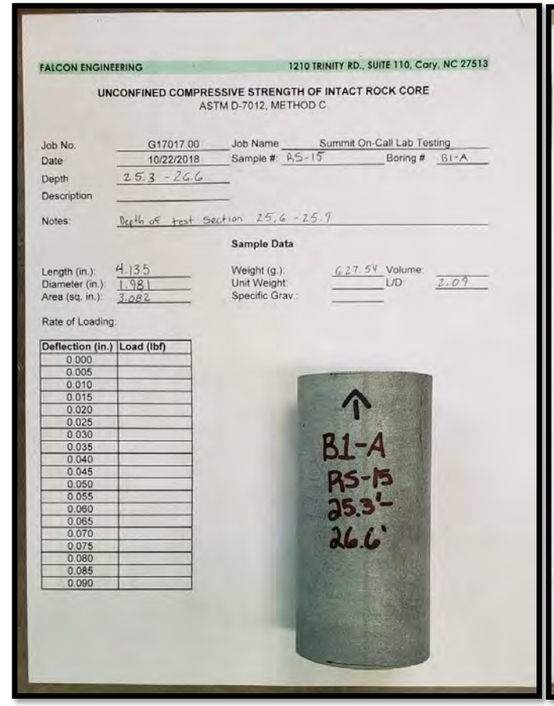
Compressive Strength (psi): 20150
Time to Failure, mins:sec: 5:45

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.121	80	30	24,810
0.010	0.242	1770	570	235,695
0.015	0.363	11950	3880	1,069,587
0.020	0.484	24250	7870	1,627,123
0.025	0.605	36090	11710	1,936,834
0.030	0.726	49300	16000	2,205,333
0.035	0.846	58000	18820	2,223,449
0.039	0.943	62110	20150	2,136,417
0.045	1.088		0	0
0.050	1.209		0	0
0.055	1.330		0	0
0.060	1.451		0	0
0.065	1.572		0	0
0.070	1.693		0	0
0.075	1.814		0	0

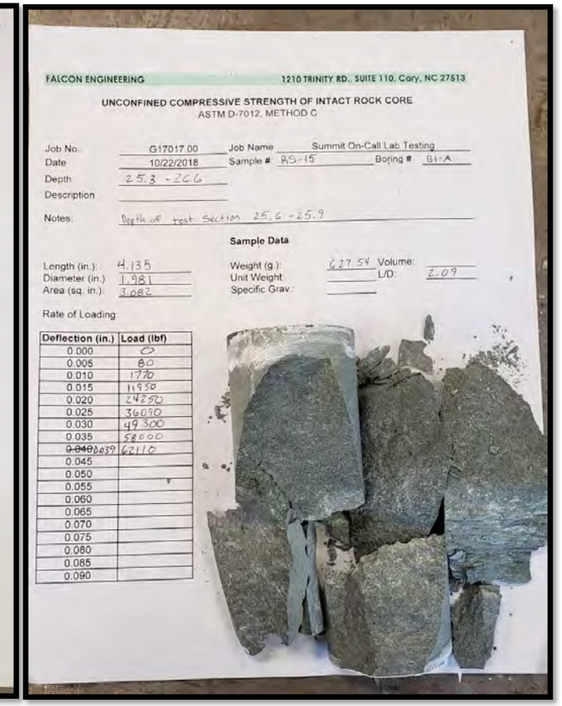


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample # RS-15 Boring # B1-A
Depth 25.3 - 26.6
Description
Notes: Depth of test Section 25.6 - 25.9
Sample Data
Length (in.): 4.135 Weight (g.): 627.54 Volume:
Diameter (in.): 1.981 Unit Weight: L/D: 2.09
Area (sq. in.): 3.082 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	
0.005	
0.010	
0.015	
0.020	
0.025	
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample # RS-15 Boring # B1-A
Depth 25.3 - 26.6
Description
Notes: Depth of test Section 25.6 - 25.9
Sample Data
Length (in.): 4.135 Weight (g.): 627.54 Volume:
Diameter (in.): 1.981 Unit Weight: L/D: 2.09
Area (sq. in.): 3.082 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	80
0.010	1770
0.015	11950
0.020	24250
0.025	36090
0.030	49300
0.035	58000
~~0.040~~ 0.039	62110
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

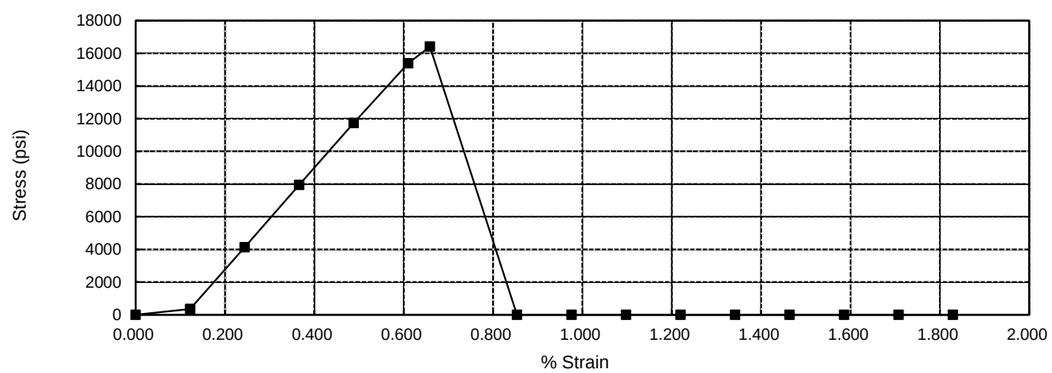
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-18
Location: B1-C
Depth (ft): 26.1 - 26.9

Length (in.): 4.10
Diameter (in.): 1.98
Area (in²): 3.079
L/D 2.07
Unit Weight (pcf): 186.3

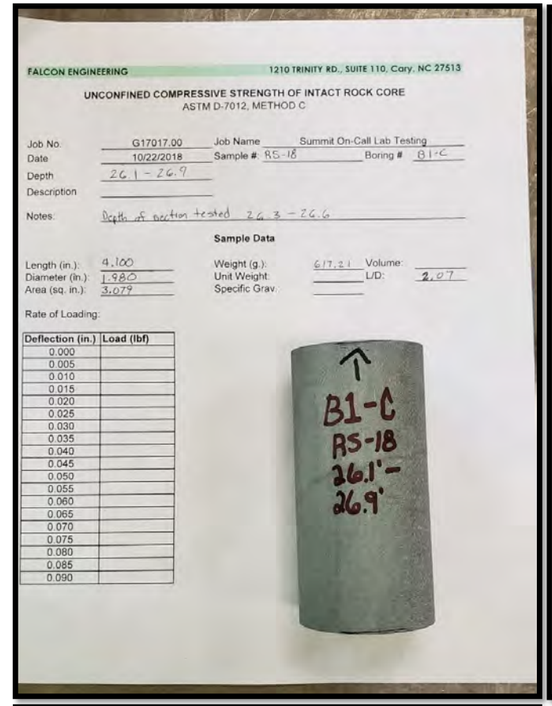
Compressive Strength (psi): 16410
Time to Failure, mins:sec: 4:41

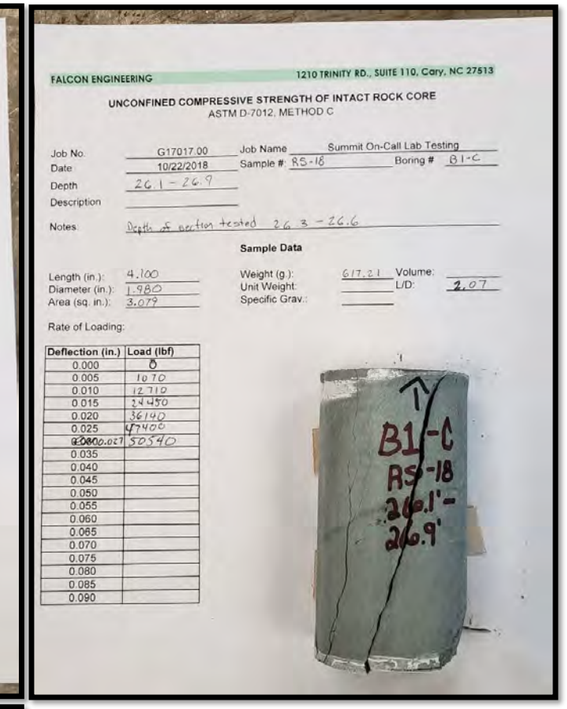
Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.122	1070	350	287,000
0.010	0.244	12710	4130	1,693,300
0.015	0.366	24450	7940	2,170,267
0.020	0.488	36140	11740	2,406,700
0.025	0.610	47400	15390	2,523,960
0.027	0.659	50540	16410	2,491,889
0.035	0.854		0	0
0.040	0.976		0	0
0.045	1.098		0	0
0.050	1.220		0	0
0.055	1.341		0	0
0.060	1.463		0	0
0.065	1.585		0	0
0.070	1.707		0	0
0.075	1.829		0	0

