

# UPPER NORTH RIVER WATERSHED OF THE POTOMAC RIVER WATERSHED PROJECT

## FLOODWATER RETARDING DAM NO. 77

AUGUSTA AND ROCKINGHAM COUNTIES, VIRGINIA

DRAINAGE AREA	10,246	ACRES
FLOOD STORAGE TO EMERGENCY SPILLWAY CREST	2768	ACRE FEET
WATER SURFACE AREA TO NORMAL POOL LEVEL	14	ACRES
HEIGHT OF DAM	102.5	FEET
VOLUME OF FILL	525,484	CUBIC YARDS

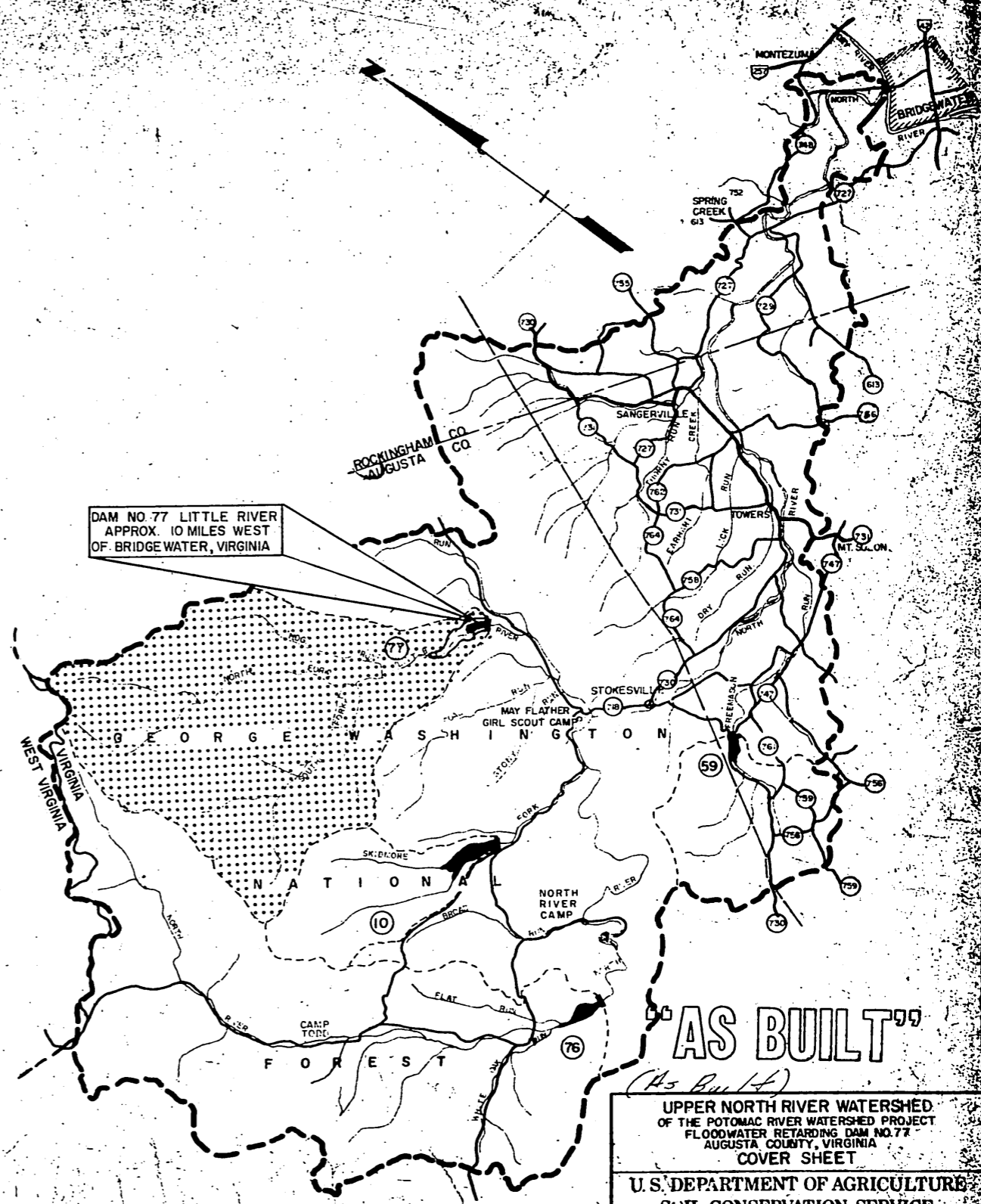
SOIL CONSERVATION SERVICE  
OF THE  
U. S. DEPARTMENT OF AGRICULTURE  
COOPERATING WITH  
SHENANDOAH VALLEY SOIL CONSERVATION DISTRICT

1964

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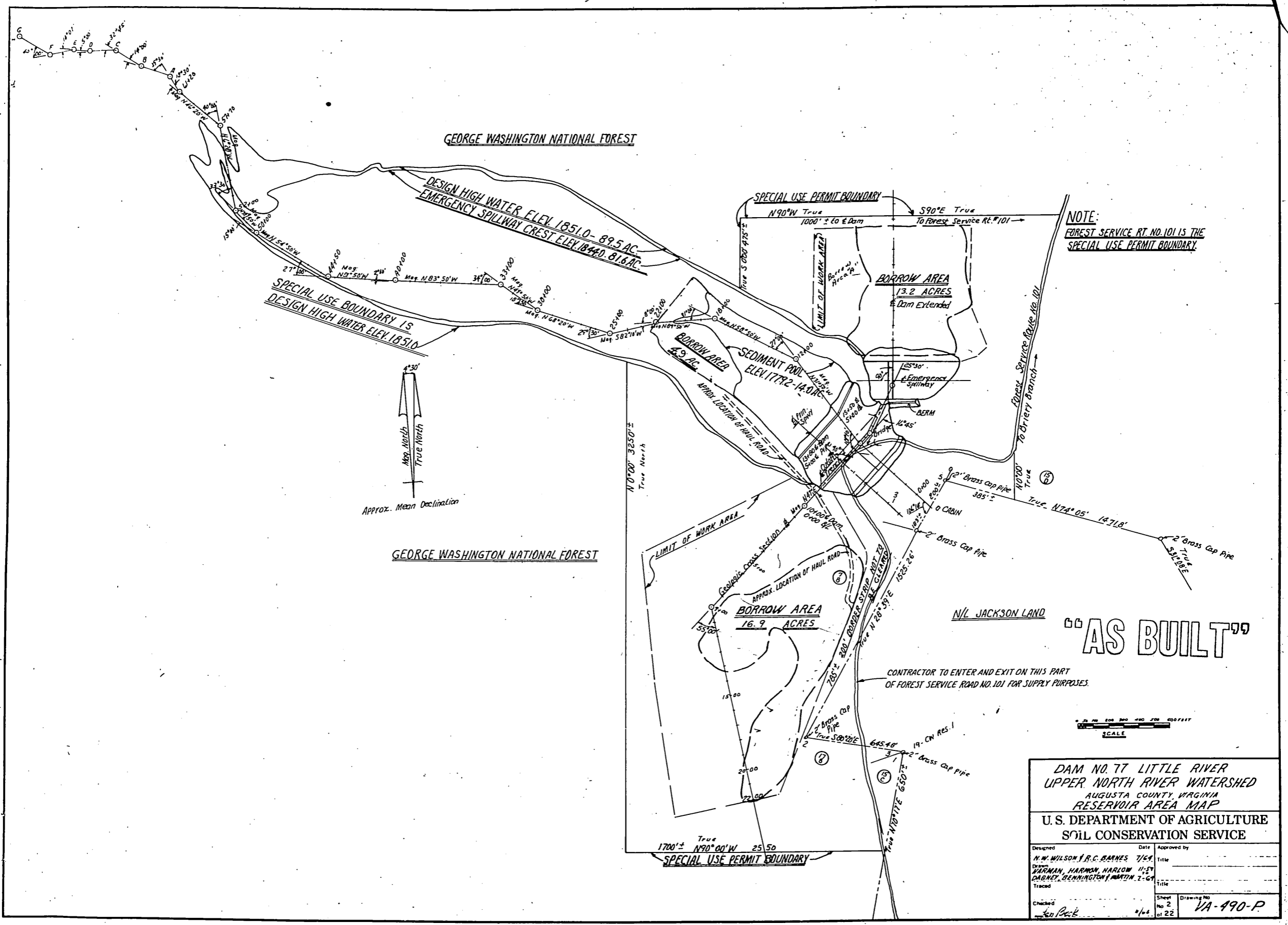
**"AS BUILT"**

UPPER NORTH RIVER WATERSHED  
OF THE POTOMAC RIVER WATERSHED PROJECT  
FLOODWATER RETARDING DAM NO. 77  
AUGUSTA COUNTY, VIRGINIA  
COVER SHEET

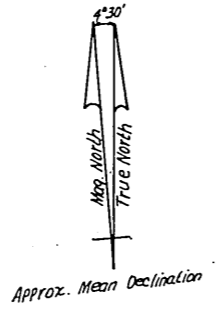
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed N. W. WILSON	Date 6-64	Approved by <i>[Signature]</i>
Drawn W. E. HARMON	Date 6-64	Checked by HEAD E. D. WILSON
Typed W. E. HARMON	Date 6-64	Checked by STATE CONSERVATION

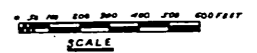
VA-49



**NOTE:**  
 FOREST SERVICE RT. NO. 101 IS THE  
 SPECIAL USE PERMIT BOUNDARY.

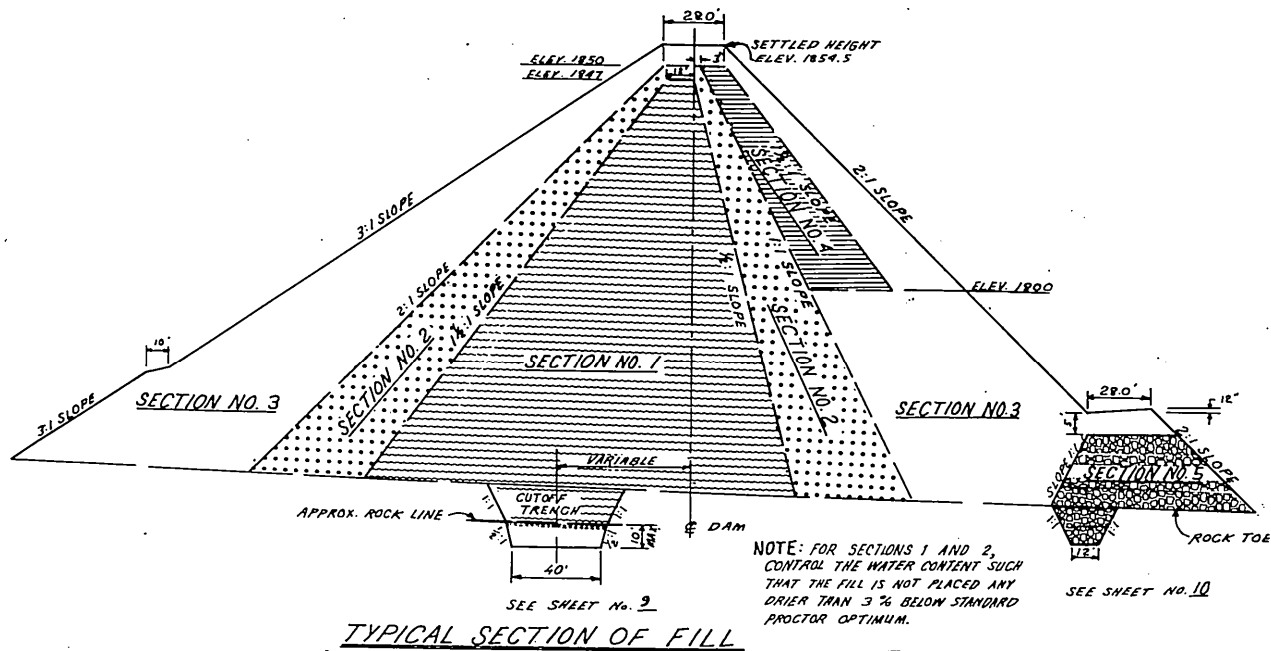


**"AS BUILT"**



DAM NO. 77 LITTLE RIVER  
 UPPER NORTH RIVER WATERSHED  
 AUGUSTA COUNTY, VIRGINIA  
 RESERVOIR AREA MAP  
 U. S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

Designed N.W. WILSON / R.C. BARNES 7/64	Date	Approved by
Drawn HARMAN, HARMON, HARLOW 11-57	Title	
Traced DARNLEY, DENNINGTON / MARTIN 2-67	Title	
Checked Jen Beck	Sheet No. 2 of 22	Drawing No. VA-490-P



**SECTION NO. 1 (CORE)**

COMPACTED FILL CLASS B-1 (See Spec. 5 "Earth Fill")

Silts and clays (ML, CL) represented by the following logs:

TP 250	from	0.4'	to	4.0'
TP 253	"	0.4'	"	7.6'
TP 255	"	0.4'	"	3.2'
TP 280	"	1.3'	"	9.1'
DH 205	"	4.2'	"	19.0'
DH 210	"	1.8'	"	5.0'

TP 131	"	0.4'	"	4.3'
TP 136	"	0.4'	"	6.1'
TP 154	"	0.4'	"	5.5'
TP 157	"	0.4'	"	4.9'
TP 160	"	0.4'	"	2.9'
TP 166	"	0.4'	"	4.0'

TP 184	"	0.4'	"	3.4'
TP 185	"	0.4'	"	5.7'
** TP 177	"	2.4'	"	12.2'

\* Use these materials in the cut off trench.  
 \*\* Use this material in the upper portion of section over the abutments. See sheet 9.

**SECTION NO. 2 (TRANSITION)**

COMPACTED FILL CLASS B-1 (See Spec. 5 "Earth Fill")

Clayey sands and silty sand (SC, SH, SC-SH) represented by the following logs:

TP 120	from	5.5'	to	10.0'
TP 124	"	2.8'	"	4.8'
TP 131	"	4.3'	"	7.2'
TP 132	"	4.3'	"	6.3'
TP 140	"	0.8'	"	7.5'
TP 142	"	2.4'	"	5.0'
TP 148	"	0.4'	"	13.0'
TP 128	"	0.4'	"	6.0'
TP 129	"	0.4'	"	4.0'

**SECTION NO. 3 (SHELL)**

COMPACTED FILL CLASS C (See Spec. 5A "Earth Fill")

Poorly graded gravels and silty gravels (GP, GM) represented by the following logs:

DH 209	from	19.0'	to	23.5'
DH 210	"	5'	"	11.5'
TP 256	"	0.4'	"	5.8'
TP 252	"	3.5'	"	7.5'
TP 101	"	0.8'	"	10.5'
TP 111	"	0.4'	"	10.5'
TP 112	"	0.4'	"	11.5'
TP 115	"	0.2'	"	7.5'
TP 102	"	1.0'	"	10.6'

**SECTION NO. 4**

COMPACTED FILL CLASS C (See Spec. 5-A "Earth Fill")

Siltstone and shale (Si, Sh.) represented by the following logs:

TP 250	from	4.0'	to	7.3'
TP 252	"	7.5'	"	9.6'
TP 132	"	4.3'	"	6.3'
TP 131	"	4.3'	"	7.2'
TP 159	"	2.6'	"	4.8'
TP 168	"	3.0'	"	4.5'

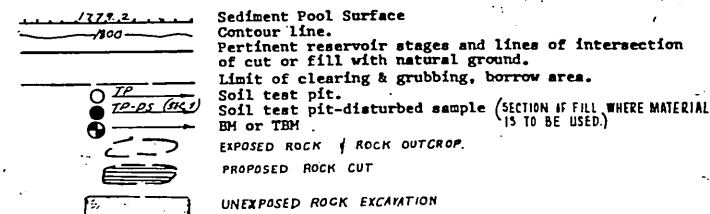
**SECTION NO. 5 ROCK FILL**

Use rock excavated from bottom of cutoff trench, abutment slopes and bottom of emergency spillway. Rock may range from 4" to 24" with enough spalls and rock chips to fill the voids.

**GENERAL NOTES**

1. Areas under dam, emergency spillway and borrow areas to be cleared and grubbed.
2. Sufficient selected borrow will be stockpiled and placed at a minimum depth of 4 inches on the emergency spillway side slopes and berm as directed by the engineer. This will be paid for as salvaging and placing topsoil.
3. All compacted fill shall be class B-1 or class C as indicated on sheet 3 or as directed by the engineer.
4. Bottom of emergency spillway to be excavated 1 foot below finished grade and backfilled with compacted select borrow material obtained as directed by the engineer.
5. No excavation for borrow material to be made within 50 feet of the toe of the dam.
6. Intersection of the face of the dam with the abutments to be shaped as directed by the engineer. Payment will be based upon the cubic yards of material used.
7. See sheets 12, 13, 14, 15, & 16 for description of test holes.
8. Clearing limits shall be:
  - (1) 15 feet (horizontal) beyond the sediment pool elevation if the slopes are equal or less than 1 foot vertical to 15 feet horizontal.
  - (2) 1 foot (vertical) above the sediment pool elevation if the slopes are steeper than 1 foot vertical to 15 feet horizontal.
9. There are approximately 45.3 acres of seedbed preparation, liming, fertilizing and mulching. This includes the borrow areas above the sediment pool, emergency spillway bottom and side slopes, top of berm and side slopes and any other disturbed areas as directed by the engineer. This is not a part of the contract.
10. All organic material, loose soil and boulders, shall be removed from under the fill areas as directed by the engineer.
11. Any overhanging or loose talus material shall be removed from under the fill areas as directed by the engineer.
12. All steep slopes and steep rock faces shall be cut back to a 1:1 slope as directed by the engineer.
13. The embankment side slopes shown are settled slopes. Side slopes will be constructed to provide for settlement as directed by the engineer.
14. Concrete slab bridge is to be removed. Payment is to be made as structure removal, Spec. 3-64. Concrete from bridge to be placed in rock toe. Steel and pipe to be disposed of as required by Use Permit.
15. All excavation, both common and rock, shall be paid to the neat lines and grades as shown on the drawings or as directed by the engineer.

**LEGENDS**

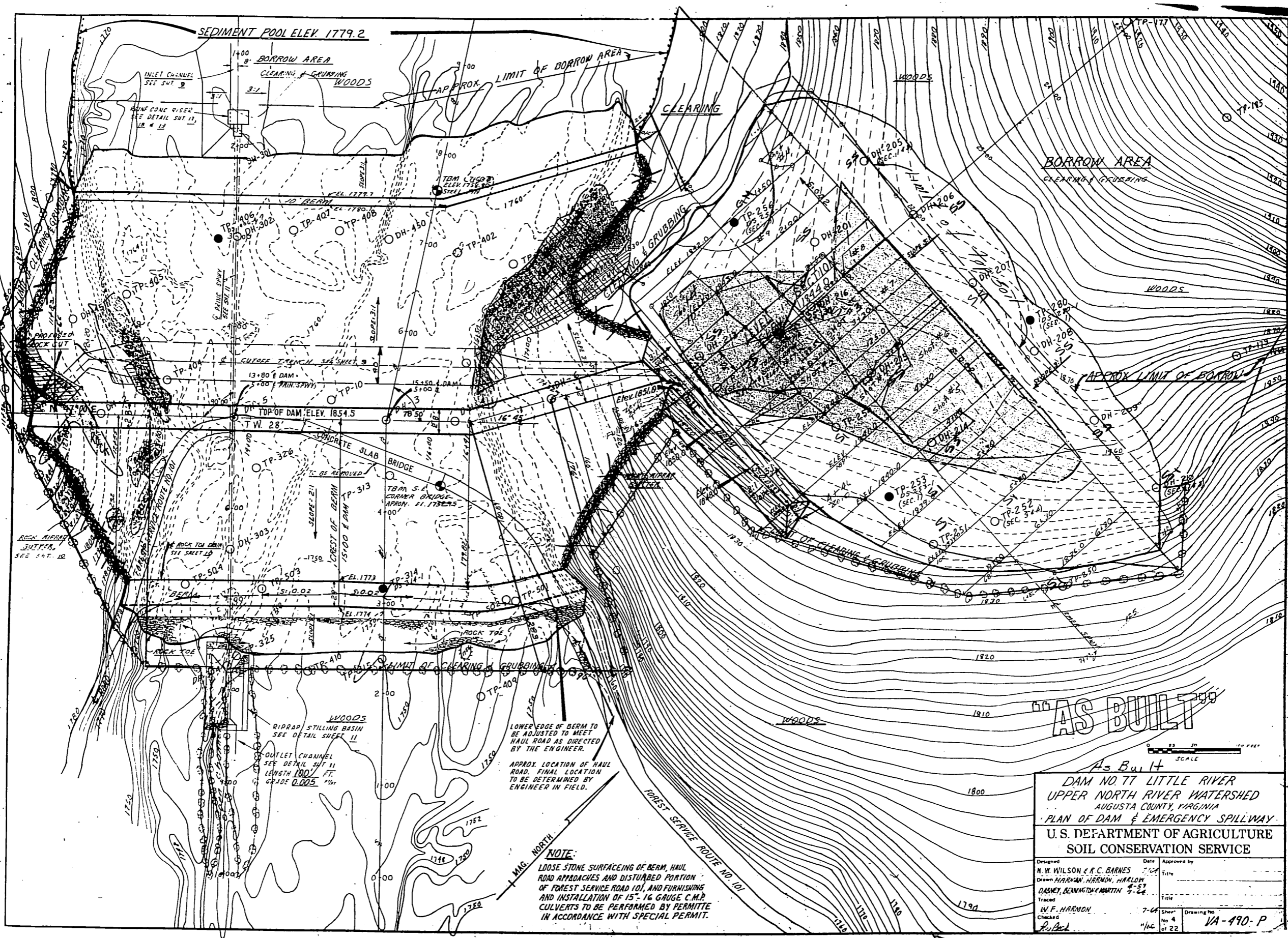


**"AS BUILT"**

**DAM NO. 77. LITTLE RIVER  
 UPPER NORTH RIVER WATERSHED  
 AUGUSTA COUNTY, VIRGINIA  
 TYPICAL SECTION OF FILL**

**U.S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE**

Designed N.W. WILSON	Date 7/64	Approved by R.C. BARNES	Title
Drawn W.F. HARMON	Date 7-64	Title	
Checked S.C. Ross	Sheet No 3 of 22	Drawing No VA-490-P	



**AS BUILT**

SCALE

As Built

**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
PLAN OF DAM & EMERGENCY SPILLWAY  
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

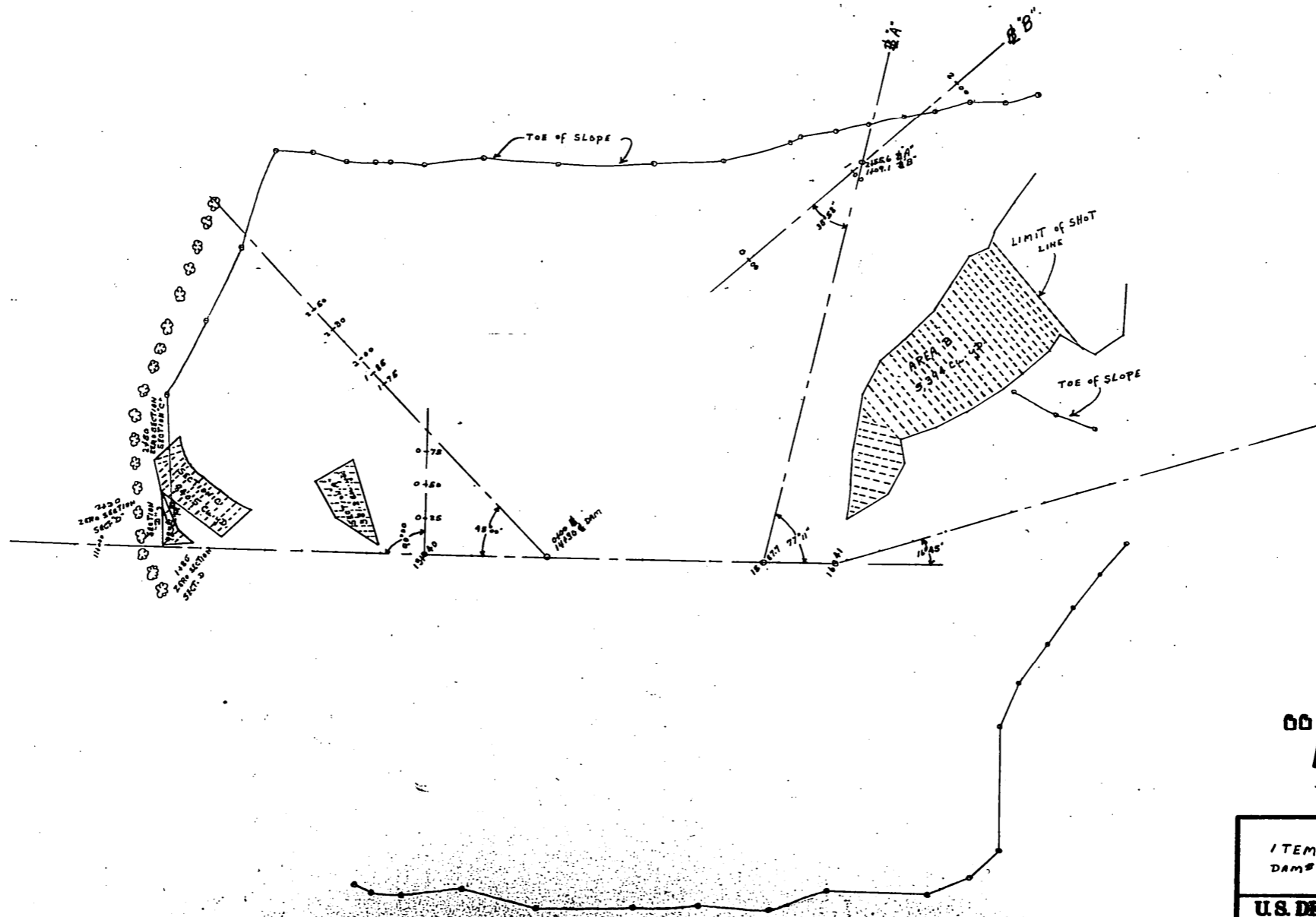
Designed N. W. WILSON & R. C. BARNES	Date 7/64	Approved by Title
Drawn HARVEY HARMON, HARLOW DANEY, BEAUMONT & MARTIN 4-57	Traced	Title
Checked W. F. HARMON	7-64 No 4 of 22	Drawing No VA-490-P

**NOTE:**  
LOOSE STONE SURFACING OF BERM, HAUL ROAD APPROACHES AND DISTURBED PORTION OF FOREST SERVICE ROAD 101, AND FURNISHING AND INSTALLATION OF 15" x 16" GAUGE C.M.P. CULVERTS TO BE PERFORMED BY PERMITTEE IN ACCORDANCE WITH SPECIAL PERMIT.

LOWER EDGE OF BERM TO BE ADJUSTED TO MEET HAUL ROAD AS DIRECTED BY THE ENGINEER.

