

REFERENCE: HE-0011

PROJECT: 50623

SEE SHEET 3 FOR PLAN SHEET LAYOUT
AT TIME OF INVESTIGATION

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-L-	11+00 TO 26+16	4 - 5
-YI-	10+00 TO 39+50	5 - 7

CROSS SECTIONS

<u>LINE</u>	<u>STATION</u>	<u>SHEETS</u>
-L-	12+00 - 24+00	8 - 11
-YI-	11+00 - 37+00	12 - 26

APPENDICES

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

ROADWAY
SUBSURFACE INVESTIGATION

COUNTY CHATHAM
PROJECT DESCRIPTION US 64 AND PROPOSED
CAM SITE ACCESS ROAD

INVENTORY

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HE-0011	1	

CAUTION NOTICE

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

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

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

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

PERSONNEL

M. SNYDER

H. FISCHER

SUMMIT

INVESTIGATED BY GANNETT FLEMING

DRAWN BY M. SNYDER, P.E.

CHECKED BY J. GARDNER, P.E.

SUBMITTED BY GANNETT FLEMING

DATE AUGUST 2023

Prepared in the Office of:



DocuSigned by:

9618E6A666EF453...
SIGNATURE DATE
8/25/2023

**DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED**

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 208, 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

Table with columns for GENERAL CLASS., GRANULAR MATERIALS (<= 35% PASSING #200), SILT-CLAY MATERIALS (> 35% PASSING #200), ORGANIC MATERIALS, and various soil types like SAND, SILTY SAND, CLAYEY SAND, etc.

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

CONSISTENCY OR DENSENESS

Table mapping soil types (e.g., LOOSE, MEDIUM DENSE, DENSE) to consistency ranges and unconfined compressive strength (TONS/FT^2).

TEXTURE OR GRAIN SIZE

Table showing U.S. STD. SIEVE SIZE (4, 10, 40, 60, 200, 270) and corresponding opening (MM) and grain size categories (BOULDER, COBBLE, GRAVEL, etc.).

SOIL MOISTURE - CORRELATION OF TERMS

Table correlating Soil Moisture Scale (Atterberg Limits), Field Moisture Description (SAT, WET, MOIST, DRY), and Guide for Field Moisture Description (LIQUID, SEMISOLID, SOLID).

PLASTICITY

Table showing Plasticity Index (PI) ranges (0-5, 6-15, 16-25, 26 OR MORE) and corresponding Dry Strength (VERY LOW, SLIGHT, MEDIUM, HIGH).

COLOR

DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YELLOW-BROWN, BLUE-BROWN). 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

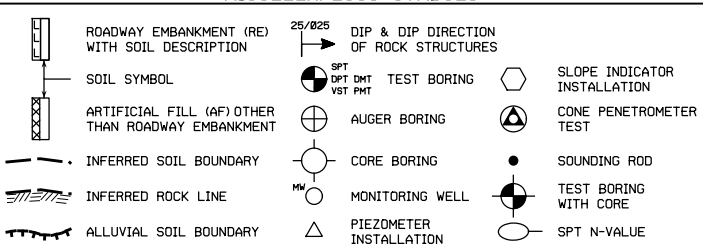
PERCENTAGE OF MATERIAL

Table showing percentages for Organic Material, Granular Soils, Silt-Clay Soils, and Other Material across different categories like Trace, Little, Moderately, and Highly Organic.

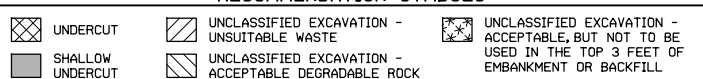
GROUND WATER

Water level symbols and descriptions: WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING, STATIC WATER LEVEL AFTER 24 HOURS, PERCHED WATER, SATURATED ZONE, SPRING OR SEEP.

MISCELLANEOUS SYMBOLS



RECOMMENDATION SYMBOLS



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, 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, UG - UNIT WEIGHT, DG - 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

Checklist for equipment used: DRILL UNITS (CME-45C, CME-55, CME-550, VANE SHEAR TEST, PORTABLE HOIST, CME-550X), ADVANCING TOOLS (CLAY BITS, 6" CONTINUOUS FLIGHT AUGER, 8" HOLLOW AUGERS, HARD FACED FINGER BITS, TUNG-CARBIDE INSERTS, CASING w/ ADVANCER, TRICONE STEEL TEETH, TRICONE TUNG-CARB., CORE BIT), HAMMER TYPE (AUTOMATIC, MANUAL), CORE SIZE (-B, -H, -N), HAND TOOLS (POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST).

ROCK DESCRIPTION

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

WEATHERED ROCK (WR) NON-COASTAL PLAIN MATERIAL THAT WOULD YIELD SPT N VALUES > 100 BLOWS PER FOOT IF TESTED.

CRYSTALLINE ROCK (CR) FINE TO COARSE GRAIN IGNEOUS AND METAMORPHIC ROCK THAT WOULD YIELD SPT REFUSAL IF TESTED. ROCK TYPE INCLUDES GRANITE, GNEISS, GABBRO, SCHIST, ETC.

NON-CRYSTALLINE ROCK (NCR) FINE TO COARSE GRAIN METAMORPHIC AND NON-COASTAL PLAIN SEDIMENTARY ROCK THAT WOULD YIELD 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 PIECES 1 INCH MAXIMUM SIZE BY HARD BLOWS OF THE POINT OF A GEOLOGIST'S PICK.
SOFT: CAN BE GROOVED 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 FINGER NAIL.

FRACTURE SPACING

Table mapping fracture spacing (VERY WIDE, WIDE, MODERATELY CLOSE, CLOSE, VERY CLOSE) to thickness ranges (MORE THAN 10 FEET, 3 TO 10 FEET, 1 TO 3 FEET, 0.16 TO 1 FOOT, LESS THAN 0.16 FEET).

BEDDING

Table mapping bedding terms (VERY THICKLY BEDDED, THICKLY BEDDED, THINLY BEDDED, VERY THINLY BEDDED, THICKLY LAMINATED, THINLY LAMINATED) to thickness ranges (4 FEET, 1.5 - 4 FEET, 0.16 - 1.5 FEET, 0.03 - 0.16 FEET, < 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 (SROD) - 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.

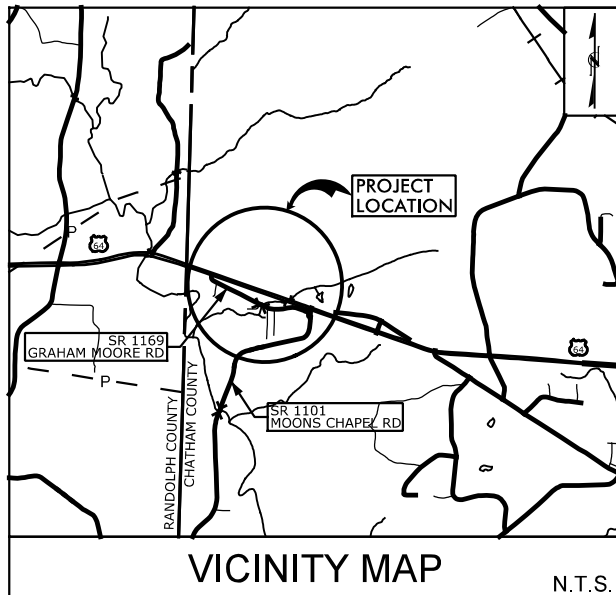
BENCH MARK: BORING COLLAR ELEVATIONS FROM HE-0011.LS.TIN.TIN DATED 1/11/2023. ELEVATION: N/A FEET

NOTES:

- FIAD - FILLED IMMEDIATELY AFTER DRILLING
HAT - HAND AUGER TERMINATED
HAR - HAND AUGER REFUSAL

CONTRACT: HE-0011

See Sheet 1A For Index of Sheets
See Sheet 1B For Symbology Sheet



VICINITY MAP
N.T.S.
25% PLANS

STATE OF NORTH CAROLINA
DIVISION OF HIGHWAYS

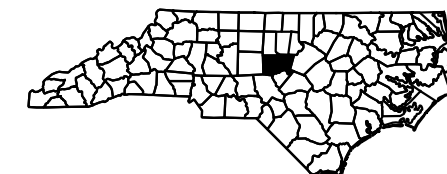
CHATHAM COUNTY

LOCATION: US 64 AND PROPOSED CAM SITE ACCESS ROAD

TYPE OF WORK: GRADING, DRAINAGE & PAVING

STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	HE-0011	3	
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
50623.1.1		PE	

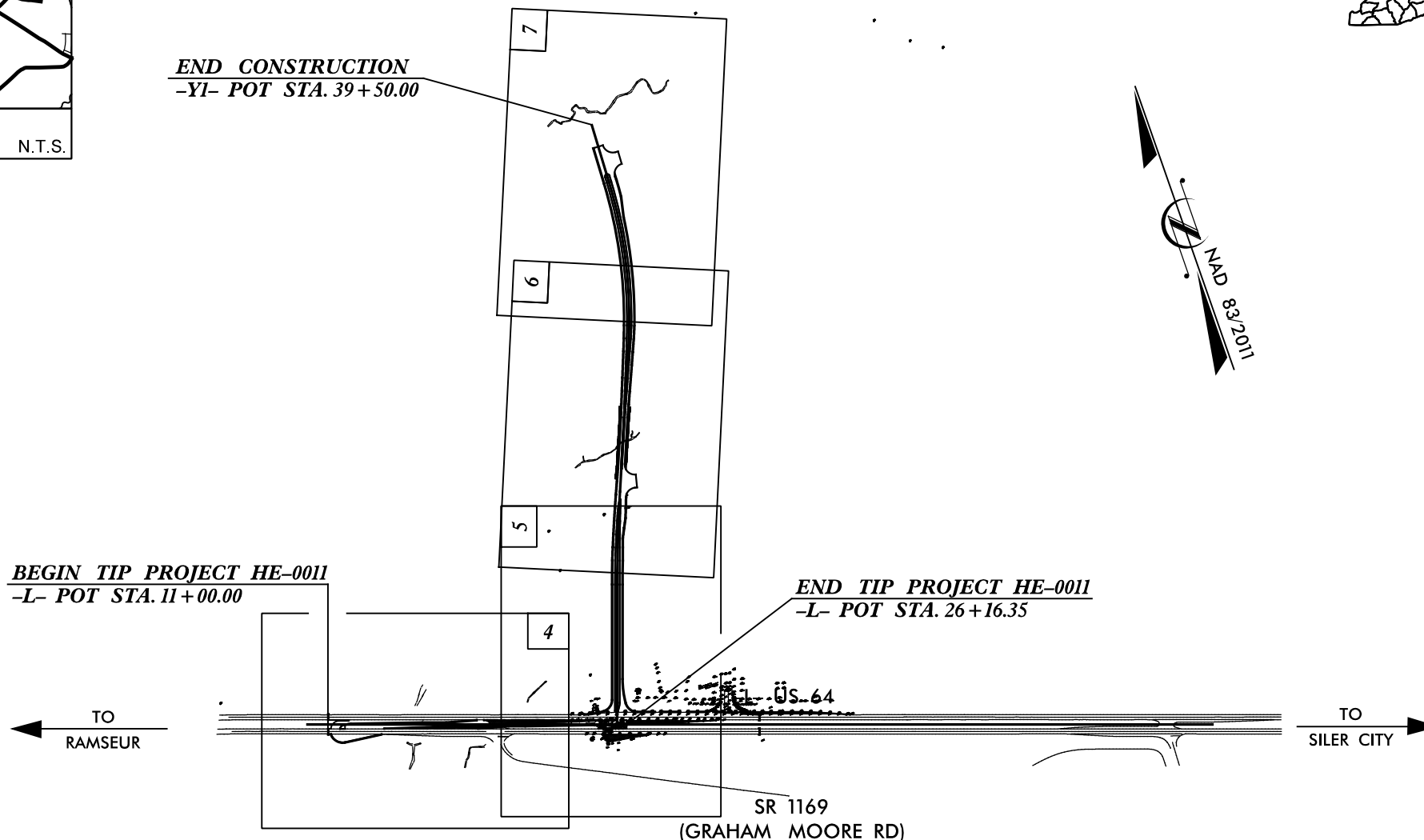
DIVISION 8



END CONSTRUCTION
-YI- POT STA. 39+50.00

BEGIN TIP PROJECT HE-0011
-L- POT STA. 11+00.00

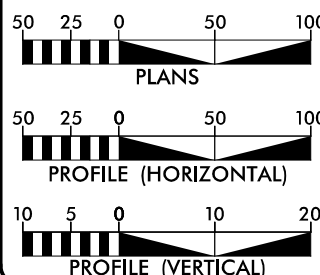
END TIP PROJECT HE-0011
-L- POT STA. 26+16.35



CLEARING ON THIS PROJECT SHALL BE PERFORMED TO THE LIMITS ESTABLISHED BY METHOD .

INCOMPLETE PLANS
DO NOT USE FOR R/W ACQUISITION
DOCUMENT NOT CONSIDERED FINAL
UNLESS ALL SIGNATURES COMPLETED

GRAPHIC SCALES



DESIGN DATA

ADT 2023 = 12,900
ADT 2043 = 13,400
K = 9 %
D = 60 %
T = 10 % *
V = 60 MPH
* TTST = 5% DUAL 5%
FUNC CLASS = PRINCIPAL ARTERIAL
STATEWIDE TIER

PROJECT LENGTH

LENGTH OF ROADWAY TIP PROJECT HE-0011 = 0.287 MI
TOTAL LENGTH OF TIP PROJECT HE-0011 = 0.287 MI

Prepared in the Office of: **GANNETT FLEMING**
One Glenwood Avenue, Suite 900, Raleigh, NC 27603, 919-420-7560, NC Lic. No. F-0270

2018 STANDARD SPECIFICATIONS

RIGHT OF WAY DATE: TBD

LETTING DATE: TBD

RICKY A TIPTON, PE
PROJECT ENGINEER

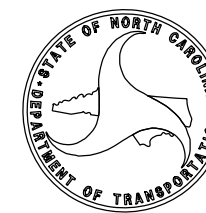
BENJAMIN A. WHITE, PE
PROJECT DESIGN ENGINEER

HYDRAULICS ENGINEER

SIGNATURE: _____ P.E.

ROADWAY DESIGN ENGINEER

SIGNATURE: _____ P.E.



August 21, 2023

State Project: 50623.1.1
TIP No.: HE-0011
County: Chatham
Description: US 64 and Proposed CAM Site Access Road
Subject: Roadway Subsurface Inventory Report

PROJECT DESCRIPTION

The proposed project (HE-0011) consists of upgrades to existing US 64 (-L-) and construction of approximately 0.55 miles of new alignment access road (-Y1-) for the Chatham-Siler City Advanced Manufacturing (CAM) Site. Upgrades to existing US 64 consist of shoulder widening and construction of a bulb turnaround from westbound to eastbound US 64. The new alignment access road will be a four-lane typical section with embankments up to 13 feet and cut sections as deep as 20 feet. The current project will consist of subgrade preparation and paving for a two-lane section while allowing for a future widening to a four-lane section.