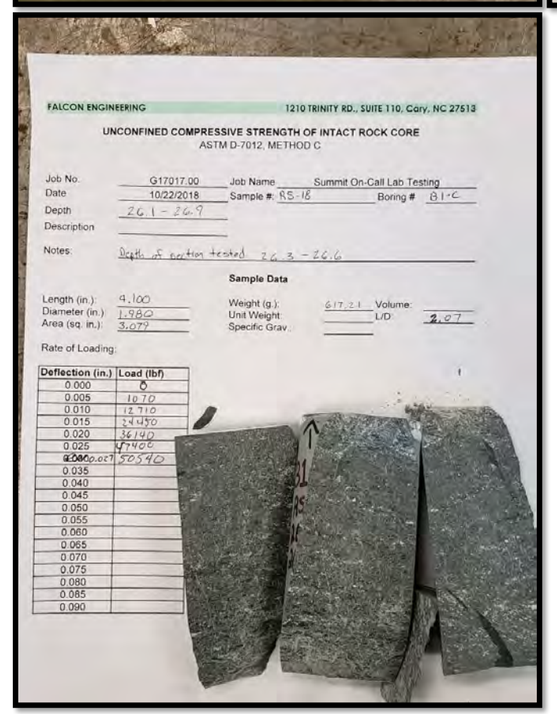


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803







UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

FALCON ENGINEERING

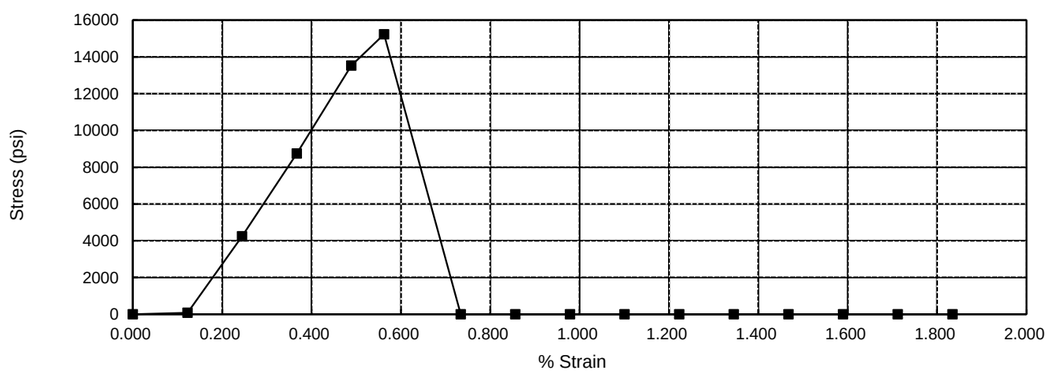
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-19
Location: B1-C
Depth (ft): 31.2 - 32.4

Length (in.): 4.09
Diameter (in.): 1.98
Area (in²): 3.079
L/D 2.07
Unit Weight (pcf): 186.5

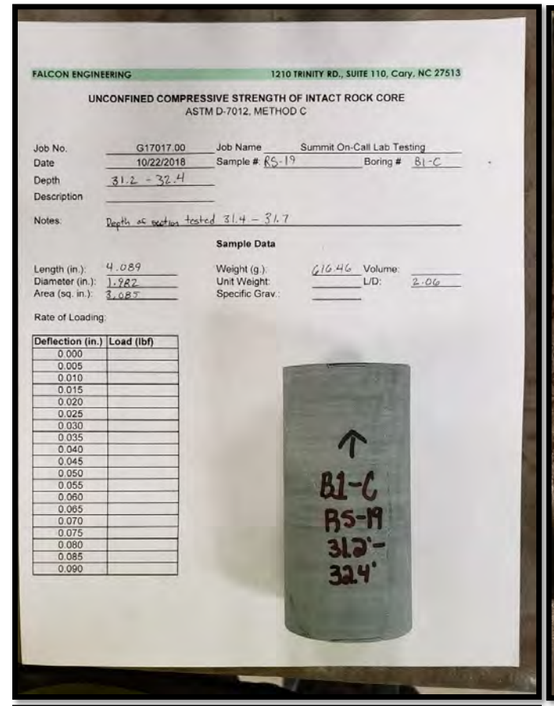
Compressive Strength (psi): 15230
Time to Failure, mins:sec: 4:20

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.122	240	80	65,424
0.010	0.245	13070	4240	1,733,736
0.015	0.367	26910	8740	2,382,524
0.020	0.489	41650	13530	2,766,209
0.023	0.562	46880	15230	2,707,629
0.030	0.734		0	0
0.035	0.856		0	0
0.040	0.978		0	0
0.045	1.101		0	0
0.050	1.223		0	0
0.055	1.345		0	0
0.060	1.467		0	0
0.065	1.590		0	0
0.070	1.712		0	0
0.075	1.834		0	0

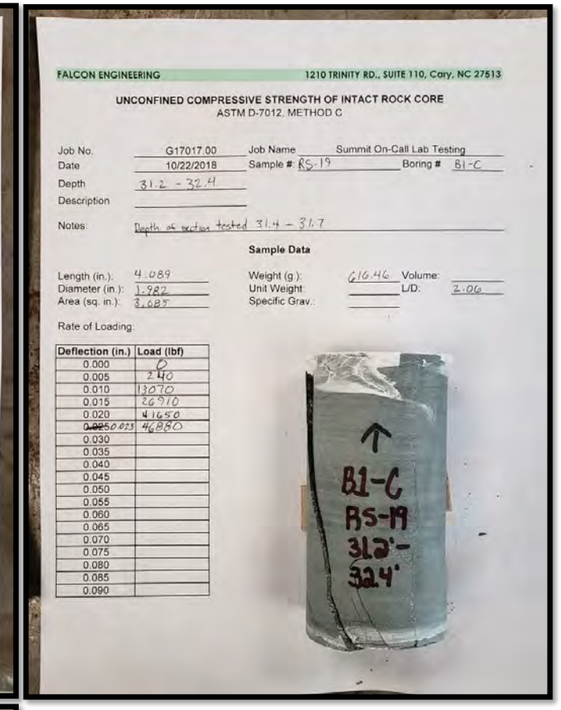


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample # RS-19 Boring # B1-C
Depth 31.2 - 32.4
Description
Notes: Depth of section tested 31.4 – 31.7
Sample Data
Length (in.): 4.089 Weight (g.): 616.46 Volume:
Diameter (in.): 1.982 Unit Weight: L/D: 2.06
Area (sq. in.): 3.085 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	
0.005	
0.010	
0.015	
0.020	
0.025	
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample # RS-19 Boring # B1-C
Depth 31.2 - 32.4
Description
Notes: Depth of section tested 31.4 – 31.7
Sample Data
Length (in.): 4.089 Weight (g.): 616.46 Volume:
Diameter (in.): 1.982 Unit Weight: L/D: 2.06
Area (sq. in.): 3.085 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	240
0.010	13070
0.015	26910
0.020	41650
~~0.025~~ 0.023	46880
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample # RS-19 Boring # B1-C
Depth 31.2 - 32.4
Description
Notes: Depth of section tested 31.4 – 31.7
Sample Data
Length (in.): 4.089 Weight (g.): 616.46 Volume:
Diameter (in.): 1.982 Unit Weight: L/D: 2.06
Area (sq. in.): 3.085 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	240
0.010	13070
0.015	26910
0.020	41650
~~0.025~~ 0.023	46880
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

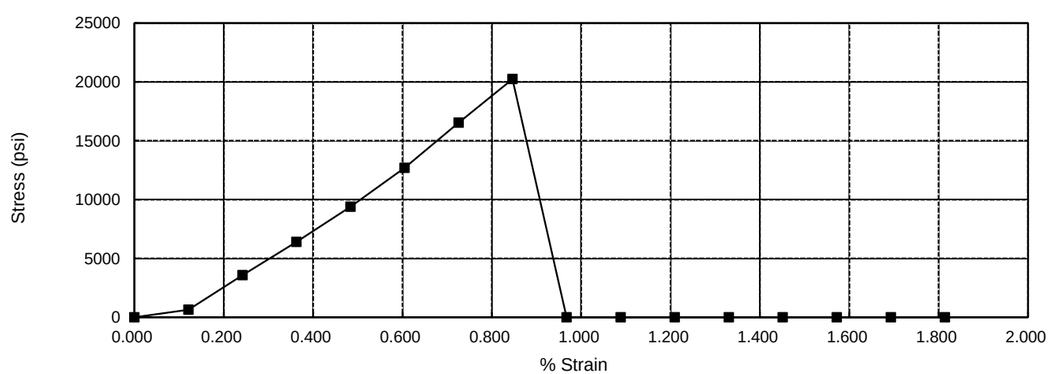
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-11
Location: EB2-A
Depth (ft): 24.5 -25.3

Length (in.): 4.14
Diameter (in.): 1.98
Area (in²): 3.079
L/D 2.09
Unit Weight (pcf): 183.6