APPROX. LOCATION OF HAUL ROAD. FINAL LOCATION TO BE DETERMINED BY ENGINEER IN FIELD.

MAG. NORTH

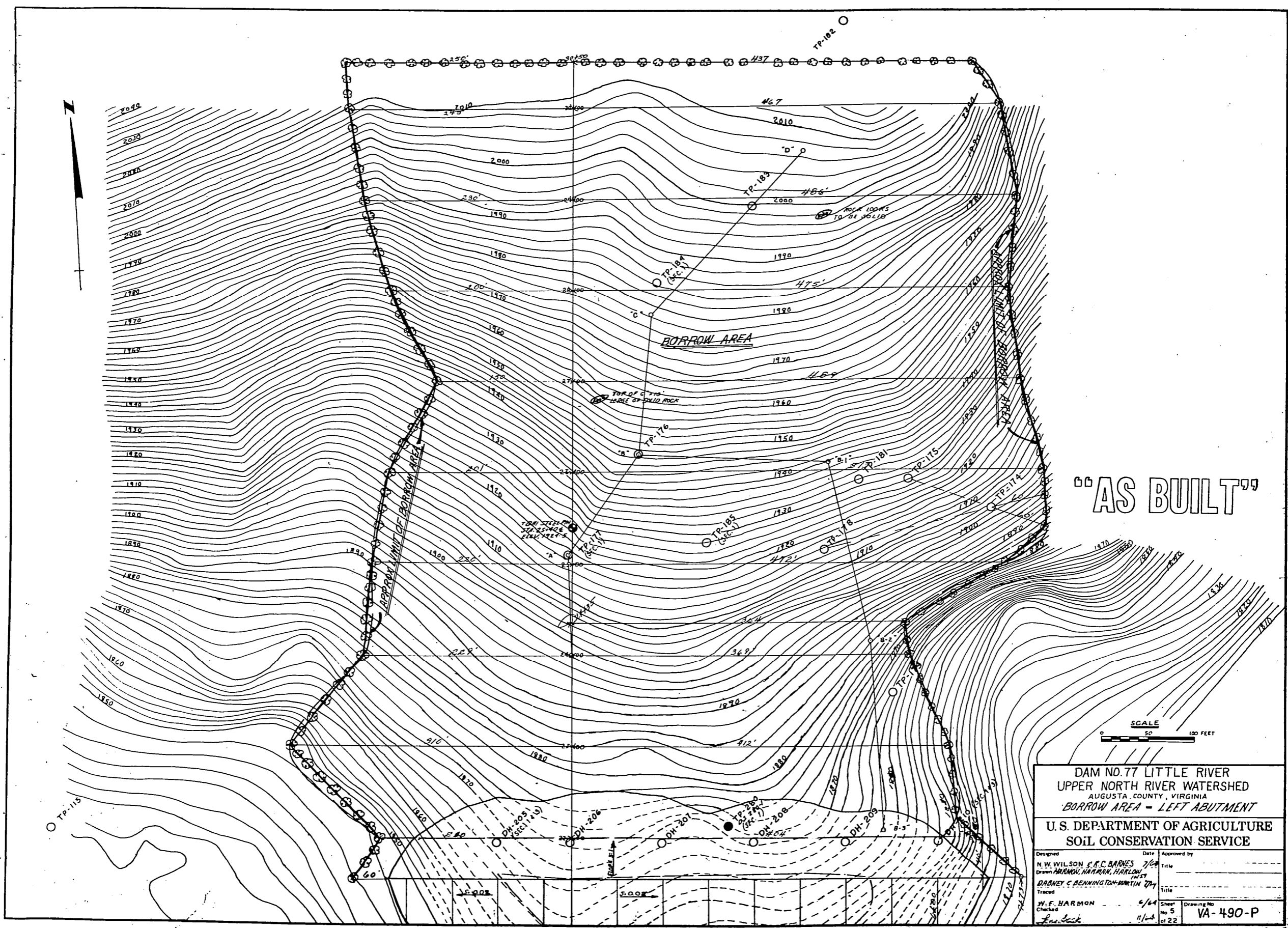


**"AS BUILT"**

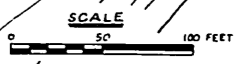
ITEM #20 PRE-SPLITTING PLAN  
DAM #77 NORTH RIVER

U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

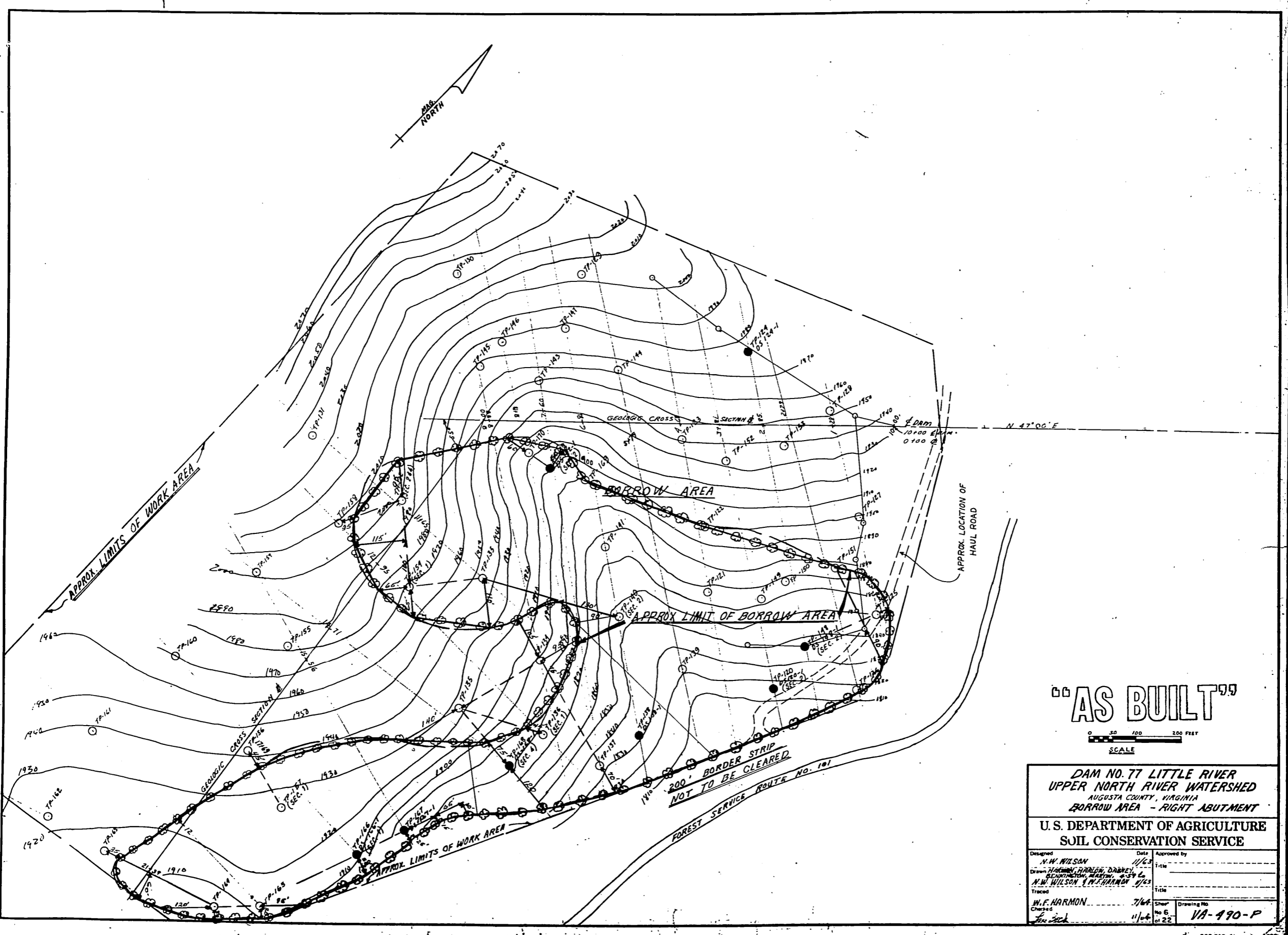
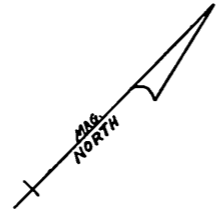
Designed by	Date	Reviewed by
W. J. HARLOW	4/66	



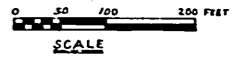
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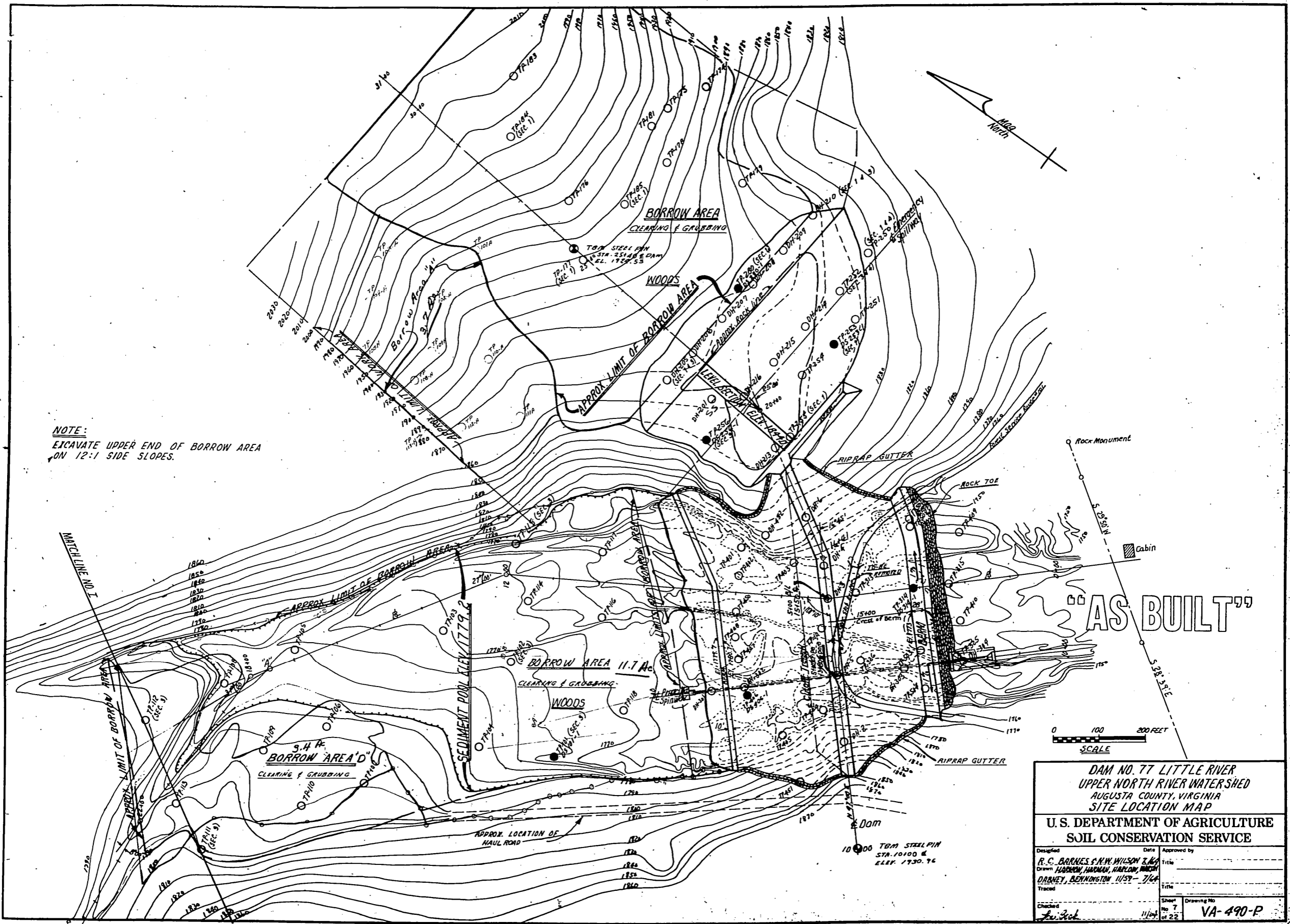
<p align="center"><b>DAM NO. 77 LITTLE RIVER</b>  <b>UPPER NORTH RIVER WATERSHED</b>          AUGUSTA COUNTY, VIRGINIA  <b>BORROW AREA - LEFT ABUTMENT</b></p>			
<p align="center"><b>U. S. DEPARTMENT OF AGRICULTURE</b>  <b>SOIL CONSERVATION SERVICE</b></p>			
Designed by <b>N. W. WILSON &amp; C. C. BARNES</b>	Date <b>7/29</b>	Approved by _____	
Drawn by <b>HAROLD, HARTMAN, HARLOW</b>	Checked by <b>DABNEY C. BENNINGTON-MARTIN</b>	Title _____	
Traced by <b>W. F. HARMON</b>	Checked by <b>W. F. HARMON</b>	Sheet No. <b>5</b>	Drawing No. <b>VA-490-P</b>
<p>10.000'      5.000'</p>		<p>11/28</p>	



**"AS BUILT"**



<b>DAM NO. 77 LITTLE RIVER UPPER NORTH RIVER WATERSHED AUGUSTA COUNTY, VIRGINIA BORROW AREA - RIGHT ABUTMENT</b>			
<b>U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE</b>			
Designed <b>N. W. WILSON</b>	Date <b>11/63</b>	Approved by	
Drawn <b>WILSON, HARMON, DRAKE</b>	Checked <b>N. W. WILSON &amp; M. F. HARMON</b>	Title	
Traced	Sheet <b>7/64</b>	Drawing No. <b>VA-490-P</b>	
Checked <b>W. F. HARMON</b>	Scale <b>11/64</b>	No. 6 of 22	



NOTE:  
EXCAVATE UPPER END OF BORROW AREA  
ON 12:1 SIDE SLOPES.

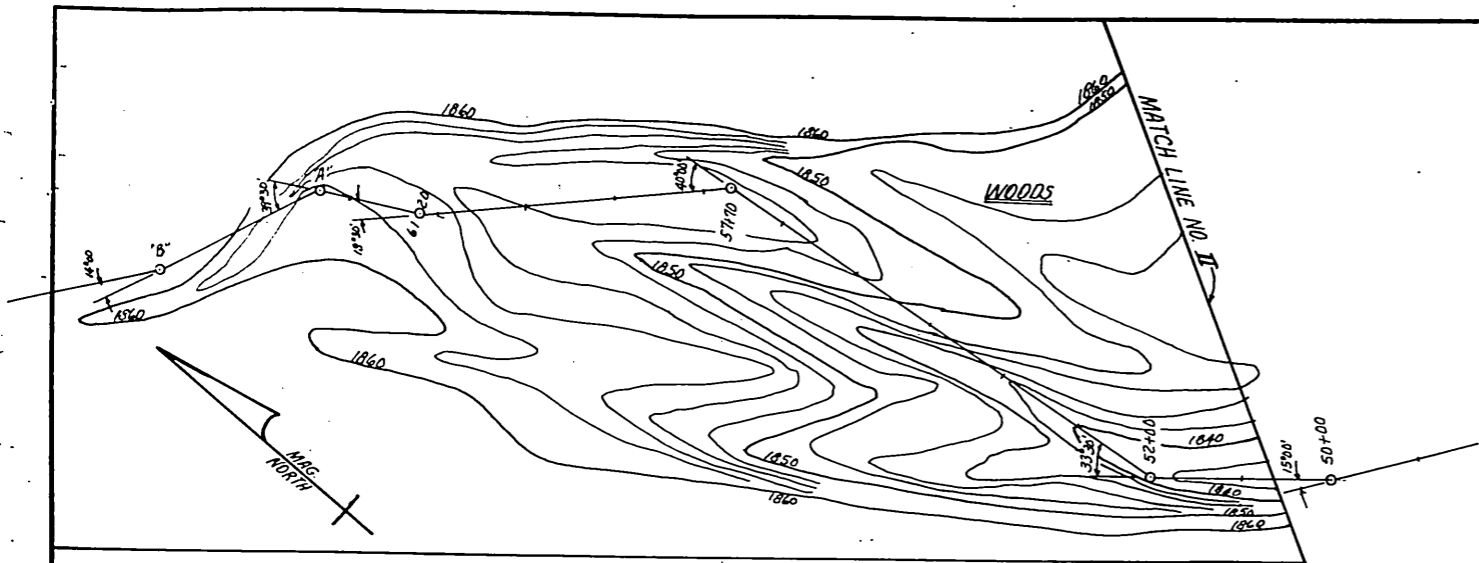
"AS BUILT"

DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
SITE LOCATION MAP

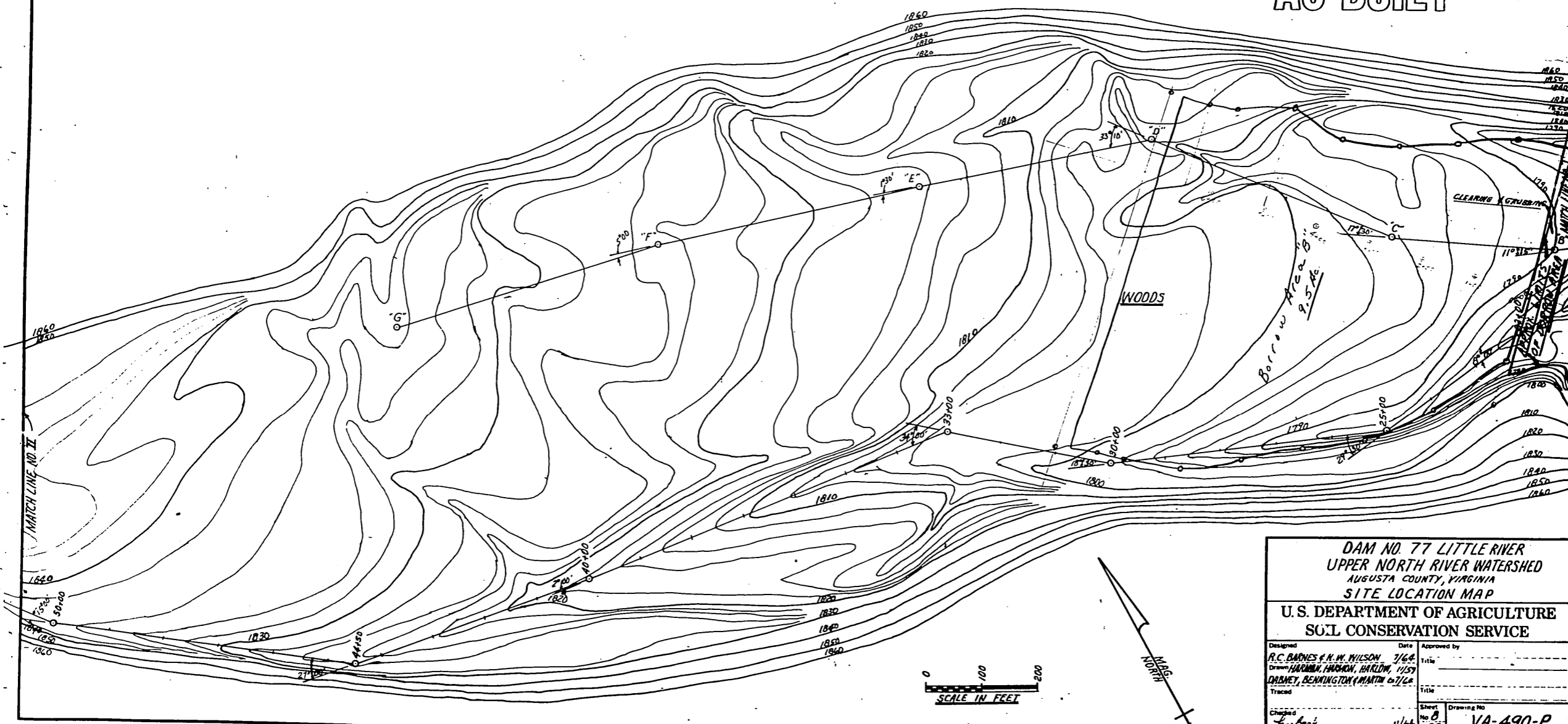
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed	Date	Approved by
R. C. BARNES & H. WILSON & Co.		
Drawn	HARDEN, HARDMAN, HARLOW, HENRY	Title
Traced	DORNEY, BENNINGTON 11/57-7/64	
Checked		Sheet No. 7 of 22
		Drawing No. VA-490-P

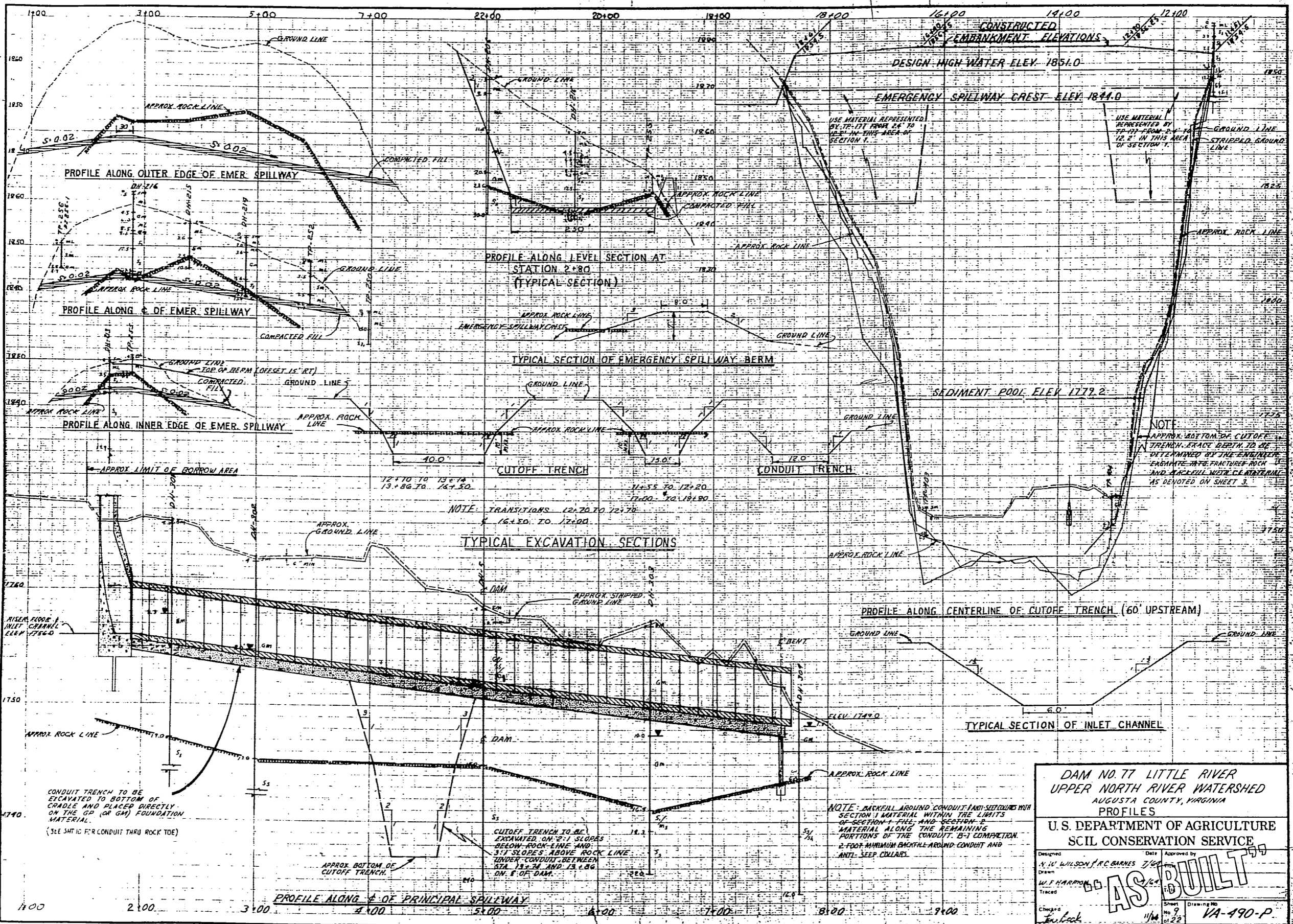




"AS BUILT"



<b>DAM NO. 77 LITTLE RIVER</b> <b>UPPER NORTH RIVER WATERSHED</b> <b>AUGUSTA COUNTY, VIRGINIA</b> <b>SITE LOCATION MAP</b>			
<b>U. S. DEPARTMENT OF AGRICULTURE</b> <b>SOIL CONSERVATION SERVICE</b>			
Designed <b>R. C. BARNES &amp; N. W. WILSON</b>	Date <b>7/64</b>	Approved by	
Drawn <b>HAROLD HARRISON, BARLOW</b>	<b>11/59</b>	Title	
Traced <b>DOBNEY, BENNINGTON &amp; MARTIN</b>	<b>12/64</b>	Title	
Checked <b>L. J. B. B.</b>	<b>11/64</b>	Sheet <b>No. 8</b> of <b>22</b>	Drawing No. <b>VA-490-P</b>



**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
PROFILES**

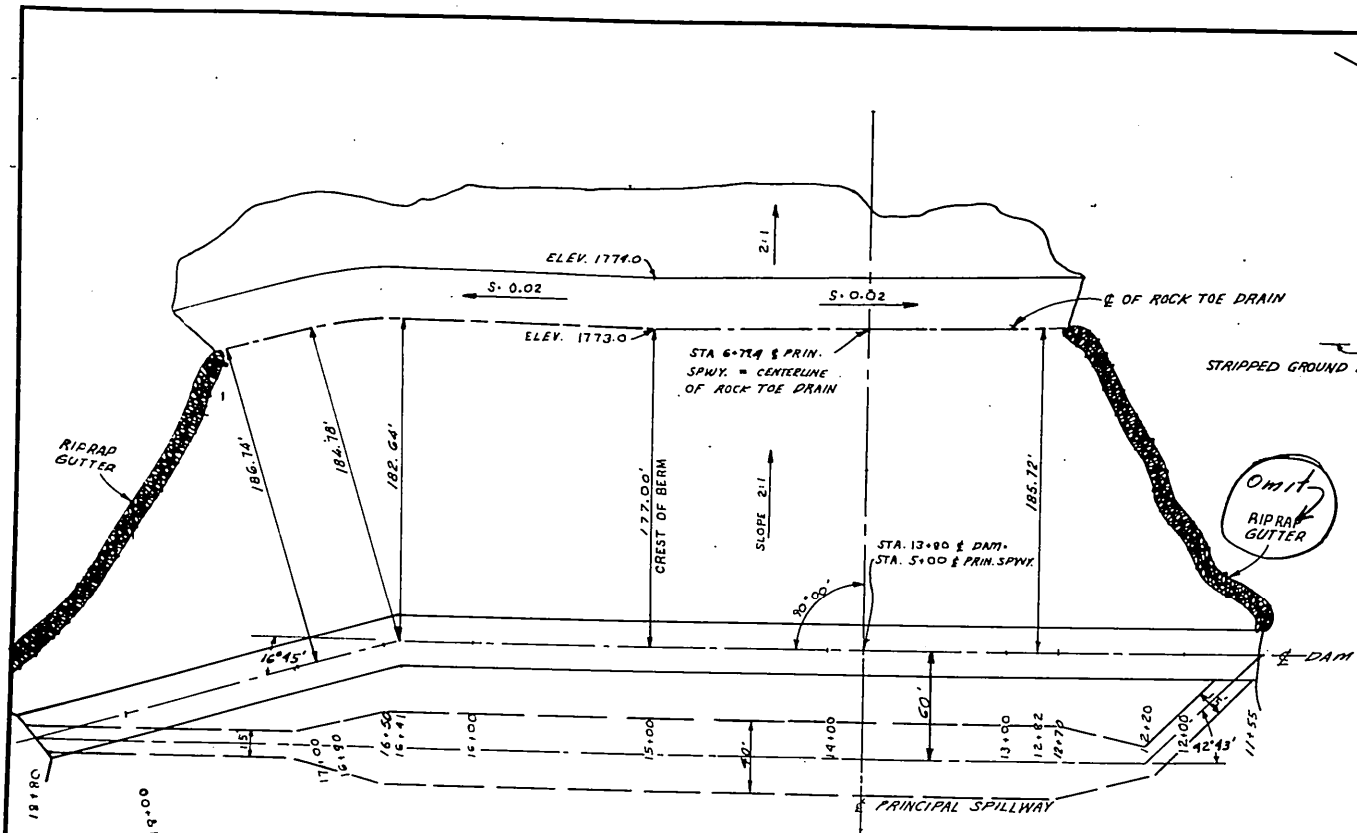
**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed by **N. W. WILSON / R. C. BARNES** 7/64  
 Drawn by **W. F. HARRISON** 1/64  
 Traced by **Paul Cook** 1/64