The geotechnical investigation was performed during January of 2023. Sixteen (16) Standard Penetration test (SPT) borings were performed with a CME 550X ATV-mounted drill rig equipped with an automatic hammer. An additional eight (8) hand auger borings were completed in areas that were inaccessible to drilling equipment and along US 64 to evaluate subgrade conditions. Representative soil samples were collected from split spoon samples and soil cuttings for visual classification in the field and selected samples were submitted for laboratory analysis and classification.

The following alignments, totaling approximately 0.9 miles, were investigated. Selected cross sections of these alignments are included in this report.

<u>Line</u>	<u>Stations (+/-)</u>
-L-	11+00 – 26+16
-Y1-	10+00 – 39+50

PHYSIOGRAPHY AND GEOLOGY

The proposed project is located within the Piedmont Physiographic Province. The terrain within the project corridor consists of rolling hills, portions of which have been cut and graded during construction of existing US 64. Outside the project corridor, the landscape is dominated by farmland and forested rolling hills.

Based on review of the 1985 Geologic Map of North Carolina, the proposed project is underlain by Metamudstone. The occurrence of these rock types is indicated by the weathered and non-crystalline rock samples recovered during the geotechnical investigation, as well as the composition of the local residual soils. The overlying residual soils are a result of physical and chemical weathering of the underlying parent bedrock.

SOIL PROPERTIES

Soils encountered during the geotechnical investigation are split into three (3) categories based on their origin. The origins consist of roadway embankment, alluvial soils, and residual soils.

Roadway Embankment: Roadway embankment material was encountered in four (4) hand auger borings completed along the existing US 64 alignment and generally consisted of sandy silt (A-4). The plasticity index of the roadway embankment material is 7 percent with 42 percent passing the #200 sieve and natural moisture content of 22 percent based on laboratory testing. Varying amounts of mica and gravel were noted within soils interpreted as roadway embankment.

Alluvial Soils: Alluvial soils associated with streams crossing the proposed new alignment access road generally consisted of silty sand (A-2-4).

Residual Soils: Residual soils were encountered in all SPT and hand auger borings and generally consisted of very soft to hard sandy silt (A-4), and soft to hard sandy and silty clay (A-6, A-7-5, A-7-6). The plasticity indices of the residual soils range from 5 to 26 percent with 50 to 96 percent passing the #200 sieve and natural moisture contents of 8 to 32 percent based on laboratory testing. Varying amounts of mica, manganese, and rock fragments were noted within soils interpreted as residual soils.

ROCK PROPERTIES

Weathered Rock: Weathered Rock is defined by penetration by split spoon of less than 1.0 foot per 100 blows. Weathered Rock was encountered in eleven (11) borings. One (1) boring (Y1_3300) encountered an intermediate lense of Weathered Rock (4.2' in thickness) that transitioned back to residual soils at a greater depth. Weathered Rock was encountered at elevations ranging from 569 to 618, excluding the intermediate lense.

Non-Crystalline Rock: Non-Crystalline Rock is defined by auger refusal and SPT refusal with penetration by split spoon of less than or equal to 0.1 feet per 60 blows. Non-Crystalline Rock was encountered in eight (8) borings at elevations ranging from 571 to 619. Non-Crystalline Rock encountered at the site was Metamudstone.

GROUNDWATER

Groundwater measurements were attempted in most of the borings immediately upon completion of drilling and/or a minimum of 24-hr after completion of drilling. Groundwater was encountered during drilling operations (0-hr) in seven (7) hand auger and SPT borings at depths ranging from 5.2 to 15.1 feet and elevations ranging from 558 to 577. Hand auger borings were backfilled immediately upon completion. Stabilized groundwater table (24-hr) measurements were attempted in all SPT borings and recorded in six (6) borings at depths ranging from 0.2 to 8.0 feet and elevations ranging from 572 to 588. Groundwater was not encountered in the remaining borings.

AREAS OF SPECIAL GEOTECHNICAL INTEREST

Alluvial Soils: The following areas contain alluvial soils associated with existing streams crossing the proposed alignment:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	23+20 – 24+25	LT & RT

Soft, Loose and/or Wet Soils: The following areas contain relatively soft (clay/silt $N \leq 4$) or loose (sand $N \leq 10$) and/or wet, near surface soils that have the potential to cause subgrade problems during construction:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	11+00 – 12+00	LT & RT
-Y1-	14+50 – 20+00	LT & RT
-Y1-	21+50 – 24+50	LT & RT

Cohesive Soils: The following areas contain cohesive soils (AASHTO Classification A-5, A-6, A-7 and/or greater than 50% passing No. 200 sieve) at existing subgrade in fill areas or near proposed subgrade in cut areas and have the potential to cause subgrade problems during construction:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-L-	11+00 – 26+16	LT & RT
-Y1-	11+00 – 39+50	LT & RT

Highly Plastic Soils: Highly plastic soils with plasticity indices (PI) greater than 25 were encountered in the following areas:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	24+75 – 26+00	LT & RT

Weathered Rock: The following areas contain weathered rock above or within six (6) feet of proposed grade and have the potential to required ripping or blasting for removal:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	12+50 – 14+00	RT
-Y1-	16+50 – 21+50	RT
-Y1-	26+50 – 28+50	LT & RT
-Y1-	31+00 – 36+00	LT & RT

Non-Crystalline Rock: The following areas contain non-crystalline rock above or within six (6) feet of proposed grade and will likely require ripping or blasting for removal:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	19+50 – 21+25	LT & RT
-Y1-	27+50 – 32+75	RT

Groundwater: Groundwater was not encountered within proposed cut sections.

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

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	11+00 – 12+00	LT & RT
-Y1-	14+00 – 16+00	RT
-Y1-	18+00 – 20+00	LT & RT
-Y1-	21+50 – 23+00	RT

The following areas exhibited groundwater within three (3) feet of the existing grade, which have the potential to cause subgrade issues during construction:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	11+00 – 12+00	LT & RT
-Y1-	18+00 – 20+00	LT & RT
-Y1-	21+50 – 24+50	LT & RT
-Y1-	38+00 – 39+50	LT & RT

Poor Drainage: The following areas appear either to exhibit poor drainage or have a perched groundwater table which could potentially result in wet conditions during and after rainfall events during construction:

<u>Line</u>	<u>Stations (+/-)</u>	<u>Offset</u>
-Y1-	11+00 – 20+00	LT & RT
-Y1-	21+50 – 25+00	LT & RT

Sincerely,
Gannett Fleming, Inc.



Matthew Snyder, P.E.
 Senior Project Geotechnical Engineer

Appendix A

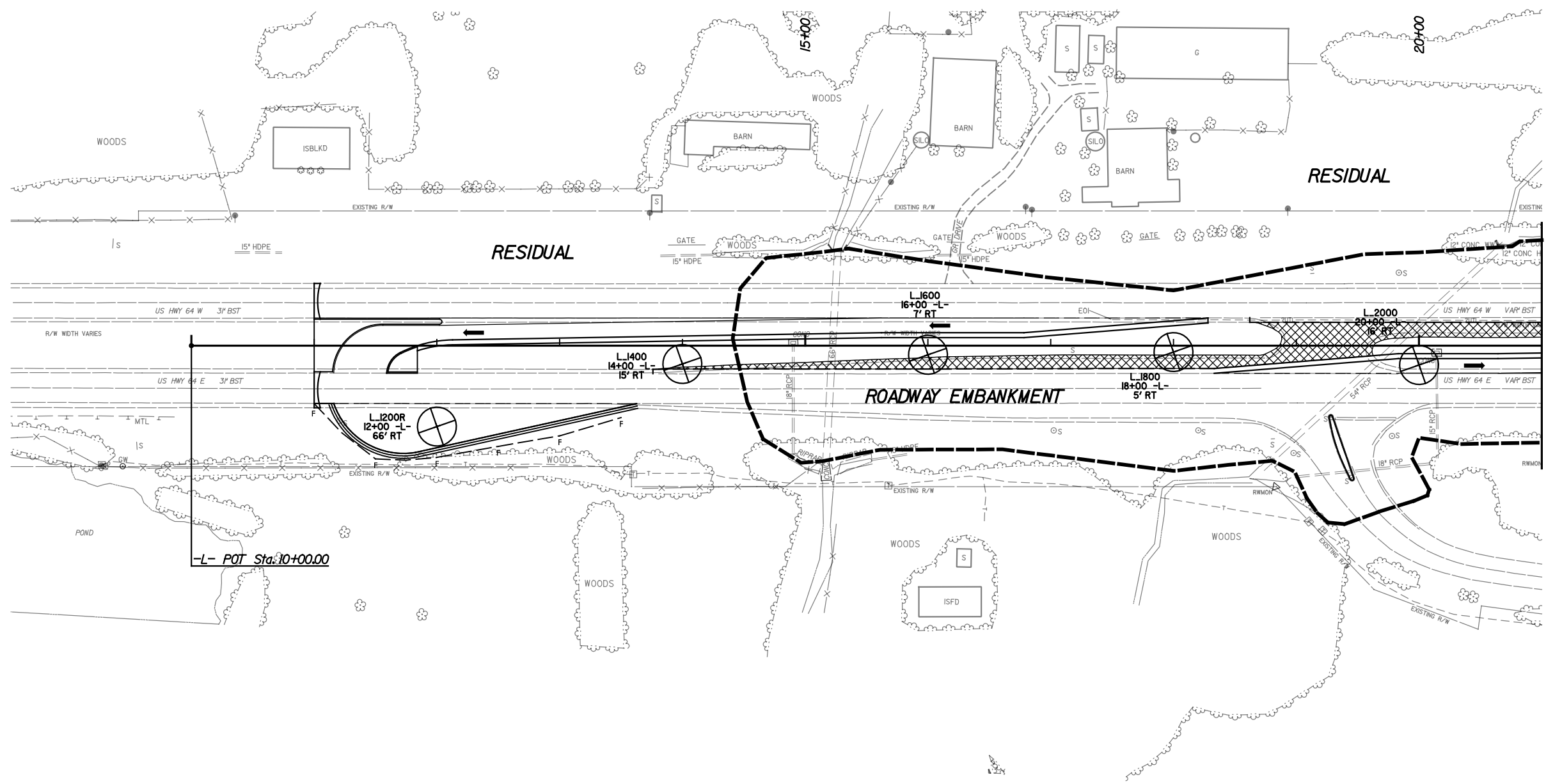
Bulk Samples

The following bulk sample was obtained and submitted for laboratory testing to determine the engineering properties of the soil:

Sample No.	Boring No.	Line	Station	Offset	Depth (ft)	Test(s) Performed
CBR-1	Y1_3100	-Y1-	31+02	60' RT	0.0 – 10.0	Standard Proctor

8/17/99

PROJECT REFERENCE NO. HE-0011	SHEET NO. 4
ROADWAY DESIGN ENGINEER	HYDRAULICS ENGINEER
INCOMPLETE PLANS DO NOT USE FOR R/W ACQUISITION	
DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



-L- POT Sta: 10+00.00

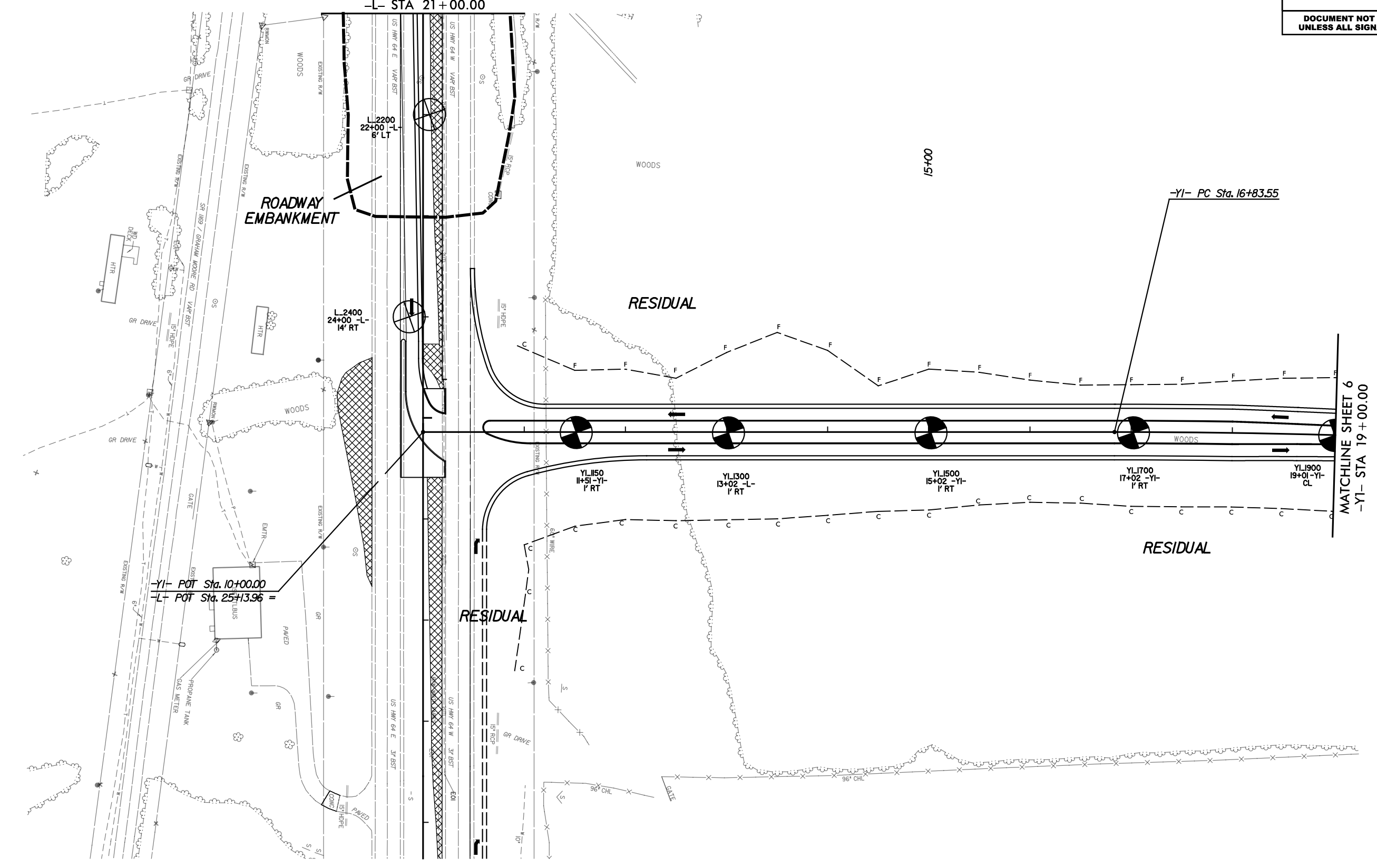
MATCHLINE SHEET 5
-L- STA 21 + 00.00

8/17/99

PROJECT REFERENCE NO. HE-0011	SHEET NO. 5
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DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



