

CONTRACT: C201578 ID: R-2409B

CONTENTS: -L- FROM STA 10+00  
TO STA 37+00

# STATE OF NORTH CAROLINA

## DEPARTMENT OF TRANSPORTATION

### DIVISION OF HIGHWAYS

### GEOTECHNICAL UNIT

# SUBSURFACE INVESTIGATION

STATE PROJECT 34428.3.1 I.D. NO. R-2409B  
F.A. PROJECT \_\_\_\_\_  
COUNTY JACKSON  
DESCRIPTION RELOCATION OF US-64  
EAST OF CASHIERS

## INVENTORY

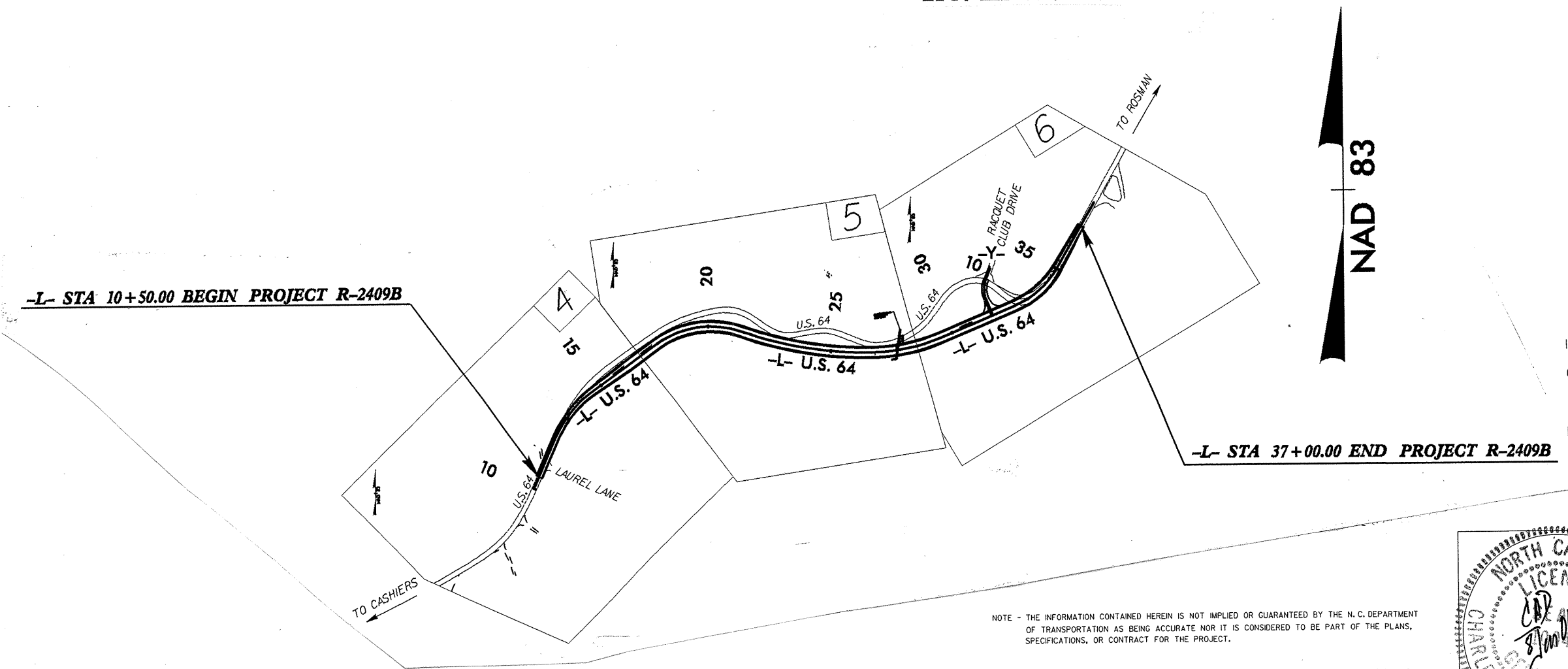
STATE	STATE PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
N.C.	R-2409B	1	71
STATE PROJ. NO.	F.A. PROJ. NO.	DESCRIPTION	
34428.1.1		P.E.	
34428.2.1		R.O.W.	
34428.3.1		CONSTRUCTION	

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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 THIS 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.

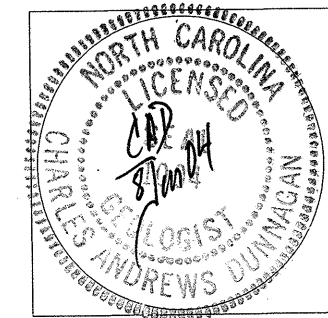


INVESTIGATED BY C A DUNNAGAN PERSONNEL \_\_\_\_\_  
 CHECKED BY W D FRYE, JR \_\_\_\_\_  
 SUBMITTED BY W D FRYE, JR \_\_\_\_\_  
 DATE JUNE 2004 \_\_\_\_\_

DRAWN BY: C A DUNNAGAN

NOTE - THE INFORMATION CONTAINED HEREIN IS NOT IMPLIED OR GUARANTEED BY THE N.C. DEPARTMENT OF TRANSPORTATION AS BEING ACCURATE NOR IS IT CONSIDERED TO BE PART OF THE PLANS, SPECIFICATIONS, OR CONTRACT FOR THE PROJECT.

NOTE - 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.



SEAL  
 SIGNATURE C A Dunnagan

DIVISION OF HIGHWAYS  
GEOTECHNICAL UNIT

SUBSURFACE INVESTIGATION

SOIL AND ROCK LEGEND, TERMS, SYMBOLS, AND ABBREVIATIONS

SOIL DESCRIPTION										GRADATION										ROCK DESCRIPTION										TERMS AND DEFINITIONS									
SOIL IS CONSIDERED TO BE THE UNCONSOLIDATED, SEMI-CONSOLIDATED OR WEATHERED EARTH MATERIALS WHICH CAN BE PENETRATED WITH A CONTINUOUS FLIGHT POWER AUGER, AND WHICH YIELDS LESS THAN 100 BLOWS PER FOOT ACCORDING TO STANDARD PENETRATION TEST (AASHTO T206, ASTM D-1586). SOIL CLASSIFICATION IS BASED ON THE AASHTO SYSTEM AND BASIC DESCRIPTIONS GENERALLY SHALL INCLUDE: CONSISTENCY, COLOR, TEXTURE, MOISTURE, AASHTO CLASSIFICATION, AND OTHER PERTINENT FACTORS SUCH AS MINERALOGICAL COMPOSITION, ANGULARITY, STRUCTURE, PLASTICITY, ETC. EXAMPLE: VERY STIFF, GRAY SILTY CLAY, MOIST WITH INTERBEDDED FINE SAND LAYERS, HIGHLY PLASTIC, A-7-6										WELL GRADED- INDICATES A GOOD REPRESENTATION OF PARTICLE SIZES FROM FINE TO COARSE UNIFORM- INDICATES THAT SOIL PARTICLES ARE ALL APPROXIMATELY THE SAME SIZE. (ALSO POORLY GRADED) GAP-GRADED- INDICATES A MIXTURE OF UNIFORM PARTICLES OF TWO OR MORE SIZES.										HARD ROCK IS NON-COASTAL PLAIN MATERIAL THAT WHEN TESTED, WOULD YIELD SPT REFUSAL, 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:										ALLUVIUM (ALLUV.) - SOILS WHICH 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, AS SHALE, SLATE, ETC. ARTESIAN - GROUND WATER THAT IS UNDER SUFFICIENT PRESSURE TO RISE ABOVE THE LEVEL AT WHICH IS ENCOUNTERED, BUT WHICH DOES NOT NECESSARILY RISE TO OR ABOVE THE GROUND SURFACE. CALCAREOUS (CALC.) - SOILS WHICH 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 (F.P.) - 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 SOIL - SOIL FORMED IN PLACE BY THE WEATHERING OF ROCK. ROCK QUALITY DESIGNATION (R.Q.D.) - 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 WHICH 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, WHICH 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 B.P.F.) 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 LESS THAN 0.1 FOOT PENETRATION WITH 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 (S.R.Q.D.) - 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 (T.S.) - SURFACE SOILS USUALLY CONTAINING ORGANIC MATTER.									
<b>SOIL LEGEND AND AASHTO CLASSIFICATION</b> 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 SYMBOL [Diagrams showing soil patterns for various groups]										<b>MINERALOGICAL COMPOSITION</b> MINERAL NAMES SUCH AS QUARTZ, FELDSPAR, MICA, TALC, KAOLIN, ETC. ARE USED IN DESCRIPTIONS WHENEVER THEY ARE CONSIDERED OF SIGNIFICANCE.										<b>WEATHERING</b> 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 ROCKS 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, YIELDS SPT N VALUES > 100 BPF. VERY SEVERE (V. SEV.) ALL ROCK EXCEPT QUARTZ DISCOLORED OR STAINED. ROCK FABRIC ELEMENTS ARE DISCERNIBLE BUT THE MASS IS EFFECTIVELY REDUCED TO SOIL STATUS, WITH ONLY FRAGMENTS OF STRONG ROCK REMAINING. SAPROLITE IS AN EXAMPLE OF ROCK WEATHERED TO A DEGREE SUCH THAT ONLY MINOR VESTIGES OF THE ORIGINAL ROCK FABRIC REMAIN. IF TESTED, YIELDS 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.										<b>COMPRESSION</b> SLIGHTLY COMPRESSIBLE LIQUID LIMIT LESS THAN 30 MODERATELY COMPRESSIBLE LIQUID LIMIT 31-50 HIGHLY COMPRESSIBLE LIQUID LIMIT GREATER THAN 50									
<b>CONSISTENCY OR DENSENESS</b> PRIMARY SOIL TYPE COMPACTNESS OR CONSISTENCY RANGE OF STANDARD PENETRATION RESISTANCE (N-VALUE) RANGE OF UNCONFINED COMPRESSIVE STRENGTH (TONS/FT <sup>2</sup> ) GENERALLY GRANULAR MATERIAL (NON-COHESIVE) VERY LOOSE, LOOSE, MEDIUM DENSE, DENSE, VERY DENSE <4, 4 TO 10, 10 TO 30, 30 TO 50, >50 N/A GENERALLY SILT-CLAY MATERIAL (COHESIVE) VERY SOFT, SOFT, MEDIUM STIFF, STIFF, VERY STIFF, HARD <2, 2 TO 4, 4 TO 8, 8 TO 15, 15 TO 30, >30 <0.25, 0.25 TO 0.5, 0.5 TO 1, 1 TO 2, 2 TO 4, >4										<b>GROUND WATER</b> WATER LEVEL IN BORE HOLE IMMEDIATELY AFTER DRILLING. STATIC WATER LEVEL AFTER 24 HOURS. PERCHED WATER, SATURATED ZONE OR WATER BEARING STRATA SPRING OR SEEPAGE										<b>ROCK HARDNESS</b> VERY HARD CANNOT BE SCRATCHED BY KNIFE OR SHARP PICK. BREAKING OF HAND SPECIMENS REQUIRES SEVERAL HARD BLOWS OF THE GEOLOGISTS 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 GEOLOGISTS 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 GEOLOGISTS 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.										<b>MISCELLANEOUS SYMBOLS</b> ROADWAY EMBANKMENT WITH SOIL DESCRIPTION SOIL SYMBOL ARTIFICIAL FILL OTHER THAN ROADWAY EMBANKMENTS INFERRED SOIL BOUNDARIES INFERRED ROCK LINE ALLUVIAL SOIL BOUNDARY DIP/DIP DIRECTION OF ROCK STRUCTURES SOUNDING ROD TEST BORING AUGER BORING CORE BORING MONITORING WELL PIEZOMETER INSTALLATION SLOPE INDICATOR INSTALLATION SPT N-VALUE SPT REFUSAL SAMPLE DESIGNATIONS S- BULK SAMPLE SS- SPLIT SPOON SAMPLE ST- SHELBY TUBE SAMPLE RS- ROCK SAMPLE RT- RECOMPACTED TRIAXIAL SAMPLE CBR - CBR SAMPLE									
<b>TEXTURE OR GRAIN SIZE</b> U.S. STD. SIEVE SIZE OPENING (MM) 4, 10, 40, 60, 200, 270 4.76, 2.0, 0.42, 0.25, 0.075, 0.053										<b>ABBREVIATIONS</b> 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 FRAGS. - FRAGMENTS MED. - MEDIUM PMT - PRESSUREMETER TEST SD - SAND, SANDY SL - SILT, SILTY SLI - SLIGHTLY TCR - TRICONE REFUSAL γ - UNIT WEIGHT γ <sub>d</sub> - DRY UNIT WEIGHT W - MOISTURE CONTENT V - VERY VST - VANE SHEAR TEST										<b>FRACATURE SPACING</b> TERM SPACING VERY WIDE MORE THAN 10 FEET WIDE 3 TO 10 FEET MODERATELY CLOSE 1 TO 3 FEET CLOSE 0.16 TO 1 FEET VERY CLOSE LESS THAN 0.16 FEET										<b>BEDDING</b> 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									
<b>SOIL MOISTURE - CORRELATION OF TERMS</b> SOIL MOISTURE SCALE (ATTERBERG LIMITS) FIELD MOISTURE DESCRIPTION GUIDE FOR FIELD MOISTURE DESCRIPTION LL - LIQUID LIMIT PL - PLASTIC LIMIT OM - OPTIMUM MOISTURE SHRINKAGE LIMIT SAT - SATURATED - USUALLY LIQUID; VERY WET, USUALLY FROM BELOW THE GROUND WATER TABLE W - WET - (W) SEMISOLID; REQUIRES DRYING TO ATTAIN OPTIMUM MOISTURE M - MOIST - (M) SOLID; AT OR NEAR OPTIMUM MOISTURE D - DRY - (D) REQUIRES ADDITIONAL WATER TO ATTAIN OPTIMUM MOISTURE										<b>EQUIPMENT USED ON SUBJECT PROJECT</b> DRILL UNITS: MOBILE B-51, BK-51, CME-45, CME-550, PORTABLE HOIST, OTHER 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, OTHER HAMMER TYPE: AUTOMATIC, MANUAL CORE SIZE: B, N-XWL, H HAND TOOLS: POST HOLE DIGGER, HAND AUGER, SOUNDING ROD, VANE SHEAR TEST, OTHER										<b>INDURATION</b> FOR SEDIMENTARY ROCKS, INDURATION IS THE HARDENING OF THE 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.																			
<b>PLASTICITY</b> NONPLASTIC, LOW PLASTICITY, MED. PLASTICITY, HIGH PLASTICITY PLASTICITY INDEX (PI) DRY STRENGTH VERY LOW, SLIGHT, MEDIUM, HIGH										<b>COLOR</b> DESCRIPTIONS MAY INCLUDE COLOR OR COLOR COMBINATIONS (TAN, RED, YEL-BRN, BLUE-GRAY) MODIFIERS SUCH AS LIGHT, DARK, STREAKED, ETC. ARE USED TO DESCRIBE APPEARANCE.										<b>NOTES:</b> BENCH MARK: _____ ELEVATION: _____																			



STATE OF NORTH CAROLINA  
DEPARTMENT OF TRANSPORTATION

MICHAEL F. EASLEY  
GOVERNOR

LYNDO TIPPETT  
SECRETARY

May 2004

STATE PROJECT: 34428.1.1 (R-2409B)  
COUNTY: Jackson  
DESCRIPTION: US-64 East of Cashiers  
SUBJECT: Geotechnical Report – Inventory

**Introduction**

This project pertains to the upgrading of a short (2700 ft.) section of US-64 east of Cashiers. Under consideration is the straightening of the existing alignment and the addition of truck climbing lanes.

The subsurface investigation was conducted using a CME-45C tracked drill machine. The borings were drilled with 8-inch hollow-stem augers and -N- casing with advancer. Rock core was retrieved using -NXWL- tools. Where possible, Standard Penetration Tests were performed with a 140-lb. manual drop hammer.

**Physiography, Land Use and Surface Drainage**

The project corridor crosses an extremely rugged stretch of terrain. Specifically, centerline crosses a spur of the Chattooga Ridge to the south. The project corridor is bounded on the north by the Horsepasture River. The elevation difference between river and ridge is approximately 500 feet.

The land not already involved in the existing US-64 is predominately wooded. Interspersed throughout are single-family houses. These include both permanent residences and vacation homes.

Surface drainage is provided by the Horsepasture River. Several smaller streams cross centerline to empty into the river.

**Geology and Rock Characteristics**

The rocks involved in this project are diorites and quartz diorites. These are generally very weakly foliated or non-foliated (massive). Rock data was gathered along the existing cuts. These are listed in the following table; the joints (fractures) are listed in no particular order.

<u>Discontinuity</u>	<u>Strike, Dip</u>	<u>Dip/Dip Direction</u>
J <sub>1</sub>	065, 75 SE	75 / 155
J <sub>2</sub>	057, 62 NW	62 / 327
J <sub>3</sub>	283, 50 SW	50 / 193
J <sub>4</sub>	085, 05 SE	05 / 175
J <sub>5</sub>	320, 55 NE	55 / 050
J <sub>6</sub>	330, 33 NE	33 / 060

In conjunction with the core boring reports, these data should give a fairly clear picture of the subsurface orientation of the discontinuities.

**Areas of Geotechnical Interest**

The houses on the mountain, right of centerline, share common wells.

**Descriptive Analysis of the Project**

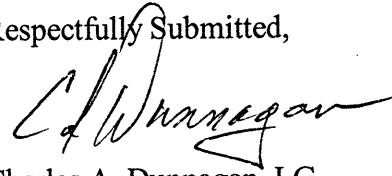
The mountainside to be involved in construction is covered with a thin veneer of colluvium. As encountered in the borings, the colluvial horizon is less than, or equal to, 3.0 feet in thickness. The composition is generally a clayey silt with some organic material and occasional boulders. The colluvium is usually underlain by saprolite. The saprolite horizon has a trend of increasing thickness from the beginning to the end of the project. The saprolite is composed of light gray silty sand.

Weathered rock was rarely encountered in the SPT's: when encountered it was usually in the corings. The material considered "weathered rock" is represented by low Recoveries and RQD's in the core boring reports. Generally, this material is limited to the upper 20.0 to 25.0 feet of core. Occasional severely to completely weathered zones are present throughout the rock column.

Static groundwater was measured in only two of the borings advanced within the project corridor. However, water is probably present, above proposed grade, through most of the project. The most likely exceptions will be the Station intervals 10+00 to 13+00 and 28+50 to 32+50.

Right of approximate Station 27+50, a bold stream originates close to the top of the ridge and flows to the ditchline. This stream is a permanent feature, not seasonal run-off.

Respectfully Submitted,



Charles A. Dunnagan, LG  
Project Engineering Geologist



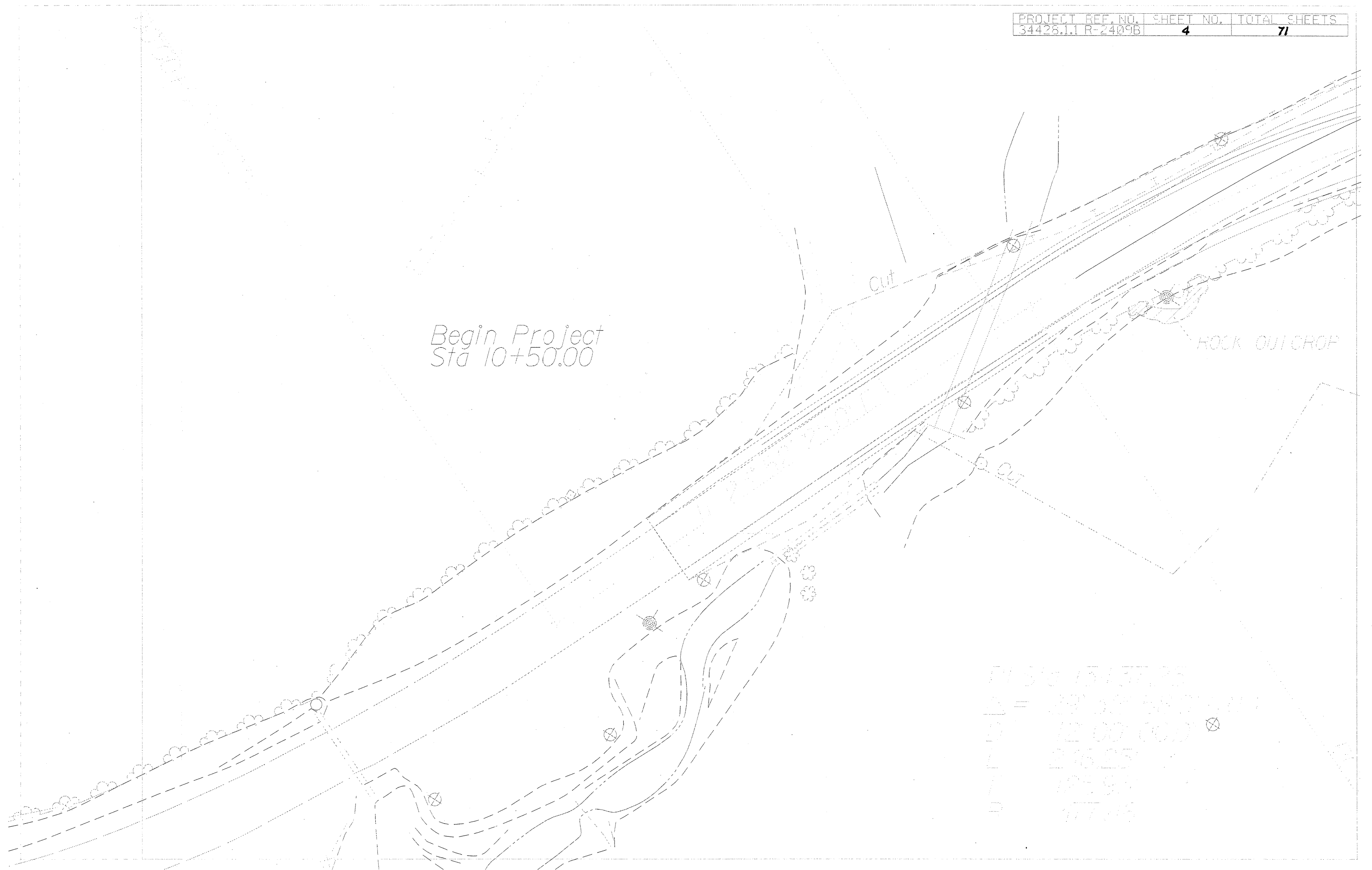


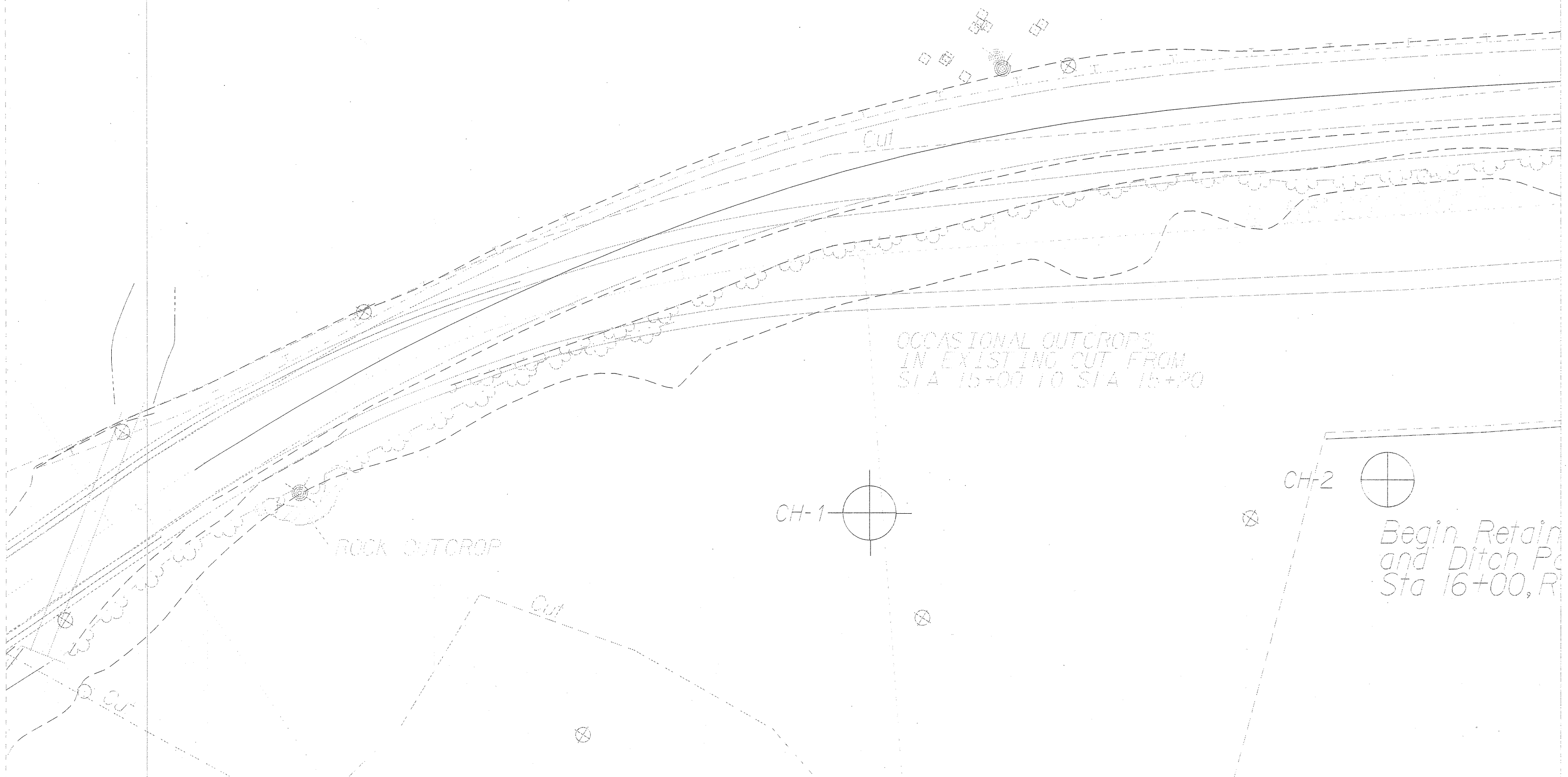
Begin Project  
Sta 10+50.00

Cut

ROCK OUT CROP

P.I.S.'s 13437.25  
 $\Delta = 39^{\circ} 02' 58.74''$   
 $D = 12' 00' 00''$   
 $L = 216.25'$   
 $T = 125.93'$   
 $D = 117.06'$





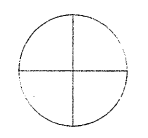
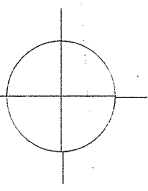
OCCASIONAL OUTCROPS  
IN EXISTING CUT FROM  
STA 15+00 TO STA 15+20

ROCK OUTCROP

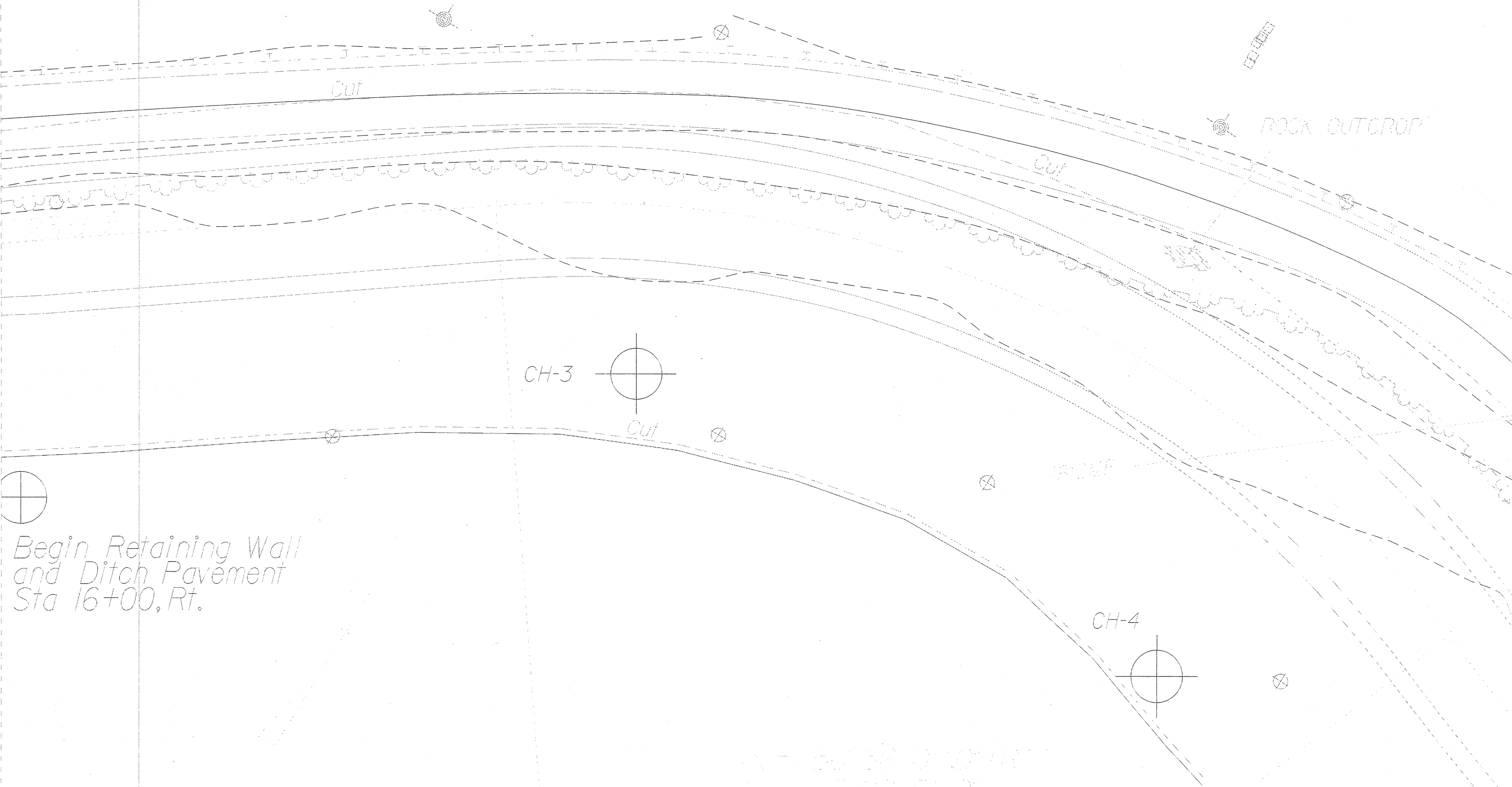
CH-1

CH-2

Begin Retain  
and Ditch Pa  
Sta 16+00, R



SPORADIC OUTCROPS IN  
EXISTING CUT FROM STA 17+25  
TO STA 18+25



Begin Retaining Wall  
and Ditch Pavement  
Sta 16+00, Rt.

