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REFERENCE: I-4400BB

PROJECT: 34232

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

ROADWAY SUBSURFACE INVESTIGATION

COUNTY *HENDERSON*

PROJECT DESCRIPTION *I-26 FROM US 64 (EXIT 49) TO US 25 BUSINESS (EXIT 44)*

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-4400BB	1	151

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	2

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
DIVISION OF HIGHWAYS
GEOTECHNICAL ENGINEERING UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION

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

SOIL LEGEND AND AASHTO CLASSIFICATION

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

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

CONSISTENCY OR DENSENESS

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

TEXTURE OR GRAIN SIZE

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

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

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

SOIL MOISTURE - CORRELATION OF TERMS

SOIL MOISTURE SCALE (ATTERBERG LIMITS)	FIELD MOISTURE DESCRIPTION	GUIDE FOR FIELD MOISTURE DESCRIPTION
	- SATURATED - (SAT.)	USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE
LL — LIQUID LIMIT		
PLASTIC RANGE (PI)	- WET - (W)	SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE
PL — PLASTIC LIMIT		
OM — OPTIMUM MOISTURE	- 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
- [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 _____
- [X] -N 03

HAND TOOLS:
- [ ] POST HOLE DIGGER
- [X] HAND AUGER
- [X] 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:

⊕ =HAND AUGER BORING WITH SOUNDING ROD
SRT= SOUNDING ROD TERMINATED
FIAD= FILLED IMMEDIATELY AFTER DRILLING
BORING ELEVATIONS OBTAINED FROM .TIN FILE RECEIVED FROM HNTB ON 6/20/2017

DATE: 8-15-14

PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	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

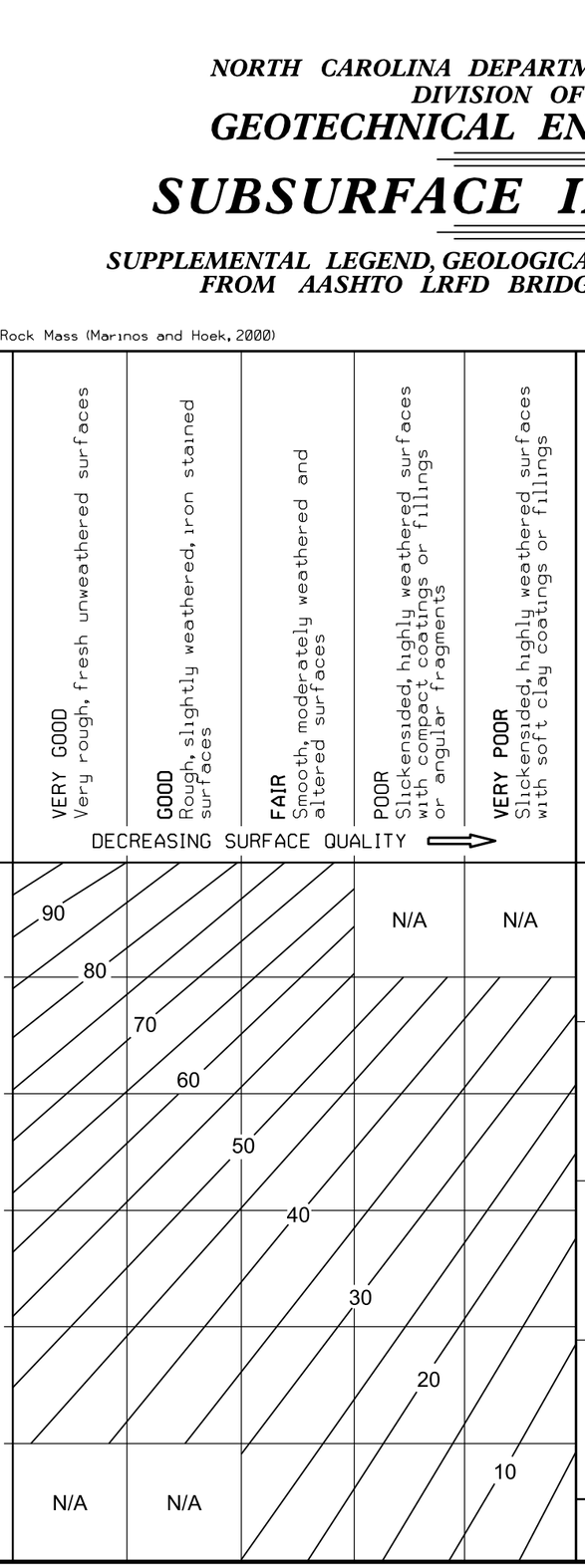
AASHTO LRFD Figure 10.4.6.4-1 — Determination of GSI for Jointed Rock Mass (Marinos and Hoek, 2000)

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

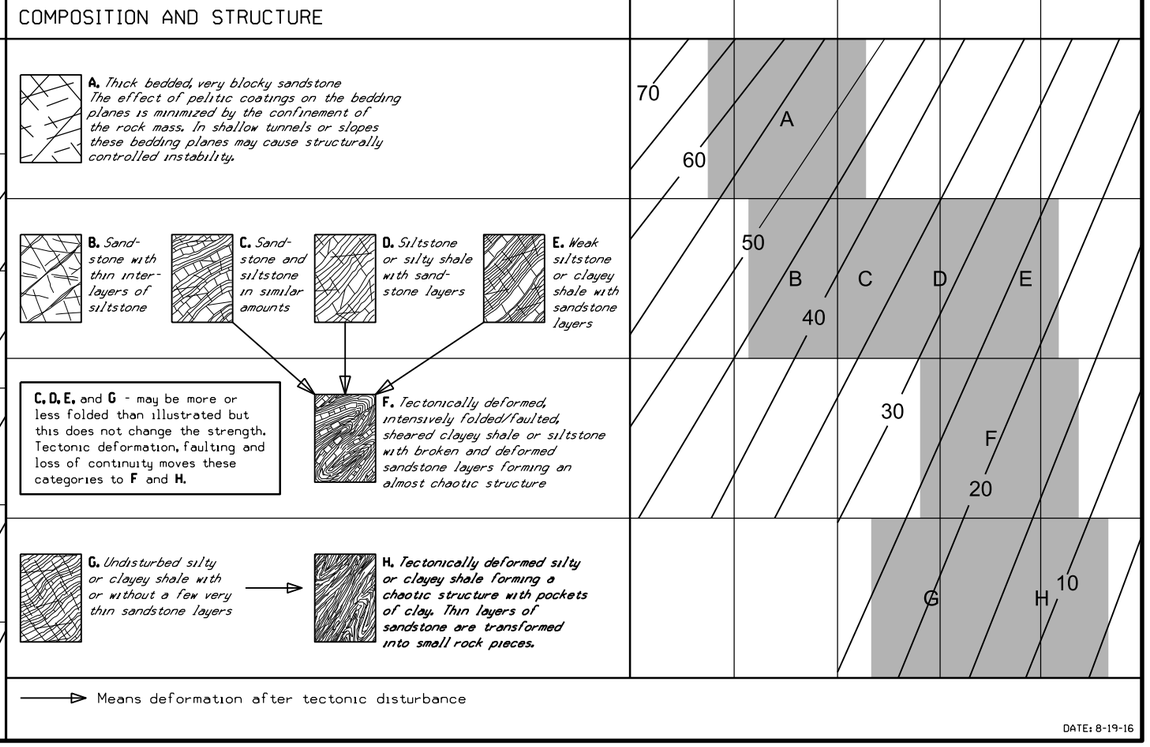


AASHTO LRFD Figure 10.4.6.4-2 — Determination of GSI for Tectonically Deformed Heterogeneous Rock Masses (Marinos and Hoek, 2000)

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



A. *Thick bedded, very blocky sandstone The effect of pelitic coatings on the bedding planes is minimized by the confinement of the rock mass. In shallow tunnels or slopes these bedding planes may cause structurally controlled instability.*

B. *Sandstone with thin interlayers of siltstone*

C. *Sandstone and siltstone in similar amounts*

D. *Siltstone or silty shale with sandstone layers*

E. *Weak siltstone or clayey shale with sandstone layers*

C, D, E, and **G** - may be more or less folded than illustrated but this does not change the strength. Tectonic deformation, faulting and loss of continuity moves these categories to **F** and **H.**

F. *Tectonically deformed, intensively folded/faulted, sheared clayey shale or siltstone with broken and deformed sandstone layers forming an almost chaotic structure*

G. *Undisturbed silty or clayey shale with or without a few very thin sandstone layers*

H. ***Tectonically deformed silty or clayey shale forming a chaotic structure with pockets of clay. Thin layers of sandstone are transformed into small rock pieces.***

→ Means deformation after tectonic disturbance

DATE: 8-19-16

7/24/2017

TIP PROJECT: I-4400BB

CONTRACT:

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

HENDERSON COUNTY

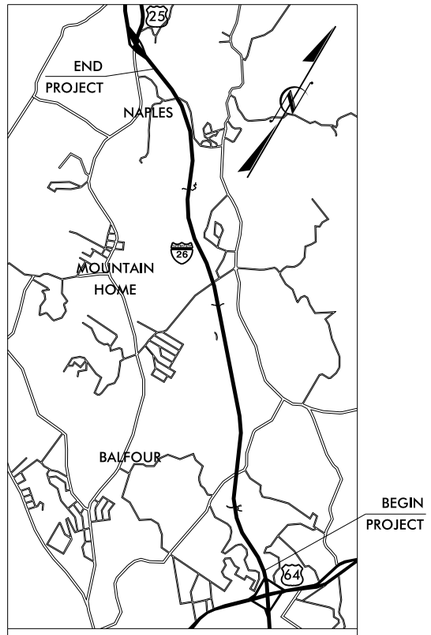
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	I-4400BB	3	151

STATE PROJ. NO.	F. A. PROJ. NO.	DESCRIPTION
34232.1.6	NHP-0026(015)	I-4400BB (P.E.)
34232.2.10	NHP-0026(015)	I-4400BB (R/W/UTIL)
34232.3.8	NHP-0026(015)	I-4400BB (CONST.)

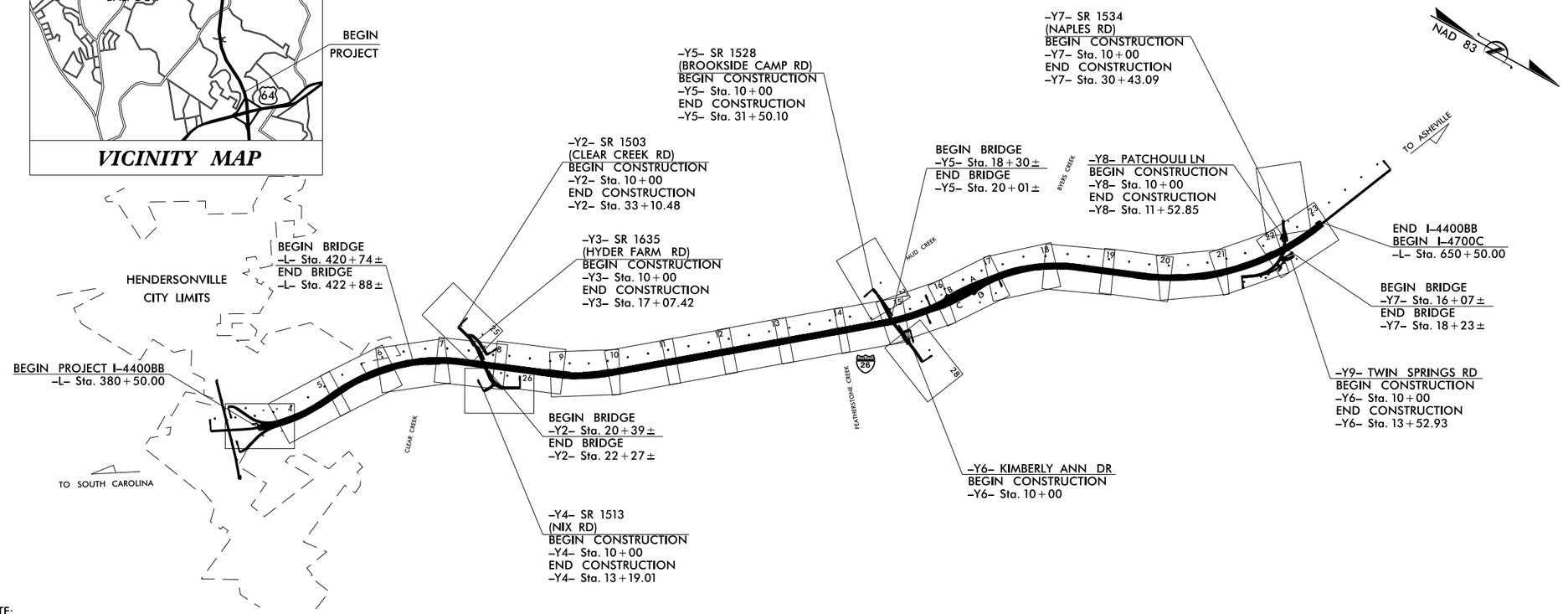
25% PRELIMINARY PLANS

LOCATION: I-26 FROM 0.05MI NORTH OF US 64
TO 0.5MI SOUTH OF US 25 (ASHEVILLE HIGHWAY)

TYPE OF WORK: GRADING, PAVING, DRAINAGE, RESURFACING, AND STRUCTURES



VICINITY MAP

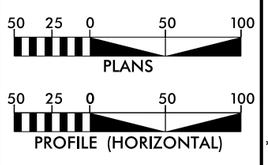


NOTE:
1. CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD II.
2. THIS PROJECT IS PARTIALLY WITHIN THE MUNICIPAL BOUNDARIES OF THE CITY OF HENDERSONVILLE.
3. THIS IS A CONTROLLED-ACCESS PROJECT WITH ACCESS BEING LIMITED TO INTERCHANGES.

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES



DESIGN DATA

ADT 2019 = 84,200
ADT 2039 = 116,400
K = 10%
D = 55%
T = 10% *
V = 70 MPH
* TTST = 4% DUAL 6%

FUNC CLASS = INTERSTATE
STATEWIDE TIER

PROJECT LENGTH

TOTAL LENGTH OF ROADWAY TIP PROJECT
I-4400BB = 5.073 MI

TOTAL LENGTH OF STRUCTURES OF TIP PROJECT
I-4400BB = 0.041 MI

TOTAL LENGTH OF TIP PROJECT
I-4400BB = 5.114 MI

NOTE: LENGTHS WERE CALCULATED USING THE WBL ALIGNMENT

Prepared in the Office of:
HNTB
HNTB NORTH CAROLINA, P.C.
343 E. Six Forks Road, Suite 200
Raleigh, North Carolina 27609
NC License No: C-1554

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE:
November, 2018

LETTING DATE:
June 2019

JOSEPH OLSON, P.E.
PROJECT ENGINEER

JEFF HESS, P.E.
PROJECT DESIGN ENGINEER

WANDA AUSTIN, P.E.
NCDOT CONTACT

HYDRAULICS ENGINEER

P.E.
SIGNATURE:

ROADWAY DESIGN ENGINEER

P.E.
SIGNATURE:

STATE OF NORTH CAROLINA • DEPARTMENT OF TRANSPORTATION •

7/24/2017
I4400C_RDY_TSH.dgn
3:11 PM

FROEHLING & ROBERTSON, INC.

Engineering Stability Since 1881

310 Hubert Street
Raleigh, North Carolina 27603-2302 I USA
T 919.828.3441 I F 919.828.5751
NC Engineering License # F-0266

June 27, 2019

State Project No.: 34232.1.3
TIP No.: I-4400BB
Project ID: 30850
County: Henderson
Description: I-26 from US 64 (Exit 49) to US 25 Business (Exit 44)

SUBJECT: Geotechnical Report – Inventory

Project Description

This project primarily involves the widening of approximately 5 miles of existing I-26 (-L-) in Asheville and Hendersonville, Henderson County, North Carolina. The majority of the widening generally remains within existing right-of-way along I-26. The existing roadway consists of two eastbound and two westbound lanes separated by a grass median, and there are no major interchanges in this section.

As shown on plan sheets initially received on 9/18/17, the project consisted of: widening I-26 (-L-) from approximately 1,100 feet south of the intersection of I-26 with US 64 (Exit 49) and ending approximately 700 feet north of the intersection of I-26 with US 25 Business; proposed retaining walls along -L- and Ramp B at US 64; and proposed bridge realignment and replacements at Clear Creek, Clear Creek Road, Brookside Camp Road, and Naples Road.

Based on revised plans received on 9/24/18, the project begins approximately 750 feet north of the intersection of I-26 with US 64 (Exit 49) and ends approximately 1,000 feet south of the intersection of I-26 with Naples Road (-Y7-). The revised plans exhibit slight alignment shifts along -L-; the addition, removal, and changes in lengths of proposed retaining walls; and -Y- line designation changes and realignments.

The typical proposed section for the project will include four eastbound and four westbound lanes separated by a concrete barrier. More-specifically, the typical section will incorporate 12-foot lanes, 4-foot outside shoulders, and 12-foot inside shoulders. The mainline of the proposed widening of I-26 will cross over Clear Creek, and under Clear Creek Road (-Y2-), Brookside Camp Road (-Y5-), and Naples Road (-Y7-). In addition, several bridges, culverts, and retaining walls are proposed, although the specifics of such structures were unknown at the time of this investigation, and all of which were not fully investigated at that time. Additional structures are also located along the project limits but were not investigated as part of our scope. The locations shown below represent areas where additional subsurface investigation was performed in anticipation of the listed structures:

Bridge on -Y2- over -L-;
Bridge on -Y5- over -L-;
Bridge on -Y7- over -L-;

Retaining wall along -Y1RPB- (part of original alignment but is now outside of project limits);
Retaining wall from approximate -L- station 405+40 to 414+40, left;
Retaining wall from approximate -L- station 440+30 to 449+85, left;
Retaining wall from approximate -L- station 456+30 to 472+80, left;
Retaining wall from approximate -L- station 615+25 to 625+30, right;
Retaining wall from approximate -L- station 634+25 to 638+30, left;

Culvert at approximate -L- station 495+00;
Culvert at approximate -L- station 526+00;
Culvert at approximate -L- station 588+18;
60” CMP at approximate -L- station 611+00.

The boring locations were selected by NCDOT based on the plans dated 9/8/17, and the geotechnical field investigation was performed between December 2017 and March 2018. During this time period, a total of 166 Standard Penetration Test (SPT) borings were advanced with ATV- and track-mounted CME-55 drill rigs with automatic hammers. In addition, 4 hand auger borings with sounding rods were completed due to restrictive drill rig access. However, it was determined upon receipt of plans dated 9/24/18 that borings B-1 through B-9 and B-162 through B-165 were drilled outside of the revised project limits and the results of these borings are not discussed in this report. Representative soil samples were collected from the split spoon or hand auger cuttings for visual classification in the field and for analysis by F&R’s testing laboratory.

Generally the following alignments were investigated, although a majority of the borings were for the purpose of investigating anticipated structures listed above. The limits of the listed alignments were determined by the attached plan sheets:

Alignment	Station (±)
-L-	439+89 to 648+08
-Y1RPA-	17+00 to 17+50
-Y1RPD-	16+00 to 16+50
-Y2-	21+55 to 23+28
-Y5-	18+03 to 20+29
-Y7-	15+24 to 16+71

Areas of Special Geotechnical Interest

1) Crystalline Rock: The following areas were found to contain crystalline rock above or within six feet of the proposed grade and will likely require ripping or blasting for removal:

Alignment	Station (±)
-L-	408+75 to 409+25, left
-L-	412+00 to 412+75, left
-L-	413+00 to 414+75, left
-L-	467+00 to 469+00, left
-L-	472+00 to 472+75, left
-L-	488+75 to 490+75, left
-L-	504+25 to 510+25, right
-L-	517+75 to 522+25, right
-L-	531+25 to 538+25, left
-L-	581+00 to 583+25, right
-L-	620+00 to 621+00, right
-Y1RPA-	16+75 to 17+25, right

2) Weathered Rock: The following areas were found to contain weathered rock above or within six feet of the proposed grade and have a potential to require ripping or blasting for removal:

Alignment	Station (±)
-L-	410+00 to 410+50, left
-L-	412+50 to 413+00, left
-L-	413+50 to 414+75, left
-L-	439+25 to 439+75, left
-L-	440+00 to 440+50, left
-L-	466+50 to 468+00, left
-L-	468+50 to 470+00, left
-L-	472+00 to 472+75, left
-L-	517+25 to 522+75, right
-L-	531+25 to 538+25, left
-L-	580+75 to 583+25, right
-L-	600+50 to 601+60, right
-L-	620+50 to 621+00, right
-L-	621+50 to 622+00, right
-L-	625+00 to 625+50, right
-Y1RPA-	16+75 to 17+75, right

3) Soft, Loose and/or Wet Soils: The following areas contain relatively soft or loose (clay N≤5, sand N≤7) and/or wet, near-surface soils that have the potential to cause subgrade problems during construction:

Alignment	Station (±)
-L-	405+25 to 406+75, left
-L-	440+50 to 441+00
-L-	460+50 to 462+50, left
-L-	465+50 to 466+50, left
-L-	471+75 to 472+25, left
-L-	490+00 to 490+25, left
-L-	495+75 to 496+25, left
-L-	520+25 to 520+75, right
-L-	539+50 to 540+00
-L-	581+00 to 581+50
-L-	588+25 to 588+75, right
-L-	596+00 to 596+75, right
-L-	600+75 to 601+25, right
-L-	608+00 to 608+50, right
-L-	615+50 to 616+50, right
-L-	618+00 to 618+50, right
-L-	622+50 to 623+00, right
-L-	639+50 to 640+25, right
-L-	642+00 to 642+50
-L-	647+00 to 648+25
-Y1RPA-	17+00 to 17+25, right
-Y5-	20+00 to 20+50

4) Cohesive Soils: The following areas contain cohesive soils (AASHTO A-5, A-6 & A-7 soils) at existing subgrade in fill areas or at/near proposed subgrade that have the potential to cause subgrade problems during construction:

Alignment	Station (±)
-L-	460+00 to 461+50, left
-L-	610+50 to 611+00, left
-L-	642+00 to 642+50, left
-L-	647+00 to 647+50, left
-Y2-	22+25 to 22+75
-Y5-	17+75 to 18+50
-Y5-	20+00 to 20+50

5) Cohesive Soils: The following areas contain deeper deposits of relatively soft cohesive soils (AASHTO A-5, A-6 & A-7 soils) that have the potential to cause embankment instability or long-term settlement problems:

Alignment	Station (±)
-L-	460+75 to 462+50, left
-L-	495+50 to 496+25, left
-L-	525+75 to 526+75
-L-	610+50 to 611+00, left
-L-	634+00 to 635+00, left
-L-	640+75 to 641+25, left
-L-	642+00 to 642+50
-Y5-	20+00 to 20+50

6) Groundwater: The following areas exhibited groundwater within six feet of the proposed grade:

Alignment	Station (±)
-L-	520+25 to 520+75, right
-L-	533+00 to 533+50, left
-L-	539+25 to 540+50
-L-	636+50 to 638+50, left
-L-	647+00 to 647+50, left
-Y1RPA-	16+75 to 17+25, right

7) The following areas exhibited groundwater within three feet of existing grade, which have the potential to cause subgrade problems during construction:

Alignment	Station (±)
-L-	539+25 to 540+50
-L-	637+00 to 638+00, left
-L-	642+00 to 642+50, left
-L-	647+00 to 647+50, left
-Y1RPA-	16+75 to 17+25, right
-Y5-	18+00 to 18+50

8) Highly Plastic Soils: The following areas of unclassified excavation contain soils with plasticity indices of 26 through 38:

Alignment	Station (±)
-L-	405+25 to 408+00, left
-L-	577+00 to 577+50, right
-L-	584+25 to 584+75, right
-L-	596+00 to 596+50, right
-L-	600+75 to 601+25, right

9) Artificial Fill: The following locations contain artificial fill. These soils have the potential to be highly variable, which could cause subgrade problems during construction if undetected pockets of organics, debris, or soft/loose/wet soils are present. In addition, a majority of these soils are cohesive, which may cause embankment instability or long-term settlement problems.

Alignment	Station (±)
-L-	518+00 to 521+34, right
-L-	525+85 to 527+00, right
-L-	612+29 to 616+10, right
-L-	619+25 to 622+25, right

Physiography and Geology

The proposed road widening will accommodate additional lanes in the eastbound and westbound directions. The widening will generally remain within existing right-of-way. At the beginning of the project at -L- station 380+50, the roadway elevation (EL) starts at EL ±2,166 feet and gradually descends to EL ±2,120 feet at about -L- station 426+00. From this point the roadway elevation ascends to the maximum elevation of the project, EL ±2,186 feet at about -L- station 462+00, and then descends again to the lowest elevation of the project, EL ±2072 feet at about -L- station 526+00. The remainder of the existing roadway grade ascends to EL ±2,106 at about -L- station 568+00, descends to EL ±2,083 at about -L- station 590+50, ascends to EL ±2,151, then descends to EL ±2,122 feet at -L- station 650+50, the end of the project.

The surface water across the project is generally drained by Mud Creek and several other smaller tributaries, which are all tributaries of the French Broad River. Mud Creek is located approximately 300 to 3,500 feet west of the proposed widening and runs northwest, generally parallel to the existing interstate. The majority of the smaller tributaries run generally in a northeast-to-southwest direction.

The project is located in the Blue Ridge Province of North Carolina. More-specifically, it is located in an area mapped as muscovite-biotite gneiss (Zatm). Typical weathered rock samples recovered from our borings primarily exhibit the characteristics of biotite gneiss. Soils weathered from the parent rock generally consist of sandy silts and silty sands, along with some silty and sandy clays. The in-situ soils are the residual product of in-place chemical weathering of rock that was similar to the rock presently underlying the site.

Soils Properties

The subsurface conditions discussed below and those shown on the attached drawings represent an estimate of the subsurface conditions based on interpretation of the boring data using normally-accepted geotechnical engineering judgments. The transitions between different soil strata are usually less distinct than those shown on the boring logs and cross sections. Sometimes the relatively small sample obtained in

the field is insufficient to definitively describe the origin of the subsurface material. Although individual soil test borings are representative of the subsurface conditions at the boring locations on the dates shown, they are not necessarily indicative of subsurface conditions at other locations or at other times. Borings B-1 through B-9 and B-162 through B-165 were drilled outside of the revised project limits and the results of these borings are not discussed in this section of the report.

Soils within the area of this project have been divided into four categories: artificial fill, roadway embankment, alluvial soils, and residual soils.

Artificial Fill: Artificial fill (AF) was encountered at the surface of borings B-105, B-106, B-137, and B-137(2). The AF extended to depths up to about 6.6 feet. The artificial fill was described as moist to wet, loose to medium dense, silty SAND (A-2-4), soft to stiff, clayey SILT (A-5), and silty CLAY (A-7). A majority of the samples contained trace organic matter and mica. There is also an area of artificial fill near approximate -L- station 621+29 to 616+10, right, as indicated in the field by NCDOT GEU personnel, although no borings were performed in this area and the actual dimensions of the area are unknown. This area is as shown on the attached plans.

Roadway Embankment: Roadway embankment (RE) soils were encountered at the surface of 80 borings; however, boring B-71(2) was an offset of B-71, B-72(2) was an offset of B-72, and B-75(2) was an offset of B-75. The RE extended to depths up to 32 feet. The fill was variable and typically described as moist to wet, loose to medium dense, silty and clayey SAND (A-2-4 & A-2-6), soft to stiff, sandy and clayey SILT (A-4 & A-5), and sandy and silty CLAY (A-6 & A-7). A majority of the samples contained trace organic matter and gravel. Probable boulders were encountered in borings B-71, B-72, B-73, B-75, and B-77 from approximate -L- stations 457+00 to 495+50, left, and may also be encountered in other unexplored areas of the project.

Alluvial Soil: Alluvial soils were encountered in 25 borings. The alluvial soils were typically encountered below artificial fill and roadway embankment. The alluvial soils extended to depths up to 37 feet with an average depth of about 7.5 feet. The alluvial soil types were variable and typically described as moist to wet, loose to medium dense, silty SAND (A-2-4), soft to stiff, sandy and clayey SILT (A-4 & A-5), and sandy and silty CLAY (A-6 & A-7). A majority of the soil samples contained trace organic matter, mica, and gravel.

Residual Soil: A majority of the soils encountered on this project were residual soils. Residual soils were encountered at the surface of 67 borings, below artificial fill at 1 boring, below weathered rock at 1 boring, below alluvial soils at 17 borings, and below roadway embankment at 58 borings. No residual soils were encountered in 13 borings, and these borings were terminated in alluvial soils, artificial fill, roadway embankment, weathered rock, or crystalline rock. The residual soils were variable and typically described as moist to wet, loose to medium dense, silty and clayey SAND (A-2-4 & A-2-6), medium stiff to very stiff, sandy and clayey SILT (A-4 & A-5), and soft to stiff, silty and sandy CLAY (A-6 & A-7). A majority of the samples contained varying amounts of mica, manganese, and rock fragments.

Rock Properties

Weathered Rock (WR) was encountered in 47 borings. Of these 47 borings, 5 of the borings terminated in residual soils, 17 terminated in WR, and 25 terminated in or on Crystalline Rock (CR). Thirteen of the borings encountered intermediate layers of WR before re-encountering soil or rock below this layer. Of these 13 borings, five borings terminated in residual soils and the remaining eight borings re-encountered WR and/or CR at boring termination. These intermediate zones of WR ranged in thickness from about 1.5 to 15 feet. Excluding the intermediate zones of WR, the WR was encountered at depths ranging from about 2 to 57 feet and elevations ranging from about 2,028 to 2,187 feet.

CR was encountered in 36 borings as indicated by auger and SPT refusal. All of these borings were terminated in or on CR. Of these 36 borings, 12 transitioned directly from residual soils to CR, and 24 encountered WR before being terminated. Boring B-91 encountered an intermediate layer of CR before re-encountering soil and rock below this layer. The intermediate zone of CR was about 2.1 feet thick. The WR layers above the CR varied in thickness from 0.9 to 18.5 feet. The CR was encountered at depths ranging from about 4 to 67 feet, or elevations ranging from about 2,018 to 2,183 feet. The rock typically consisted of gneiss. Refusal is a designation applied to any material that cannot be penetrated by the soil auger, and is typically caused by encountering boulders, hard rock lenses/ledges or bedrock. The nature of the materials causing refusal was not explored in the majority of these borings, but is anticipated to represent the CR level.

Rock coring was performed in borings B-14, B-21, and B-26 after encountering auger refusal. The coring extended to depths of 49.9, 65.9, and 56.0 feet, respectively, after SPT refusal was achieved. The rock generally consisted of very slightly to severely weathered, soft to very hard, biotite gneiss. The strata recovery and RQD are indicated on the cross sections. Strata recovery ranged from 51% to 82%, and strata RQD ranged from 6% to 64%.