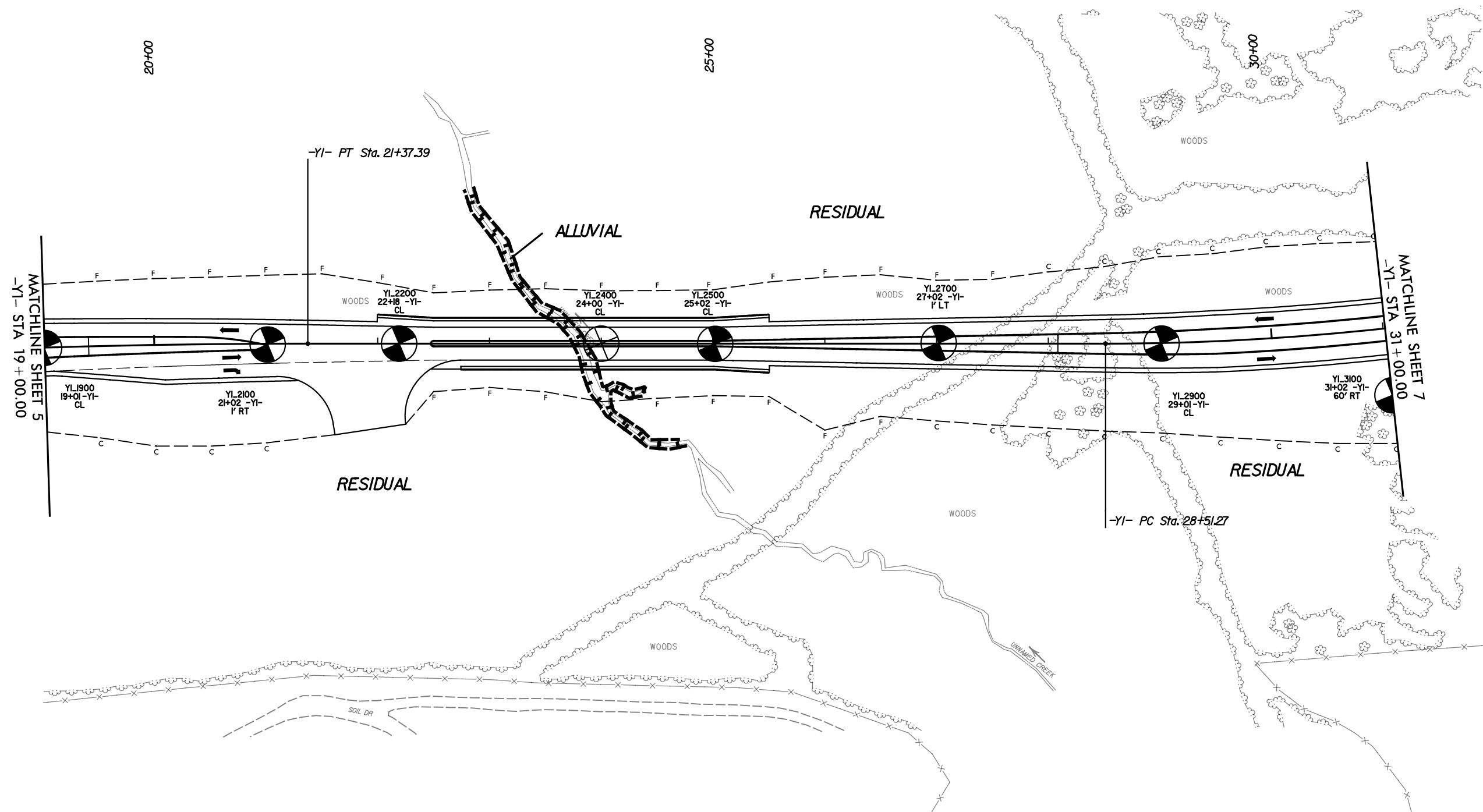
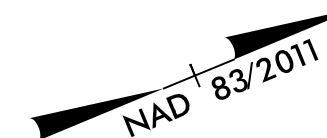
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8/17/99

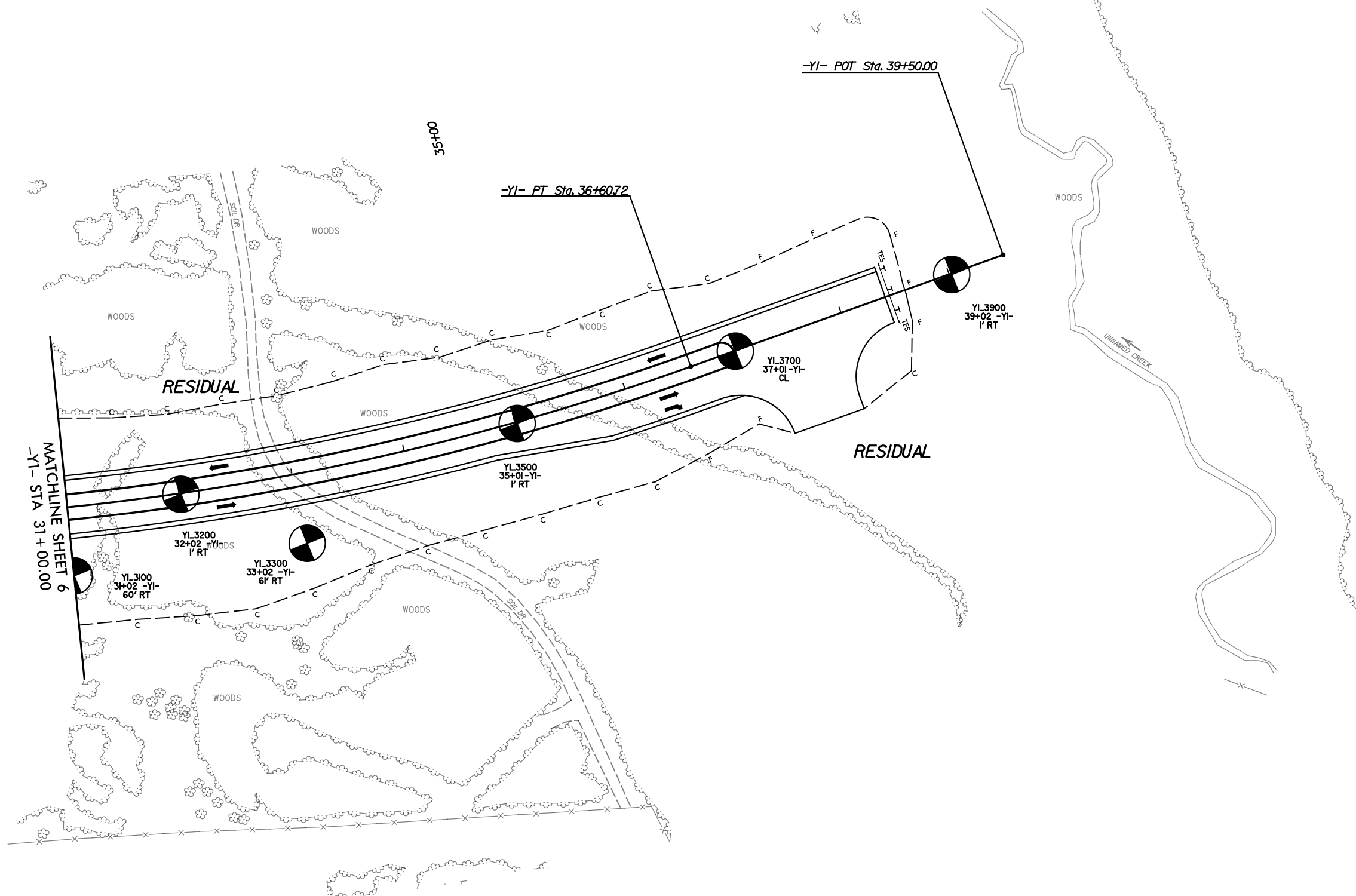
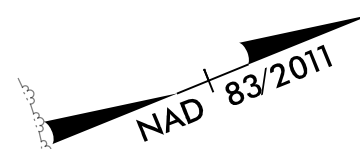
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DOCUMENT NOT CONSIDERED FINAL UNLESS ALL SIGNATURES COMPLETED	



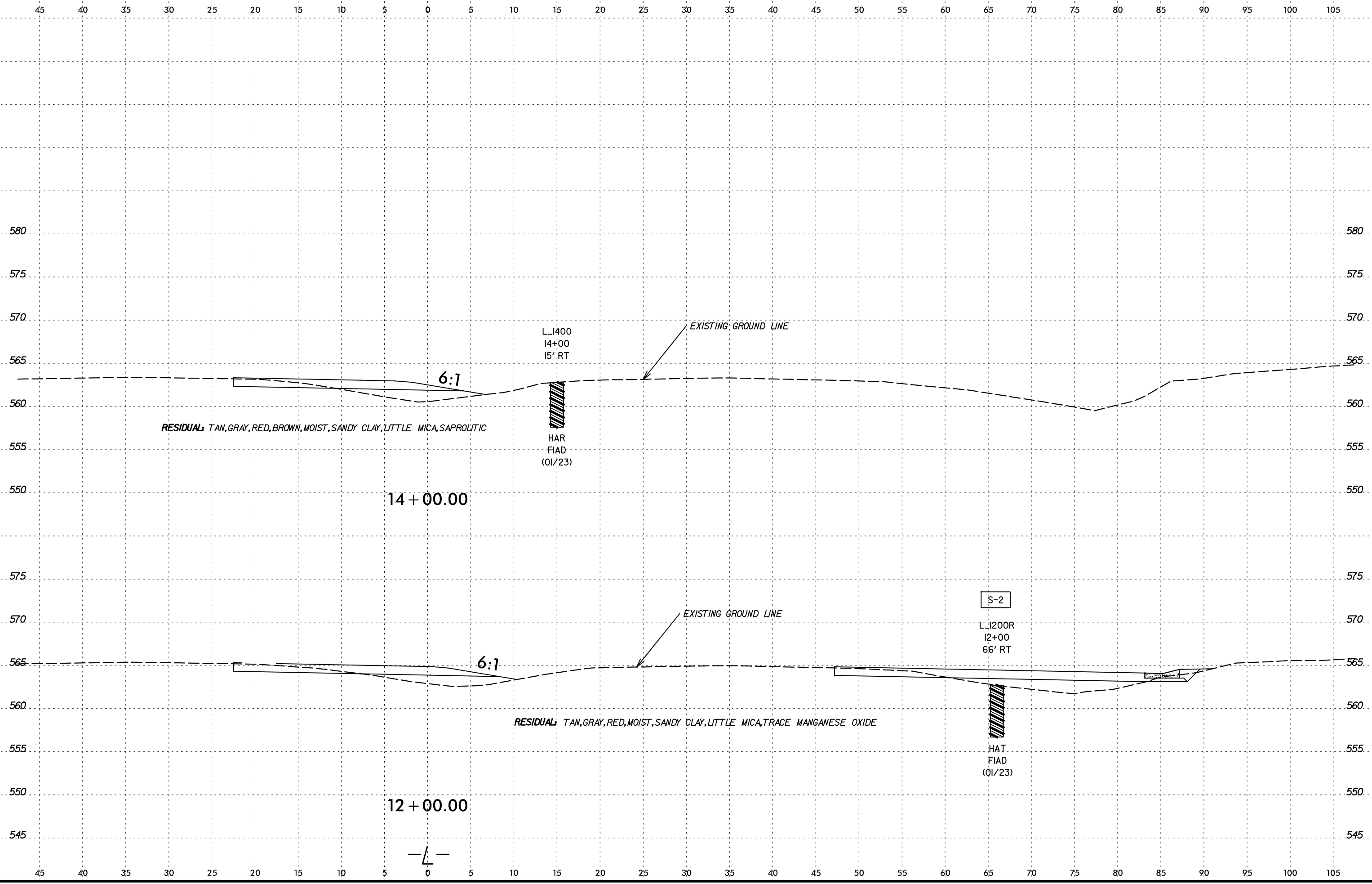
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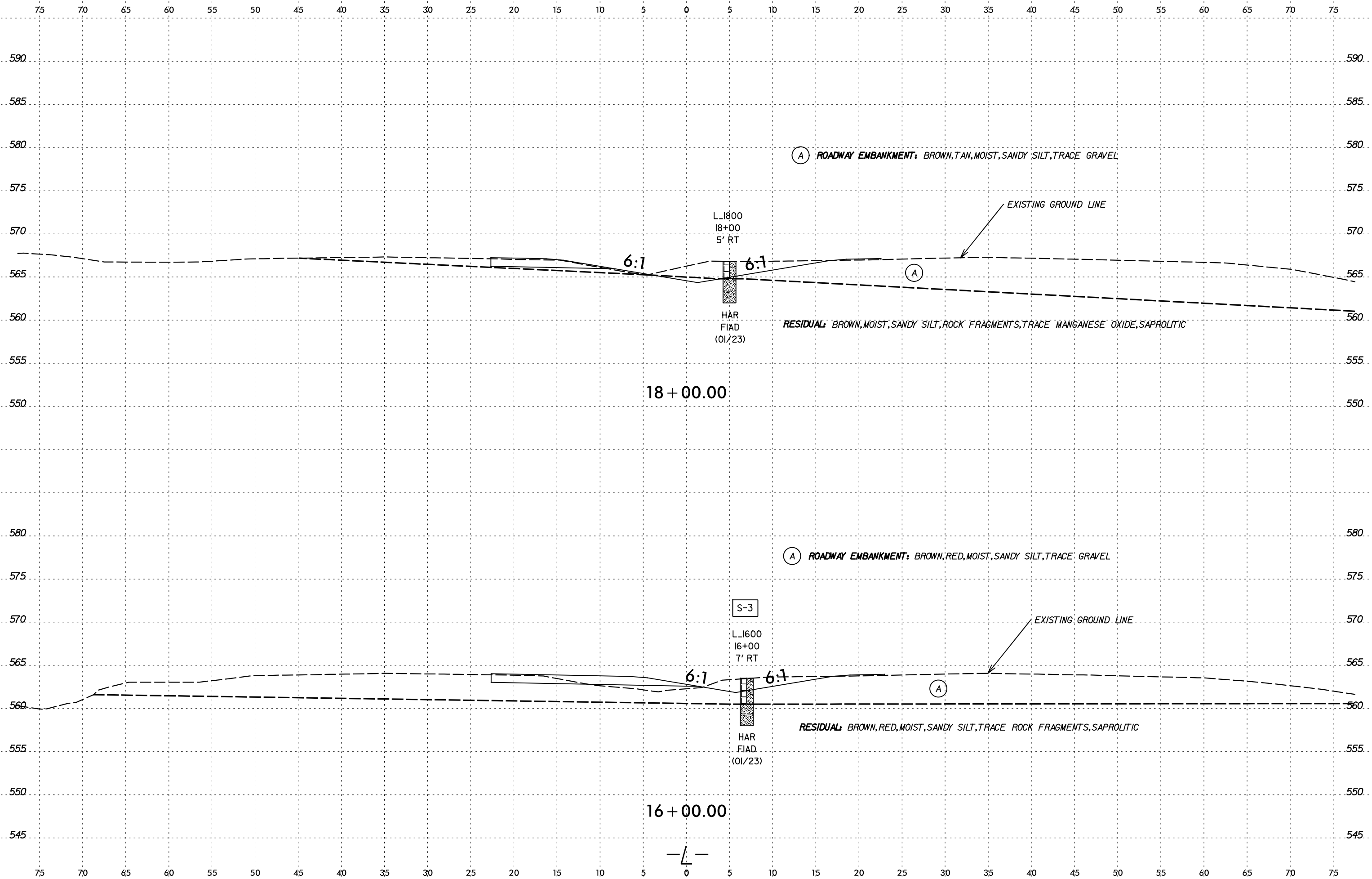
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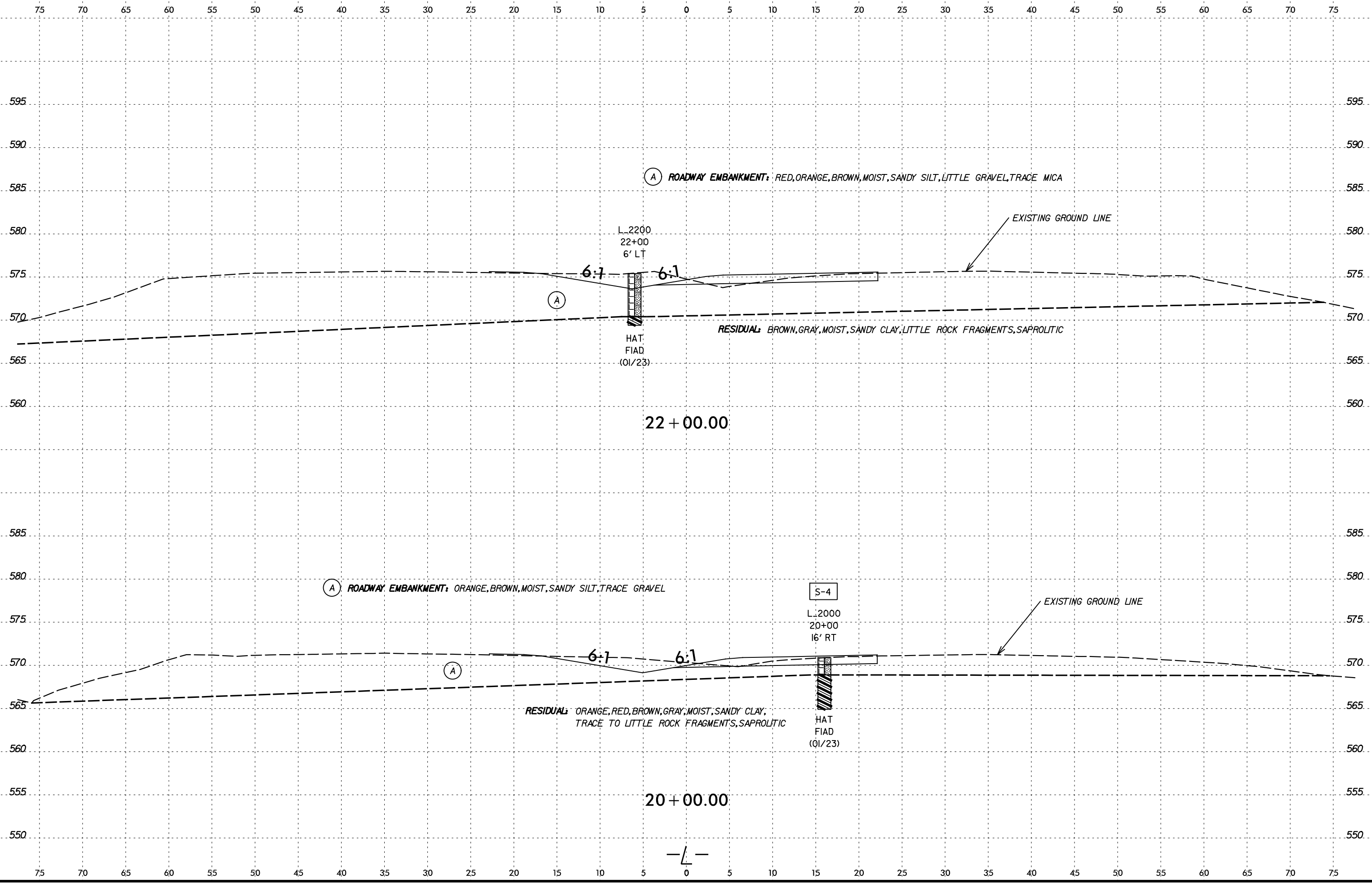