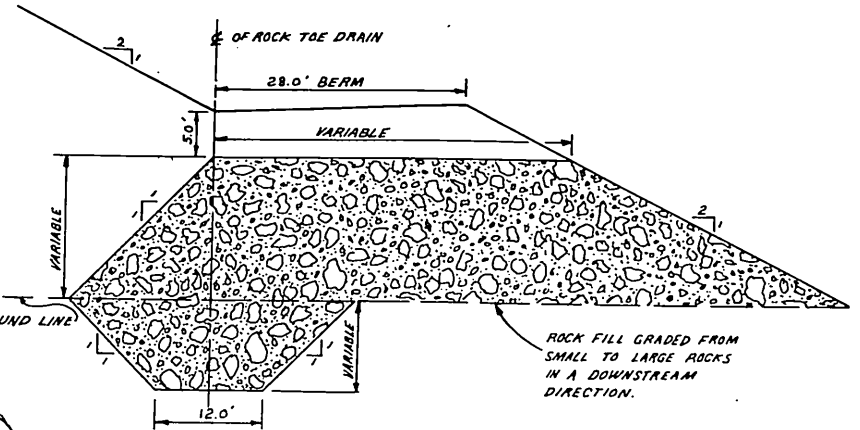
Date **7/64**  
 Approved by **[Signature]**

**AS BUILT**

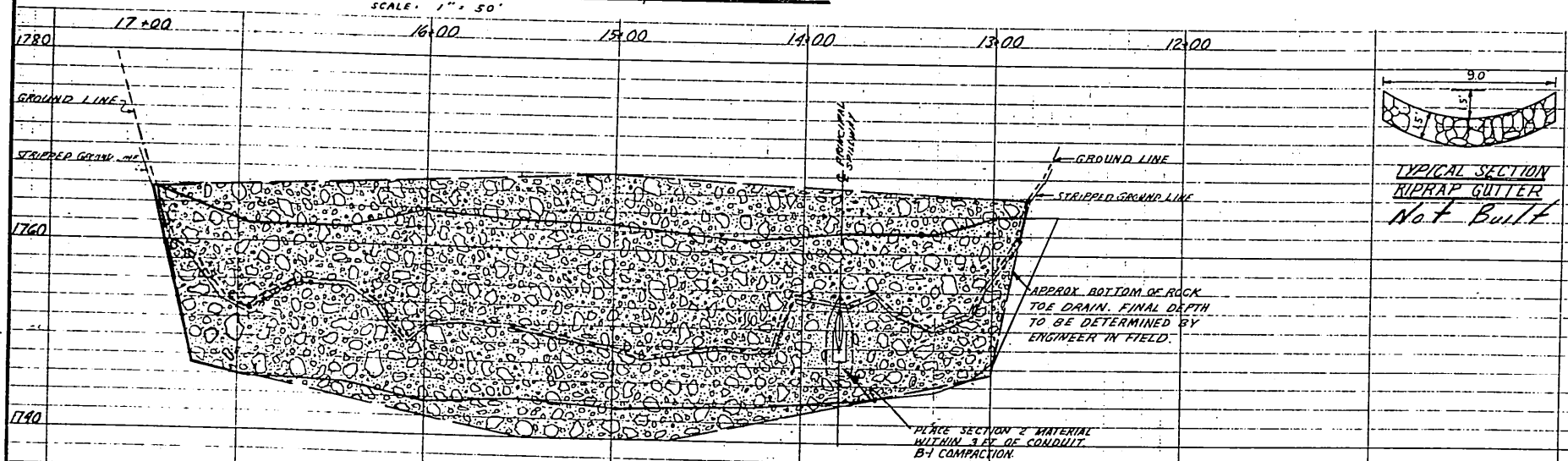
Sheet No. **9** of **22**  
 Drawing No. **VA-490-P**



PLAN VIEW OF ROCK TOE DRAIN & CUTOFF TRENCH  
SCALE: 1" = 50'



TYPICAL SECTION OF ROCK TOE DRAIN

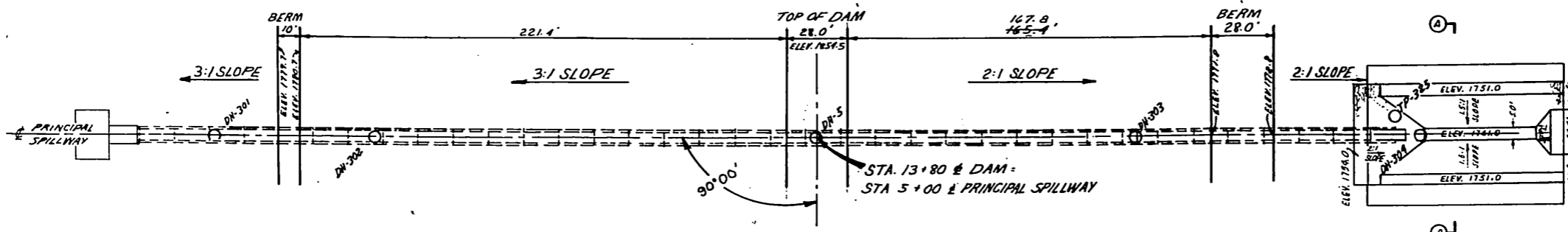


PROFILE ALONG & OF ROCK TOE DRAIN LOOKING DOWNSTREAM  
SCALE: HOR. 1" = 40'  
VERT. 1" = 8'

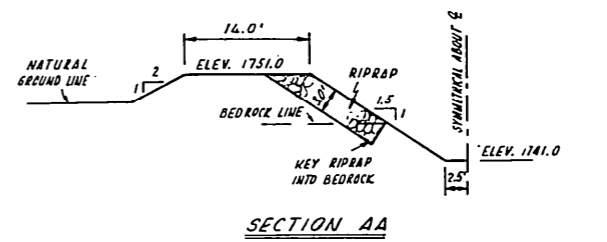
"AS BUILT"

DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
ROCK TOE AND MISC. DETAILS  
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

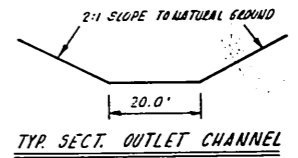
Designed N.W. WILSON & R. BARNES 7/64	Date 7/64	Approved by
Drawn M. F. HARMON	Traced 7/64	Title
Checked R. C. JONES	Sheet No. 10 of 22	Drawing No. VA-490-P



PLAN VIEW



SECTION AA



TYP. SECT. OUTLET CHANNEL

JOINT	DISTANCE FROM RISER WALL	INVERT ELEV. OF 48" DIA. PIPE
J-1	0.55	1756.00
J-2	16.33	1755.81
J-3	32.55	1755.61
J-4	48.33	1755.42
J-5	64.55	1755.22
J-6	80.33	1755.03
J-7	96.55	1754.83
J-8	112.33	1754.64
J-9	128.55	1754.44
J-10	144.33	1754.25
J-11	160.55	1754.06
J-12	176.33	1753.86
J-13	192.55	1753.67
J-14	208.33	1753.47
J-15	224.55	1753.28
J-16	240.33	1753.08
J-17	256.55	1752.89
J-18	272.33	1752.69
J-19	288.55	1752.50
J-20	304.33	1752.31
J-21	320.55	1752.11
J-22	336.33	1751.92
J-23	352.55	1751.72
J-24	368.33	1751.53
J-25	384.55	1751.33
J-26	400.33	1751.14
J-27	416.55	1750.94
J-28	432.33	1750.75
J-29	448.55	1750.56
J-30	464.33	1750.36
J-31	480.55	1750.17
J-32	496.33	1749.97
J-33	512.55	1749.78
J-34	528.33	1749.58
J-35	544.55	1749.39
J-36	560.33	1749.19
OUTLET	576.55	1749.00

NOTE: ABOVE DIMENSIONS FOR LENGTHS OF PIPE ARE BASED ON NOMINAL LENGTHS AND DO NOT INCLUDE CREEP.

COLLAR	DISTANCE FROM RISER WALL	INVERT ELEV. OF 48" DIA. PIPE
I	68.0	1755.17
II	88.0	1754.93
III	108.0	1754.69
IV	126.0	1754.46
V	148.0	1754.20
VI	168.0	1753.96
VII	188.0	1753.71
VIII	206.0	1753.49
IX	228.0	1753.23
X	248.0	1752.99
XI	268.0	1752.74
XII	286.0	1752.52
XIII	308.0	1752.26
XIV	328.0	1752.01
XV	348.0	1751.77
XVI	368.0	1751.55
XVII	388.0	1751.28
XVIII	408.0	1751.04
XIX	428.0	1750.80
XX	446.0	1750.58

REINF. CONC. RISER CLASS "A" CONC. TYPE I DETAILS SHTS. 17, 18 & 19

RISER CREST EL. 1802.0

ORIFICE EL. 1778.2

RISER FLOOR EL. 1756.0

SED. POOL EL. 1779.2

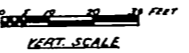
144.0' OF CONC. CRADLE DETAILS SHT. 20 CLASS "A" TYPE III

298.0' OF REINF. CONC. CRADLE DETAILS SHT. 20 CLASS "A" TYPE II

112.0' OF CONC. CRADLE DETAILS SHT. 20 CLASS "A" TYPE III

29.0' OF REINF. CONC. CRADLE DETAILS SHT. 20 CLASS "A" TYPE II

PROFILE ALONG C OF PRINCIPAL SPILLWAY



48" INSIDE DIA. REINF. CONC. WATER PIPE  
(36) - 16'-0" SECTIONS  
(1) - WALL FITTINGS FOR 12" WALL  
TOTAL LENGTH 577.33'  
PRESSURE HEAD = 100.0'

J-1 TO J-5 & J-31 TO OUTLET 10 SECTIONS  
LOAD = 24,570 LBS. PER LIN. FT. BASED ON O.D. OF 4.65'  
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK  
(NON-PRESTRESSED PIPE) = 79,60 LBS. PER LIN. FT. AWWA-C300  
MIN 3 EDGE BEARING STRENGTH FOR 0.001" CRACK  
(PRESTRESSED PIPE) = 5,980 LBS. PER LIN. FT. AWWA-C301

J-5 TO J-10 & J-28 TO J-31 8 SECTIONS  
LOAD = 56,900 LBS. PER LIN. FT. BASED ON O.D. OF 4.65'  
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK  
(NON-PRESTRESSED PIPE) = 18,880 LBS. PER LIN. FT. AWWA-C300  
MIN 3 EDGE BEARING STRENGTH FOR 0.001" CRACK  
(PRESTRESSED PIPE) = 14,190 LBS. PER LIN. FT. AWWA-C301

J-10 TO J-15 & J-26 TO J-28 9 SECTIONS  
LOAD = 92,870 LBS. PER LIN. FT. BASED ON O.D. OF 4.65'  
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK  
(NON-PRESTRESSED PIPE) = 26,400 LBS. PER LIN. FT. AWWA-C300  
MIN 3 EDGE BEARING STRENGTH FOR 0.001" CRACK  
(PRESTRESSED PIPE) = 19,850 LBS. PER LIN. FT. AWWA-C301

J-15 TO J-24 9 SECTIONS  
LOAD = 116,070 LBS. PER LIN. FT. BASED ON O.D. OF 4.65'  
MIN 3 EDGE BEARING STRENGTH FOR 0.01" CRACK  
(NON-PRESTRESSED PIPE) = 31,070 LBS. PER LIN. FT. AWWA-C300  
MIN 3 EDGE BEARING STRENGTH FOR 0.001" CRACK  
(PRESTRESSED PIPE) = 23,360 LBS. PER LIN. FT. AWWA-C301

"AS BUILT"

DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
PLAN - PROFILE OF PRINCIPAL SPILLWAY

U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed H. F. WILSON & R. C. BARNES	Date 7/68	Approved by Title
Drawn		
Traced		
Checked 11/88	Sheet 11 of 22	Drawing No. VA-490-P

DRILL HOLES WITH PENETRATION RESISTANCE AND ROCK CORE BORING

DH 1, STA. C/L DAM 11+55, ELEV. 1861.1

Table with columns for depth (0.0 to 60.0), lithology (e.g., Topsoil, Sandstone, Siltstone), and penetration resistance (e.g., 0.0, 0.6, 3.0, 5.5, 9.5, 12.2, 10.5, 12.1, 15.1, 17.8, 18.0, 33.5, 34.2, 37.1, 38.8, 42.5, 45.5, 46.9, 56.5, 57.8, 60.0).

Water Tests in 3-3/4" ID casing, 0.3' above ground. @ 5.0' = 2.1 gpm, @ 10.0' = 0.22 gpm, @ 10.0 to 18.0 = .775 gpm.

DH 2, STA. C/L DAM 12+36, ELEV. 1804.0. Topsoil - silt, fine sandy - dark gray & gray - (ML) loose - leaves.

DH 3, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - silty - brown - loose - dry - alluvium - topsoil.

DH 4, STA. C/L DAM 16+25, ELEV. 1756.3. Sand - silty - brown - loose - alluvial - topsoil.

DH 5, STA. C/L DAM 13+80, ELEV. 1758.9. Topsoil - sand, silty - red brown - loose - moist - alluvial.

DH 6, STA. C/L DAM 17+40, ELEV. 1805.0. Topsoil - silt, fine sandy - dark gray - loose - moist - residual.

Water Tests in 3-3/4" ID casing, 0.3' above ground. @ 11.0 - 16.0 = .20 gpm @ 20 psi, @ 16.0 - 42.0 = .43 gpm @ 20 psi, @ 21.0 - 42.5 = 11.7 gpm @ 30 psi.

DH 7, STA. C/L DAM 14+25, ELEV. 1756.3. Boulders - cobbles - sandstone (est. 50% by weight) sub-ang. with sand & gravel - silty - red brown - loose - moist.

DH 8, STA. C/L DAM 12+36, ELEV. 1804.0. Silt, fine sandy - yellow brown - moist medium (ML) drills fairly easily - residual soil.

DH 9, STA. C/L DAM 13+80, ELEV. 1758.9. Topsoil - sand, silty - red brown - loose - moist - alluvial.

DH 10, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - silty - brown - loose - dry - alluvium - topsoil.

DH 11, STA. C/L DAM 17+40, ELEV. 1805.0. Topsoil - silt, fine sandy - dark gray - loose - moist - residual.

DH 12, STA. C/L DAM 14+25, ELEV. 1756.3. Boulders - cobbles - sandstone (est. 60% by weight) - sub-ang. - red & gray sandstone & quartzite with sand - silty - brown red - loose - moist - water at 7.0'.

Water Tests in 3-3/4" ID casing, 0.5" above ground. @ 5.0' = 14.0+ gpm, @ 12.9 - 21.5 = 10.6 gpm @ 20 psi, @ 17.0 gpm @ 30 psi.

DH 13, STA. C/L DAM 13+80, ELEV. 1758.9. Topsoil - sand, silty - dark gray - loose - damp - Allen series.

DH 14, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - clayey - gravelly - yellow red - hard - moist.

DH 15, STA. C/L DAM 17+40, ELEV. 1805.0. Topsoil - sand, silty - dark gray - loose - damp - Allen series.

DH 16, STA. C/L DAM 14+25, ELEV. 1756.3. Boulders - cobbles & gravels - red sandstone with red silt - clayey - moist - hard.

DH 17, STA. C/L DAM 12+36, ELEV. 1804.0. Topsoil - sand, silty - dark gray - leaves & roots - Allen series.

DH 18, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - clayey - gravelly with some boulders & cobbles - yellow red brown - hard - moist.

Interbedded gray med. grained sandstone & black carbonaceous fine grained sandstone - 5° dipping fractures 8.6', 8.8', 9.4', 9.6' & 9.8' - iron stain in fractures - broken approx. every 4".

DH 19, STA. C/L DAM 13+80, ELEV. 1758.9. Topsoil - sand, silty - dark gray - leaves & roots - Allen series.

DH 20, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - clayey - gravelly - yellow red - hard - moist.

DH 21, STA. C/L DAM 17+40, ELEV. 1805.0. Topsoil - sand, silty - dark gray - loose - damp - Allen series.

DH 22, STA. C/L DAM 14+25, ELEV. 1756.3. Boulders - cobbles & gravels with silt clayey - yellow red - mottled - hard - moist.

DH 23, STA. C/L DAM 12+36, ELEV. 1804.0. Topsoil - sand, silty - dark gray - leaves & roots - Allen series.

DH 24, STA. C/L DAM 15+50, ELEV. 1755.7. Sand - clayey - gravelly with some boulders & cobbles - yellow red brown - hard - moist.

AS BUILT logo and project information: DAM NO. 77 LITTLE RIVER UPPER NORTH RIVER WATERSHED AUGUSTA COUNTY, VIRGINIA LOGS OF TEST HOLES. U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE. Investigated by Finner, Mack, Britton & Co., Inc. Geologist's Const. Eng. Helen J. Erdman. 12/63. State Consv. Engineer. VA-490-P.

0.0	SM	Topsoil sand, silty - dark gray - loose - leaves residual.
0.4	ML	Silt, fine sandy - light yellow red - moist - stiff.
3.5	SM	Sandstone - light gray - massive - fine grained some white mica - 10° dipping fracture 5.6' - broken approx. every 2' - iron stain in fractures.
5.0	SS	Interbedded gray massive fine grained sandstone & iron stained weathered sandy siltstone - 3 1/2° dipping fractures - broken approx. every 3'.
7.5	SS	Sandstone - fine grained - massive - gray - few brecciated pieces black shale ranging from 1x1x2 mm. to 20x20x30 mm. - fractured 70° fracture 10.6'-11.6' - 10° fracture 12.6'-14.2' 15.2 15.4 - iron stain in fractures - broken approx. every 1'.
19.9	SS	Sandstone - fine grained - massive - gray - few breccia black shale & siltstone - fractured in brecciated zones 19.9'-20.6', 21.9'-22.7', 23.3'-23.6', 25.5'-26.0' - 10° fracture 28.9' - iron stain in fractures.
30.1	SS	Sandstone - fine grained - gray - with common breccia of black shale - breccia range from 15x10 mm. to 50x50x100 mm. - pyrite nodules - sandstone massive with faint bedding - fracture zones with 10° fracture 30.7', 30.9', 32.2', 32.9', 33.8', 34.1', 34.6', 35.7' - broken approx. every 6".
36.5	Sh	Interbedded black shale & gray sandstone 75% shale 25% sandstone - 10° fractures 36.6', 37.4, 38.2', 39.1', 40.2', 40.7', 41.3' - broken approx. every 8" - iron stain in fractures.
52.1	SS	Sandstone - fine grained - gray - massive with faint bedding - black shale & siltstone breccia present - broken approx. every 1'.
58.8	SS	Sandstone - gray - massive with faint bedding - solid core to 58.8 - 10° fracture 58.8'.
60.0		Bottom of hole

0.0	SM	Topsoil sand, silty - dark gray - loose - leaves residual.
0.4	ML	Silt, fine sandy - light yellow red - moist - stiff.
3.5	SM	Sandstone - light gray - massive - fine grained some white mica - 10° dipping fracture 5.6' - broken approx. every 2' - iron stain in fractures.
5.0	SS	Interbedded gray massive fine grained sandstone & iron stained weathered sandy siltstone - 3 1/2° dipping fractures - broken approx. every 3'.
7.5	SS	Sandstone - fine grained - massive - gray - few brecciated pieces black shale ranging from 1x1x2 mm. to 20x20x30 mm. - fractured 70° fracture 10.6'-11.6' - 10° fracture 12.6'-14.2' 15.2 15.4 - iron stain in fractures - broken approx. every 1'.
19.9	SS	Sandstone - fine grained - massive - gray - few breccia black shale & siltstone - fractured in brecciated zones 19.9'-20.6', 21.9'-22.7', 23.3'-23.6', 25.5'-26.0' - 10° fracture 28.9' - iron stain in fractures.
30.1	SS	Sandstone - fine grained - gray - with common breccia of black shale - breccia range from 15x10 mm. to 50x50x100 mm. - pyrite nodules - sandstone massive with faint bedding - fracture zones with 10° fracture 30.7', 30.9', 32.2', 32.9', 33.8', 34.1', 34.6', 35.7' - broken approx. every 6".
36.5	Sh	Interbedded black shale & gray sandstone 75% shale 25% sandstone - 10° fractures 36.6', 37.4, 38.2', 39.1', 40.2', 40.7', 41.3' - broken approx. every 8" - iron stain in fractures.
52.1	SS	Sandstone - fine grained - gray - massive with faint bedding - black shale & siltstone breccia present - broken approx. every 1'.
58.8	SS	Sandstone - gray - massive with faint bedding - solid core to 58.8 - 10° fracture 58.8'.
60.0		Bottom of hole

0.0	SM	Topsoil - sand, silty - dark gray - loose - damp - Waynesboro series.
0.4	ML	Silt, fine sandy - light yellow brown - hard - moist.
3.6	SM	Weathered & slightly weathered cobbles & boulders with sand, clayey, silty - yellow red - hard - old terrace deposit.
7.5	SS	Sandstone - gray - massive - weathered - small fractures 7.7, 7.9, 8.2 - sandstone unbroken 8.2'-10.0' - iron stain in fractures - seismic velocity 10,000 ft/sec. dry hole.
10.0		Bottom of hole

0.0	SM	Topsoil - sand, silty - dark gray - loose - damp - Waynesboro series.
0.5	ML	Silt, fine sandy - yellow brown - hard - damp.
4.5	GM	Cobbles & boulders slightly weathered & weathered with sand - clayey - red yellow - hard - moist.
6.0	ML	Silt, clayey, sandy - red & yellow & yellow red - hard - moist - weathered gravels - sandstone present.
8.5	GM	Cobbles & boulders weathered & unweathered with clay sandy - yellow red - hard - moist.
9.1	SS	Interbedded weathered sandstone & silt seams - sandstone gray & light red with thin seams of siltstone - sandstone lenses 9.1'-10.0', 10.5'-11.0', 11.6'-12.3' - silt seams - sandy, clayey - yellow red - silt seams from weathered siltstone - ripplable.
12.5	SS	Siltstone - gray - highly broken with weathered zones - lenses sandstone 12.9'-13.0', 13.3'-13.6' ripplable.
17.3	SS	Interbedded siltstone & fine grained sandstone - cross bedded - gray - unweathered - non-ripplable.
18.3	SS	Sandstone - gray with red iron stain - massive - fine grained - joints dipping 70° - clay in joints - non-ripplable, dry hole.
19.0		Bottom of hole

0.0	SM	Topsoil - sand, silty - red brown - loose - moist - alluvial.
0.4	GM	Boulders, cobbles & gravel (70% by wt. est.) - red sandstone - sub-ang. with sand, silty - brown red - loose - moist - water at 10.0'.
10.0	GM	Boulders large with some cobbles - most red sandstone - one boulder 1 1/2" thick with sand, silty - brown red - loose - wet.
16.5	SS	Siltstone & mudstone - black - carbonaceous - soft - broken approx 2" - no iron stain in breaks.
18.3	SS	Sandstone - fine grained - gray - broken - breaks every 4" approx. - fractures with iron stain in fractures at 19.9' & 21.0' - massive with faint bedding - dip of bedding 10°.
22.0		Bottom of hole

"AS BUILT"

**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
LOGS OF TEST HOLES**

**U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Investigated by Fanner, Mack, Bultman Date 02.03.43  
 Checked by Helen J. Erdman Date 12/43  
 State Cons. Engineer VA-490-P  
 Drawing No. 11/43

Water Tests in 3-1/8" ID casing, 0.5' above ground  
 @ 9.0' = 0 gpm (casing on rock)  
 Water Tests in 3-1/8" ID casing, 3.0' hole - casing 0.5' above ground  
 @ 11.0' - 60.0' = 21.0 gpm - end of pressure test

Water Pressure Tests  
 @ 16.0 - 21.0 = 1.6 gpm @ 30 psi  
 2.5 gpm @ 40 psi  
 1.8 gpm @ 30 psi  
 1.2 gpm @ 20 psi  
 0.4 gpm @ 10 psi  
 @ 21.0 - 26.0 = 0 gpm @ 10 psi  
 0.1 gpm @ 20 psi  
 0.15 gpm @ 30 psi  
 0.1 gpm @ 40 psi  
 0.1 gpm @ 50 psi  
 0 gpm @ 60 psi  
 0 gpm @ 30 psi  
 0 gpm @ 20 psi  
 0.4 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0.15 gpm @ 40 psi  
 0 gpm @ 50 psi  
 0 gpm @ 60 psi  
 @ 26.0 - 31.0 = 0 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0.1 gpm @ 40 psi  
 0.15 gpm @ 50 psi  
 0 gpm @ 60 psi  
 @ 31.0 - 36.0 = 0 gpm @ 10 psi  
 0.2 gpm @ 20 psi  
 0.4 gpm @ 30 psi  
 0.5 gpm @ 40 psi  
 0.6 gpm @ 50 psi  
 0.3 gpm @ 60 psi  
 0.1 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0 gpm @ 40 psi  
 0 gpm @ 50 psi  
 0 gpm @ 60 psi  
 @ 36.0 - 41.0 = 0 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0 gpm @ 40 psi  
 0 gpm @ 50 psi  
 @ 41.0 - 46.0 = 1.1 gpm @ 10 psi  
 2.9 gpm @ 20 psi  
 4.9 gpm @ 30 psi  
 6.2 gpm @ 40 psi  
 7.5 gpm @ 50 psi  
 6.3 gpm @ 60 psi  
 4.6 gpm @ 70 psi  
 4.1 gpm @ 80 psi  
 3.1 gpm @ 90 psi  
 0 gpm @ 100 psi  
 0 gpm @ 200 psi  
 0.6 gpm @ 30 psi  
 2.6 gpm @ 40 psi  
 8.5 gpm @ 50 psi  
 Water at 40.0' 10/2/53

@ 20.0 - 25.0 = 0 gpm @ 10 psi  
 0.1 gpm @ 20 psi  
 0.1 gpm @ 30 psi  
 0.1 gpm @ 40 psi  
 0.1 gpm @ 50 psi  
 @ 25.0 - 30.0 = 0 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0 gpm @ 40 psi  
 0 gpm @ 50 psi  
 @ 30.0 - 35.0 = 0 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0.1 gpm @ 40 psi  
 0.1 gpm @ 50 psi  
 @ 35.0 - 40.0 = 0 gpm @ 10 psi  
 0 gpm @ 20 psi  
 0 gpm @ 30 psi  
 0 gpm @ 40 psi  
 0 gpm @ 50 psi  
 @ 40.0 - 45.0 = 0 gpm @ 10 psi  
 0.4 gpm @ 20 psi  
 1.2 gpm @ 30 psi  
 1.7 gpm @ 40 psi  
 1.7 gpm @ 50 psi  
 1.5 gpm @ 60 psi  
 1.3 gpm @ 70 psi  
 1.1 gpm @ 80 psi  
 1.3 gpm @ 90 psi  
 0.9 gpm @ 100 psi  
 0.9 gpm @ 110 psi  
 1.1 gpm @ 120 psi  
 1.6 gpm @ 130 psi  
 1.3 gpm @ 140 psi  
 1.1 gpm @ 150 psi  
 1.1 gpm @ 160 psi  
 0.9 gpm @ 170 psi  
 0.9 gpm @ 180 psi  
 Water at 43.7' 10/11/53

TEST PITS (CASE GASOLINE POWERED TRACTOR, MODEL 760 BACKHOE)

TP 10, STA. 21' L/C/L DAM 11+89, ELEV. 1755.4  
 0.0 0.2 Topsoil - sand, fine silty - brown - loose (SM)  
 0.2 6.2 Boulders & cobbles & gravel (70% by wt.) - (GM)  
 sub-ang. - sandstone & quartzite with sand, fine silty - few non-plastic fines - brown red - moist to wet - loose - water at 3.1'  
 6.2 6.3 Large boulders - too hard to dig. (GP)  
 Bottom of hole.