Groundwater Properties

Generally, groundwater measurements were attempted in a majority of the 157 borings along the project immediately upon their completion and after a stabilization period of approximately 24 hours. Nine borings were backfilled immediately upon their completion. Immediately upon completion, groundwater was encountered in 29 borings at depths ranging from 0 to 56.2 feet, and elevations ranging from about 2,055 to 2,172 feet. Stabilized groundwater was encountered in 45 borings at depths ranging from 0 to 47.1 feet, and elevations ranging from 2,058 to 2,154 feet. Groundwater was not encountered in the remaining 107 borings. The recovered soil samples were generally described as moist above the groundwater level and wet or saturated below the groundwater level. It should be noted that the groundwater levels fluctuate depending upon seasonal factors such as precipitation and temperature. As such, soil moisture and groundwater conditions at other times may vary or be different from those described in this report.

We appreciate the opportunity to work with you on this project. Please contact us if you have any questions regarding this report or if we may be of further service.

Sincerely,
FROEHLING & ROBERTSON, INC.

DocuSigned by:
Patrick Alton
W. Patrick Alton, P.E.
Transportation Services Manager

DocuSigned by:
Derick Racey
Derick Racey
Geotechnical Project Manager

Appendix A

Bulk Samples

The following bulk samples were obtained and transported to our laboratory for testing to determine the engineering properties of the soil:

Sample No.	Boring No.	Line	Station	Offset	Depth (ft)	Test(s) Performed
CBR-1	B-10	-Y1RPD-	16+23	105’ Lt.	3.0-18.0’	Standard Proctor, CBR
CBR-2	B-109	-L-	549+16	138’ Rt.	3.3-25.0’	Standard Proctor, CBR
CBR-3	B-110	-L-	577+18	101’ Rt.	3.5-10.0’	Standard Proctor, CBR
CBR-4	B-118	-L-	601+01	161’ Rt.	5.0-23.5’	Standard Proctor, CBR
CBR-5	B-119	-L-	608+24	160’ Rt.	3.5-25.0’	Standard Proctor, CBR

Undisturbed Samples

Undisturbed Shelby tube samples were not requested to be collected as part of this investigation.

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	4

R/W SHEET NO.

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ROADWAY DESIGN ENGINEER

HYDRAULICS ENGINEER

INCOMPLETE PLANS
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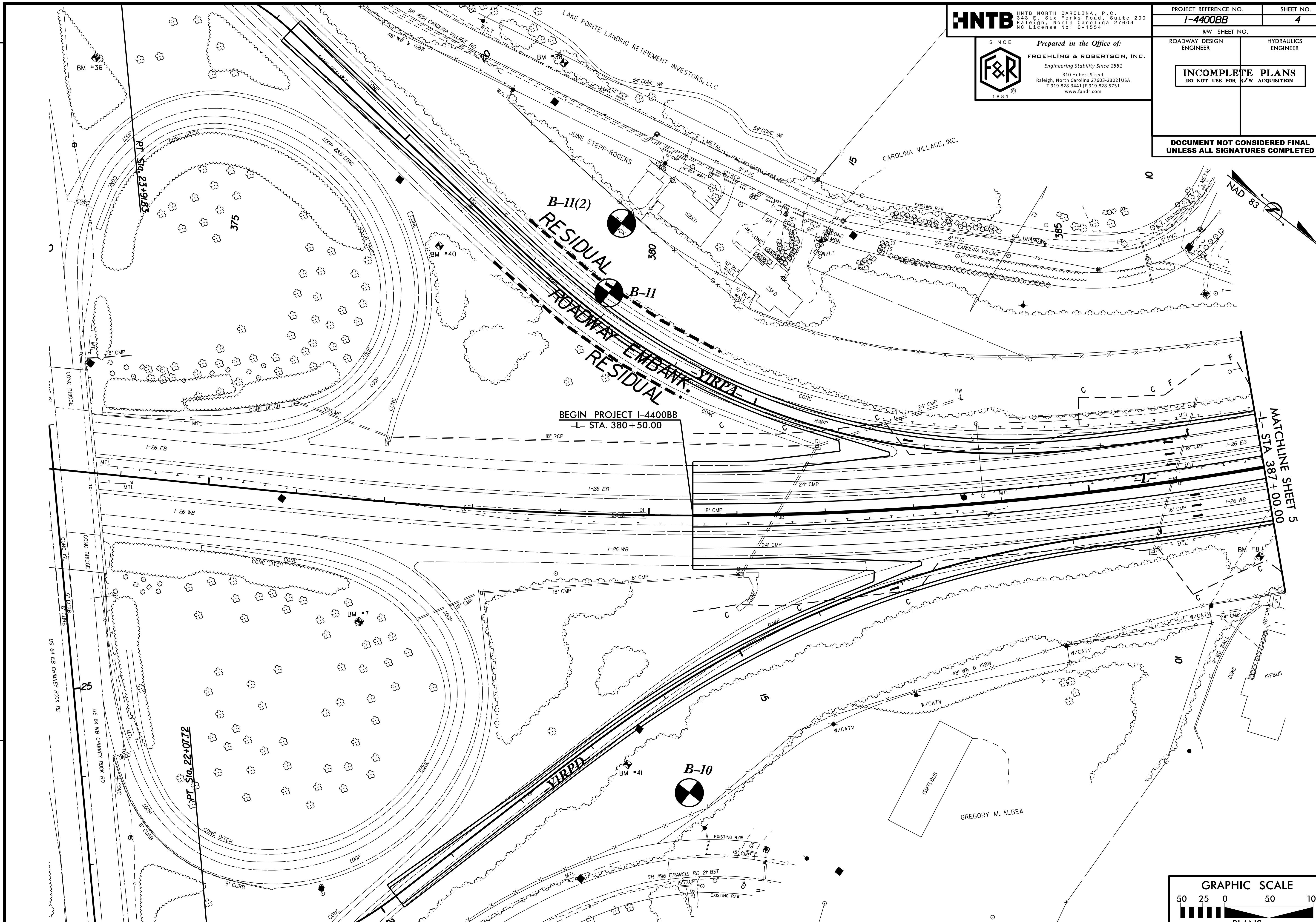
REVISIONS



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TWalker AT 66D261102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	5
R/W SHEET NO.	

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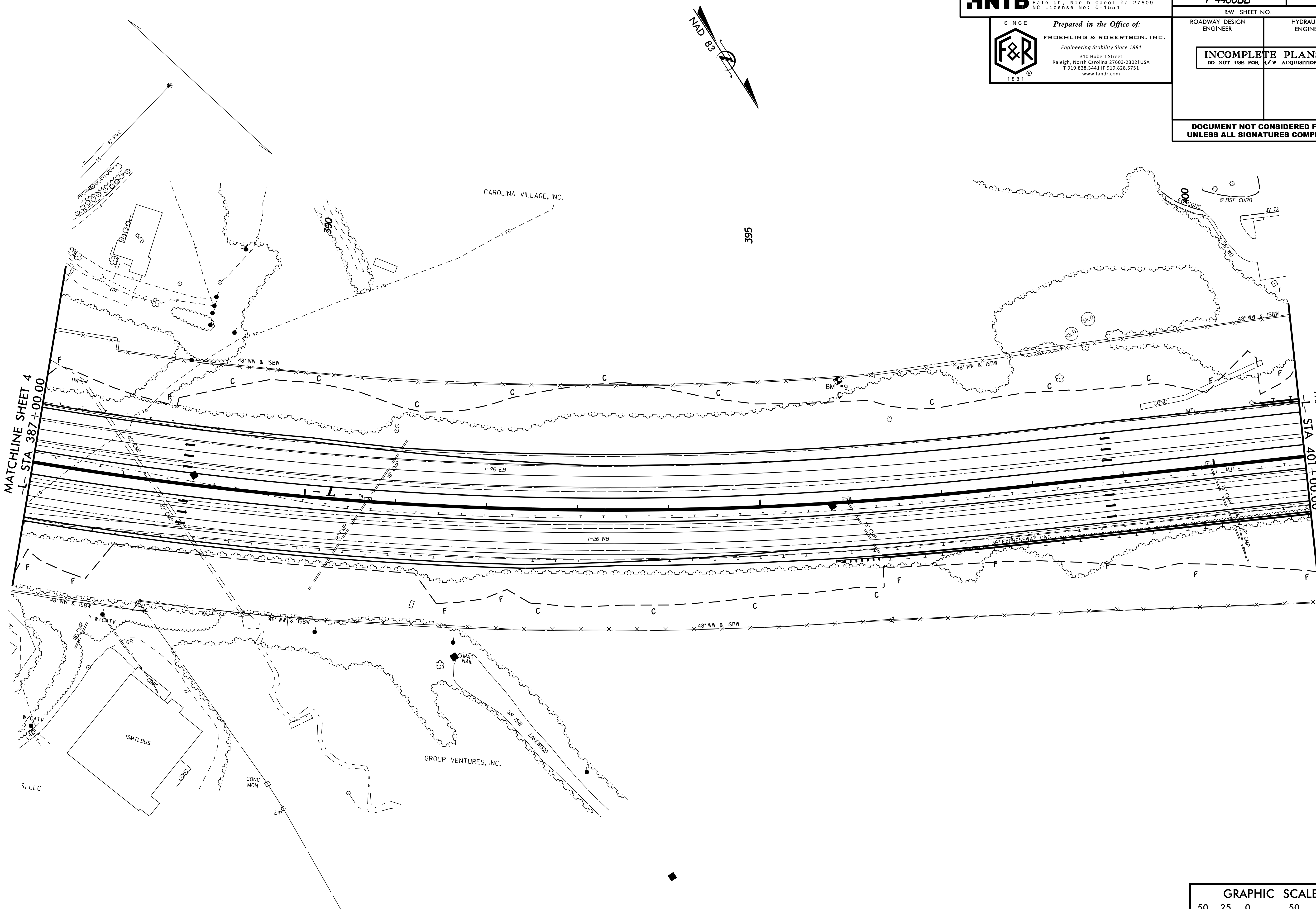
REVISIONS



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PLANS

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TWalker AT 66D26102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	6
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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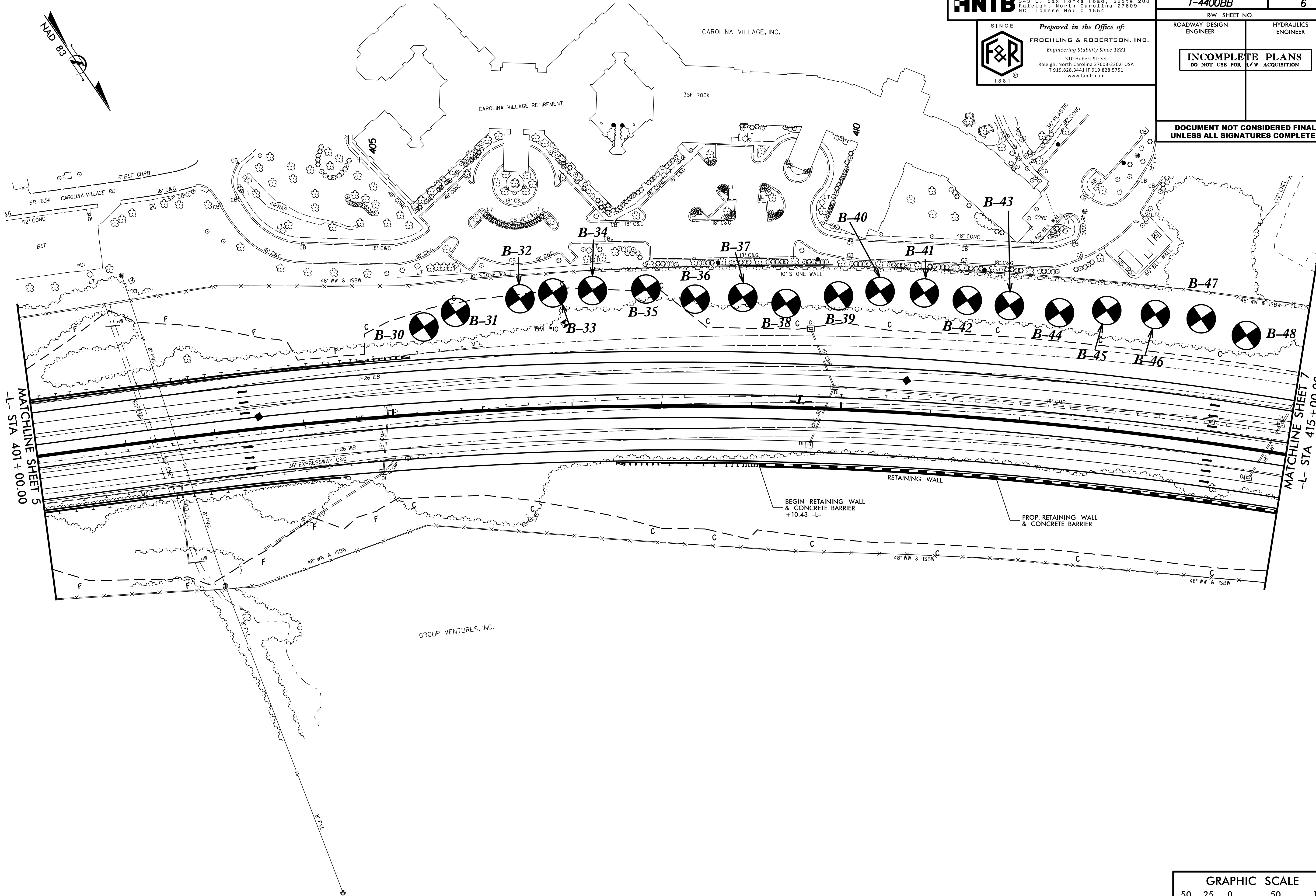

GRAPHIC SCALE

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PLANS

REVISIONS

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TWalker AT 66D26102
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	7

RW SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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NAD 83

CAROLINA VILLAGE, INC.

HEATHER G. FERNANDEZ

GROUP VENTURES, INC.

420

425

72" CHL

8" GR

12" HDPE

MTL

GR

EIP

18" DI

CLEAR CREEK

48" WW

48" WW & ISBW

15" CMP

BM #11

BM #12

24" CMP

I-26 EB

I-26 WB

CONC. BRIDGE

CONC

RETAINING WALL

PROP. RETAINING WALL & CONCRETE BARRIER

END RETAINING WALL & CONCRETE BARRIER +74.27 -L-

BEGIN RETAINING WALL & CONCRETE BARRIER +99.34 -L-

PROP. RETAINING WALL & CONCRETE BARRIER

END RETAINING WALL & CONCRETE BARRIER +49.39 -L-

ALLEN BRANCH

MATCHLINE SHEET 6 -L- STA 415+00.00

MATCHLINE SHEET 8 -L- STA 429+00.00

GRAPHIC SCALE
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PLANS

REVISIONS

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Walker AT 6602611102
10.0000000:1.000000
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	8
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REVISIONS

MATCHLINE –Y3– STA 14+00.00

MATCHLINE –Y2– STA 16+00.00

MATCHLINE SHEET 7 –L– STA 429+00.00

MATCHLINE SHEET 9 –L– STA 443+00.00

MATCHLINE –Y2– STA 28+00.00

HEATHER G. FERNANDEZ

HEATHER G. FERNANDEZ

NAD 83

RESIDUAL

ROADWAY

EMBANKMENT

RESIDUAL

RESIDUAL

RESIDUAL

B–12 B–13 B–51 B–53 B–52 B–54 B–50 B–49 B–15 B–14 B–16 B–17

BEGIN BRIDGE –Y2– STA 20+39.23

END BRIDGE –Y2– STA 22+27.03

SR 1635 HINDER FARD RD

I-26 EB

I-26 WB

48" WW & ISBW

BM #13

BM #46

EXISTING R/W

CONC BRIDGE

MTL

GRAPHIC SCALE
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PLANS

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TWalker
AT 660261102
100.000000H.000000
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	9

R/W SHEET NO.

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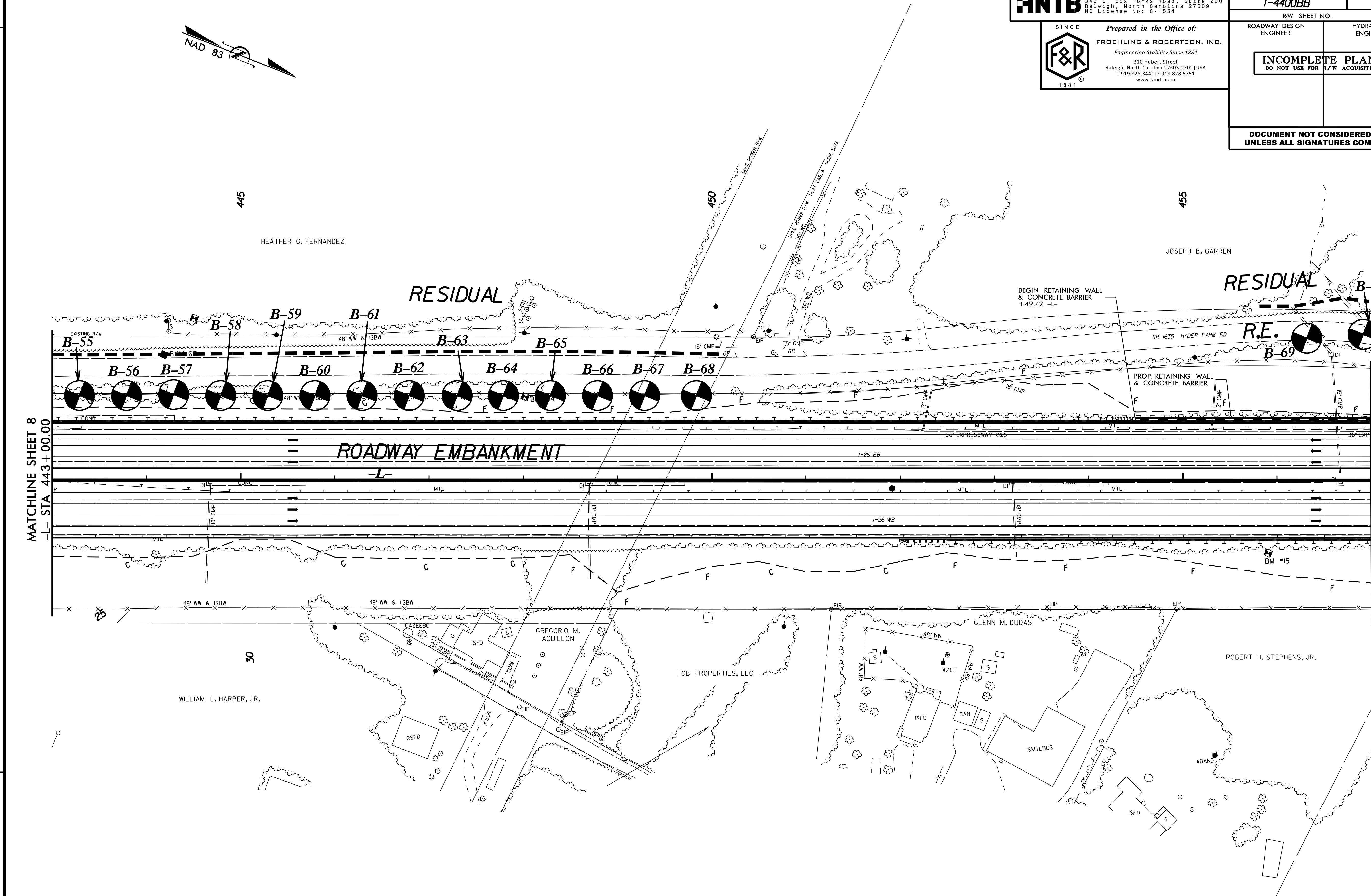
REVISIONS



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TWalker AT 66D26102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	10
R/W SHEET NO.	

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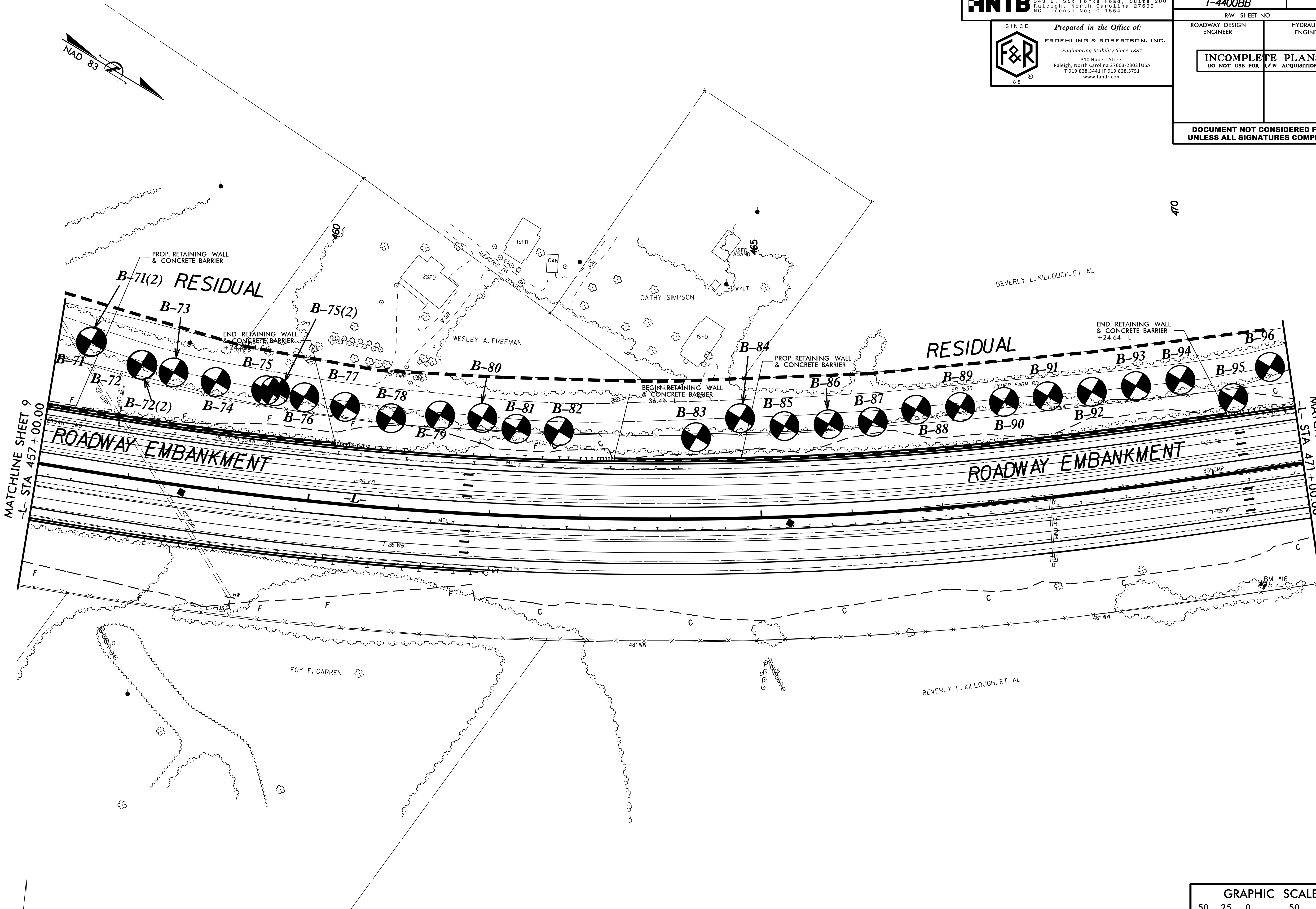
NAD 83
PROP. RETAINING WALL & CONCRETE BARRIER
B-71(2) RESIDUAL
B-73
B-71
B-72
B-72(2)
B-74
B-75
B-75(2)
B-76
B-77
B-78
B-79
B-80
B-81
B-82
B-83
B-84
B-85
B-86
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B-88
B-89
B-90
B-91
B-92
B-93
B-94
B-95
B-96
END RETAINING WALL & CONCRETE BARRIER
BEGIN RETAINING WALL & CONCRETE BARRIER +36.44 -L-
END RETAINING WALL & CONCRETE BARRIER +24.64 -L-
RESIDUAL
WESLEY A. FREEMAN
CATHY SIMPSON
BEVERLY L. KILLOUGH, ET AL
FOY F. GARREN
ALEXONE DR
HYDER FARM RD
SR 1635
ROADWAY EMBANKMENT
ROADWAY EMBANKMENT
MATCHLINE SHEET 9 -L- STA 457+00.00
MATCHLINE SHEET 11 -L- STA 471+00.00
-L-
I-26 EB
I-26 WB
MTL
460
465
470
48" WW
BM #16

GRAPHIC SCALE
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PLANS

REVISIONS

27-JUN-2019 08:19
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TWalker AT 66D26102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	11
RW SHEET NO.	

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INCOMPLETE PLANS
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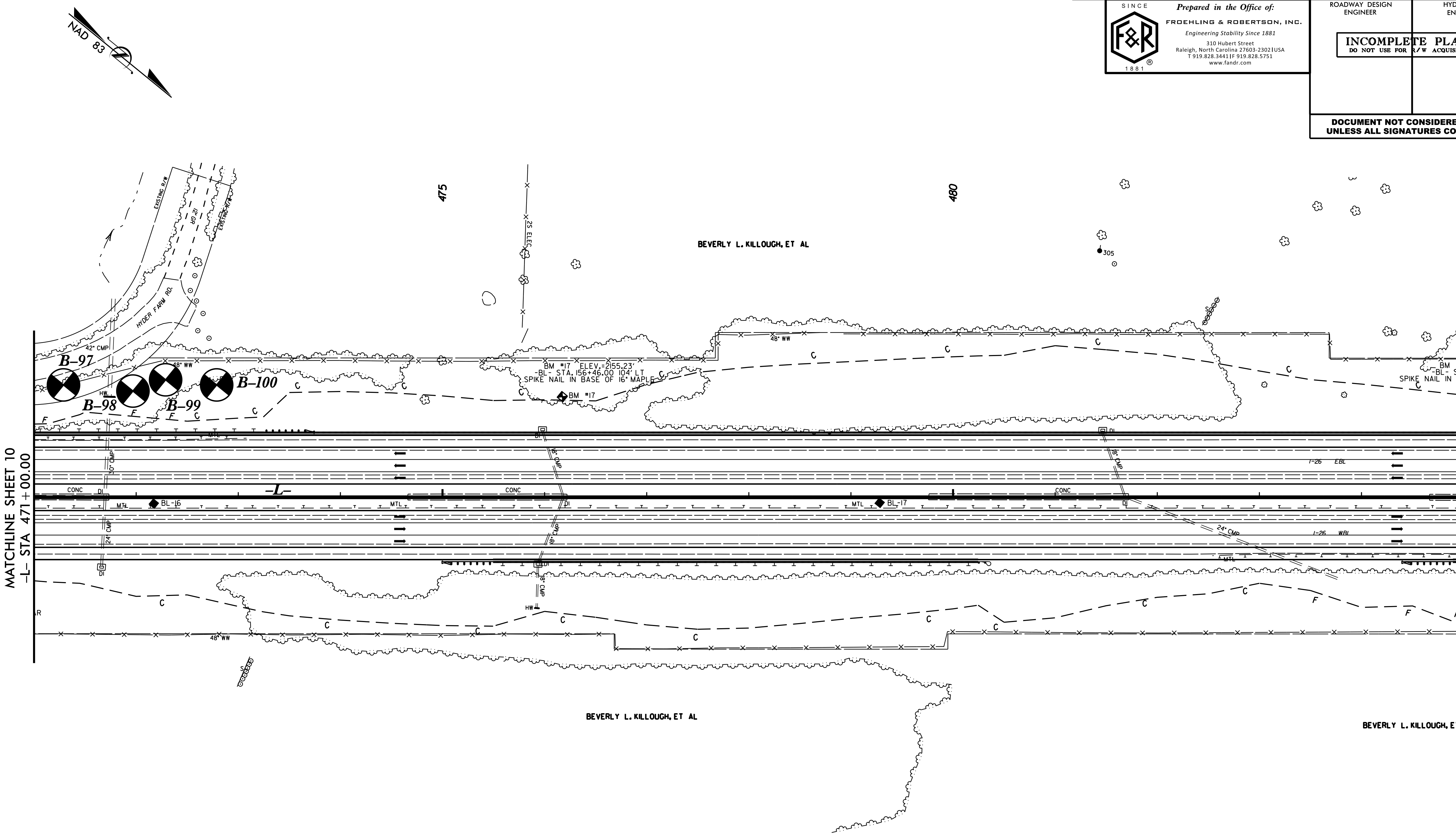
REVISIONS



GRAPHIC SCALE
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PLANS

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TWalker AT 66D26102
100.000000:1.000000

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	12

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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NAD 83

485 490 495

BEVERLY L. KILLOUGH, ET AL

HRR PROPERTIES, LLC

RESIDUAL ALLUVIAL RESIDUAL

B-104 B-103 B-102

BM #18 BM #19

ROADWAY EMBANKMENT

ROADWAY EMBANKMENT

ALLUVIAL RESIDUAL

RESIDUAL

MATCHLINE SHEET 11
-L- STA 485+00.00

MATCHLINE SHEET 13
-L- STA 499+00.00

I-26 EB

I-26 WB

7' X 7' SINGLE BARREL CONCRETE BOX CULVERT

CONC. MON. W/ DISK

AL

G. RAY FUSSELL

RICHARD F. MIHALIK

MITCHELL G. BULLINGTON

GRAPHIC SCALE
50 25 0 50 100
PLANS

27-JUN-2019 08:20
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TWalker AT 6602611102
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REVISIONS

PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	13
R/W SHEET NO.	