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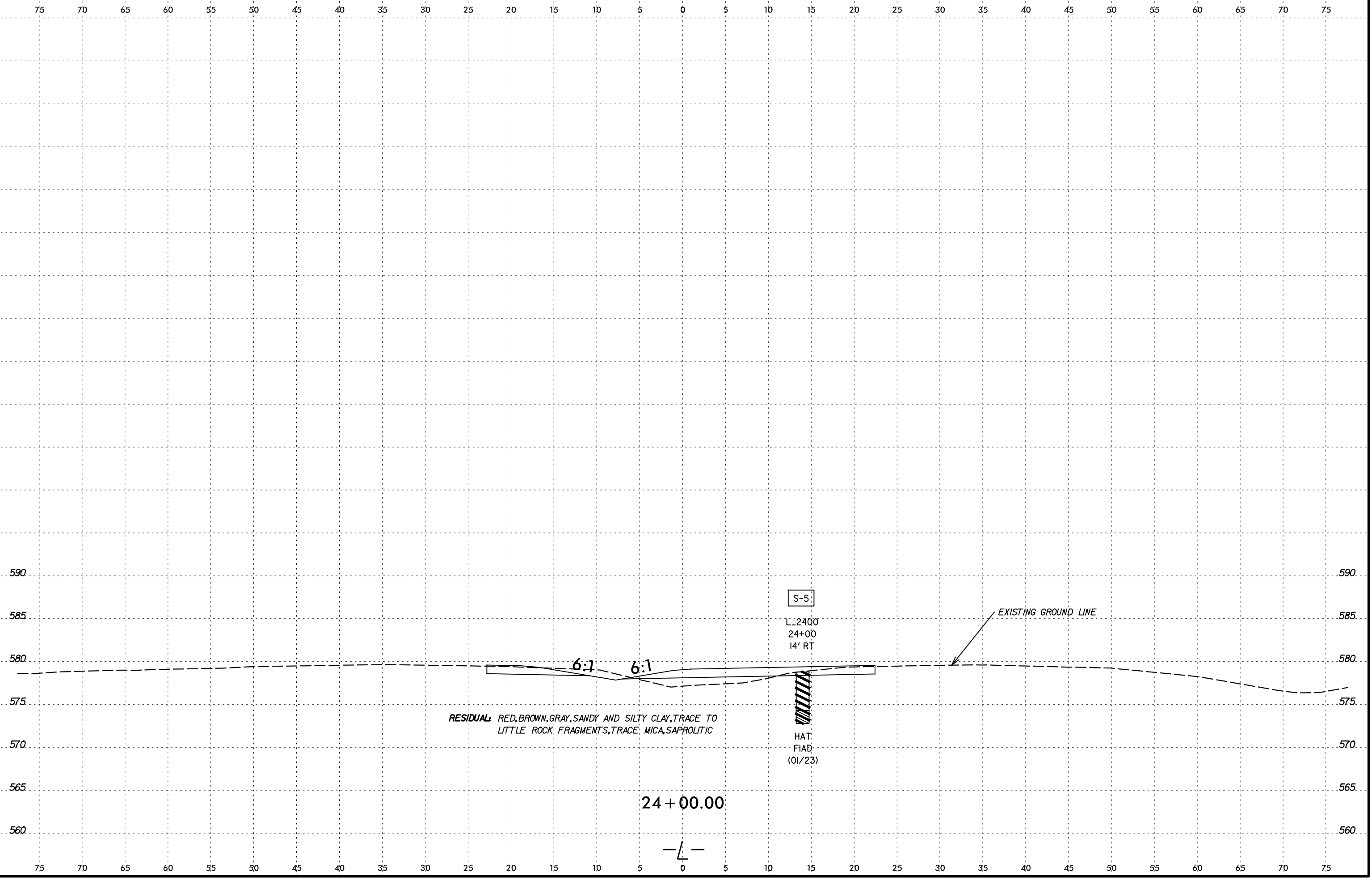


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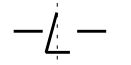


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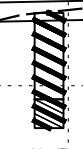
24 + 00.00



RESIDUAL: RED, BROWN, GRAY, SANDY AND SILTY CLAY, TRACE TO
LITTLE ROCK FRAGMENTS, TRACE MICA, SAPROLITIC

S-5

L:2400
24+00
14' RT

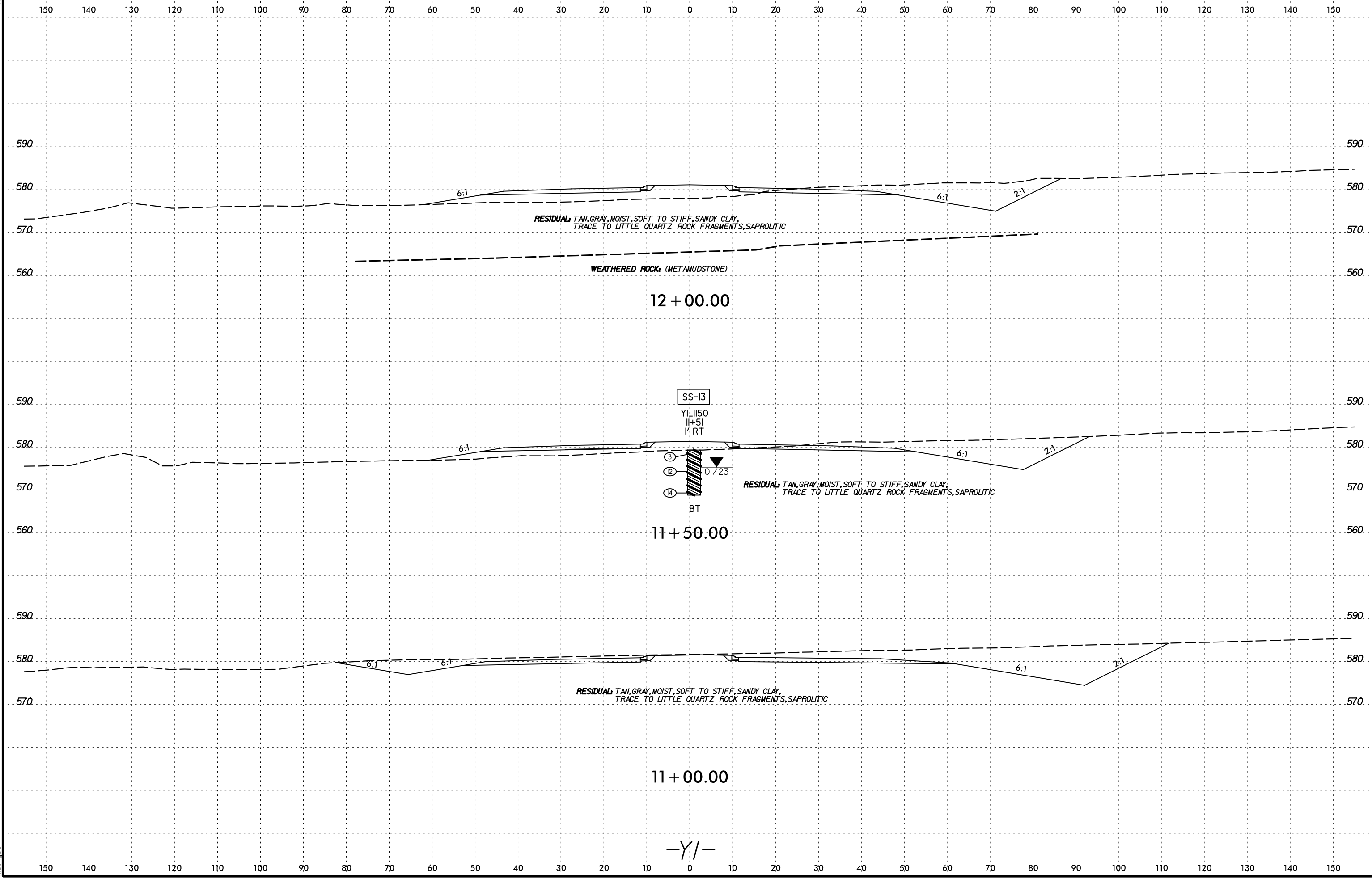


HAT
FIAD
(01/23)

EXISTING GROUND LINE

6:1

6:1



RESIDUAL TAN, GRAY, MOIST, SOFT TO STIFF, SANDY CLAY,
TRACE TO LITTLE QUARTZ ROCK FRAGMENTS, SAPROLITIC

WEATHERED ROCK (METAMUDSTONE)

12 + 00.00

SS-13
Y1-1150
11+51
1' RT

3
12
14
BT

01/23

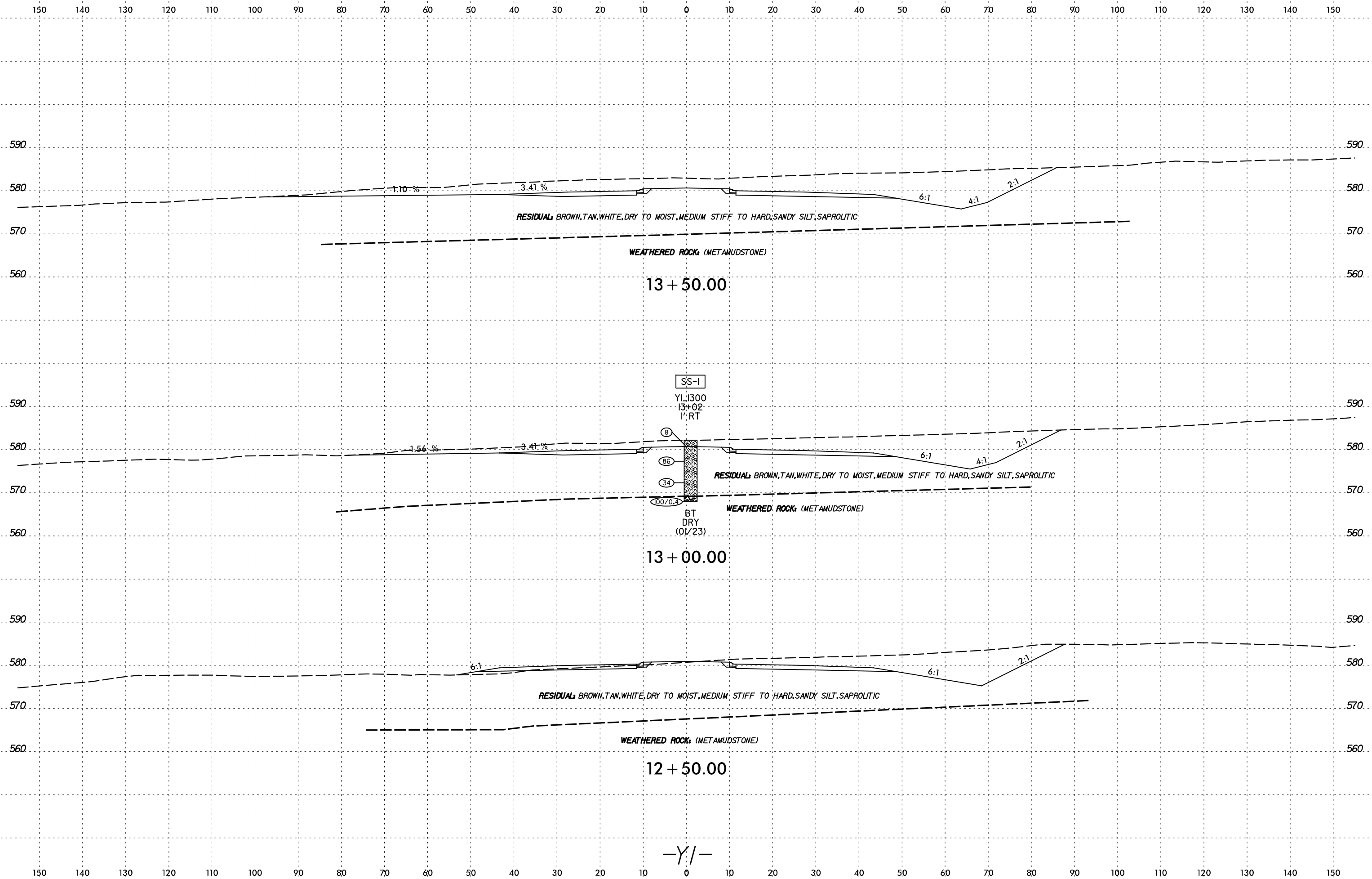
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TRACE TO LITTLE QUARTZ ROCK FRAGMENTS, SAPROLITIC