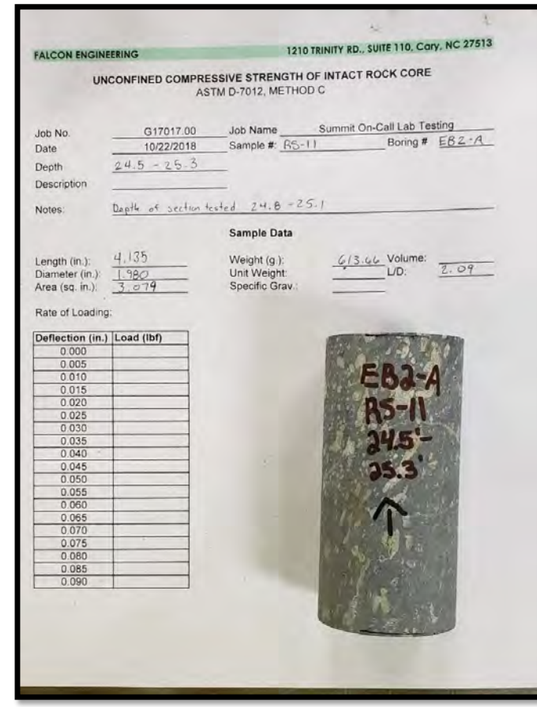
Compressive Strength (psi): 20240
Time to Failure, mins:sec: 5:46

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.121	1970	640	529,280
0.010	0.242	10990	3570	1,476,195
0.015	0.363	19750	6410	1,767,023
0.020	0.484	28900	9390	1,941,383
0.025	0.605	39110	12700	2,100,580
0.030	0.726	50900	16530	2,278,385
0.035	0.846	62320	20240	2,391,211
0.040	0.967		0	0
0.045	1.088		0	0
0.050	1.209		0	0
0.055	1.330		0	0
0.060	1.451		0	0
0.065	1.572		0	0
0.070	1.693		0	0
0.075	1.814		0	0

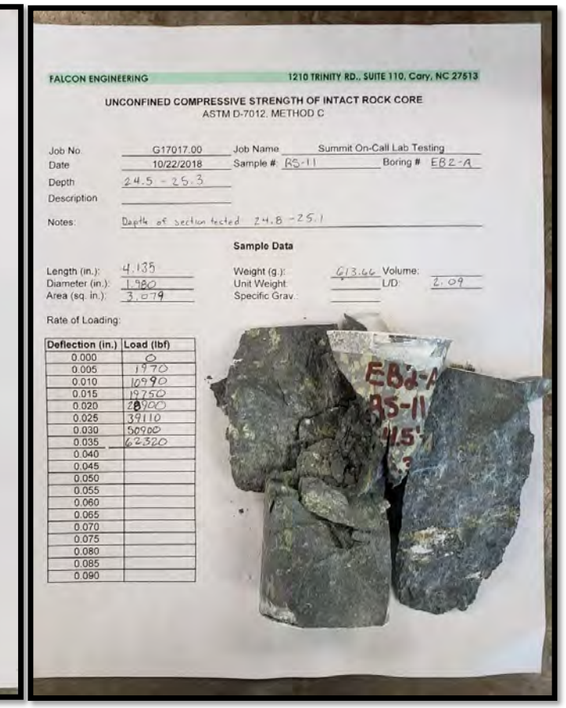


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-11 Boring # EB2-A
Depth 24.5 - 25.3
Description
Notes: Depth of section tested 24.8 - 25.1
Sample Data
Length (in.): 4.135 Weight (g.): 613.66 Volume:
Diameter (in.): 1.980 Unit Weight: L/D: 2.09
Area (sq. in.): 3.079 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	
0.005	
0.010	
0.015	
0.020	
0.025	
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-11 Boring # EB2-A
Depth 24.5 - 25.3
Description
Notes: Depth of section tested 24.8 - 25.1
Sample Data
Length (in.): 4.135 Weight (g.): 613.66 Volume:
Diameter (in.): 1.980 Unit Weight: L/D: 2.09
Area (sq. in.): 3.079 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	1970
0.010	10990
0.015	19750
0.020	28900
0.025	39110
0.030	50900
0.035	62320
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

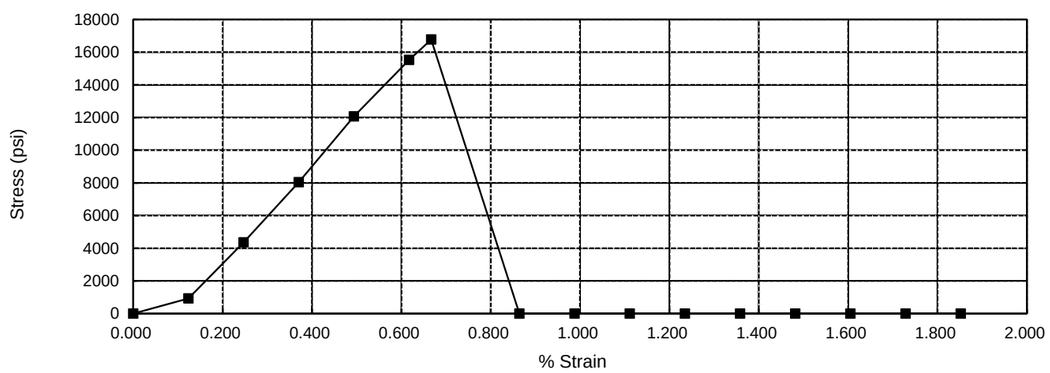
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-5
Location: EB2-B
Depth (ft): 22.4 - 23.4

Length (in.): 4.05
Diameter (in.): 1.98
Area (in²): 3.079
L/D 2.05
Unit Weight (pcf): 183.5

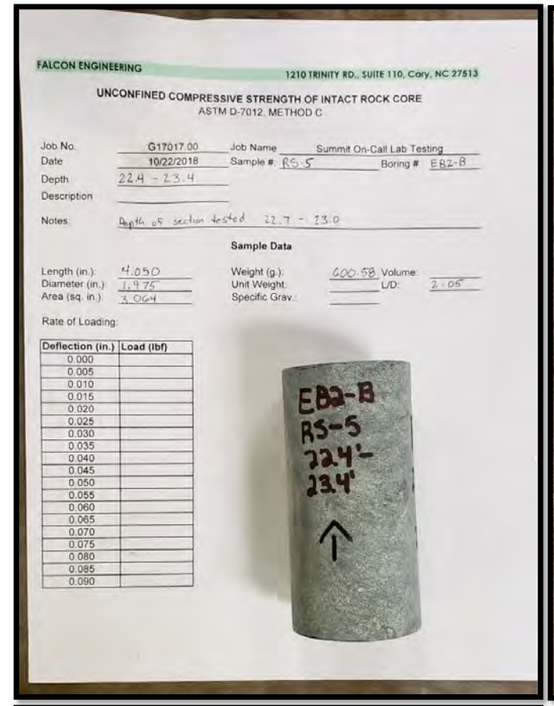
Compressive Strength (psi): 16770
Time to Failure, mins:sec: 4:47

Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.123	2850	930	753,300
0.010	0.247	13430	4360	1,765,800
0.015	0.370	24770	8040	2,170,800
0.020	0.494	37140	12060	2,442,150
0.025	0.617	47800	15520	2,514,240
0.027	0.667	51650	16770	2,515,500
0.035	0.864		0	0
0.040	0.988		0	0
0.045	1.111		0	0
0.050	1.235		0	0
0.055	1.358		0	0
0.060	1.481		0	0
0.065	1.605		0	0
0.070	1.728		0	0
0.075	1.852		0	0

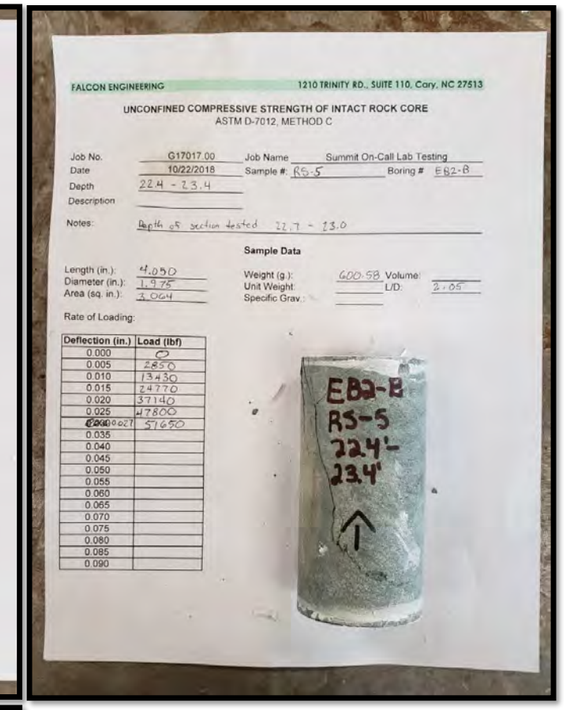


***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

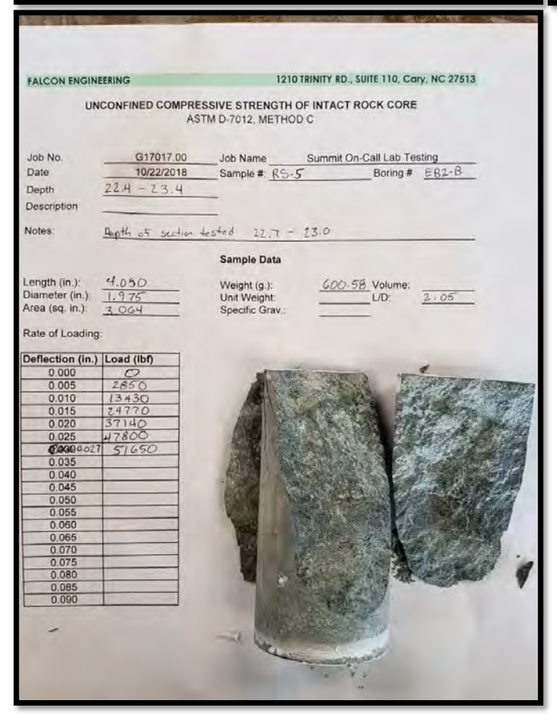
Technician: M. Bauer
NCDOT CERT.# 105-02-0803