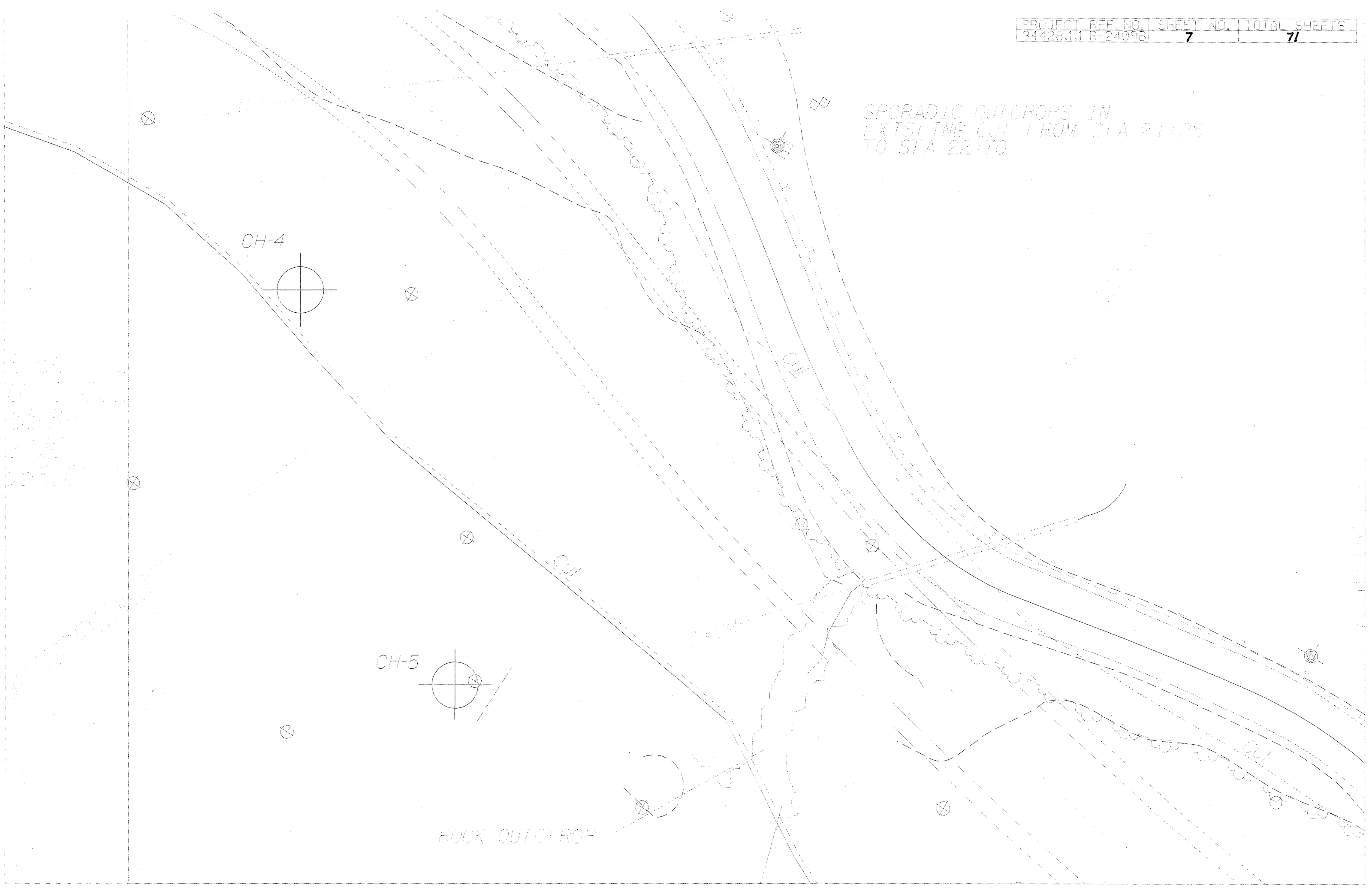
DATE: 08/26/2010  
BY: [Signature]