11 + 50.00

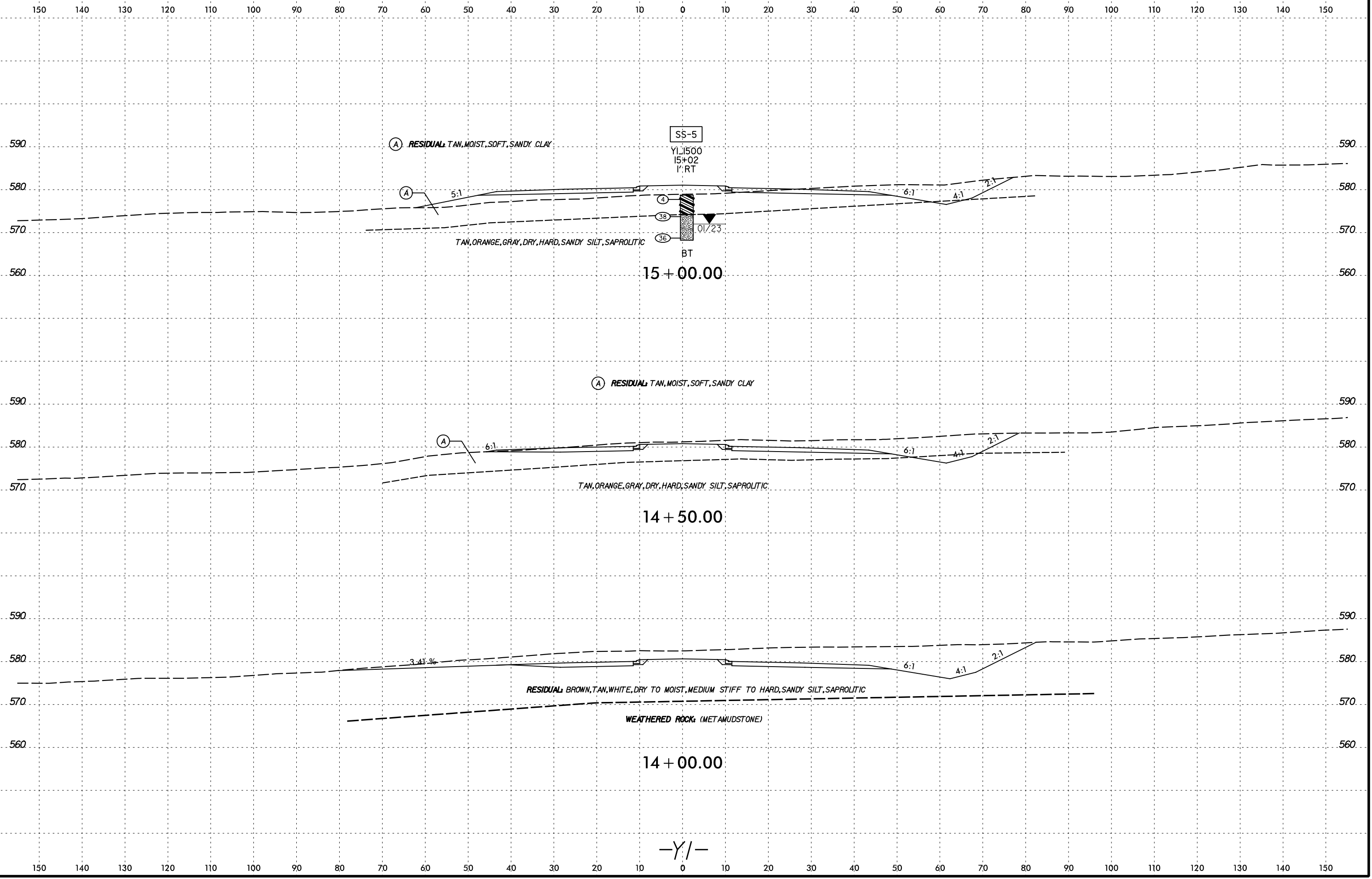
RESIDUAL TAN, GRAY, MOIST, SOFT TO STIFF, SANDY CLAY,
TRACE TO LITTLE QUARTZ ROCK FRAGMENTS, SAPROLITIC

11 + 00.00

-Y1-

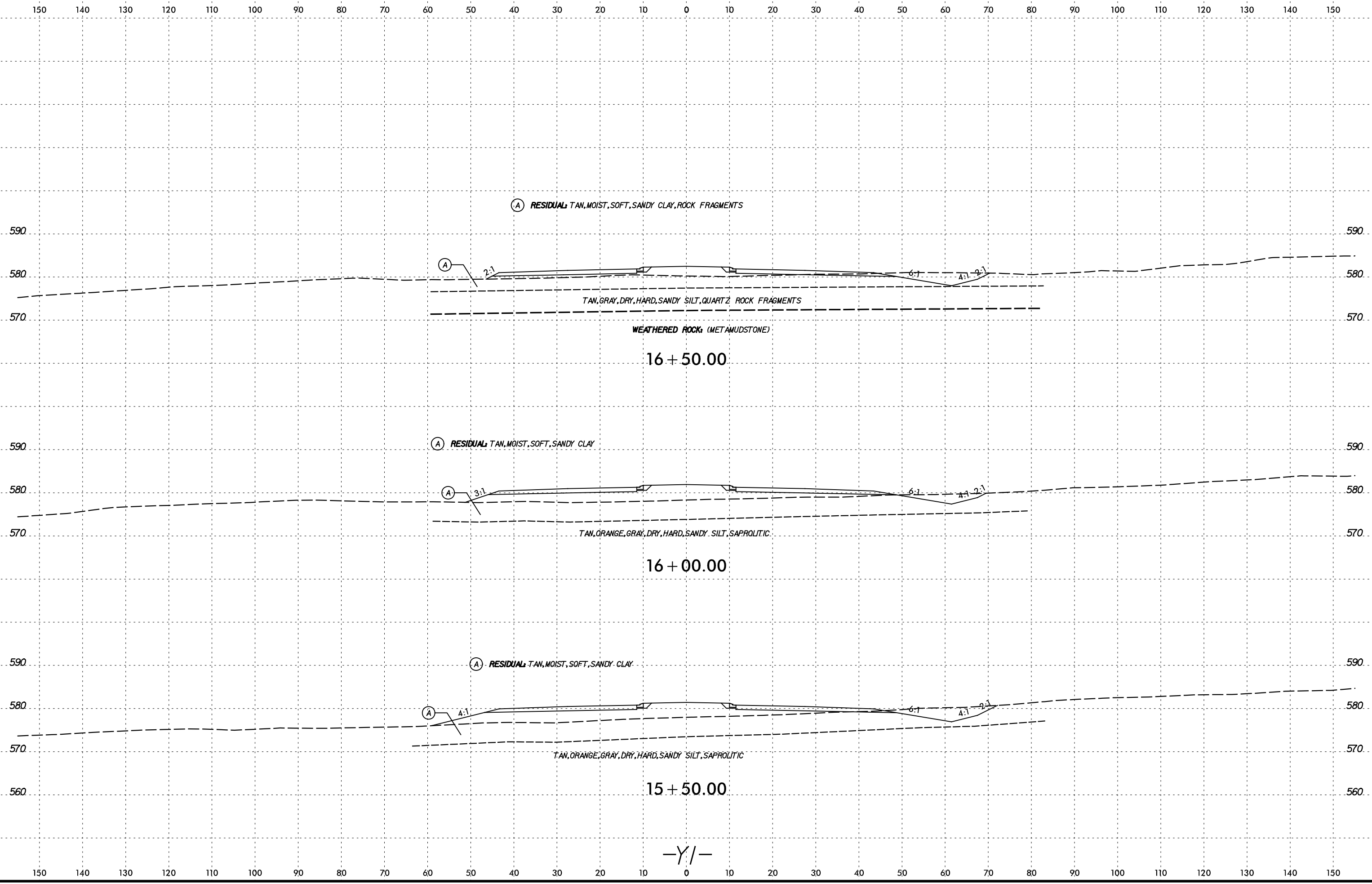


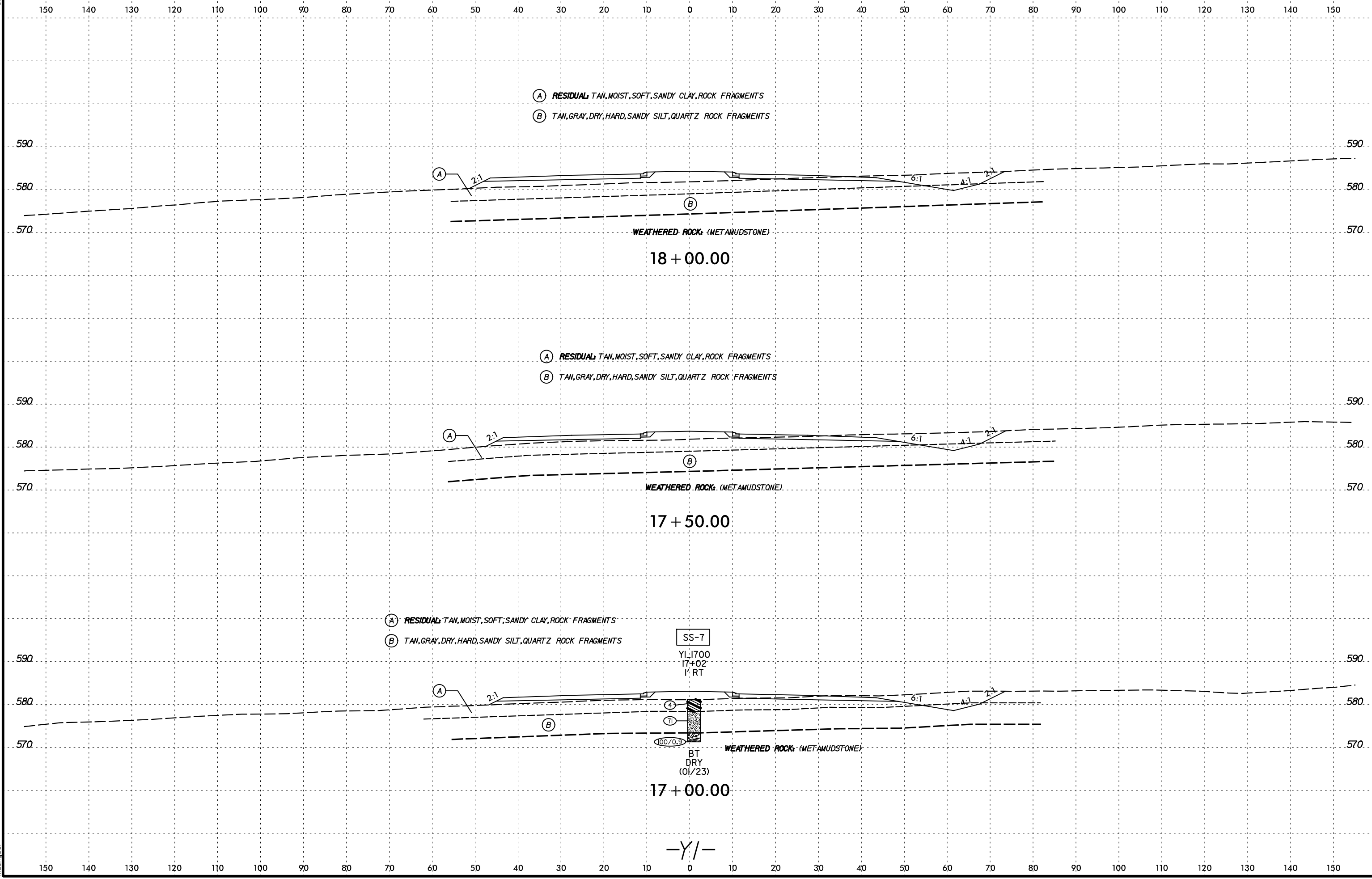
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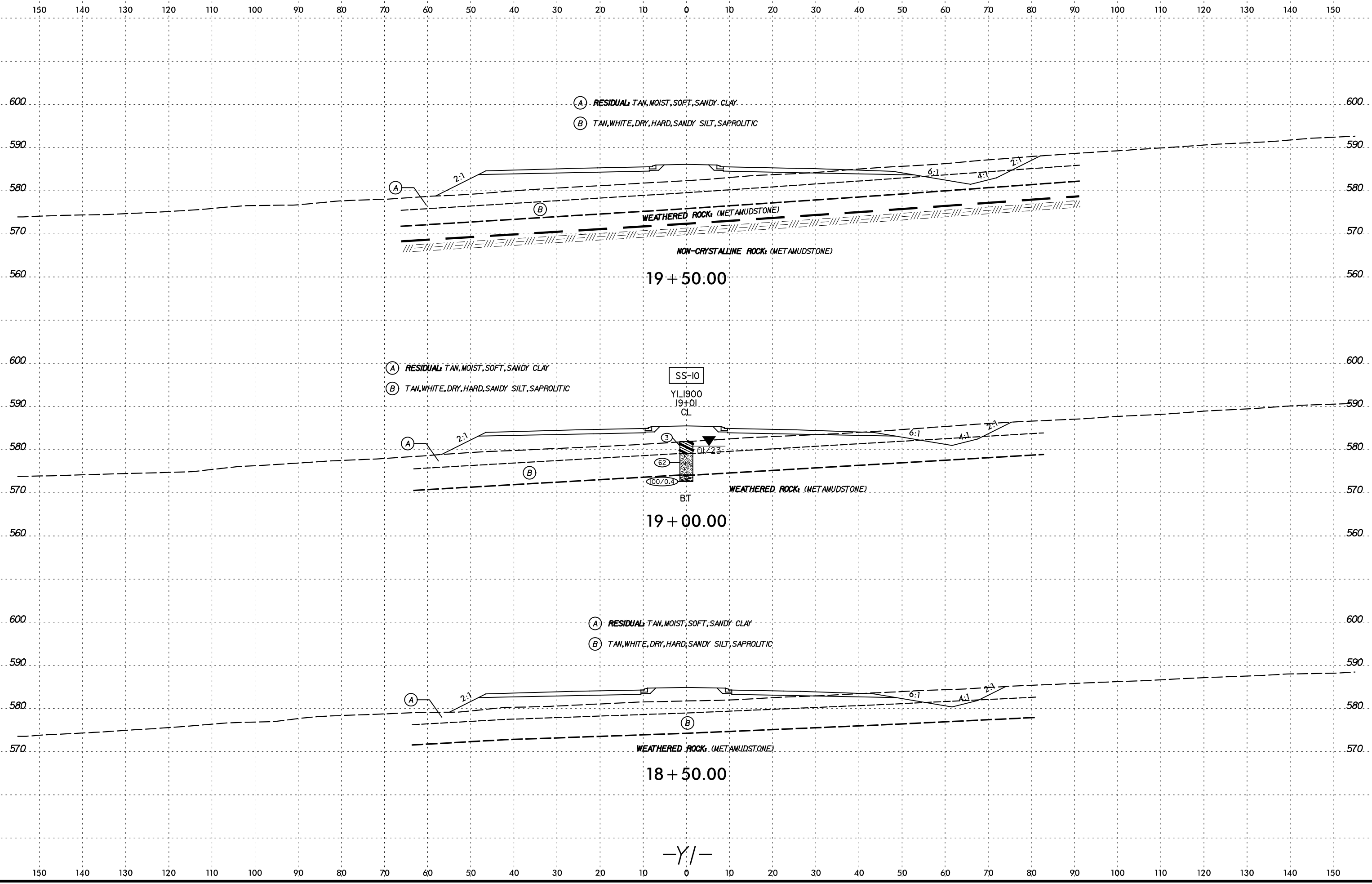