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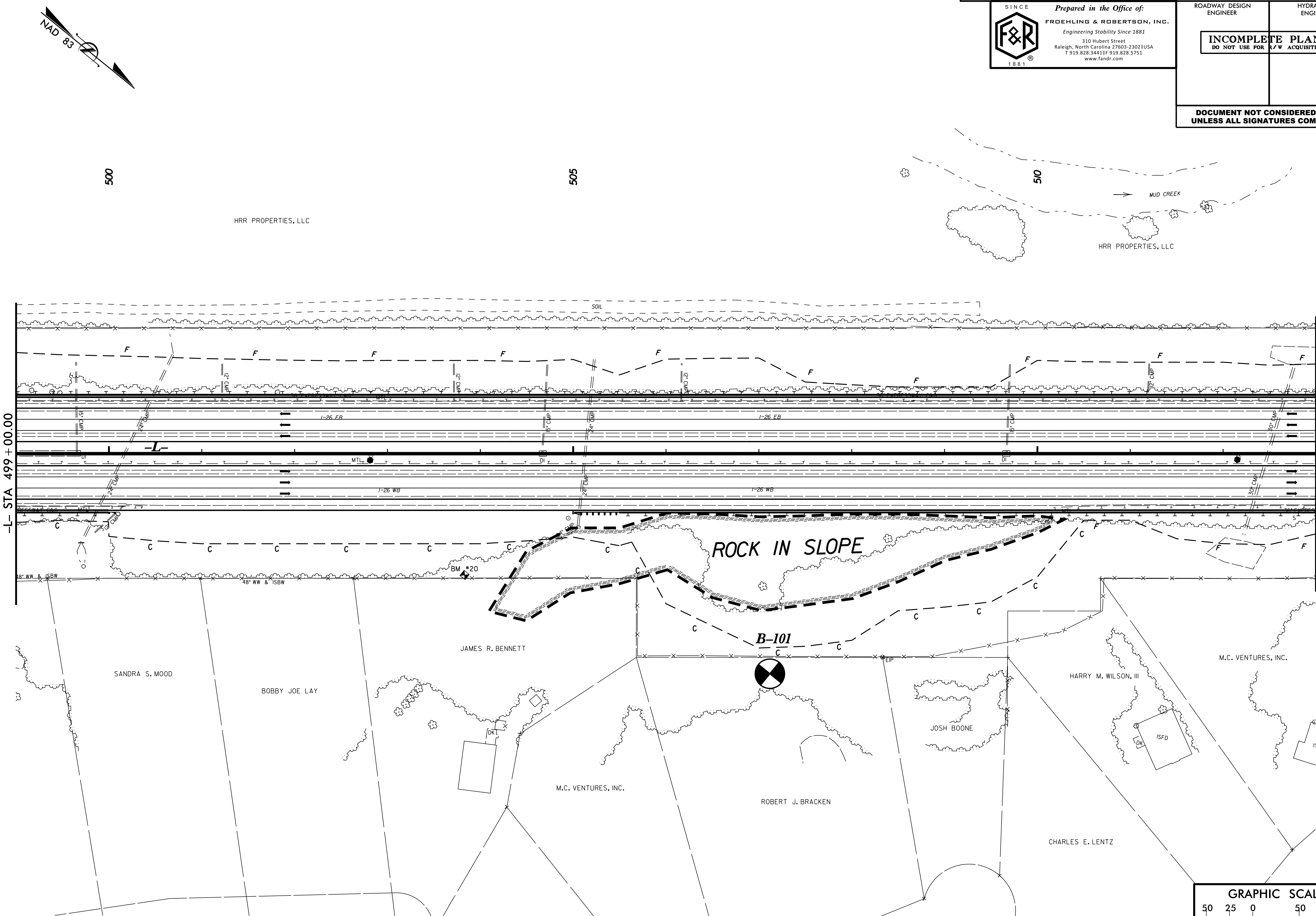
REVISIONS



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TWalker AT 66D26102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	14

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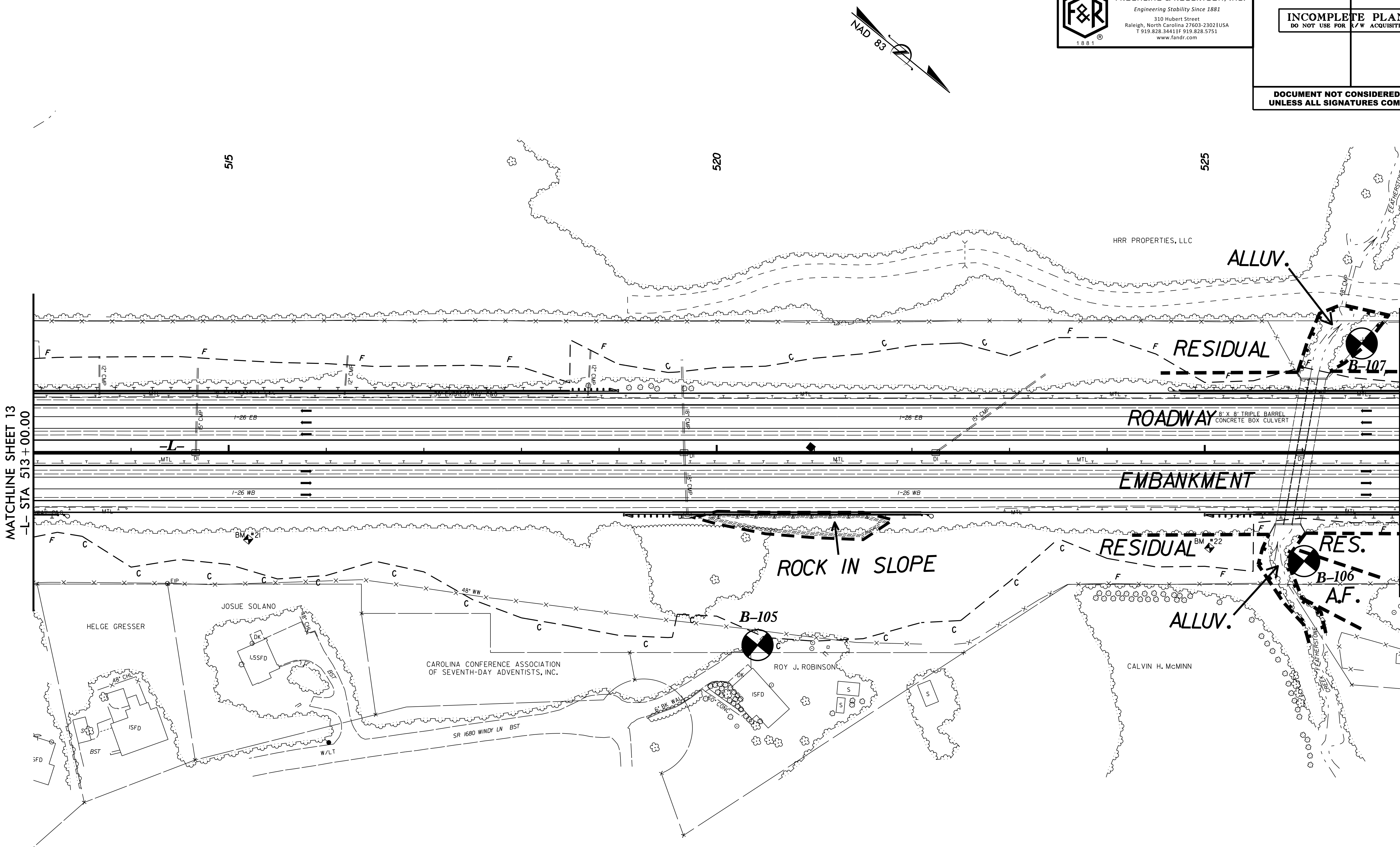

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PLANS

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TWalker AT 66D26102
100.000000:1.000000
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	15

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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REVISIONS

NAD 83

MATCHLINE SHEET 14
-L- STA 527+00.00

MATCHLINE SHEET 16
-L- STA 539+00.00

RESIDUAL

ROADWAY

EMBANKMENT

RESIDUAL

B-108

530

535

W/LT

ISMTL BUS ABAND

DK

SOIL

HRR PROPERTIES, LLC

I-26 EBL

I-26 WBL

18" CMP

MTL

DI

48" WW

48" WW & ISBW

BM #23

CAROLINA CIR.

DENISE E. BARNWELL

TABITHA WILLS

CARMEN H. LONDON

EDDIE LARRIUZ

CAROLYN J. DAVIS

12" CMP

48" CHL

60" CMP

ISFD

HTR

ISBKD

WD RAMP

16" GR

12" GR

12" CONC

6" DIP

EIP

RAIL NAIL

GRAPHIC SCALE
50 25 0 50 100
PLANS

27-JUN-2019 08:20
Fi:\Projects 6SV.6SV-0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_RDWY\CADD_GEOTECH\PlanProf\I4400BB_RDY_PSH_15.dgn
Walker AT 6602611102
10.0000000:1.000000
[]

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	16
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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Walker AT 6602611102
100.0000000:0000000
[]

NAD 83

MATCHLINE -Y5- STA 14+75.00

MATCHLINE SHEET 14 -L- STA 539+00.00

MATCHLINE SHEET 16 -L- STA 553+00.00

MATCHLINE -Y5- STA 24+25.00

RO = SEE PLANS
SE = SEE PLANS

CHAMPIONS GOLF LEARNING CENTER, INC.

CLEMENT PAPPAS NC.

B-18 B-19 B-21 B-20 B-22 B-23 B-109

BEGIN BRIDGE -Y5- STA 18+30.00

-WEIGH B-

-WEIGH C-

I-26 EB

I-26 WB

BL-23

BM-24

NATHAN A. BENSON

JOSHUA WALLACE

AARON K. SMITH

JAMES R. ANTHONY

McARTHUR WALKER, JR.

MARY N. CONTOMARINOS, ET AL

PAULA B. ROBERTS

MICHAEL C. HODGE

LEON LAMB

HEASLEY W. HILL

RUSSELL E. GIPE

S. WRIGHT

ANTHONY G. BAILEY

GRAPHIC SCALE
50 25 0 50 100
PLANS

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HYDRAULICS ENGINEER

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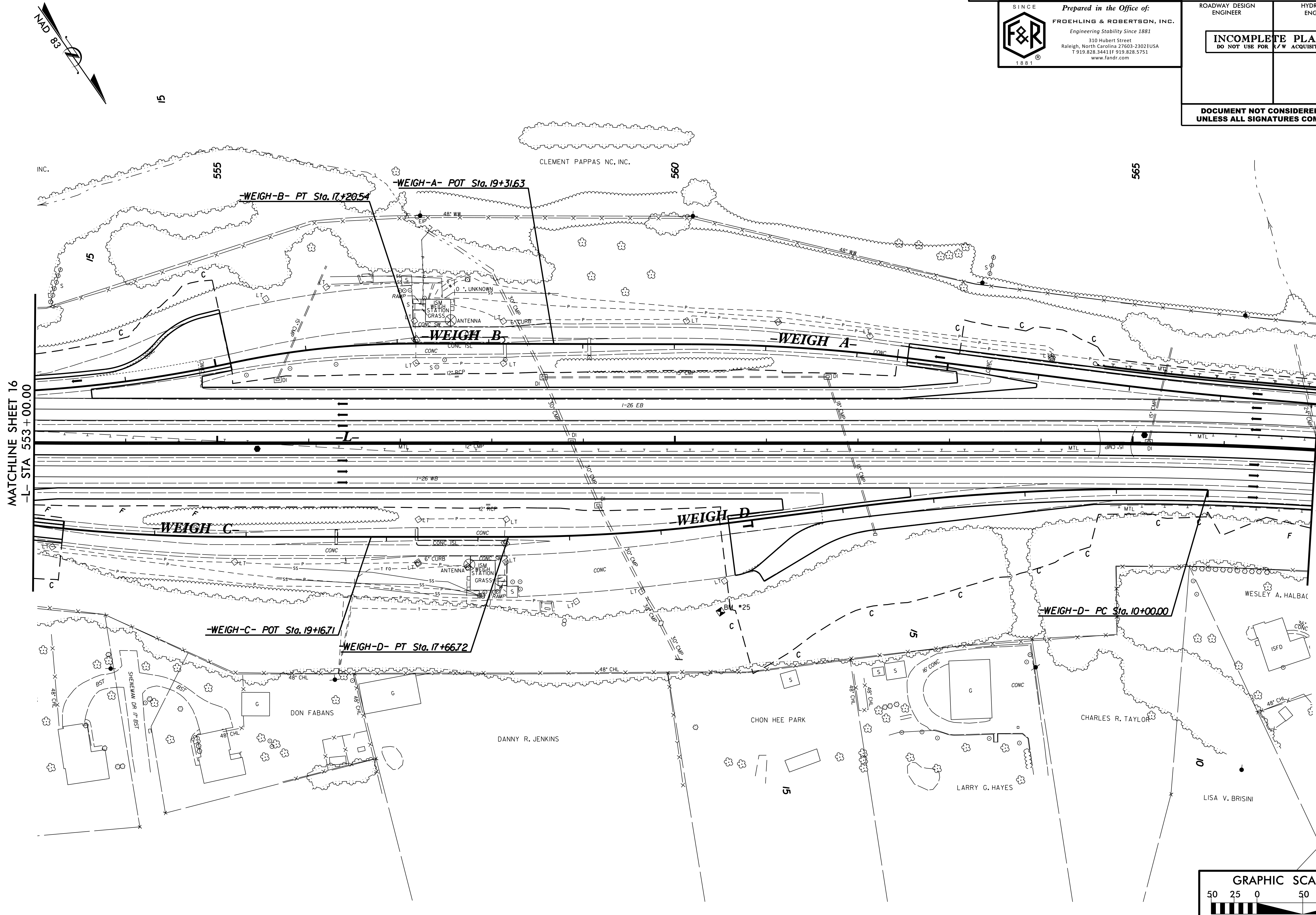
REVISIONS



GRAPHIC SCALE
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PLANS

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TWalker AT 66D261102
100.000000:1.000000
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	18
RW SHEET NO.	
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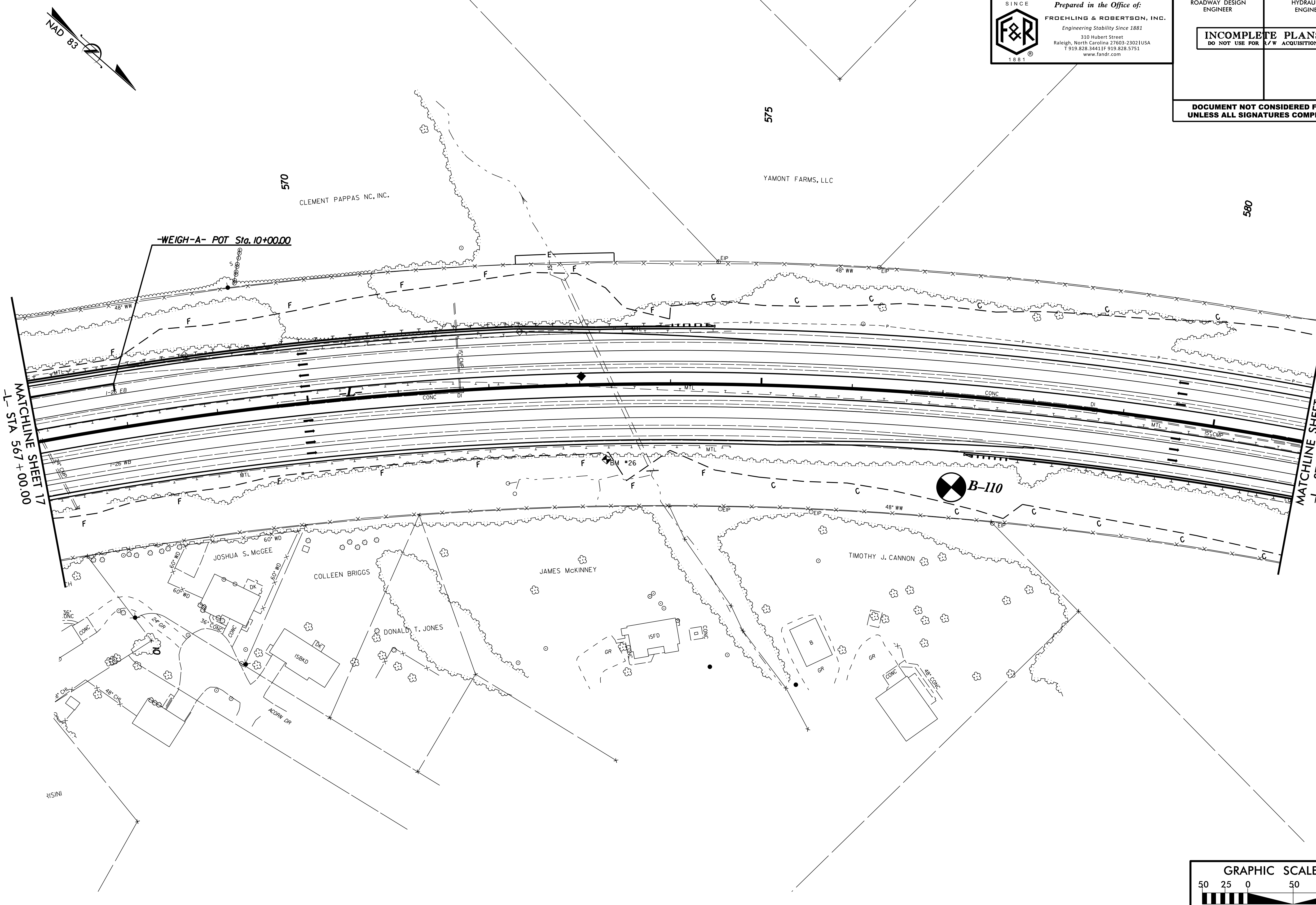

GRAPHIC SCALE
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PLANS

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TWalker AT 66D261102
100.000000:1.000000

HNTB NORTH CAROLINA, P.C.
343 E. Six Forks Road, Suite 200
Raleigh, North Carolina 27609
NC License No: C-1554

PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	19

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION

DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED

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NAD 83

585

590

595

LAYMAN FOUNDATION OF NC, INC.

LAYMAN FOUNDATION OF NC, INC.

48" WW & ISBW

48" WW & ISBW

B-112

MATCHLINE SHEET 18
-L- STA 581+00.00

MTL

18" CMP

CONC

DI

10' X 8' DOUBLE BARREL
CONCRETE BOX CULVERT

24" CMP

I-26 EB

I-26 WB

B-113

BM #27

B-114

8" RCP

B-111

48" WW & ISBW

LAYMAN FOUNDATION OF NC, INC.

LAYMAN FOUNDATION OF NC, INC.

BYERS CREEK

RUINS

MATCHLINE SHEET 20
-L- STA 595+00.00

GRAPHIC SCALE
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PLANS

REVISIONS

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Walker
AT 660261102
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	20
RW SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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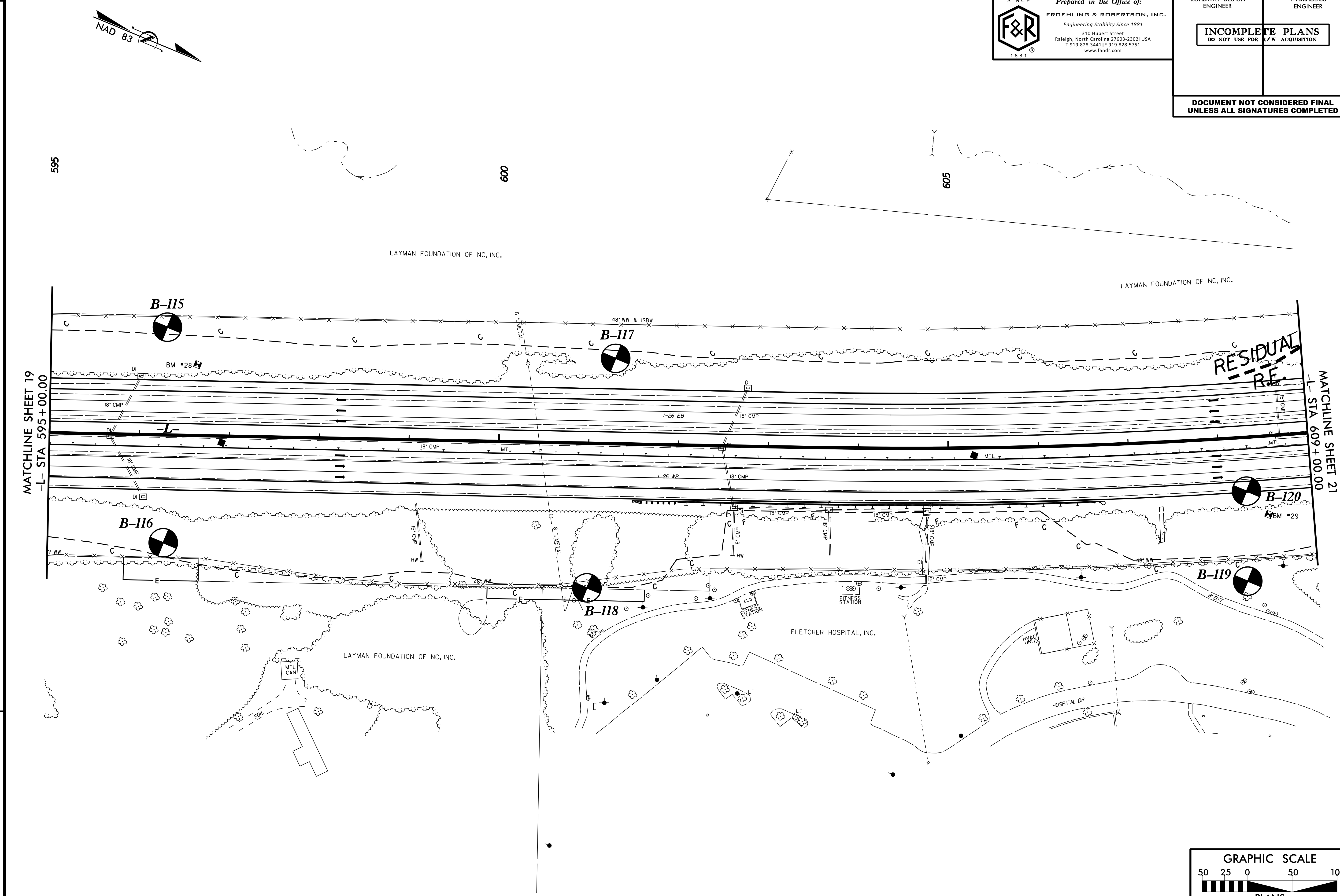

REVISIONS

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TWalker AT 66D26102

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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	21
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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NAD 83

REVISIONS

MATCHLINE SHEET 20
-L- STA 609+00.00

MATCHLINE SHEET 22
-L- STA 623+00.00

CANTERBURY WAY

SUSAN L. LONDON

ALLUVIAL

RESIDUAL

RESIDUAL

ROADWAY EMBANKMENT

B-166

B-135

B-139

B-121

B-123

B-124

B-125

B-126

B-127

B-127(2)

B-128

B-129

B-130

B-131

B-132

B-133

B-134

B-136

B-138

B-140

B-141

B-122

B-137

B-137(2)

I-26 EB

I-26 WB

36" RCP

30" CMP

24" CMP

18" CMP

60" CMP

15" CMP

48" WW & ISBW

PROP. RETAINING WALL & CONCRETE BARRIER

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+99.89 -L-

RES.

A.F.

R.E.

NAPLES RD.

BY20-83

FLETCHER HOSPITAL, INC.

ADVENTIST HEALTH SYSTEM/
SUNBELT HEALTH CARE CORP.

ARTIFICIAL FILL

AREA U/C

LAYMAN FOUNDATION OF NC, INC.

EXISTING R/W

GRAPHIC SCALE
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PLANS

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TWalker AT 66D261102
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PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	22

R/W SHEET NO.

ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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NAD 83

CANTERBURY WAY

MACK C. YOUNBLOOD, JR.

BRENDA J. PARSONS, TRUSTEE

LEI SHI

RESIDUAL

R.E.

B-142 B-143 B-144 B-145 B-146 B-147 B-148 B-149 B-150 B-151

MATCHLINE SHEET 21 -L- STA 623+00.00

MATCHLINE SHEET 23 -L- STA 637+00.00

MATCHLINE SHEET 23 -Y7- STA 20+25.00

END RETAINING WALL & CONCRETE BARRIER 209.91 -L-

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SR 1534 NAPLES RD

PATTIENGLE

DAVIS E. JAMES

RYAN YATES

RODNEY A. SMITH

JOHN W. LINDSEY

ROBERT E. HANSEN

SUNSET WARD

BM #30

BM #31

BY20-84

GRAPHIC SCALE
50 25 0 50 100
PLANS

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TWalker AT 6602611102
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NC License No: C-1554

PROJECT REFERENCE NO.	SHEET NO.
I-4400BB	23
R/W SHEET NO.	
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER

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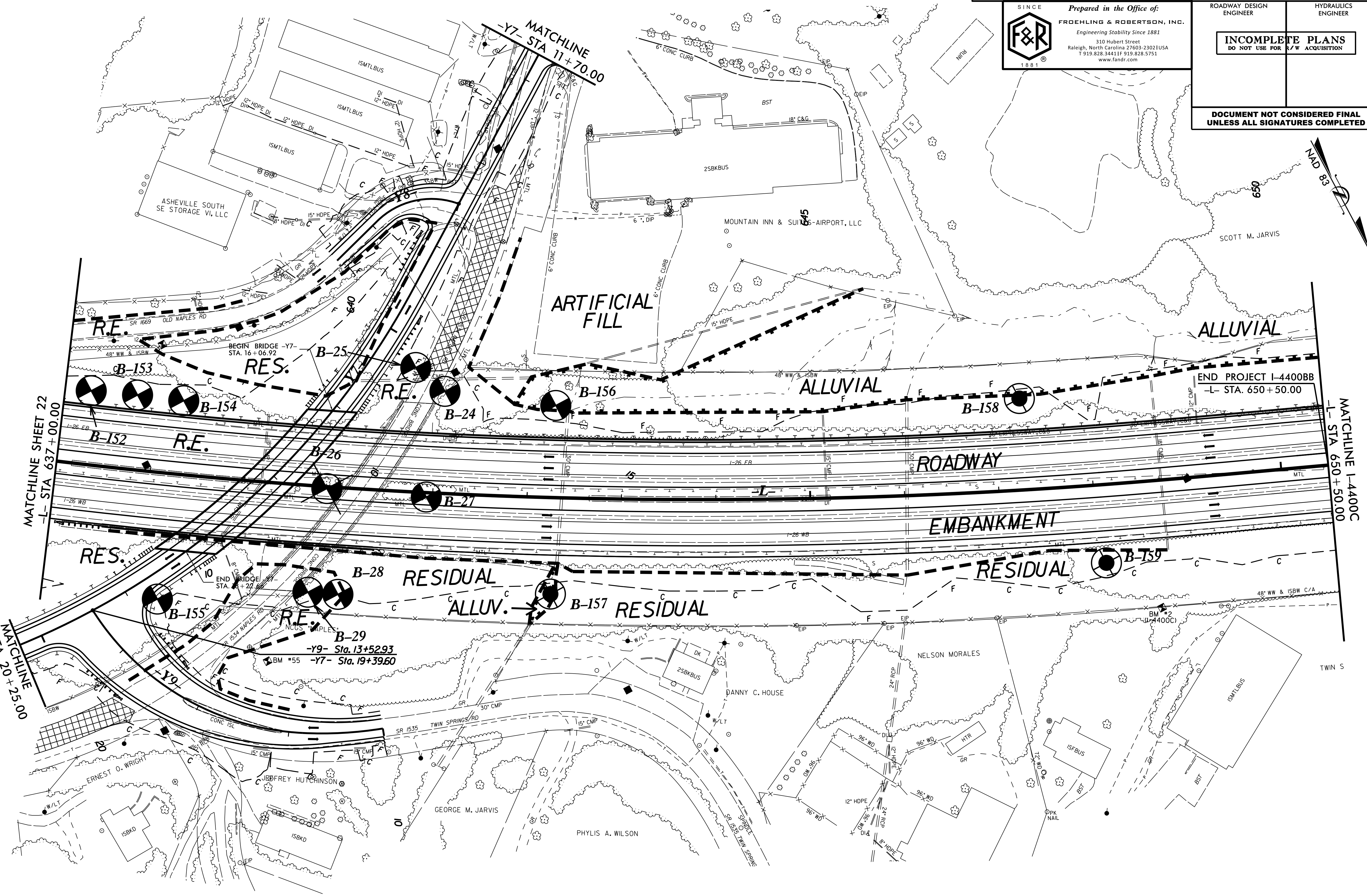
REVISIONS



GRAPHIC SCALE
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PLANS

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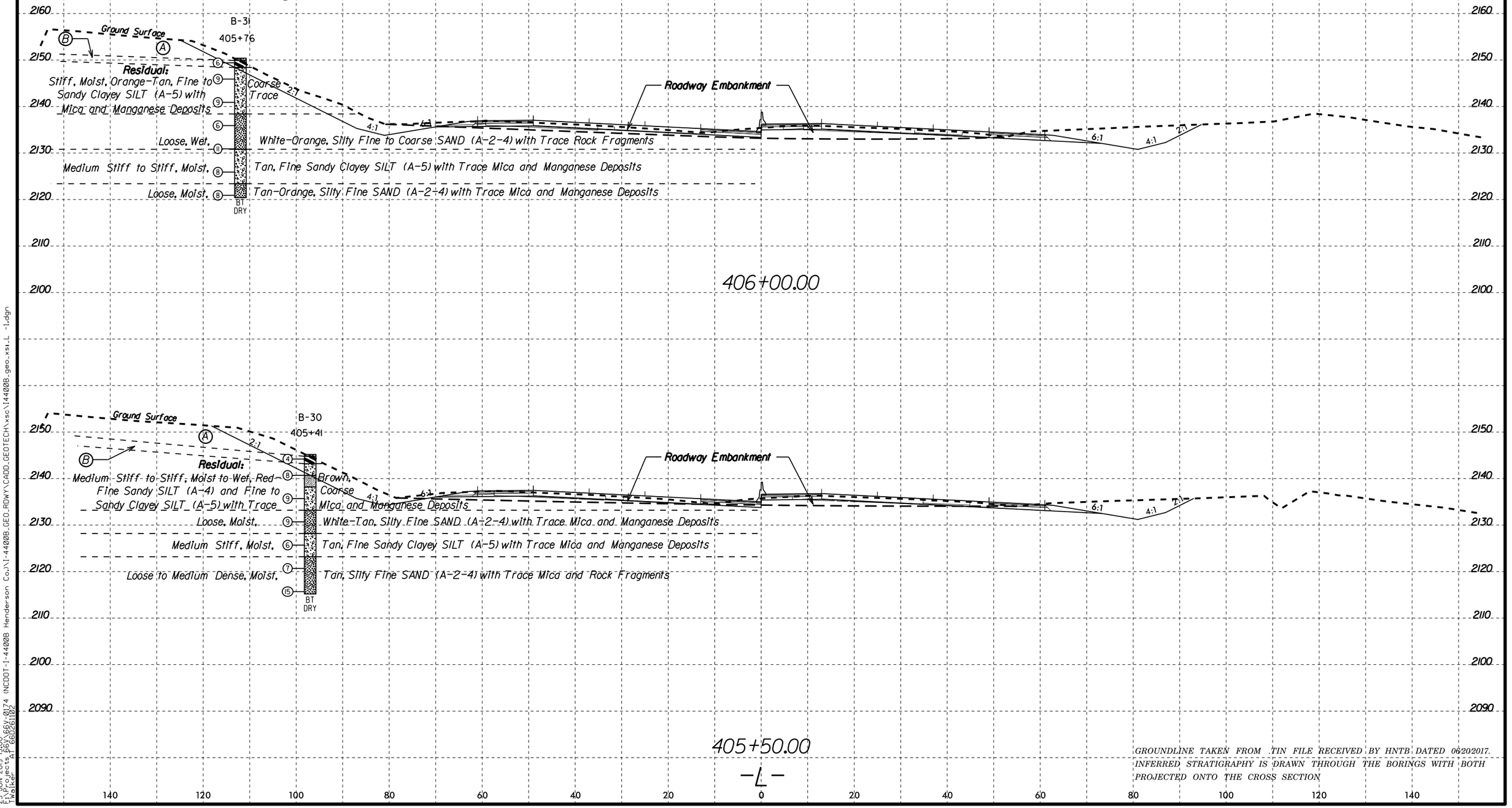
TWalker AT 66D261102
100.000000:1.000000