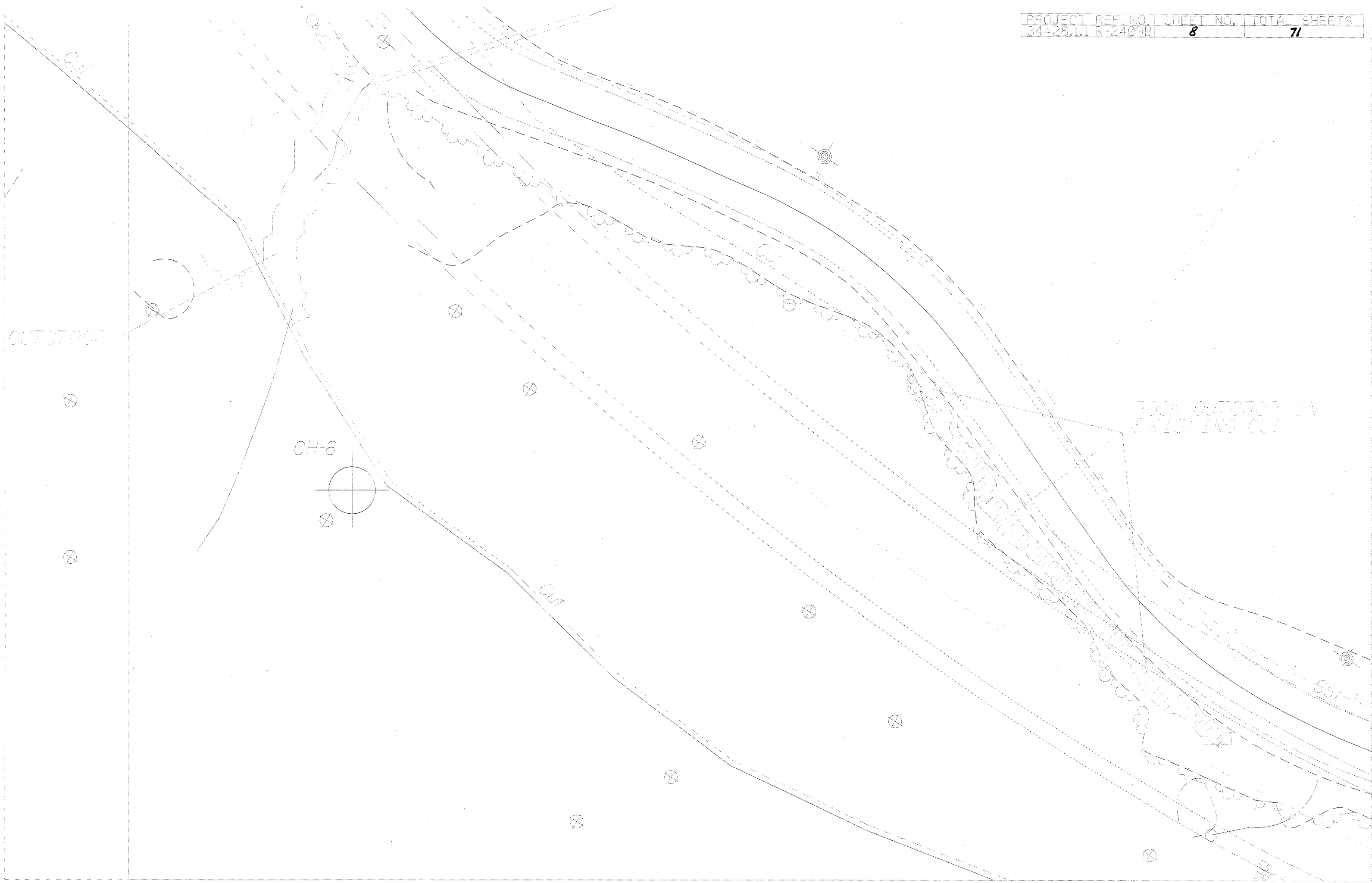
SPORADIC OUTCROPS IN  
EXISTING CUI FROM STA 21+25  
TO STA 22+70

CH-4

CH-5

ROCK OUTCROP





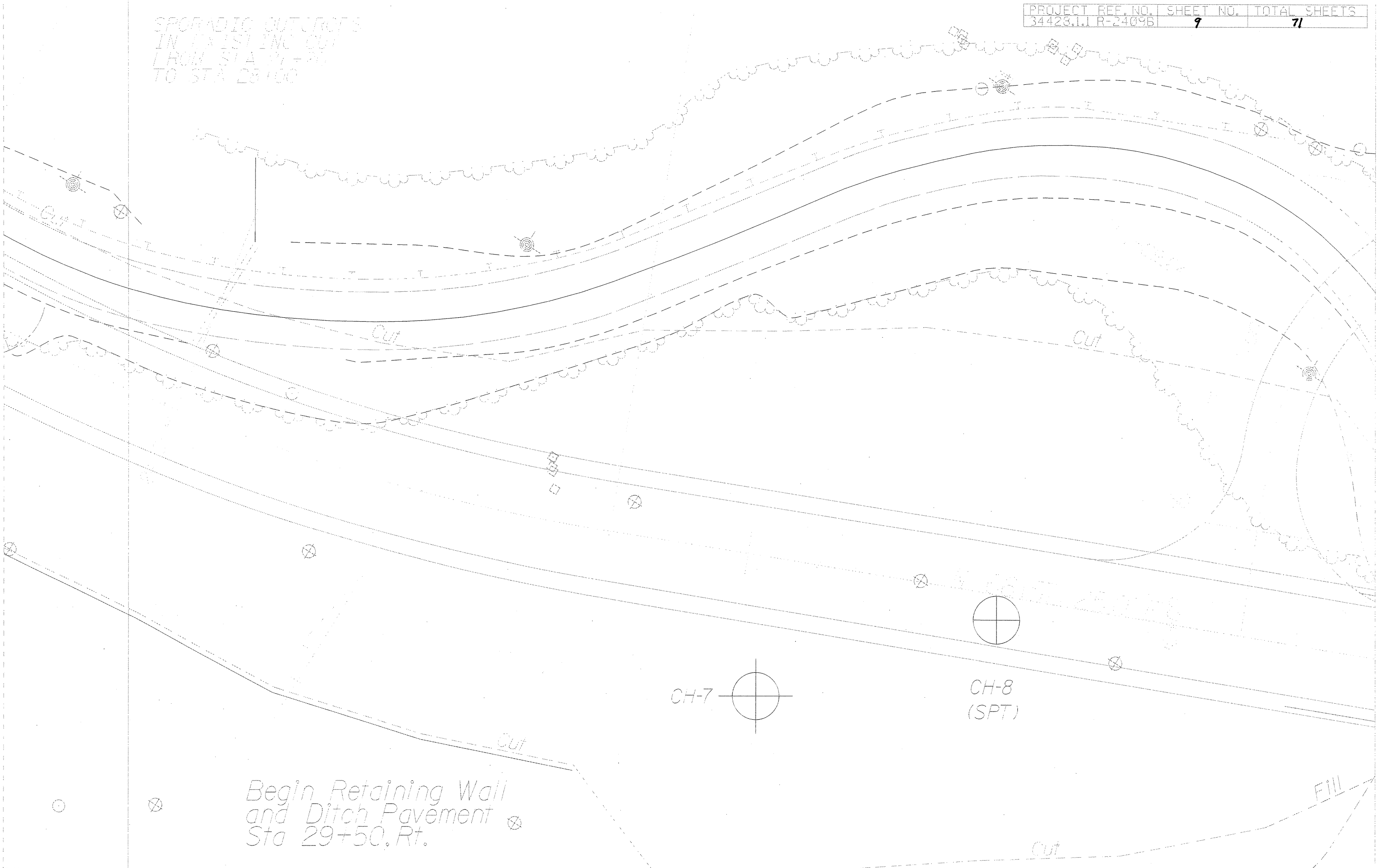
OUTSTOP

CH-6

OUT

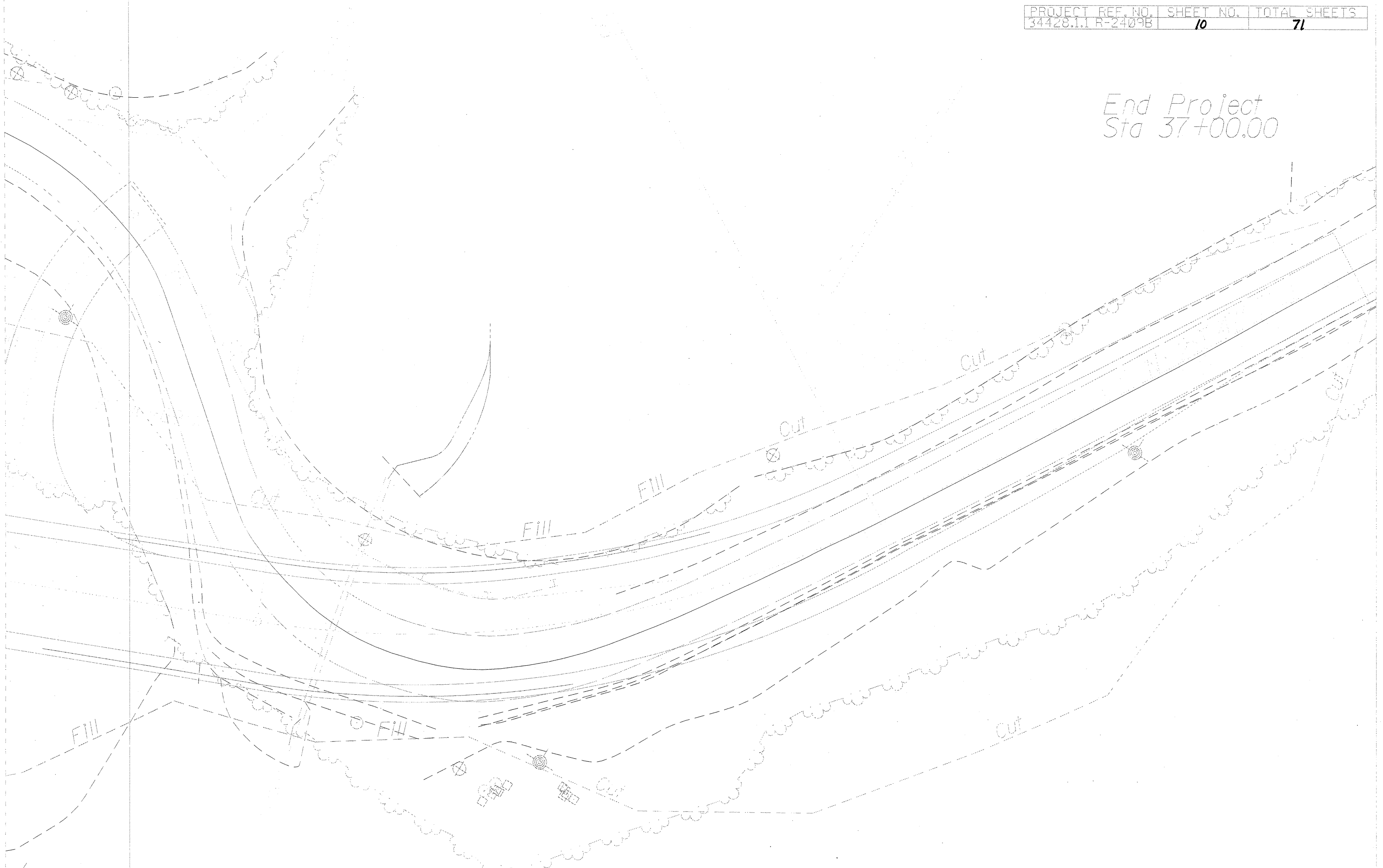
EDGE OUTCROP IN EXISTING CUT

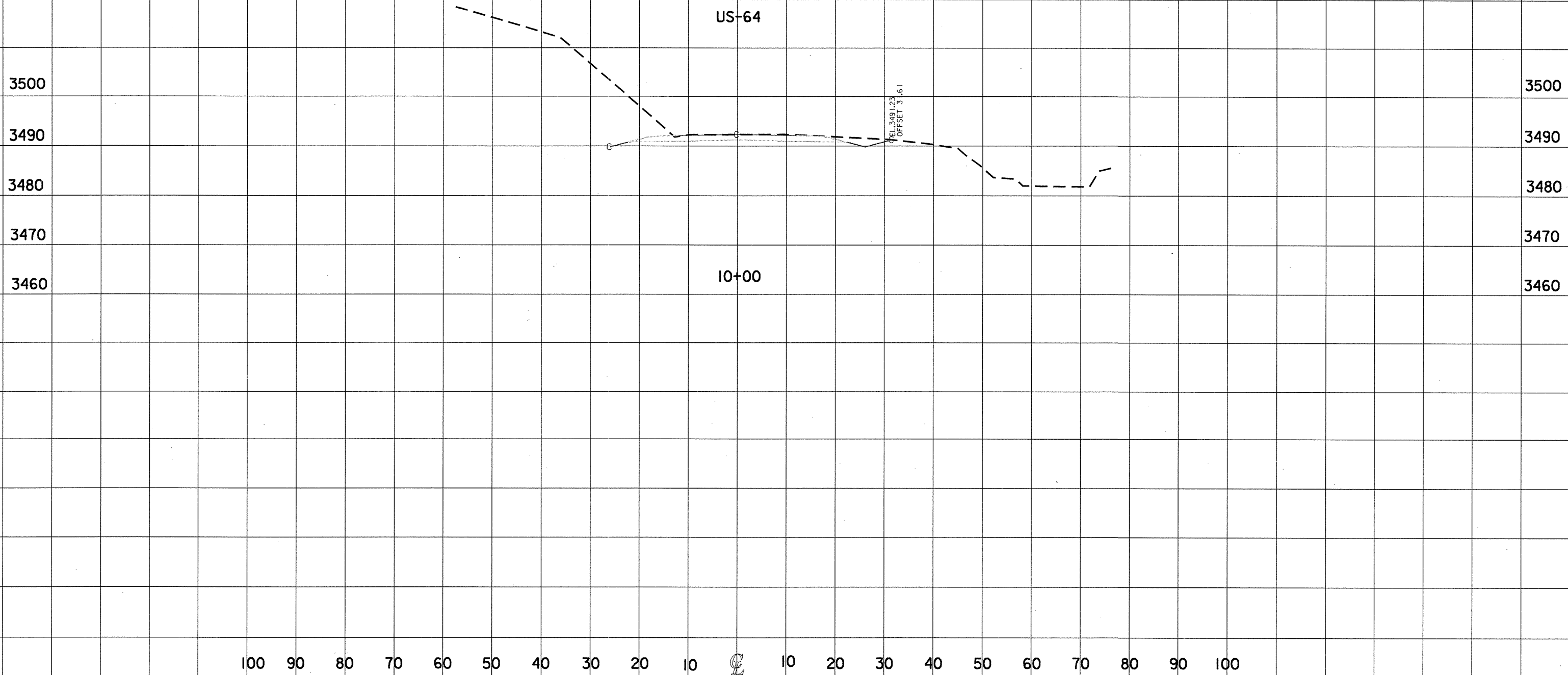
SPORADIC OUTCROPS  
 IN EXISTING CUT  
 FROM STA 27+00  
 TO STA 28+00





End Project  
Sta 37+00.00





3510

3510

3500

3500

3490

3490

3480

3480

3470

3470

3460

3460

3450

3450

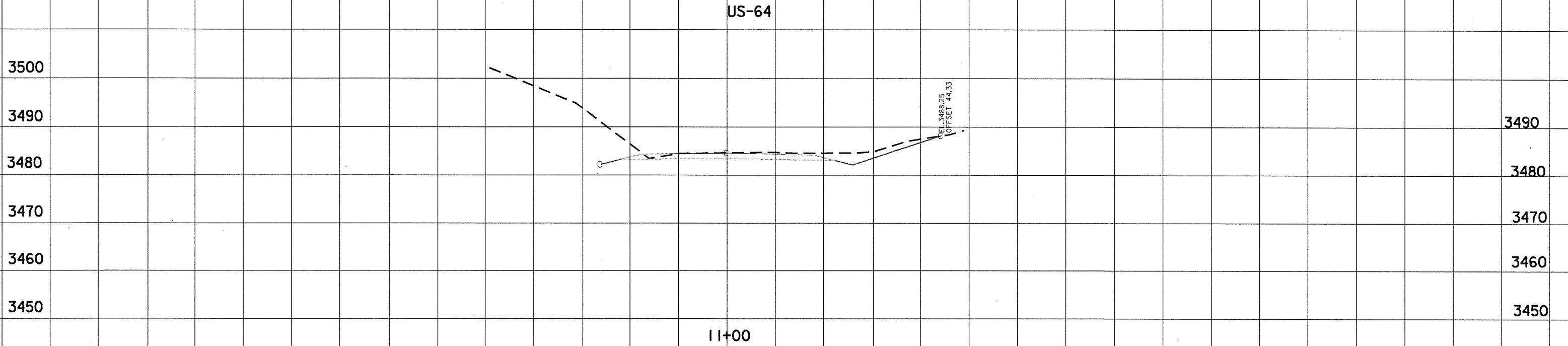
US-64

10+50

VERTICAL CURVE  
OFFSET 38.96

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100





70 60 50 30 20 10 0 10 20 30 40 50 60 70

3500

3490

3480

3470

3460

3450

3500

3490

3480

3470

3460

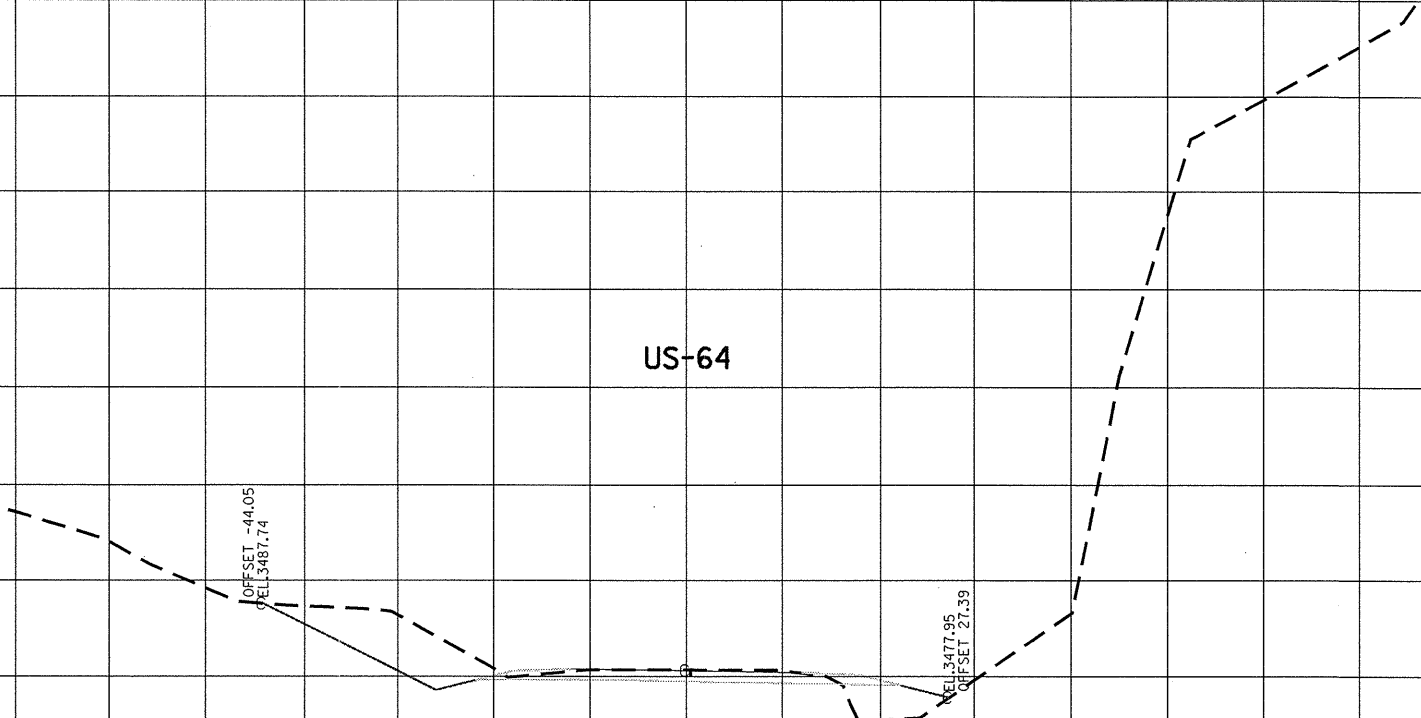
3450

US-64

11+50

OFFSET -44.05  
CELL 3487.74

CELL 3477.95  
OFFSET 27.39



3490

3490

3480

3480

3470

3470

3560

3560

3450

3450

US-64

12+00

OFFSET -31.98  
REL. 3476.72

OFFSET 3517.99  
REL. 113.55

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100



3500

3500

3490

3490

3480

3480

3470

3470

3460

3460

3450

3450

3540

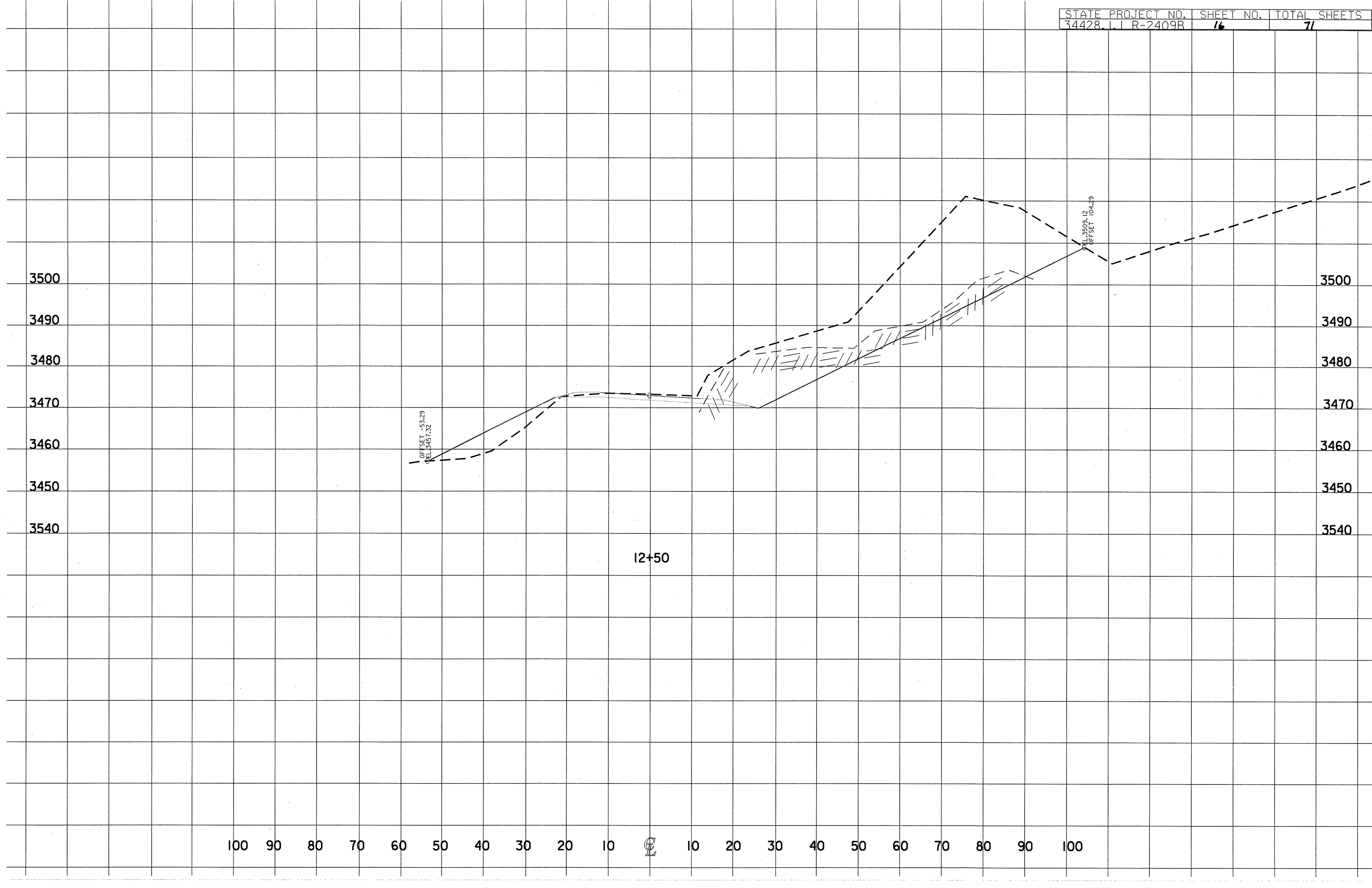
3540

12+50

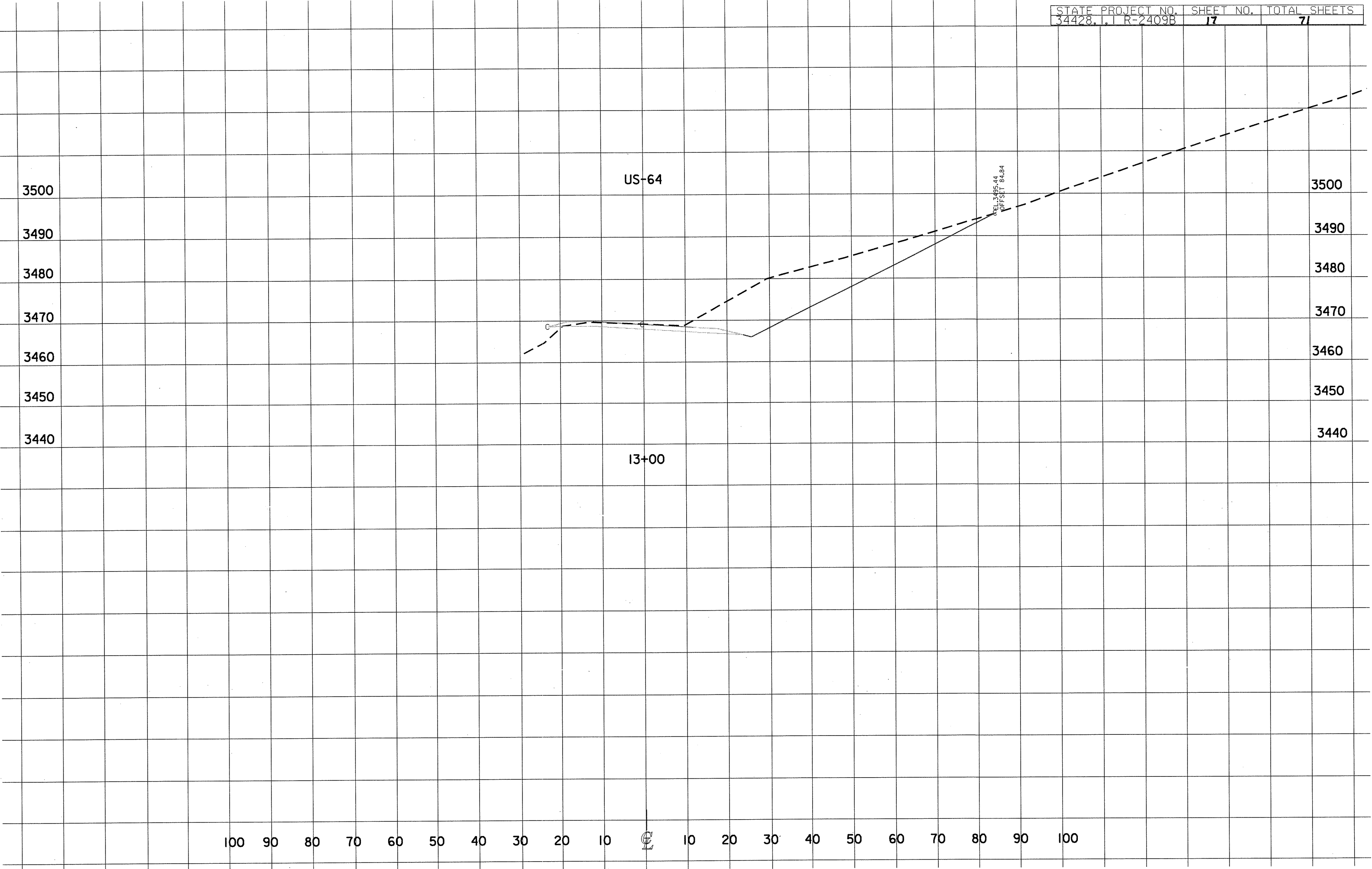
OFFSET -53.29  
REL 3457.32

REL 3509.12  
OFFSET 104.29

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100







3500  
3490  
3480  
3470  
3460  
3450  
3440

3500  
3490  
3480  
3470  
3460  
3450  
3440

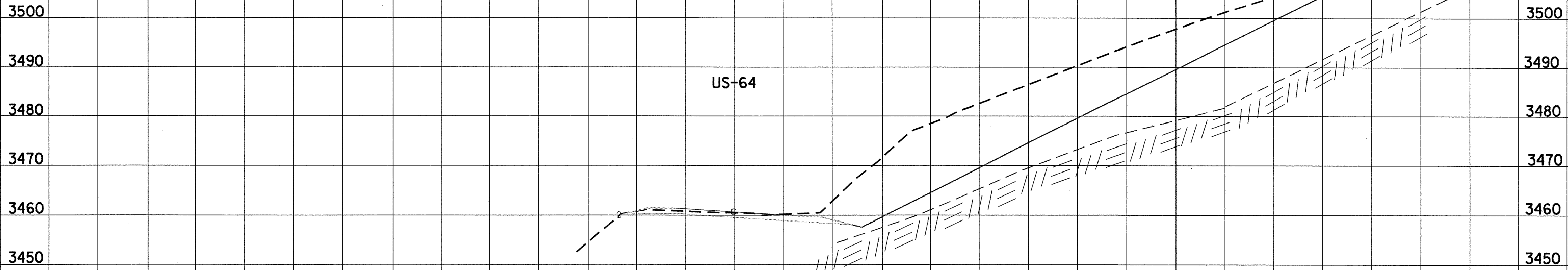
US-64

I3+50

CEL 3505.83  
OFFSET 113.93

100 90 80 70 60 50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100





100 90 80 70 60 50 40 30 20 10 CL 10 20 30 40 50 60 70 80 90 100

3500

3490

3480

3470

3460

3450

3440

3500

3490

3480

3470

3460

3450

3440

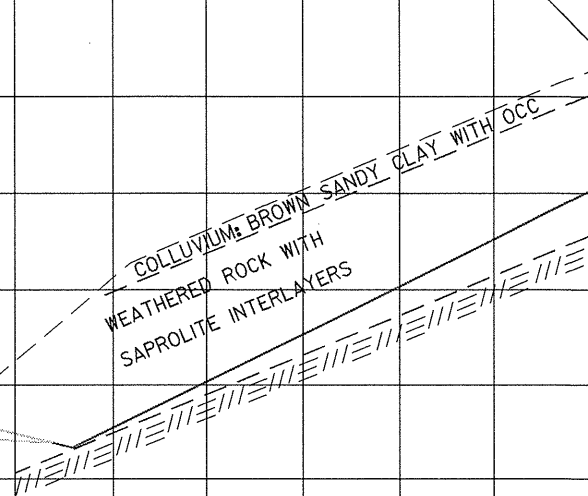
US-64

14+50

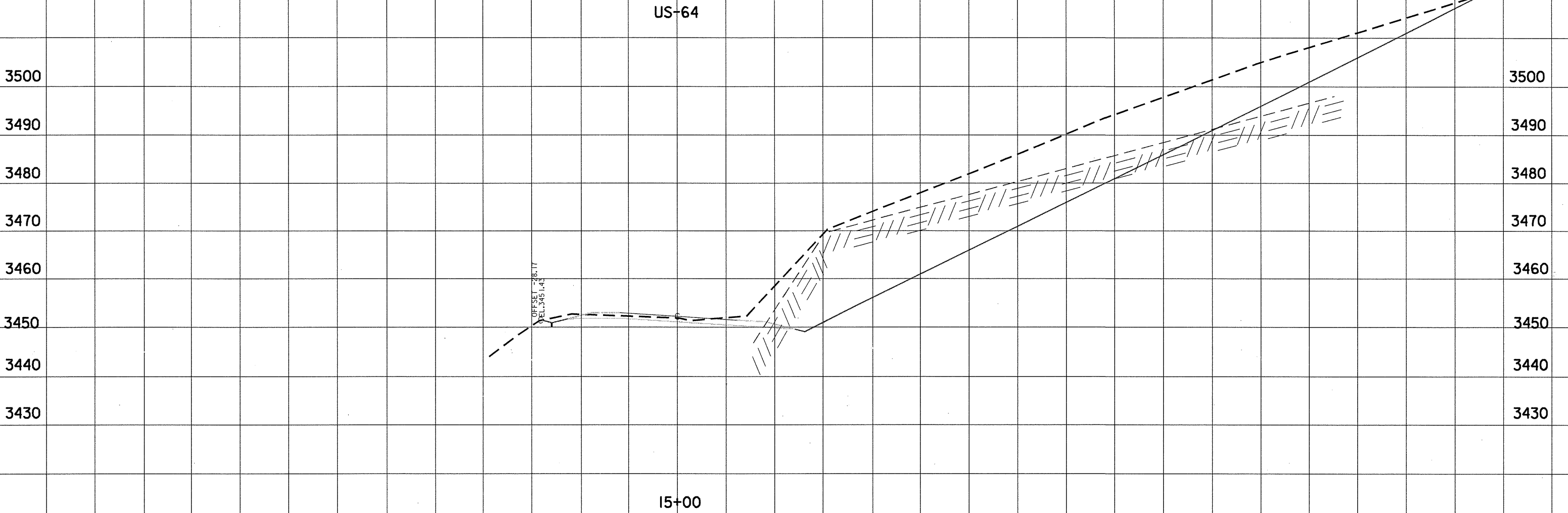
STA 14+54.37, 82.05/RT

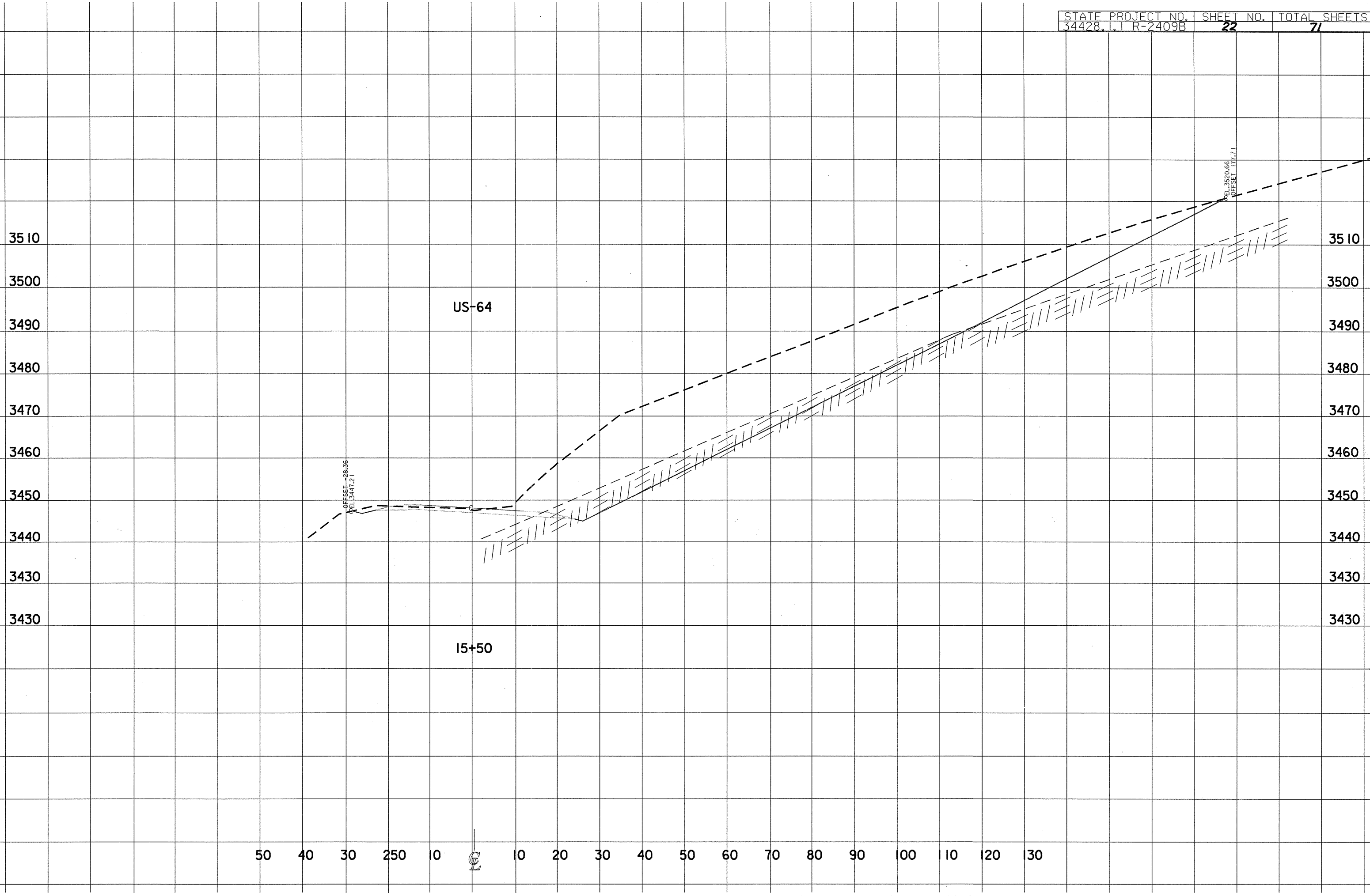
OFFSET -27.08  
CEL 3455.42

CEL 3517.15  
OFFSET 153.66



CORE 1: 0.9'- 5.2'	REC=44% RQD=28%
CORE 2: 5.2'- 10.4'	REC=10% RQD=0%
CORE 3: 10.4'- 15.4'	REC=32% RQD=0%
CORE 4: 15.4'- 20.4'	REC=70% RQD=50%
CORE 5: 20.4'- 25.4'	REC=92% RQD=70%
CORE 6: 25.4'- 30.2'	REC=98% RQD=98%
CORE 7: 30.2'- 35.0'	REC=100% RQD=100%
CORE 8: 35.0'- 40.3'	REC=100% RQD=100%
CORE 9: 40.3'- 45.5'	REC=98% RQD=98%
CORE 10: 45.5'- 50.8'	REC=94% RQD=94%
CORE 11: 50.8'- 55.6'	REC=100% RQD=100%
CORE 12: 55.6'- 60.4'	REC=100% RQD=100%





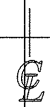
US-64

15+50

OFFSET 28.36  
ELEV 3447.21

OFFSET 171.71  
ELEV 3520.66

50 40 30 250 10 10 20 30 40 50 60 70 80 90 100 110 120 130



3510

3510

3500

3500

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3490

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3450

3450

3440

3440

3430

3430

3420

3420

40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120

US-64

16+00

COLLUVIUM: BROWN SANDY CLAY WITH OCCASIONAL BOULDERS

SAPROLITE AND WEATHERED ROCK WITH ROCK SEAMS

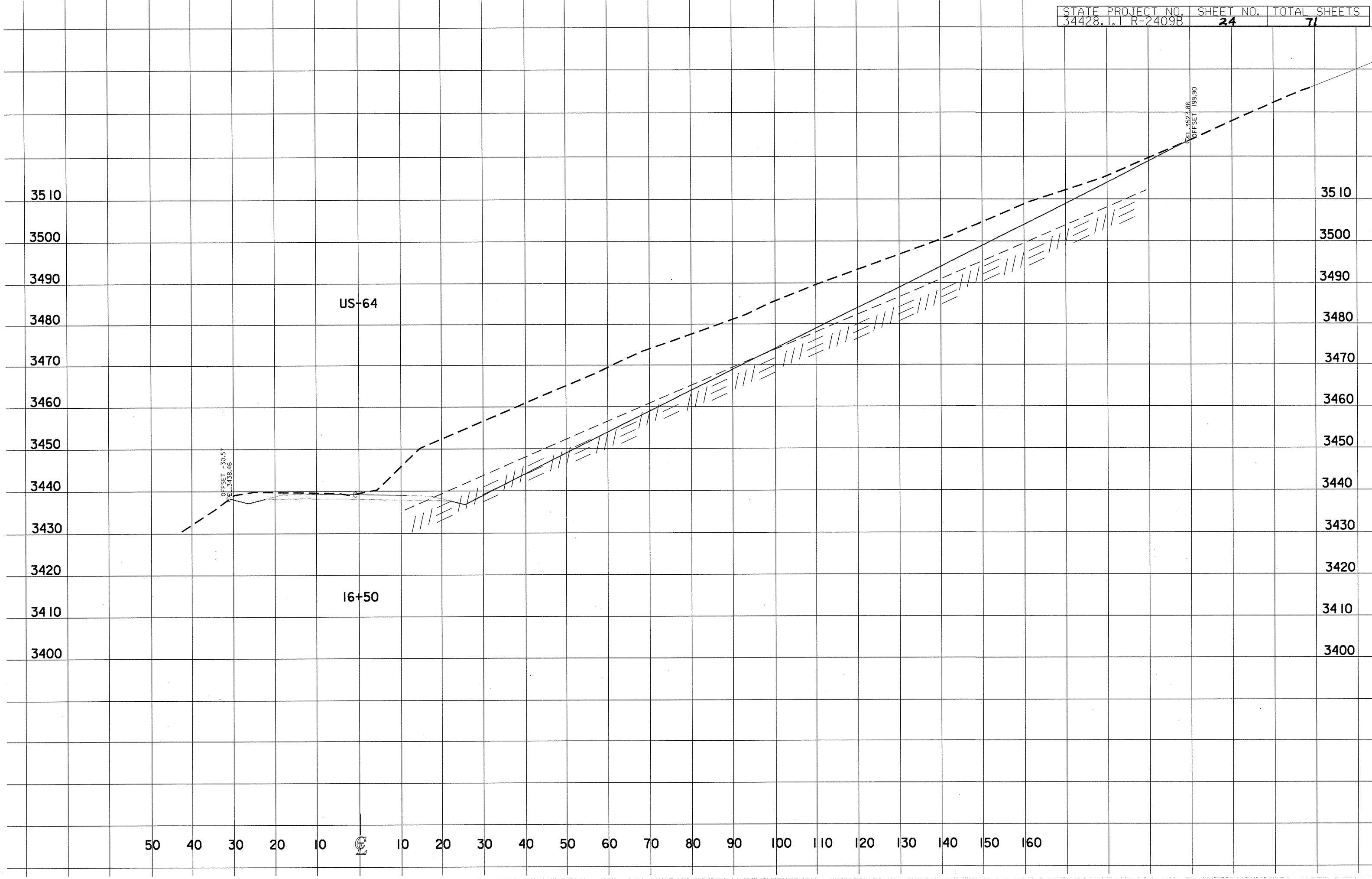
Sta 16+20.44, 83.6' RT

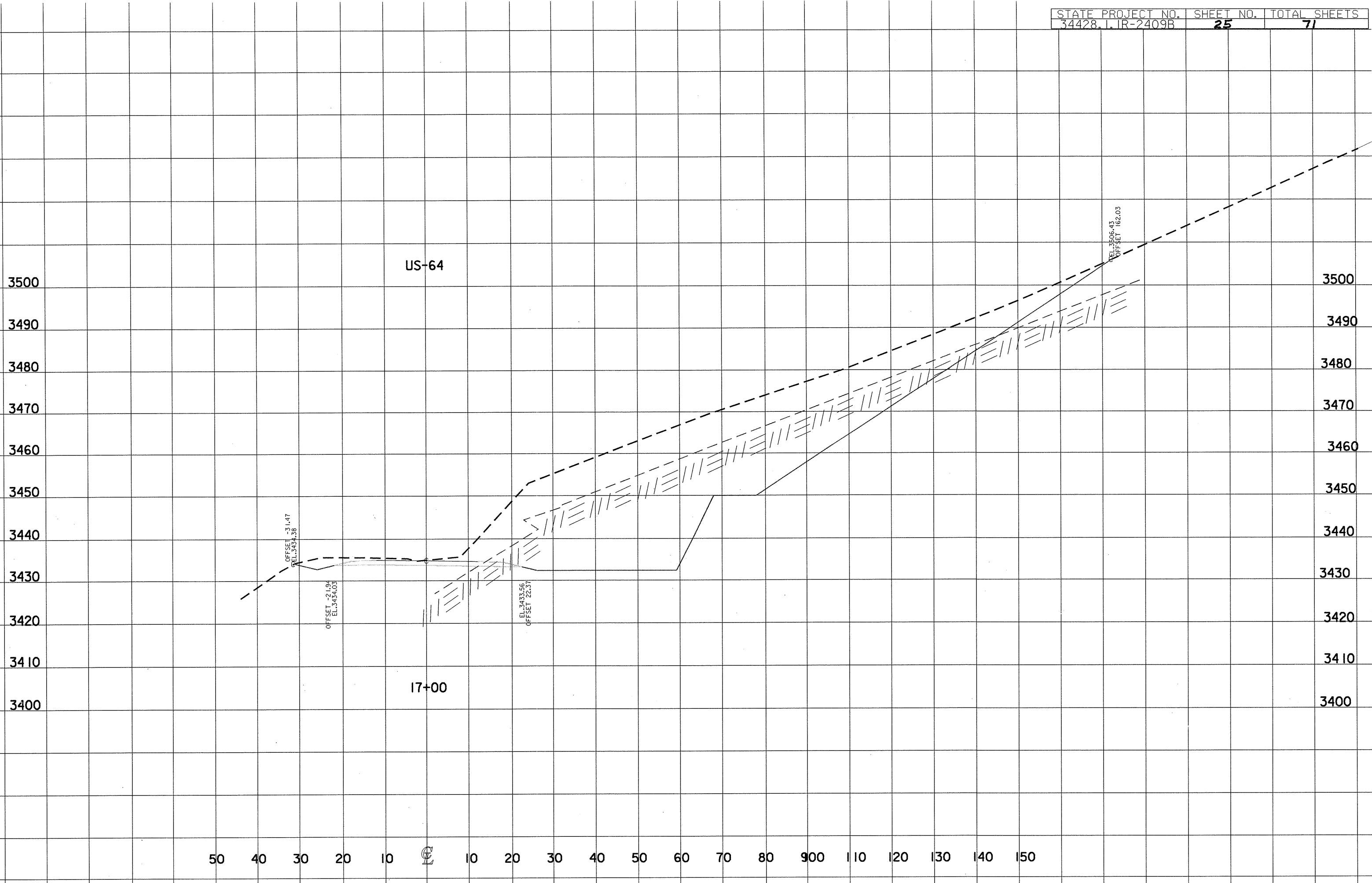
REL. 3520.32  
OFFSET 184.73

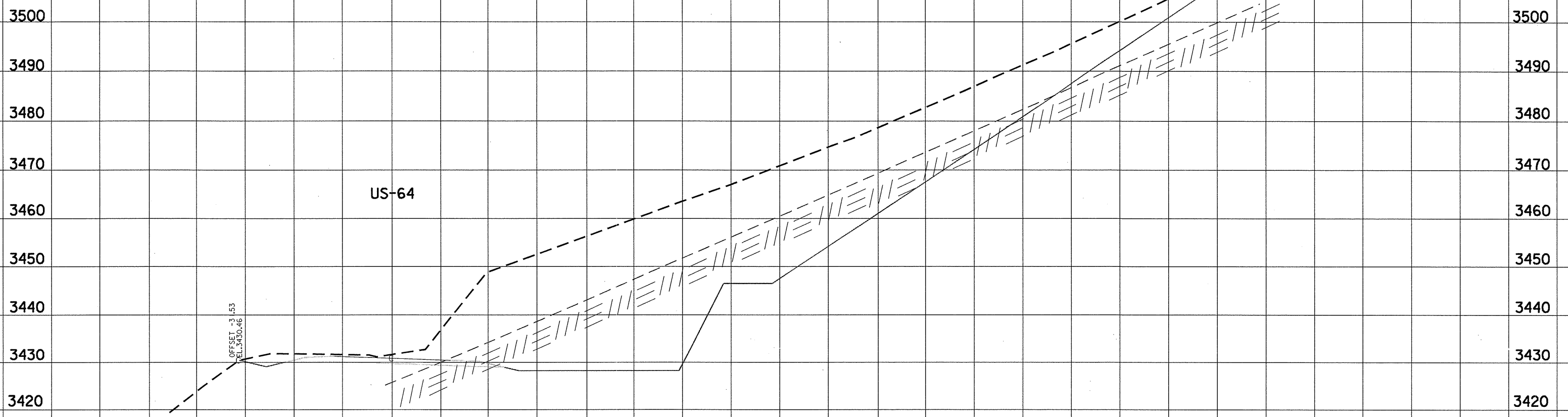
OFFSET 29.46  
REL. 3442.79

- CORE 1: 1.1' - 4.8'
- REC=84% RQD=89%
- CORE 2: 4.8' - 9.8'
- REC=98% RQD=66%
- CORE 3: 9.8' - 14.8'
- REC=14% RQD=0%
- CORE 4: 14.8' - 19.8'
- REC=72% RQD=40%
- CORE 5: 19.8' - 24.8'
- REC=66% RQD=16%
- CORE 6: 24.8' - 29.6'
- REC=98% RQD=98%
- CORE 7: 29.6' - 34.5'
- REC=100% RQD=100%
- CORE 8: 34.5' - 39.8'
- REC=62% RQD=58%
- CORE 9: 39.8' - 44.6'
- REC=100% RQD=100%
- CORE 10: 44.6' - 49.8'
- REC=98% RQD=98%
- CORE 11: 49.8' - 54.6'
- REC=100% RQD=100%
- CORE 12: 54.6' - 57.3'
- REC=93% RQD=93%