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-5 Boring # EB2-B
Depth 22.4 - 23.4
Description
Notes: Depth of section tested 22.7 - 23.0
Sample Data
Length (in.): 4.050 Weight (g.): 600.58 Volume:
Diameter (in.): 1.975 Unit Weight: L/D: 2.05
Area (sq. in.): 3.064 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	
0.005	
0.010	
0.015	
0.020	
0.025	
0.030	
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	


FALCON ENGINEERING 1210 TRINITY RD., SUITE 110, Cary, NC 27513
UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-5 Boring # EB2-B
Depth 22.4 - 23.4
Description
Notes: Depth of section tested 22.7 - 23.0
Sample Data
Length (in.): 4.050 Weight (g.): 600.58 Volume:
Diameter (in.): 1.975 Unit Weight: L/D: 2.05
Area (sq. in.): 3.064 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	2850
0.010	13430
0.015	24770
0.020	37140
0.025	47800
0.027	51650
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	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UNCONFINED COMPRESSIVE STRENGTH OF INTACT ROCK CORE
ASTM D-7012, METHOD C
Job No. G17017.00 Job Name Summit On-Call Lab Testing
Date 10/22/2018 Sample #: RS-5 Boring # EB2-B
Depth 22.4 - 23.4
Description
Notes: Depth of section tested 22.7 - 23.0
Sample Data
Length (in.): 4.050 Weight (g.): 600.58 Volume:
Diameter (in.): 1.975 Unit Weight: L/D: 2.05
Area (sq. in.): 3.064 Specific Grav.:
Rate of Loading:

Deflection (in.)	Load (lbf)
0.000	0
0.005	2850
0.010	13430
0.015	24770
0.020	37140
0.025	47800
0.027	51650
0.035	
0.040	
0.045	
0.050	
0.055	
0.060	
0.065	
0.070	
0.075	
0.080	
0.085	
0.090	

UNIAXIAL COMPRESSIVE STRENGTH OF INTACT ROCK CORE SPECIMENS

Performed in General Accordance with ASTM D7012

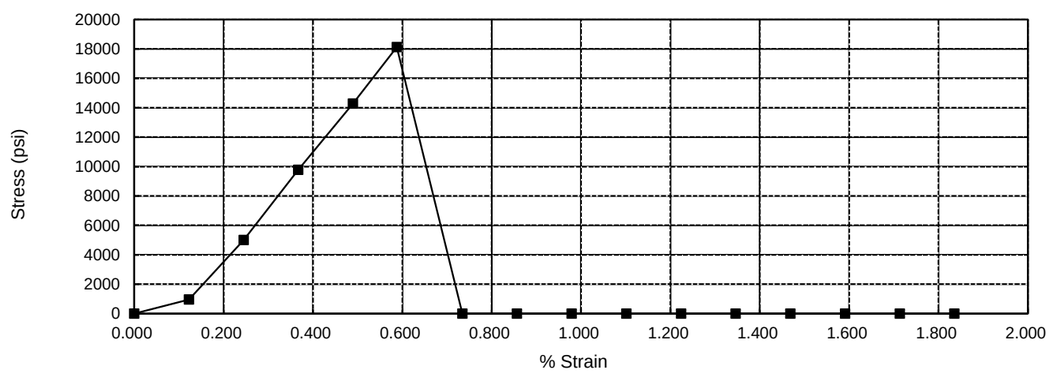
October 24, 2018

Project Name: Bridge Over Watauga River on NC 105
Project Number: 37512.1.4 (R-2566BA)
Sample ID: RS-8
Location: EB2-C
Depth (ft): 20.2 - 21.6

Length (in.): 4.09
Diameter (in.): 1.98
Area (in²): 3.079
L/D 2.06
Unit Weight (pcf): 186.1

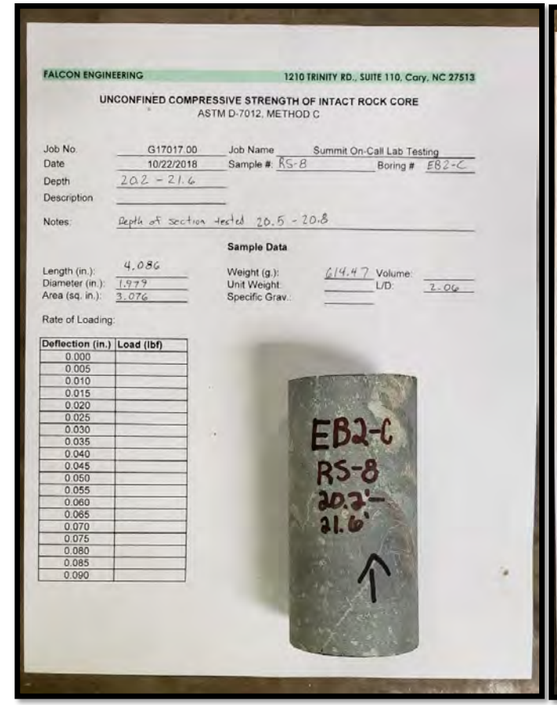
Compressive Strength (psi): 18120
Time to Failure, mins:sec: 5:10

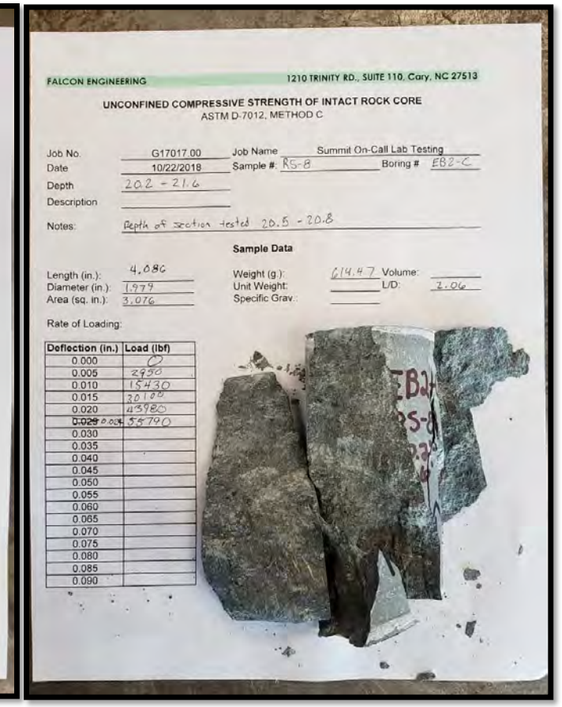
Deflection (in.)	Strain (%)	Load (lbf)	Compressive Strength (psi)	Young's Modulus (psi)
0.000	0.000	0	0	-----
0.005	0.122	2950	960	784,512
0.010	0.245	15430	5010	2,047,086
0.015	0.367	30100	9780	2,664,072
0.020	0.489	43980	14280	2,917,404
0.024	0.587	55790	18120	3,084,930
0.030	0.734		0	0
0.035	0.857		0	0
0.040	0.979		0	0
0.045	1.101		0	0
0.050	1.224		0	0
0.055	1.346		0	0
0.060	1.468		0	0
0.065	1.591		0	0
0.070	1.713		0	0
0.075	1.836		0	0



***Note** : "Uniaxial compressive strength was determined in general accordance with ASTM D7012-14 Method C. Deflection, Strain, and Young's modulus data is provided for reference only and is not intended to be in accordance with ASTM D7012-14 Method D as deflection and strain is not measured in accordance with that procedure. Young's Modulus is calculated using this data to determine the secant modulus at each data interval per Figure 2 (C) in ASTM D 7012-14."*

Technician: M. Bauer
NCDOT CERT.# 105-02-0803





SITE PHOTOGRAPHS
R-2566BA, BRIDGE NO. 5, WATAUGA COUNTY

View along existing NC 105, facing North

View along existing NC 105, facing South

REFERENCE: R-2566BA

PROJECT: 37512

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2566BA	1	10

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

STRUCTURE SUBSURFACE INVESTIGATION

COUNTY WATAUGA

PROJECT DESCRIPTION NC 105 - CONSTRUCT NEW BRIDGE OVER WATAUGA RIVER AND LEFT-TURN AT SR 1112 WITHIN LIMITS OF R-2566B

SITE DESCRIPTION WALL ALONG -Y5-

CONTENTS

SHEET NO.	DESCRIPTION
1	TITLE SHEET
2	LEGEND (SOIL & ROCK)
3	SITE PLAN
4-5	PROFILES
6-10	CROSS SECTIONS

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.