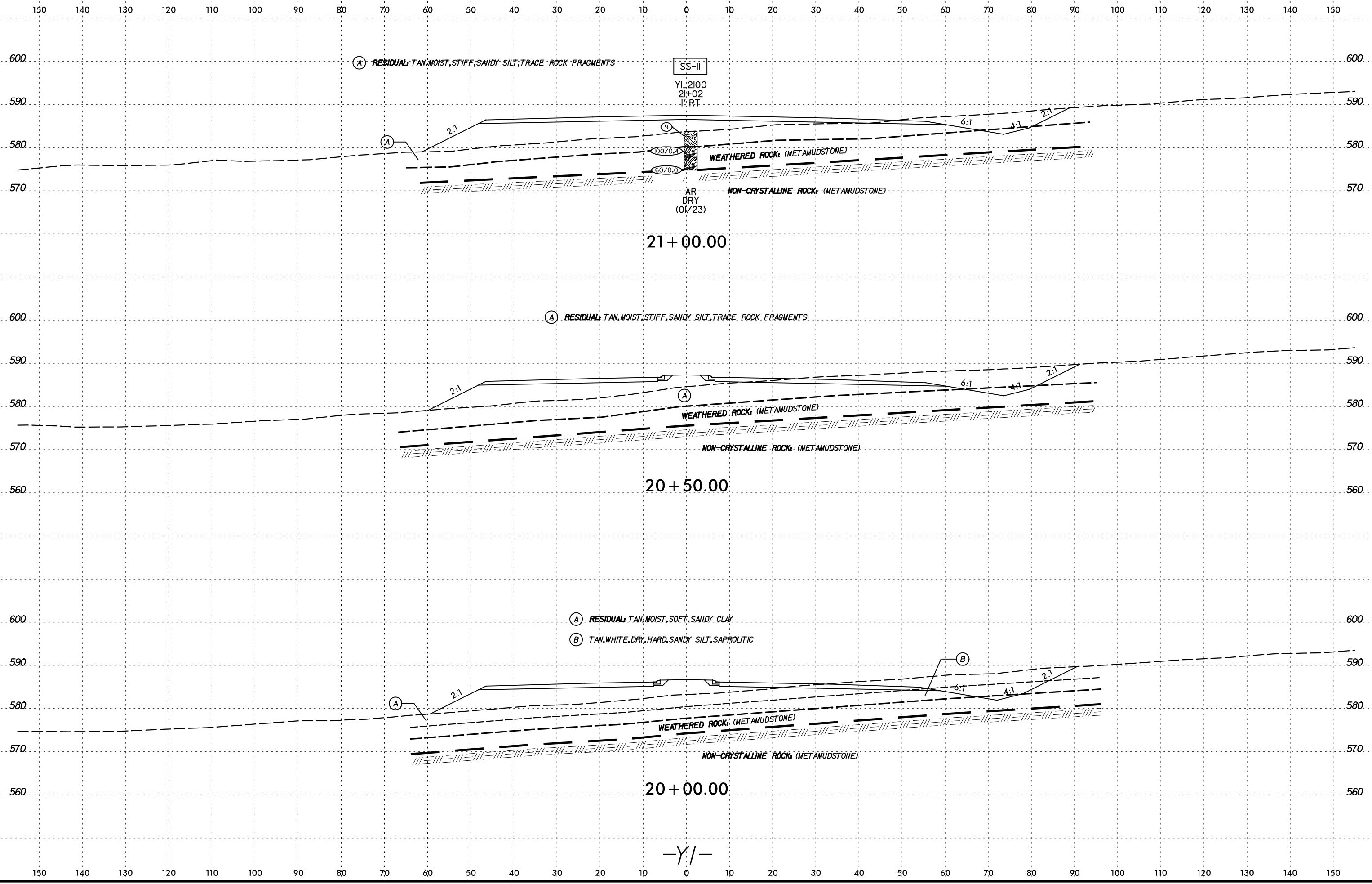
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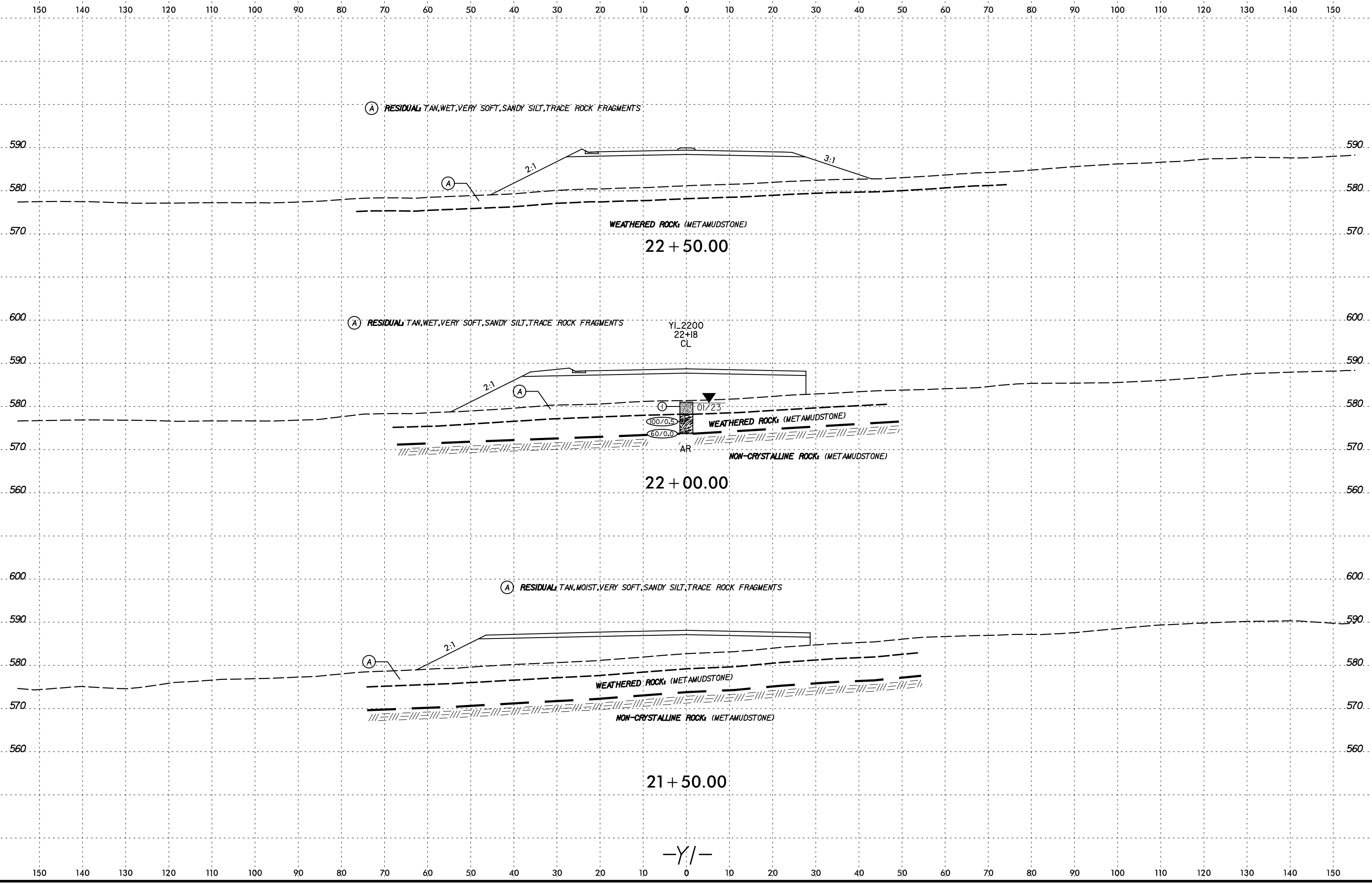
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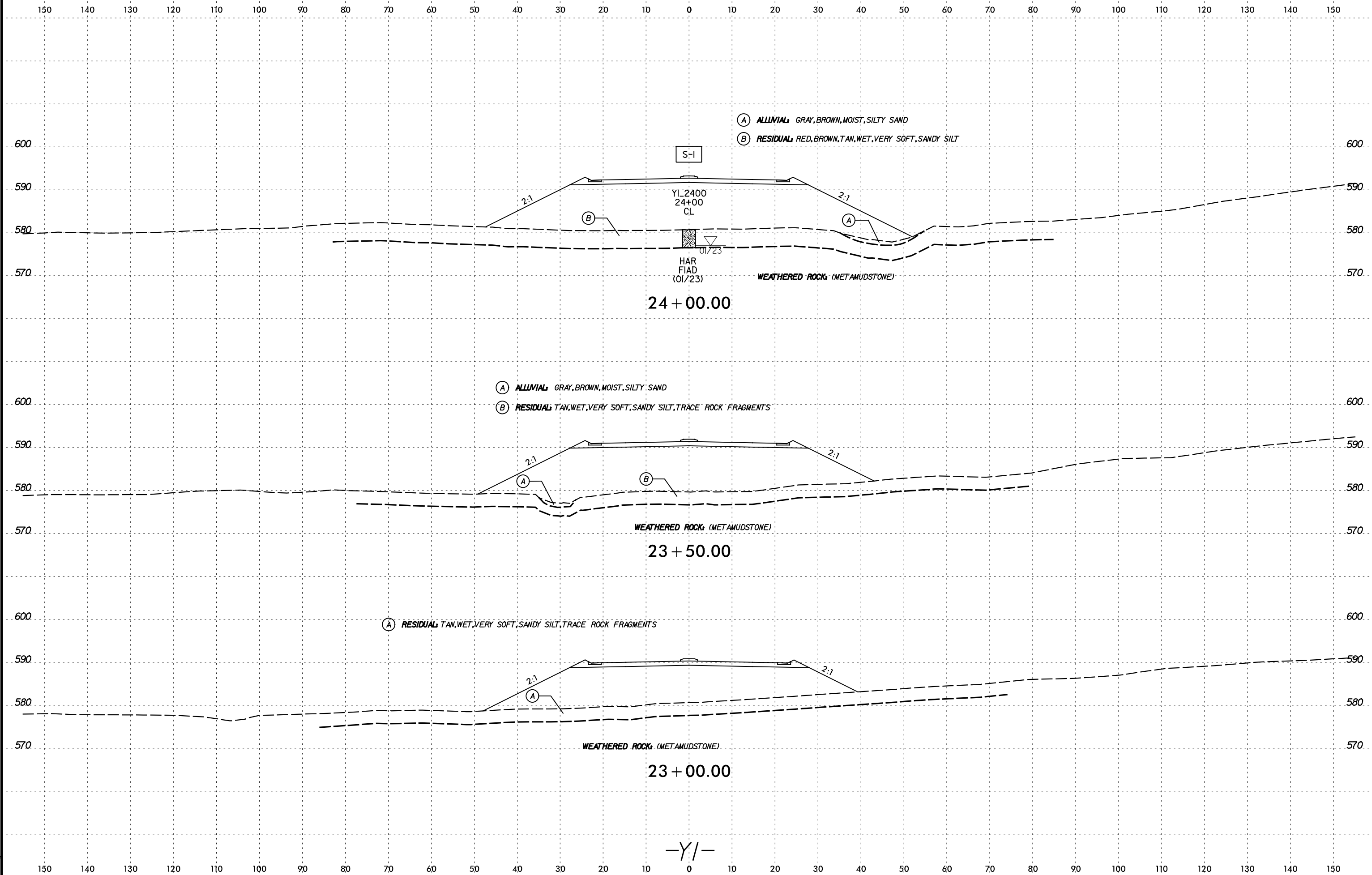