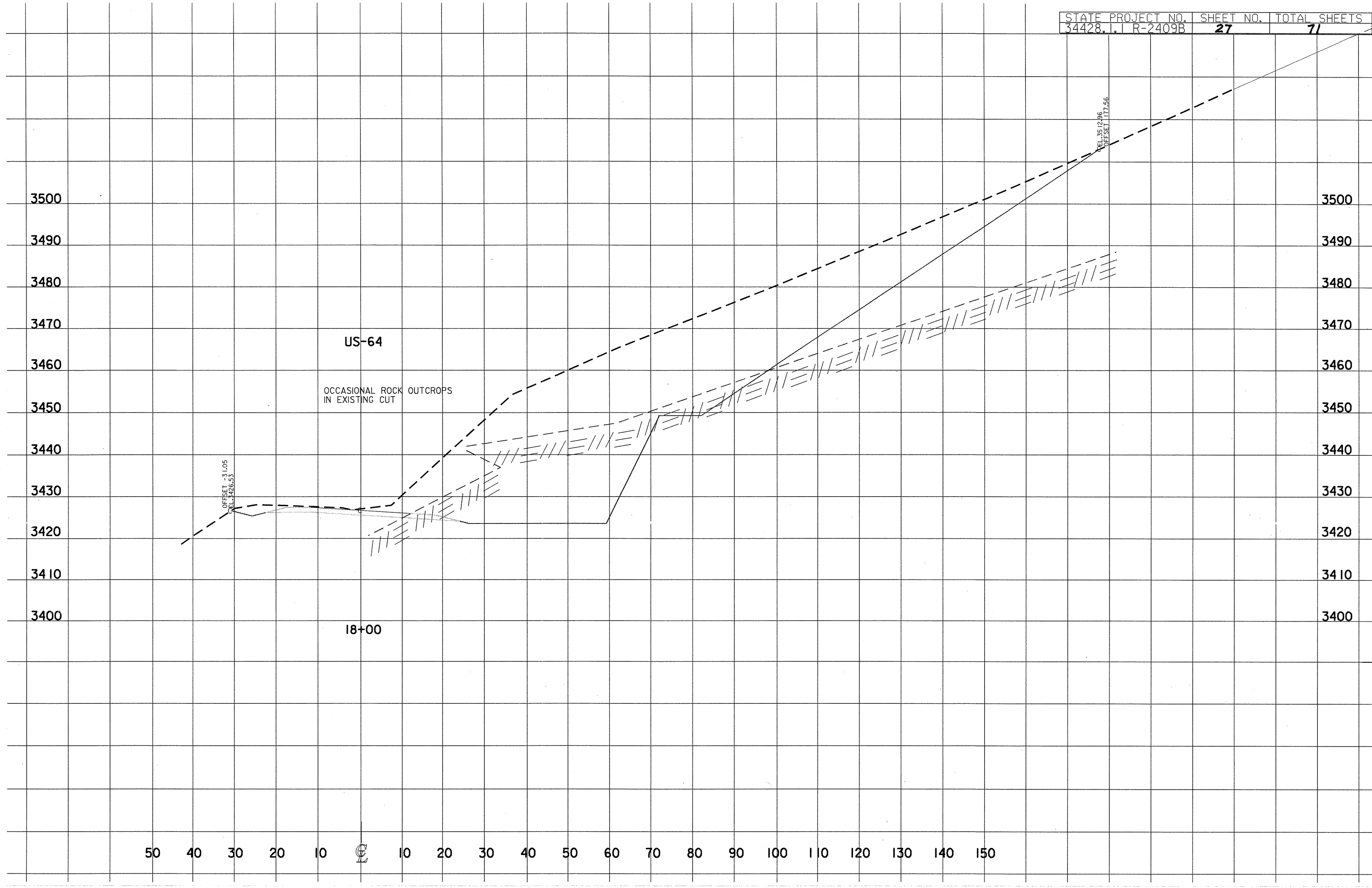




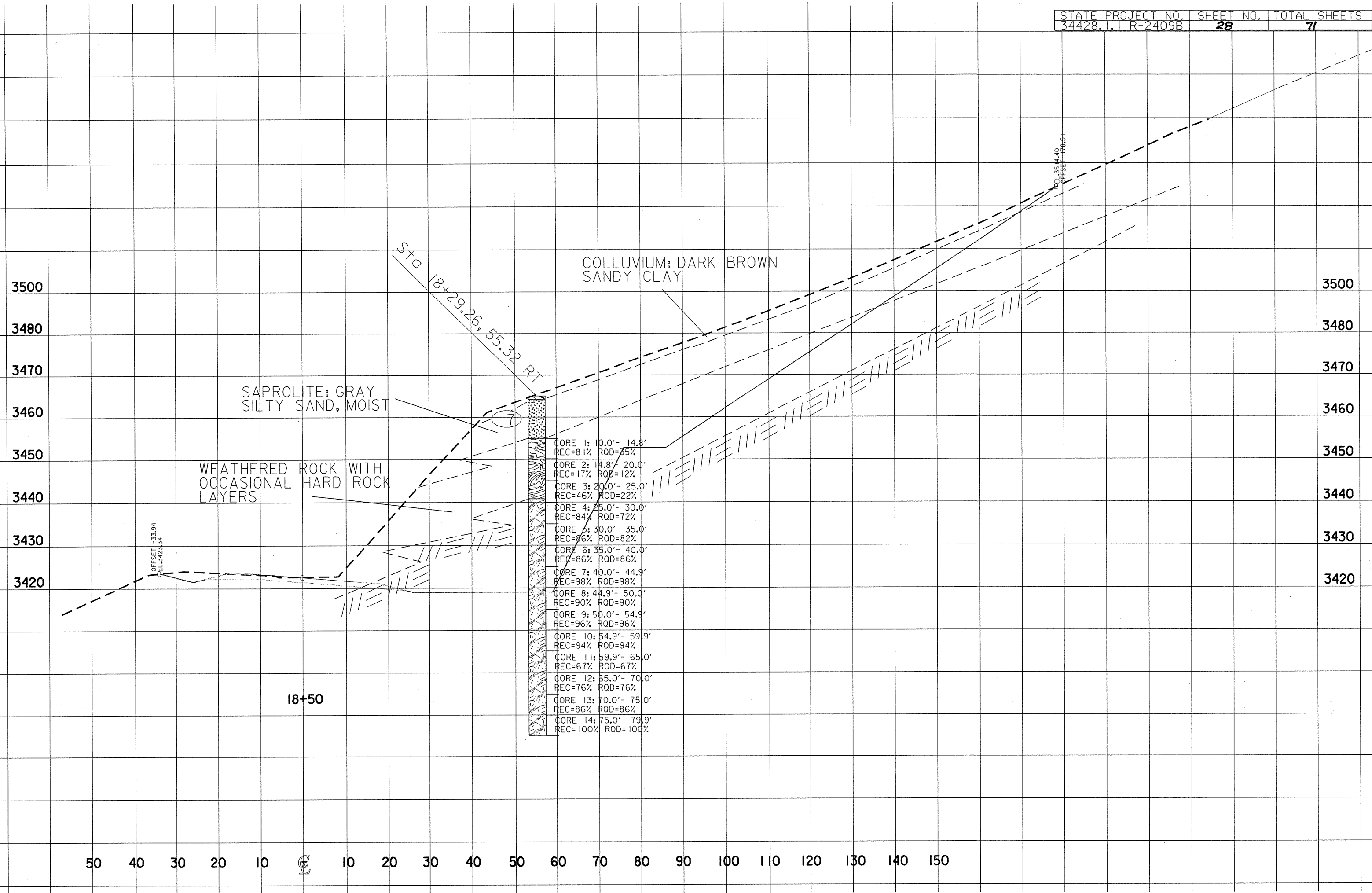




60 50 40 30 20 10 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150



50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150



CORE 1:	10.0' - 14.8'	REC=81%	ROD=75%
CORE 2:	14.8' - 20.0'	REC=17%	ROD=12%
CORE 3:	20.0' - 25.0'	REC=46%	ROD=22%
CORE 4:	25.0' - 30.0'	REC=84%	ROD=72%
CORE 5:	30.0' - 35.0'	REC=86%	ROD=82%
CORE 6:	35.0' - 40.0'	REC=86%	ROD=86%
CORE 7:	40.0' - 44.9'	REC=98%	ROD=98%
CORE 8:	44.9' - 50.0'	REC=90%	ROD=90%
CORE 9:	50.0' - 54.9'	REC=96%	ROD=96%
CORE 10:	54.9' - 59.9'	REC=94%	ROD=94%
CORE 11:	59.9' - 65.0'	REC=67%	ROD=67%
CORE 12:	65.0' - 70.0'	REC=76%	ROD=76%
CORE 13:	70.0' - 75.0'	REC=86%	ROD=86%
CORE 14:	75.0' - 79.9'	REC=100%	ROD=100%

SAPROLITE: GRAY SILTY SAND, MOIST

COLLUVIUM: DARK BROWN SANDY CLAY

WEATHERED ROCK WITH OCCASIONAL HARD ROCK LAYERS

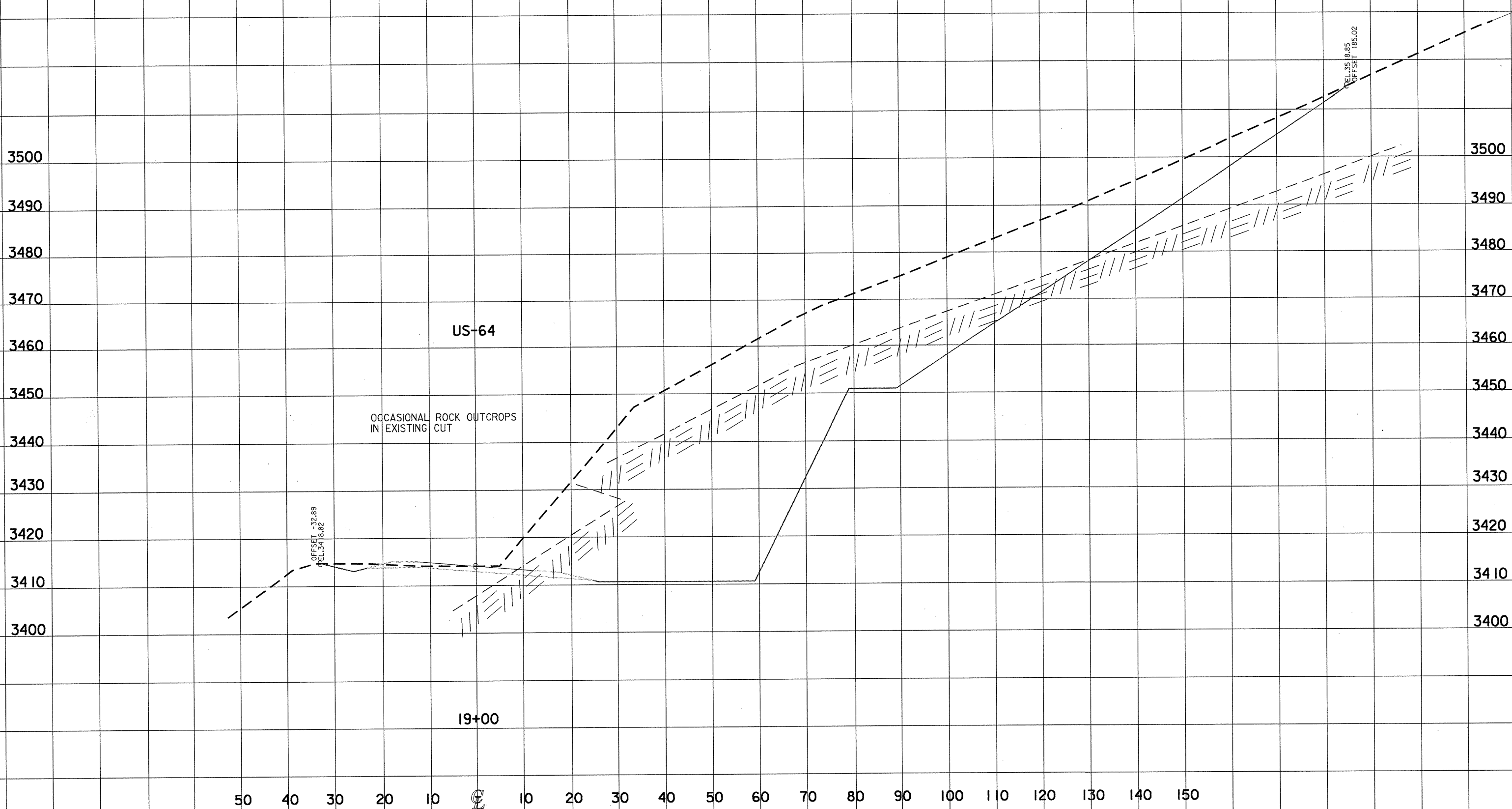
STA 18+29.26, 55.32 RT

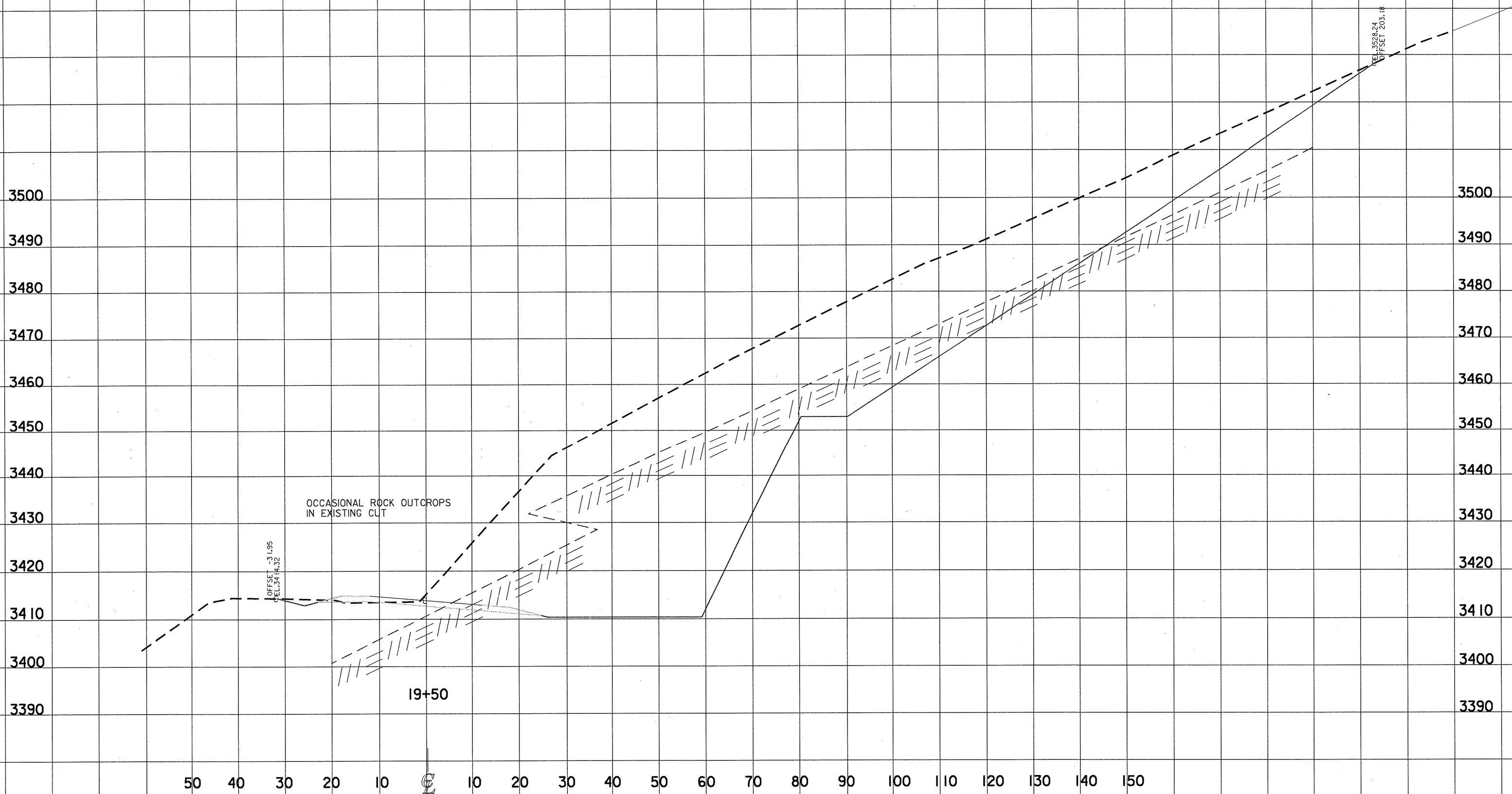
18+50

OFFSET -33.94  
CEL. 3423.34

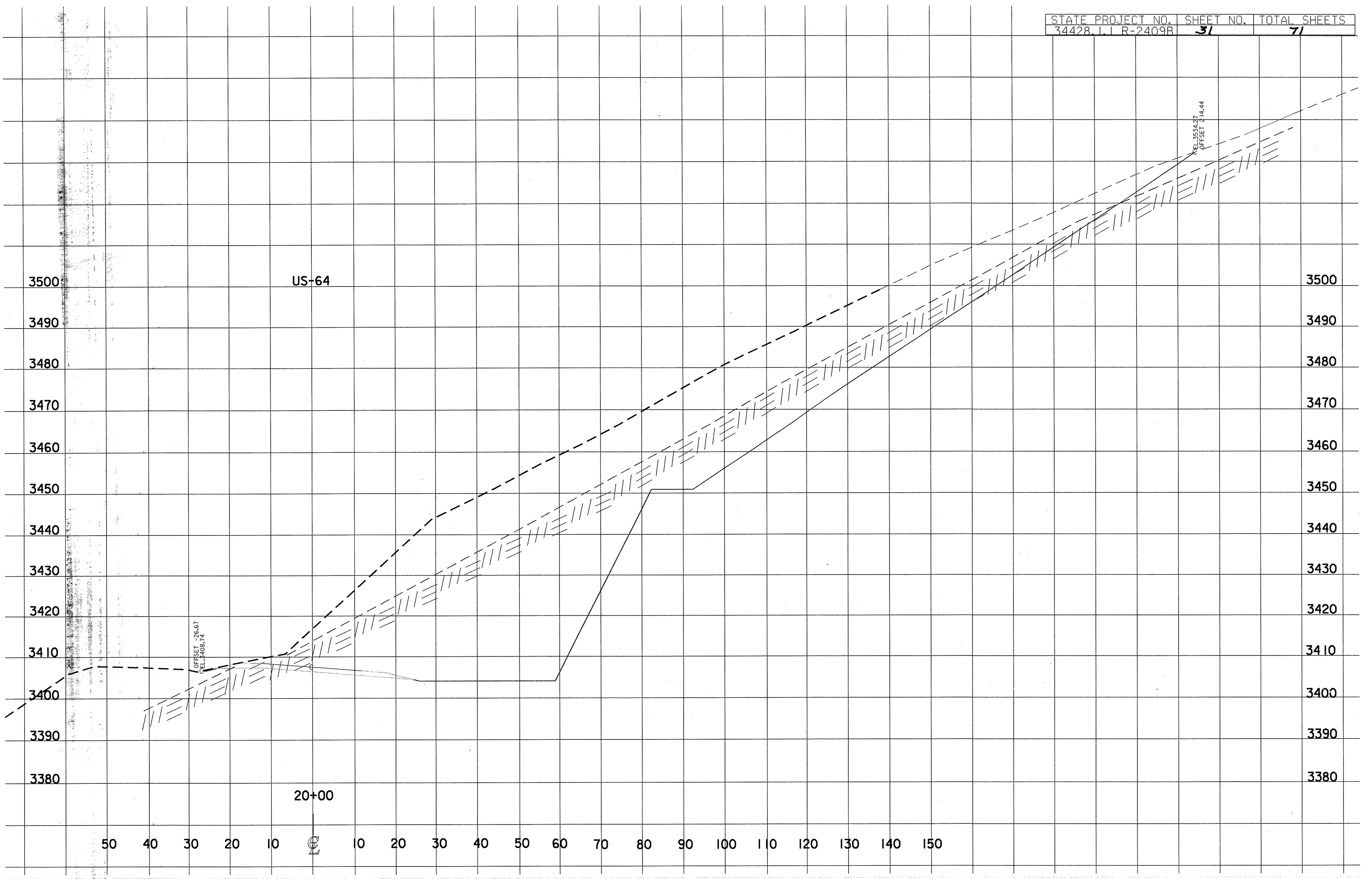
OFFSET 14.40  
CEL. 176.51

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150









US-64

20+00

OFFSET -26.67  
ELEV. 3408.74

ELEV. 3534.27  
OFFSET 214.44

3500  
3490  
3480  
3470  
3460  
3450  
3440  
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3420  
3410  
3400  
3390  
3380

3500  
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3480  
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3460  
3450  
3440  
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3420  
3410  
3400  
3390  
3380

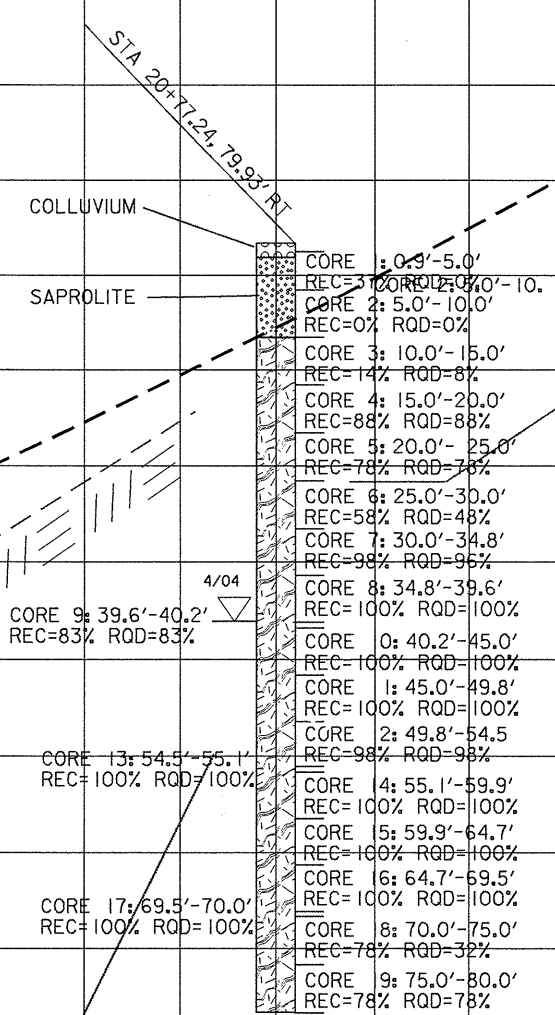
50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

3500  
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3480  
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3420  
3410  
3400  
3390  
3380

US-64

20+50



- CORE 1: 0.9'-5.0'  
REC=31% ROD=20%
- CORE 2: 5.0'-10.0'  
REC=0% ROD=0%
- CORE 3: 10.0'-15.0'  
REC=14% ROD=8%
- CORE 4: 15.0'-20.0'  
REC=88% ROD=88%
- CORE 5: 20.0'-25.0'  
REC=78% ROD=78%
- CORE 6: 25.0'-30.0'  
REC=58% ROD=48%
- CORE 7: 30.0'-34.8'  
REC=98% ROD=96%
- CORE 8: 34.8'-39.6'  
REC=100% ROD=100%
- CORE 9: 39.6'-40.2'  
REC=83% ROD=83%
- CORE 0: 40.2'-45.0'  
REC=100% ROD=100%
- CORE 1: 45.0'-49.8'  
REC=100% ROD=100%
- CORE 2: 49.8'-54.5'  
REC=98% ROD=98%
- CORE 4: 55.1'-59.9'  
REC=100% ROD=100%
- CORE 5: 59.9'-64.7'  
REC=100% ROD=100%
- CORE 6: 64.7'-69.5'  
REC=100% ROD=100%
- CORE 8: 70.0'-75.0'  
REC=78% ROD=32%
- CORE 9: 75.0'-80.0'  
REC=78% ROD=78%

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

OFFSET -34.61  
REL. 3406.05

REL. 3505.28  
OFFSET 212.25

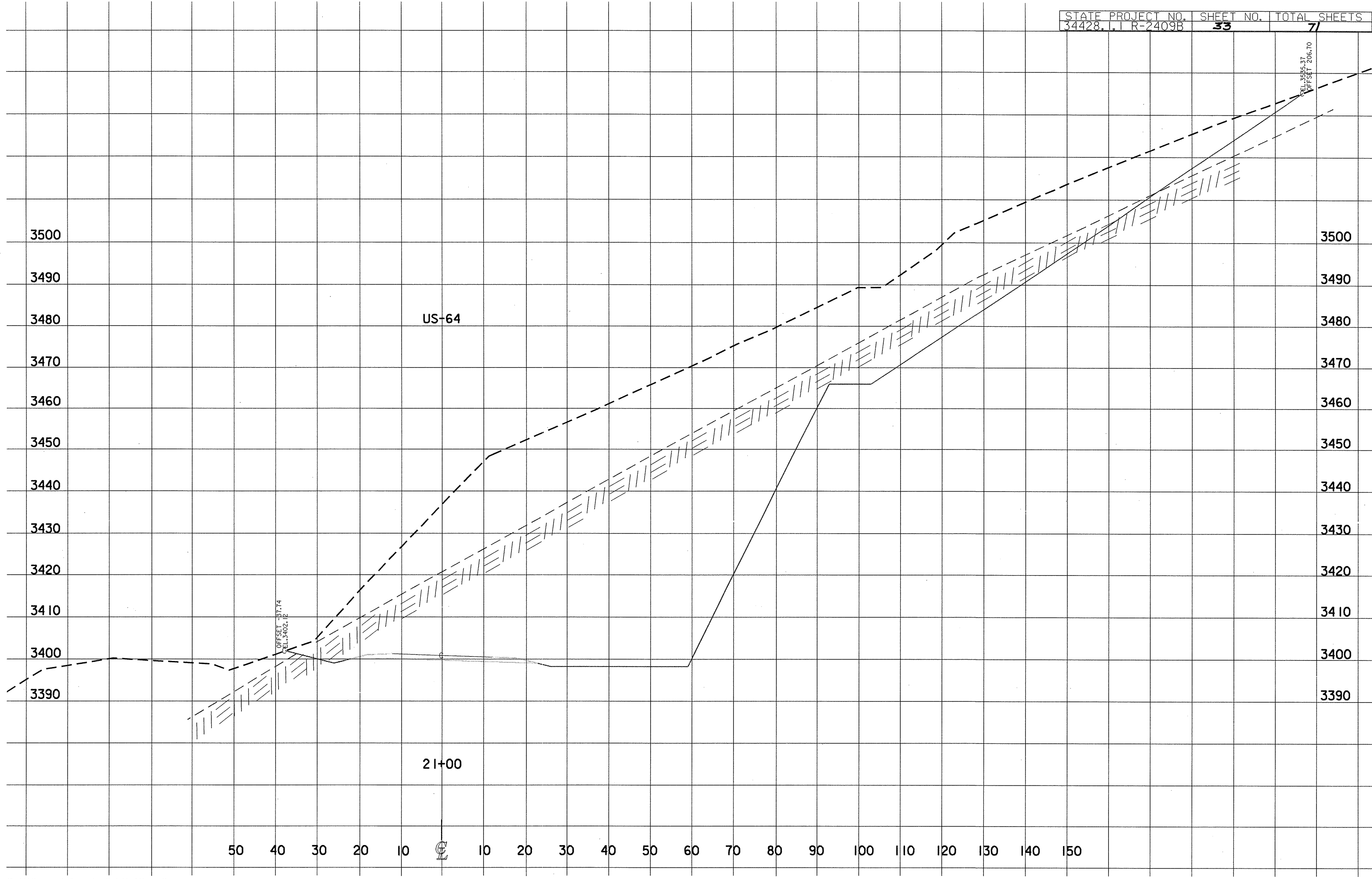
4/04  
CORE 9: 39.6'-40.2'  
REC=83% ROD=83%

CORE 13: 54.5'-55.1'  
REC=100% ROD=100%

CORE 17: 69.5'-70.0'  
REC=100% ROD=100%

STA 20+17.24, 79.93, RT

COLLUVIUM  
SAPROLITE



US-64

21+00

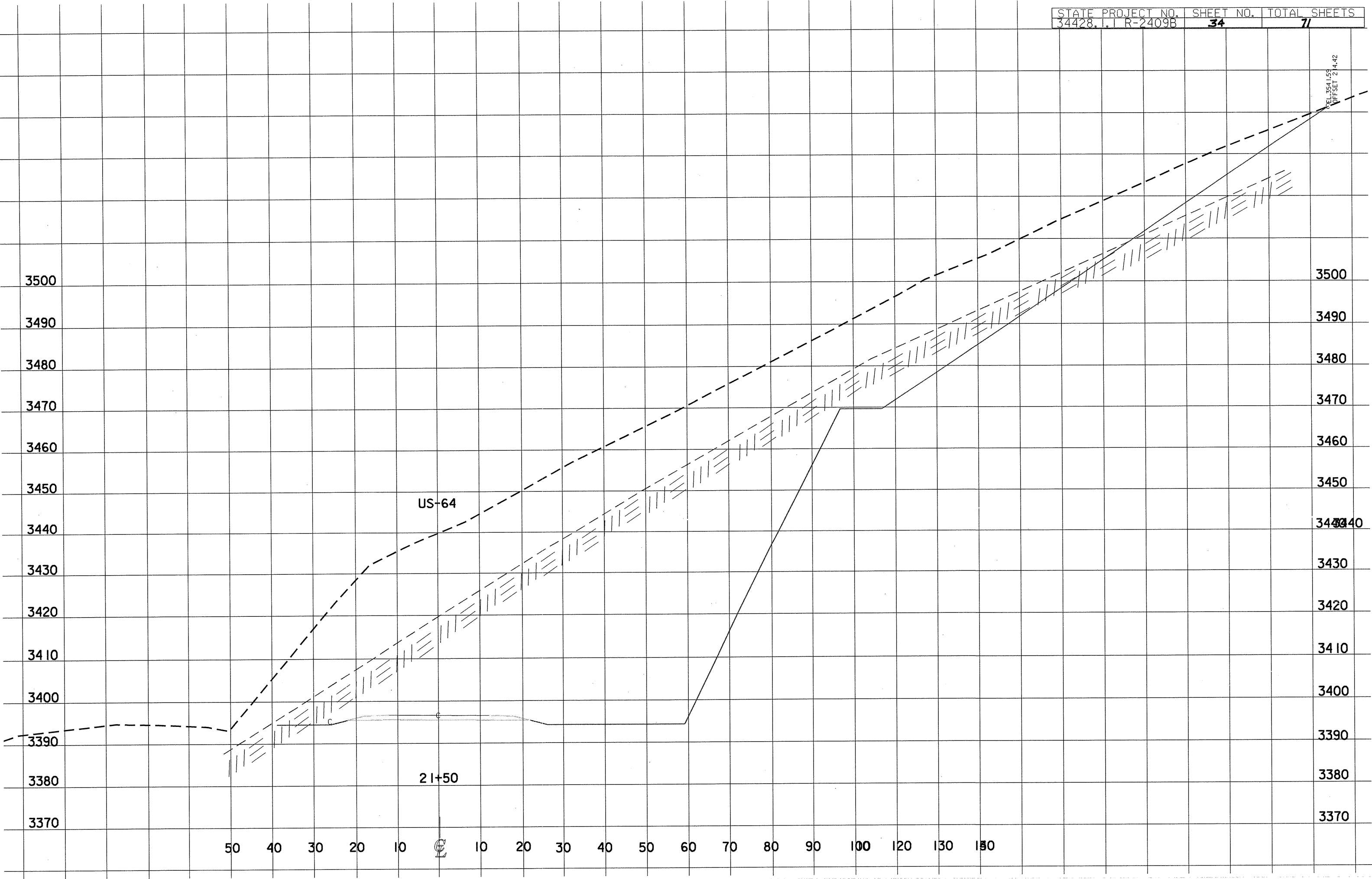
OFFSET 37.74  
LEVEL 3402.1E

OFFSET 206.70  
LEVEL 3505.37

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

3500  
3490  
3480  
3470  
3460  
3450  
3440  
3430  
3420  
3410  
3400  
3390