TP 101, STA. 391' R MAIN B/L 10+62, ELEV. 1771.0  
 0.0 0.8 Topsoil - sand, silty - red brown - damp (SM)  
 0.8 10.5+ Boulders, cobbles & gravels (est. 50% by wt.) (GM)  
 - sandstone with sand, silty - brown red - GP  
 loose - moist to wet - seepage at 8.3'  
 DS 101-1 1.0-10.5  
 Bottom of hole.

Field Gradation 0.4"-11.2"

Mean Diam.	No. Particles	Weight	%
18-24	0	111	5
12-18	1		
6-12	28	522	23
3-6	165	623	27
less than 3"		1031	45
Total Wt.		2267 lbs	100%

TP 102, STA. 190' R MAIN B/L 11+72, ELEV. 1773.5  
 0.0 1.0 Topsoil - sand, silty - brown - loose - moist (SM)  
 1.0 10.6+ Boulders & cobbles - (60% est. by wt.) - (GM)  
 sub-ang. sandstone with gravel & sand - brown red - loose - moist - water at 10.0' - digs hard at 10.3' - large boulders.  
 Bottom of hole.

TP 103, STA. 62' R MAIN B/L 13+72, ELEV. 1771.7  
 0.0 0.0 Dry stream channel  
 0.0 8.4 Boulders & cobbles - (75% est. by wt.) - (GM)  
 sub-ang. sandstone with gravel & sand - red brown - loose - water at 5.9'  
 8.4 8.6 Boulders, large - 2x2x1 - backhoe refusal (GP)  
 Bottom of hole.

TP 104, STA. 329' R MAIN B/L 13+94, ELEV. 1772.2  
 0.0 0.6 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.6 9.6 Boulders & cobbles (75% est. by wt.) - sub-ang. sandstone - with gravel & sand - red brown - loose - moist - water at 5.8' (GM)  
 backhoe refusal  
 9.6 9.7 Boulders, large, tightly wedged together - backhoe refusal (GP)  
 Bottom of hole.

TP 105, STA. 19' L MAIN B/L 16+88, ELEV. 1776.8  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 8.0 Boulders & cobbles (est. 60% by wt.) - (GM)  
 sandstone - sub-ang. with gravel & sand - silty - red brown - loose - moist - water at 6.8'  
 8.0 8.1 Large boulders - sandstone - est. 3'x3'x1' - (GP)  
 cannot be dug.  
 Bottom of hole.

TP 106 STA. 164' R MAIN B/L 16+88, ELEV. 1781.4  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 11.0 Boulders & cobbles (est. 60% by wt.) - (GM)  
 sandstone sub-ang. with sand & gravel, silty - red brown - loose - moist - water at 7.9' - some boulders 3x2x1'  
 11.0 11.2 Large boulders - sandstone - 3x2x1' - backhoe refusal (GP)  
 Bottom of hole.

TP 107 STA. 309' R MAIN B/L 16+58, ELEV. 1783.7  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 11.1 Boulders & cobbles (60% by wt.) - sandstone (GM)  
 sub-ang. with gravel & sand - brown red - loose - moist - water at 10.1' - some boulders 3'x2'x1'  
 11.1 11.2 Boulders - large - sandstone - some 3'x2'x1' - backhoe refusal. (GP)  
 Bottom of hole.

TP 108 STA. 36' L MAIN B/L 18+18, ELEV. 1778.0  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 7.3 Boulders & cobbles (60% by wt.) - sandstone (GM)  
 sub-ang. with gravel & sand, silty - brown red - loose - moist - water at 4.8'  
 7.3 7.4+ Probable bedrock - gray sandstone - backhoe refusal. (GP)  
 Bottom of hole.

TP 109 STA. 120' R MAIN B/L 19+13, ELEV. 1783.3  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 11.0 Boulders & cobbles (60% by wt.) - sandstone (GM)  
 sub-ang. with gravel & sand - brown red - loose - moist - water at 9.0'  
 11.0 11.2 Large boulders - sandstone 2'x2'x1' - backhoe refusal. (GP)  
 Bottom of hole.

TP 110 STA. 260' R MAIN B/L 19+58, ELEV. 1783.6  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 3.0 Sand, silty - brown red - loose - moist - (SM)  
 few cobbles - some fine roots  
 3.0 9.1 Boulders & cobbles (60% by wt.) - sandstone (GM)  
 sub-ang. with gravel & sand, silty - brown red - loose - moist - water at 8.8'  
 9.1 9.2 Probable bedrock - gray sandstone - backhoe refusal. (GP)  
 Bottom of hole.

TP 111 STA. 145' R MAIN B/L 21+70, ELEV. 1787.9  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 5.5 Boulders, cobbles & gravel - (75% by wt.) - (GM)  
 sandstone - sub-ang. with sand, silty - brown red - loose - moist  
 5.5 7.0 Boulders - some sand - well sorted - loose - moist - (GM)  
 cobbles - gravel  
 5.5 10.5 Same as 0.4 to 5.5 - water at 9.6 feet (GM)  
 10.5 10.6 Large boulders - backhoe refusal. (GP)  
 Bottom of hole.

TP 112 STA. 123' L MAIN B/L 20+19, ELEV. 1788.1  
 0.0 0.4 Topsoil - sand, silty - brown red - moist - (SM)  
 0.4 11.5+ Cobbles & some boulders (60% by wt.) - (GM)  
 sandstone - sub-ang. with gravel & sand, silty - red - loose - moist - water at 11.0' - digs fairly easy with backhoe.  
 Bottom of hole.

TP 113 STA. 40' R MAIN B/L 21+32, ELEV. 1785.9  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 10.8 Boulders, cobbles & gravels (est. 75% by wt.) - (GM)  
 sandstone - indurated & quartzite with sand, silty - brown red - loose - moist - water at 7.4'  
 10.8 10.9 Boulders - large - backhoe refusal. (GP)  
 Bottom of hole.

TP 114 STA. 53' R MAIN B/L 11+46, ELEV. 1767.8  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 9.1 Boulders, cobbles & gravel (75% by wt.) - (GM)  
 sandstone with sand, silty - brown red - loose - moist - water at 8.0'  
 9.1 9.2 Boulders - large - tight in place - backhoe refusal. (GP)  
 Bottom of hole.

TP 115 STA. 67' L MAIN B/L 11+84, ELEV. 1763.7  
 0.0 0.2 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.2 7.5 Boulders & cobbles & gravel - (75% est. by wt.) - sandstone - sub-ang. - with sand, silty - brown red - loose - moist - water at 4.2'  
 7.5 7.6 Boulders tightly cemented together - backhoe refusal. (GP)  
 Bottom of hole.

TP 116 STA. 77' R MAIN B/L 9+86, ELEV. 1767.7  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 7.8 Boulders, cobbles & gravels - (est. 70% by wt.) - sandstone - sub-ang. - with sand silty - loose - moist - water at 4.6'  
 7.8 7.9 Boulders - large - tight - backhoe refusal (GP)  
 some 2'x1'x1'.  
 Bottom of hole.

TP 117 STA. 69' L MAIN B/L 9+92, ELEV. 1766.2  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 5.1 Boulders, cobbles & gravels - (75% est. by wt.) - sandstone - sub-ang. - with sand silty - brown red - loose - moist - water at 3.6'  
 5.1 5.2 Boulders - large - tight - backhoe refusal. (GP)  
 Bottom of hole.

TP 118 STA. 278' R MAIN B/L 9+20, ELEV. 1773.4  
 0.0 0.4 Topsoil - sand, silty - red brown - loose - moist (SM)  
 0.4 10.8 Boulders, cobbles & gravel - (est. 75% by wt.) - sandstone - sub-ang. - with sand, silty - brown red - loose - moist - water at 6.2'  
 10.8 10.9 Boulders - large - tightly wedged together (GP)  
 backhoe refusal.  
 Bottom of hole.

TP 120 STA. 596' R RT. ABUTMENT 3+81, ELEV. 1817.4  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 leaves & roots - Allen series - colluvial  
 0.4 5.5 Silt, fine sandy, cobbly - light yellow brown - hard in place - loose when dug - angular cobbles of red iron stained sandstone - moist (ML)  
 5.5 10.0+ Silt, clayey - mottled - yellow & red - hard in place - moist - dry hole SC-SM  
 DS 120-1 5.5-10.0  
 by seismic survey sandstone 9.0' - velocity 15,000 ft/sec.  
 Bottom of hole.

TP 121 STA. 375' R RT. ABUTMENT 4+68, ELEV. 1868.8  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 3.0 Silt, fine sandy - light brown - hard in place - loose when dug - moist - angular boulders & cobbles - gray - sandstone present  
 Sand, silty - red - moist - weathered - red (SM)  
 sandstone - boulders - hard to dig  
 4.5 4.6 Red sandstone - backhoe refusal - dry hole  
 Bottom of hole.

TP 122 STA. 231' R RT. ABUTMENT 4+68, ELEV. 1898.9  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 3.0 Silt, fine sandy - light brown - hard in place - loose when dug - platy structure - moist  
 3.0 3.1 Gray sandstone - backhoe refusal - dry hole  
 Bottom of hole.

TP 123 STA. 35' R RT. ABUTMENT 4+68, ELEV. 1940.7  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 4.7 Silt, fine sandy - light brown - hard in place - loose when dug - moist - some angular cobbles weathered shale - damp  
 4.7 4.8 Weathered interbedded light red & gray siltstone - backhoe refusal - dry hole - (ML)  
 Bottom of hole.

TP 124 STA. 167' L RT. ABUTMENT 2+85, ELEV. 1975.5  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 2.8 Silt, fine sandy - light brown - loose - moist  
 2.8 4.8 Silt, fine sandy - light gray - some ang. cobbles & gravels siltstone - compact - (SM)  
 digs hard - moist  
 DS 124-1 2.8-4.8  
 4.8 4.9 Siltstone - gray - unweathered - compact backhoe refusal - dry hole - seismic  
 velocity 5,100 ft/sec.  
 Bottom of hole.

TP 125 STA. 425' R RT. ABUTMENT 1+28, ELEV. 1850.8  
 0.0 0.3 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - leaves - Muskingum series  
 0.3 2.4 Silt, fine sandy - pale brown - hard in place - loose when dug - moist (ML)

2.4 5.3 Sand, silty, cobbly - (SM)  
 pale brownish red - firm in place - hard to dig - cobbles - abundant - cobbles angular - sandstone - moist.  
 5.3 5.4 Cobbles & boulders - firm in place - backhoe refusal - dry hole (GP)  
 Bottom of hole.

TP 126 STA. 603' R RT. ABUTMENT 2+29, ELEV. 1818.0  
 0.0 0.5 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.5 3.5 Silt, fine sandy, cobbly - light brown - (ML)  
 hard in place - loose when dug - moist - angular cobbles - pink & gray - sandstone  
 3.5 3.6 Slightly weathered pink & gray sandstone - backhoe refusal - dry hole (GP)  
 Bottom of hole.

TP 127 STA. 205' R RT. ABUTMENT 1+28, ELEV. 1899.7  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 2.7 Silt, fine sandy, cobbly - light brown - (ML)  
 hard in place - loose when dug - moist - angular cobbles - gray - sandstone  
 2.7 2.8 Gray medium bedded sandstone - backhoe refusal - dry hole - seismic  
 velocity 12,000 ft/sec.  
 Bottom of hole.

TP 128 STA. 35' L RT. ABUTMENT 1+28, ELEV. 1952.4  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 6.0 Silt, fine sandy - pale brown - hard in place - moist - few cobbles - angular gray sandstone  
 6.0 6.1 Interbedded sandstone & shale - backhoe refusal - dry hole  
 Bottom of hole.

TP 129 STA. 340' L RT. ABUTMENT 5+79, ELEV. 2003.1  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 4.0 Silt, fine sandy - pale brown - hard in place - loose dug - moist - few ang. cobbles weathered red sandstone  
 4.0 4.1 Red sandstone - backhoe refusal - dry hole - (ML)  
 Bottom of hole.

TP 130 STA. 334' L RT. ABUTMENT 8+88, ELEV. 2025.0  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 2.9 Silt, fine sandy - pale brown - hard in place - loose dug - moist - some ang. cobbles - weathered gray sandstone  
 2.9 3.0 Light gray sandstone - backhoe refusal - dry hole. (ML)  
 Bottom of hole.

TP 131 STA. 282' L RT. ABUTMENT 11+65, ELEV. 2037.5  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 4.3 Silt, fine sandy - pale brown - hard in place - loose when dug - moist  
 4.3 7.2 Weathered shale - thick bedded - soft - gray with thin red beds - moist - some feel - digs fairly easily  
 7.2 7.3 Shale - gray - thick bedded - with thin red beds - digs hard - backhoe refusal - dry hole. (ML)  
 Bottom of hole.

TP 132 STA. 40' L RT. ABUTMENT 11+65, ELEV. 1997.8  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series  
 0.4 4.3 Silt, fine sandy - pale brown - hard in place - loose when dug - moist  
 4.3 6.3 Weathered shale - gray with thin red beds soft - soapy feel - digs fairly easily  
 6.3 6.4 Shale - color same as above - backhoe refusal - dry hole. (ML)  
 Bottom of hole.

TP 133 STA. 207' R RT. ABUTMENT 11+65, ELEV. 1946.1  
 0.0 0.4 Topsoil - silt, fine sandy - dark gray - (ML)  
 loose - Muskingum series

DAM NO. 77 LITTLE RIVER  
 UPPER MONTH OVERFLOW WATERFED  
 BY STATE CANAL, VIRGINIA  
 1965 PROJECT 1445

U.S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

Collected Investigated by Date Approved by  
 Fonger Mack, button oct 63 Title  
 Geologist's Const. Eng. Title  
 Typed by Title  
 Helen J. Erdman 12/43 State Const. Engineer  
 Checked No. 14 Sheet No. 22  
 No. 14 Drawing No. VA-490-P





TP 184 STA. 93'R C/L DAM 28+10. ELEV. 1984.5

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - Muskingum series (ML)

0.4 3.4 Silt, fine sandy, cobbly - yellow brown - hard to dig - moist (ML) CL

3.4 3.5 Siltstone - brown olive - blocky - soft - backhoe refusal - dry hole. Bottom of hole.

TP 185 STA. 148'R C/L DAM 28+23. ELEV. 1927.5

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - Muskingum series (ML)

0.4 5.7 Silt, fine sandy - pale yellow brown - hard - blocky with some clay skins - moist (ML) CL

5.8 6.8 Siltstone - yellow brown - weathered - backhoe refusal at 5.9' - dry hole - seismic velocity 1820 ft/sec - depth determined by seismic survey DS 185-1 5.8-5.9

6.8 26.0 Siltstone - unweathered - seismic velocity 5,000 ft/sec - contacts determined by seismic survey DS 185-1 20,000 ft/sec. Bottom of hole.

TP 250 STA. 14' ES 6+93. ELEV. 1836.5

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - Muskingum series (ML)

0.4 4.0 Silt, fine sandy - hard in place - pp 3.5 - moist - light brown (ML)

4.0 7.3 Interbedded - red & light gray - siltstone - soft - saprolite - digs fairly easy with backhoe dip 20° - dry hole. Bottom of hole.

TP 251 STA. 44' ES 5+65. ELEV. 1842.2

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Allen series (ML)

0.4 8.0 Silt, fine sandy - light brown - mottled with silt, clayey - yellow red - moist - stiff (ML)

8.0 8.1 Siltstone - gray - fairly soft - backhoe refusal - dip 20° - dry hole. Bottom of hole.

TP 252 STA. 5' ES 5+92. ELEV. 1847.3

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Waynesboro series (ML)

0.4 3.5 Silt, fine sandy - light brown - fairly hard - moist - pp 3.0 (ML)

3.5 7.5 Sand, silty, cobbly - cobbles highly weathered - iron sandstone - subangular - red & brown - calico pattern - moist - hard - terrace deposit (SA)

7.5 9.6 Highly weathered interbedded gray & red siltstone - rippable - dip 20° E, strike N 48° E - dry hole - dug with soil auger (ML)

9.6 9.7 Siltstone - gray - fairly hard - backhoe refusal - dry hole - seismic velocity 1400 ft/sec. Bottom of hole.

TP 253 STA. 75'R C/L ES 4+95. ELEV. 1845.7

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Muskingum series (ML)

0.4 7.6 Silt, fine sandy - light brown - hard - moist - pp 3.5 (ML)

7.6 7.7 Weathered siltstone - gray with brown red seams - dry hole. Bottom of hole.

TP 254 STA. 68' R C/L ES 3+98. ELEV. 1853.2

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Muskingum series (ML)

0.4 6.0 Silt, fine sandy - light brown - moist - hard - digs hard (ML)

6.0 6.1 Interbedded weathered gray & brown siltstone & brown sandstone - backhoe refusal - dry hole. Bottom of hole.

TP 255 STA. 135' R C/L ES 2+78. ELEV. 1853.5

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Muskingum series (ML)

0.4 3.7 Silt, fine sandy - light brown - hard - (ML)

3.7 3.8 Slightly fractured sandstone - backhoe refusal - gray with some brown weathered surfaces - dry hole. Bottom of hole.

TP 256 STA. 1'R C/L ES 1+55. ELEV. 1850.9

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - damp - Waynesboro series (ML)

0.4 5.8 Cobbles, boulders & gravel - (15% est. by wt.) - sub-ang. - red sandstone with sand, silty - red brown - hard - moist - terrace deposit (SM) CL

5.8 5.9 Cobbles - light in place - backhoe refusal - dry hole. Bottom of hole.

TP 280 STA. 172'R C/L ES22+13. ELEV. 1971.3

0.0 0.4 Topsoil - silt, fine sandy - dark gray - loose - Allen series (ML)

0.4 1.3 Silt, fine sandy - pale brown - hard in place (ML)

1.3 9.1 Silt, clayey, fine sandy - red - hard - moist - blocky - clay skins - pp 4.0 - dry hole (ML) CL

DS 280-1 1.3-9.1 Bottom of hole.

TP 313 STA. 170' L C/L PIPE 5+60. ELEV. 1750.9

0.0 5.9 Boulders, cobbles & gravel - (80% by wt.) - quartzite - sub-ang. & subblocky with sand, fine silty - few non-plastic fines - brown red - moist to wet - water at 4.4' - alluvial (GM)

5.9 6.0 Assumed hard quartzite - backhoe refusal - gray - quartzite slab brought to surface - same as on rt. abutment. Bottom of hole.

TP 314 STA. 170' L C/L PIPE 3+15. ELEV. 1751.8

0.0 0.4 Topsoil - sand, silty, fine - few fines - (SM)

0.4 7.5 Boulders, cobbles & gravels - (80% by wt.) - subangular & sub-blocky with sand; fine silty, few non-plastic fines - brown red - moist - loose - alluvial - water at 4.4' - quartzite boulders & cobbles (GM)

7.5 7.6 Hard bedrock - backhoe refusal - assumed quartzite - no fragments brought - DS above water (GP)

DS 314-1 1.0-7.6 Field Gradation 0.4'-7.6'

Mean Diam.	No. Particles	Weight	Percent
2.0"	1	229 lbs	15%
1.8-2.0"	0	0	0
1.2-1.8"	1	14	3
0.6-1.2"	16	364	24
3-6"		373	24
less than 3"		523	34 (sent to Lab.)
Total Wt.		1530 lbs.	100%

TP 315 STA. 170' L C/L PIPE 7+63. ELEV. 1749.8

0.0 0.4 Topsoil - sand, fine, silty - few fines - (SM)

0.4 7.7 Cobbles, boulders & gravels - (75% by wt.) - with sand, fine silty - few non-plastic fines - brown red - moist - loose - water at 3.0' - boulders & cobbles - subangular and sub-blocky - alluvial - digs slow at 7.5' - more compact (SM)

7.7 7.8 Assumed unweathered - quartzite - gray - backhoe refusal. Bottom of hole.

TP 325 STA. 9' L C/L PIPE 7+63. ELEV. 1747.7

0.0 0.5 Topsoil - sand, silty - red brown - loose - moist (SM)

0.5 10.5 Boulders & cobbles (70% est. wt.) - sandstone - subangular with sand & gravel, silty - brown red - moist to wet - loose - water at 8.5' seepage (GM)

10.5 10.6 Apparent bedrock or large boulder that measures (6'x4'x1') - no boulders in vicinity of this size. Bottom of hole.

TP 326 STA. 27' L C/L PIPE 5+55. ELEV. 1757.0

0.0 0.7 Topsoil - sand, silty - red brown - loose - moist (SM)

0.7 10.5 Boulders & cobbles (70% est. by wt.) - subangular - quartzite - with sand & gravel - silty - red brown - moist - loose - water at 9.3' (GM)

10.5 11.0 Large boulders - some 1x1x1 - light - hard to dig. Bottom of hole.

TP 401 STA. 306' L C/L PIPE 3+21. ELEV. 1757.7

0.0 0.2 Topsoil - sand, fine silty - topsoil red brown (SM)

0.2 5.5 Boulders, cobbles & gravels - (80% by wt.) - quartzite & sandstone - subangular - with sand, silty, fine - brown red - moist to wet - loose - water at 4.5' (GM) GP

5.5 5.6 Hard unfractured quartzite. Bottom of hole.

TP 402 STA. 245' L C/L PIPE 3+11. ELEV. 1756.5

0.0 Dry stream channel (GM)

0.0 6.2 Cobbles, gravel & boulders - subangular - (75% by wt.) - quartzite & sandstone with sand, fine, silty - brown red - moist to wet - looser - water at 4.7' (GM)

6.2 6.3 In place boulders - cannot be dug. Bottom of hole.

TP 403 STA. 65' L C/L DAM 16+37. ELEV. 1755.8

0.0 0.3 Topsoil - silt, fine sandy - red brown - damp - loose (SM)

0.3 6.2 Boulders, cobbles & gravel (75% by wt.) - quartzite & sandstone - subangular - with sand, fine silty - red brown - moist - loose - dry hole (GM)

6.2 6.3 Black carbonaceous mudrock. Bottom of hole.

TP 404 STA. 72'R C/L PIPE 4+60. ELEV. 1757.1

0.0 0.4 Topsoil - sand, silty - brown - loose - moist (SM)

0.4 6.3 Boulders, cobbles & gravels - subangular - (75% by wt.) - sandstone & quartzite - with sand, fine silty - few non-plastic fines - brown red - moist - loose - water at 4.9' - joint pattern - general - N 90° E, NS Bottom of hole.

6.3 6.4 Hard bedrock - unweathered - quartzite - joint pattern - general - N 90° E, NS Bottom of hole.

TP 405 STA. 119'R C/L PIPE 3+67. ELEV. 1760.7

0.0 0.3 Topsoil - sand, silty - red brown - loose - leaves & roots (SM)

0.3 7.0 Boulders, cobbles & gravel - (75% est. by wt.) - sandstone & quartzite - subangular with sand, fine silty - few non-plastic fines - brown red - moist - dry hole (GM)

7.0 7.1 Hard bedrock - unweathered - quartzite - shale on abutment - black - 1' thick. Bottom of hole.

TP 406 STA. 20'R C/L PIPE 3+40. ELEV. 1761.4

0.0 0.9 Topsoil - sand, silty - brown - roots and leaves (SM)

0.9 9.0 Boulders, cobbles & gravels - (75% est. by wt.) - subangular - sandstone & quartzite - with sand, fine silty - few non-plastic fines - brown red - loose - moist - seepage at 9.5' (GM)

9.0 12.0 Boulders, gravels & cobbles - clean - little sand - subrounded - loose DS 406-1 1.0-12.0 Bottom of hole.

Field Gradation 0.9' - 12.0'

Mean Diam.	No. Particles	Weight	Percent
12-18"	1	80 lbs.	9%
6-12"	26	425	24
3-6"	111	190	27
less than 3"		785	44 (sent to Lab.)
Total Wt.		1780 lbs.	100%

TP 407 STA. 62' L C/L PIPE 2+90. ELEV. 1762.5

0.0 0.9 Topsoil - sand, silty - brown - loose - damp (SM)

0.9 11.0 Boulders, cobbles & gravels - (est. 75% by wt.) - subangular - quartzite & sandstone - with sand, fine silty - few non-plastic fines - brown red - loose - moist - seepage at 8.5' - hole caves (GM)

11.0 11.2 Boulders - large with small cobbles & gravels - clean - compact - cannot be dug. Bottom of hole.

TP 408 STA. 111' L C/L PIPE 2+90. ELEV. 1760.8

0.0 0.8 Topsoil - sand, silty - red brown - damp - loose (SM)

0.8 8.6 Boulders, cobbles (70% by wt.) - subangular - sandstone - with gravel & sand - brown red - loose - moist to wet - water at 6.0' (GM)

8.6 8.7 Boulders - large - too hard to dig - with gravel and cobbles, clean - few fines. Bottom of hole.