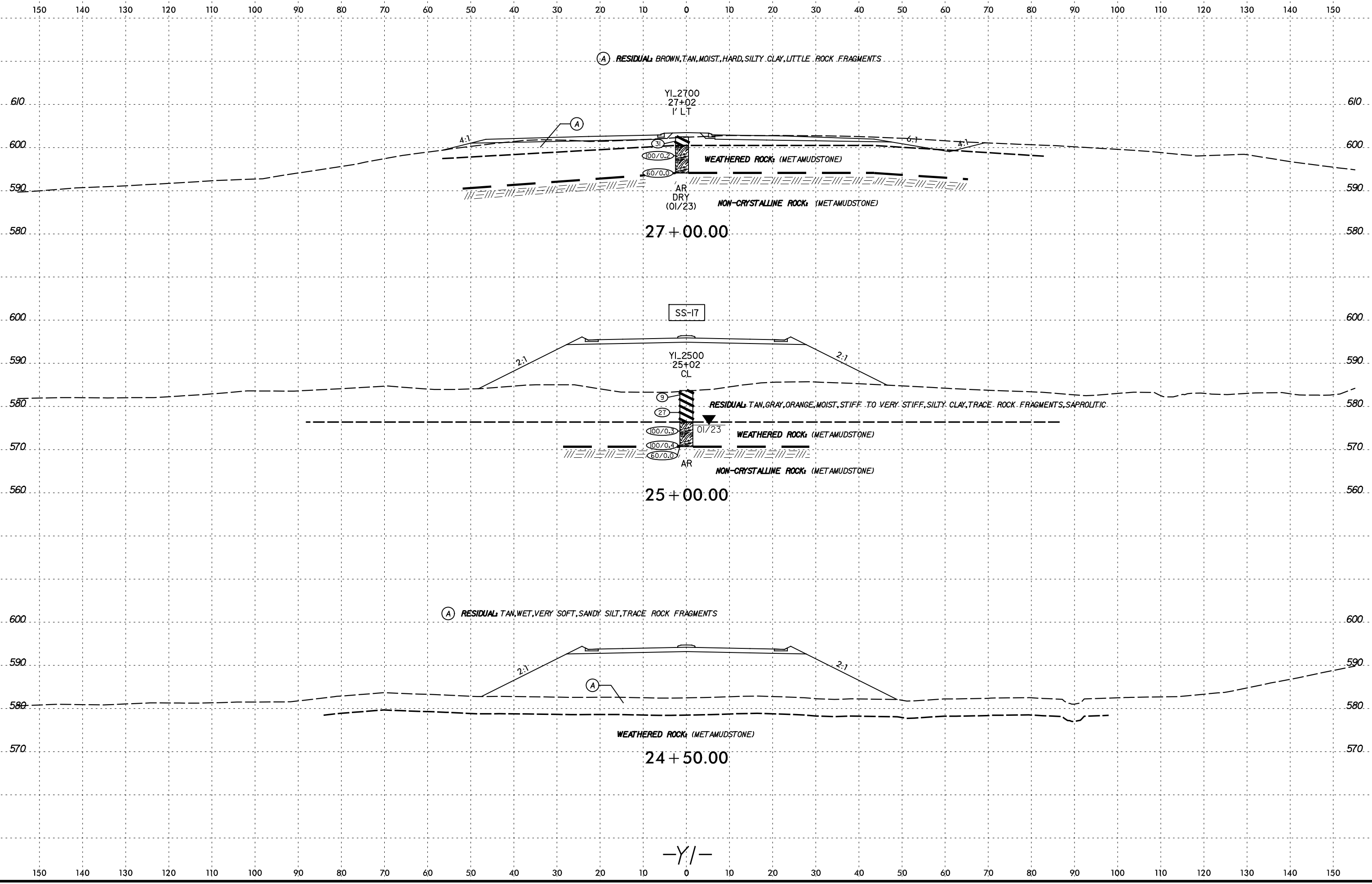


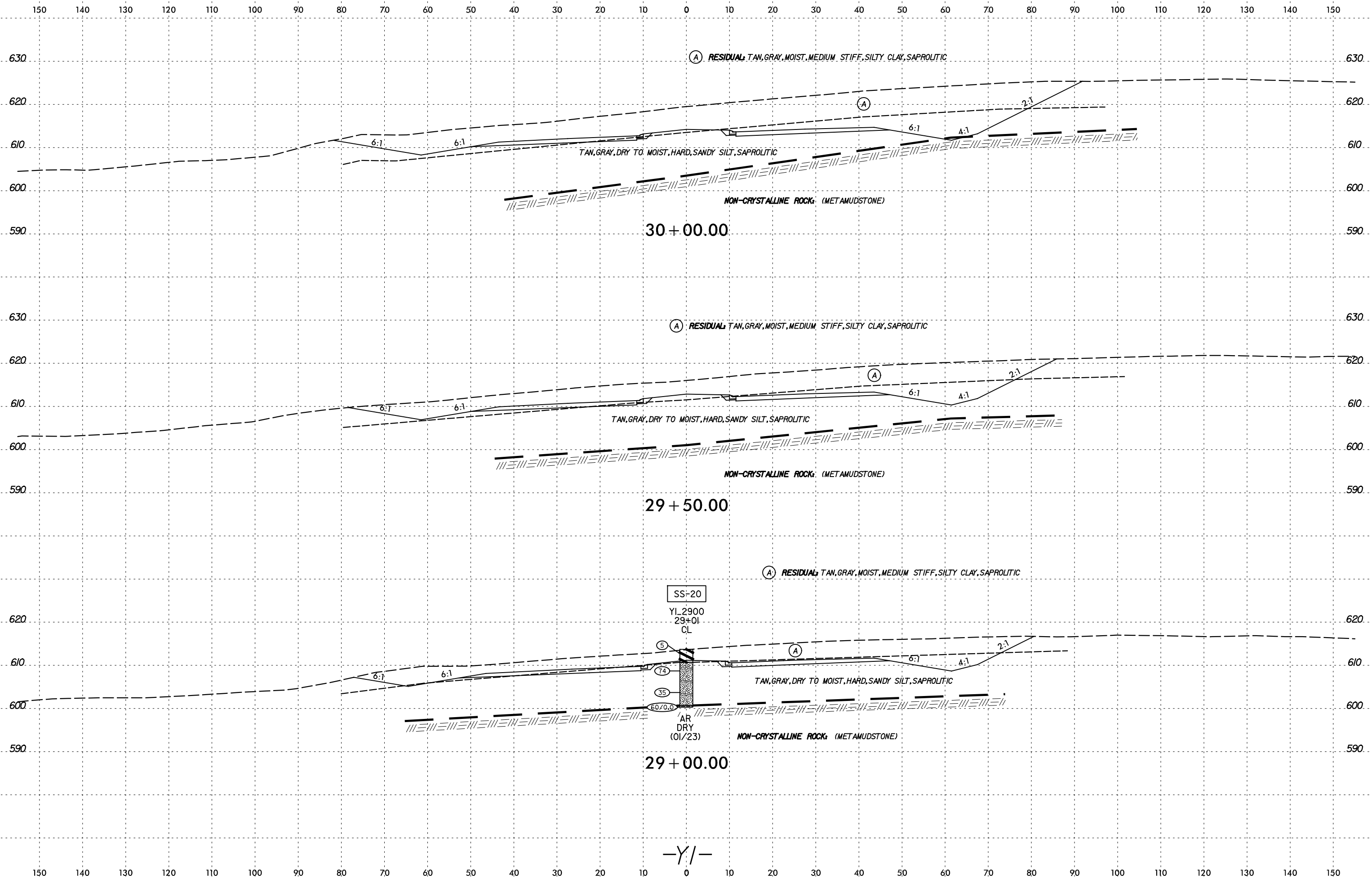


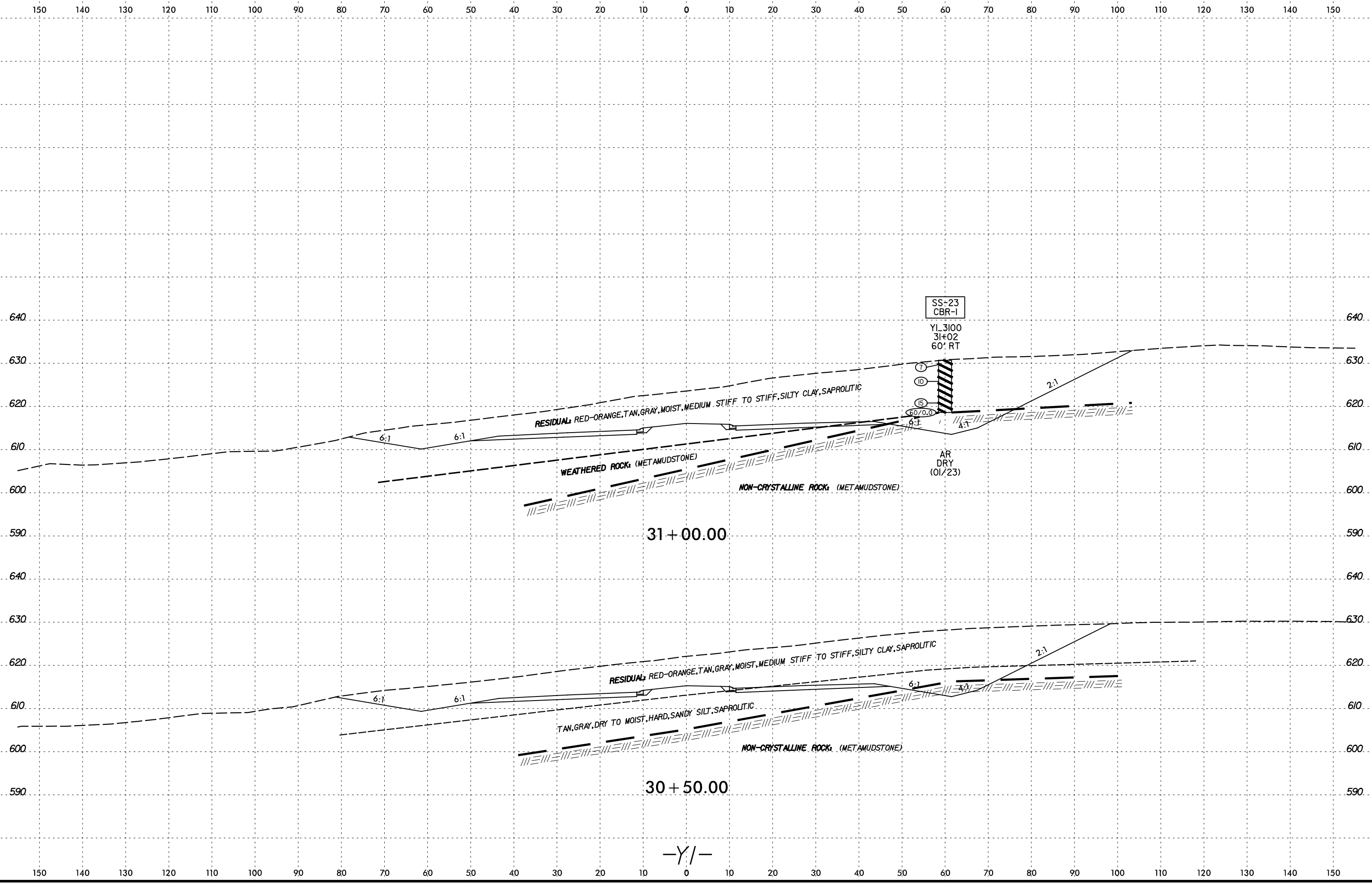




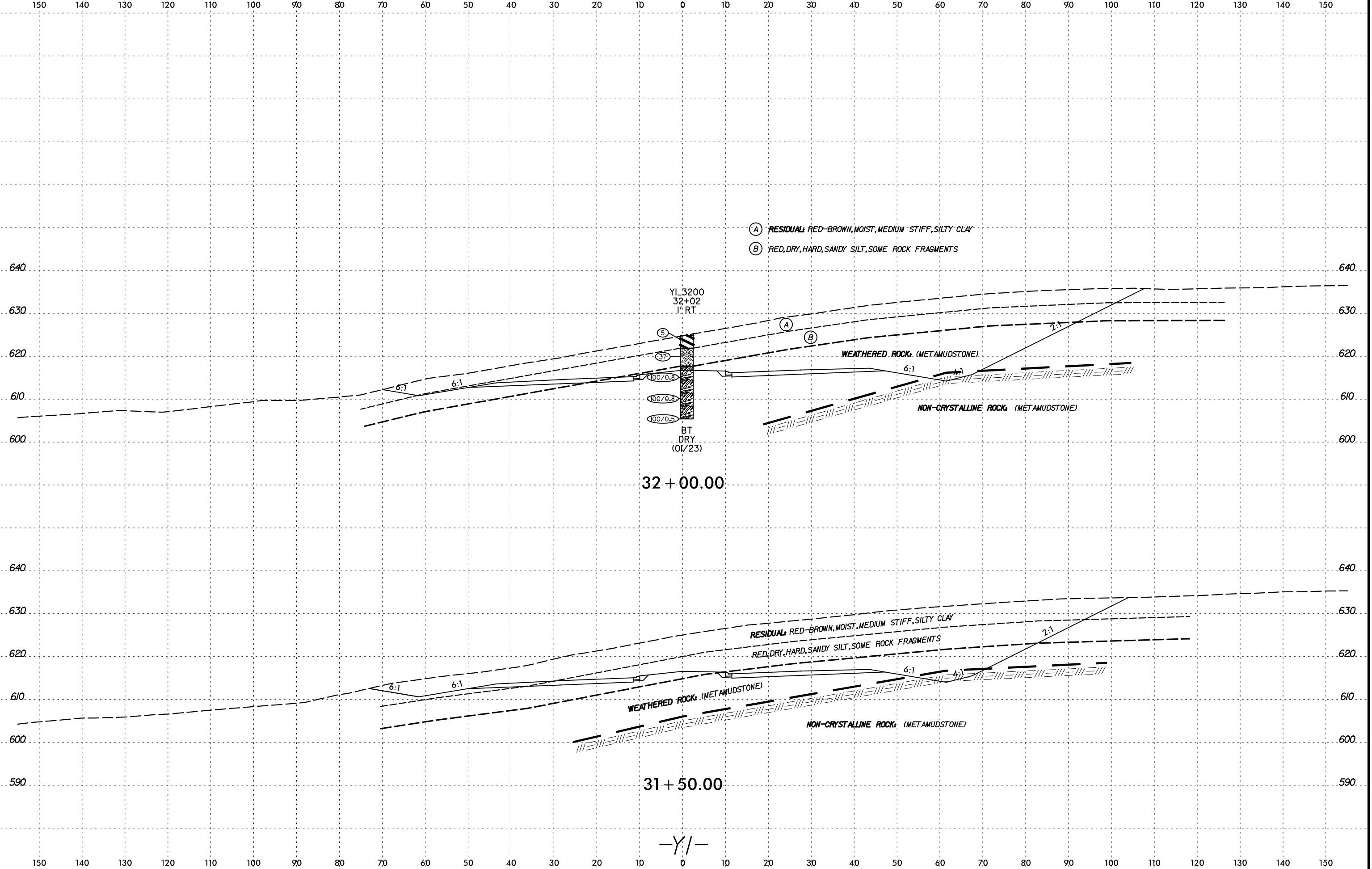




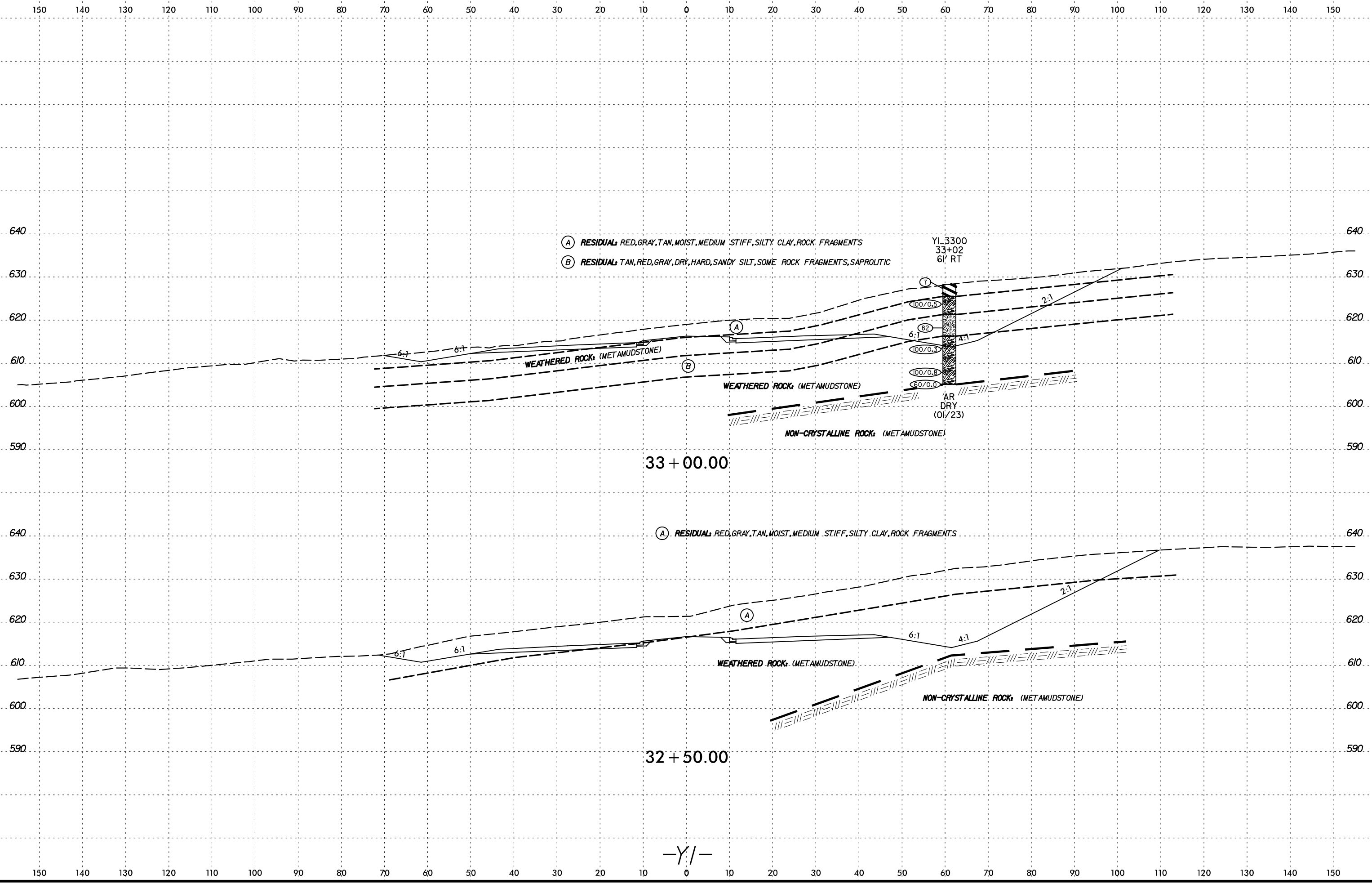


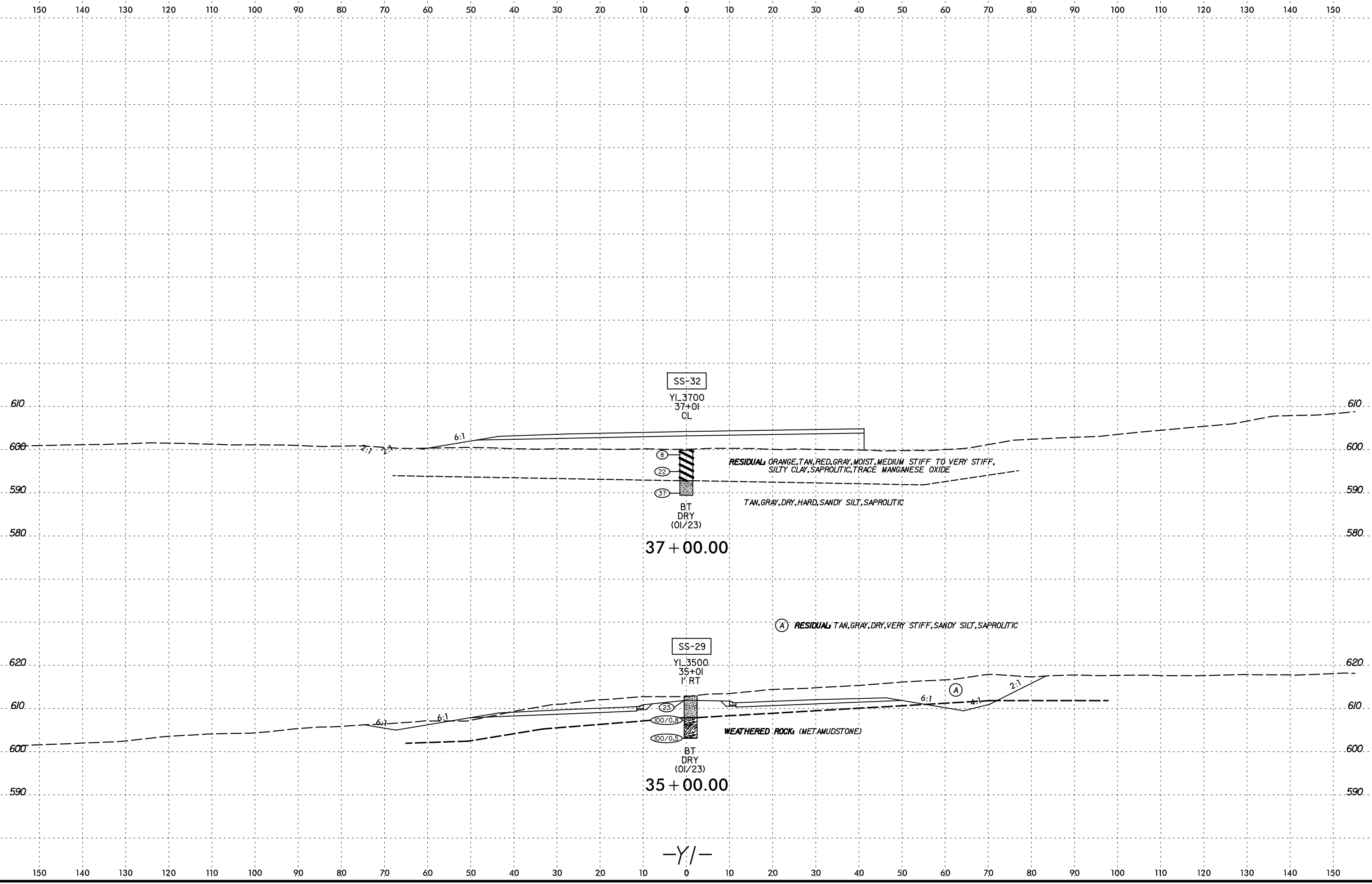


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STATE OF NORTH CAROLINA

DEPARTMENT OF TRANSPORTATION

DIVISION OF HIGHWAYS

GEOTECHNICAL ENGINEERING UNIT

**ROADWAY
SUBSURFACE INVESTIGATION****APPENDIX A****BORE LOGS****REFERENCE: HE-0011****PROJECT: 50623**

GEOTECHNICAL BORING REPORT

BORE LOG

WBS 50623		TIP HE-0011		COUNTY CHATHAM		GEOLOGIST H. Fischer											
SITE DESCRIPTION US 64 and Proposed CAM Site Access Road							GROUND WTR (ft)										
BORING NO. Y1_3900		STATION 39+02		OFFSET 1 ft RT		ALIGNMENT -Y1-											
COLLAR ELEV. 589.6 ft		TOTAL DEPTH 16.4 ft		NORTHING 727,905		EASTING 1,840,303											
DRILL RIG/HAMMER EFF./DATE SUM2603 CME-550X 83% 11/12/2021				DRILL METHOD H.S. Augers		HAMMER TYPE Automatic											
DRILLER M.G. Moseley		START DATE 01/26/23		COMP. DATE 01/26/23		SURFACE WATER DEPTH N/A											
ELEV (ft)	DRIVE ELEV (ft)	DEPTH (ft)	BLOW COUNT			BLOWS PER FOOT					SAMP. NO.	LOG	SOIL AND ROCK DESCRIPTION				
			0.5ft	0.5ft	0.5ft	0	25	50	75	100			ELEV. (ft)	DEPTH (ft)			
590	589.6	0.0	1	2	5									589.6	0.0	GROUND SURFACE	
																	RESIDUAL
																	Tan, Gray, Medium Stiff to Very Stiff, Silty CLAY, Saprolitic
585	585.8	3.8	8	9	18												
580	580.8	8.8	100/0.5														WEATHERED ROCK (METAMUDSTONE)
575	575.8	13.8	100/0.4														
	573.2	16.4	60/0.0											573.2	16.4		Boring Terminated with Standard Penetration Test Refusal at Elevation 573.2 ft on Non-Crystalline Rock (METAMUDSTONE)
																	Auger Refusal at 16.4'

NCDOT BORE DOUBLE HE-0011_GEO_BH.GPJ NC_DOT.GDT 4/14/23

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

ROADWAY
SUBSURFACE INVESTIGATION

APPENDIX A

LABORATORY TESTING SUMMARY
PROCTOR TEST RESULTS

REFERENCE: HE-0011

PROJECT: 50623

Prepared in the Office of:

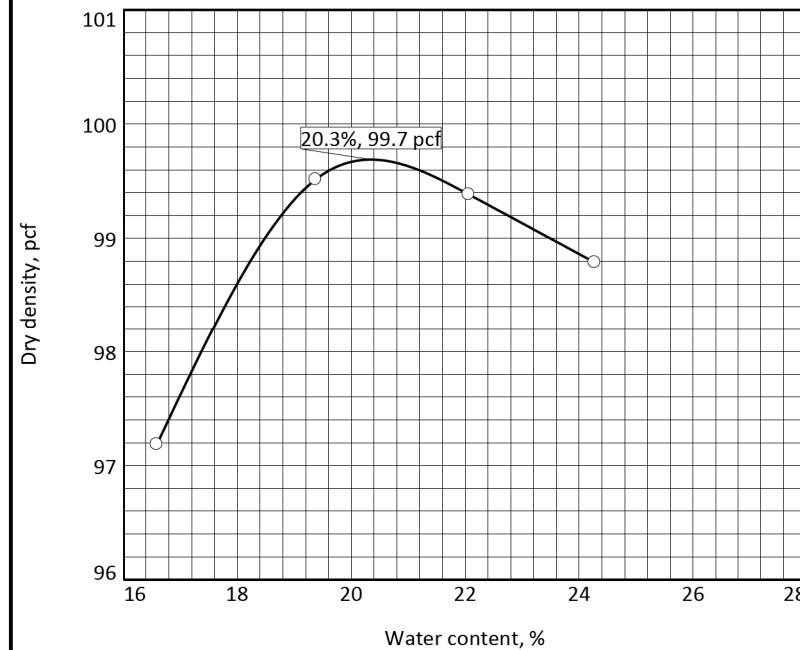
SUMMIT DESIGN AND ENGINEERING
HILLSBOROUGH, NC

SOIL TEST RESULTS

SAMPLE NO.	ALIGNMENT	STATION	OFFSET	DEPTH INTERVAL	AASHTO CLASS.	L.L.	P.I.	% BY WEIGHT				% PASSING SIEVE			% MOISTURE	% ORGANIC
								C. SAND	F. SAND	SILT	CLAY	10	40	200		