3500  
3490  
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3470  
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3450  
3440  
3430  
3420  
3410  
3400  
3390

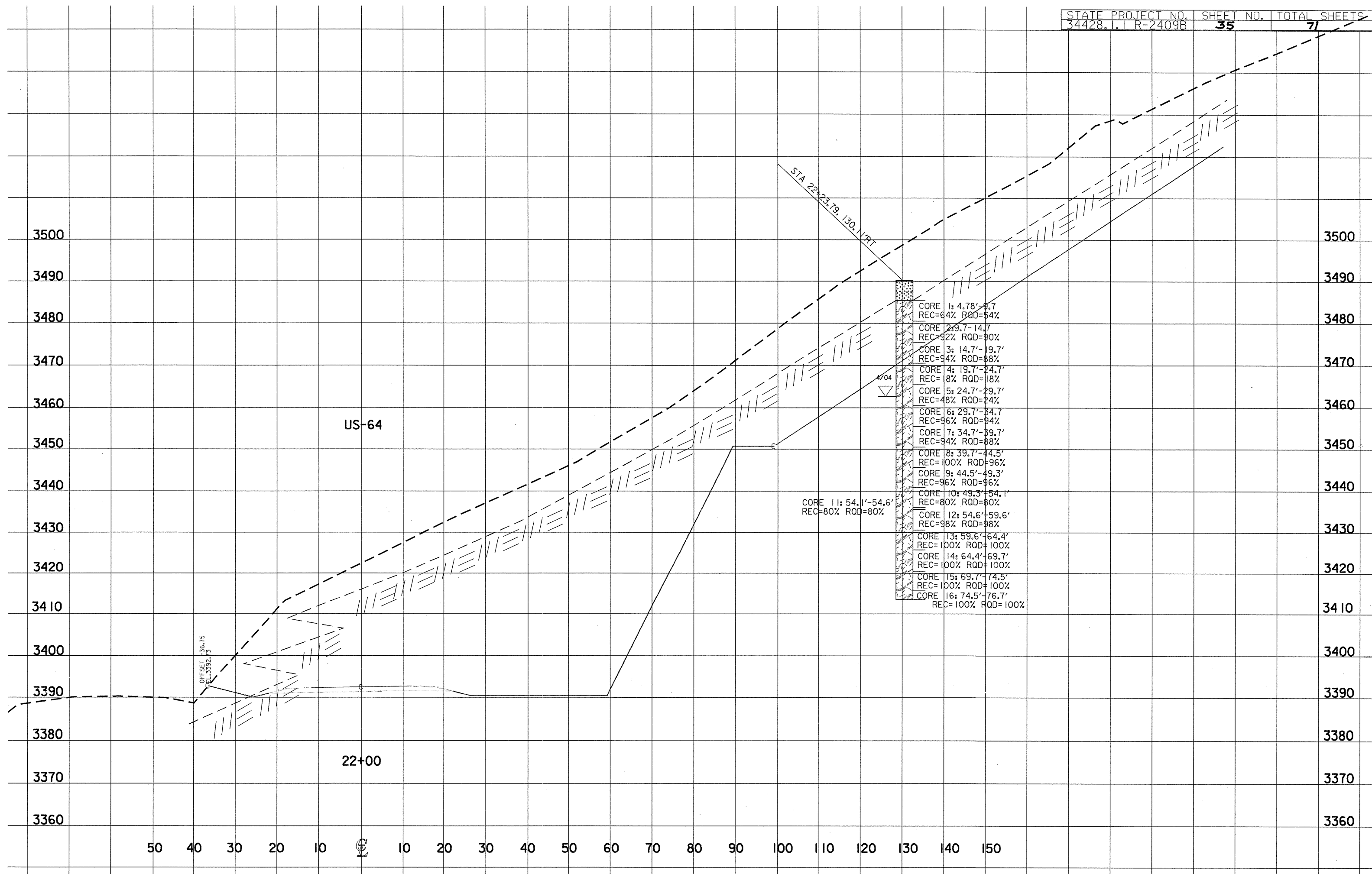


VEL 3541.55  
 OFFSET 24.42

US-64

21+50

E



CORE 1: 4.78'-9.7'	REC=64% RQD=54%
CORE 2: 9.7'-14.7'	REC=92% RQD=90%
CORE 3: 14.7'-19.7'	REC=94% RQD=88%
CORE 4: 19.7'-24.7'	REC= 8% RQD=18%
CORE 5: 24.7'-29.7'	REC=48% RQD=24%
CORE 6: 29.7'-34.7'	REC=96% RQD=94%
CORE 7: 34.7'-39.7'	REC=94% RQD=88%
CORE 8: 39.7'-44.5'	REC=100% RQD=96%
CORE 9: 44.5'-49.3'	REC=96% RQD=96%
CORE 10: 49.3'-54.1'	REC=80% RQD=80%
CORE 11: 54.1'-54.6'	REC=80% RQD=80%
CORE 12: 54.6'-59.6'	REC=98% RQD=98%
CORE 13: 59.6'-64.4'	REC=100% RQD=100%
CORE 14: 64.4'-69.7'	REC=100% RQD=100%
CORE 15: 69.7'-74.5'	REC=100% RQD=100%
CORE 16: 74.5'-76.7'	REC=100% RQD=100%

STA 22+23.79, 130.11/RT

US-64

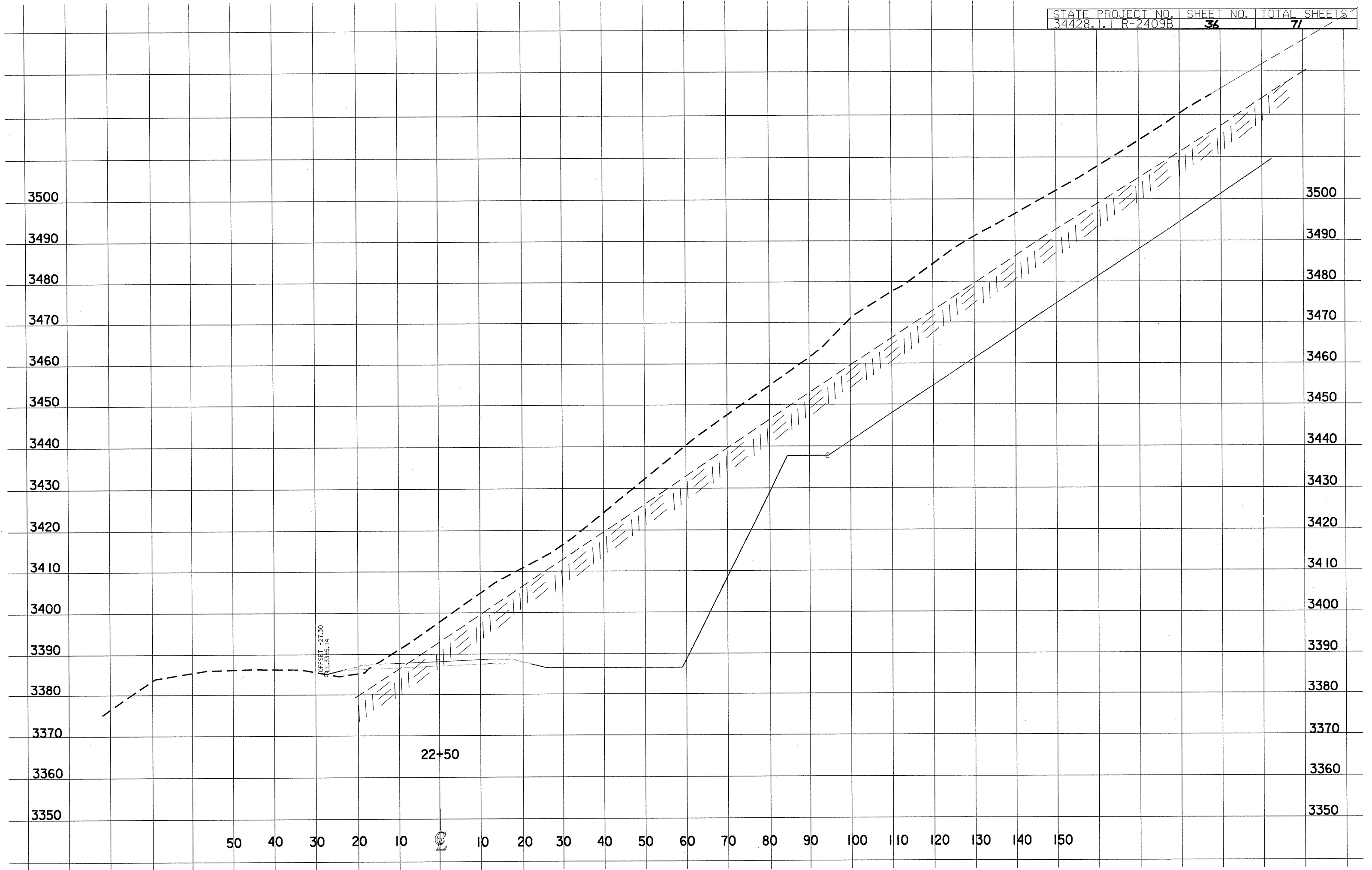
22+00

OFFSET -36.75  
REL. 3392.73

4.704

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150





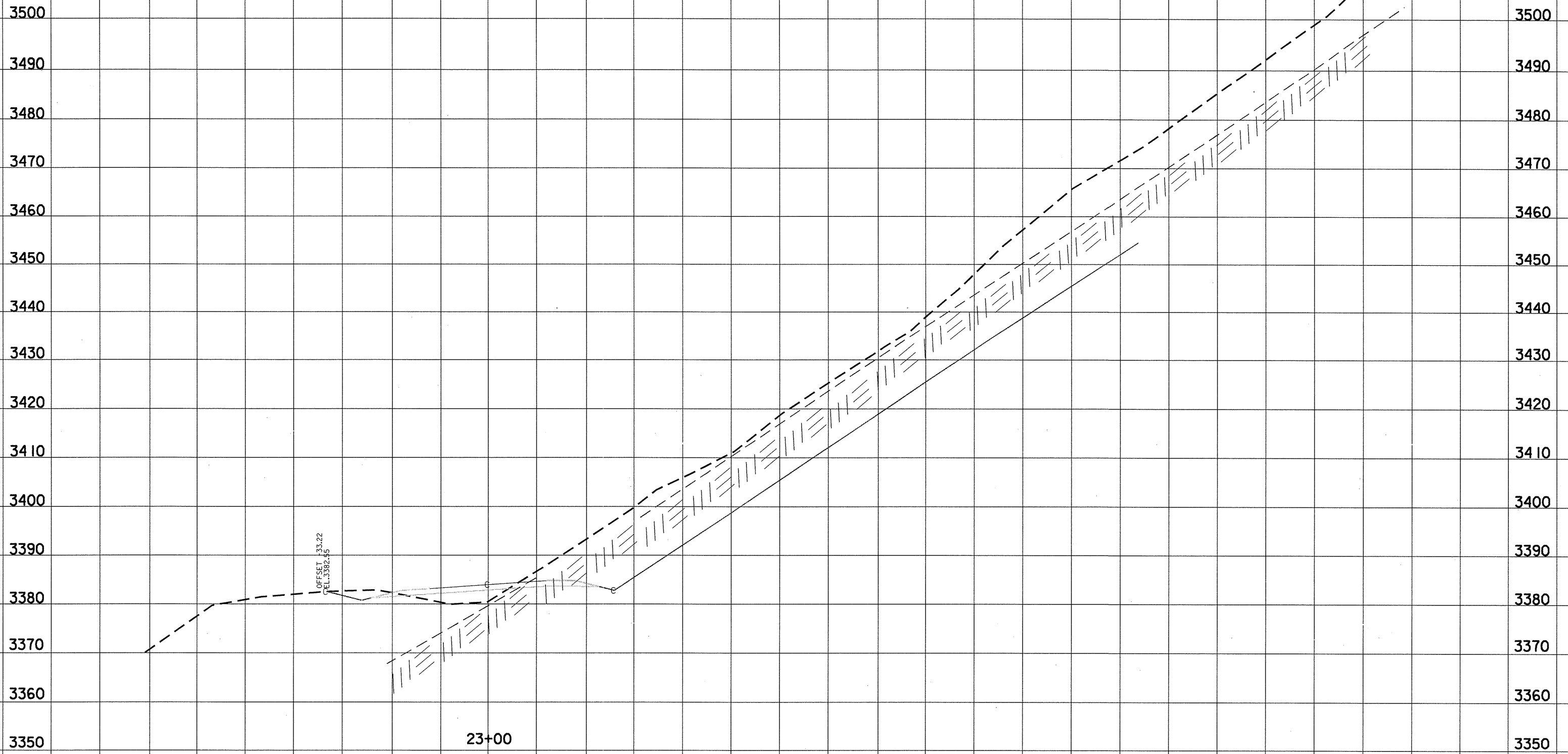
OFFSET -27.30  
REL. 3385.14

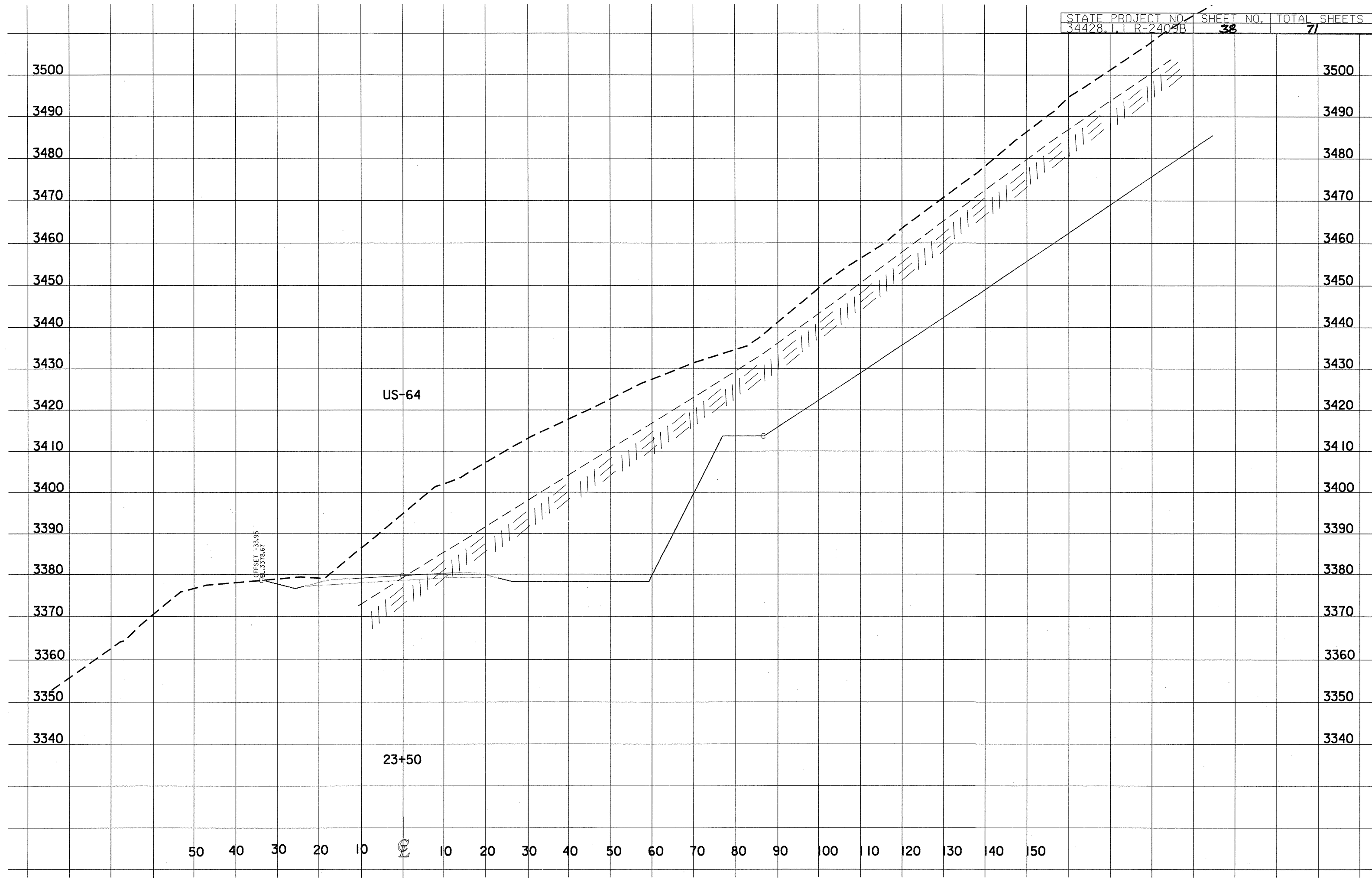
22+50

50 40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

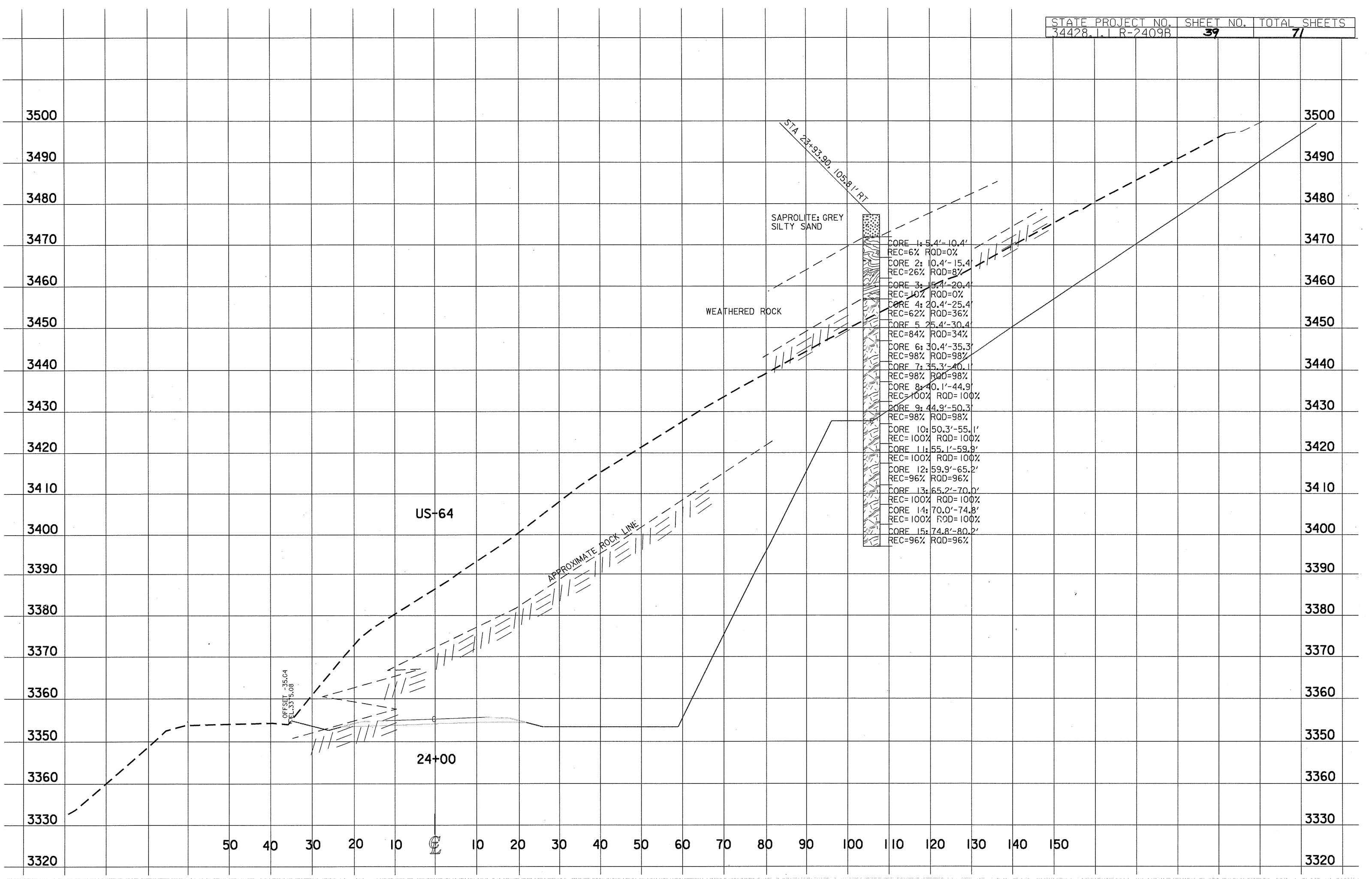
3500  
3490  
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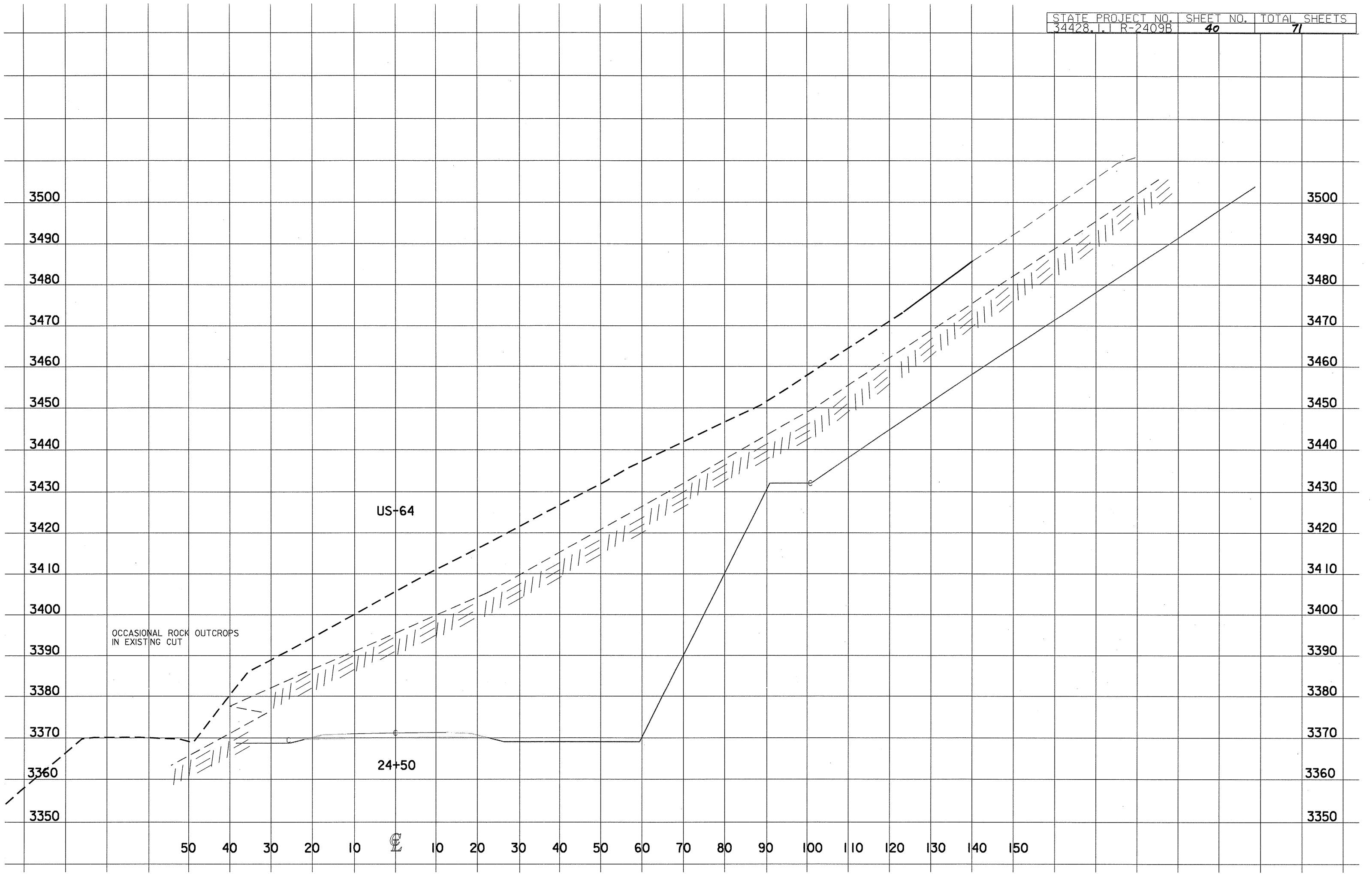