GENERAL SOIL AND ROCK STRATA DESCRIPTIONS AND INDICATED BOUNDARIES ARE BASED ON A GEOTECHNICAL INTERPRETATION OF ALL AVAILABLE SUBSURFACE DATA AND MAY NOT NECESSARILY REFLECT THE ACTUAL SUBSURFACE CONDITIONS BETWEEN BORINGS OR BETWEEN SAMPLED STRATA WITHIN THE BOREHOLE. THE LABORATORY SAMPLE DATA AND THE IN SITU (IN-PLACE) TEST DATA CAN BE RELIED ON ONLY TO THE DEGREE OF RELIABILITY INHERENT IN THE STANDARD TEST METHOD. THE OBSERVED WATER LEVELS OR SOIL MOISTURE CONDITIONS INDICATED IN THE SUBSURFACE INVESTIGATIONS ARE AS RECORDED AT THE TIME OF THE INVESTIGATION. THESE WATER LEVELS OR SOIL MOISTURE CONDITIONS MAY VARY CONSIDERABLY WITH TIME ACCORDING TO CLIMATIC CONDITIONS INCLUDING TEMPERATURES, PRECIPITATION AND WIND, AS WELL AS OTHER NON-CLIMATIC FACTORS.

THE BIDDER OR CONTRACTOR IS CAUTIONED THAT DETAILS SHOWN ON THE SUBSURFACE PLANS ARE PRELIMINARY ONLY AND IN MANY CASES THE FINAL DESIGN DETAILS ARE DIFFERENT. FOR BIDDING AND CONSTRUCTION PURPOSES, REFER TO THE CONSTRUCTION PLANS AND DOCUMENTS FOR FINAL DESIGN INFORMATION ON THIS PROJECT. THE DEPARTMENT DOES NOT WARRANT OR GUARANTEE THE SUFFICIENCY OR ACCURACY OF THE INVESTIGATION MADE, NOR THE INTERPRETATIONS MADE, OR OPINION OF THE DEPARTMENT AS TO THE TYPE OF MATERIALS AND CONDITIONS TO BE ENCOUNTERED. THE BIDDER OR CONTRACTOR IS CAUTIONED TO MAKE SUCH INDEPENDENT SUBSURFACE INVESTIGATIONS AS HE DEEMS NECESSARY TO SATISFY HIMSELF AS TO CONDITIONS TO BE ENCOUNTERED ON THE PROJECT. THE CONTRACTOR SHALL HAVE NO CLAIM FOR ADDITIONAL COMPENSATION OR FOR AN EXTENSION OF TIME FOR ANY REASON RESULTING FROM THE ACTUAL CONDITIONS ENCOUNTERED AT THE SITE DIFFERING FROM THOSE INDICATED IN THE SUBSURFACE INFORMATION.

NOTES:
1. THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS ACCURATE NOR IS IT CONSIDERED PART OF THE PLANS, SPECIFICATIONS OR CONTRACT FOR THE PROJECT.
2. BY HAVING REQUESTED THIS INFORMATION, THE CONTRACTOR SPECIFICALLY WAIVES ANY CLAIMS FOR INCREASED COMPENSATION OR EXTENSION OF TIME BASED ON DIFFERENCES BETWEEN THE CONDITIONS INDICATED HEREIN AND THE ACTUAL CONDITIONS AT THE PROJECT SITE.

PERSONNEL

DC CHEEK

CJ COFFEY

CD JOHNSON

DC ELLIOTT

INVESTIGATED BY DC ELLIOTT

DRAWN BY DC ELLIOTT

CHECKED BY JC KUHNE

SUBMITTED BY JC KUHNE

DATE

DS

NORTH CAROLINA LICENSED SEAL 2376 GEOLOGIST D CLAYTON ELLIOTT

DocuSigned by:
D. Clayton Elliott 6/19/2018
FD421F60CB0E40E...
SIGNATURE DATE

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

PROJECT REFERENCE NO.	SHEET NO.
R-2566BA	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	50 MX											GRANULAR SOILS	SILT-CLAY SOILS	MUCK, PEAT
#40	30 MX	50 MX	51 MN											
#200	15 MX	25 MX	10 MX	35 MX	35 MX	35 MX	35 MX	36 MN	36 MN	36 MN	36 MN			
MATERIAL PASSING #40 LL	—		—	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	40 MX	41 MN	SOILS WITH LITTLE OR MODERATE AMOUNTS OF ORGANIC MATTER		HIGHLY ORGANIC SOILS
PI	6 MX		NP	10 MX	10 MX	11 MN	11 MN	10 MX	10 MX	11 MN	11 MN			
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
GRAIN SIZE 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) PL — PLASTIC LIMIT	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
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
- [x] CME-55
- [ ] CME-550
- [ ] VANE SHEAR TEST
- [ ] PORTABLE HOIST
- [ ] _____
- [ ] _____

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

HAMMER TYPE:
- [x] AUTOMATIC
- [ ] MANUAL

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

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: N/A FEET

NOTES:

FIAD - FILLED IMMEDIATELY AFTER DRILLING
TOP OF BORING & SOUNDING ELEVATIONS OBTAINED FROM CROSS SECTIONS.

DATE: 8-15-14

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R-2566BA	3

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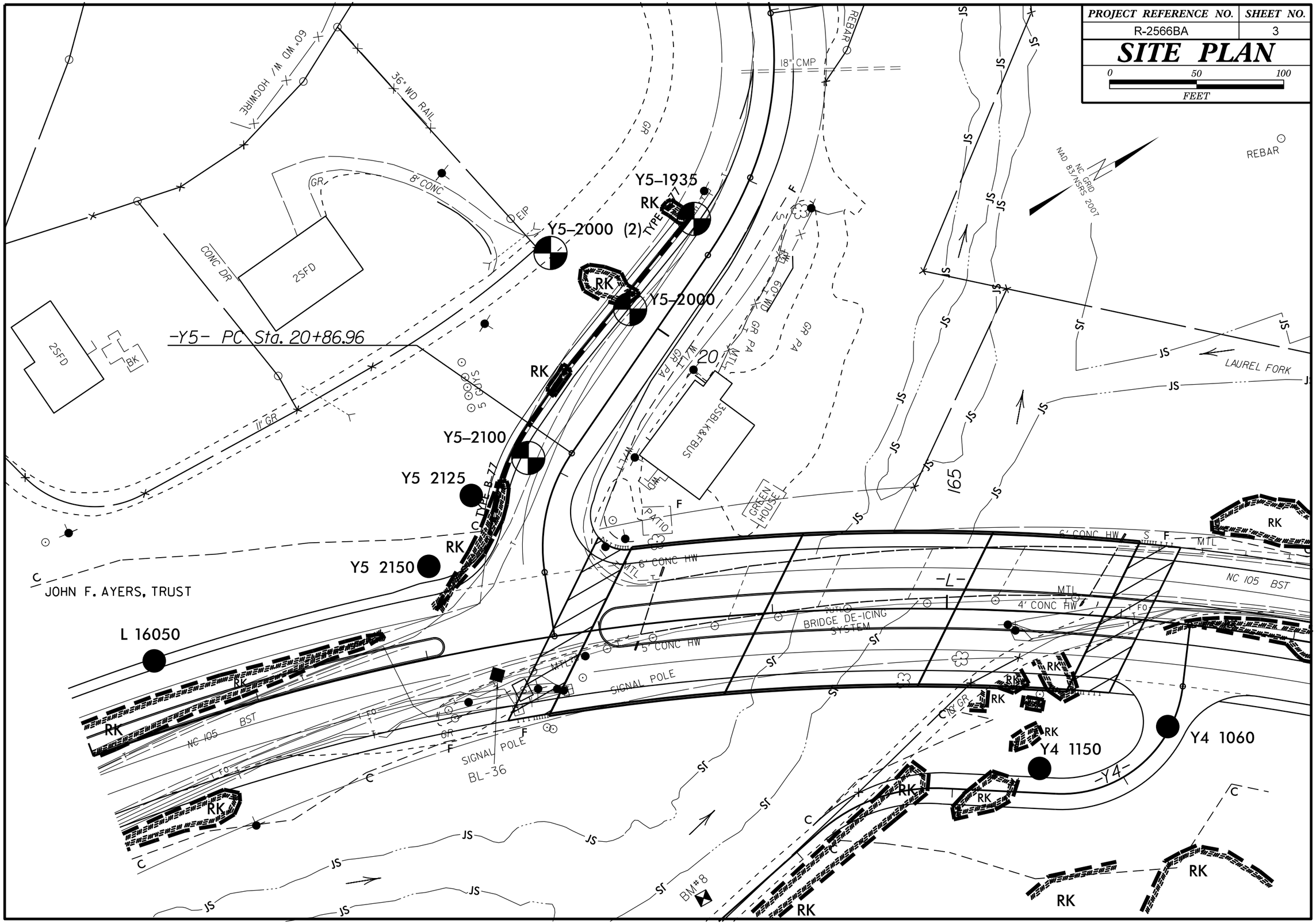
FEET