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	24

Ⓐ **Residual:** Loose, Wet, Dark Brown, Silty Fine SAND (A-2-4) with Trace Organics (Roots, Wood Fragments)

Ⓑ **Residual:** Medium Stiff, Wet, Orange, Fine to Coarse Sandy Silty CLAY (A-7-5) with Trace Organics (Roots), Highly Plastic

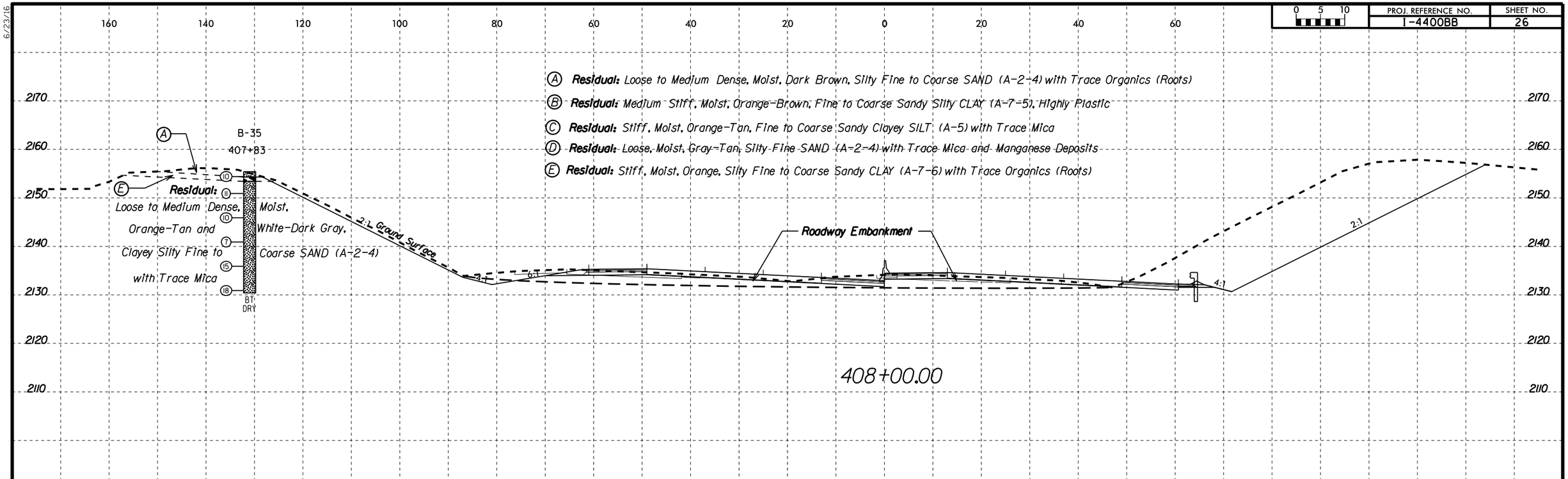


GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	26

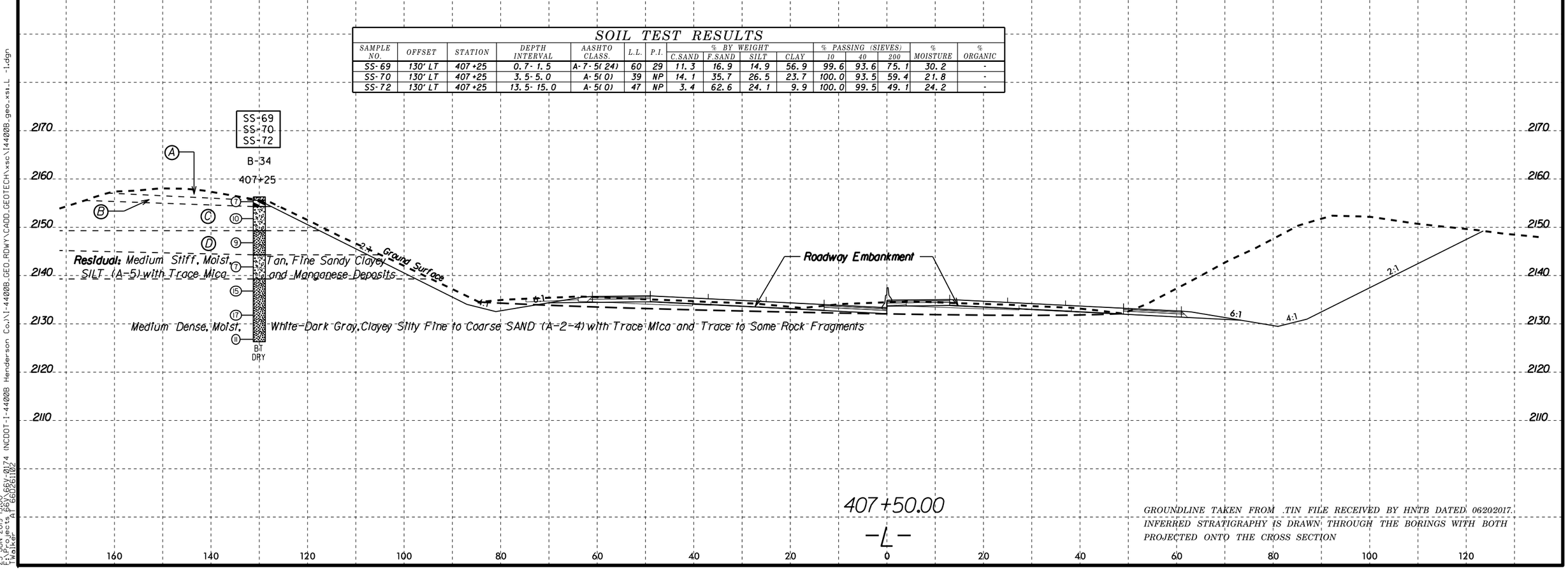
0 5 10

Ⓐ **Residual:** Loose to Medium Dense, Moist, Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)
Ⓑ **Residual:** Medium Stiff, Moist, Orange-Brown, Fine to Coarse Sandy Silty CLAY (A-7-5), Highly Plastic
Ⓒ **Residual:** Stiff, Moist, Orange-Tan, Fine to Coarse Sandy Clayey SILT (A-5) with Trace Mica
Ⓓ **Residual:** Loose, Moist, Gray-Tan, Silty Fine SAND (A-2-4) with Trace Mica and Manganese Deposits
Ⓔ **Residual:** Stiff, Moist, Orange, Silty Fine to Coarse Sandy CLAY (A-7-6) with Trace Organics (Roots)



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-69	130' LT	407+25	0.7- 1.5	A-7-5(24)	60	29	11.3	16.9	14.9	56.9	99.6	93.6	75.1	30.2	-
SS-70	130' LT	407+25	3.5- 5.0	A-5(0)	39	NP	14.1	35.7	26.5	23.7	100.0	93.5	59.4	21.8	-
SS-72	130' LT	407+25	13.5- 15.0	A-5(0)	47	NP	3.4	62.6	24.1	9.9	100.0	99.5	49.1	24.2	-



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	25

Ⓐ **Residual:** *Loose, Moist to Wet, Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)*

Ⓑ **Residual:** *Medium Stiff, Moist to Wet, Orange, Fine to Coarse Sandy Silty CLAY (A-7-5) with Trace Organics (Roots), Highly Plastic*

B-33
406+82

Ⓐ
Ⓑ **Residual:**
Medium Stiff to Very Stiff, Moist, Orange-Tan, Fine to Coarse Sandy Clayey SILT (A-5) with Trace Mica, Rock Fragments, and Manganese Deposits

6 6 14 9 9 15 13
BT
DRY

Ground Surface
2:1 4:1 6:1
Roadway Embankment
6:1 4:1 2:1

2160 2150 2140 2130 2120 2110

160 140 120 100 80 60 40 20 0 20 40 60

407+00.00

B-32
406+47

Ⓐ
Ⓑ **Residual:**
Medium Stiff to Stiff, Moist, Orange-Tan, Fine to Coarse Sandy Clayey SILT (A-5) with Trace Mica and Manganese Deposits

7 9 9 5 6 28 11
BT
DRY

Ground Surface
4:1 6:1
Roadway Embankment
6:1 4:1 2:1

Medium Dense, Moist, Tan-Brown, Silty Fine SAND (A-2-4) with Trace Mica and Manganese Deposits

Stiff, Moist, Tan, Fine Sandy Clayey SILT (A-5) with Trace Mica and Manganese Deposits

406+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB, DATED 06/20/2017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

160 140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

Ⓐ **Residual:** *Loose, Moist to Wet, Dark Brown to Orange-Brown, Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Mica*

Ⓑ **Residual:** *Soft to Medium Stiff, Wet, Orange, Silty Fine Sandy CLAY (A-6)*

B-37
408+89

Ⓐ **Residual:** *Medium Stiff to White-Tan, Fine* — *Stiff, Moist, Sandy SILT (A-4) with Trace Mica, Rock Fragments, and Manganese Deposits*

Crystalline Rock: *Gray (GNEISS)*

Ground Surface

Roadway Embankment

2:1 4:1 6:1 2:1 4:1

409+00.00

B-36
408+37

Ⓐ **Residual:** *Loose to Dense, Orange, and White-Dark Fine to Coarse SAND* — *Moist, Tan, Gray, Clayey Silty (A-2-4) with Trace Mica and Rock Fragments*

Ⓑ

Ground Surface

Roadway Embankment

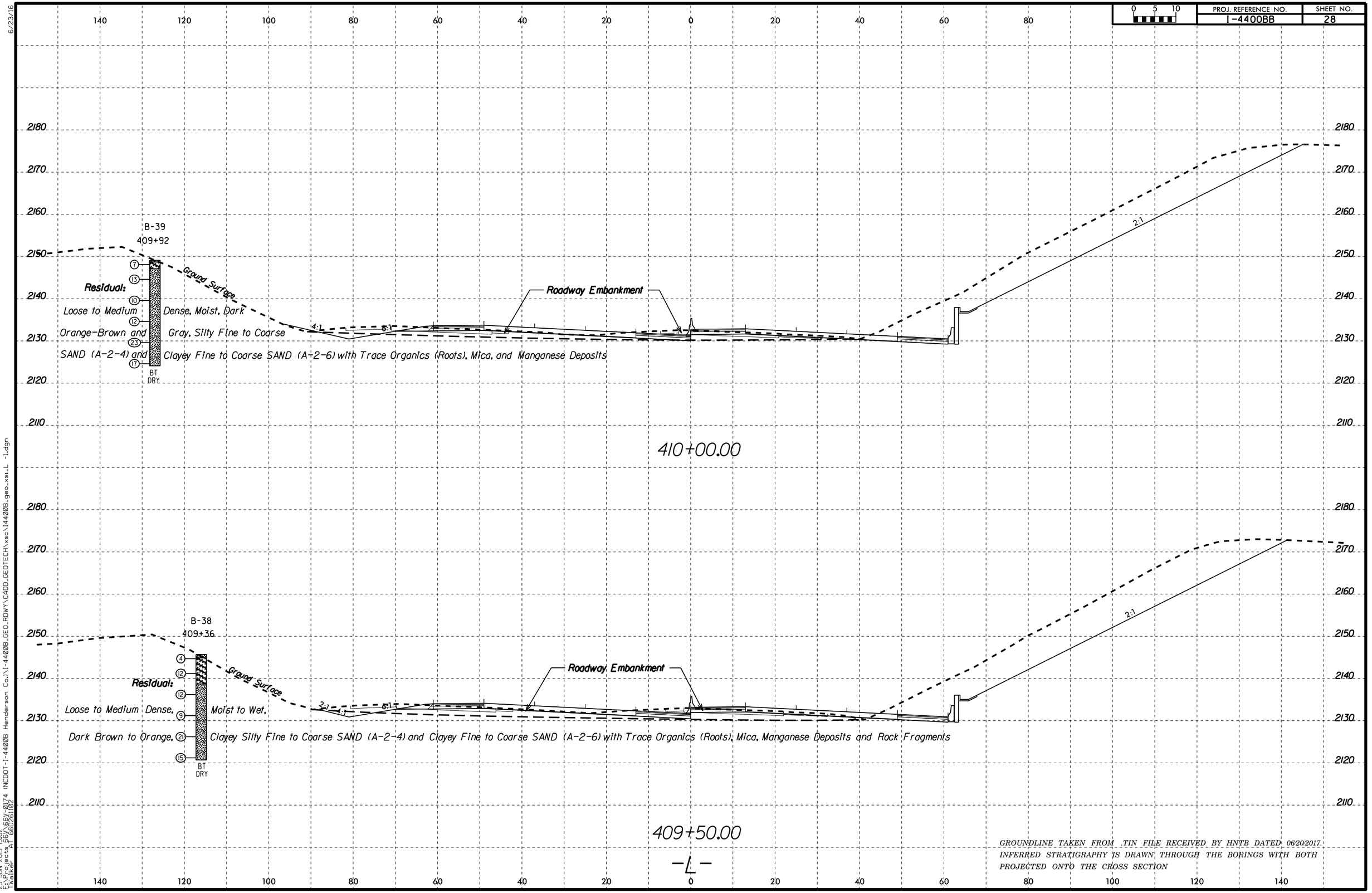
2:1 6:1 2:1 4:1

408+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	28



6/23/16

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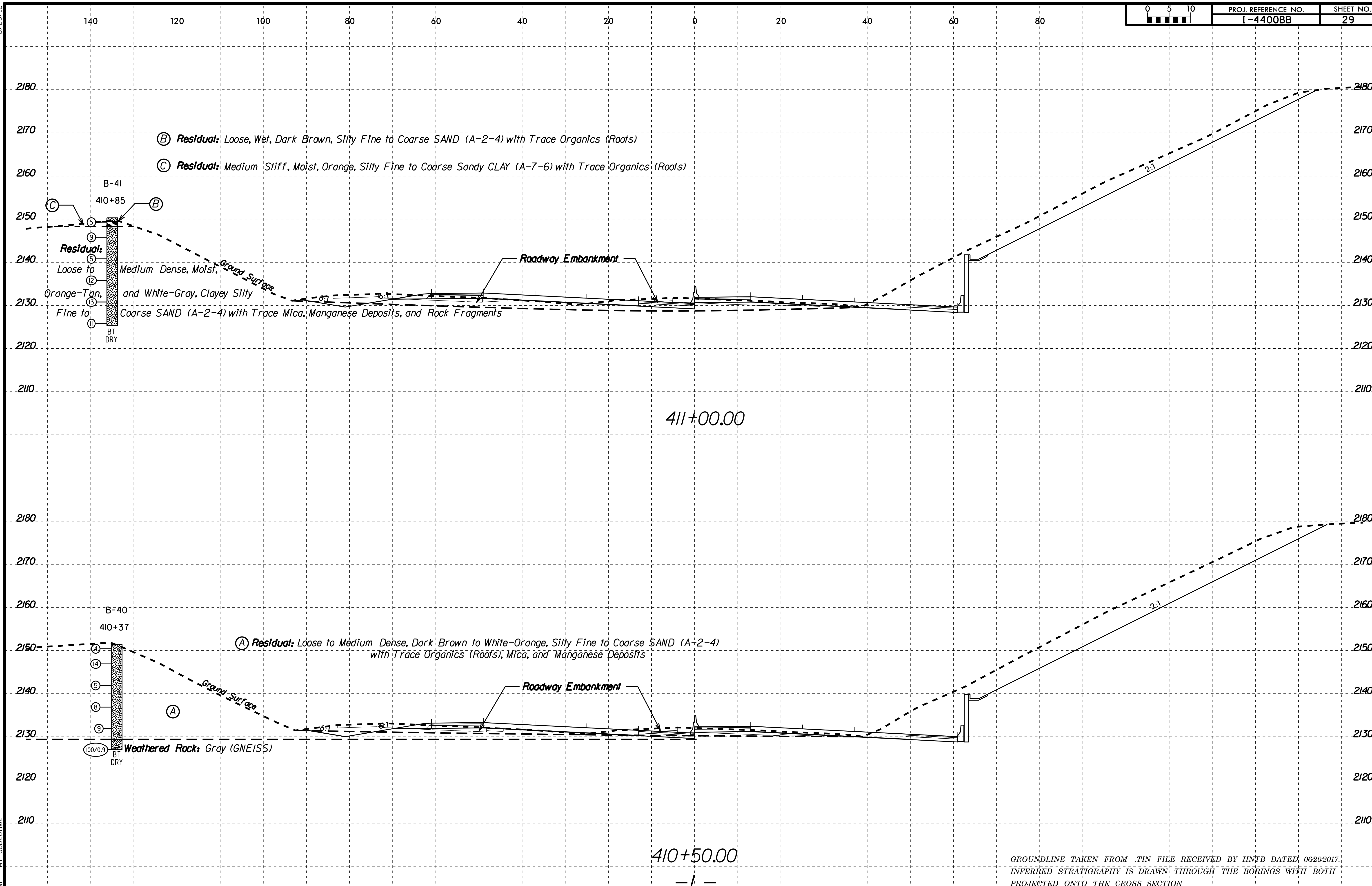
Walker AT 6602611102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20
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20
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60
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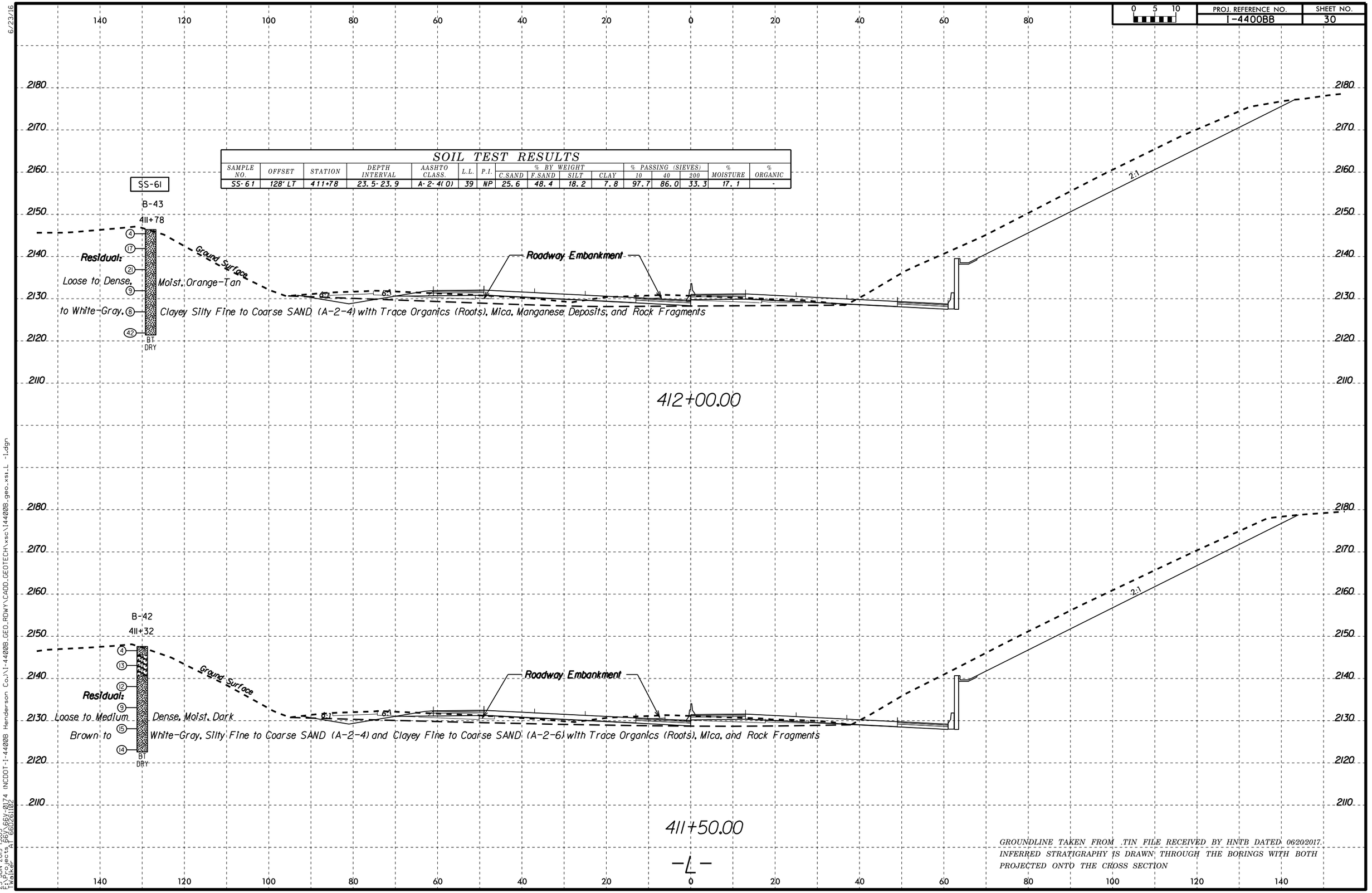
2180
2170
2160
2150
2140
2130
2120
2110
(B) Residual: Loose, Wet, Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)
(C) Residual: Medium Stiff, Moist, Orange, Silty Fine to Coarse Sandy CLAY (A-7-6) with Trace Organics (Roots)
B-41
410+85
Residual:
Loose to Medium Dense, Moist,
Orange-Tan, and White-Gray, Clayey Silty
Fine to Coarse SAND (A-2-4) with Trace Mica, Manganese Deposits, and Rock Fragments
BT
DRY
Ground Surface
Roadway Embankment
2:1
411+00.00
B-40
410+37
(A) Residual: Loose to Medium Dense, Dark Brown to White-Orange, Silty Fine to Coarse SAND (A-2-4)
with Trace Organics (Roots), Mica, and Manganese Deposits
Weathered Rock: Gray (GNEISS)
100/0.9
410+50.00
-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-61	128' LT	411+78	23.5-23.9	A-2-4(0)	39	NP	25.6	48.4	18.2	7.8	97.7	86.0	33.3	17.1	-



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

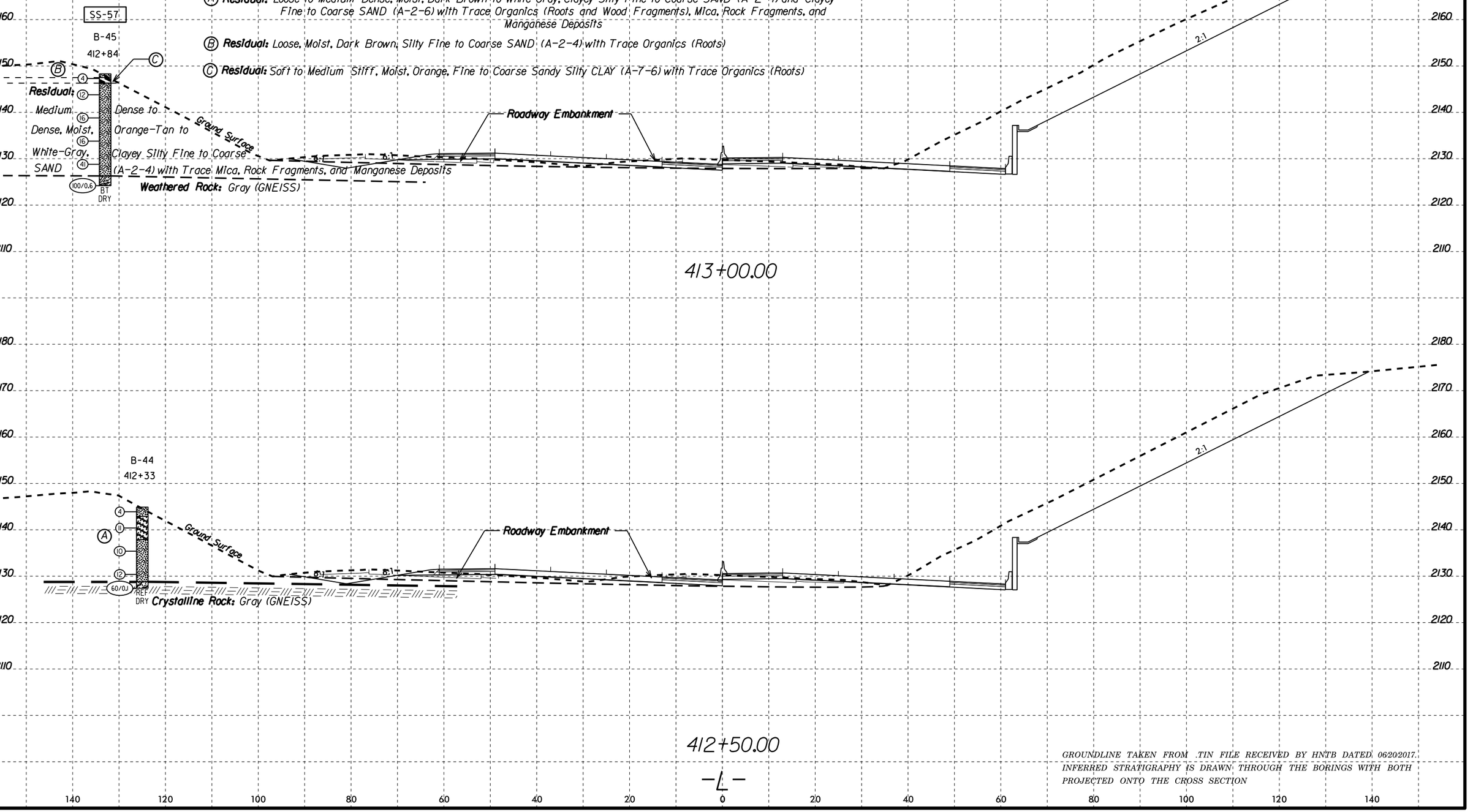
SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-57	133' LT	412+84	0.8-1.5	A-7-6(11)	47	22	19.2	24.2	17.5	39.1	98.5	87.4	60.4	24.0	-

Ⓐ **Residual:** *Loose to Medium Dense, Moist, Dark Brown to White Gray, Clayey Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots and Wood Fragments), Mica, Rock Fragments, and Manganese Deposits*

Ⓑ **Residual:** *Loose, Moist, Dark Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)*

Ⓒ **Residual:** *Soft to Medium Stiff, Moist, Orange, Fine to Coarse Sandy Silty CLAY (A-7-6) with Trace Organics (Roots)*



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-56	136' LT	413+86	3.5-5.0	A-2-4(0)	34	NP	32.5	39.3	7.9	20.3	91.0	74.8	31.2	8.5	-

SS-56

B-47

413+86

4 45 42 31 100/0.9 60/0.0 REF

Ⓐ **Residual:** Loose to Medium Dense, Moist, Dark Brown to White-Gray, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots), Mica, and Manganese Deposits

Ⓑ **Residual:** Loose to Dense, Moist to Wet, Dark Brown to White-Gray, Clayey Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots and Wood Fragments) and Rock Fragments

Ground Surface

Roadway Embankment

6:1 6:1 2:1

Weathered Rock: White-Gray (GNEISS)

DRY

Crystalline Rock: White-Gray (GNEISS)

414+00.00

B-46

413+36

4 11 8 7 60/0.0 REF

Ⓐ

Ground Surface

Roadway Embankment

6:1 6:1 2:1

Crystalline Rock: DRY Gray (GNEISS)

413+50.00

-L-

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Walker, AT 6602611102

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	33

140 120 100 80 60 40 20 0 20 40 60 80

2170
2160
2150
2140
2130
2120
2110
2100

B-48
414+37

5
14
46
100/0.9
60/0.0
REF
DRY

Ⓐ **Residual:** *Loose to Dense, Moist to Wet, Brown, Clayey Silty Fine to Coarse SAND (A-2-4) and Clayey Fine SAND (A-2-6) with Trace Organics (Roots and Wood Fragments), Mica, and Rock Fragments*

Ⓐ

Ground Surface

Roadway Embankment

6:1

6:1

2:1

Weathered Rock: *Gray (GNEISS)*

Crystalline Rock: *Gray (GNEISS)*

414+50.00
-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

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6/23/16

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TWalker AT 6602611102

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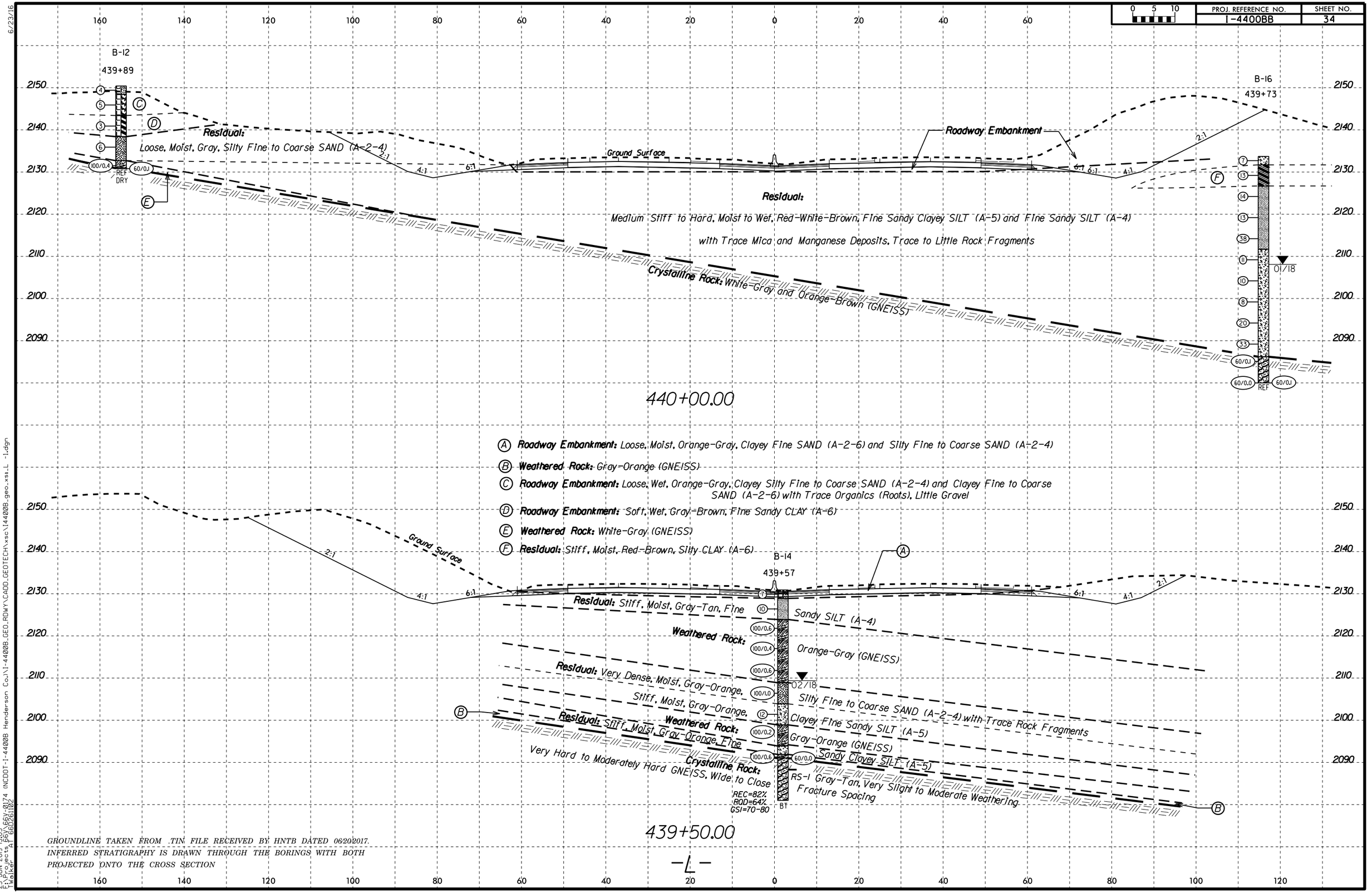