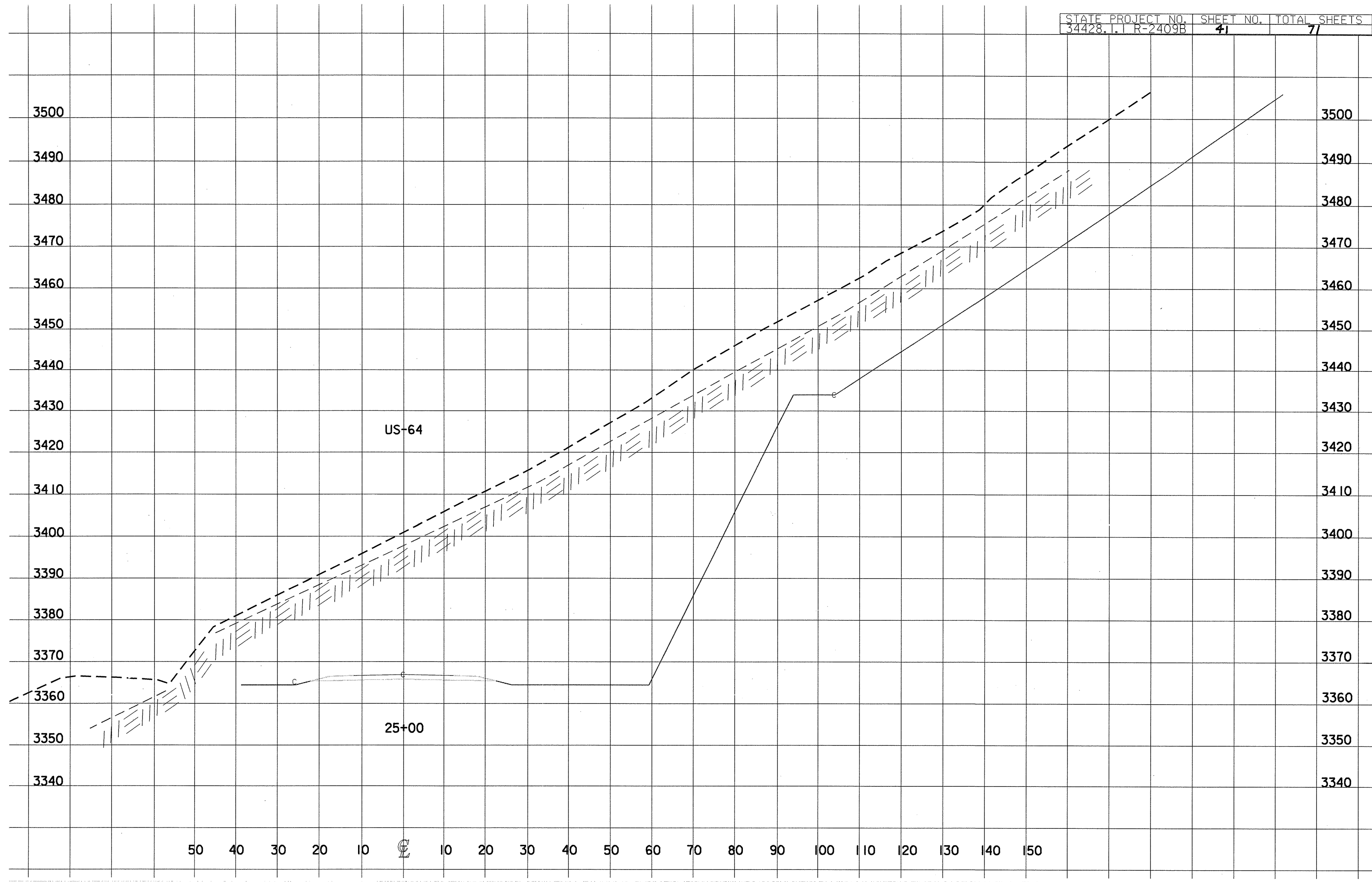


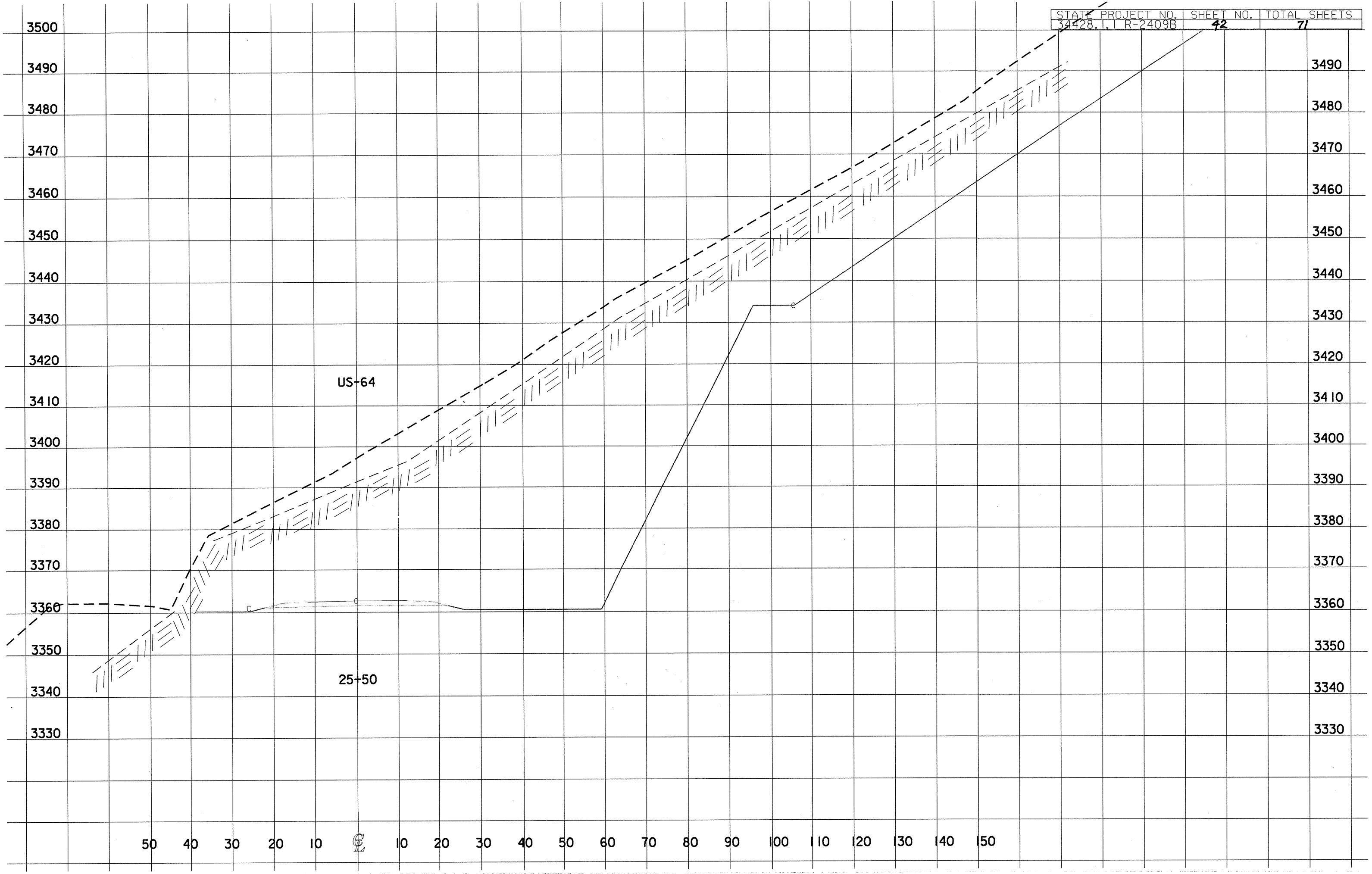


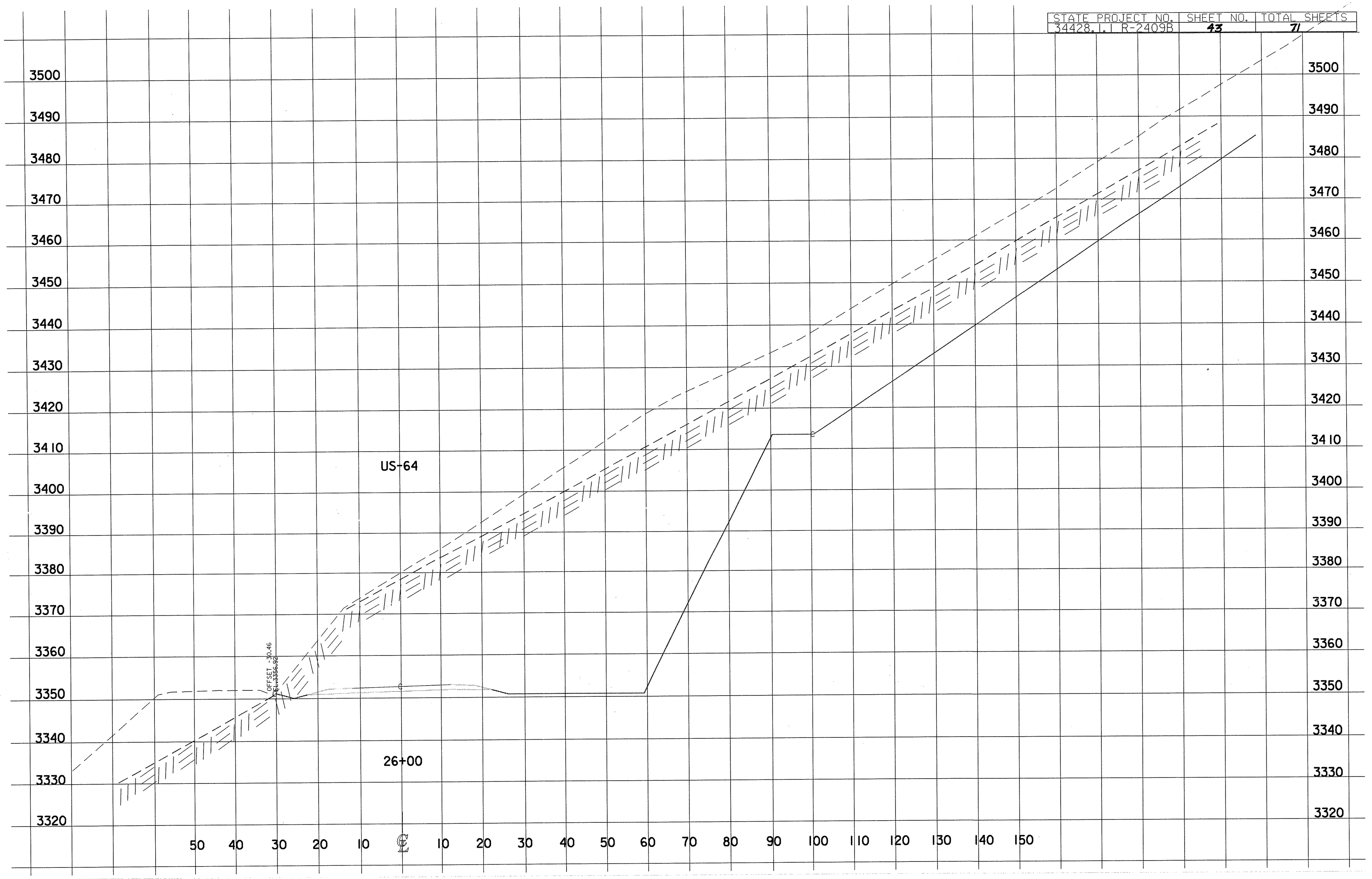


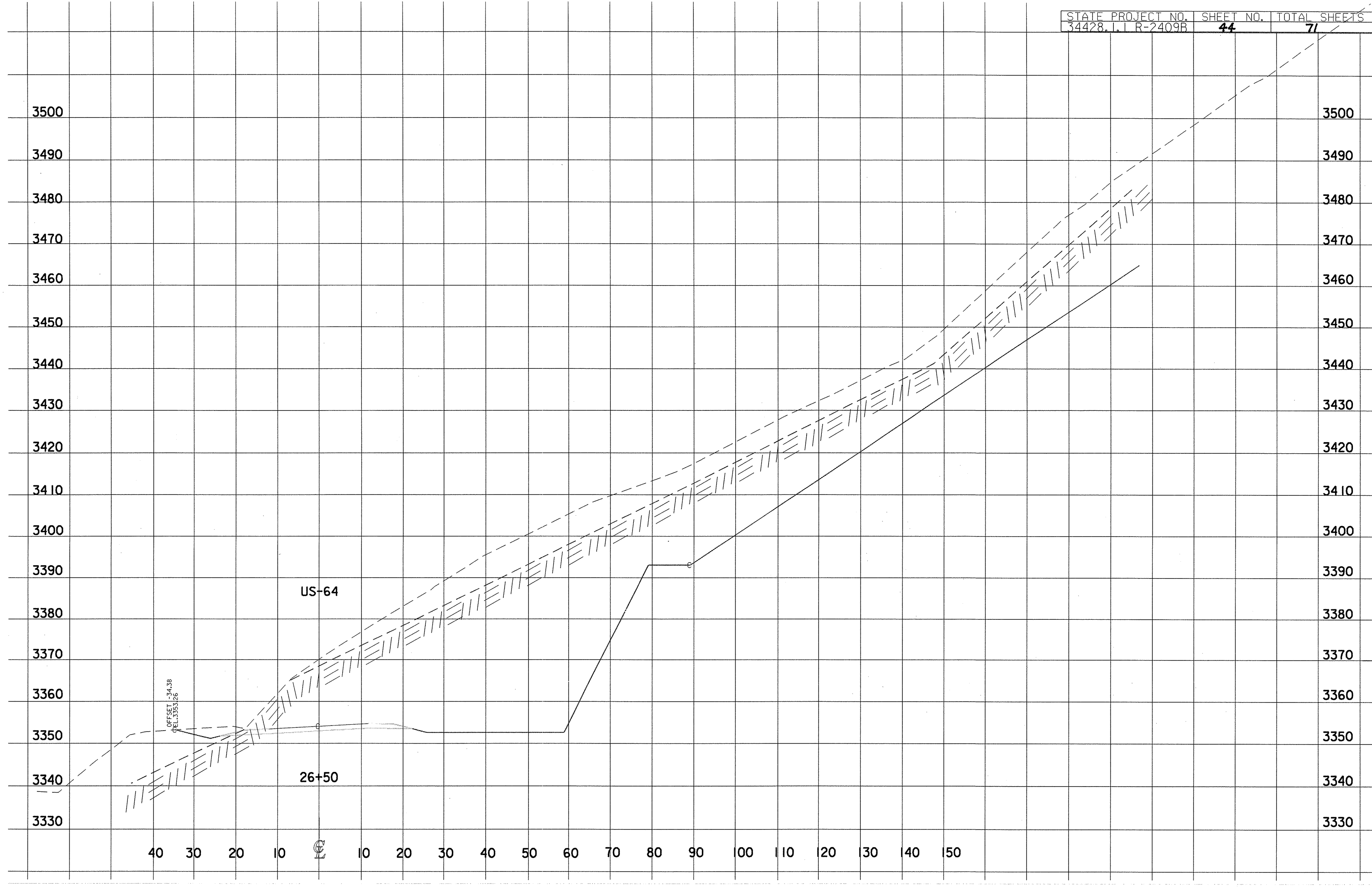
CORE 1: 5.4'-10.4'	REC=6% RQD=0%
CORE 2: 10.4'-15.4'	REC=26% RQD=8%
CORE 3: 15.4'-20.4'	REC=10% RQD=0%
CORE 4: 20.4'-25.4'	REC=62% RQD=36%
CORE 5: 25.4'-30.4'	REC=84% RQD=34%
CORE 6: 30.4'-35.3'	REC=98% RQD=98%
CORE 7: 35.3'-40.1'	REC=98% RQD=98%
CORE 8: 40.1'-44.9'	REC=100% RQD=100%
CORE 9: 44.9'-50.3'	REC=98% RQD=98%
CORE 10: 50.3'-55.1'	REC=100% RQD=100%
CORE 11: 55.1'-59.9'	REC=100% RQD=100%
CORE 12: 59.9'-65.2'	REC=96% RQD=96%
CORE 13: 65.2'-70.0'	REC=100% RQD=100%
CORE 14: 70.0'-74.8'	REC=100% RQD=100%
CORE 15: 74.8'-80.2'	REC=96% RQD=96%

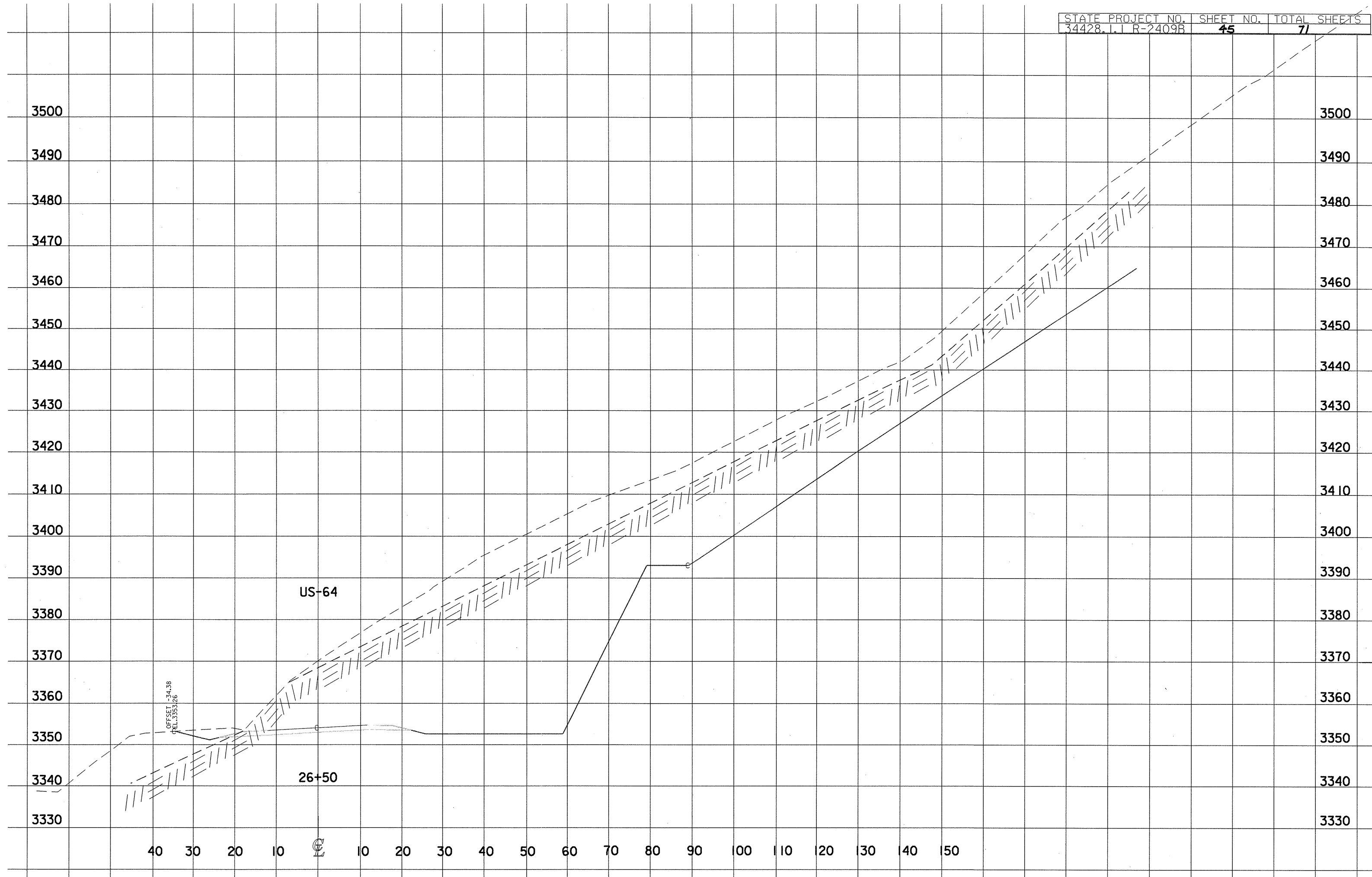


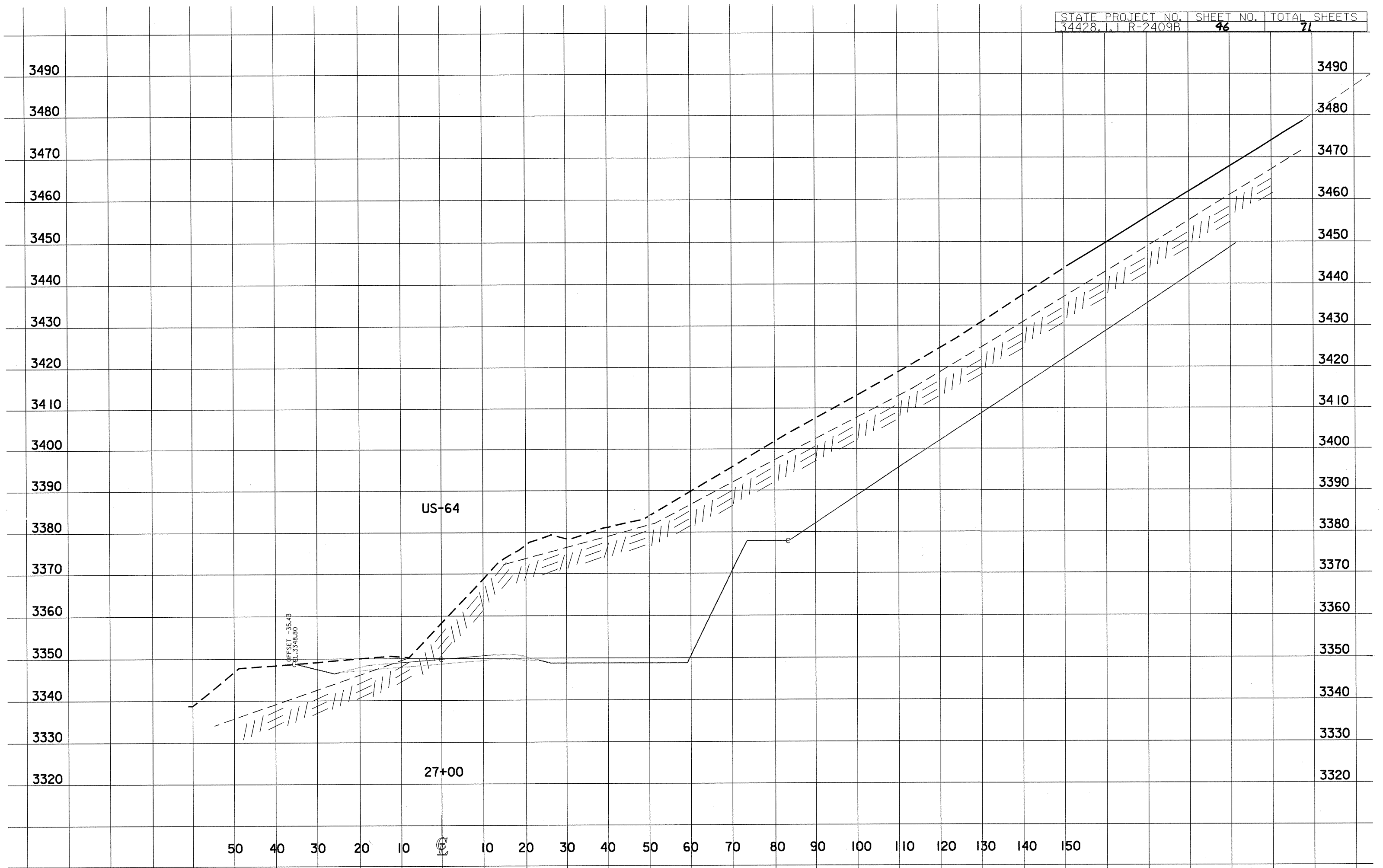












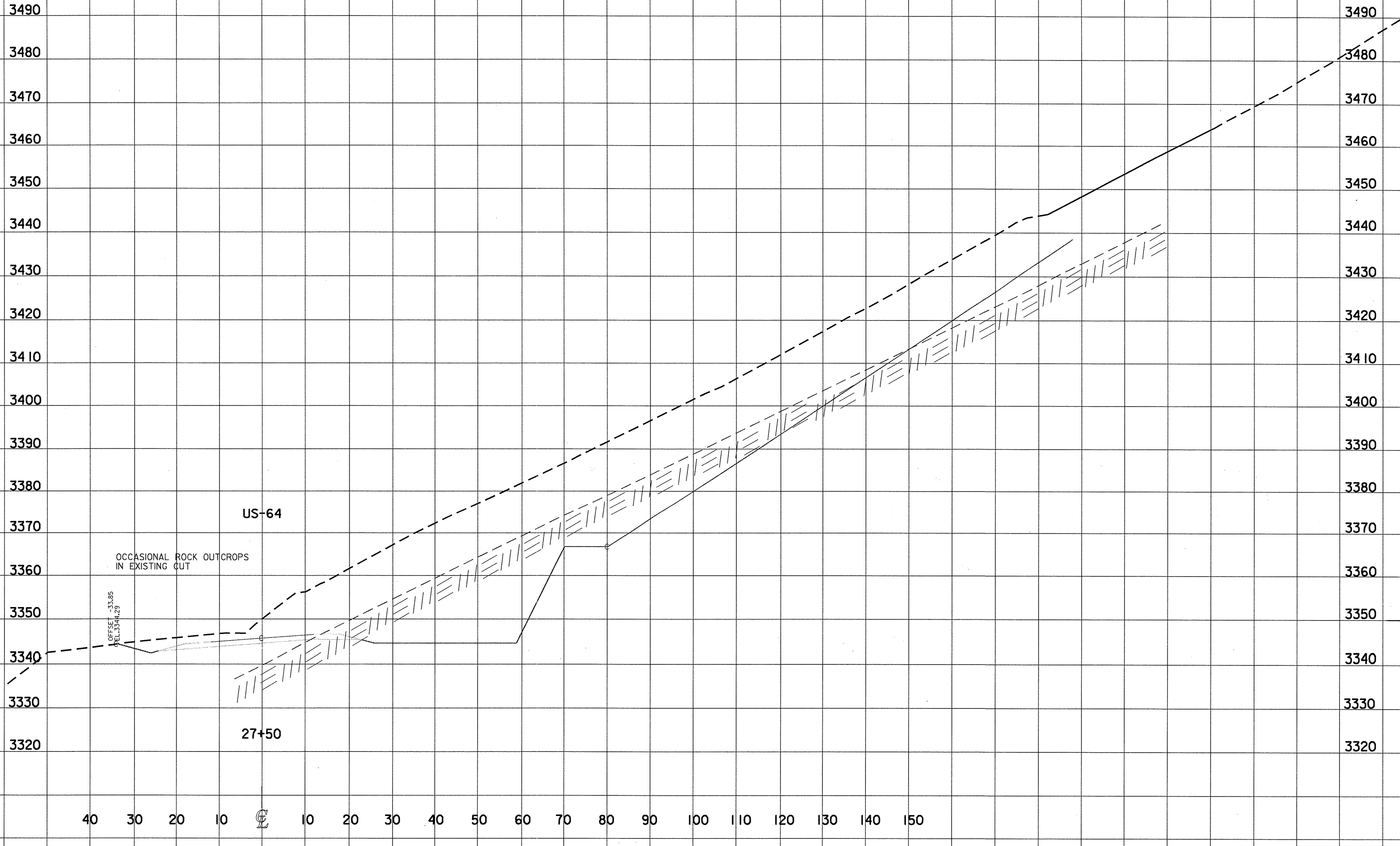
US-64

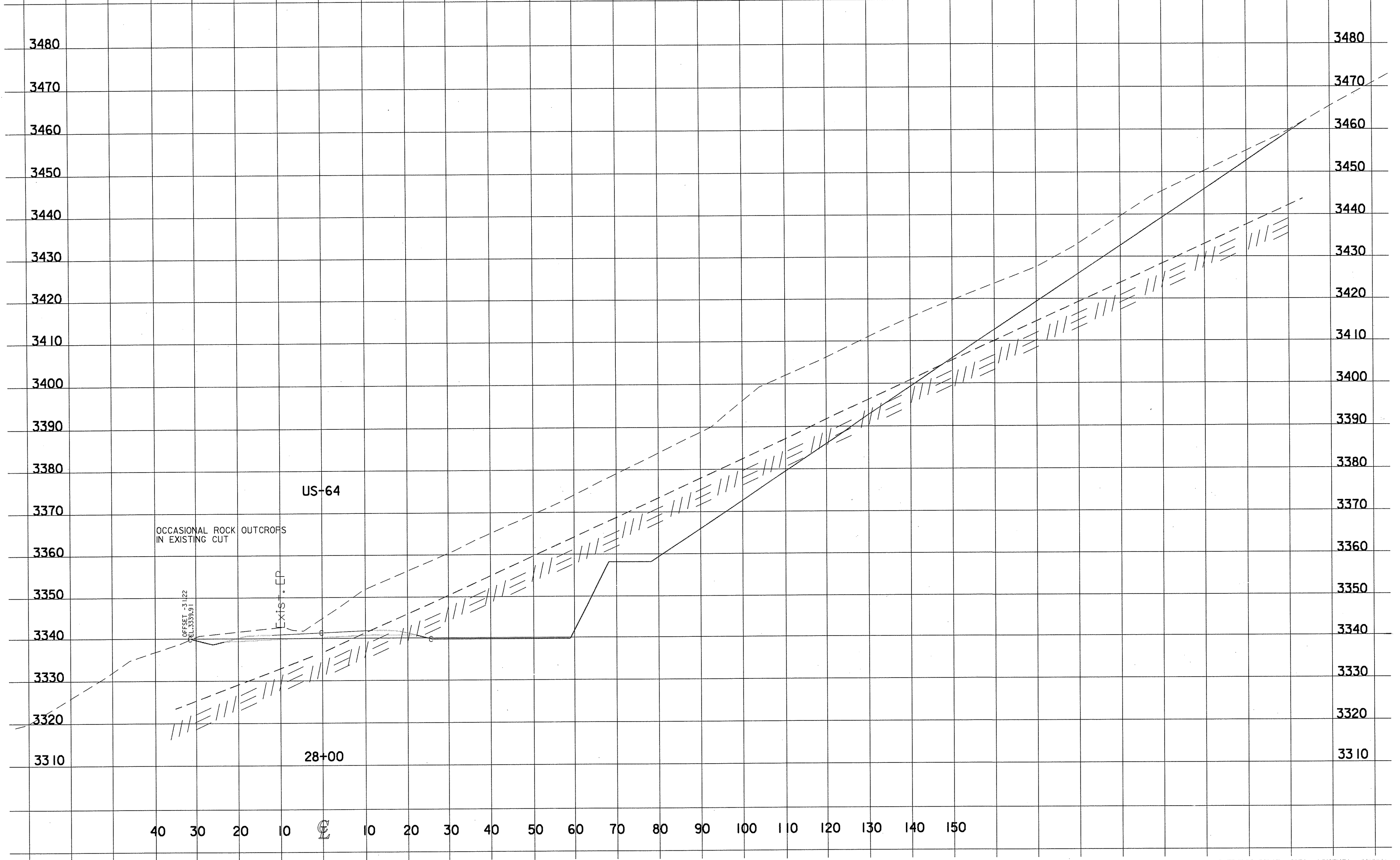
OFFSET -35.45  
REL. 3348.80

27+00

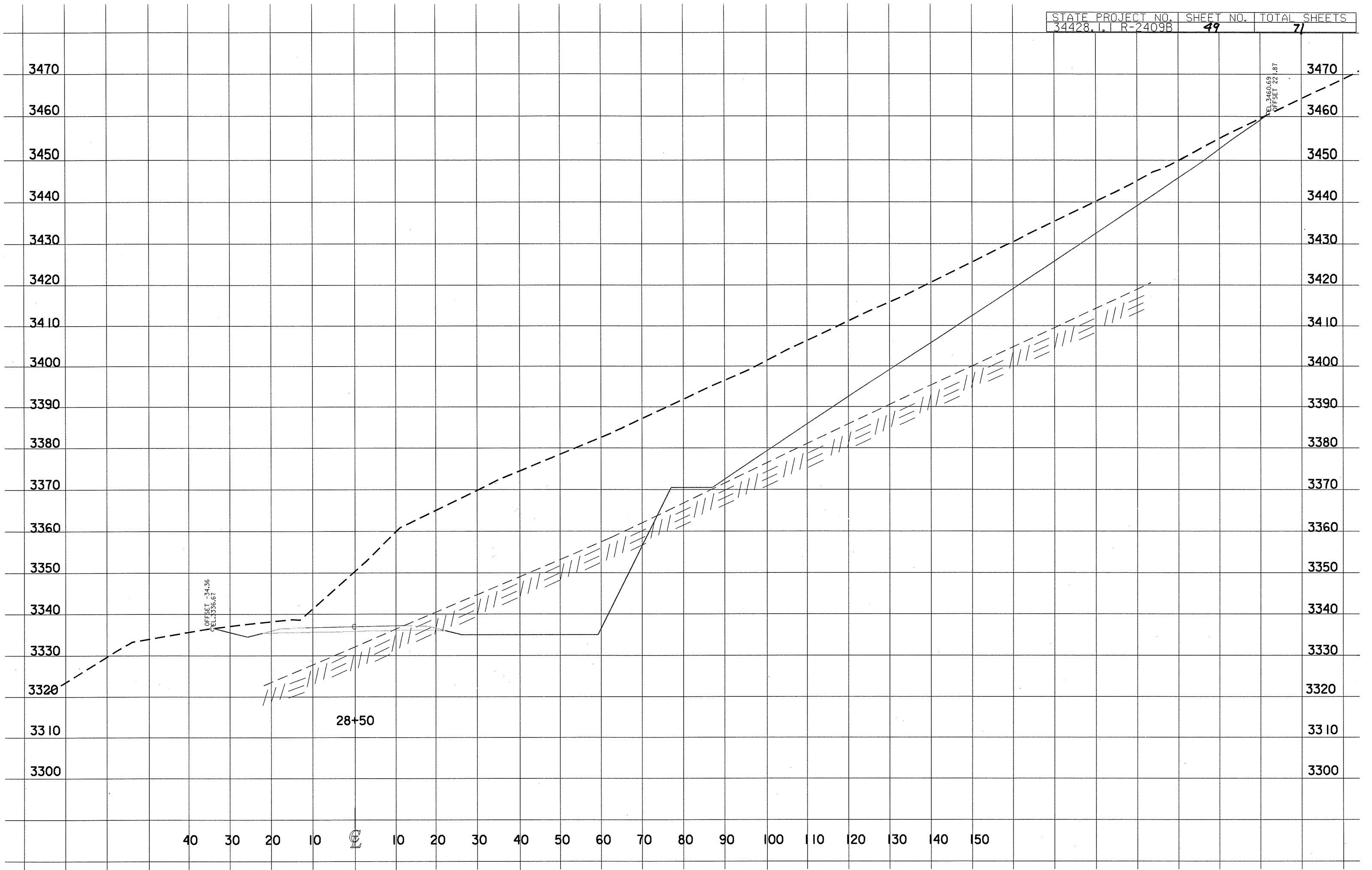
50 40 30 20 10 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150