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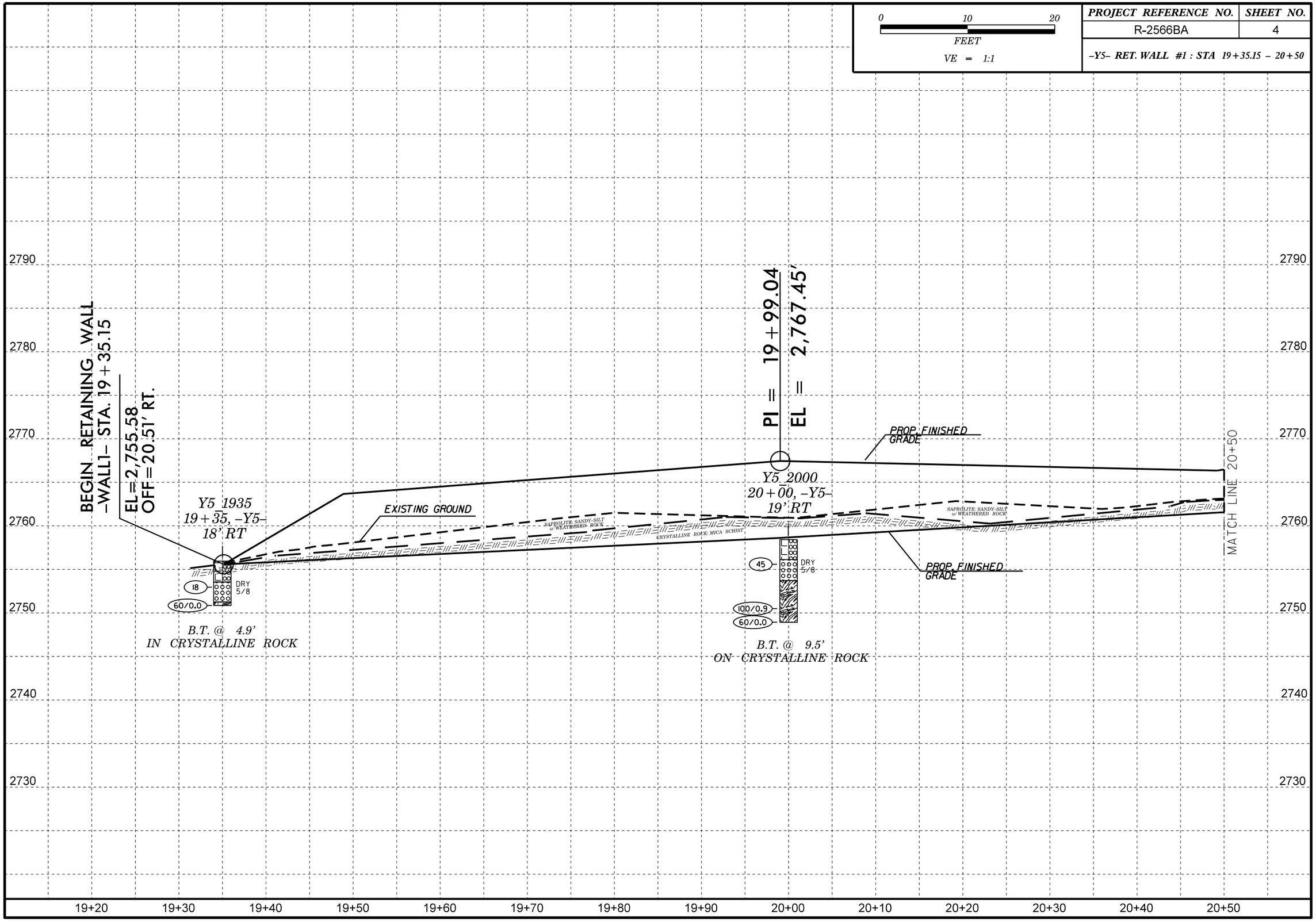

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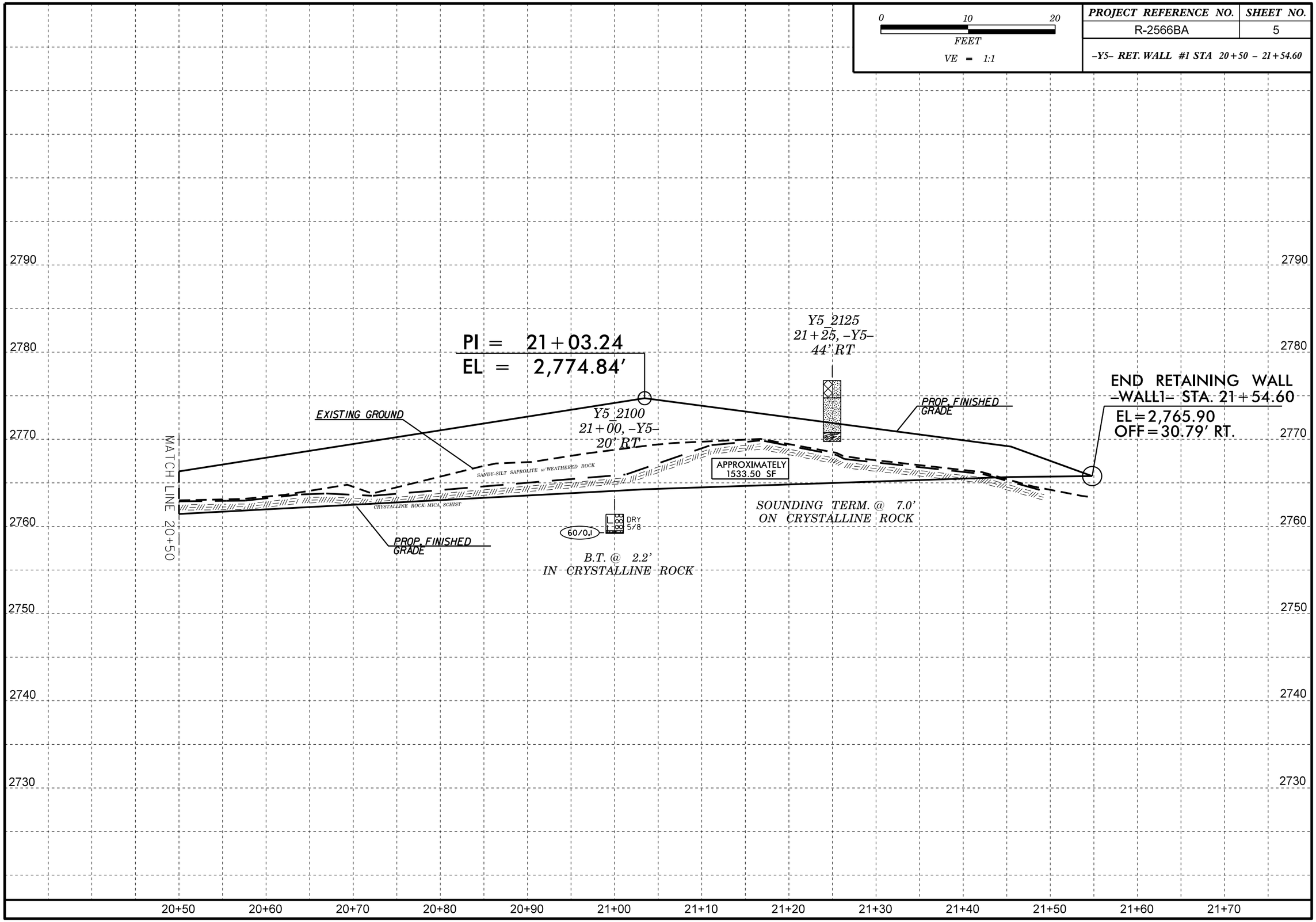