Ⓐ **Roadway Embankment:** Loose, Moist, Orange-Gray, Clayey Fine SAND (A-2-6) and Silty Fine to Coarse SAND (A-2-4)

Ⓑ **Weathered Rock:** Gray-Orange (GNEISS)

Ⓒ **Roadway Embankment:** Loose, Wet, Orange-Gray, Clayey Silty Fine to Coarse SAND (A-2-4) and Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots), Little Gravel

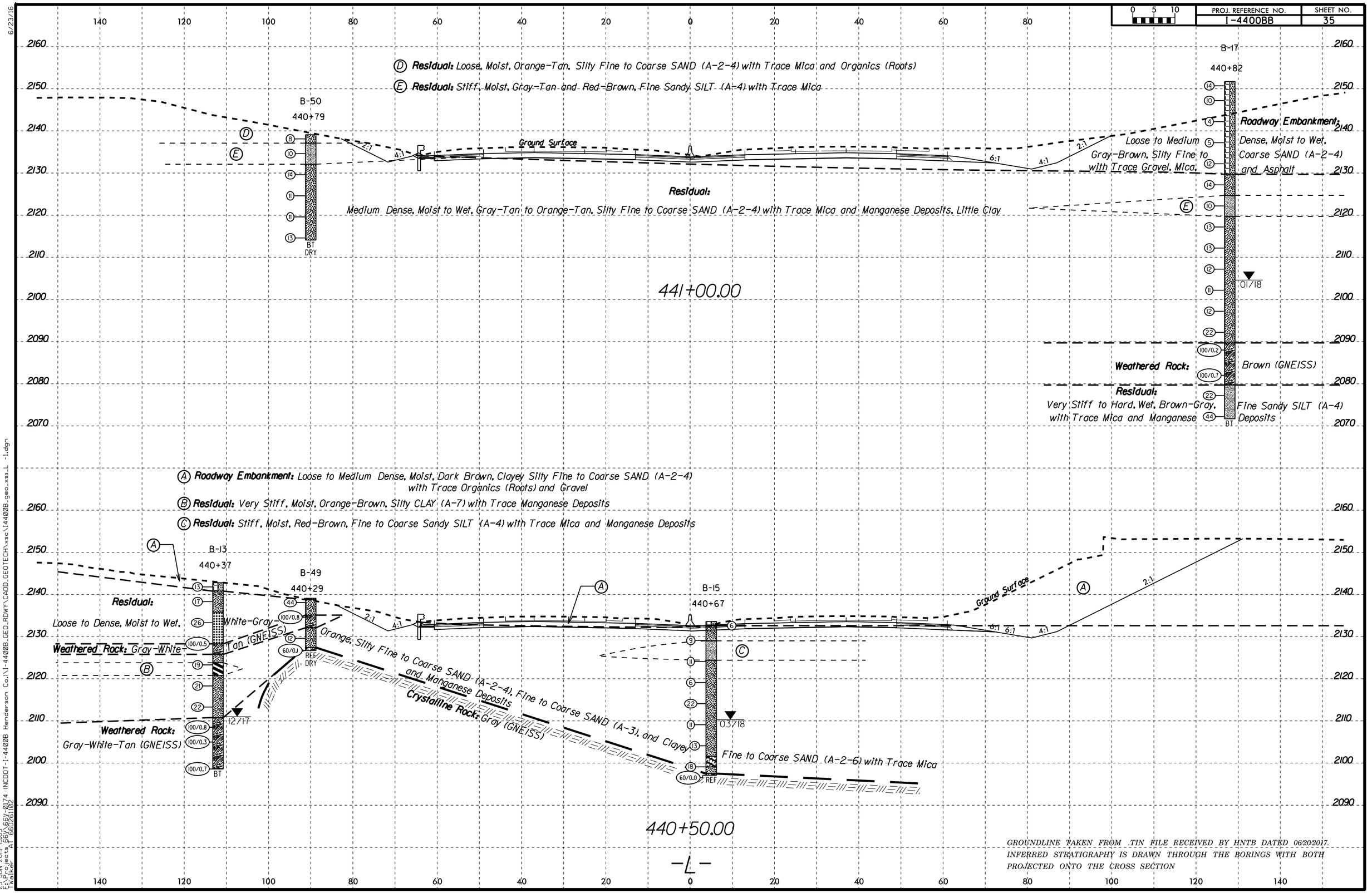
Ⓓ **Roadway Embankment:** Soft, Wet, Gray-Brown, Fine Sandy CLAY (A-6)

Ⓔ **Weathered Rock:** White-Gray (GNEISS)

Ⓕ **Residual:** Stiff, Moist, Red-Brown, Silty CLAY (A-6)

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.

INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	36

0 5 10

140 120 100 80 60 40 20 0 20 40 60 80

2170 2160 2150 2140 2130 2120 2110 2100 2090

Ⓐ **Roadway Embankment:** *Medium Dense, Moist, Brown, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)*

B-52
441+85

13 16 13 82 100/0.4 19 24
BT DRY

Residual:
Medium Dense to Very Dense, Moist, White-Gray-Orange, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits, Mica, and Rock Fragments, Little Clay

Weathered Rock: *Gray (GNEISS)*

Residual:
Medium Dense, Moist, Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Rock Fragments

Ground Surface

6:1 6:1

442+00.00

Roadway Embankment

B-51
441+19

9 13 14 14 20 100/0.5
BT DRY

4:1

Ground Surface

Roadway Embankment

6:1 6:1

Residual:
White-Gray-Orange, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay

Weathered Rock: *Gray (GNEISS)*

441+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

6/23/16
25-JUN-2019 15:06
F:\Projects_66Y\66Y-0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_RDWY\CADD_GEOTECH\xsc\I4400B_geo_xsi_L -1.dgn
Walker, AT 6602621102

140 120 100 80 60 40 20 0 20 40 60 80

2160 2150 2140 2130 2120 2110

B-54
442+69

Roadway Embankment:

Ground Surface

2:1 4:1 6:1 6:1

8 7 10 16 18 16
BT
DRY

Loose, Moist, Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) and Gravel

Residual:

Loose to Medium Dense, Moist, Orange-Tan to White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay

443+00.00

B-53
442+17

Roadway Embankment: Very Loose, Moist, Brown, Clayey

2:1 4:1

Ground Surface

3 13 9 9 24 10
BT
DRY

Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)

Residual:

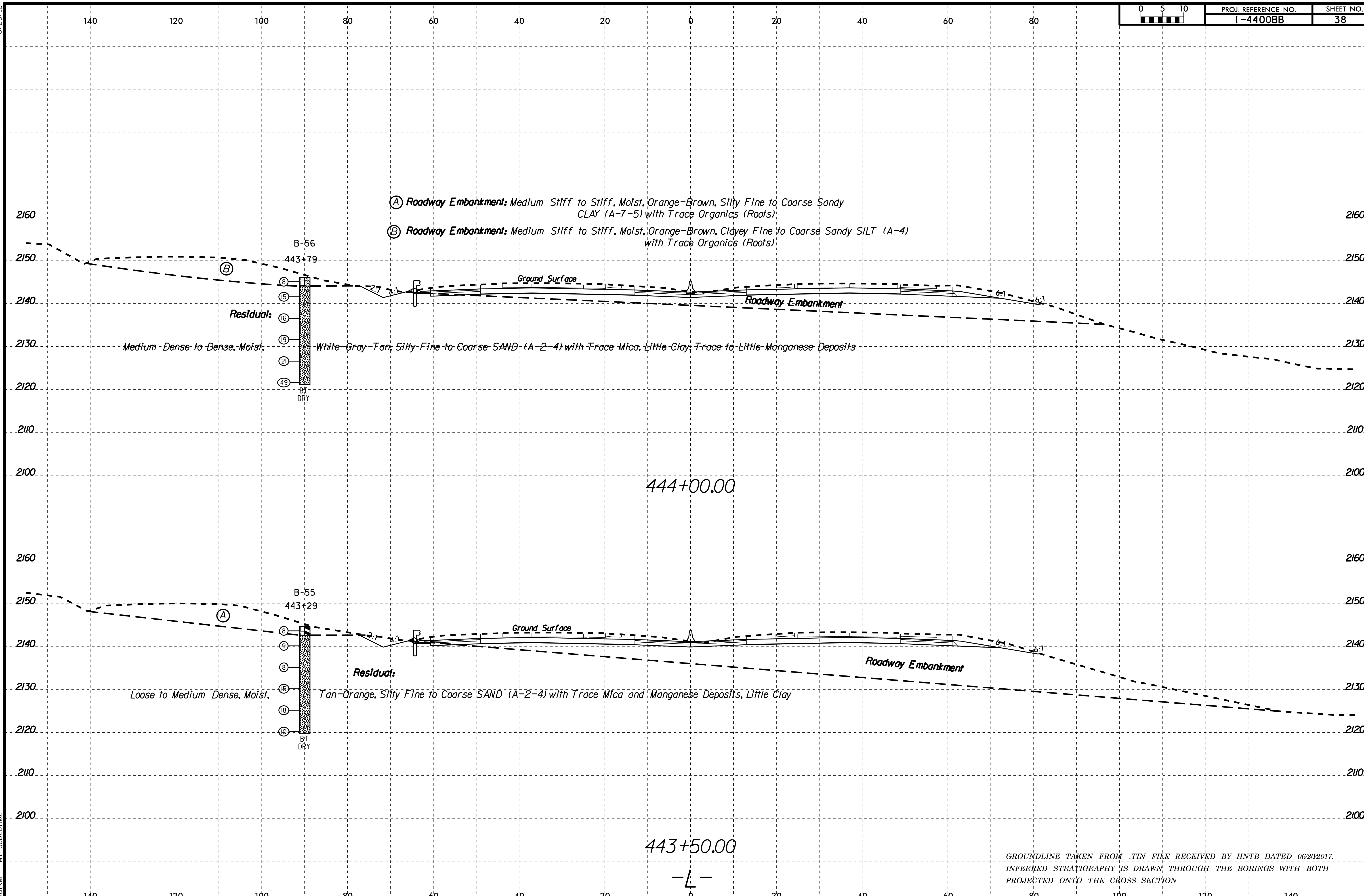
Loose to Medium Dense, Moist, White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay

442+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	38



0 5 10
140 120 100 80 60 40 20 0 20 40 60 80
2160 2150 2140 2130 2120 2110 2100
(A) Roadway Embankment: Medium Stiff to Stiff, Moist, Orange-Brown, Silty Fine to Coarse Sandy CLAY (A-7-5) with Trace Organics (Roots)
(B) Roadway Embankment: Medium Stiff to Stiff, Moist, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)
B-56
443+79
8 15 16 19 21 49
BT
DRY
Ground Surface
Roadway Embankment
Residual:
Medium Dense to Dense, Moist, White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica, Little Clay, Trace to Little Manganese Deposits
444+00.00
B-55
443+29
8 9 8 15 18 10
BT
DRY
Ground Surface
Roadway Embankment
Residual:
Loose to Medium Dense, Moist, Tan-Orange, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay
443+50.00
-L-
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

6/23/16

25-JUN-2019 15:06 F:\Projects\66V\66Y-0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_RDWY\CADD_GEOTECH\xsc\I4400B_geo_xsl_L -1.dgn
TWalker AT 66026I102

140 120 100 80 60 40 20 0 20 40 60 80

2160 2150 2140 2130 2120 2110

B-58
444+79

Ⓐ **Roadway Embankment:** Medium Stiff to Stiff, Moist, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots), Little Clay

Ground Surface

Roadway Embankment

Residual:

Loose to Very Dense, Moist, White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay

7 10 11 19 15 69 BT DRY

445+00.00

B-57
444+29

Ground Surface

Roadway Embankment

Residual:

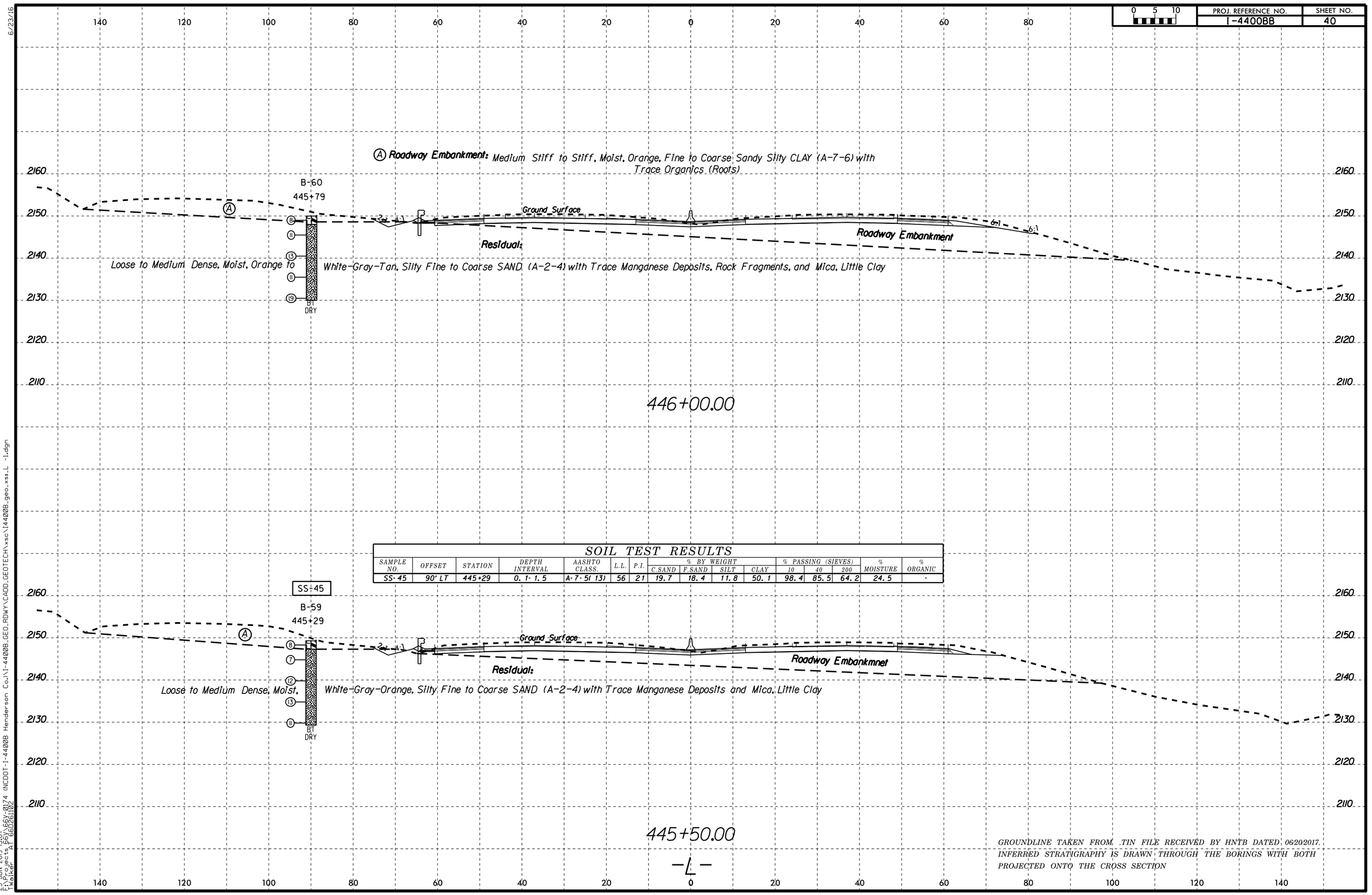
Loose to Medium Dense, Moist, White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay

Weathered Rock: 9 10 18 14 15 100/0.6 BT DRY White-Gray (GNEISS)

444+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06/20/2017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-45	90' LT	445+29	0.1-1.5	A-7-5(13)	56	21	19.7	18.4	11.8	50.1	98.4	85.5	64.2	24.5	-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	41

0 5 10

140 120 100 80 60 40 20 0 20 40 60 80

Ⓐ **Roadway Embankment:** *Very Stiff to Hard, Moist, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)*

2160 2150 2140 2130 2120

Ⓐ

B-62
446+79

19 12 10 21 23
BT
DRY

2:1 4:1

Residual:

Loose to Medium Dense, Moist, *White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Mica and Manganese Deposits, Little Clay*

Roadway Embankment

6:1 6:1 Ground Surface

447+00.00

2160 2150 2140 2130 2120 2110

Ⓐ

B-61
446+29

68 8 39 13 13
BT
DRY

2:1 4:1

Ground Surface

Residual:

Loose to Dense, Moist, *White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits, Mica, and Rock Fragments, Little Clay*

Roadway Embankment

6:1 6:1 Ground Surface

446+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

6/23/16

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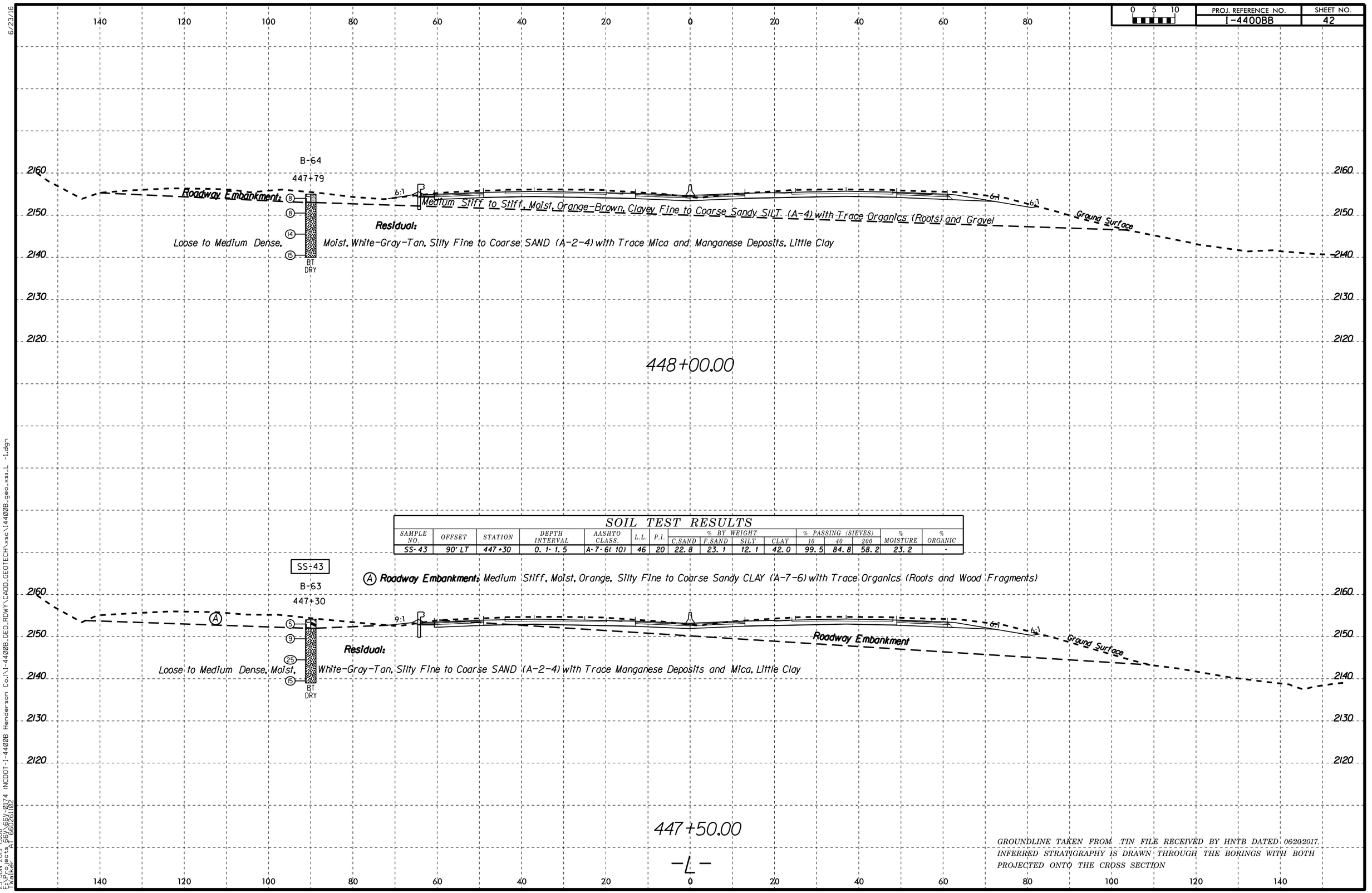
Walker, T 6602261102



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-43	90' LT	447+30	0.1-1.5	A-7-6(10)	46	20	22.8	23.1	12.1	42.0	99.5	84.8	58.2	23.2	-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	43

0 5 10

140 120 100 80 60 40 20 0 20 40 60 80

B-67
449+29

3:1

Roadway Embankment: *Stiff, Moist, Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)*

6:1

Ground Surface

Residual:

Loose to Medium Dense, Moist, White-Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese and Mica, Little Clay

9 13 8 10

BT
DRY

2160 2150 2140 2130

449+50.00

B-66
448+79

Ground Surface

5:1

Roadway Embankment: *Medium Stiff, Moist, Brown-Orange, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)*

6:1

Residual:

Loose to Medium Dense, Moist, White-Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits and Mica, Little Clay

7 6 8 10

BT
DRY

2160 2150 2140 2130

449+00.00

SS-41
SS-42
B-65
448+29

Ground Surface

5:1

Roadway Embankment: *Medium Stiff, Moist, Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)*

6:1

Residual:

Loose to Medium Dense, Moist, White-Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits and Mica, Little Clay

6 9 13 14

BT
DRY

2160 2150 2140 2130 2120

448+50.00

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-41	90' LT	448+29	0.1-1.5	A-4(0)	NP	NP	33.2	26.3	9.0	31.5	98.3	76.3	44.4	18.9	-
SS-42	90' LT	448+29	3.5-5.0	A-2-4(0)	35	NP	40.9	35.7	11.1	12.3	98.7	72.2	29.5	13.5	-

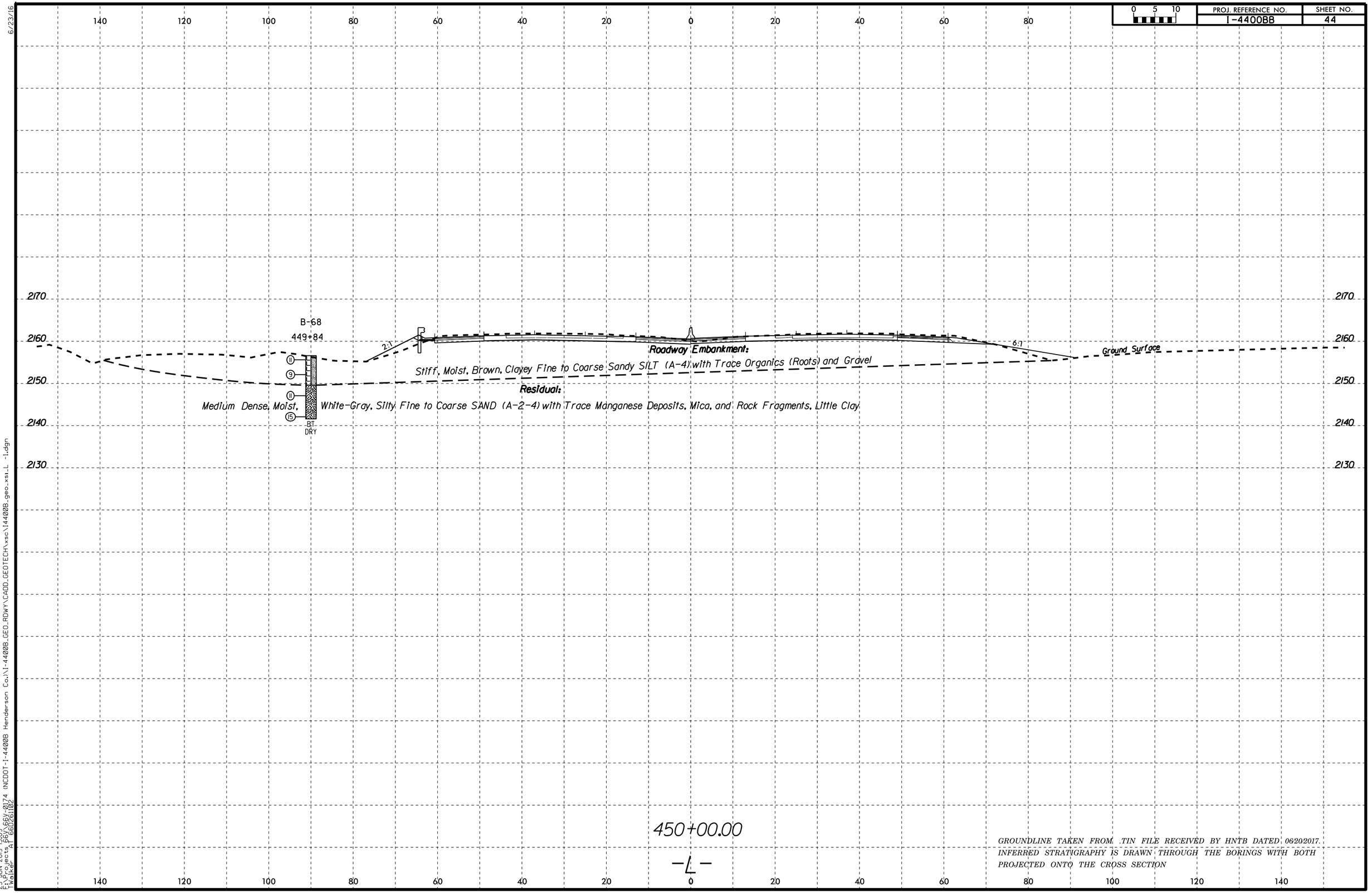
448+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

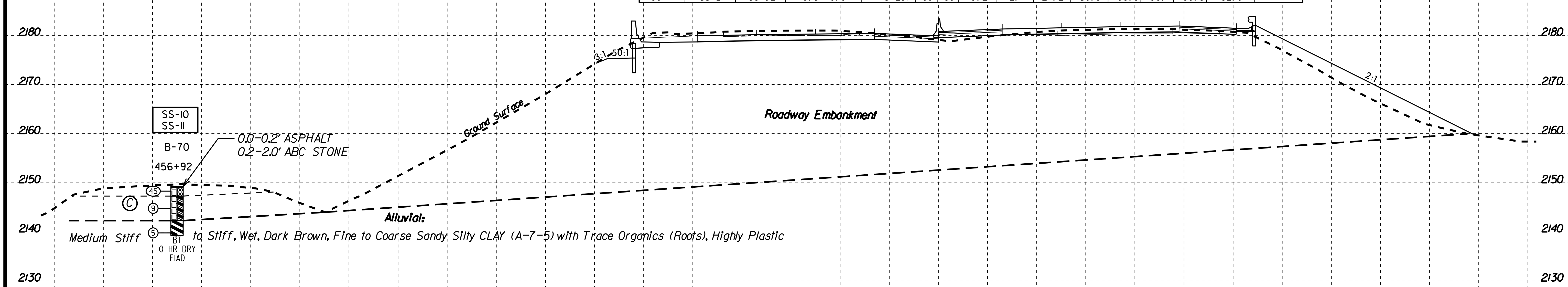
6/23/16
25-JUN-2019 15:08
F:\Projects_66y\66y_0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_RDWY\CADD_GEOTECH\xsc\I4400B_geo_xsL -1.dgn
T Walker AT 6602611102



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-10	155' LT	456+92	3.5-5.0	A-6(6)	38	16	24.6	25.5	15.4	34.5	97.8	82.7	53.6	17.7	-
SS-11	155' LT	456+92	8.5-10.0	A-7-5(26)	60	30	9.2	12.7	27.2	50.9	98.9	93.1	80.6	32.0	-



457+00.00

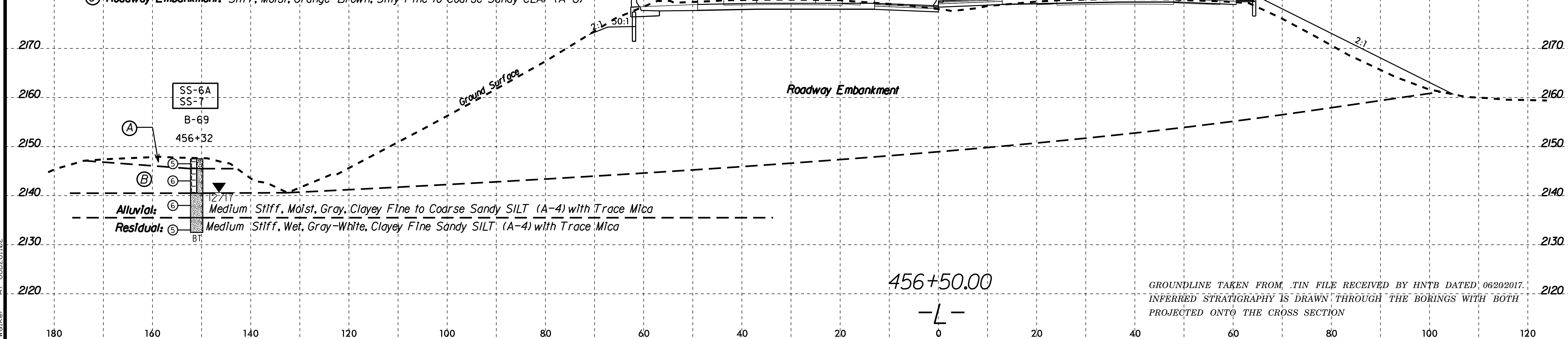
SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-6A	151' LT	456+32	3.5-5.0	A-4(2)	28	9	28.4	26.5	17.3	27.8	94.3	77.0	47.3	17.0	-
SS-7	151' LT	456+32	8.5-10.0	A-4(0)	NP	NP	31.1	33.9	14.3	20.7	96.1	78.4	39.4	17.6	-

(A) **Roadway Embankment:** Loose, Wet, Gray-Tan, Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) and Gravel

(B) **Roadway Embankment:** Medium Stiff, Moist, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots)

(C) **Roadway Embankment:** Stiff, Moist, Orange-Brown, Silty Fine to Coarse Sandy CLAY (A-6)