TP 409 STA. 280' L C/L PIPE 8+00. ELEV. 1753.7

0.0 0.4 Topsoil - sand, silty - loose - moist - red brown (SM)

0.4 11.2 Boulders, cobbles & gravels - (75% by wt.) - sandstone incutated with sand, silty - brown red - loose - moist - water at 9.3' - boulder 6'x4'x1'. Bottom of hole.

TP 410 STA. 89' L C/L PIPE 7+78. ELEV. 1749.3

0.0 0.4 Topsoil - sand, silty - red brown - loose - damp (SM)

0.4 5.5 Boulders, cobbles & gravel - (75% by wt.) - subangular - quartzite & sandstone - with sand, silty - brown - red - loose - moist - water at 2.5' (GM)

5.5 5.6 Apparent bedrock - gray sandstone - sandstone slabs brought to surface that match sandstone in abutments. Bottom of hole.

TP 501 STA. 316' L C/L PIPE 6+34. ELEV. 1753.1

0.0 0.3 Topsoil - organic - sand, silty - dark brown - roots & leaves (OL)

0.3 9.4 Cobbles, boulders & gravel - (80% by wt.) - quartzite - subangular & sub-blocky with sand, fine silty - few non-plastic fines - brown red - moist - loose - alluvial - water at 4.4' - increasing sandiness with depth (sand 35% by wt. at 9.4') (GM)

9.4 9.5 Assumed hard rock - backhoe refusal - gray flaggy sandstone brought to surface - some sandstone exposed in roadbank. Bottom of hole.

TP 502 STA. 306' L C/L PIPE 6+34. ELEV. 1753.1

0.0 0.3 Topsoil - organic - sand, silty - dark brown - roots & leaves (OL)

0.3 8.1 Cobbles, boulders & gravel (60% by wt.) - quartzite - subangular & sub-blocky - with sand, fine, silty - some non-plastic fines - brown red - moist - loose - alluvial - water at 7.0' (GM)

8.1 8.1 Assumed rockline - no rock brought to surface - backhoe refusal Bottom of hole.

TP 503 STA. 36' L C/L PIPE 6+88. ELEV. 1749.5

0.0 0.4 Topsoil - sand, silty - brown red - loose - damp (SM)

0.4 5.0 Sand, silty fine - (60% fine sand) - common cobbles at bottom - brown red - loose - moist - water at 9.1' (SM)

5.0 10.8 Boulders, cobbles & gravel - (75% by wt.) - quartzite - subangular - with sand, fine silty - (60% fine sand) - few non-plastic fines - brown red - wet - alluvial - hard to dig - boulder bed at 9.3' - large flat boulders 2'x2'x1' average (GM)

10.8 10.9 Tightly cemented large boulders - cannot be dug - boulders average 2'x2'x1'. Bottom of hole.

TP 504 STA. 50'R C/L PIPE 6+88. ELEV. 1752.7

0.0 0.7 Topsoil - sand, fine silty - many non-plastic fines - organic - dark brown - roots (SM)

0.7 10.0 Cobbles, boulders & gravels - (70% by wt.) - red - sandstone - subangular - with sand, fine silty - few non-plastic fines - dark brown red - moist to wet - water at 7.0' (GM)

10.0 10.1 Boulder bed - large boulders - some 3'x2'x1' - flat lying - cannot be dug. Bottom of hole.

LEGEND

TEST HOLE NUMBERING SYSTEM

Centerline of dam 1 - 99

Borrow area 101 - 199

Emergency spillway 201 - 299

Centerline of outlet structure 301 - 399

Foundation 401 - 499

Toe Drain 501 - 599

UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOLS

GW Well graded gravels; gravel-sand mixtures

GP Poorly graded gravels

GM Silty gravels; gravel-sand-silt mixtures

GC Clayey gravels; gravel-sand-clay mixtures

SW Well graded sands; sand-gravel mixtures

SP Poorly graded sands

SM Silty sands; sand-silt mixtures

SC Clayey sands; sand-clay mixtures

ML Silts; silty, v. fine sands; sandy or clayey silts

CL Clays of low to medium plasticity; silty, sandy or gravelly

CH Clays of high plasticity; fat clays

OH Organic silts; silty or clayey silts

OL Organic silts; silty or clayey silts of low plasticity

OH Organic clays or silts of medium to high plasticity

BEDROCK SYMBOLS

Sh Shale

Sl Siltstone

Ss Sandstone

Co Coal

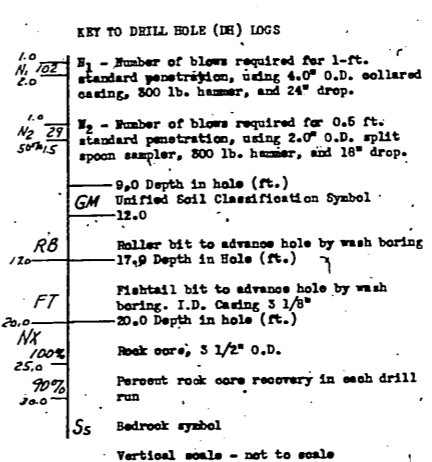
Ms Mudstone

SAMPLES

DS Disturbed

US Undisturbed

PP Pocket Penetrometer readings expressed in tons per sq. ft.



ALL SOIL AND ROCK DESCRIPTIONS WERE DETERMINED BY VISUAL EXAMINATIONS.

(ML) SOIL CLASSIFICATION DETERMINED BY VISUAL EXAMINATION.

CL) SOIL CLASSIFICATION DETERMINED BY LABORATORY TEST.

**“AS BUILT”**

DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
LOGS OF TEST HOLES

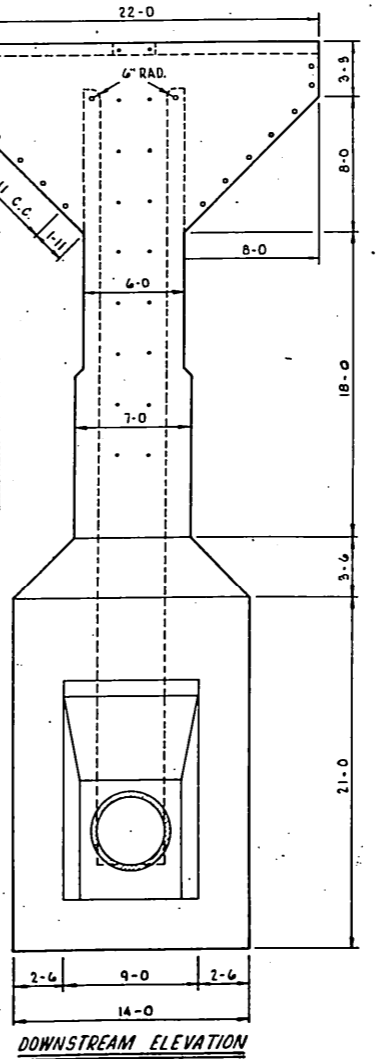
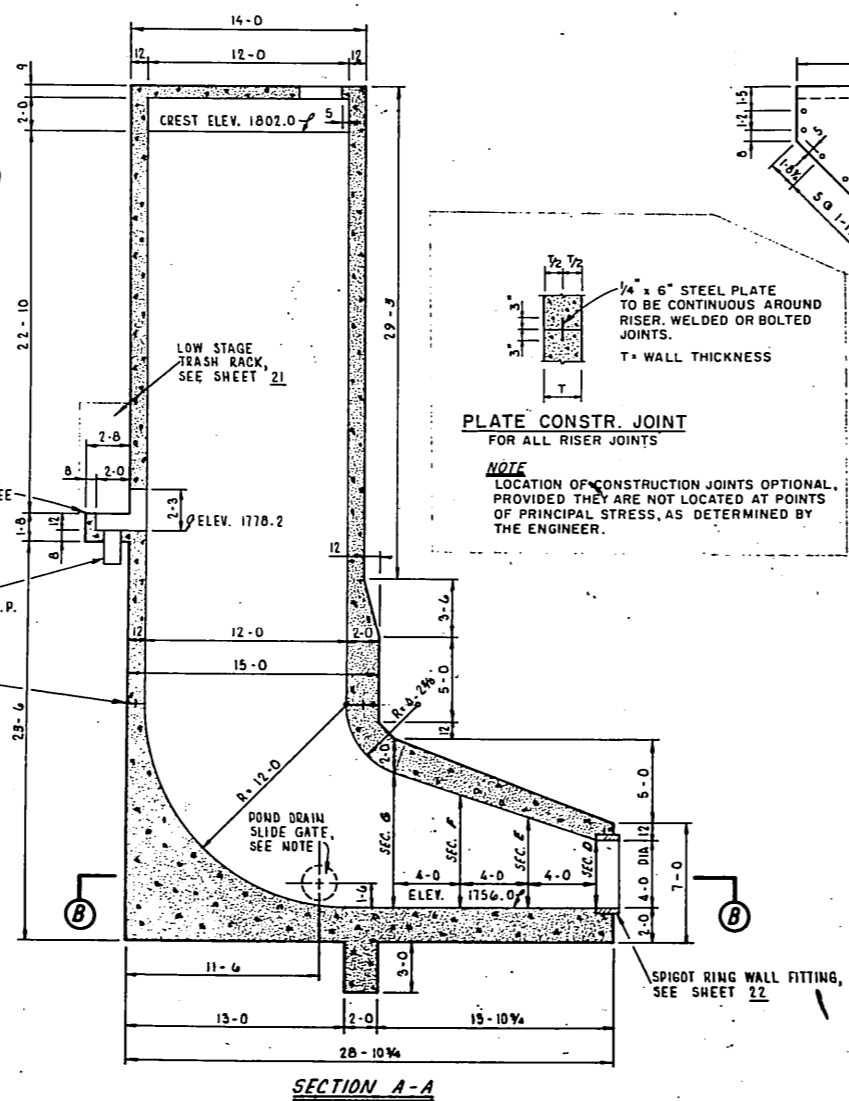
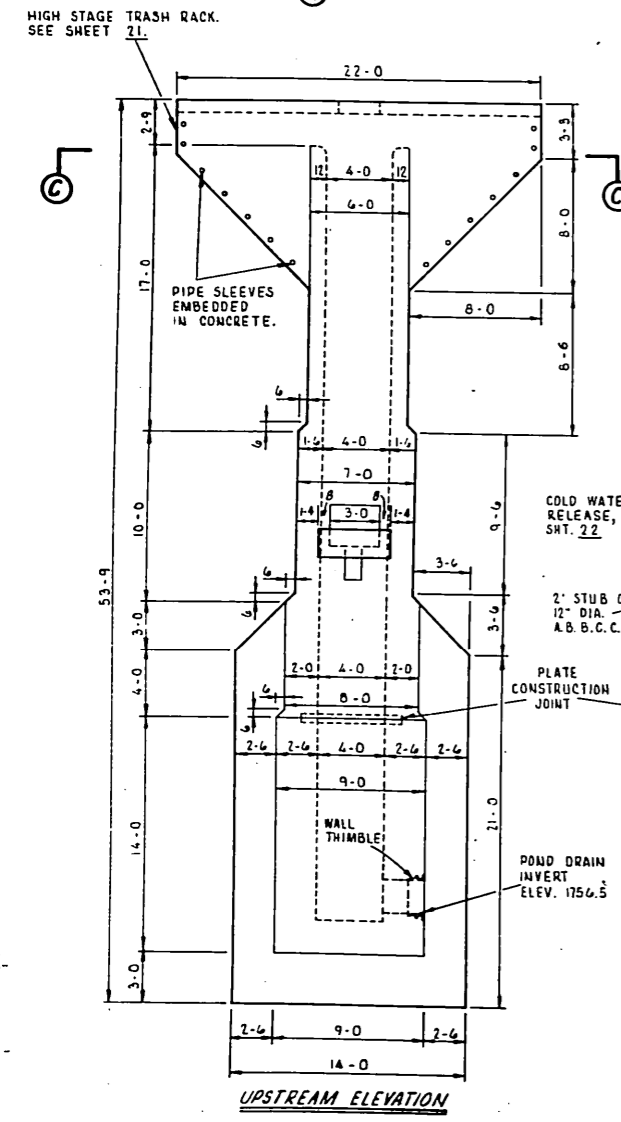
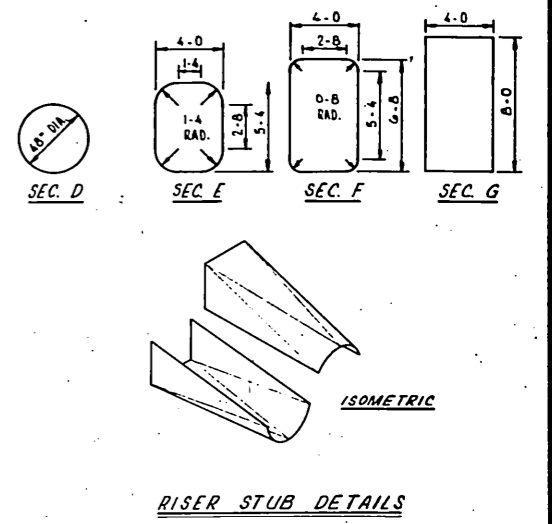
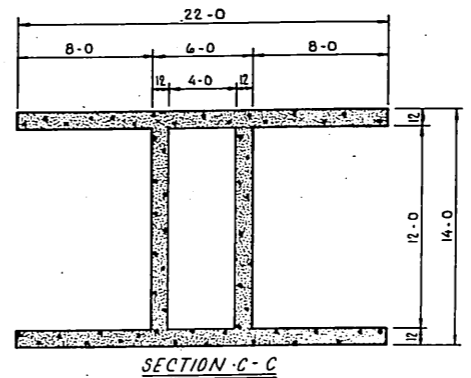
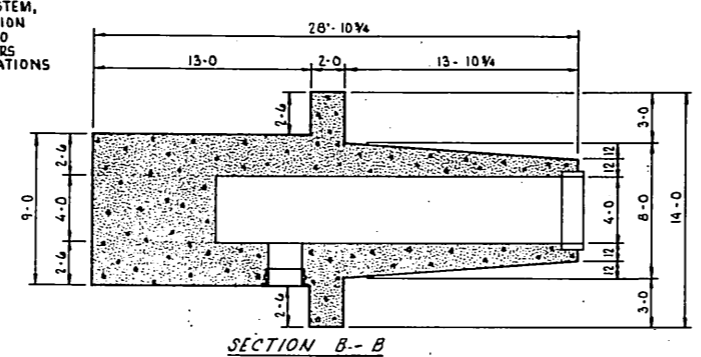
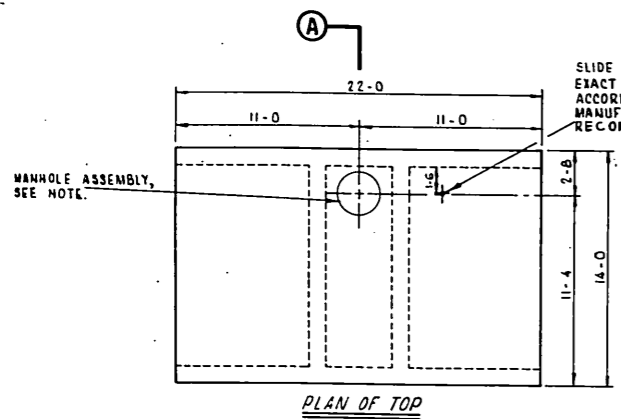
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Investigated by Forner, Moser, & Burton, Oct. '63 Date 10/1/63

Approved by [Signature] Title State Const. Engineer

Geologist's Const. Eng. Helen J. Erdman 12/63 Sheet 1164 Drawing No. VA-490-P

Checked by [Signature] No. 16 of 22



**PLATE CONSTR. JOINT**  
FOR ALL RISER JOINTS

**NOTE**  
LOCATION OF CONSTRUCTION JOINTS OPTIONAL PROVIDED THEY ARE NOT LOCATED AT POINTS OF PRINCIPAL STRESS, AS DETERMINED BY THE ENGINEER.

- MANHOLE ASSEMBLY:**  
30" DIA. HEENAH FOUNDRY MODEL R-6077-A WITH TYPE "A" LIFT HANDLE AND TYPE "E" LOCKING DEVICE OR APPROVED EQUIVALENT.
- SLIDE GATE NOTE:**
- 24" DIA. SLIDE GATE, MODEL 50-10C ARMCO OR APPROVED EQUIVALENT.
  - "F" TYPE WALL THIMBLE, 12" DEEP
  - FLAT BACK
  - 2" DIA. 505' LG. RISING STEM, THREADED PORTION BRONZE, UNTHREADED PORTION STEEL.
  - ARMCO MODEL LIFT CPE-4 OR APPROVED EQUIVALENT
  - SEATING AND OPERATING HEAD = 46.5'
  - BRONZE LIFT NUT AND SEAT FACINGS
  - STEM GUIDES TO BE PROVIDED IN ACCORDANCE WITH MANUFACTURERS RECOMMENDATIONS.
  - STOP NUT TO BE USED.
  - GATE STEM TO BE ENCASED IN OIL FILLED GALVANIZED PIPE EQUIPPED WITH OIL RETAINERS AT BOTH ENDS ACCORDING TO MANUFACTURERS RECOMMENDATIONS.
- SEE SHEET 22 FOR ISOMETRIC VIEW OF RISER.

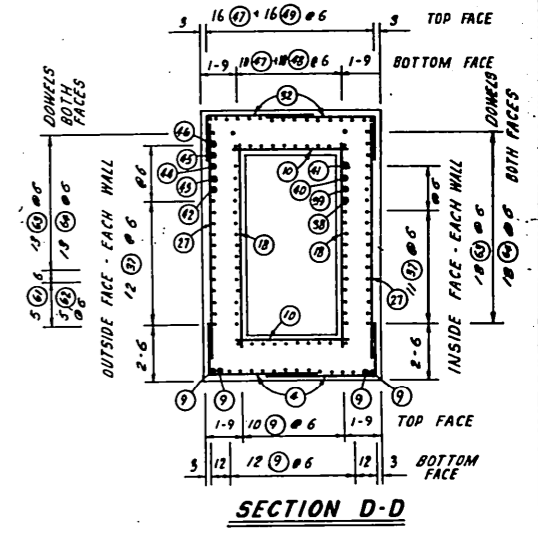
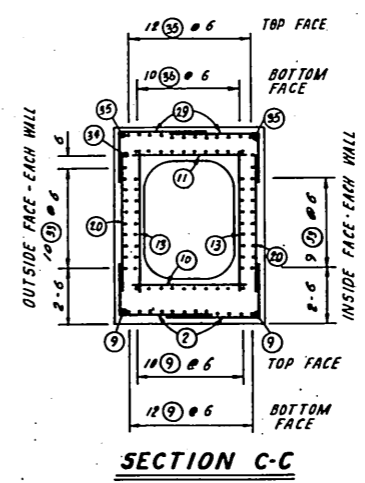
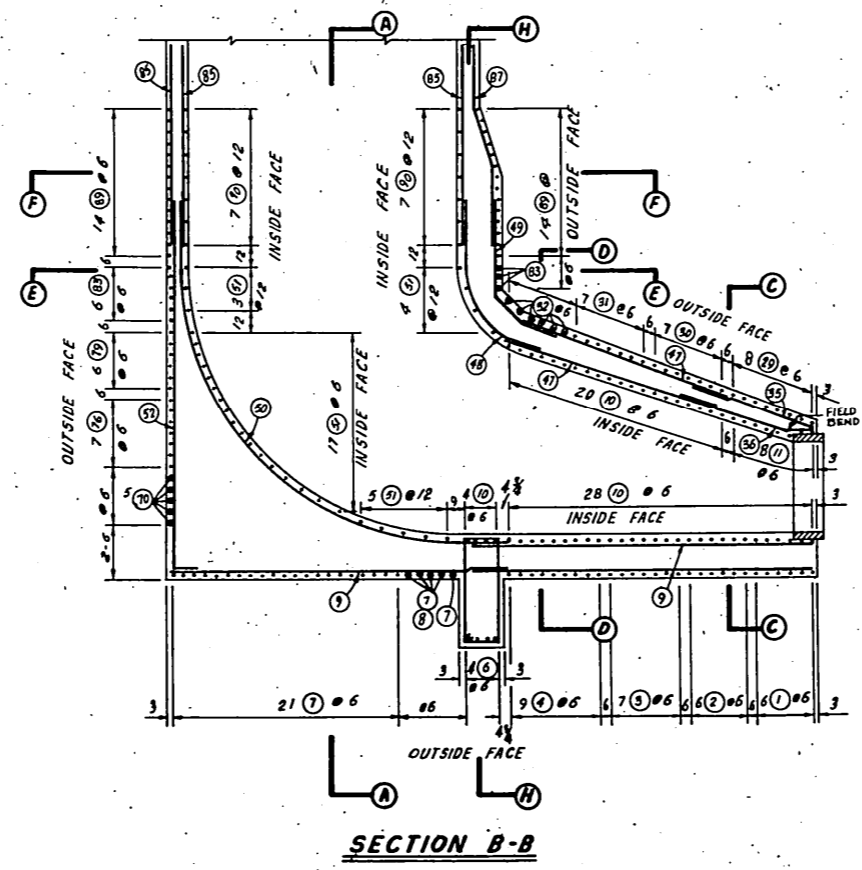
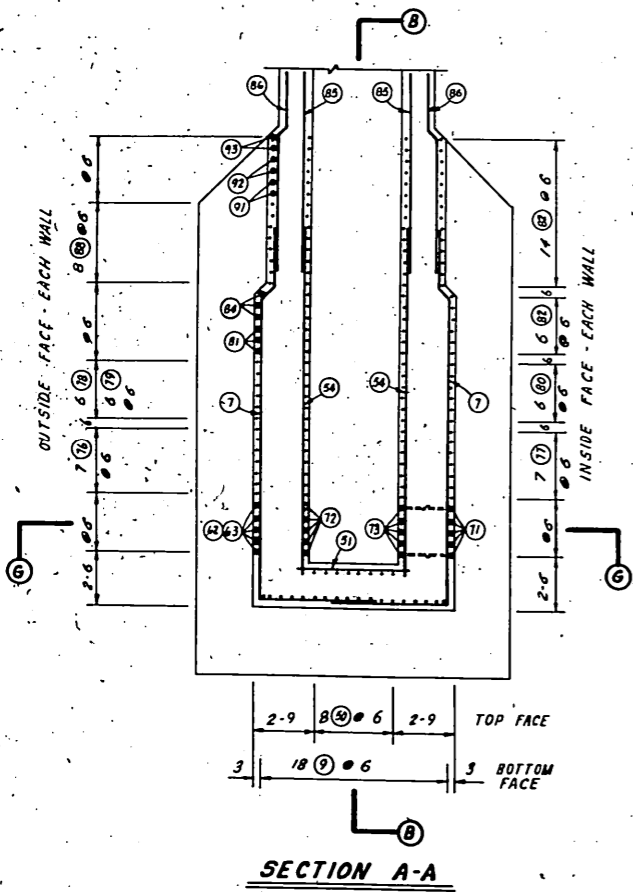
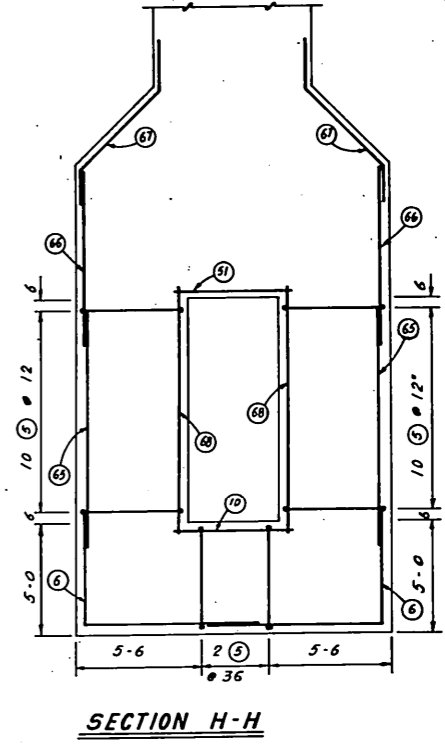
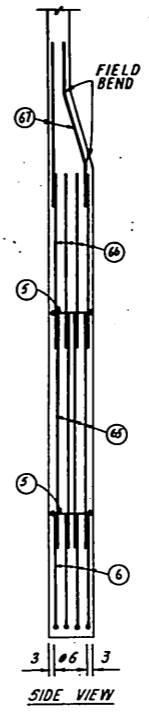
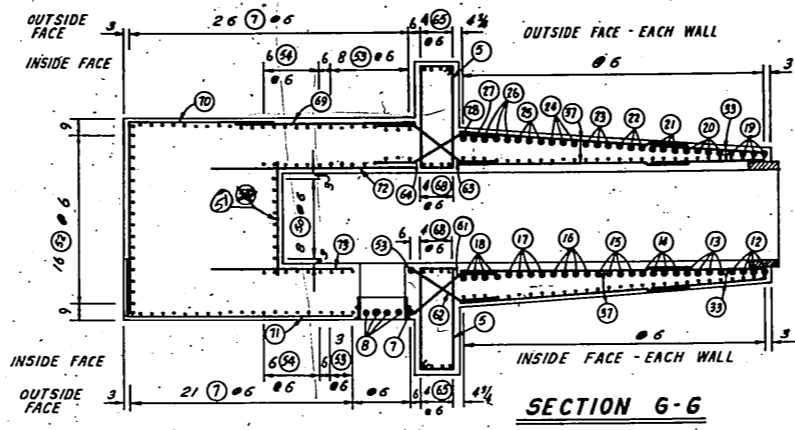
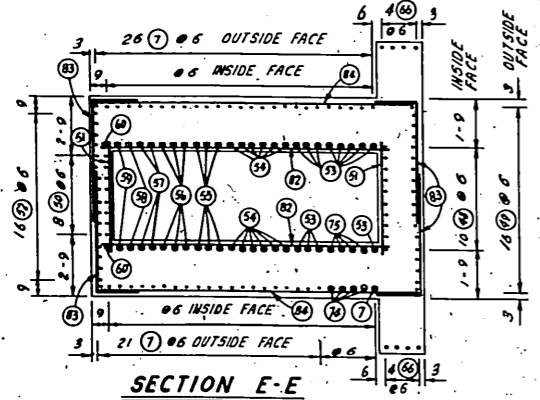
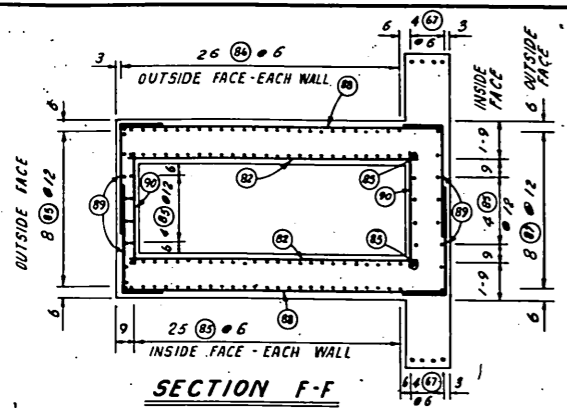
**"AS BUILT"**