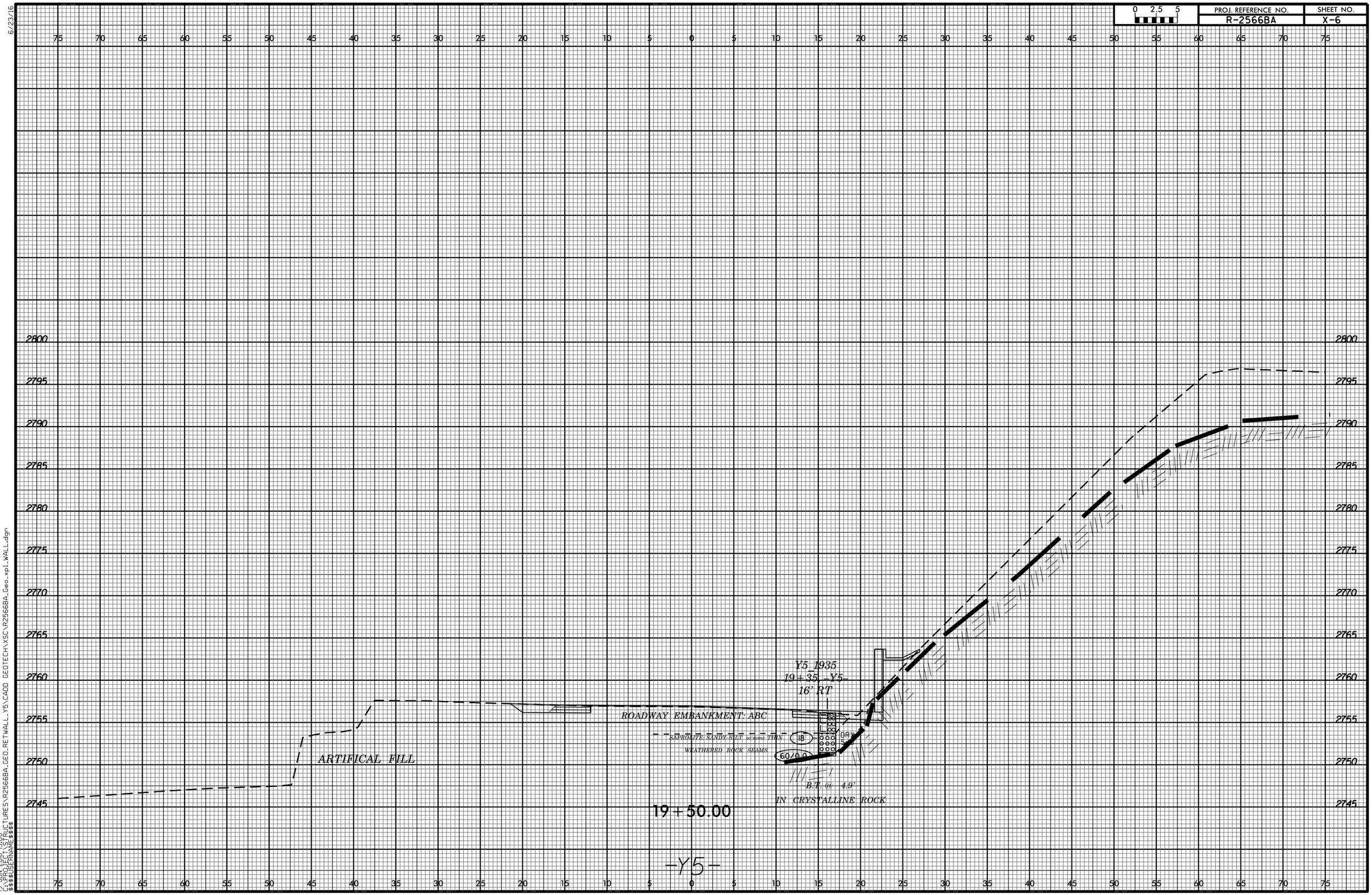

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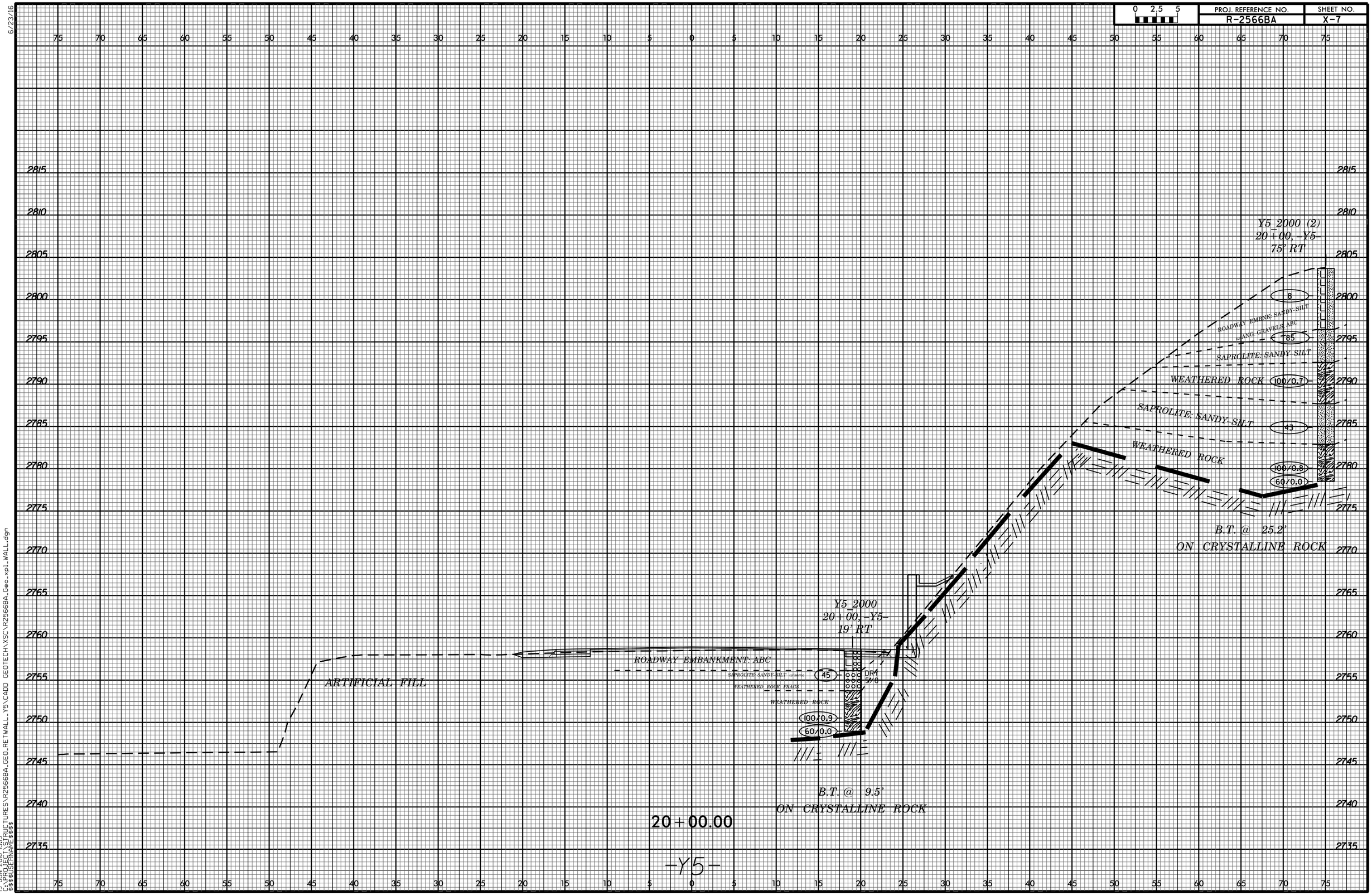

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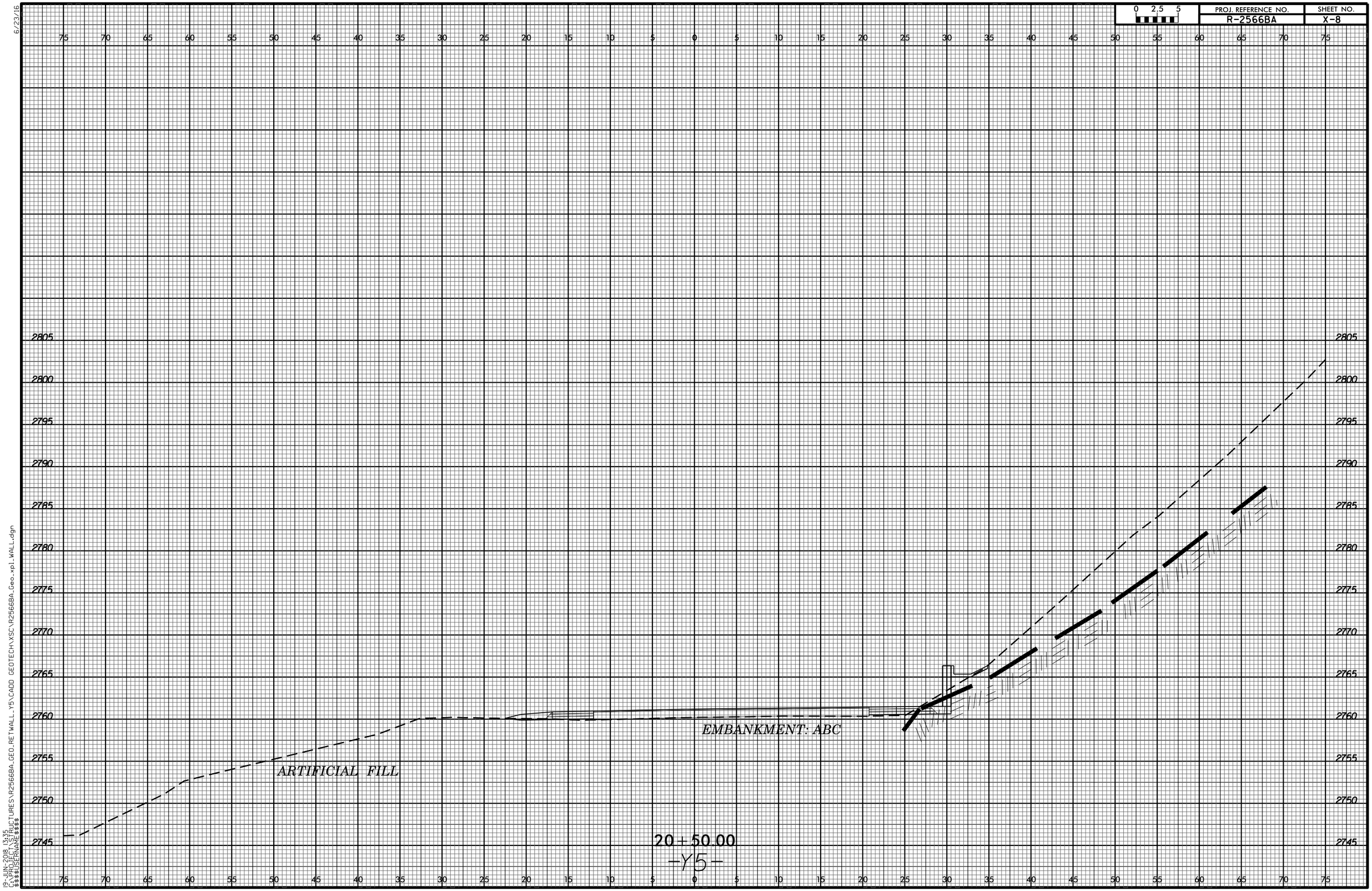