40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

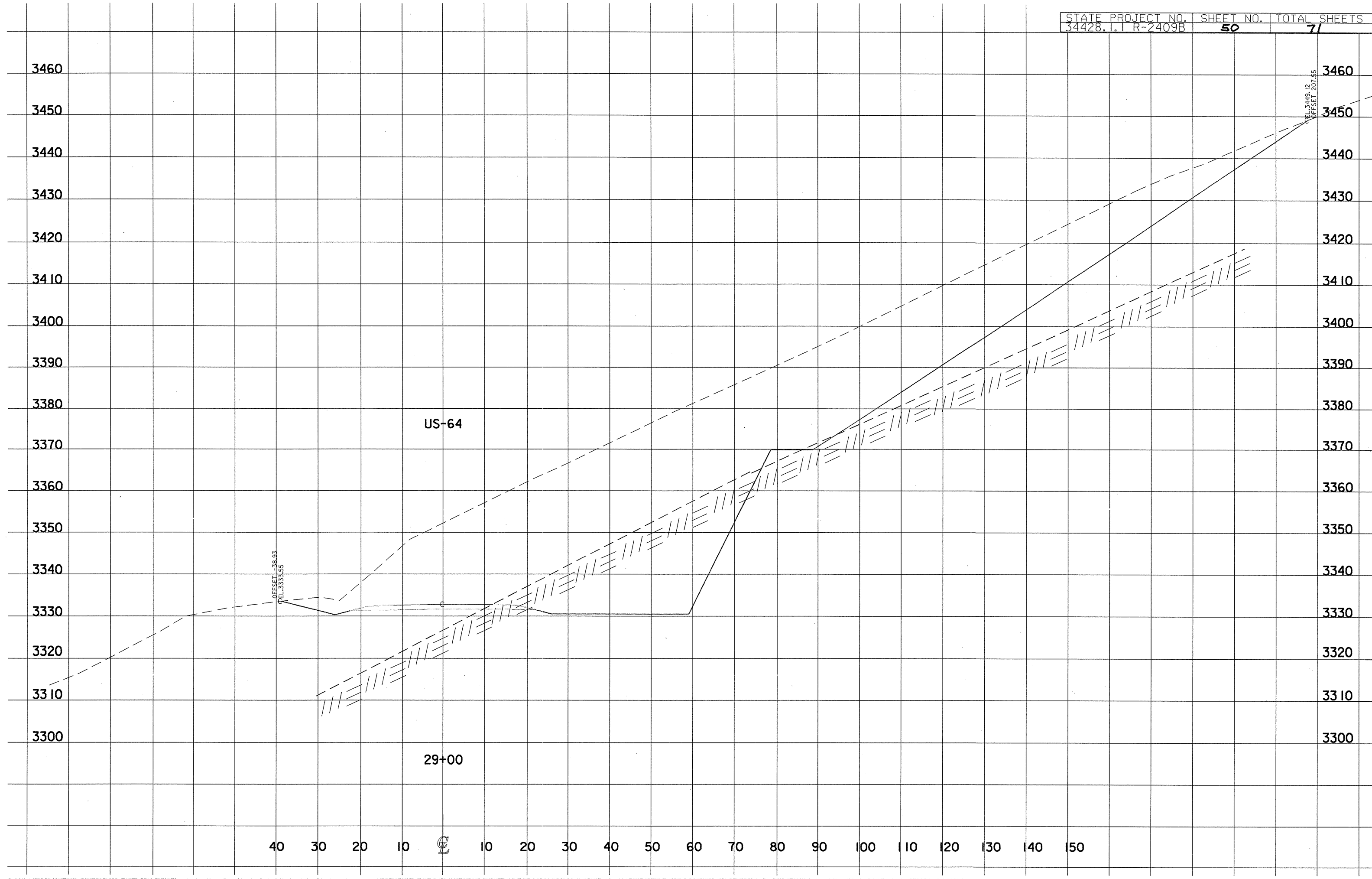


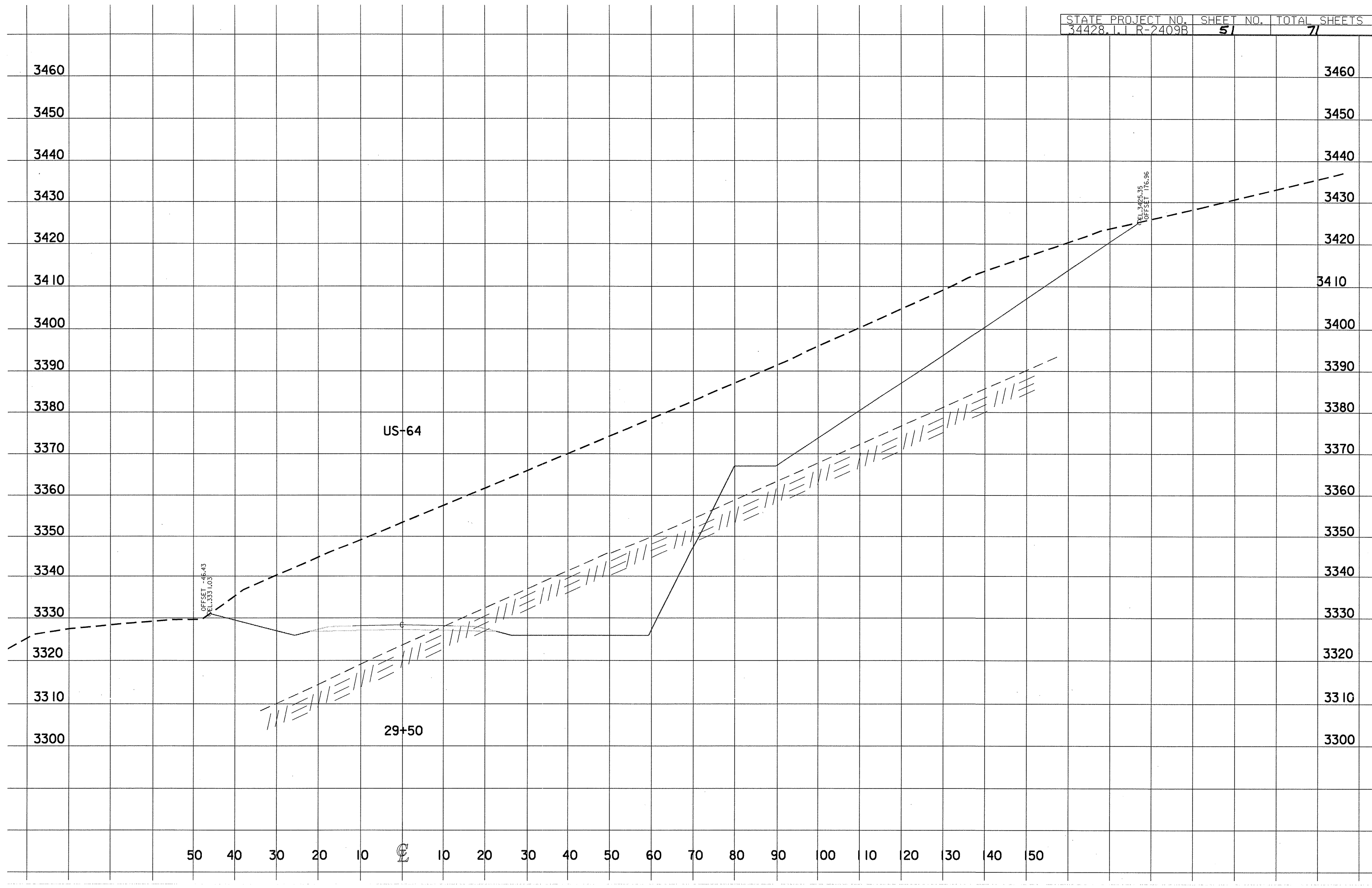
40 30 20 10 0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

28+50

OFFSET -34.36  
REL. 3336.67

REL. 3460.69  
OFFSET 22.87





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3450  
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3310  
3300

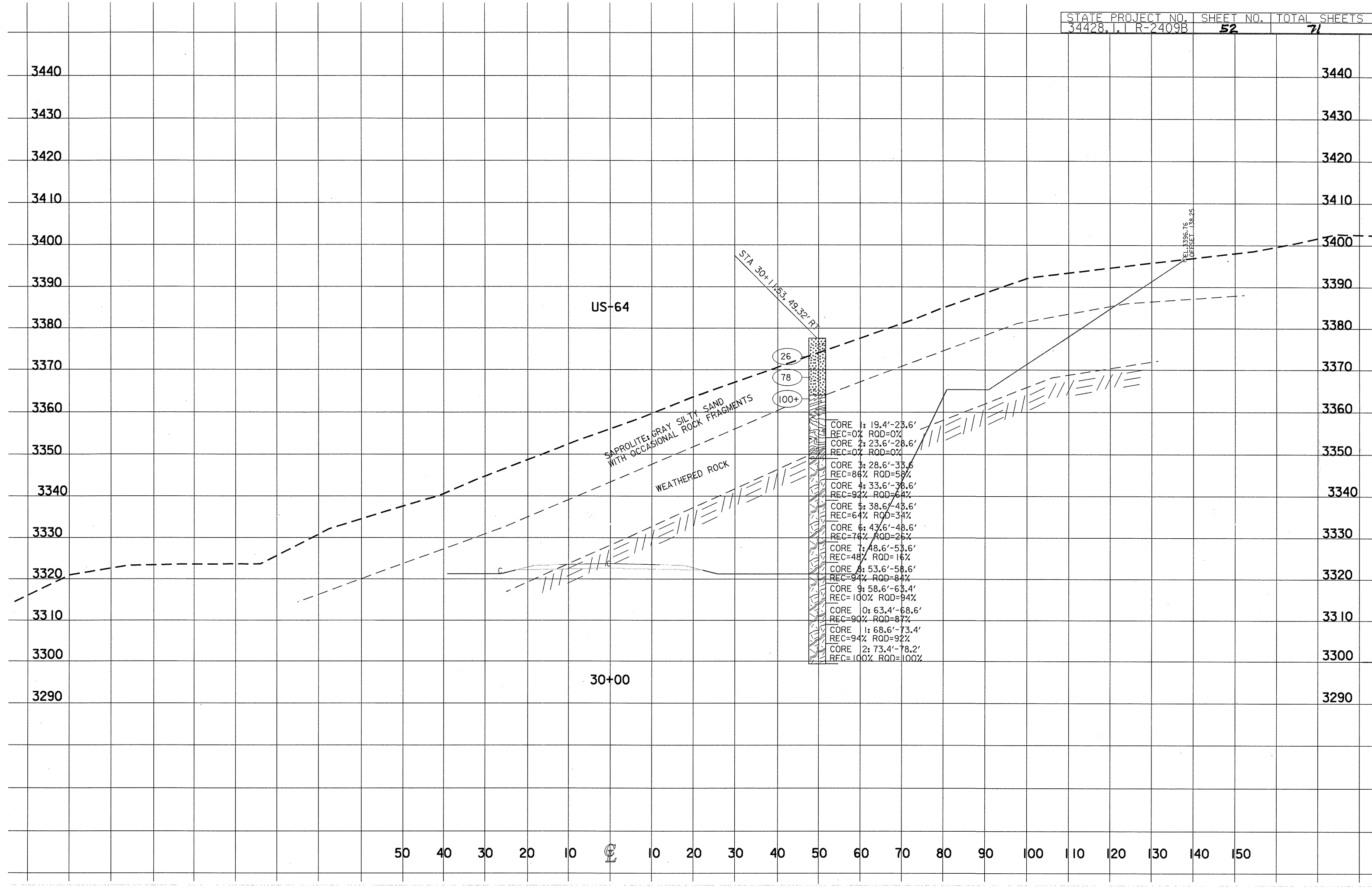
50 40 30 20 10  $\text{C}$  10 20 30 40 50 60 70 80 90 100 110 120 30 140 150

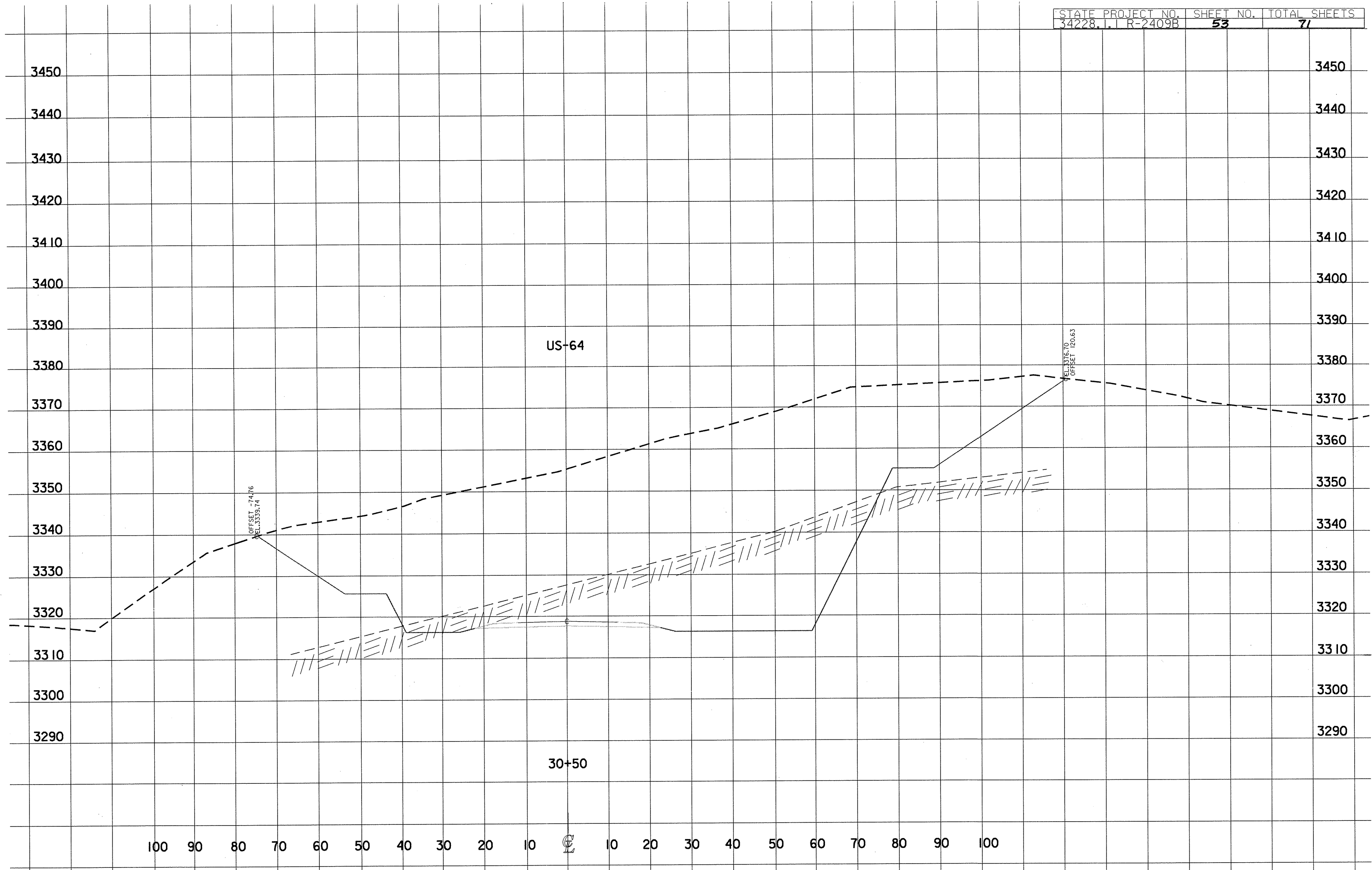
US-64

29+50

OFFSET -46.43  
ELEV. 3331.03

ELEV. 3425.35  
OFFSET 176.96





US-64

30+50

3440  
3430  
3420  
3410  
3400  
3390  
3380  
3370  
3360  
3350  
3340  
3330  
3320  
3310  
3300  
3290  
3280

3430  
3420  
3410  
3400  
3390  
3380  
3370  
3360  
3350  
3340  
3330  
3320  
3310  
3300  
3290  
3280