SCALE 0 1 2 3 4 5 6 FEET

**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
RISER DETAILS**

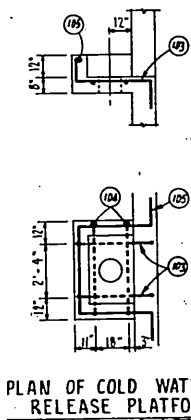
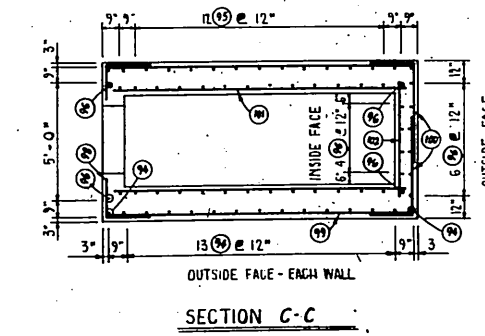
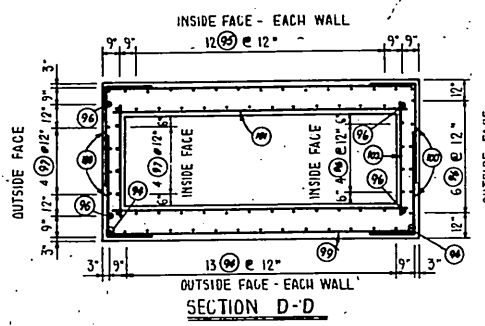
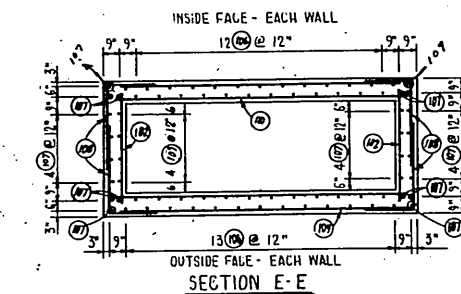
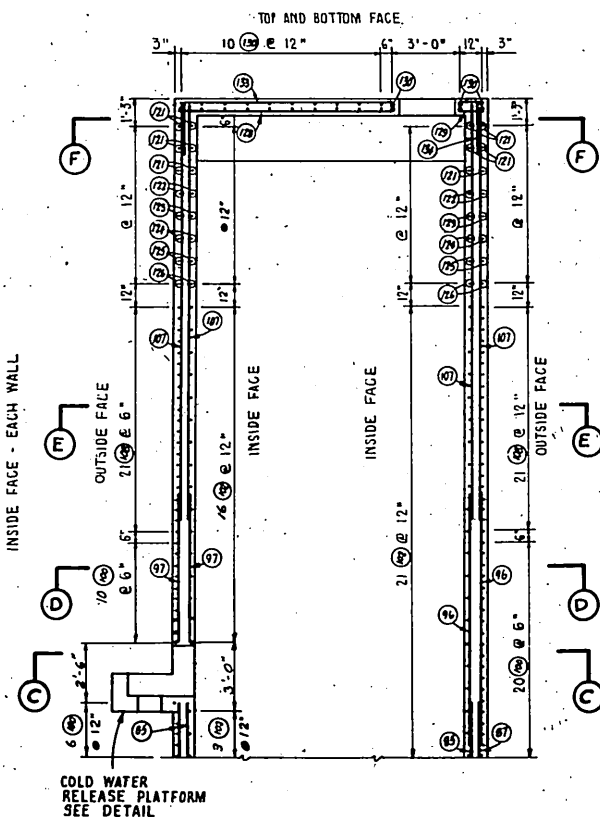
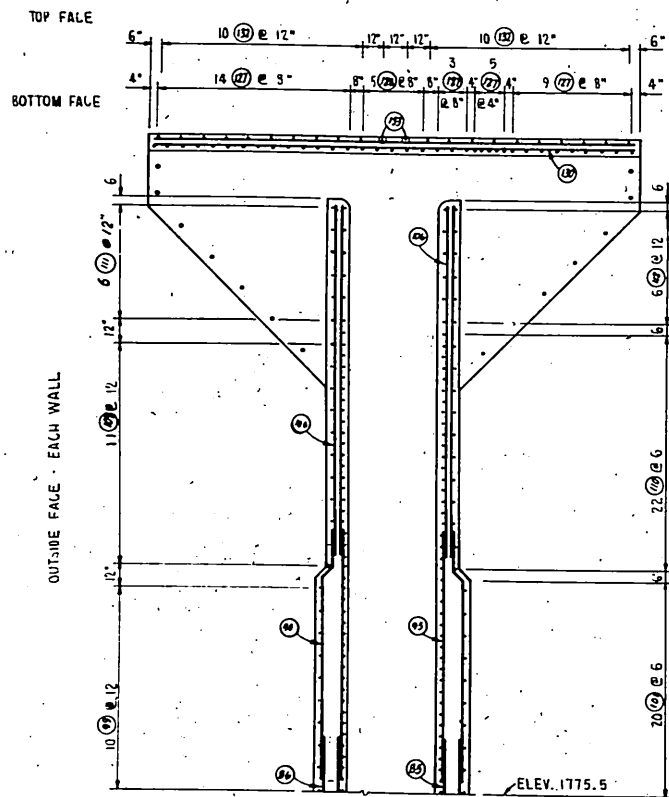
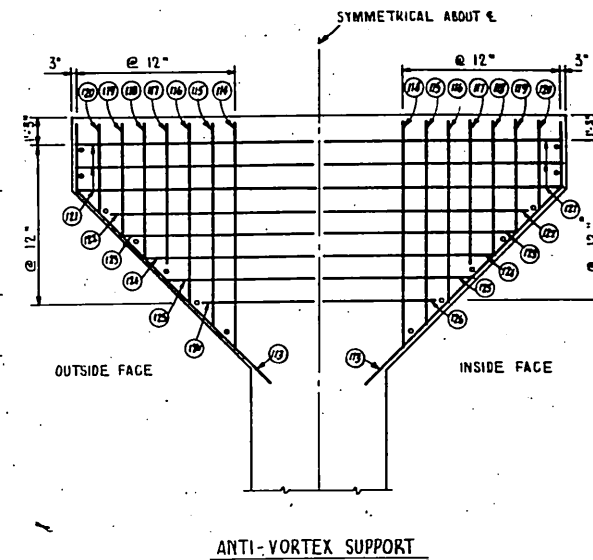
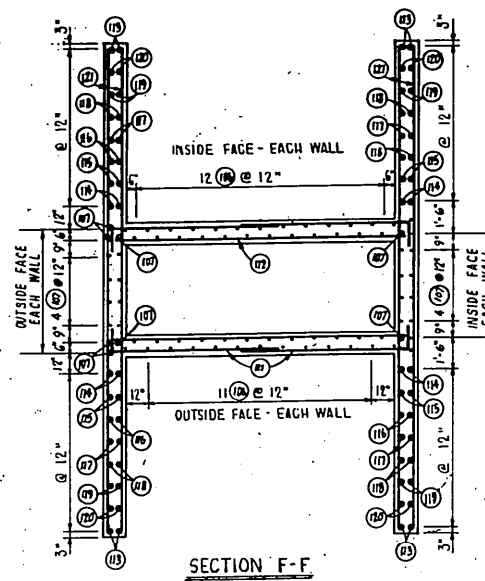
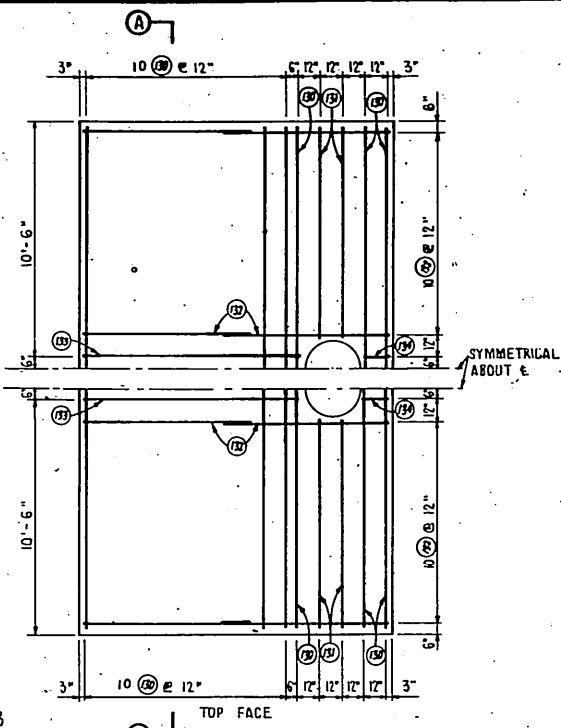
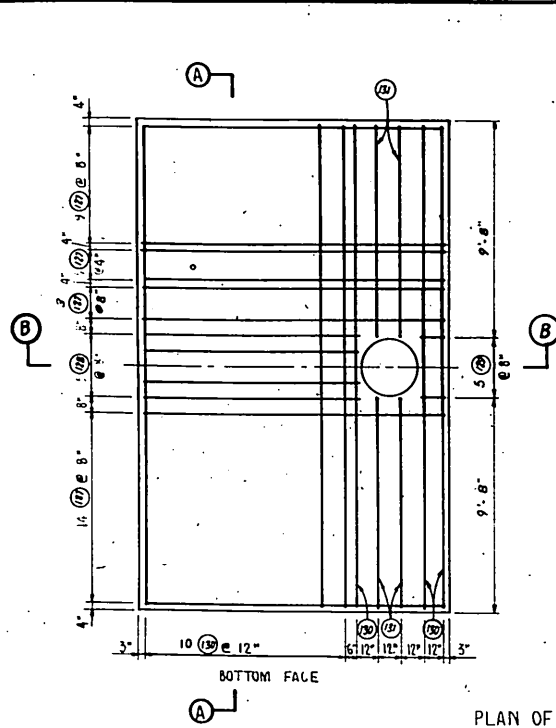
**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed <i>Lee Beck</i>	Date 11/64	Approved by Title
Drawn <i>M. NIKOLICH</i>	Date OCT '64	Title
Traced	Sheet No. 17 of 22	Drawing No. <b>VA-490-P</b>
Checked <i>W. J. Gilman</i>	Date 11/64	



**"AS BUILT"**

<b>DAM NO.77 LITTLE RIVER</b>			
<b>UPPER NORTH RIVER WATERSHED</b>			
AUGUSTA COUNTY, VIRGINIA			
<b>RISER REINF. STEEL DETAILS</b>			
<b>U. S. DEPARTMENT OF AGRICULTURE</b>			
<b>SOIL CONSERVATION SERVICE</b>			
Designed	Date	Approved by	Title
<i>Lee Beck</i>	11/64		
Drawn			
<i>C.B. FORD</i>	OCT '64		
Traced			
Checked			
<i>Doc. Simpson</i>	11/64		
Sheet	Drawing No.		
No. 18	VA-490-P		
of 22			

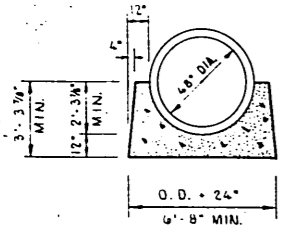


**"AS BUILT"**

**DAM NO. 77 - LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
RISER REINF. STEEL DETAILS**

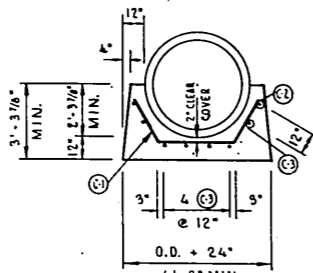
**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed <i>J.W. Cook</i>	Date 11/68	Approved by <i>W.H. Morgan</i>	Title
Drawn <b>W.H. MORGAN</b>	<b>OCT '64</b>		
Traced			
Checked <i>W.H. Morgan</i>	11/64	Sheet No 19 of 22	Drawing No <b>VA-490-P</b>



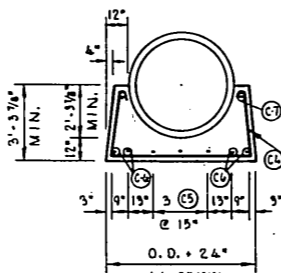
CONC. CRADLE DETAILS

FROM J-1 TO J-10 &  
FROM J-28 TO J-35



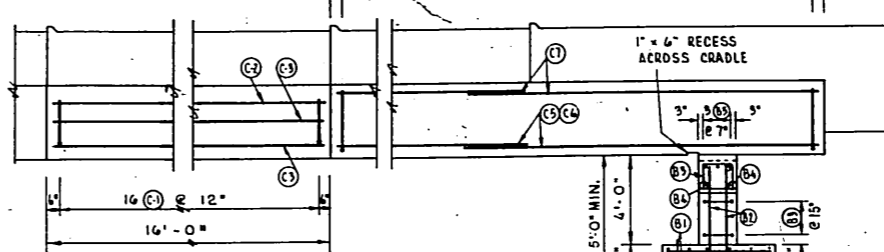
REINF. CONC. CRADLE DETAILS

FROM J-10 TO J-28

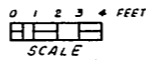


REINF. CONC. CRADLE DETAILS

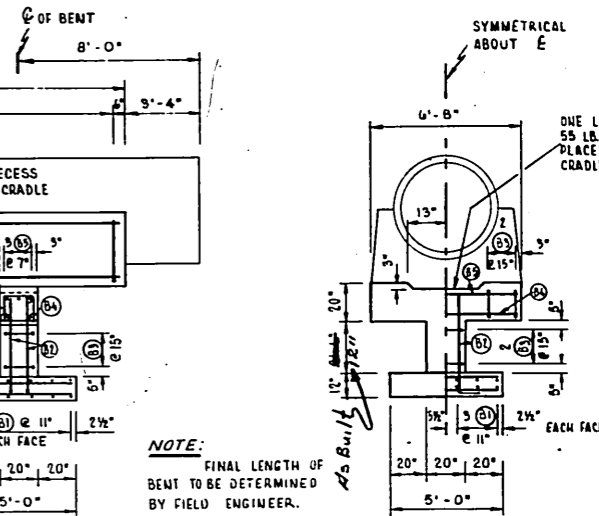
FROM J-35 TO 3'-4\"/>



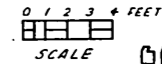
CONC. & REINF. CONC. CRADLE DETAILS



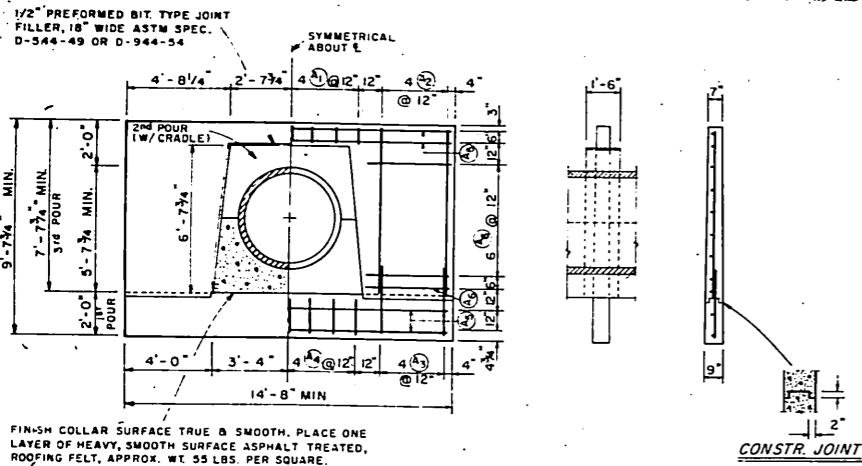
Note: Collars IX thru XII  
Bar #2-A had to be  
longer than by adding 2.25 ft  
to each bar because O.D.  
of pipe was 6 1/2\"/>



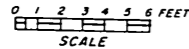
REINF. CONC. BENT DETAILS



“AS BUILT”



REINFORCED CONCRETE ANTI-SEEP COLLAR DETAILS 20 REQ.



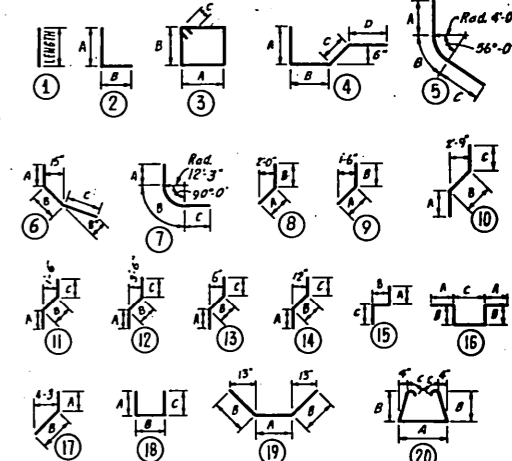
STEEL SCHEDULE

MARK	LOCATION	QUAN	SIZE	LENGTH	TYPE	A	B	C	TOTAL FT.
51		29	6	5-0	1				145.00
52		16	6	17-9	2	16-9	1-0		284.00
53		6	6	15-6	1				174.00
54		12	6	14-6	1				174.00
55		6	6	13-0	1				78.00
56		6	6	12-0	1				72.00
57		4	6	10-0	1				40.00
58		2	6	8-0	1				16.00
59		2	6	7-0	1				14.00
60		2	6	5-0	1				10.00
61		5	5	4-5	8	2-10	1-7		22.08
62		5	5	4-1	9	2-6	1-7		20.42
63		31	5	6-0	10	1-7	2-10	1-7	186.00
64		31	5	5-8	11	1-7	2-6	1-7	175.66
65		8	5	11-0	1				88.00
66		8	10	8-0	1				64.00
67		4	5	8-10	12	1-7	5-0	2-3	35.33
68		8	7	11-0	1				88.00
69		5	6	8-0	1				40.00
70		5	8	15-1	2	6-6	8-7		75.42
71		5	8	12-6	2	10-0	2-6		62.50
72		5	6	19-0	1				45.00
73		5	6	6-3	1				31.25
74		4	6	12-6	13	9-0	0-9	2-9	50.00
75		4	6	12-3	1				49.00
76		14	6	18-0	2	12-9	5-3		252.00
77		14	6	11-0	1				154.00
78		12	6	11-6	1				138.00
79		12	7	8-5	2	3-0	5-5		101.00
80		12	7	12-0	1				144.00
81		6	6	12-9	1				76.50
82		40	8	13-0	1				520.00
83		18	7	7-4	2	1-11	5-5		132.00
84		6	6	14-6	1				87.00
85		68	5	9-0	1				612.00
86		52	5	9-6	13	6-0	0-9	2-9	491.82
87		8	5	8-11	14	2-9	3-2	3-0	71.35
88		16	5	14-6	1				232.00
89		56	7	6-8	2	1-9	4-11		373.33
90		14	5	5-0	1				70.00
91		4	5	14-3	1				57.00
92		4	5	13-9	1				55.00
93		4	5	13-6	1				54.00
94		30	6	11-8	13	9-0	0-9	1-11	350.00
95		24	6	11-6	1				276.00
96		14	5	11-6	1				161.00
97		8	5	6-9	1				54.00
98		8	7	3-3	2	1-6	1-9		26.00
99		20	6	13-6	1				270.00
100		72	7	6-5	2	4-5	2-0		462.00
101		40	7	13-0	1				520.00
102		40	5	5-0	1				200.00
103		2	4	3-6	15	1-0	3-3	1-3	11.00
104		2	4	6-0	18	1-0	4-0	1-0	12.00
105		1	4	9-9	16	1-3	3-3	4-0	9.75
106		50	5	15-9	1				787.50
107		28	5	18-9	1				525.00
108		84	6	5-11	2	3-9	2-2		497.00
109		22	5	12-6	1				275.00
A-1	COLLAR	140	4	0-8	1				93.33
A-2		160	4	7-3	1				116.00
A-3		160	4	3-0	1				480.00
A-4		140	4	1-6	1				210.00
A-5		80	4	14-3	1				1140.00
A-6		240	4	3-6	1				840.00
B-1	BENT	24	5	4-7	1				110.00
B-2		4	9	5-3	2	4-3	1-0		21.00
B-3		6	3	5-4	3	1-2	1-2	0-4	32.00
B-4		2	6	6-3	1				12.50
B-5		3	9	6-3	1				18.75
C-1	CRADLE	288	4	7-6	19	3-6	2-0		2160.00
C-2		36	6	15-6	1				558.00
C-3		108	4	15-6	1				1674.00
C-4		29	4	12-11	20	6-3	2-10	0-6	374.58
C-5		6	4	14-0	1				84.00
C-6		8	9	15-9	1				126.00
C-7		4	8	15-6	1				62.00
NO. 3	BAR	32.00	3	12.0	1				384.00
NO. 4	BAR	568.83	3	12.0	1				6826.00
NO. 5	BAR	9061.31	3	12.0	1				108735.72
NO. 6	BAR	2251.6	3	12.0	1				27019.2
NO. 7	BAR	2078.16	3	12.0	1				24937.92
NO. 8	BAR	719.92	3	12.0	1				8639.04
NO. 9	BAR	165.75	3	12.0	1				1989.0
NO. 10	BAR	64.00	3	12.0	1				768.0
CONCRETE:	CLASS "A" TYPE I	161.6							CU. YDS.
	TYPE II	132.1							CU. YDS.
	TYPE III	130.2							CU. YDS.

GENERAL NOTES:

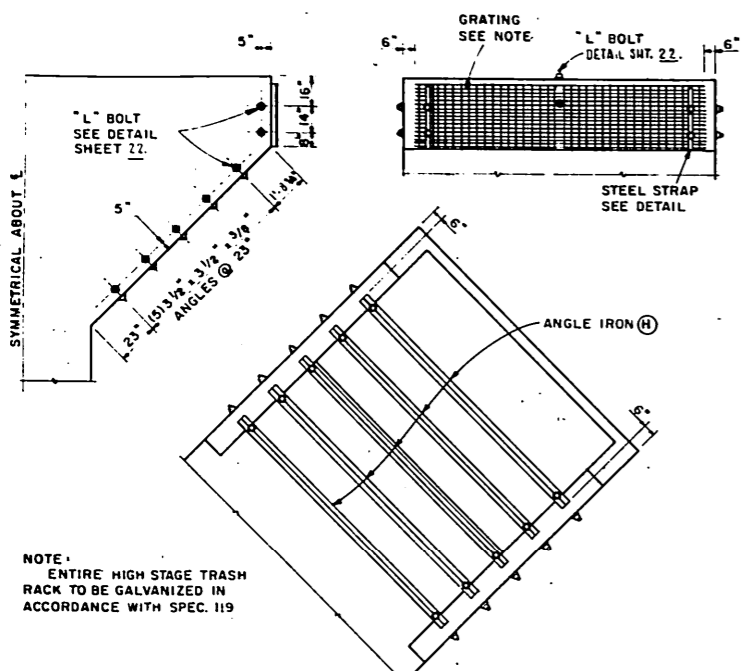
- ALL CONCRETE SHALL BE CLASS "A" & OF THE TYPE NOTED.
- PORTLAND CEMENT TYPE IA OR TYPE I WITH AN AIR-ENTRAINING ADMIXTURE SHALL BE USED.
- ALL REINF. STEEL TO BE LAPPED A MIN OF 30 BAR DIA.
- ALL REINF. STEEL PLACED IN CONCRETE POURED AGAINST THE GROUND SHALL HAVE A MIN. OF 3" CLEAR COVER. WHERE FORMS ARE USED BARS SHALL HAVE A MIN OF 2" CLEAR COVER.
- ALL EXPOSED EDGES OF CONCRETE TO HAVE A 9/16" CHAMFER UNLESS OTHERWISE NOTED.