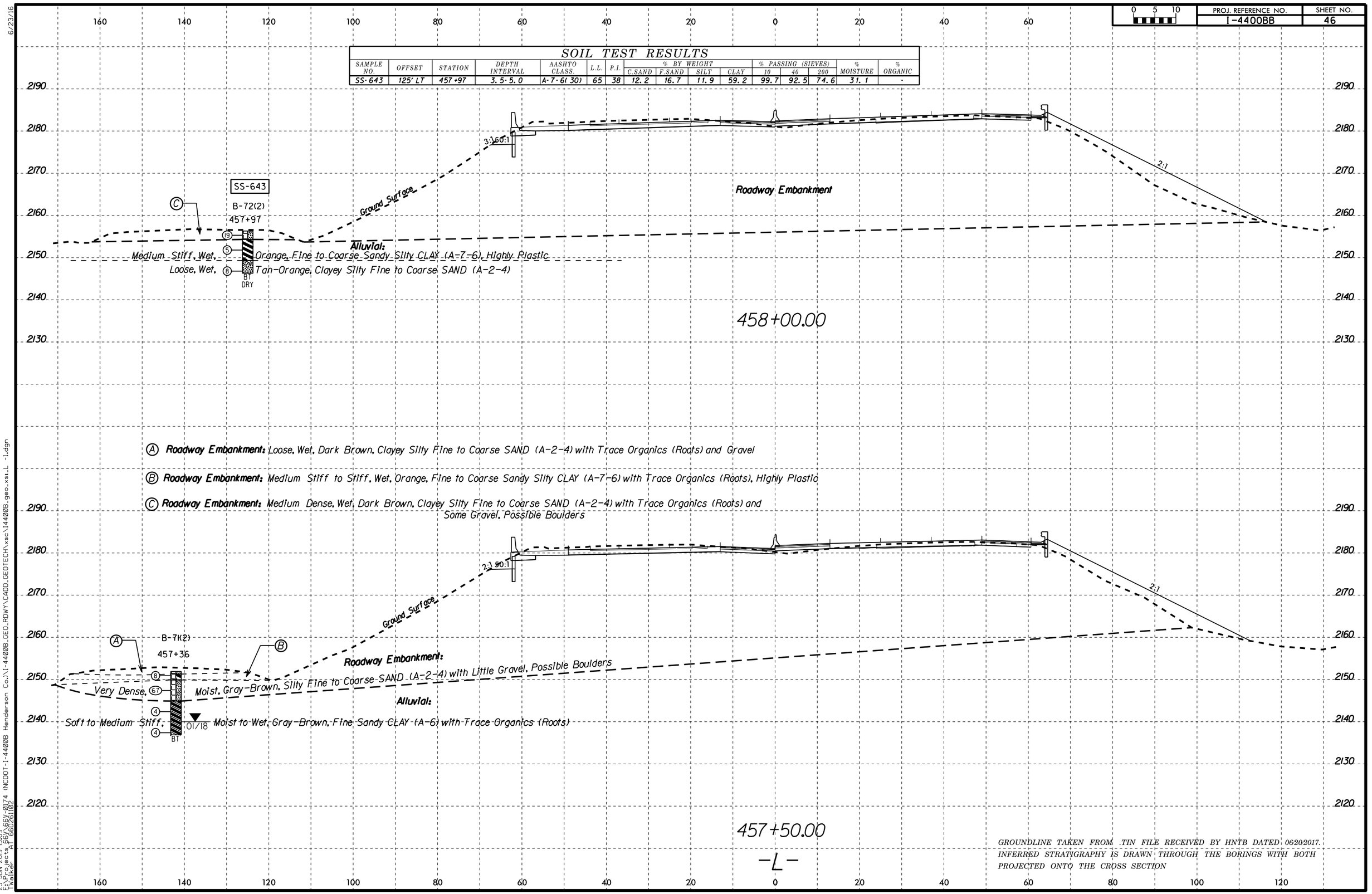
456+50.00

-L-

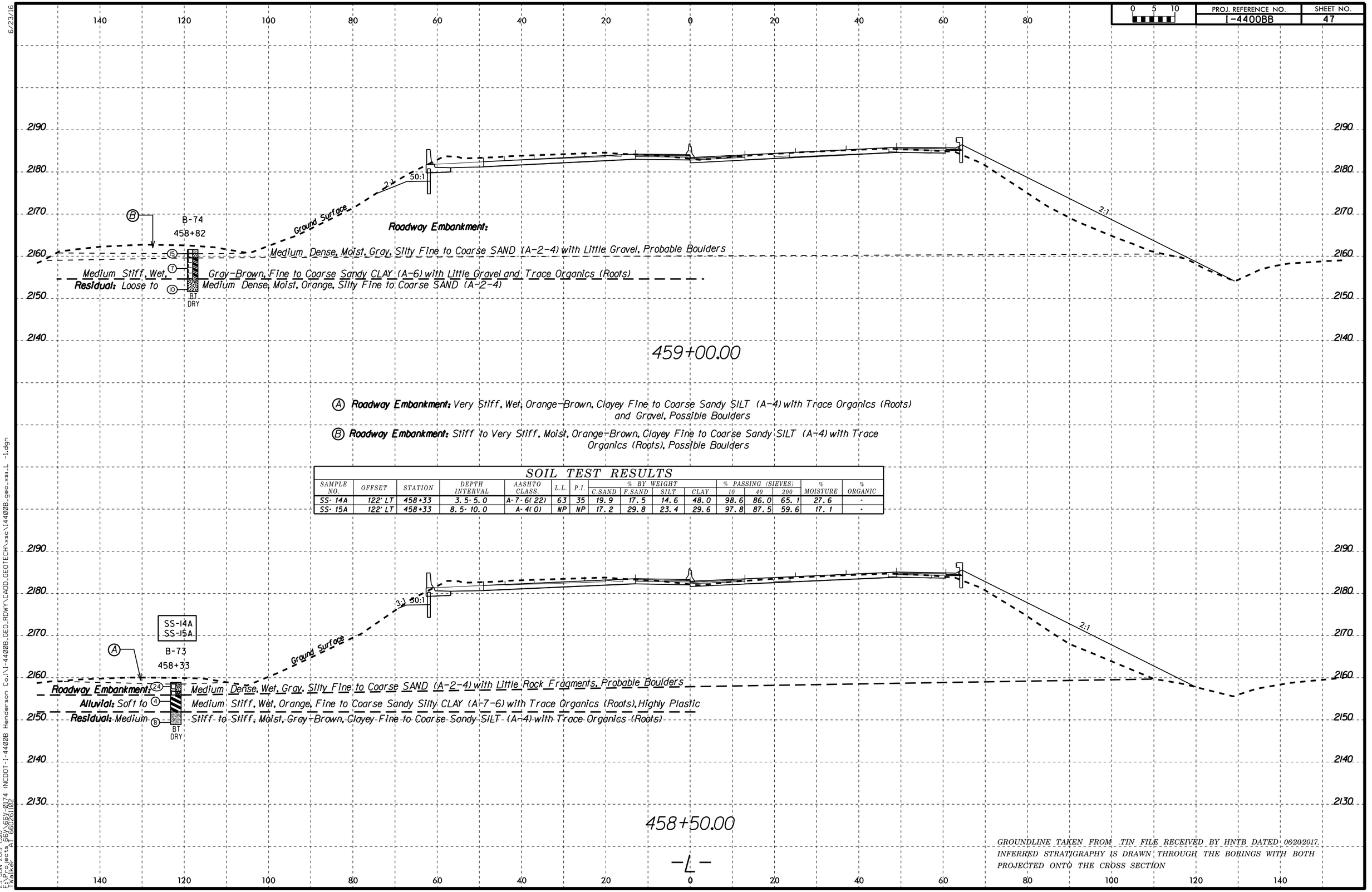
GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	% BY WEIGHT F.SAND	% BY WEIGHT SILT	% BY WEIGHT CLAY	% PASSING (SIEVES) 10	% PASSING (SIEVES) 40	% PASSING (SIEVES) 200	% MOISTURE	% ORGANIC
SS-643	125' LT	457+97	3.5-5.0	A-7-6(30)	65	38	12.2	16.7	11.9	59.2	99.7	92.5	74.6	31.1	-



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION



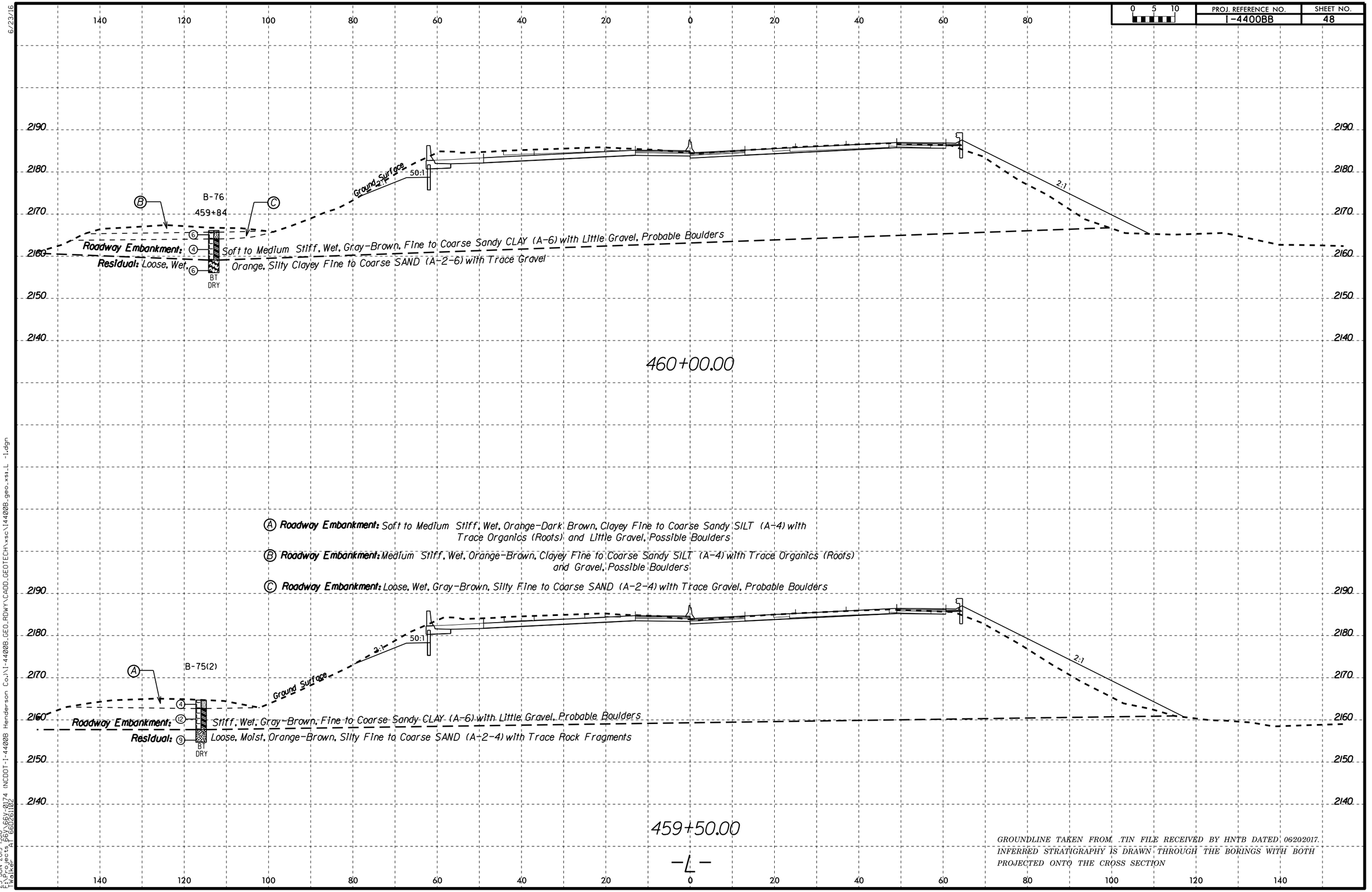
Ⓐ **Roadway Embankment:** Very Stiff, Wet, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots) and Gravel, Possible Boulders

Ⓑ **Roadway Embankment:** Stiff to Very Stiff, Moist, Orange-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Organics (Roots), Possible Boulders

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-14A	122' LT	458+33	3.5-5.0	A-7-6(22)	63	35	19.9	17.5	14.6	48.0	98.6	86.0	65.1	27.6	-
SS-15A	122' LT	458+33	8.5-10.0	A-4(0)	NP	NP	17.2	29.8	23.4	29.6	97.8	87.5	59.6	17.1	-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

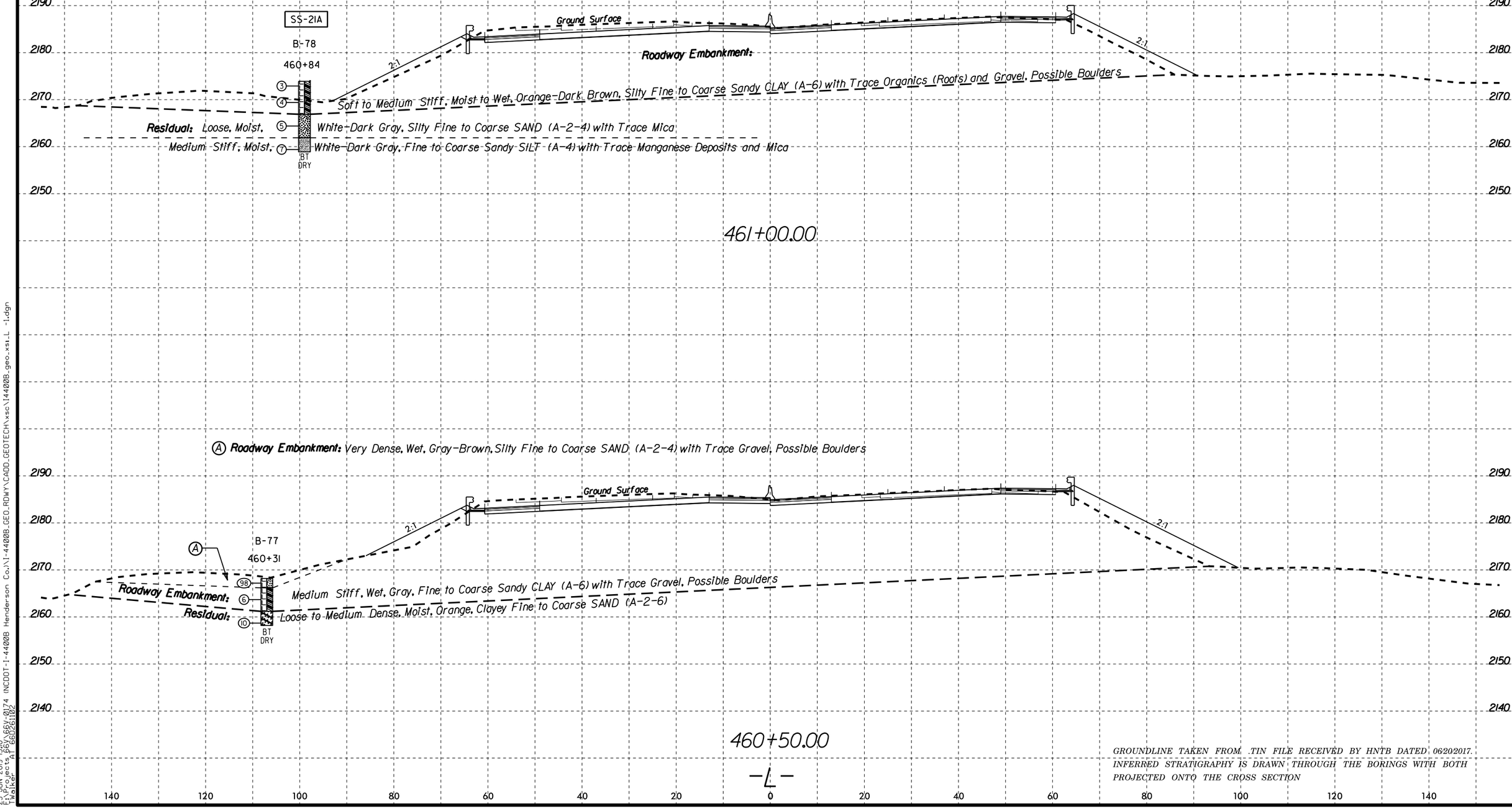


GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	49

SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING (SIEVES)			% MOISTURE	% ORGANIC
							C.SAND	F.SAND	SILT	CLAY	10	40	200		
SS-21A	99' LT	460+84	3.5-5.0	A-6(4)	31	13	24.2	22.8	20.9	32.1	96.9	82.4	55.9	18.1	-



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

140 120 100 80 60 40 20 0 20 40 60 80

2190 2180 2170 2160 2150

B-81
462+26

Roadway Embankment

Ground Surface

6:1

Residual:

Soft, Wet. (2) Orange-Brown, Silty Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots)

Medium Dense, Moist. (11) Orange-Gray-Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Rock Fragments and Manganese Deposits

(12) BT DRY

462+50.00

B-80
461+87

Ground Surface

2:1

6:1

Roadway Embankment:

Loose, Moist, Gray-Brown, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)

Residual:

(5) (2) Soft, Wet. Orange, Silty Fine to Coarse Sandy CLAY (A-6)

(8) Loose, Moist. White-Gray-Orange, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits

BT DRY

462+00.00

B-79
461+39

Ground Surface

2:1

2:1

Roadway Embankment:

Soft, Wet, Orange-Dark Brown, Silty Fine to Coarse Sandy CLAY (A-6) with Trace Organics (Roots), Possible Boulders

Residual: Medium Stiff, Wet. (3) (5) Gray, Fine to Coarse Sandy CLAY (A-6) with Trace Rock Fragments

Loose, Wet. (6) Orange, Clayey Fine to Coarse SAND (A-2-6)

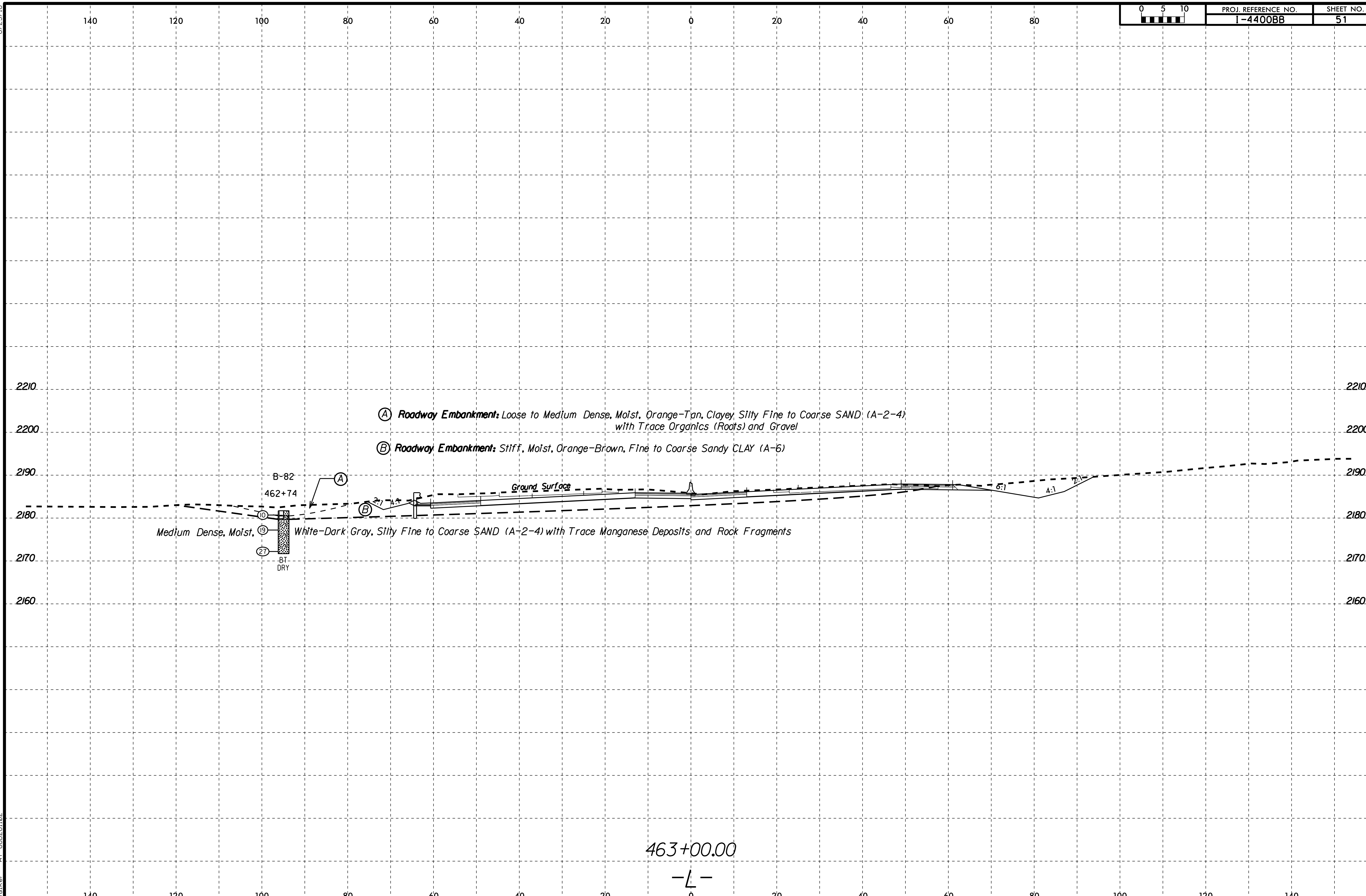
BT DRY

461+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	51


0 5 10
140 120 100 80 60 40 20 0 20 40 60 80
2210
2200
2190
2180
2170
2160
Ⓐ Roadway Embankment: Loose to Medium Dense, Moist, Orange-Tan, Clayey Silty Fine to Coarse SAND (A-2-4) with Trace Organics (Roots) and Gravel
Ⓑ Roadway Embankment: Stiff, Moist, Orange-Brown, Fine to Coarse Sandy CLAY (A-6)
B-82
462+74
Ground Surface
2:1
4:1
6:1
4:1
2:1
10
19
27
Medium Dense, Moist, White-Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits and Rock Fragments
BT
DRY
463+00.00
-L-
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

6/23/16

25-JUN-2019 15:11
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TWalker AT 66D261102

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	52

140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

2210
2200
2190
2180
2170
2160

B-83
464+29

Ground Surface
Residual:
Medium Stiff to Stiff, Moist, Orange-Brown, Silty Fine to Coarse Sandy CLAY (A-6) and Silty CLAY (A-7) with Trace Organics (Roots and Wood Fragments)
Medium Dense, Moist, White-Dark Gray, Silty Fine to Coarse SAND (A-2-4) with Trace Manganese Deposits

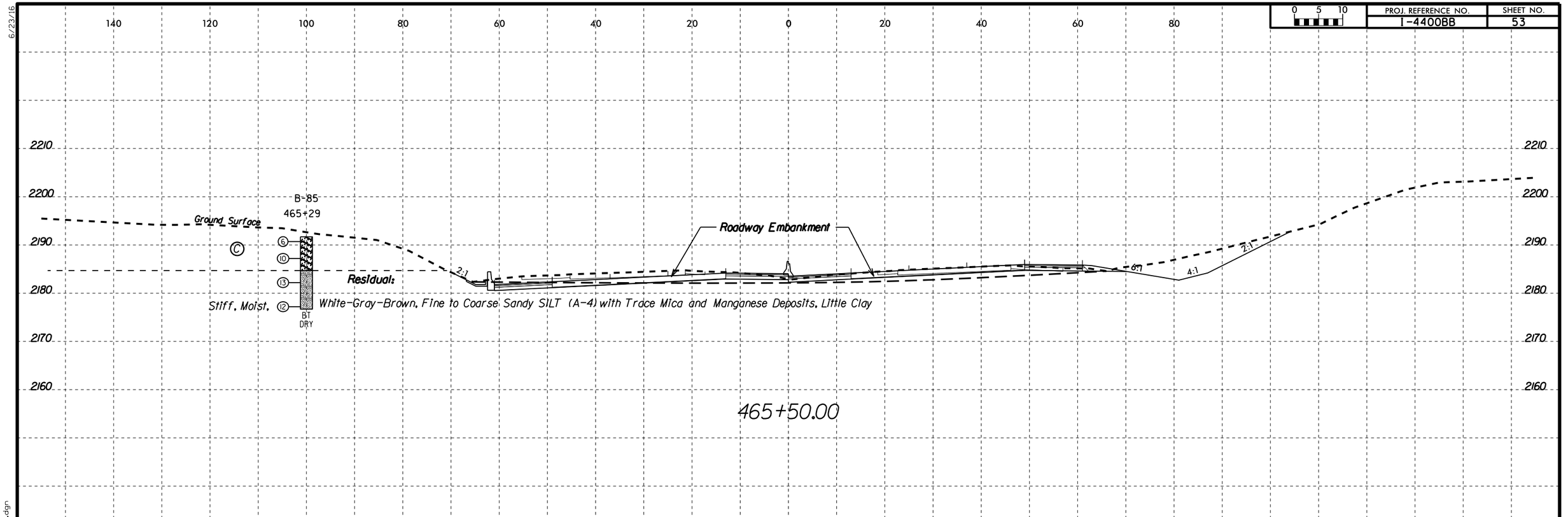
5
8
13
BT
DRY

2:1
2:1
6:1
4:1
2:1

464+50.00
-L-

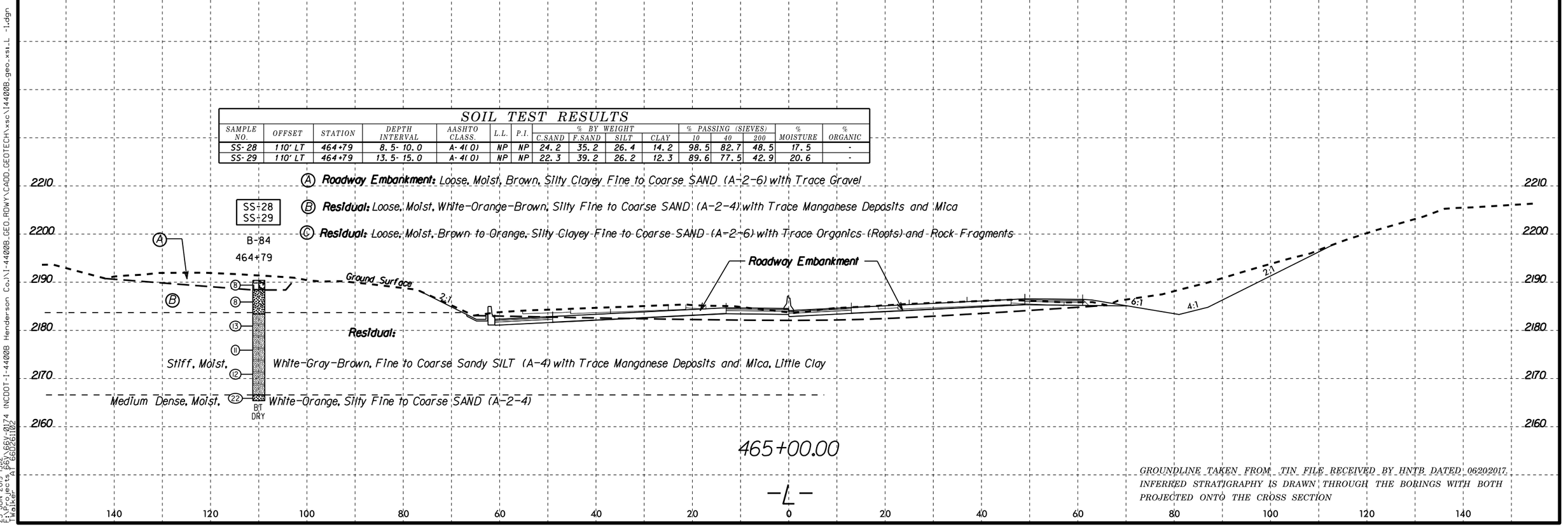
GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

25-JUN-2019 15:12
E:\Projects_66V\66V.0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_RDWY\CADD_GEOTECH\xsc\I4400B_geo_xs1_L_1.dgn
Walker, AT 6602611102



SOIL TEST RESULTS

SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-28	110' LT	464+79	8.5- 10.0	A-4(0)	NP	NP	24.2	35.2	26.4	14.2	98.5	82.7	48.5	17.5	-
SS-29	110' LT	464+79	13.5- 15.0	A-4(0)	NP	NP	22.3	39.2	26.2	12.3	89.6	77.5	42.9	20.6	-



PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	54

0 5 10

140 120 100 80 60 40 20 0 20 40 60 80

2200 2190 2180 2170 2160

B-87
466+29
A

Ground Surface

6 6 10 7 10
BT
DRY

Residual: Medium Stiff to Stiff, Moist, White-Gray-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Mica, Rock Fragments, and Manganese Deposits, Little Clay

2:1

Roadway Embankment

6:1 4:1 2:1

466+50.00

2210 2200 2190 2180 2170 2160

A **Residual:** Loose, Moist to Wet, Brown-Orange, Silty Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)

A

B-86
465+79

Ground Surface

4 8 10 10 10
BT
DRY

Residual: Medium Stiff to Stiff, Wet to Moist, White-Gray-Brown, Fine to Coarse Sandy SILT (A-4) with Trace Mica and Manganese Deposits, Little Clay