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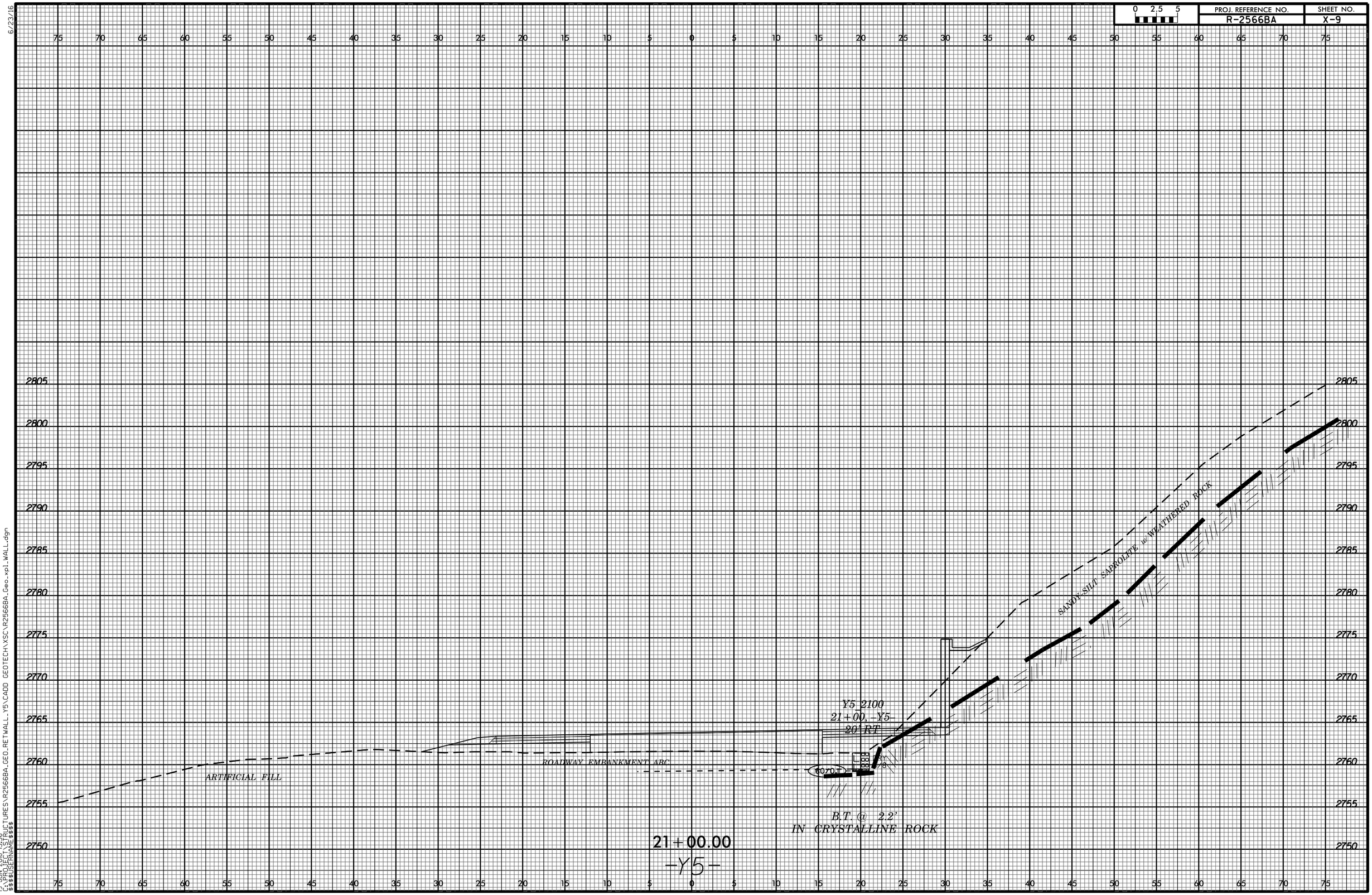

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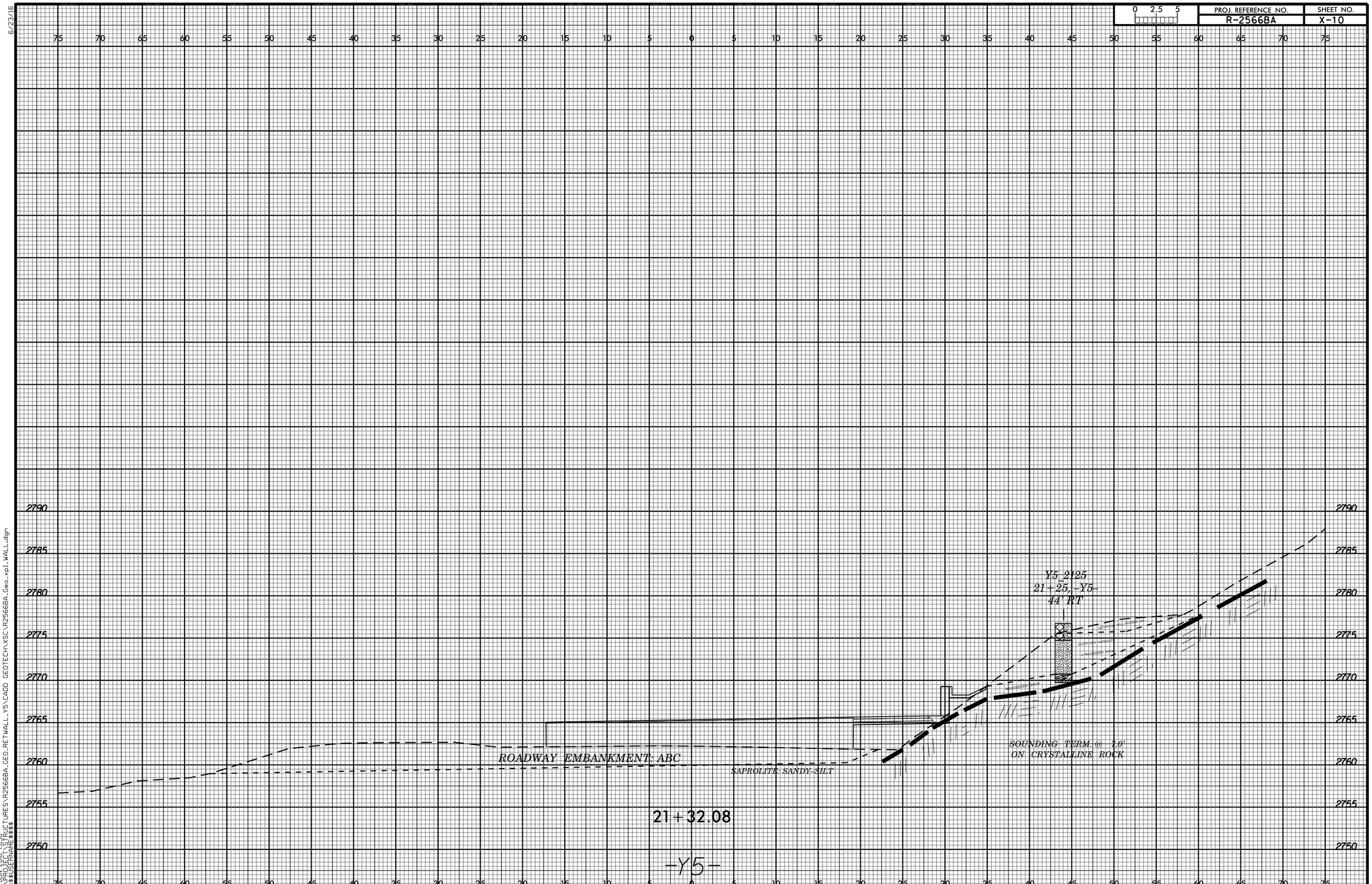

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