S-2	-L-	12+00	66' RT	1.5 - 2.5	A-6(9)	33	11	7.5	9.7	44.8	38.0	98	93	84	22.0	-
S-3	-L-	16+00	7' RT	1.5 - 2.5	A-4(0)	33	7	35.6	22.5	28.8	13.1	90	67	42	22.3	-
S-4	-L-	20+00	16' RT	2.0 - 3.0	A-6(11)	38	14	5.9	14.7	35.2	44.2	96	93	91	22.0	-
S-5	-L-	24+00	14' RT	1.5 - 2.5	A-7-6(13)	44	15	5.5	21.4	39.0	34.1	100	98	79	29.4	-
SS-13	-Y1-	11+51	1' RT	0.0 - 1.5	A-6(9)	35	16	10.7	10.9	40.1	38.3	83	77	68	20.3	-
SS-1	-Y1-	13+02	1' RT	0.0 - 1.5	A-4(1)	27	6	9.8	17.5	42.6	30.1	69	64	54	20.9	-
SS-5	-Y1-	15+02	1' RT	4.0 - 5.5	A-4(1)	28	7	21.1	31.6	21.1	26.2	96	87	51	18.7	-
SS-7	-Y1-	17+02	1' RT	0.0 - 1.5	A-6(13)	39	18	8.4	13.9	37.3	40.4	92	87	75	20.4	-
SS-10	-Y1-	19+01	0'	3.9 - 5.4	A-4(3)	31	9	4.4	30.4	24.7	40.5	77	75	56	8.1	-
SS-11	-Y1-	21+02	1' RT	0.0 - 1.5	A-4(7)	25	7	16.8	13.3	37.8	32.1	68	59	50	15.2	-
S-1	-Y1-	24+00	0'	1.0 - 2.0	A-4(7)	30	7	0.6	6.3	67.5	25.6	100	100	96	25.4	-
SS-17	-Y1-	25+02	0'	0.0 - 1.5	A-7-6(27)	49	26	1.5	6.0	37.8	54.7	100	99	94	27.7	-
SS-20	-Y1-	29+01	0'	4.0 - 5.5	A-4(7)	36	10	14.7	11.4	47.5	26.4	100	89	77	13.2	-
SS-23	-Y1-	31+02	60' RT	3.9 - 5.4	A-7-5(15)	48	14	4.8	12.1	42.0	41.1	100	98	86	32.4	-
SS-29	-Y1-	35+01	1' RT	0.0 - 1.5	A-4(1)	25	5	11.1	15.2	49.8	23.9	84	78	65	11.5	-
SS-32	-Y1-	37+01	0'	0.0 - 1.5	A-7-6(13)	42	18	8.6	10.4	44.9	36.1	89	83	75	22.8	-

COMPACTION TEST REPORT

Curve No.
S-746



Test Specification:
ASTM D 698-12 Method A Standard

Preparation Method Dry Prep
Hammer Wt. 5.5 lb.
Hammer Drop 12 in.
Hammer Type: Automatic
Layers Three **Blows/Layer** 25
Mold Size 0.03333 cu. ft.

Test Performed on Material
Passing #4 **Sieve**

NM **LL** **PI**

Sp.G. (Assumed):

%>#4 **%<No.200**

USCS **AASHTO**


Date Sampled 2/1/2023

Date Received 2/1/2023

Date Tested 2/2/2023

Tested By Jonathan Pope

TESTING DATA	1	2	3	4	5	6
WM + WS	6103.0	6020.0	6141.0	6163.0		
WM	4307.0	4307.0	4307.0	4307.0		
WW + T #1	387.0	354.5	395.4	473.1		
WD + T #1	326.7	306.3	326.5	383.4		
TARE #1	15.6	15.6	14.2	13.4		
WW + T #2						
WD + T #2						
TARE #2						
MOISTURE	19.4	16.6	22.1	24.3		
DRY DENSITY	99.5	97.2	99.4	98.8		

TEST RESULTS	Material Description
Maximum dry density = 99.7 pcf	A-7-5
Optimum moisture = 20.3 %	Remarks:
Project No. HP-HOLD.001 Client: Siler City - Gannett Fleming Project: HE-0011 CAM Site Rd.	
○ Loc.: Y1_3100 31+02 60'RT Depth: 0.0'-10.0' Sample No.: CBR-1	Checked by: Steve Fenton Title: Lab Supervisor
	Figure