2:1

Roadway Embankment

6:1 4:1 2:1

466+00.00

-L-

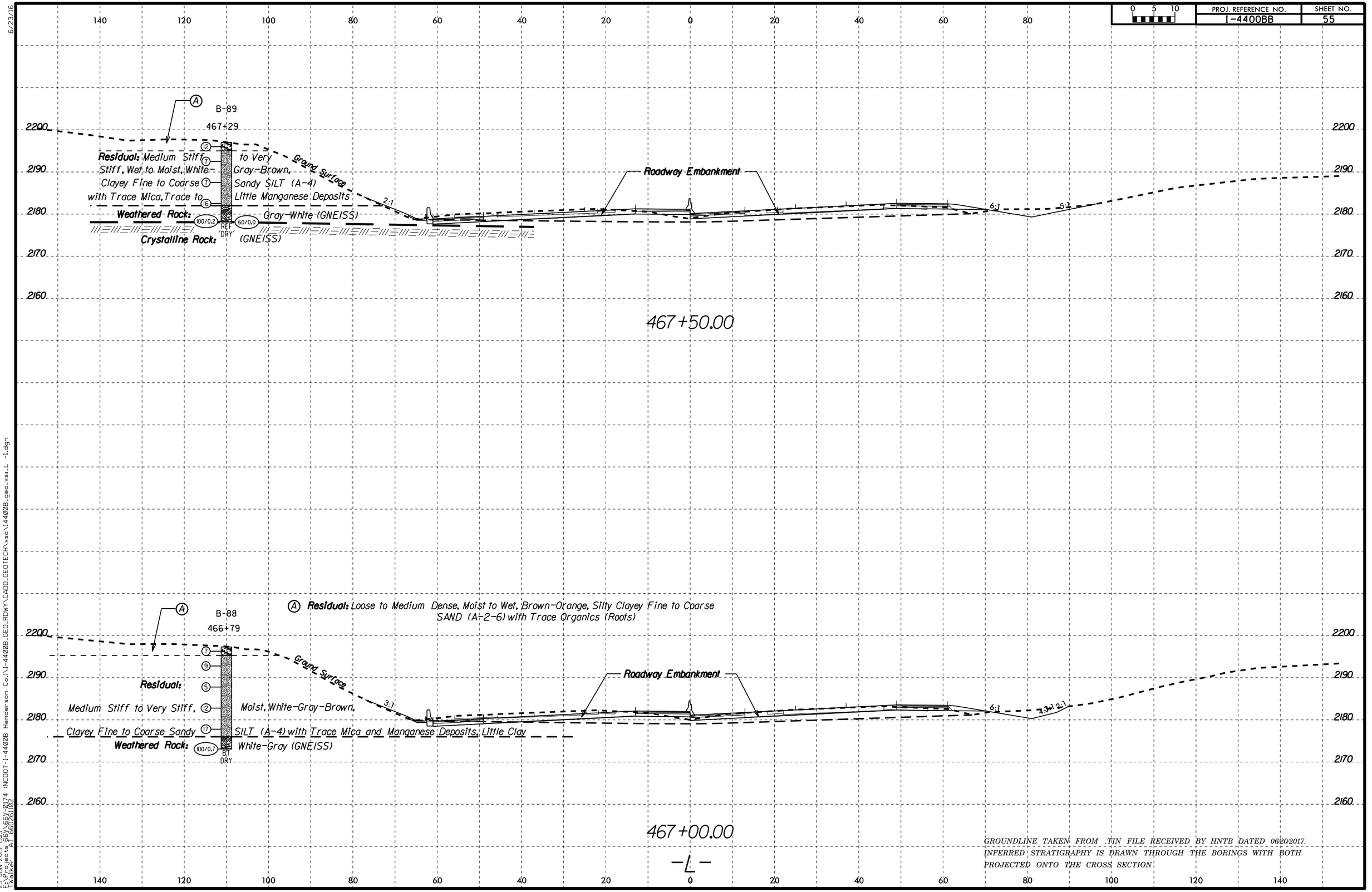
GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

6/23/16

25-JUN-2019 15:12
F:\Projects_66\66V-0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_ROW\CADD_GEOTECH\xsc\I4400B_geo_xsL -1.dgn
Walker, A. 6602261102

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	55



Ⓐ **Residual:** Loose, Moist, Orange, Silty Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots) and Mica

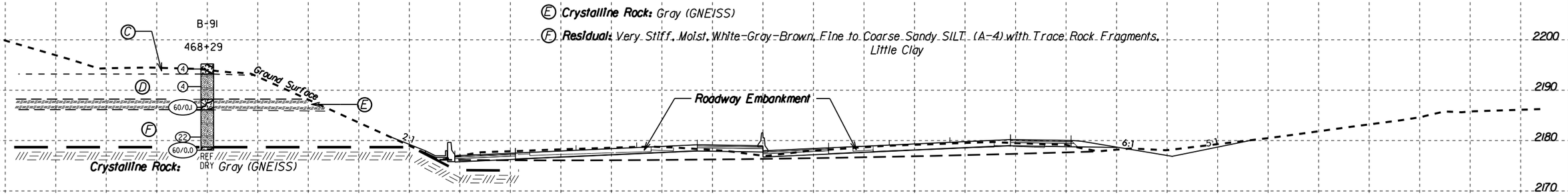
Ⓑ **Weathered Rock:** Gray (GNEISS)

Ⓒ **Residual:** Loose, Wet, Brown, Silty Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)

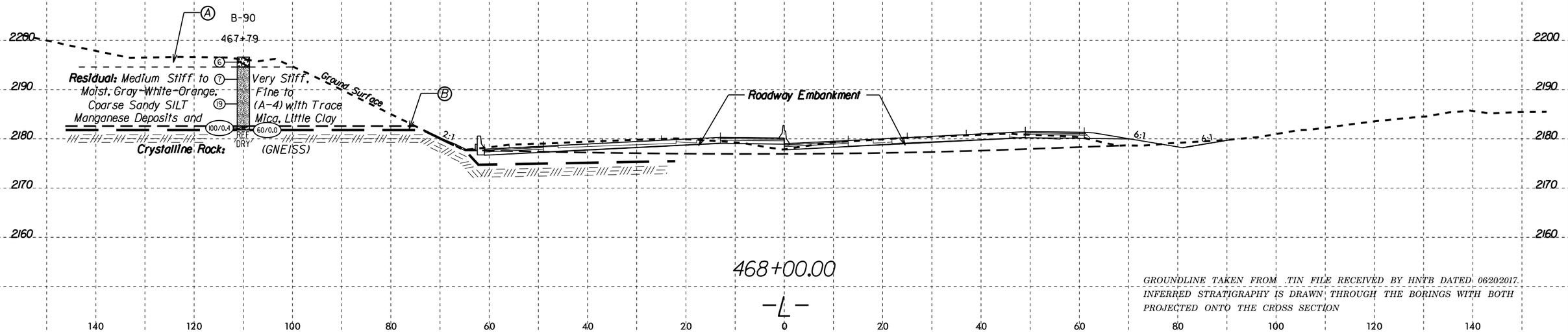
Ⓓ **Residual:** Soft to Medium Stiff, Moist, White-Gray-Brown, Fine to Coarse Sandy SILT (A-4) with Little Clay

Ⓔ **Crystalline Rock:** Gray (GNEISS)

Ⓕ **Residual:** Very Stiff, Moist, White-Gray-Brown, Fine to Coarse Sandy SILT (A-4) with Trace Rock Fragments, Little Clay



468+50.00

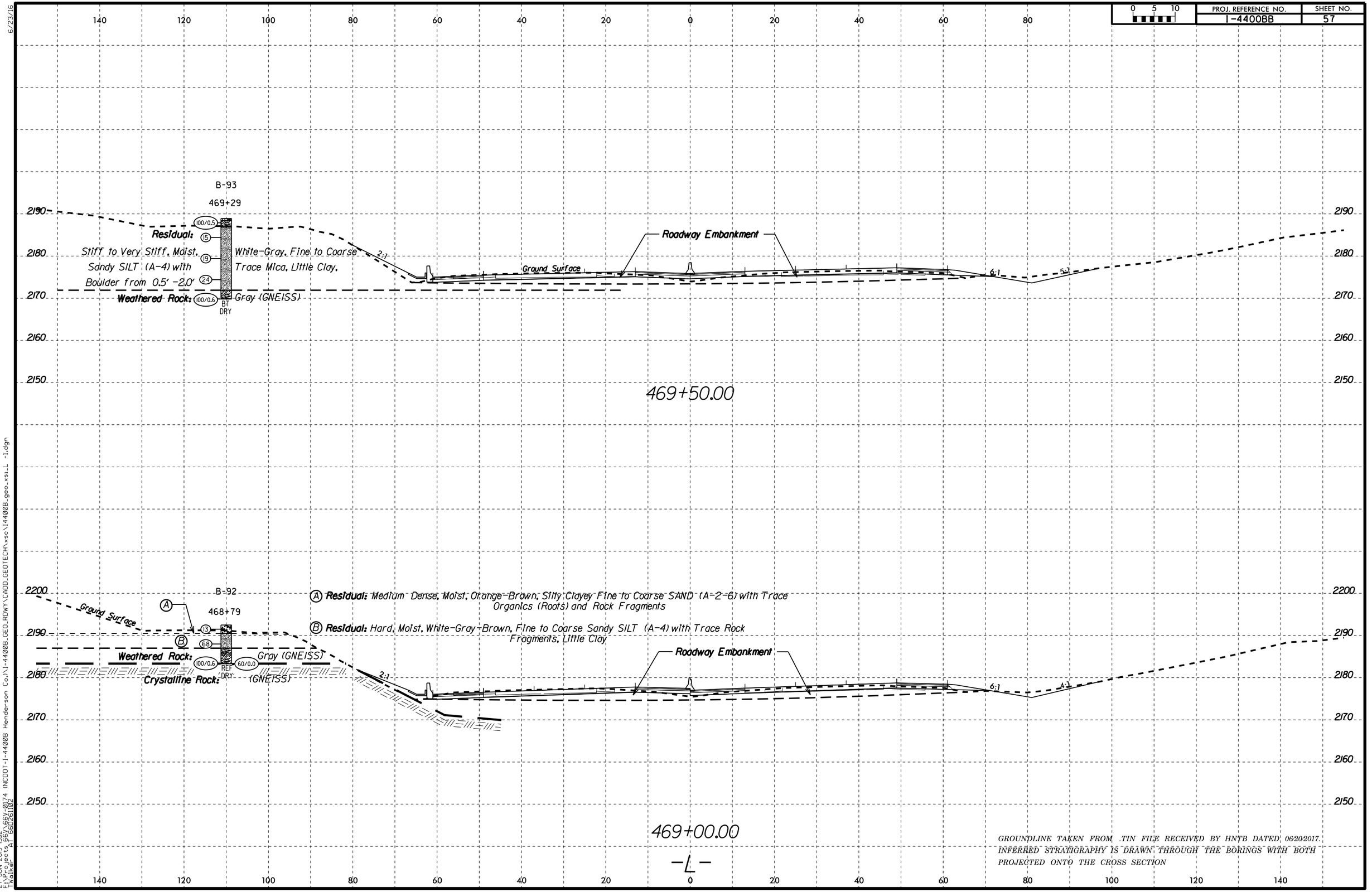


468+00.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	57



PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	58

0 5 10

140 120 100 80 60 40 20 0 20 40 60 80

Ⓐ **Residual:** *Medium Dense, Moist, Brown, Silty Fine to Coarse SAND (A-2-4) with Trace Rock Fragments, Mica, and Manganese Deposits*

Ⓑ **Roadway Embankment:** *Medium Dense, Moist, Brown, Silty Fine to Coarse SAND (A-2-4) and Silty Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots), Gravel, and Mica*

2180
2170
2160
2150

B-96
470+79
13
11
9
BT
DRY
Ⓑ
Ⓑ
Ground Surface
Residual: *Stiff, Moist,* *White-Gray-Brown, Fine to Coarse Sandy SILT (A-4) with Trace Mica, Little Clay*
2:1
Ⓑ
6:1
6:1

471+00.00

Ⓑ
B-95
470+34
Ground Surface
12
Ⓐ
12
9
BT
DRY
2:1
Roadway Embankment
6:1
6:1
Residual: *Stiff, Moist, White-Gray, Fine to Coarse Sandy SILT (A-4) with Trace Mica and Rock Fragments, Little Clay*

470+50.00

2190
2180
2170
2160
2150

B-94
469+79
9
100/0.6
100/0.9
9
13
BT
DRY
Ground Surface
Weathered Rock: *Gray (GNEISS)*
Residual: *Stiff, Moist,* *White-Gray, Fine to Coarse Sandy SILT (A-4) with Trace Mica, Little Clay*
2:1
Roadway Embankment
6:1
6:1

470+00.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

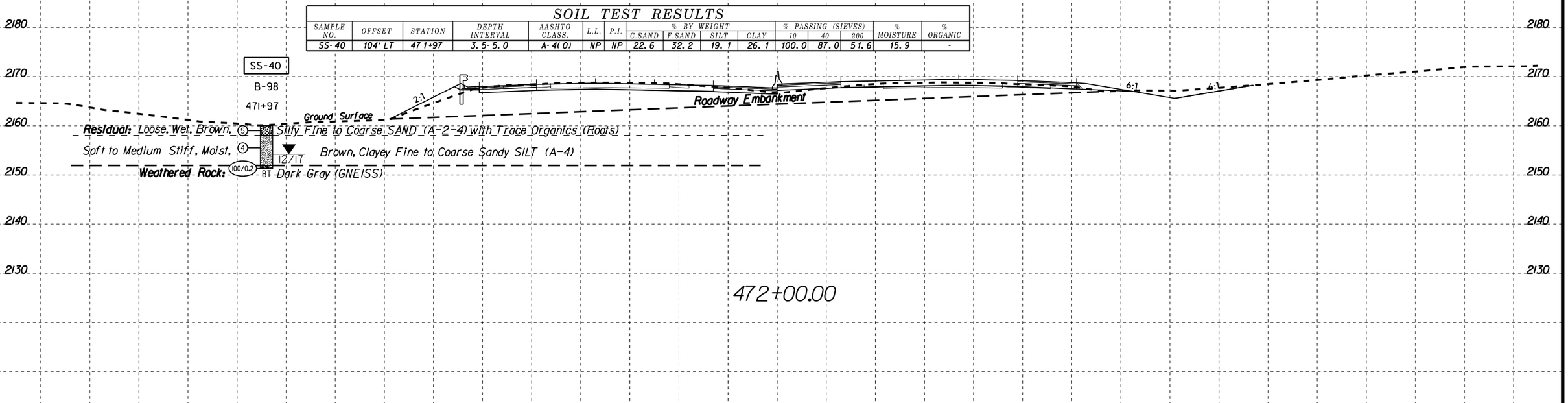
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140

6/23/16

25-JUN-2019 15:14
F:\Projects_66\66V-0174 (NCDOT-I-4400B Henderson Co.)\I-4400B_GEO_ROWY\CADD_GEOTECH\xsc\I4400B_geo_xsL -1.dgn
Walker, AT 6602261102

SOIL TEST RESULTS

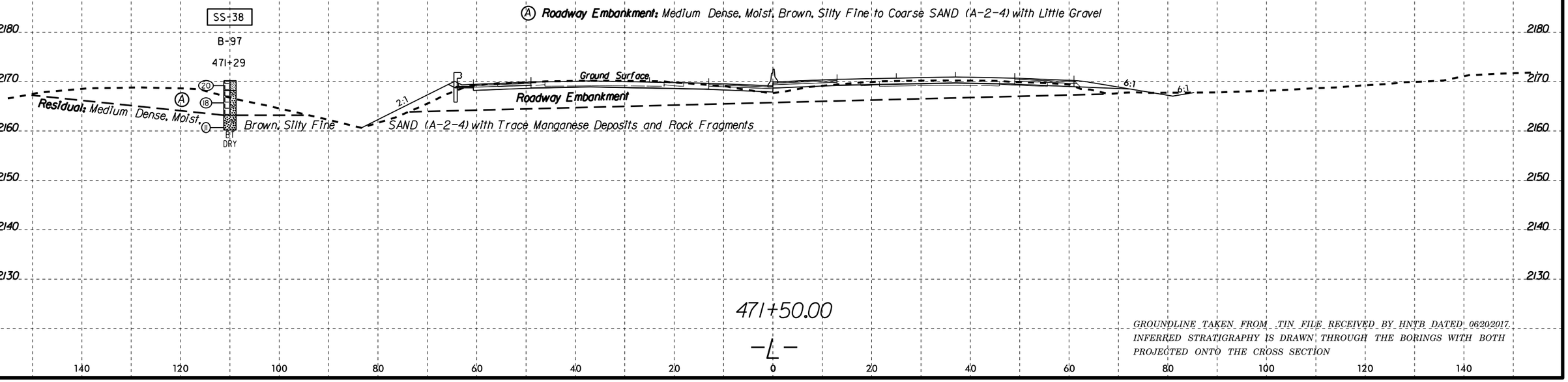
SAMPLE NO.	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-40	104' LT	471+97	3.5-5.0	A-4(0)	NP	NP	22.6	32.2	19.1	26.1	100.0	87.0	51.6	15.9	-



SOIL TEST RESULTS

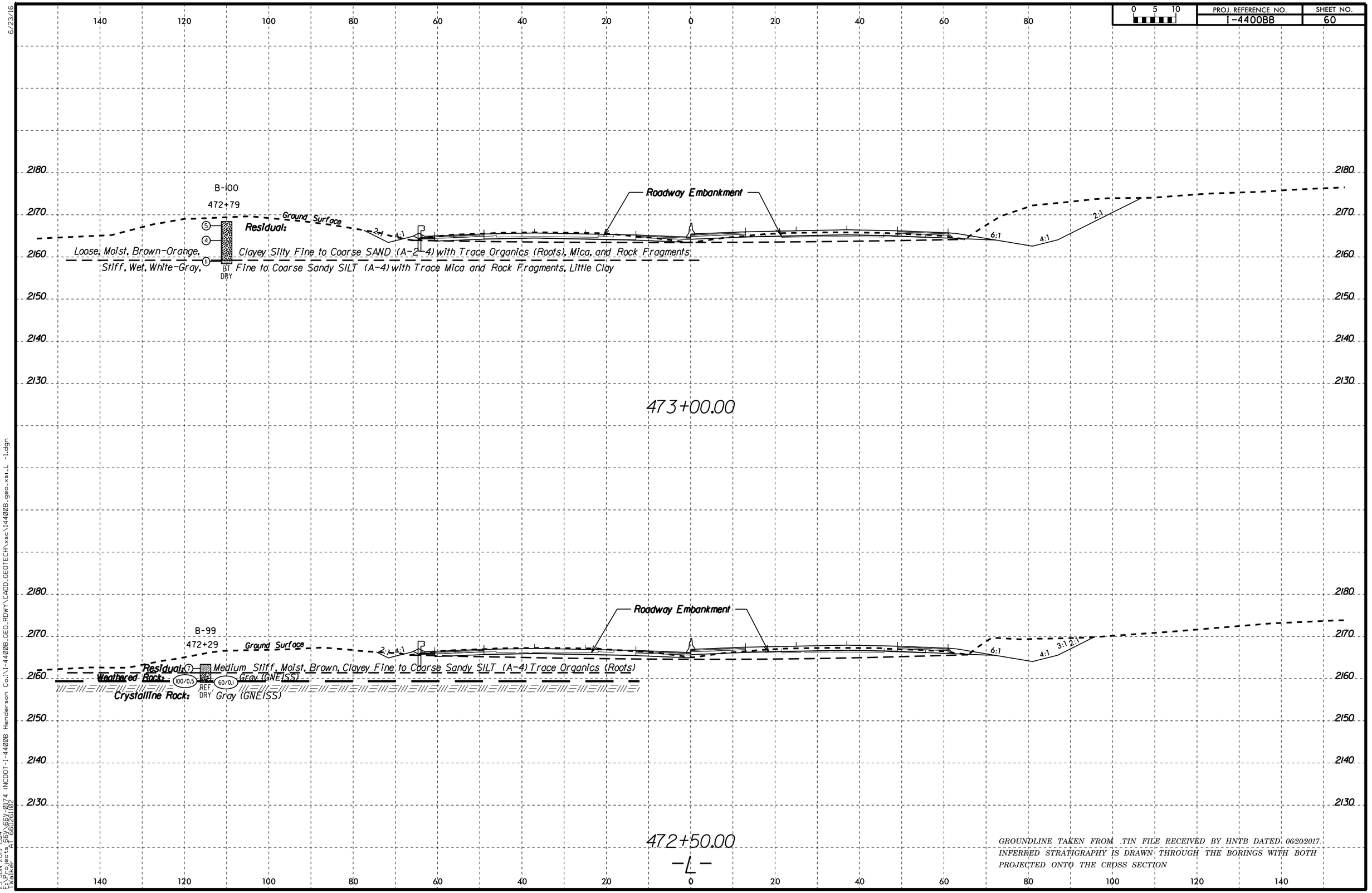
SAMPLE NO	OFFSET	STATION	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT C.SAND	F.SAND	SILT	CLAY	% PASSING (SIEVES) 10	40	200	% MOISTURE	% ORGANIC
SS-38	110' LT	471+29	0.1-1.5	A-4(0)	NP	NP	21.9	24.2	13.8	40.1	90.9	76.9	52.3	13.7	-

Ⓐ **Roadway Embankment:** Medium Dense, Moist, Brown, Silty Fine to Coarse SAND (A-2-4) with Little Gravel



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	60



6/23/16

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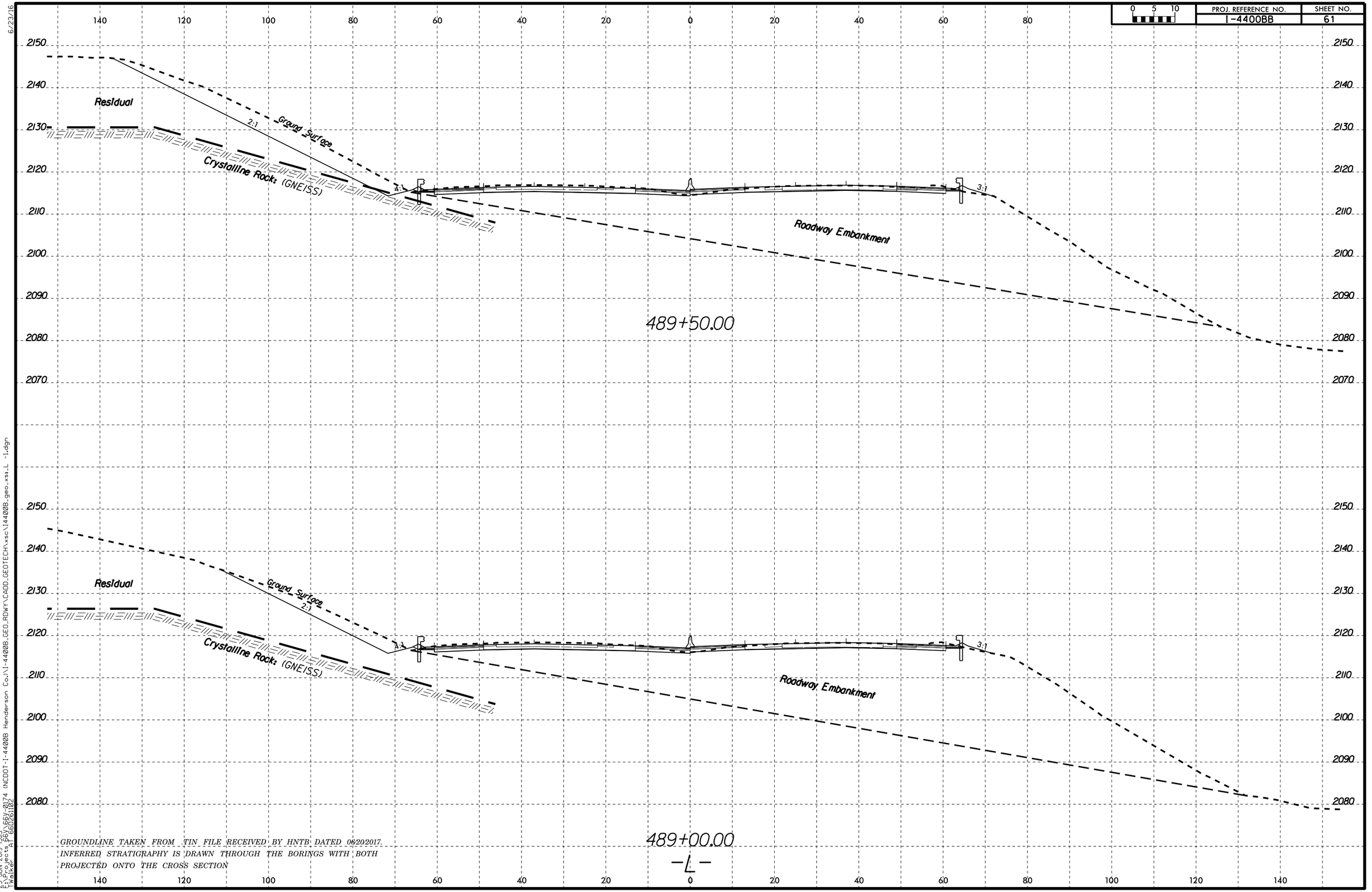
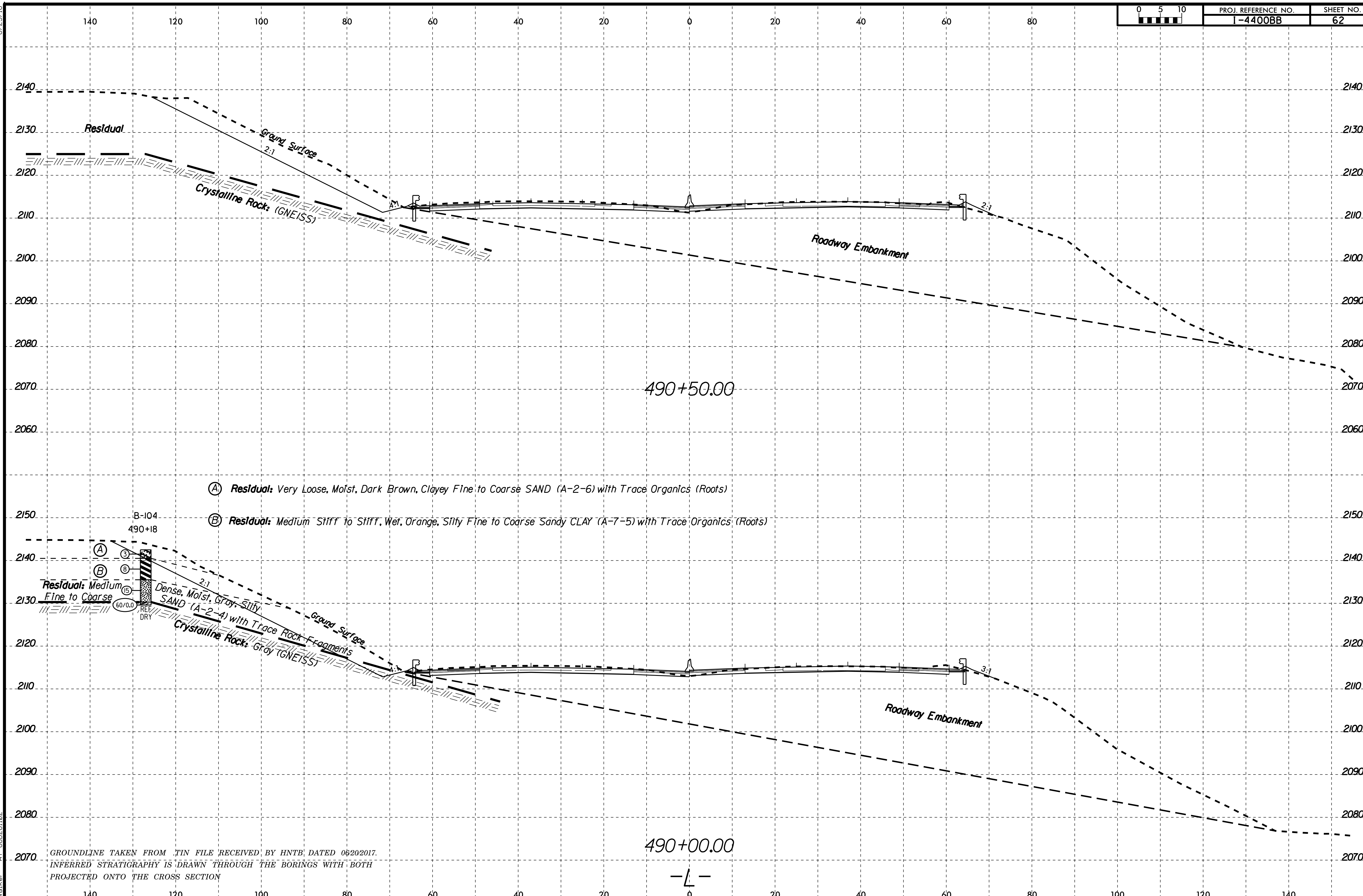
Walker AT 6802611102

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	61

0 5 10



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION


PROJ. REFERENCE NO.
I-4400BB
SHEET NO.
62
0 5 10
Residual
Ground Surface
2:1
Crystalline Rock: (GNEISS)
Roadway Embankment
490+50.00
(A) Residual: Very Loose, Moist, Dark Brown, Clayey Fine to Coarse SAND (A-2-6) with Trace Organics (Roots)
(B) Residual: Medium Stiff to Stiff, Wet, Orange, Silty Fine to Coarse Sandy CLAY (A-7-5) with Trace Organics (Roots)
B-104
490+18
Residual: Medium Fine to Coarse
Dense, Moist, Gray, Silty SAND (A-2-4) with Trace Rock Fragments
Crystalline Rock: Gray (GNEISS)
60/0.0
REF
DRY
3:1
490+00.00
-L-
GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06/20/2017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	63

120 100 80 60 40 20 0 20 40 60 80 100 120

Ⓐ **Alluvial:** *Soft to Medium Stiff, Moist, Brown, Fine Sandy Clayey (A-5) with Trace Organics (Roots)*

Ⓑ **Alluvial:** *Medium Dense, Moist, Gray-Brown, Fine to Coarse SAND (A-1-b) with Trace Gravel and Organics (Roots)*

2110 2100 2090 2080 2070 2060 2050 2040 2030 2020 2010 2000 1990 1980 1970

2:1

Roadway Embankment

2:1

Ground Surface

B-102

8	5	Ⓐ
20	16	
20	23	
40	31	Ⓑ
91	54	
65	34	
51	73	
	67	

SRT
0 HR. NM
FIAD

Notes:
Hand auger refusal at a depth of 3.6' due to gravel.
Sounding rod terminated at a depth of 16.0'

494+50.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

120 100 80 60 40 20 0 20 40 60 80 100 120 140 160 180

6/23/16
25-JUN-2019 15:15
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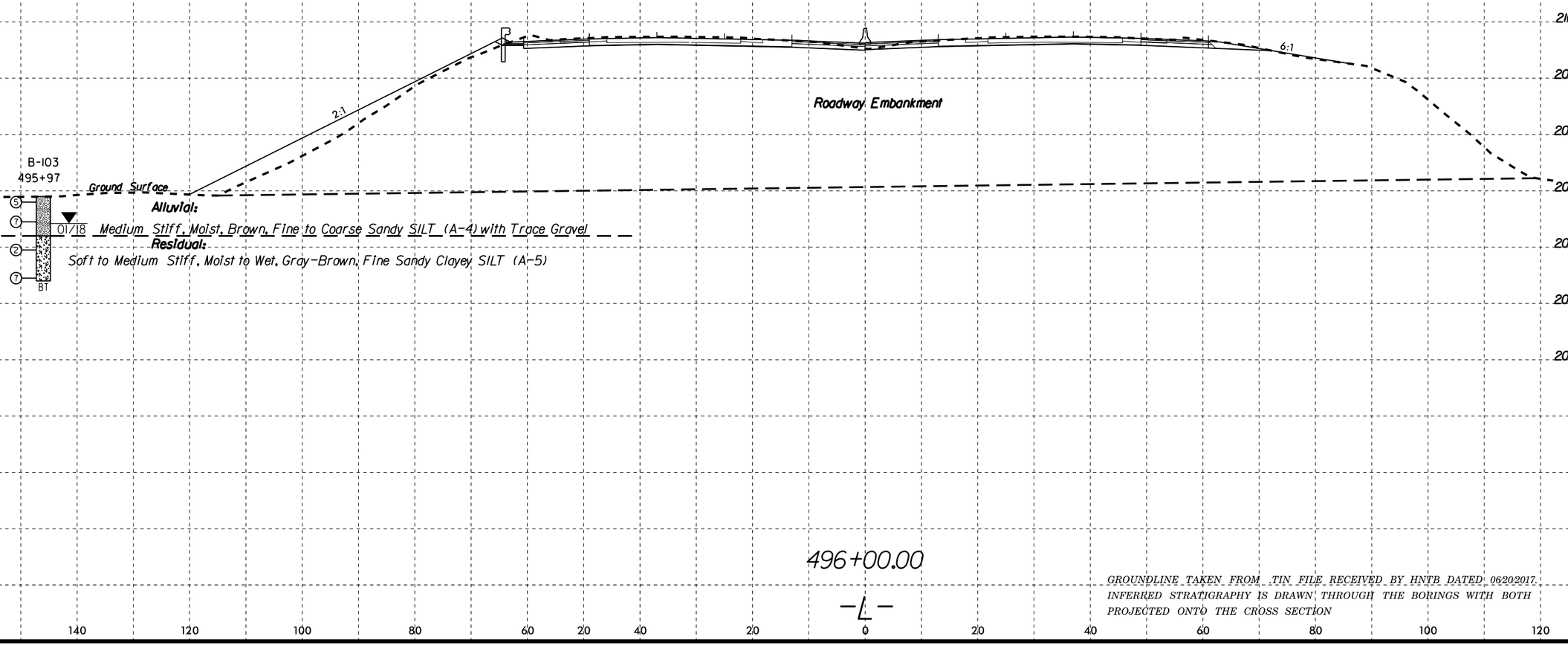
Walker, AT 66026102