US-64

STA 30+98.18, 8.94' RT

OFFSET -77.16  
ELEV. 3341.06

ELEV. 3355.99  
OFFSET 107.02

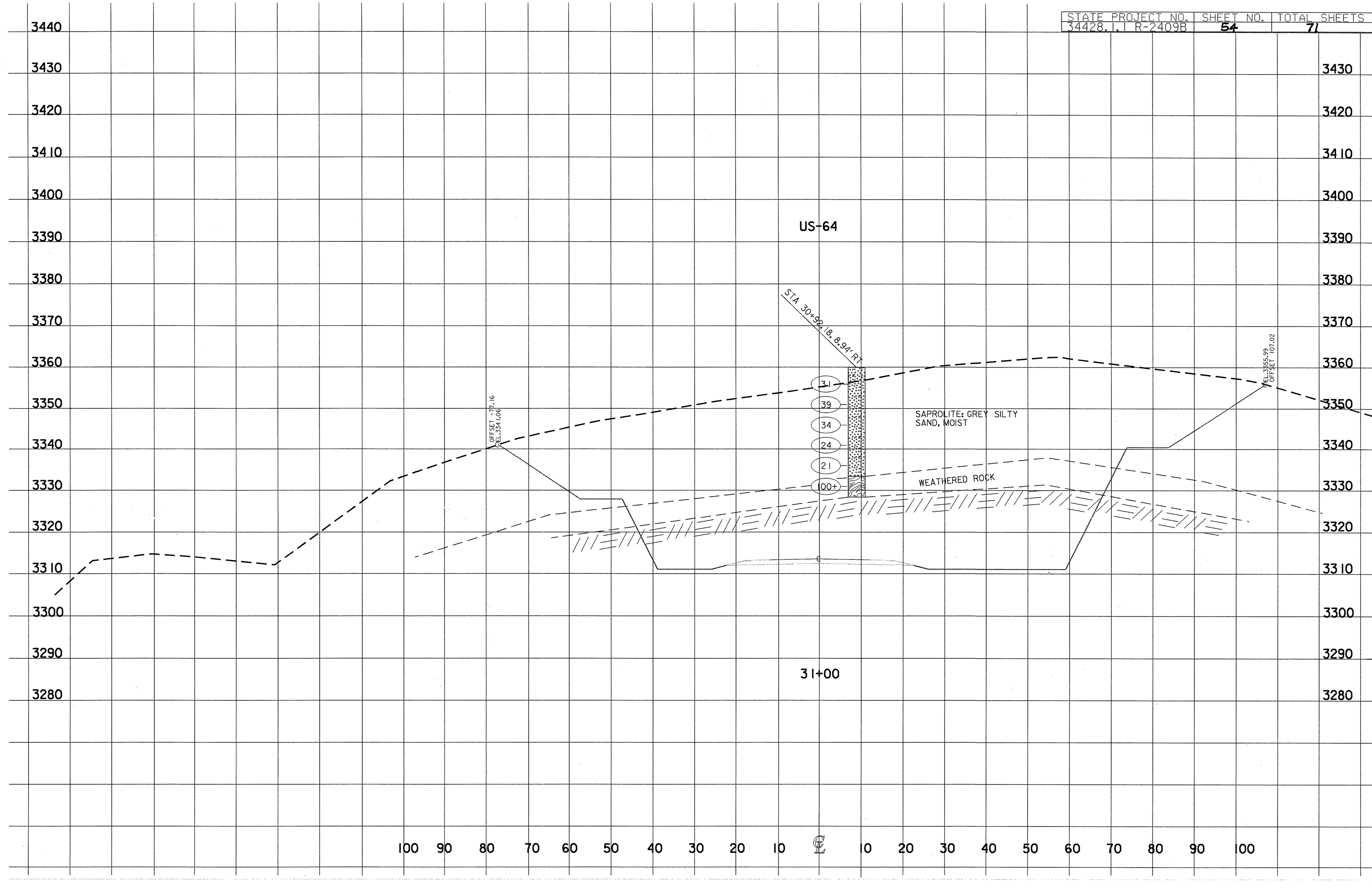
- 31
- 39
- 34
- 24
- 21
- 100+

SAPROLITE: GREY SILTY SAND, MOIST

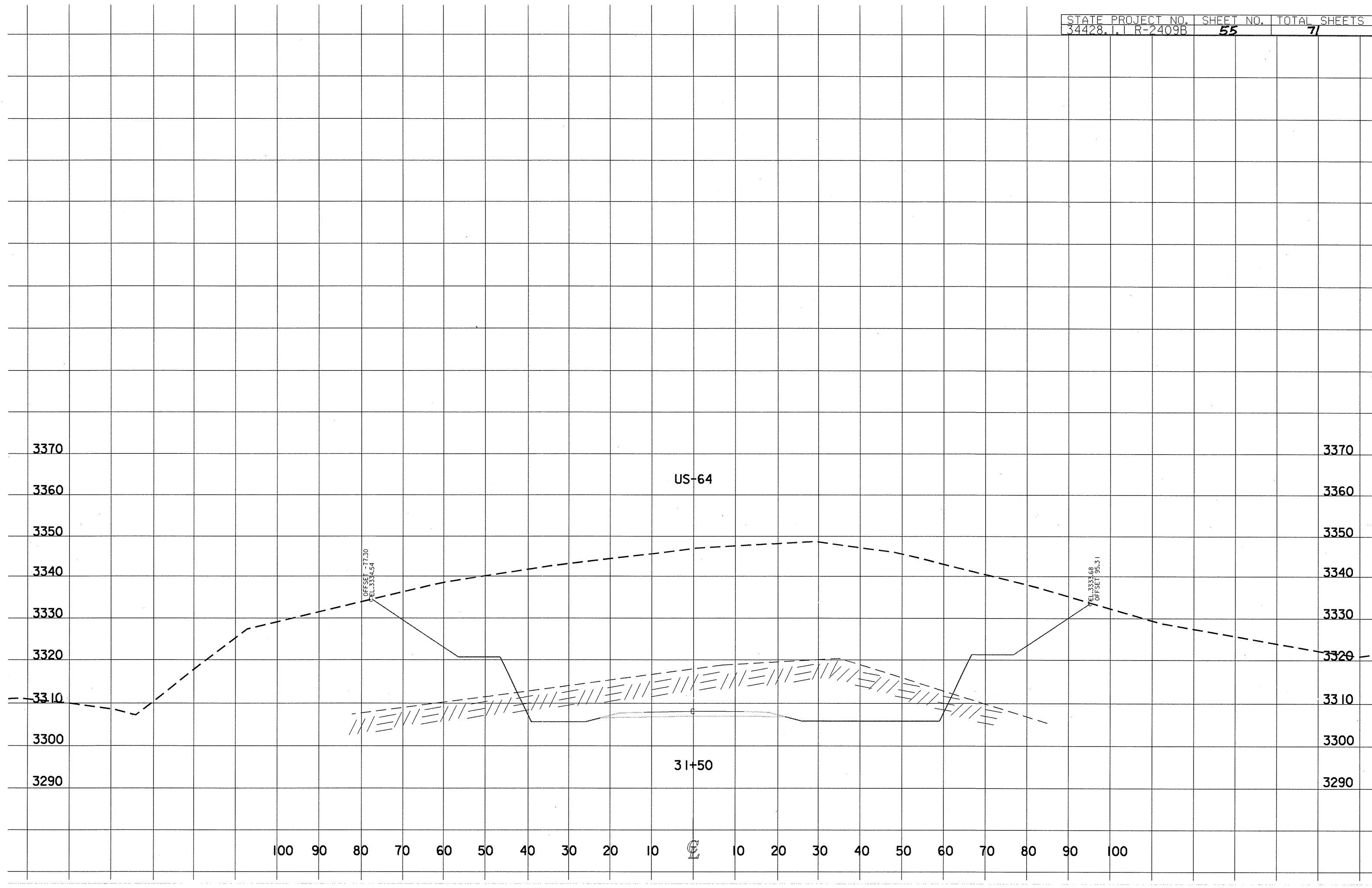
WEATHERED ROCK

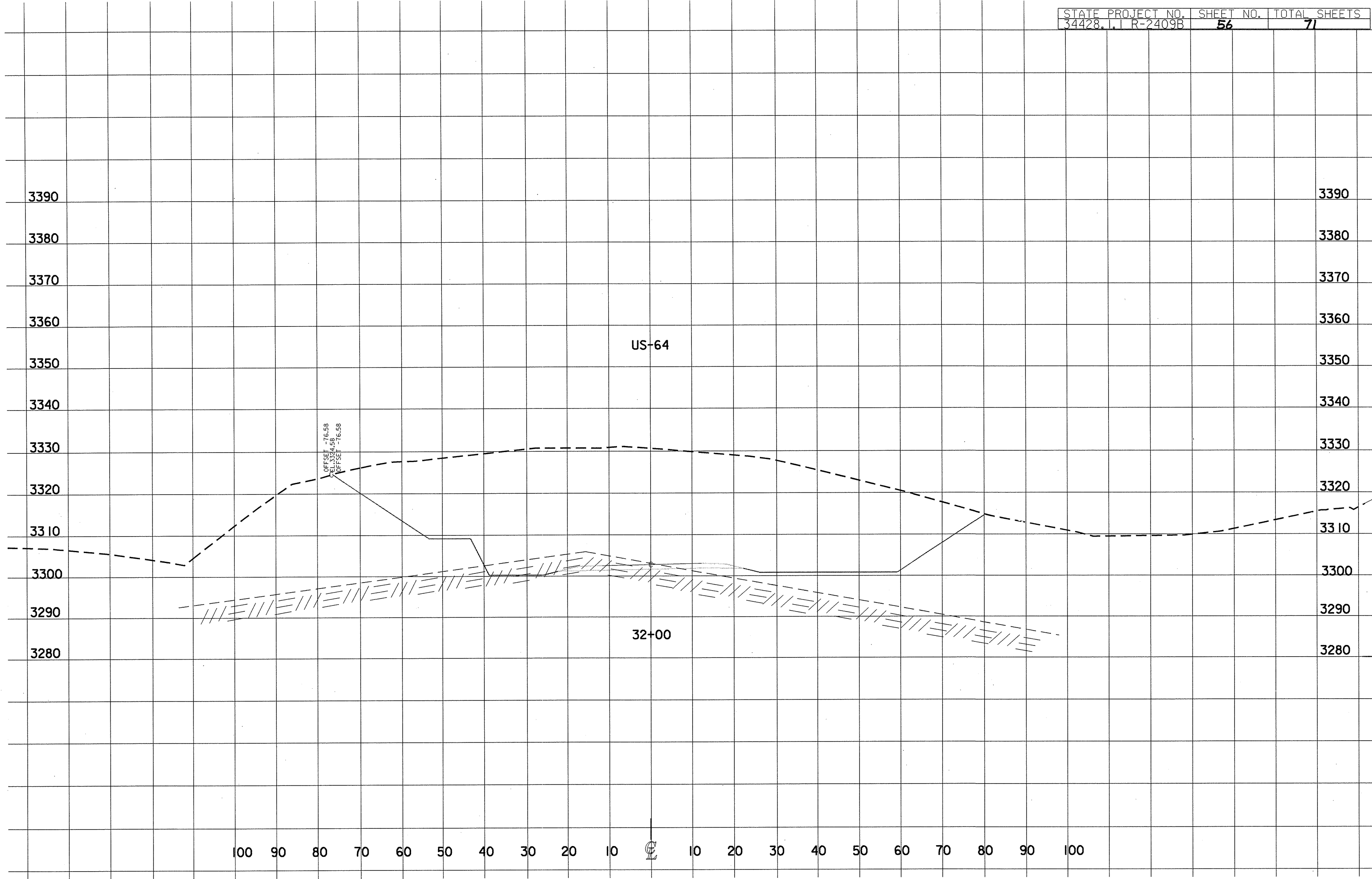
31+00

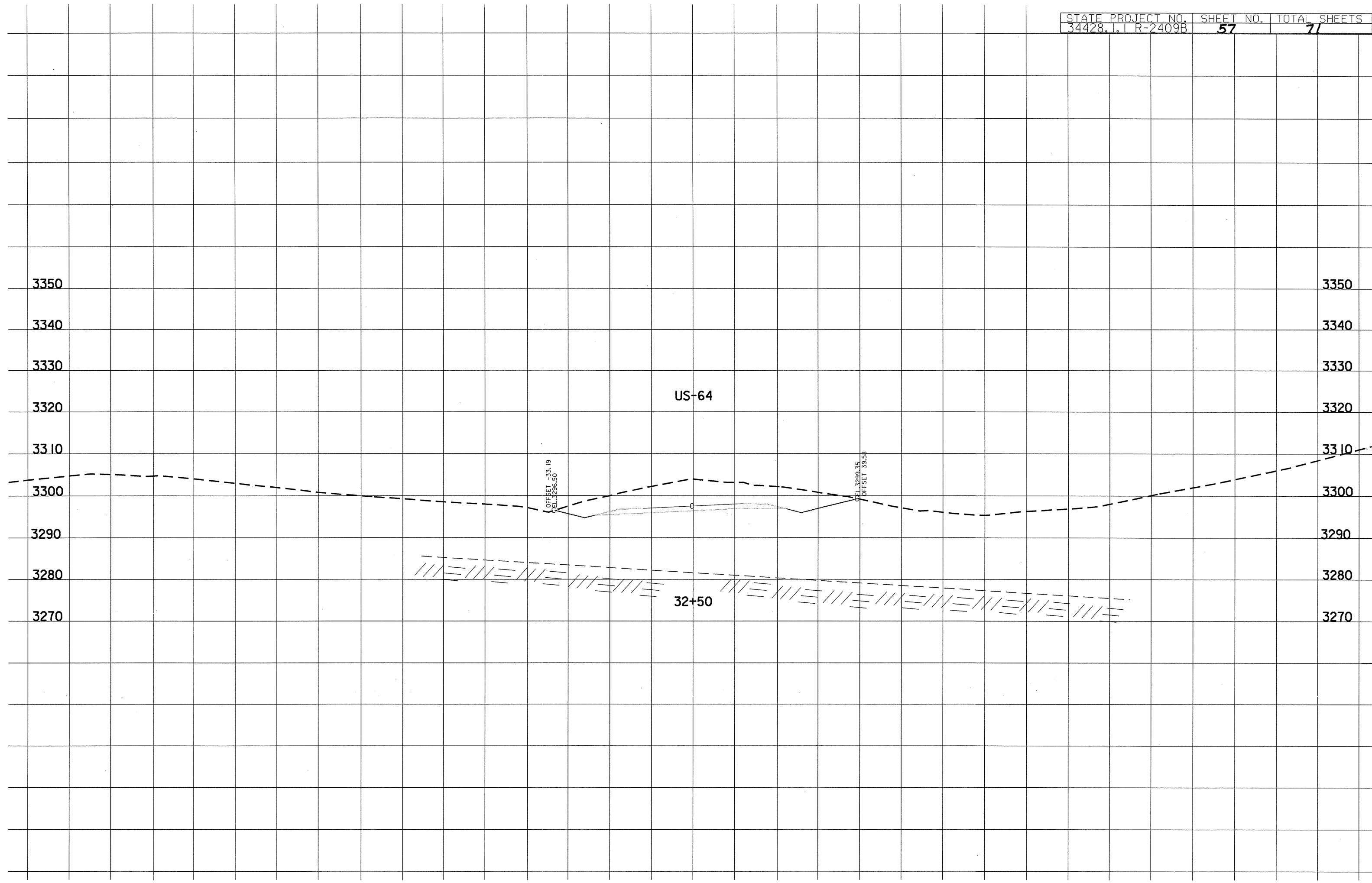
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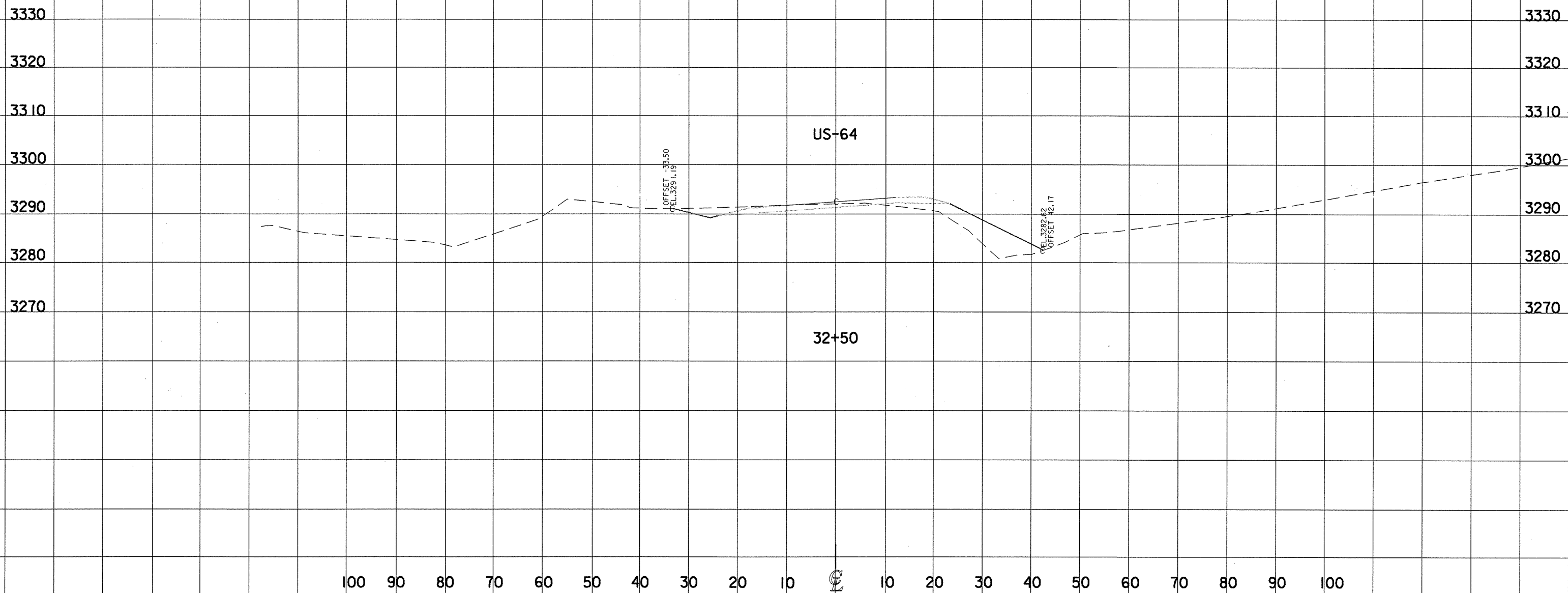


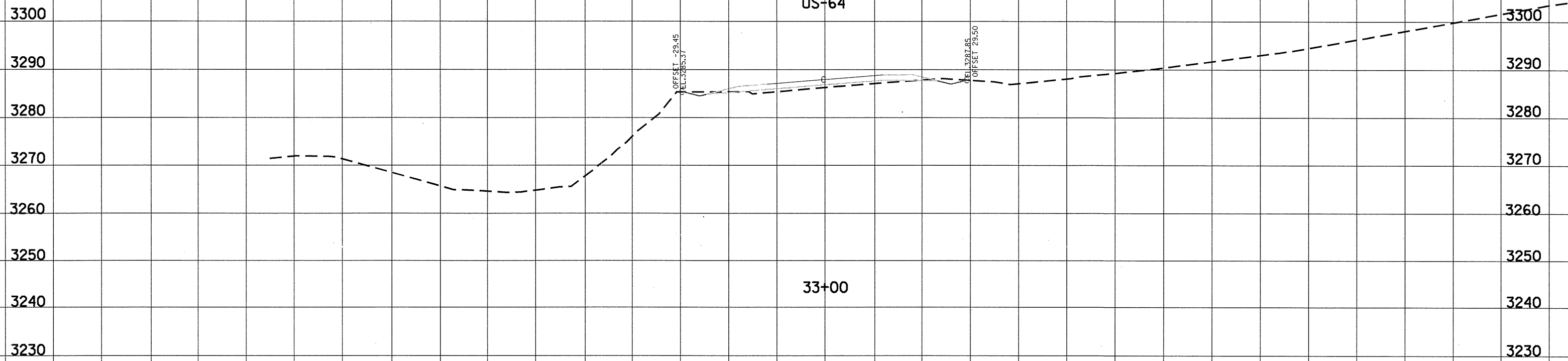












100 90 80 70 60 50 40 30 20 10 33+00 10 20 30 40 50 60 70 80 90 100

DATE 4/22/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 1 GEOLOGIST: C A Dunnagan

DESCRIPTION: US 64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3499.6 FT. TOTAL DEPTH: 60.4 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE (MIN./FT.)	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3498.7	0.9			1.9	1.2		Colluvial Boulder 3.0'
			4.3	44	28		
3494.4	5.2						White to light grey quartz diorite. Severely to moderately severely weathered. Massive to weakly foliated. Soft to medium hard.
3494.4	5.2		5.2	0.5	0.0		
				10	0		
3489.2	10.4						a) Abundant parts along foliation(?) @ 25°.
3489.2	10.4		5.0	1.6	0.0		
				32	0		
3484.2	15.4						17.9'
3484.2	15.4		5.0	3.5	2.5		
				70	50		
3479.2	20.4						White to light grey quartz diorite. Slightly weathered to fresh with very severely weathered zone from 23.2' to 24.5'. Hard to very hard. Massive to weakly foliated.
3479.2	20.4		5.0	4.6	3.5		
				92	70		
3474.2	25.4						
3474.2	25.4		4.8	4.7	4.7		
				98	98		
3469.4	30.2						

CORING TERMINATED AT ELEVATION 3439.2 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

DATE 4/22/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 1 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3499.6 FT. TOTAL DEPTH: 60.4 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE (MIN./FT.)	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3469.4	30.2			4.8	4.8		
			4.8	100	100		
3464.6	35.0						
3464.6	35.0		5.3	5.3	100		
				100	100		
3459.3	40.3						Light grey to grey quartz diorite. Massive to weakly foliated. Very hard. Fresh.
3459.3	40.3		5.2	5.1	5.1		
				98	98		
3454.1	45.5						
3454.1	45.5		5.3	5.0	5.0		
				94	94		
3448.8	50.8						
3448.8	50.8		4.8	4.8	4.8		
				100	100		
3444.0	55.6						
3444.0	55.6		4.8	4.8	4.8		
				100	100		
3439.2	60.4						

CORING TERMINATED AT ELEVATION 3439.2 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

# CORE BORING REPORT

DATE 4/25/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 2 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3491.8 FT. TOTAL DEPTH: 57.3 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3490.7	1.1		3.7	3.1	2.2		Tan and white quartz diorite and diorite. Soft to moderately hard. Massive to weakly foliated. Moderately weathered with completely weathered zones at 17.1' to 19.4' and 20.6' to 22.3'.  a) Abundant joints @ 45°. b) Abundant joints @ 10°. c) Occasional joints @ 75°.
				84	59		
3487.0	4.8		5.0	4.8	3.3		
3487.0	4.8			96	66		
3482.0	9.8		5.0	0.7	0.0		
3482.0	9.8			14	0		
3477.0	14.8		5.0	3.6	2.0		
3477.0	14.8			72	40		
3472.0	19.8		5.0	3.3	0.8		
3472.0	19.8			66	16		
3467.0	24.8		4.8	4.7	4.7		
3467.0	24.8			98	98		
3462.2	29.6						

CORING TERMINATED AT  
ELEVATION 3434.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

# CORE BORING REPORT

DATE 4/25/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 2 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3491.8 FT. TOTAL DEPTH: 57.3 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3462.2	29.6		4.9	4.9	4.9		Completely weathered (and missing) zone from 36.5' to 38.5'.
				100	100		
3457.3	34.5						
3457.3	34.5		5.3	3.3	3.1		
				62	58		
3452.0	39.8		4.8	4.8	4.8		
3452.0	39.8			100	100		
3447.2	44.6		5.2	5.1	5.1		
3447.2	44.6			98	98		
3442.0	49.8		4.8	4.8	4.8		
3442.0	49.8			100	100		
3437.2	54.6		2.7	2.5	2.5		
3437.2	54.6			93	93		
3434.5	57.3						

CORING TERMINATED AT  
ELEVATION 3434.5 FT.

DRILLER: D. W. DRILLER CORE SIZE: NWD-4 EQUIPMENT: CME-45B

### CORE BORING REPORT

DATE 4/25/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: CH-2 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3491.8 FT. TOTAL DEPTH: 57.3 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3437.2	54.6			2.5	2.5		
			2.7	93	93		
3434.5	57.3						

CORING TERMINATED AT  
ELEVATION 3434.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-551 CME-45c



DATE 4/26/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 3 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3471.7 FT. TOTAL DEPTH: 79.9 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3461.7	10.0		4.8	3.9	1.7		Light to medium grey diorite with interlayers of quartz diorite. Soft to medium hard. Moderately sever to moderately weathered. Massive to weakly foliated.
				81	35		
3456.9	14.8						a) Abundant joints @ 0°-10°. b) Occasional joints @ 70°.
3456.9	14.8		5.2	0.9	0.6		
				17	12		24.2'
3451.7	20.0						
3451.7	20.0		5.0	2.3	1.1		
				46	22		Grey diorite with occasional interlayers of quartz diorite. Hard; slightly to very slightly weathered with thin moderately weathered zones from 28.6' to 30.3'.
3446.7	25.0						
3446.7	25.0		5.0	4.2	3.6		
				84	72		a) Occasional parts along foliation @ 30° (Probably machine induced). b) 1 joint @ 75°.
3441.7	30.0						
3441.7	30.0		5.0	4.3	4.1		
				86	82		
3436.7	35.0						
3436.7	35.0		5.0	4.3	4.3		
				86	86		
3431.7	40.0						

CORING TERMINATED AT ELEVATION 3391.8 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

DATE 4/26/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 3 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3471.7 FT. TOTAL DEPTH: 79.9 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3431.7	40.0			4.8	4.8		
			4.9	98	98		
3426.8	44.9			4.6	4.6		
3426.8	44.9		5.1	90	90		
3421.7	50.0			4.7	4.7		a) 2 joints @ 45° (Probably machine induced).
3421.7	50.0		4.9	96	96		
3416.8	54.9			4.7	4.7		
3416.8	54.9		5.0	94	94		
3411.8	59.9			3.4	3.4		
3411.8	59.9		5.1	67	67		
3406.7	65.0			3.8	3.8		
3406.7	65.0		5.0	76	76		
3401.7	70.0						

CORING TERMINATED AT ELEVATION 3391.8 FT.

DRILLER: D. W. DRILLER CORE SIZE: NWD-4 EQUIPMENT: CME-45B

CORE BORING REPORT							DATE <u>4/26/2004</u>
PROJECT: <u>34428.1.1</u> I. D. NO: <u>R-2409B</u> BORING NO: <u>3</u> GEOLOGIST: <u>C A Dunnagan</u>							
DESCRIPTION: <u>US-64 East of Cashiers</u>							
COUNTY: <u>Jackson</u> COLLAR ELEVATION: <u>3471.7</u> FT. TOTAL DEPTH: <u>79.9</u> FT.							
ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3471.7	0.0		5.0	4.3	4.3		
				86	86		
3466.7	5.0						
3466.7	5.0		4.9	4.9			
				100	100		
3461.8	9.9						
CORING TERMINATED AT ELEVATION 3391.8 FT.							
DRILLER: <u>M Brown</u> CORE SIZE: <u>NXWL</u> EQUIPMENT: <u>CME-45c</u>							

DATE 4/22/204

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 4 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3483.5 FT. TOTAL DEPTH: 80.0 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3482.6	0.9			1.5	0.0		1.5 Colluvium
			4.1	37	0		
3478.5	5.0						Residual and/or Saprolite
3478.5	5.0		5.0	0.0	0.0	0	
3473.5	10.0						10.0'
3473.5	10.0		5.0	0.7	0.4		Light grey and white quartz diorite. Weakly foliated. Moderately hard and moderately severely weathered.
				14	8		
3468.5	15.0						
3468.5	15.0		5.0	4.4	4.4	88	
3463.5	20.0						Light grey and white quartz diorite. Weakly foliated. Hard; slightly weathered. Moderately weathered zone from 25.0' to 27.0'.
3463.5	20.0		5.0	3.9	3.9	78	
3458.5	25.0						
3458.5	25.0		5.0	2.9	2.4	58	
3453.5	30.0						

CORING TERMINATED AT ELEVATION 3403.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

DATE 0/0/95

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 4 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3483.5 FT. TOTAL DEPTH: 80.0 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3453.5	30.0			4.7	4.6		Moderately weathered zone from 34.7' to 34.8'.
			4.8	98	96		
3448.7	34.8						
3448.7	34.8		4.8	4.8	4.8		
				100	100		
3443.9	39.6						
3443.9	39.6		0.6	0.5	0.5		
				83	83		
3443.3	40.2						
3443.3	40.2		4.8	4.8	4.8		
				100	100		
3438.5	45.0						
3438.5	45.0		4.8	4.8	4.8		
				100	100		
3433.7	49.8						
3433.7	49.8		4.7	4.6	4.6		
				98	98		
3429.0	54.5						

CORING TERMINATED AT ELEVATION 3403.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

### CORE BORING REPORT

DATE 4/22/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 4 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3483.5 FT. TOTAL DEPTH: 80.0 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3429.0	54.5		0.6	0.6	0.6		Moderately weathered zone from 63.3' to 63.5'.
			100	100			
3428.4	55.1		4.8	4.8			
3428.4	55.1		100	100			
3423.6	59.9		4.8	4.8			
3423.6	59.9		100	100			
3418.8	64.7		4.8	4.8			
3418.8	64.7		100	100			
3414.0	69.5		0.5	0.5			
3414.0	69.5		100	100			
3413.5	70.0		3.9	1.6		Moderately weathered zones from 71.0' to 71.3' and 72.5' to 73.3'.	
3413.5	70.0		5.0	78	32		
3408.5	75.0						

CORING TERMINATED AT  
ELEVATION 3403.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

### CORE BORING REPORT

DATE 4/22/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 4 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3483.5 FT. TOTAL DEPTH: 80.0 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3408.5	75.0		5.0	3.9	3.9		CORING TERMINATED AT ELEVATION 3403.5 FT.
				78	78		
3403.5	80.0						

CORING TERMINATED AT  
ELEVATION 3403.5 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

DATE 4/27/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 5 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3490.9 FT. TOTAL DEPTH: 76.7 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3486.2	4.7		5.0	3.2	2.7		White to light grey, moderately weathered quartz diorite. Weakly foliated. Medium to moderately hard. a) Occasional joints @ 0°-10°.
				64	54		
3481.2	9.7		5.0	4.6	4.5		
3481.2	9.7			92	90		
3476.2	14.7		5.0	4.7	4.4		
3476.2	14.7			94	88		
3471.2	19.7		5.0	0.9	0.9		
3471.2	19.7			18	18		
3466.2	24.7		5.0	2.4	1.2		
3466.2	24.7			48	24		
3461.2	29.7		5.0	4.8	4.7		
3461.2	29.7			96	94		
3456.2	34.7						30.7'

CORING TERMINATED AT ELEVATION 3414.2 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

DATE 4/27/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 5 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3490.9 FT. TOTAL DEPTH: 76.7 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3456.2	34.7		5.0	4.7	4.4		Very slightly weathered diorite and quartz diorite. Hard. Very weakly foliated to massive. a) Occasional joints @ 45°. b) Occasional joints @ 0°-10°. c) Rare partings along foliation @ 70°.
				94	88		
3451.2	39.7		4.8	4.8	4.5		
3451.2	39.7			100	94		
3446.4	44.5		4.8	4.6	4.6		
3446.4	44.5			96	96		
3441.6	49.3		4.8	4.7	4.7		
3441.6	49.3			98	98		
3436.8	54.1		0.5	0.4	0.4		
3436.8	54.1			80	80		
3436.3	54.6		5.0	4.9	4.9		
3436.3	54.6			98	98		
3431.3	59.6						Fine grained quartzite from 56.6' to 58.1'.

CORING TERMINATED AT ELEVATION 3414.2 FT.

DRILLER: M Brown CORE SIZE: NXWL EQUIPMENT: CME-45c

CORE BORING REPORT							DATE <u>4/27/2004</u>
PROJECT: <u>34428.1.1</u>		I. D. NO: <u>R-2409B</u>		BORING NO: <u>5</u>		GEOLOGIST: <u>C A Dunnagan</u>	
DESCRIPTION: <u>US-64 East of Cashiers</u>							
COUNTY: <u>Jackson</u>			COLLAR ELEVATION: <u>3490.9</u> FT.			TOTAL DEPTH: <u>76.7</u> FT.	
ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3431.3	59.6		4.8	4.8 100	4.8 100		Moderately to well foliated.
3426.5	64.4						
3426.5	64.4		5.3	5.3 100	0.0 0		
3421.2	69.7						
3421.2	69.7		4.8	4.8 100	4.8 100		
3416.4	74.5						
3416.4	74.5		2.2	2.2 100	2.2 100		
3414.2	76.7						
CORING TERMINATED AT ELEVATION 3414.2 FT.							
DRILLER: <u>M Brown</u>		CORE SIZE: <u>NXWL</u>		EQUIPMENT: <u>CME-45c</u>			

DATE 5/10/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409V BORING NO: 6 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3477.3 FT. TOTAL DEPTH: 80.2 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3471.9	5.4		5.0	0.3 6	0.0 0		
3466.9	10.4						
3466.9	10.4		5.0	1.3 26	0.4 8		White quartz-diotite. Moderate severely weathered. Medium to moderately hard. Massive. a) Joint @ 85°. b) Abundant joints @ 10°.
3461.9	15.4						
3461.9	15.4		5.0	0.5 10	0.0 0		
3456.9	20.4						20.4
3456.9	20.4		5.0	3.1 62	1.8 36		Light gray diorite. Moderately weathered. Moderately hard. Weakly foliated. a) Abundant joints @10°. b) Occasional joints @ 45°.
3451.9	25.4						
3451.9	25.4		5.0	4.2 84	1.7 34		c) Abundant parts along foliation @ 20° - 45°. d) Joint @ 80°.
3446.9	30.4						
3446.9	30.4		4.9	4.8 98	4.8 98		
3442.0	35.3						

CORING TERMINATED AT ELEVATION 3397.1 FT.

DRILLER: J T Williams CORE SIZE: NXWL EQUIPMENT: CME-550

DATE 5/10/2004

## CORE BORING REPORT

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 6 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3477.3 FT. TOTAL DEPTH: 80.2 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3442.0	35.3			4.7 98	4.7 98	RS-00	
3437.2	40.1						
3437.2	40.1		4.8	4.8 100	4.8 100		
3432.4	44.9						
3432.4	44.9		5.4	5.3 98	5.3 98		Gray diorite with quartz-rich veins. Fresh, hard to very hard. a) Occasional parts along foliation @ 35°. b) Occasional joints @ 10°.
3427.0	50.3						
3427.0	50.3		4.8	4.8 100	4.8 100		
3422.2	55.1						
3422.2	55.1		4.8	4.8 100	4.8 100		
3417.4	59.9						
3417.4	59.9		5.3	5.1 96	5.1 96		
3412.1	65.2						

CORING TERMINATED AT ELEVATION 3397.1 FT.

DRILLER: D. W. DRILLER CORE SIZE: NWD-4 EQUIPMENT: CME-45B

### CORE BORING REPORT

DATE 5/10/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 6 GEOLOGIST: C A Dunnagan

DESCRIPTION: US-64 East of Cashiers

COUNTY: Jackson COLLAR ELEVATION: 3477.3 FT. TOTAL DEPTH: 80.2 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3412.1	65.2		4.8	4.8	4.8		Occasional iron staining from 71.9' to 72.1'.
				100	100		
3407.3	70.0		4.8	4.8	4.8		
3407.3	70.0			100	100		
3402.5	74.8		5.4	5.2	5.2		
3402.5	74.8			96	96		
3397.1	80.2						
CORING TERMINATED AT ELEVATION 3397.1 FT.							
DRILLER: <u>J T Williams</u>		CORE SIZE: <u>NXWL</u>		EQUIPMENT: <u>CME-550</u>			



### CORE BORING REPORT

DATE 5/11/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 7 GEOLOGIST: C A Dunnagan  
 DESCRIPTION: US-64 East of Cashiers  
 COUNTY: Jackson COLLAR ELEVATION: 3377.6 FT. TOTAL DEPTH: 78.2 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3358.2	19.4		4.2	0.0	0.0		Weathered rock.
				0	0		
3354.0	23.6						
3354.0	23.6		5.0	0.0	0.0		
				0	0		
3349.0	28.6						
3349.0	28.6		5.0	4.3	2.9		
				86	58		
3344.0	33.6						White to light grey diorite and quartz diorite. Moderately severely to moderately weathered. Medium to moderately hard. Very weakly foliated with occasional biotite-rich zones.
3344.0	33.6		5.0	4.6	3.2		
				92	64		a) Occasional joints @ 10°. b) Occasional parts along foliation @ 30°.
3339.0	38.6						
3339.0	38.6		5.0	3.2	1.7		
				64	34		
3334.0	43.6						Severely weathered zone from 42.0' to 47.2'.
3334.0	43.6		5.0	3.8	1.3		
				76	26		
3329.0	48.6						

CORING TERMINATED AT ELEVATION 3299.4 FT.

DRILLER: J T Williams CORE SIZE: NXWL EQUIPMENT: CME-550

### CORE BORING REPORT

DATE 5/11/2004

PROJECT: 34428.1.1 I. D. NO: R-2409B BORING NO: 7 GEOLOGIST: C A Dunnagan  
 DESCRIPTION: US-64 East of Cashiers  
 COUNTY: Jackson COLLAR ELEVATION: 3377.6 FT. TOTAL DEPTH: 78.2 FT.

ELEV. (FEET)	DEPTH (FEET)	DRILL RATE MIN./FT.	RUN (FEET)	REC. FEET %	RQD. FEET %	SAMP. #	FIELD CLASSIFICATION AND REMARKS
3329.0	48.6		5.0	2.4	0.8		
				48	16		
3324.0	53.6						Completely weathered zone from 53.7' to 54.1'.
3324.0	53.6		5.0	4.7	4.2		
				94	84		54.1
3319.0	58.6						
3319.0	58.6		4.8	4.8	4.5		White to light grey diorite with muscovite. Hard. Slightly weathered . Massive to very weakly foliated.
				100	94		
3314.2	63.4						a) Occasional joints @ 45°. b) Occasional joints @ 75°.
3314.2	63.4		5.2	4.7	4.5		
				90	87		Severely weathered zone from 67.9' to 68.9'
3309.0	68.6						
3309.0	68.6		4.8	4.5	4.4		
				94	92		
3304.2	73.4						
3304.2	73.4		4.8	4.8	4.8		
				100	100		
3299.4	78.2						

CORING TERMINATED AT ELEVATION 3299.4 FT.

DRILLER: D. W. DRILLER CORE SIZE: NWD-4 EQUIPMENT: CME-45B