BAR TYPES

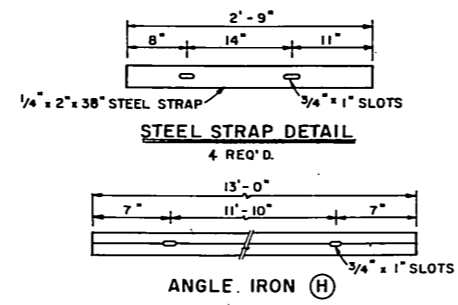


DAM NO.77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

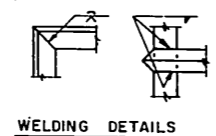
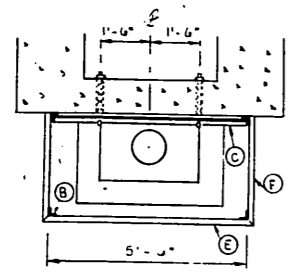
DESIGNED: [Signature] DATE: 11/64 APPROVED BY: [Signature]  
DRAWN: H.T. BROWNING, JR. OCT. '64  
CHECKED: [Signature] SHEET NO. 20 OF 22 DRAWING NO. VA-490-P



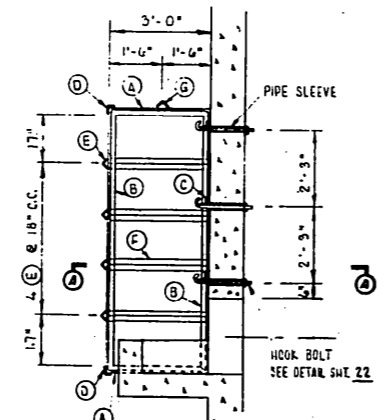
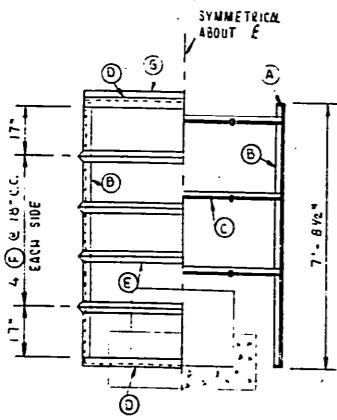
**GRATING NOTE:**  
 BORDEN STEEL GRATING OR APPROVED EQUAL  
 1. TYPE W/B  
 2. SIZE NO. II, 33<sup>7</sup>/<sub>16</sub>" x 13'-0"  
 3. HORIZONTAL BEARING BARS



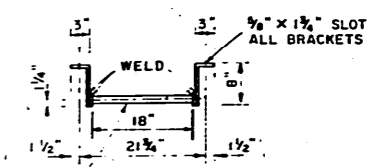
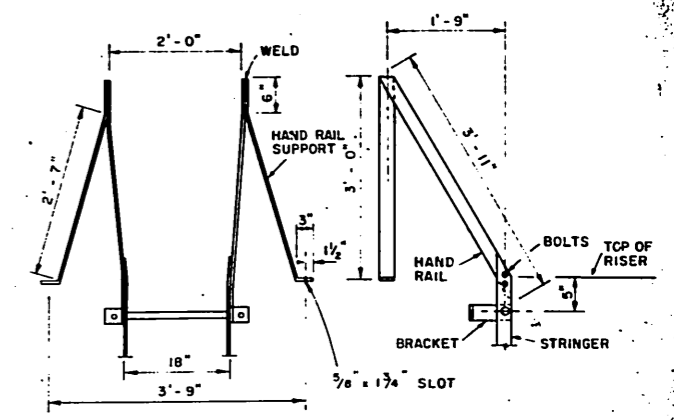
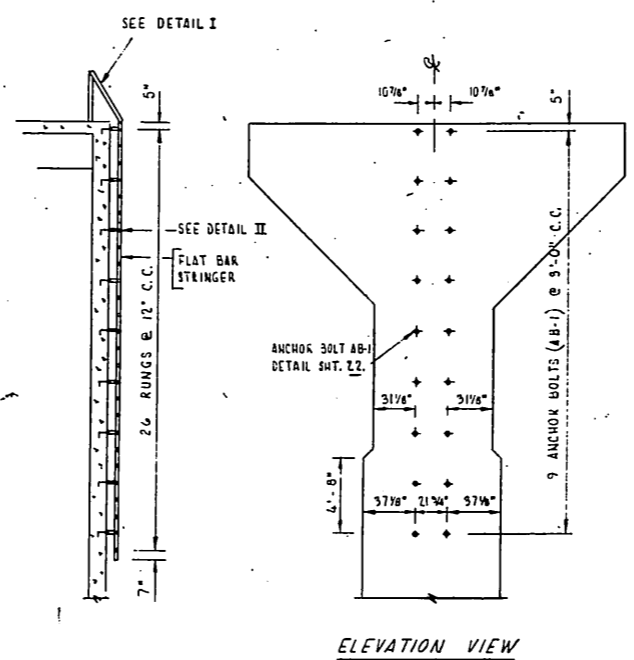
**HIGH STAGE TRASH RACK DETAILS**



**NOTES:**  
 1. ALL POINTS OF CONTACT BETWEEN ANGLE IRONS TO BE WELDED.  
 2. LOW STAGE TRASH RACK TO BE GALVANIZED IN ACCORDANCE WITH SPEC. 119



**DETAILS OF LOW STAGE TRASH RACK**



**LADDER DETAILS**  
 NOT TO SCALE

**NOTE:**  
 LADDER ASSEMBLY TO BE GALVANIZED IN ACCORDANCE WITH SPEC. 119

**"AS BUILT"**

**BILL OF MATERIAL FOR LADDER**

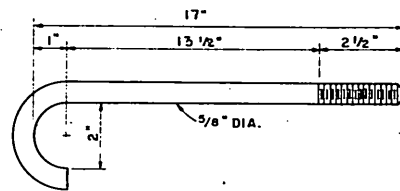
ITEM	SIZE	LENGTH	QUAN.
FLAT BAR HAND RAIL	2 1/2" x 3/8"	3'-11"	2
FLAT BAR HAND RAIL SUPPORT	2 1/2" x 3/8"	3'-4"	2
BOLTS W/NUTS & WASHERS	3/8" DIA.	1 1/2"	4
BRACKETS	2 1/2" x 3/8"	3" x 8"	18
PIPE RUNGS	1" DIA.	1'-6"	26
TOP OF BOLTS AB-1 STAINLESS ST W/NUTS	1/2" DIA.	2" x 8"	20
FLAT BAR STRINGER	2 1/2" x 3/8"	26'-0"	2

**BILL OF MATERIAL**

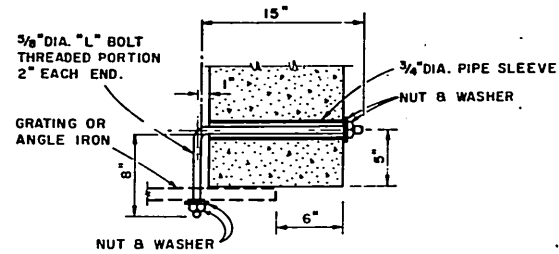
LOCATION	ITEM	SIZE	LENGTH	QUANTITY	
LOW STAGE TRASH RACK	A	ANGLE IRON	2 1/2" x 2 1/2" x 1/4"	5'-0"	4
	B	"	"	7'-8 1/2"	4
	C	"	"	5'-5"	3
	D	"	"	5'-4"	2
	E	"	1 1/2" x 1 1/2" x 1/4"	5'-8"	4
	F	"	"	3'-1"	6
HIGH STAGE TRASH RACK	G	"	5'-6"	1	
	H	STD. GALV. PIPE SLEEVE	3/4" DIA.	12"	6
	I	HORZ. BOLT W/ NUTS & WASHER	3/8" DIA.	17"	6
	J	ANGLE IRON	3 1/2" x 3 1/2" x 3/8"	15'-0"	10
	K	STD. GALV. PIPE SLEEVE	3/4" DIA.	9"	2
	L	STD. GALV. PIPE SLEEVE	3/4" DIA.	12"	28
	M	"L" BOLT GALV. W/NUTS & WASHERS	3/8" DIA.	8" x 15"	50
N	GRATING	No II	33 7/16" x 13'-0"	2	
O	STEEL STRAP	1/4" x 2" x 3/8"	2'-9"	4	

**DAM NO 77 LITTLE RIVER UPPER NORTH RIVER WATERSHED**  
 AUGUSTA COUNTY, VIRGINIA  
**TRASH RACKS & LADDER DETAILS**  
 U.S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

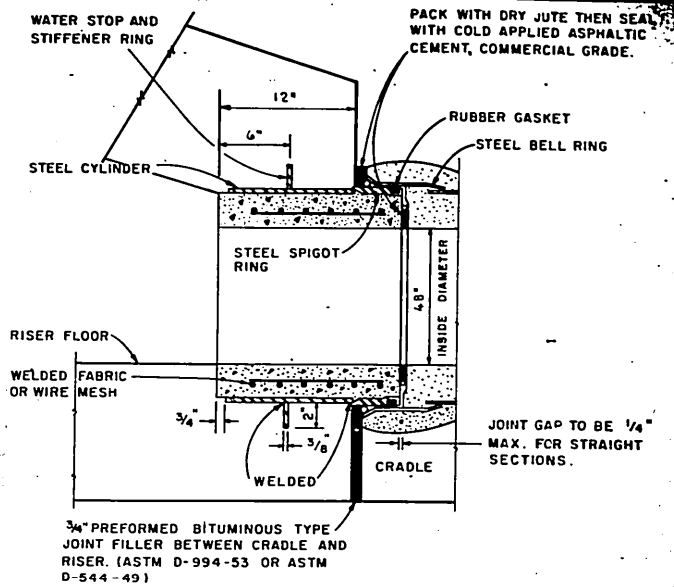
Checked by: *Ben Seed* Date: 11/64  
 Drawn by: *H.T. Browning, Jr.* Date: SEPT 64  
 Title: *VA-490-P*



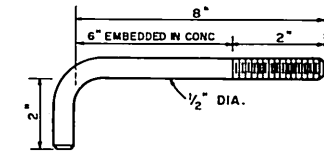
**GALV. HOOK BOLT**  
SUPPLY WITH NUT AND WASHER



**GALV. "L" BOLT DETAIL**  
NOT TO SCALE



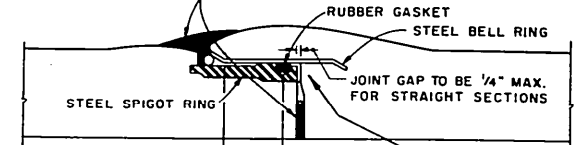
**SPIGOT RING WALL FITTING**



**STAINLESS STEEL ANCHOR BOLT, AB-1**  
SUPPLY WITH NUT AND WASHER

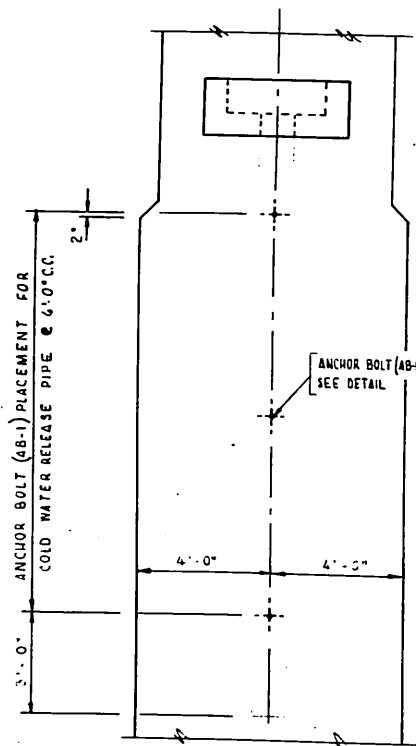
**"AS BUILT"**

PACK WITH DRY JUTE, THEN SEAL WITH COLD APPLIED ASPHALTIC CEMENT, COMMERCIAL GRADE.

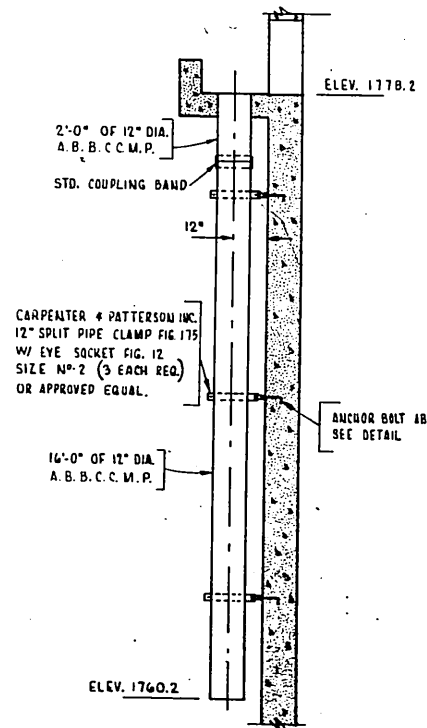


**DETAIL OF REINFORCED CONCRETE WATER PIPE JOINT**

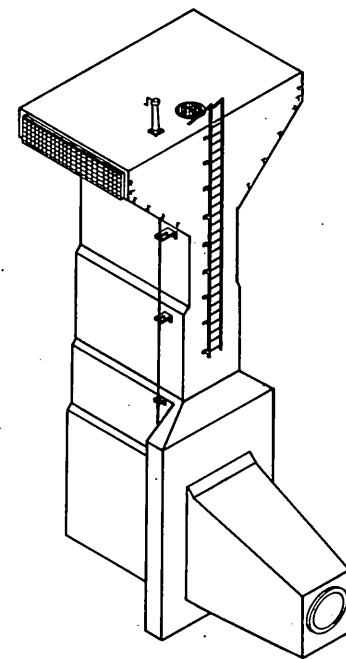
**SPECIAL JOINT:**  
LOCK JOINT DRAWING NO. D-2-944-48" OR APPROVED EQUIVALENT.



**ELEVATION VIEW**

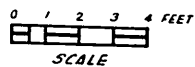


**SECTION e-e**



**ISOMETRIC VIEW OF RISER**  
NOT TO SCALE

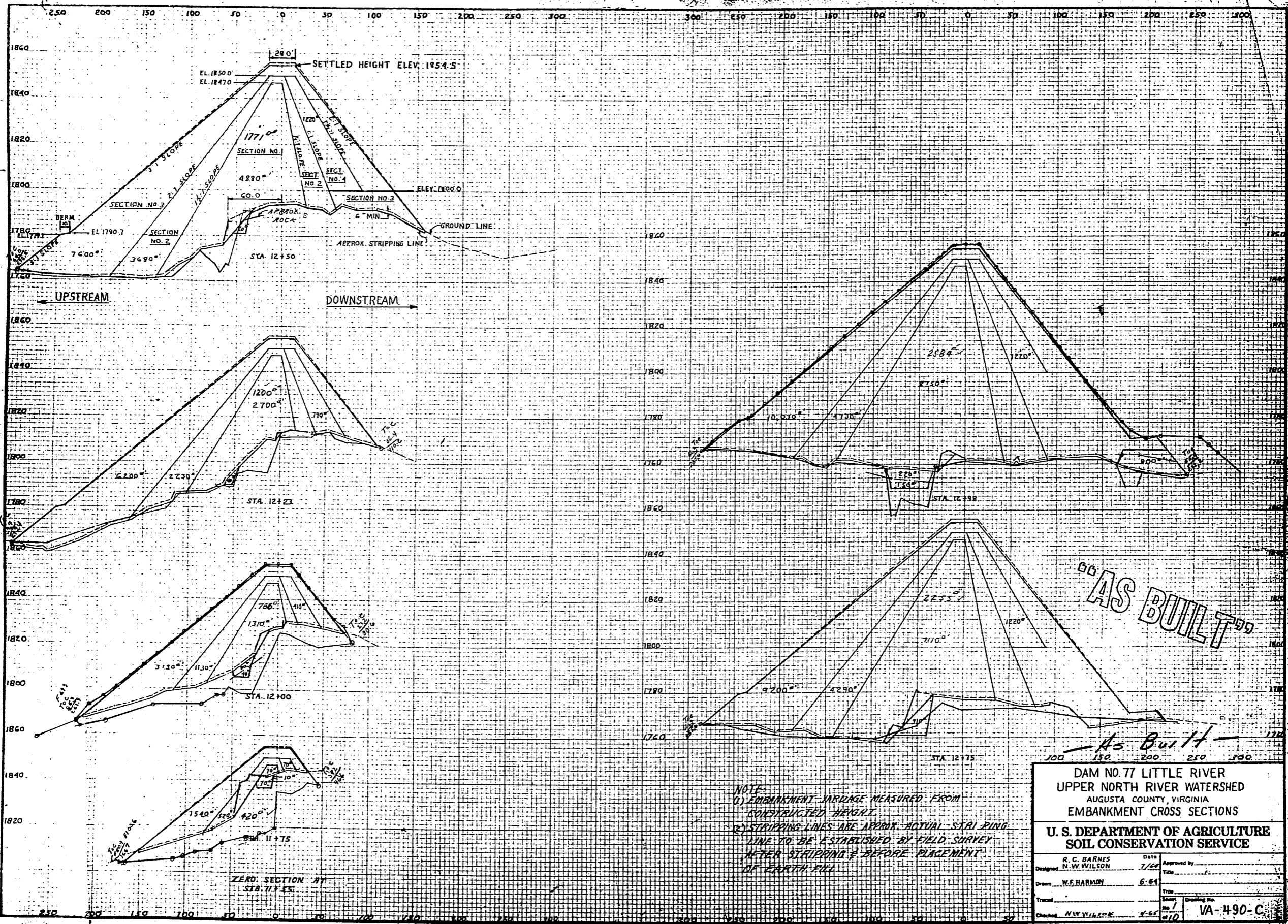
**DETAILS OF COLD WATER RELEASE**



BILL OF MATERIAL				
LOCATION	ITEM	SIZE	LENGTH	QUANTITY
COLD WATER RELEASE	STAINLESS STEEL ANCHOR BOLT AB-1	1/2" DIA.	2" x 8"	3
	SPLIT PIPE CLAMP	12" DIA.		3
	EYE SOCKET	Nº 2		3
	A.B.B.C.C.M.P.	12" DIA.	18' - 0"	
	STD. COUPLING BAND	12" DIA.		1

**DAM NO. 77 LITTLE RIVER UPPER NORTH RIVER WATERSHED**  
AUGUSTA COUNTY, VIRGINIA  
**COLD WATER RELEASE - MISC. DETAILS**  
U.S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed by F. Beck Date 11/64 Approved by \_\_\_\_\_  
 Drawn by H.T. Browning J. Title \_\_\_\_\_  
 Traced by \_\_\_\_\_  
 Checked by \_\_\_\_\_ Sheet No. 22 Drawing No. VA-490-P  
 Date 11/64



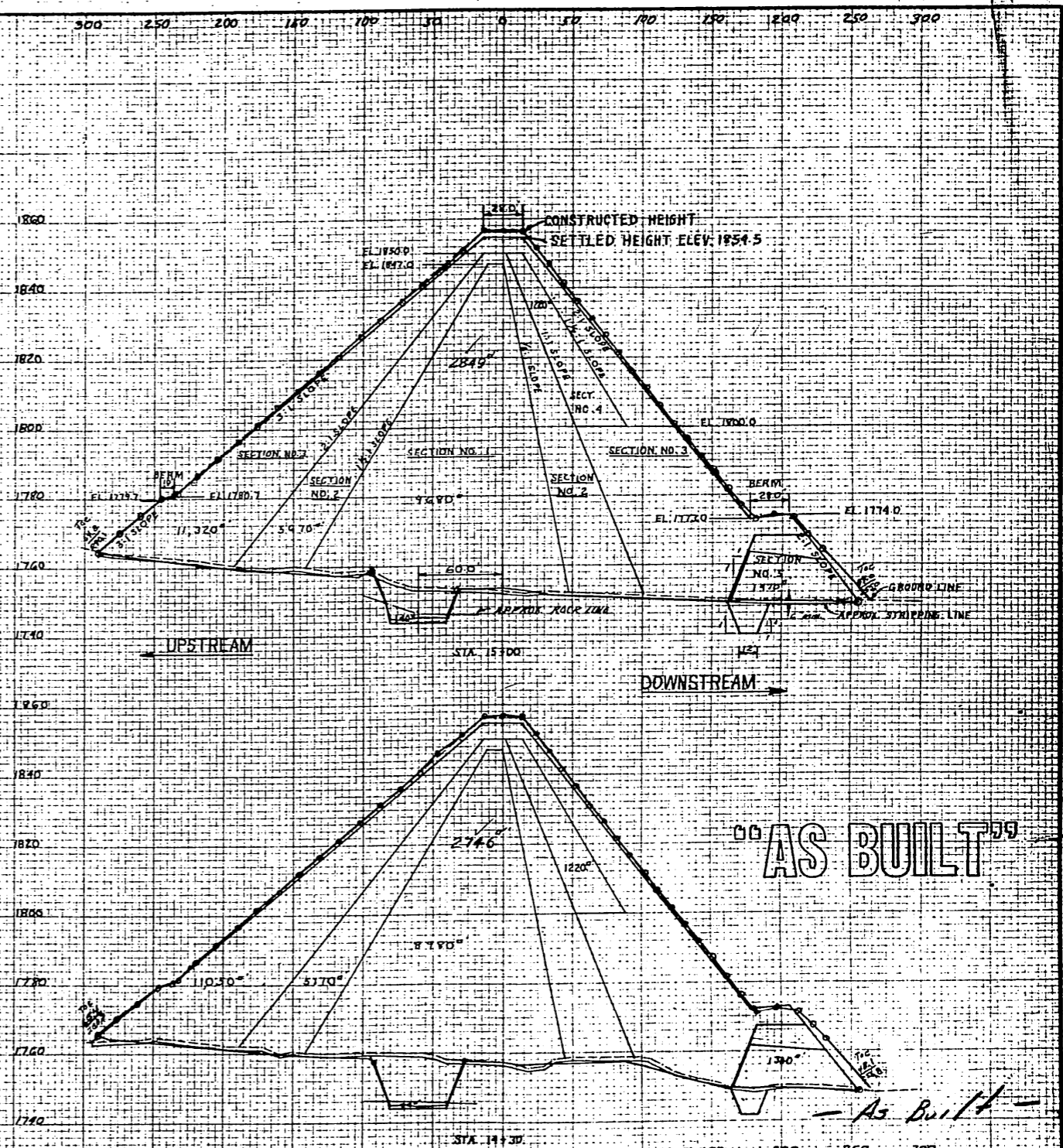
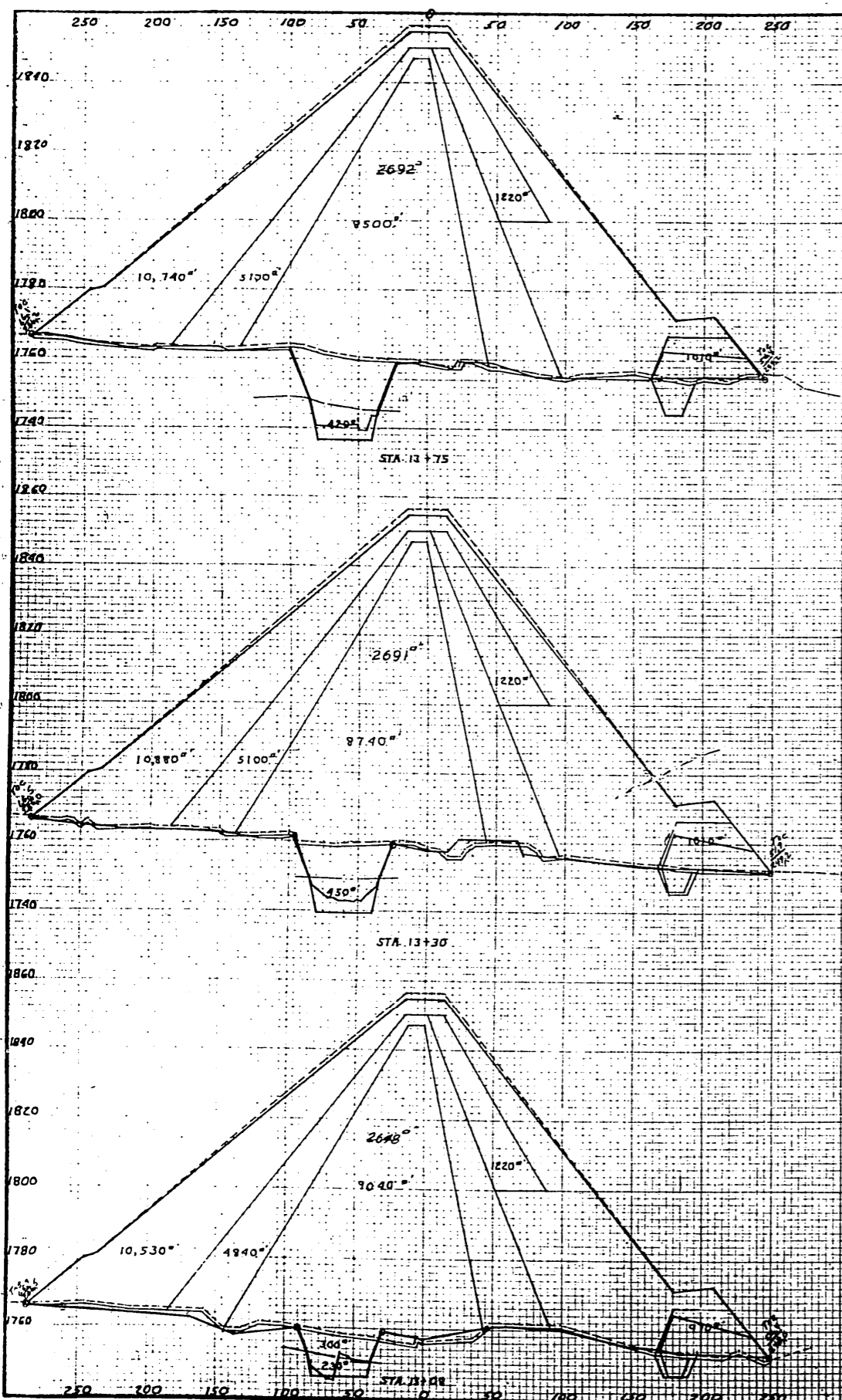
NOTE:  
 1) EMBANKMENT VARDAGE MEASURED FROM CONSTRUCTED HEIGHT.  
 2) STRIPPING LINES ARE APPROX. ACTUAL STRIPPING LINE TO BE ESTABLISHED BY FIELD SURVEY AFTER STRIPPING & BEFORE PLACEMENT OF EARTH FILL.