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	64

140 120 100 80 60 40 20 0 20 40 60 80

2100 2090 2080 2070 2060 2050 2040



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06/20/2017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

180 160 140 120 100 80 60 20 40 20 0 20 40 60 80 100 120

6/23/16

25-JUN-2019 15:15
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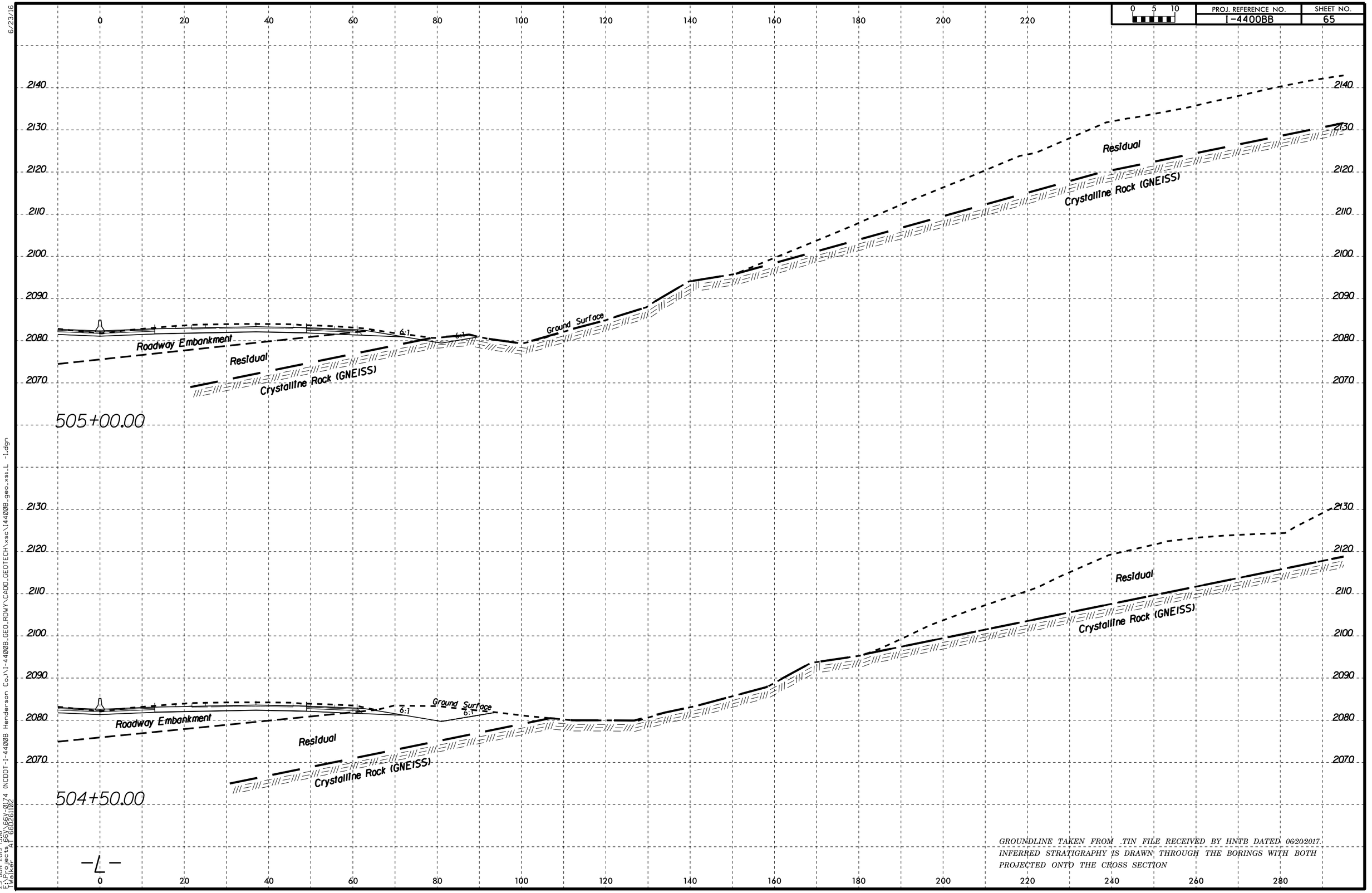
F.Walker AT 6602611002

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	65

0 5 10



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	66

0 20 40 60 80 100 120 140 160 180 200 220

2170 2160 2150 2140 2130 2120 2110 2100 2090 2080 2070 2060

Residual

Crystalline Rock (GNEISS)

Roadway Embankment

Residual

Crystalline Rock (GNEISS)

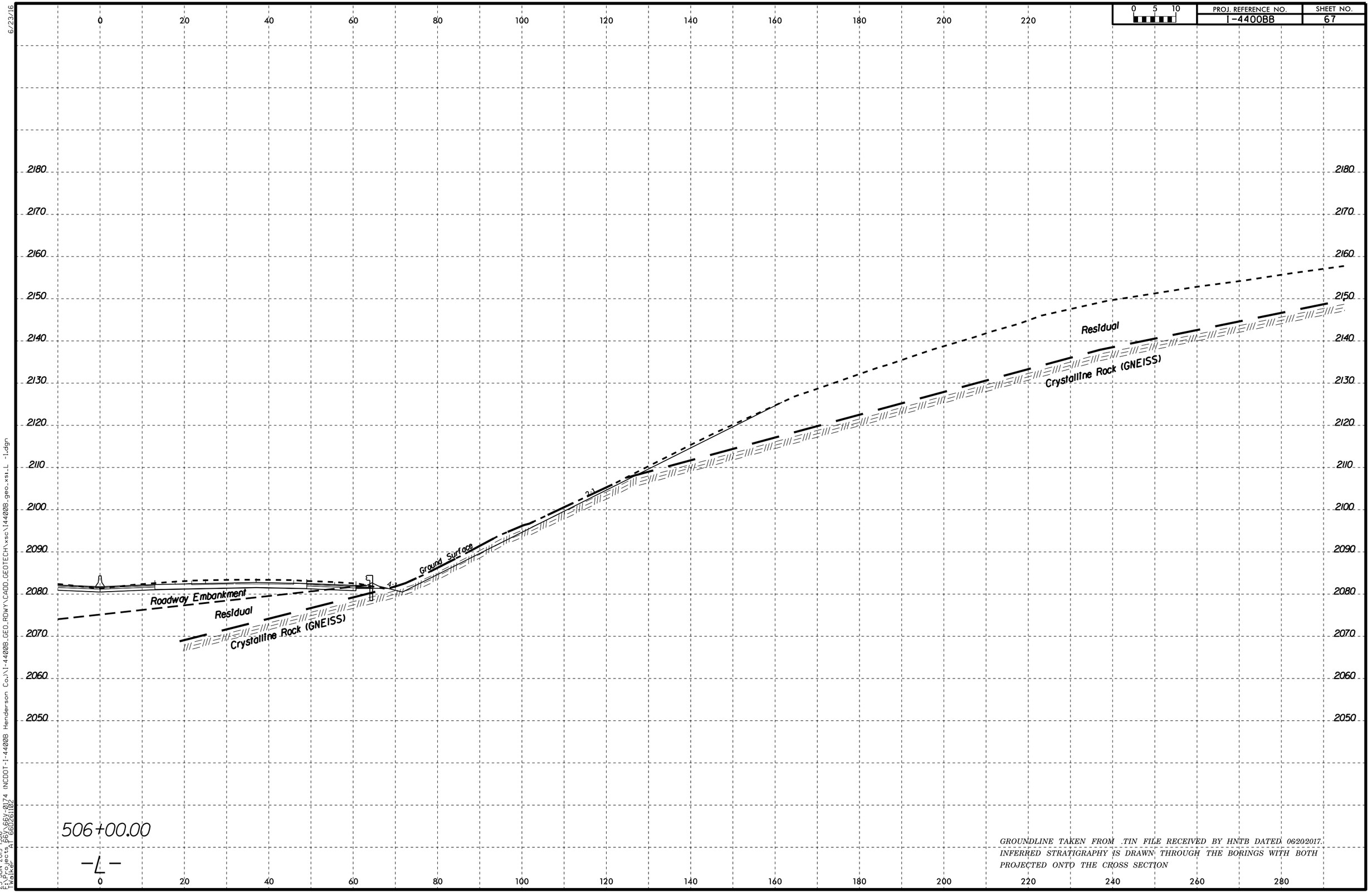
505+50.00

-L-

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280

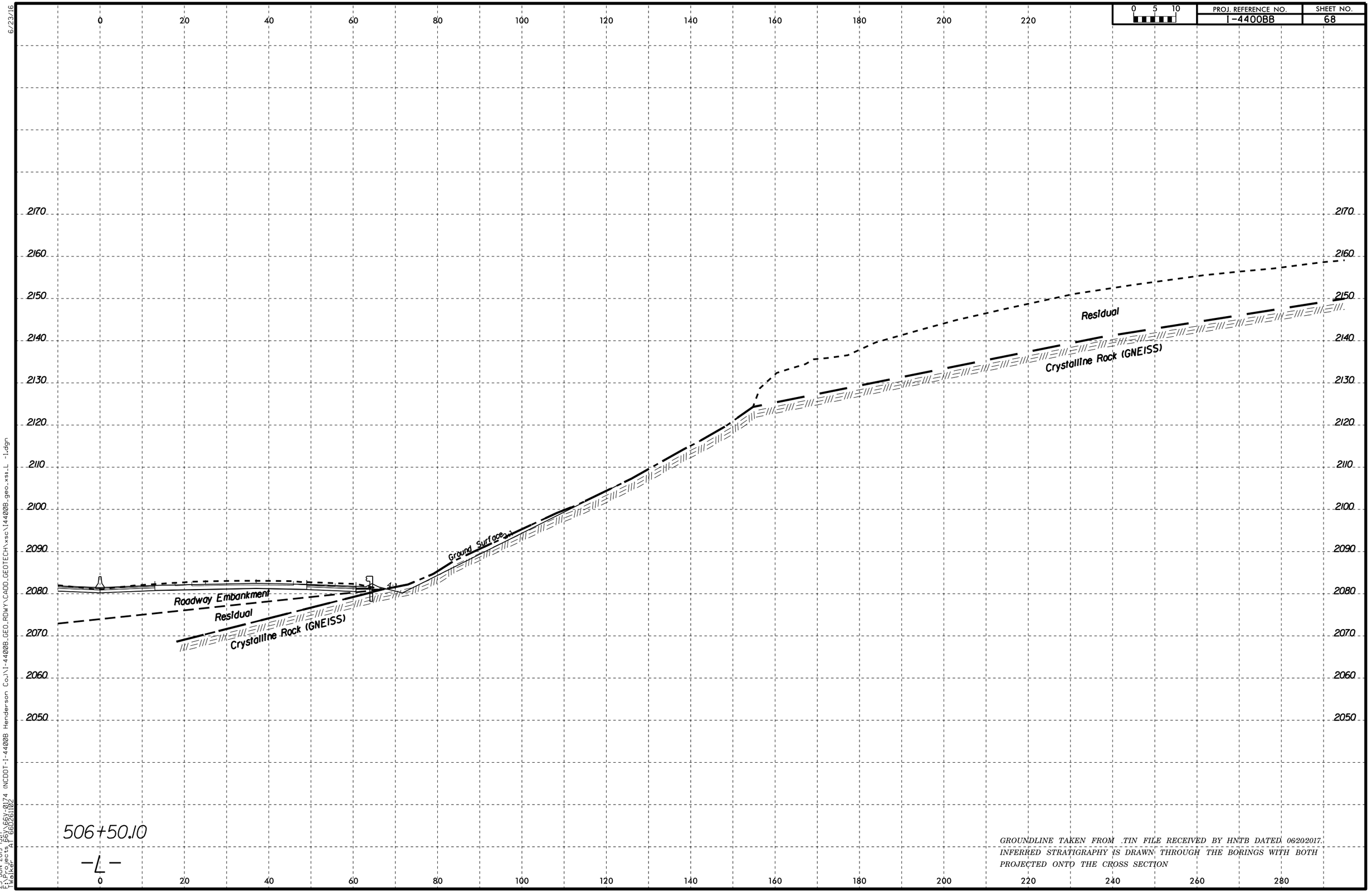
GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	67



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	68



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	69

Ⓐ **Residual:** Loose, Moist, Brown, Silty Clayey Fine to Coarse SAND (A-2-4) with Trace Organics (Roots)

Ⓑ **Residual:** Medium Stiff, Moist, Gray-Brown, Clayey Fine to Coarse Sandy SILT (A-4) with Trace Manganese Deposits and Mica

Ⓒ **Residual:** Medium Dense, Moist, White-Gray, Silty Fine to Coarse SAND (A-2-4) with Little Rock Fragments and Mica

B-101
507+12
4
7
19
60/0.0
REF.
DRY

Crystalline Rock: Gray (GNEISS)

Ground Surface

Roadway Embankment

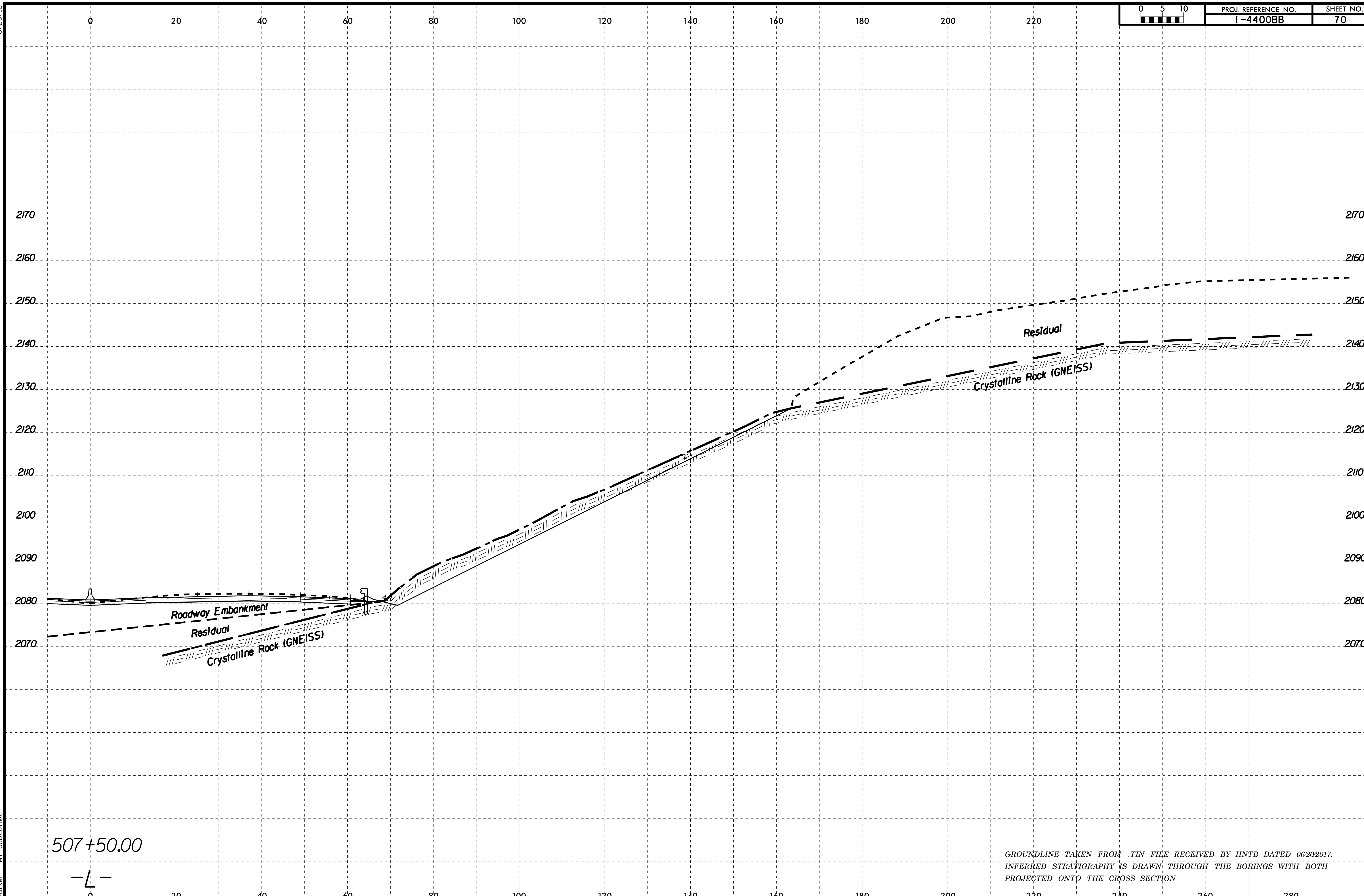
Residual

Crystalline Rock (GNEISS)

507+00.00
-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	70



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017. INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

6/23/16

25-JUN-2019 15:17
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TWalker AT 6602611022

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	71

0 5 10

0 20 40 60 80 100 120 140 160 180 200 220

2170 2160 2150 2140 2130 2120 2110 2100 2090 2080 2070 2060 2050

Residual

Crystalline Rock (GNEISS)

Roadway Embankment

Residual

Crystalline Rock (GNEISS)

508+00.00

-L-

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

0 20 40 60 80 100 120 140 160 180 200 220 240 260 280

6/23/16

25-JUN-2019 15:26
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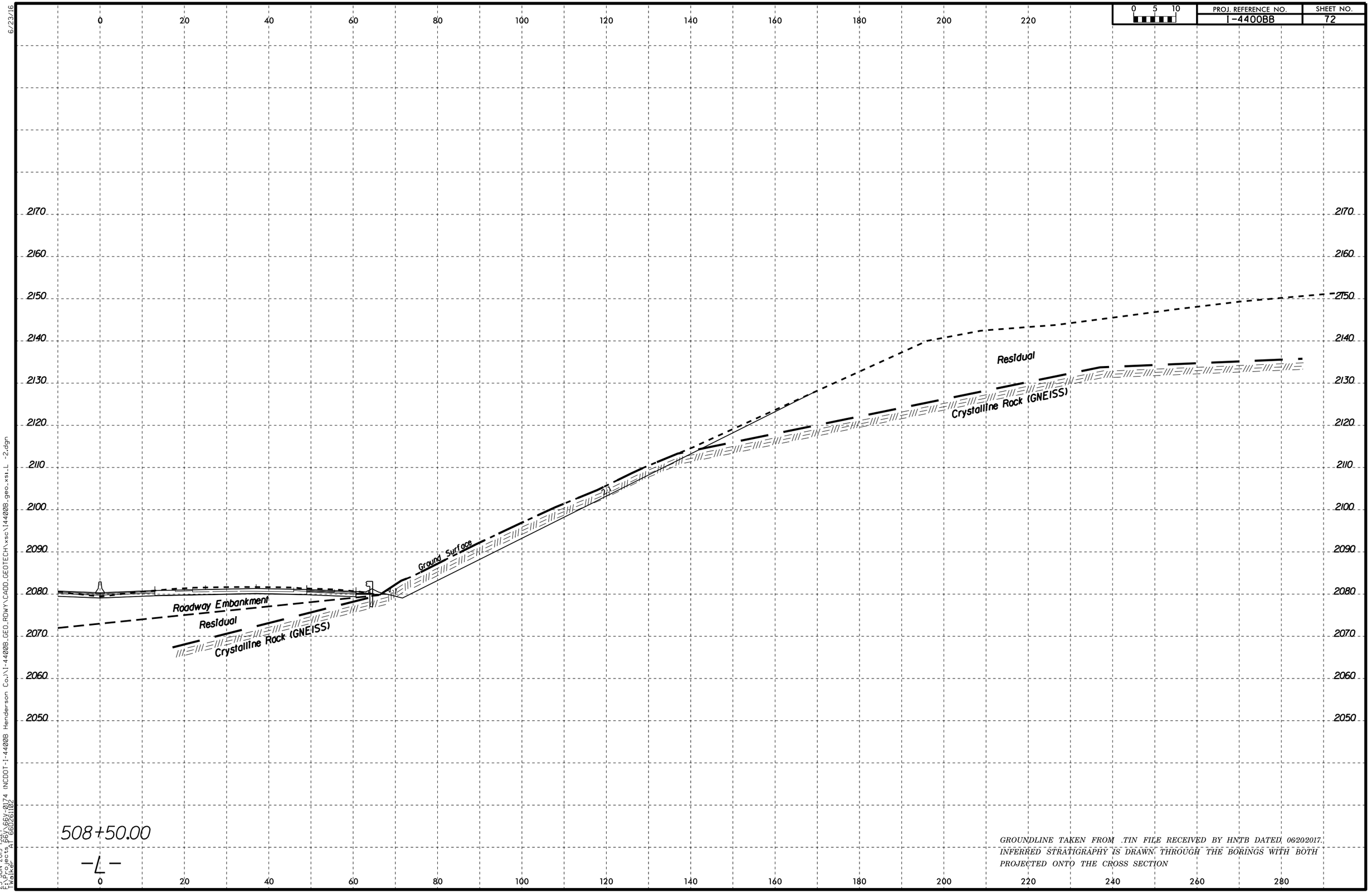
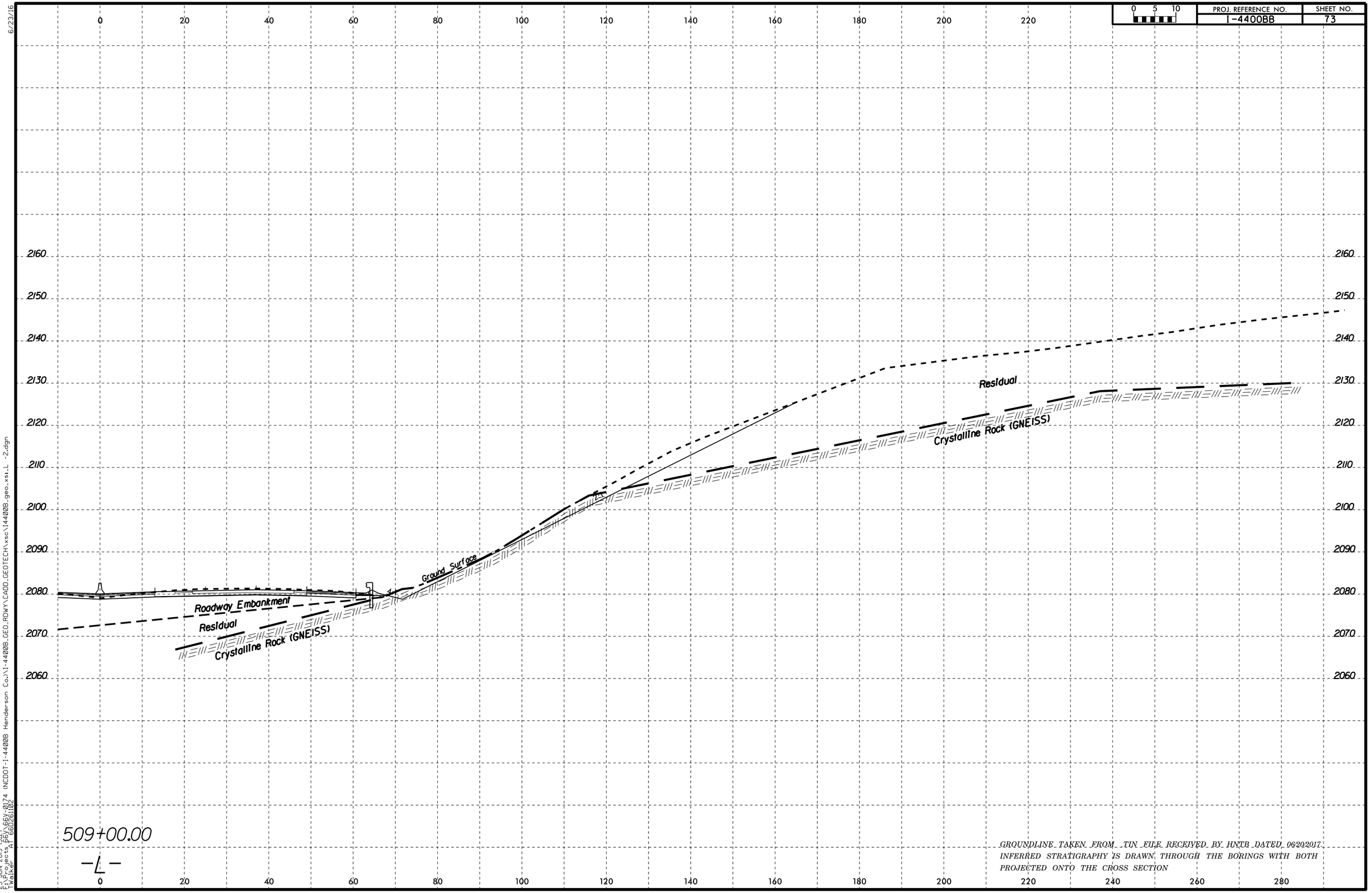
Walker AT 6602611102

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	72



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

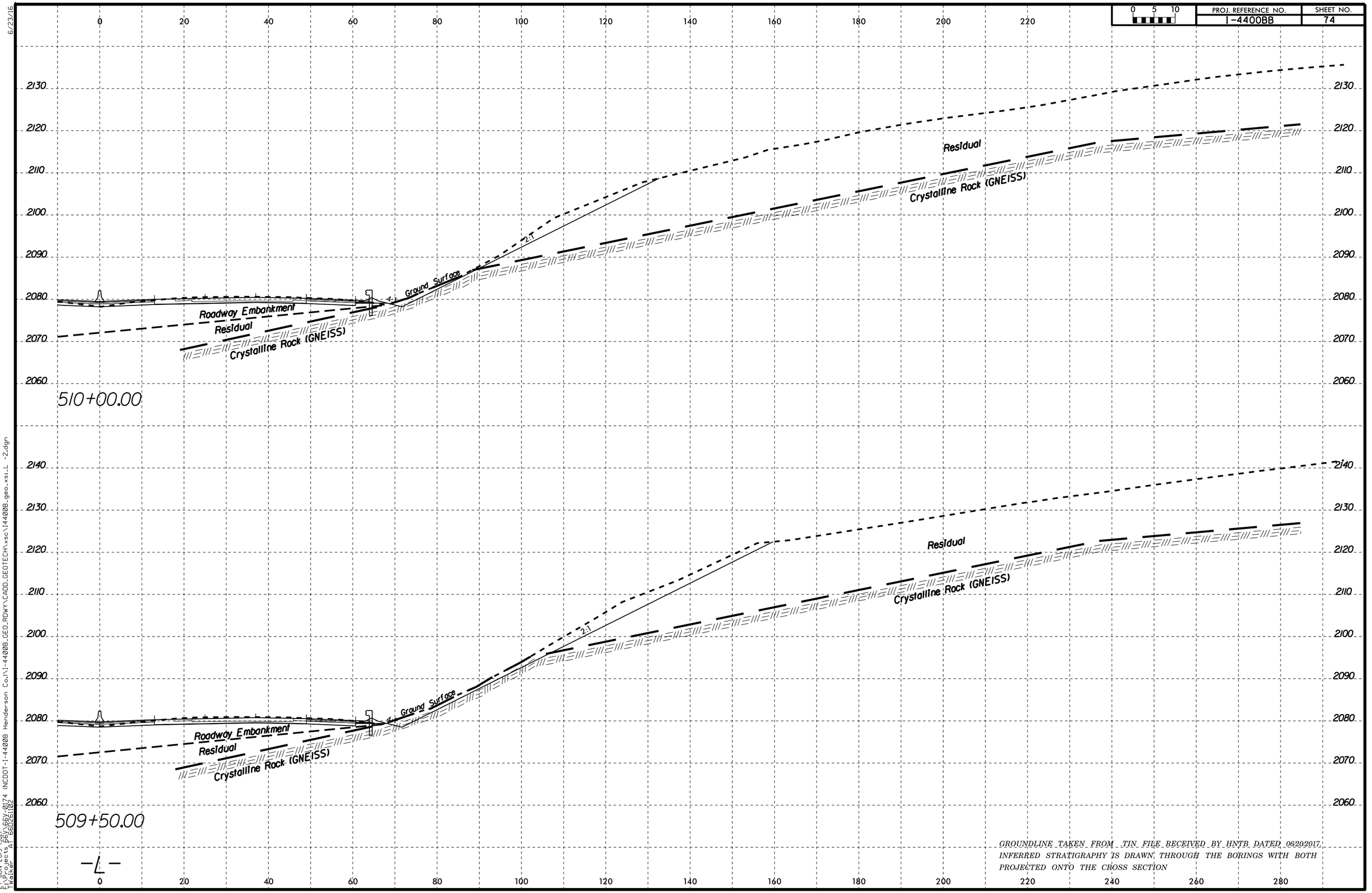
0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	73



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	74

0 5 10



GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

PROJ. REFERENCE NO.	SHEET NO.
I-4400BB	75

0 5 10

518+00.00

517+50.00

Roadway Embankment

Ground Surface

Residual

Weathered Rock (GNEISS)

Crystalline Rock (GNEISS)

6:1

4:1

2:1

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION

25-JUN-2019 15:28
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Walker A1 6602621102
6/23/16

0 5 10	PROJ. REFERENCE NO.	SHEET NO.
	I-4400BB	76

519+00.00

Roadway Embankment
Residual
Ground Surface
6:1
4:1
2:1
Residual
Weathered Rock (GNEISS)
Crystalline Rock (GNEISS)

518+50.00

GROUNDLINE TAKEN FROM .TIN FILE RECEIVED BY HNTB DATED 06202017.
INFERRED STRATIGRAPHY IS DRAWN THROUGH THE BORINGS WITH BOTH PROJECTED ONTO THE CROSS SECTION