DAM NO. 77 LITTLE RIVER  
 UPPER NORTH RIVER WATERSHED  
 AUGUSTA COUNTY, VIRGINIA  
 EMBANKMENT CROSS SECTIONS

U. S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

Designed R. C. BARNES N. W. WILSON	Date 7/66	Approved by Title
Drawn W. F. HARMON	Scale 6-64	Title
Checked N. W. WILSON	Date 4-65	Sheet No. 1 Drawing No. VA-490-C





**"AS BUILT"**

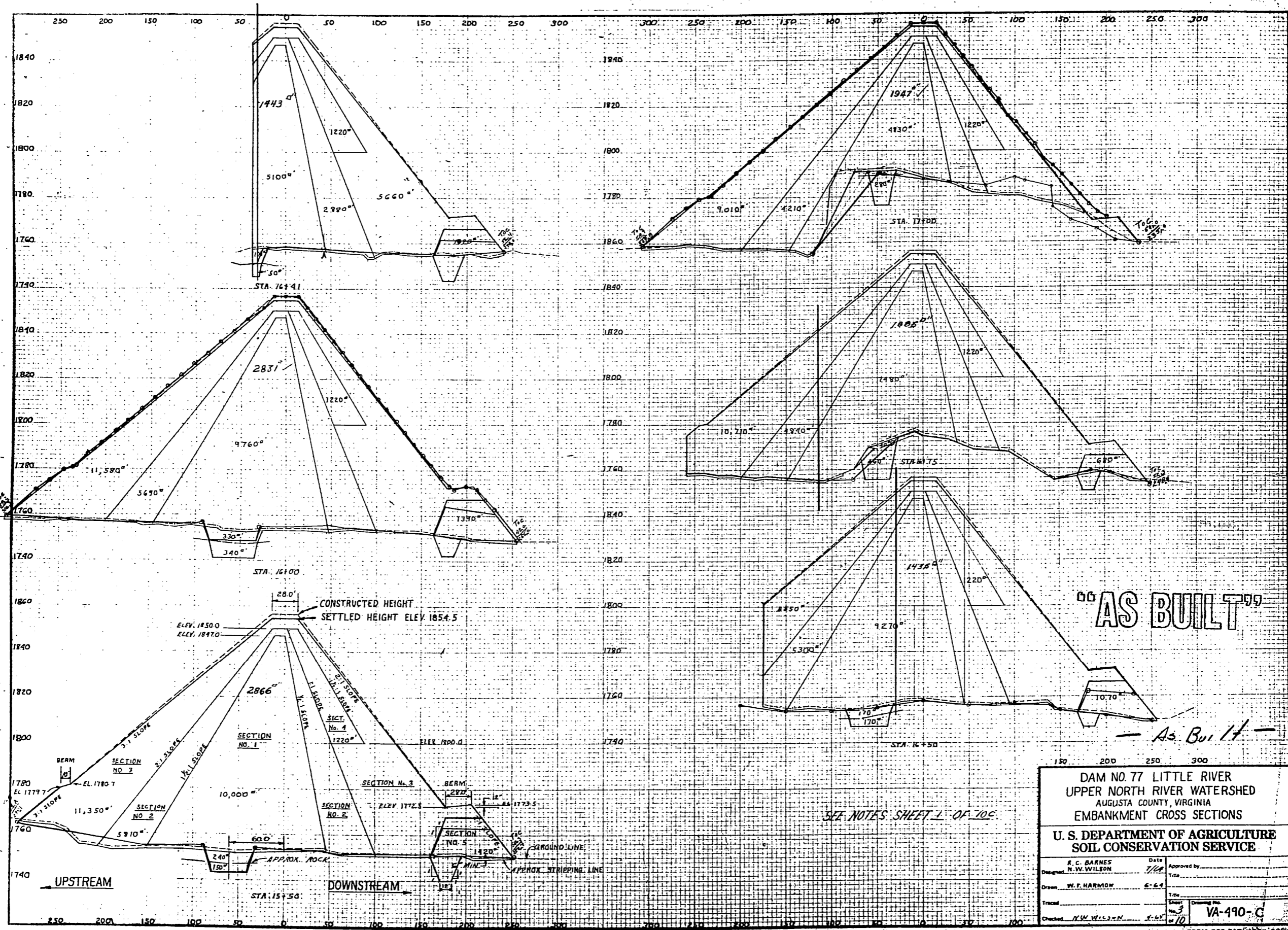
DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
EMBANKMENT CROSS SECTIONS

**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed: R. C. BARNES	Date: 7/60	Approved by: _____
Drawn: W. F. HARMON	Scale: 5'-6"	Title: _____
Traced: _____	Sheet: _____	Sheet No. 2
Checked: A. W. VICKS	Scale: 1"=50'	Drawing No. VA-490-C

FORM SCS-315 (APRIL 1954)

SEE NOTES SHEET 1 OF 107



**DAM NO. 77 LITTLE RIVER**  
**UPPER NORTH RIVER WATERSHED**  
 AUGUSTA COUNTY, VIRGINIA  
**EMBANKMENT CROSS SECTIONS**

**U. S. DEPARTMENT OF AGRICULTURE**  
**SOIL CONSERVATION SERVICE**

Designed <b>R. C. BARNES</b>	Date <b>7/68</b>	Approved by _____
Drawn <b>W. F. HARMON</b>	Scale <b>5'-6"</b>	Title _____
Traced _____	Sheet <b>3</b>	Drawing No. <b>VA-490-C</b>
Checked <b>N.W. WILSON</b>	Scale <b>1"=65'</b>	of <b>10</b>

FORM SCS-315 (APRIL 1967)

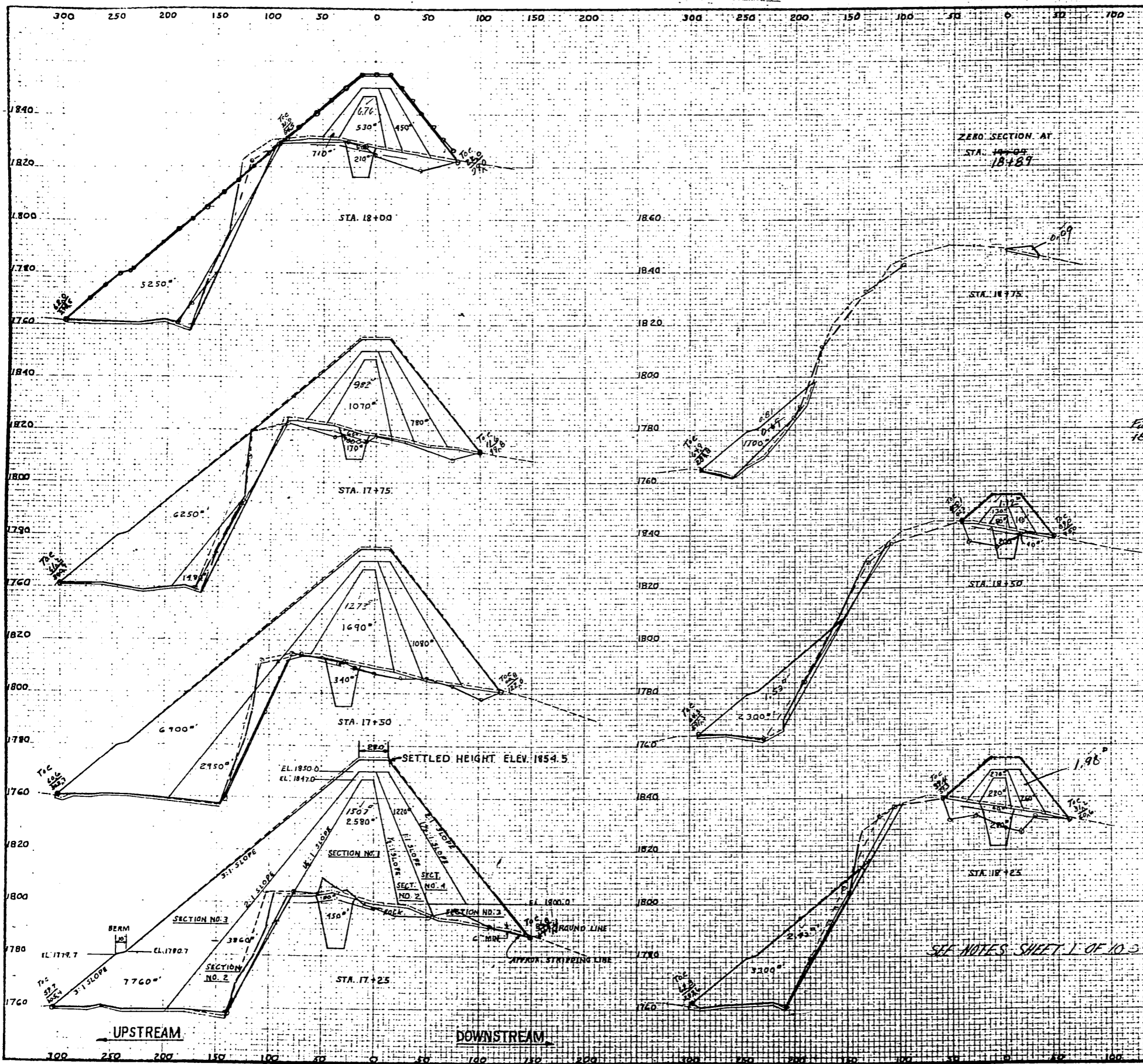
SEE NOTES SHEET 1 OF 10C

"AS BUILT"

— As Built —

UPSTREAM

DOWNSTREAM



ZERO SECTION AT  
STA. 18+00  
18+157

STA. 17+75

Full section at  
17+53.1

STA. 17+50

STA. 17+25

STA. 18+00

STA. 17+75

STA. 17+50

STA. 17+25

SETTLED HEIGHT ELEV. 1854.5

UPSTREAM

DOWNSTREAM

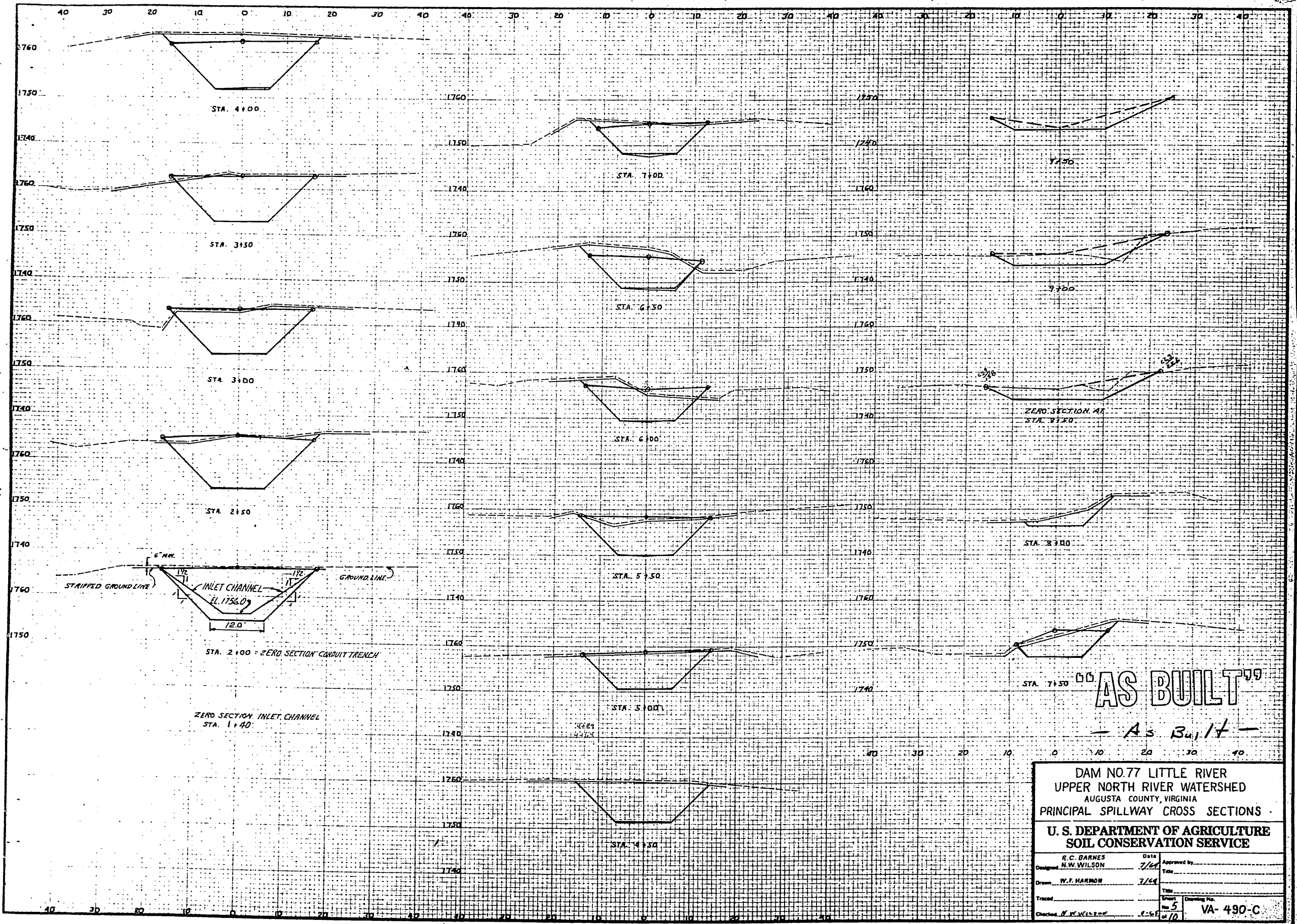
**"AS BUILT"**  
- As Built -

SEE NOTES SHEET 1 OF 10

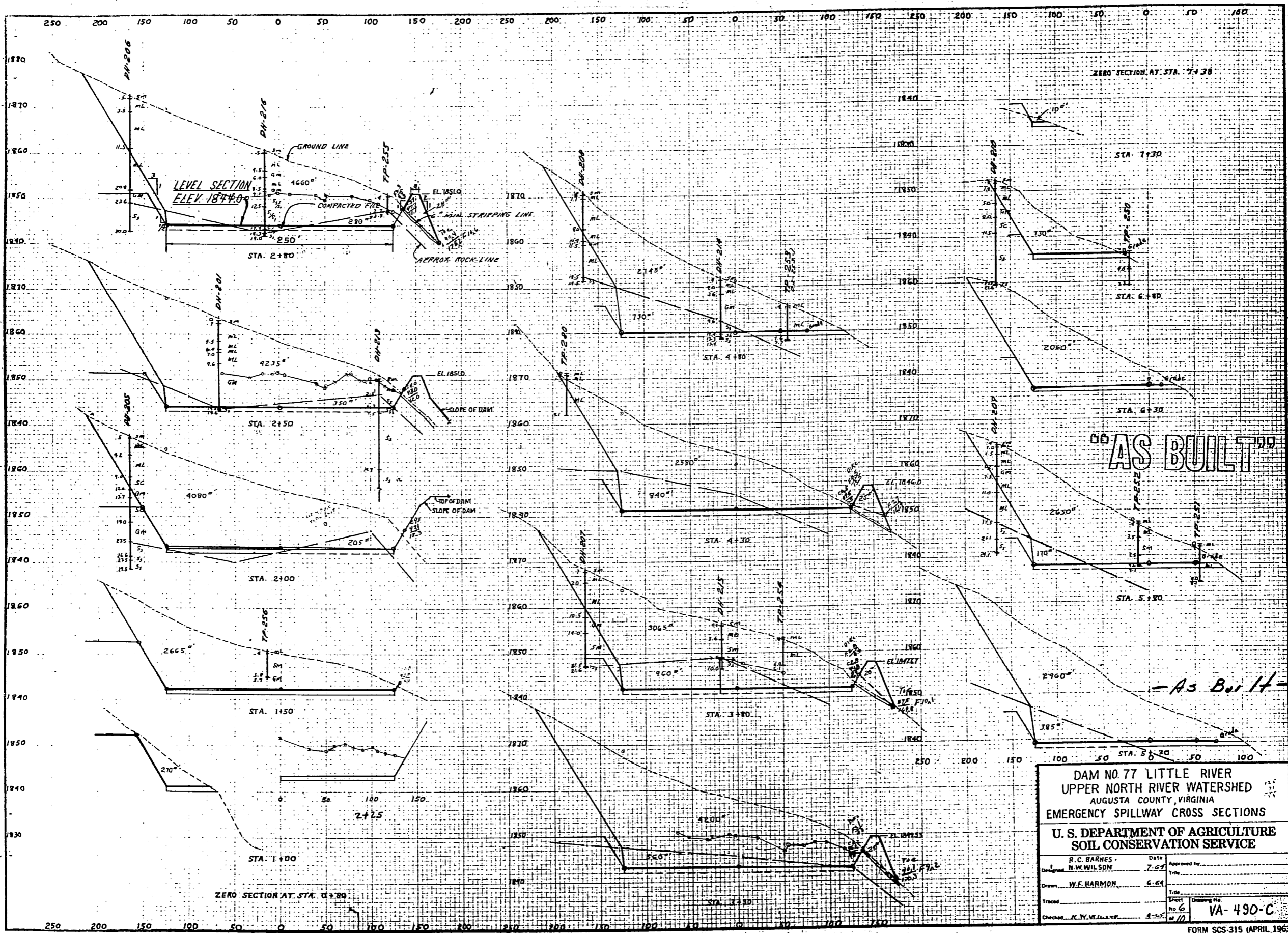
DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
EMBANKMENT CROSS SECTIONS

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed	R. C. BARNES N. W. WILSON	Date	7-61	Approved by	
Drawn	W. F. HARMON	Date	6-64	Title	
Traced		Date		Sheet	1 of 10
Checked	N. W. WILSON	Date		Drawing No.	VA-490-C



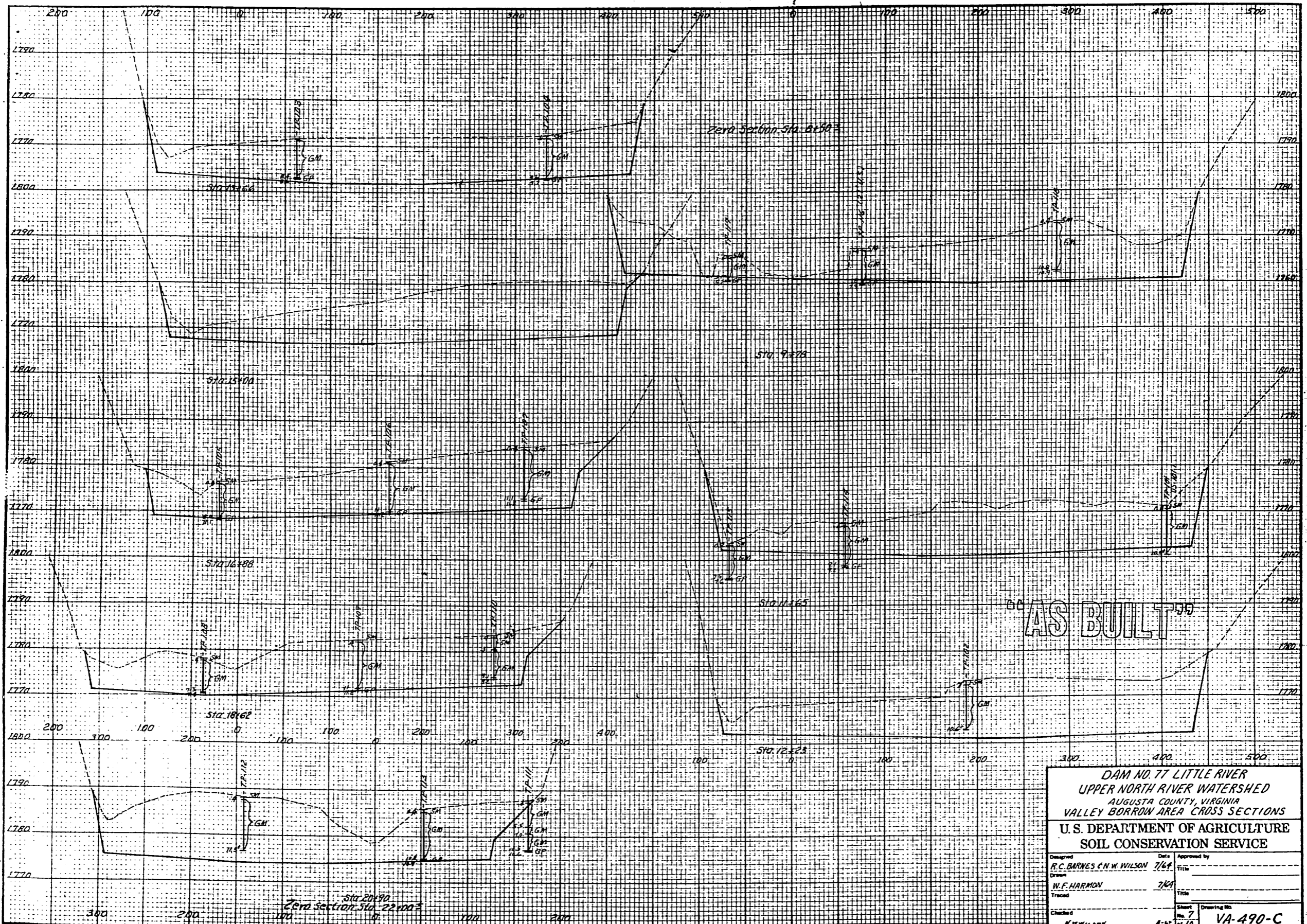
<p align="center"><b>DAM NO. 77 LITTLE RIVER</b>  <b>UPPER NORTH RIVER WATERSHED</b>          AUGUSTA COUNTY, VIRGINIA  <b>PRINCIPAL SPILLWAY CROSS SECTIONS</b></p>			
<p align="center"><b>U. S. DEPARTMENT OF AGRICULTURE</b>  <b>SOIL CONSERVATION SERVICE</b></p>			
Designer R. C. BARNES	Date 7/64	Approved by _____ Title _____	
Drawn W. F. HARMON	7/64	Title _____	
Checked H. W. WILSON	7/64	Sheet No. 5 of 10	Drawing No. VA-490-C



**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
EMERGENCY SPILLWAY CROSS SECTIONS**

**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

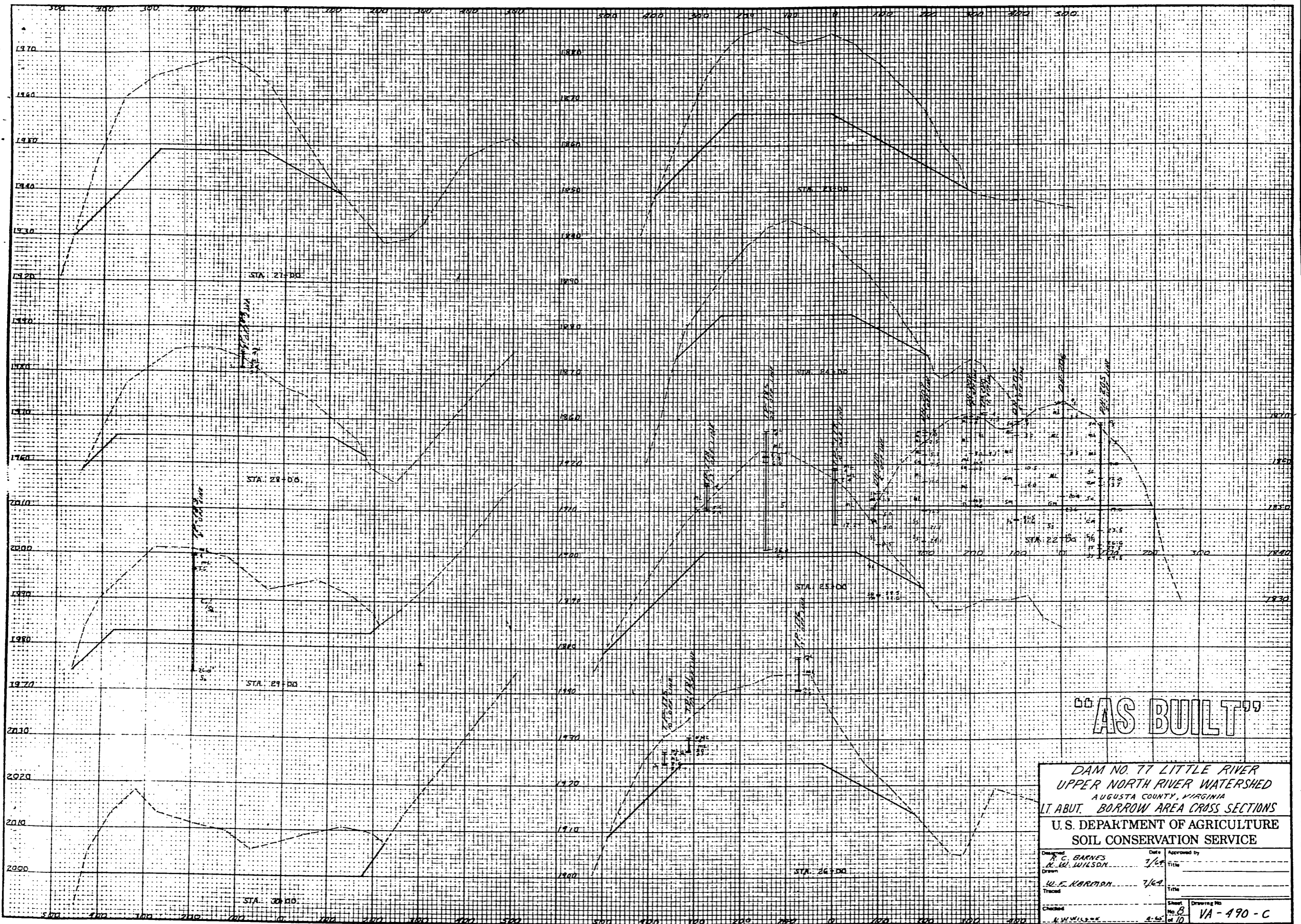
Designed <b>R. C. BARNES</b>	Date <b>7-64</b>	Approved by _____
Drawn <b>W. F. HARMON</b>	Date <b>6-64</b>	Title _____
Traced _____	Sheet <b>6</b>	Drawing No. <b>VA-490-C</b>
Checked <b>K. W. WILLIAMS</b>	Scale <b>4-1/2"</b>	



AS BUILT

**DAM NO. 77 LITTLE RIVER**  
**UPPER NORTH RIVER WATERSHED**  
 AUGUSTA COUNTY, VIRGINIA  
 VALLEY BORROW AREA CROSS SECTIONS  
 U. S. DEPARTMENT OF AGRICULTURE  
 SOIL CONSERVATION SERVICE

Designed R.C. BARNES & N.W. WILSON	Date 7/64	Approved by Title
Drawn H.F. HARMON	Date 7/64	Title
Traced		Title
Checked N.W. WILSON	Date 8/70	Sheet No. 7 of 10
		Drawing No. <b>VA-490-C</b>

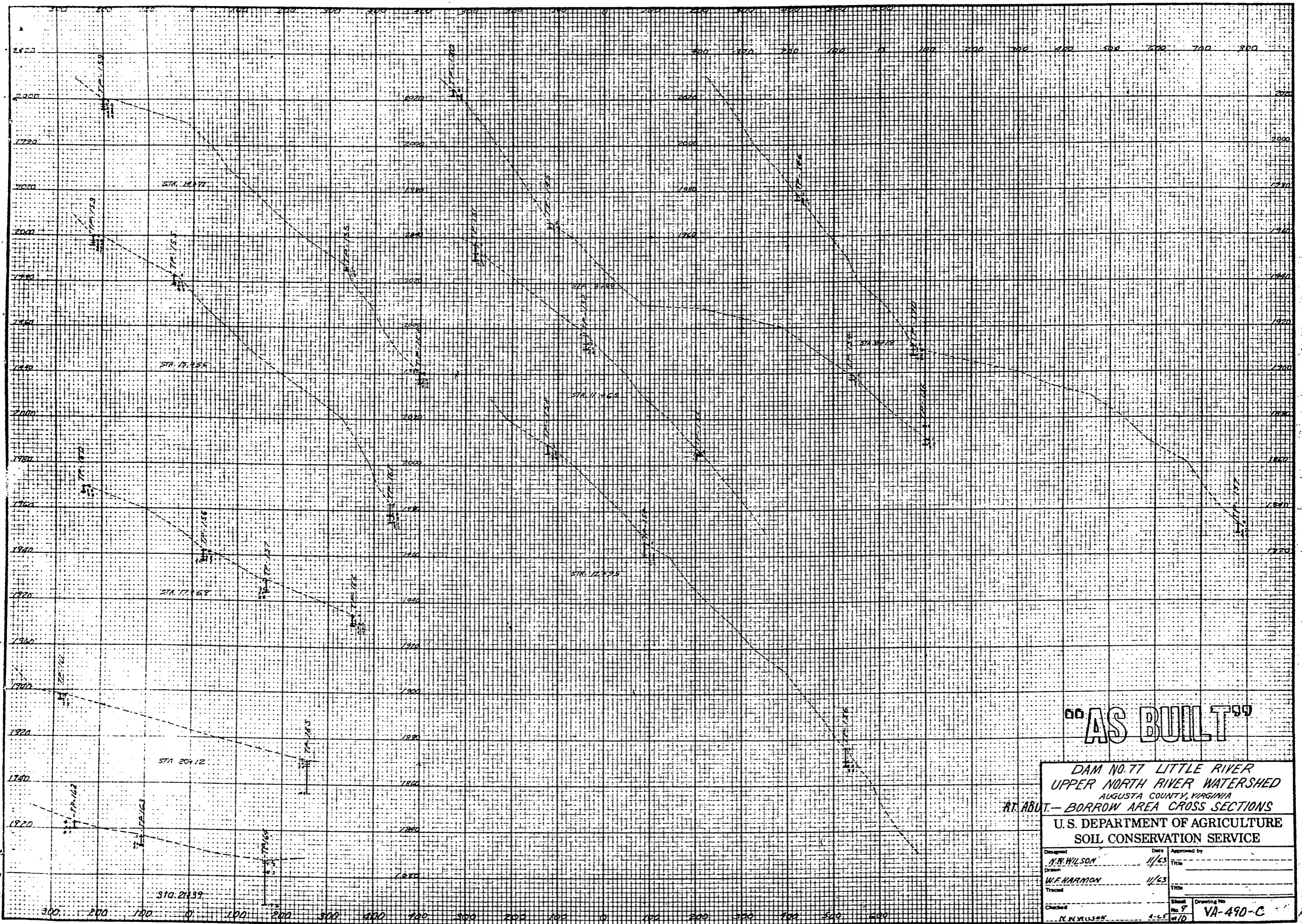


"AS BUILT"

DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
LT. ABUT. BORROW AREA CROSS SECTIONS

U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE

Designed R. C. BARNES	Date 1/69	Approved by
Drawn R. W. WILSON		Title
Traced W. E. HARRISON	Date 7/69	Title
Checked R. W. WILSON	Sheet No. 8 of 10	Drawing No. VA-490-C



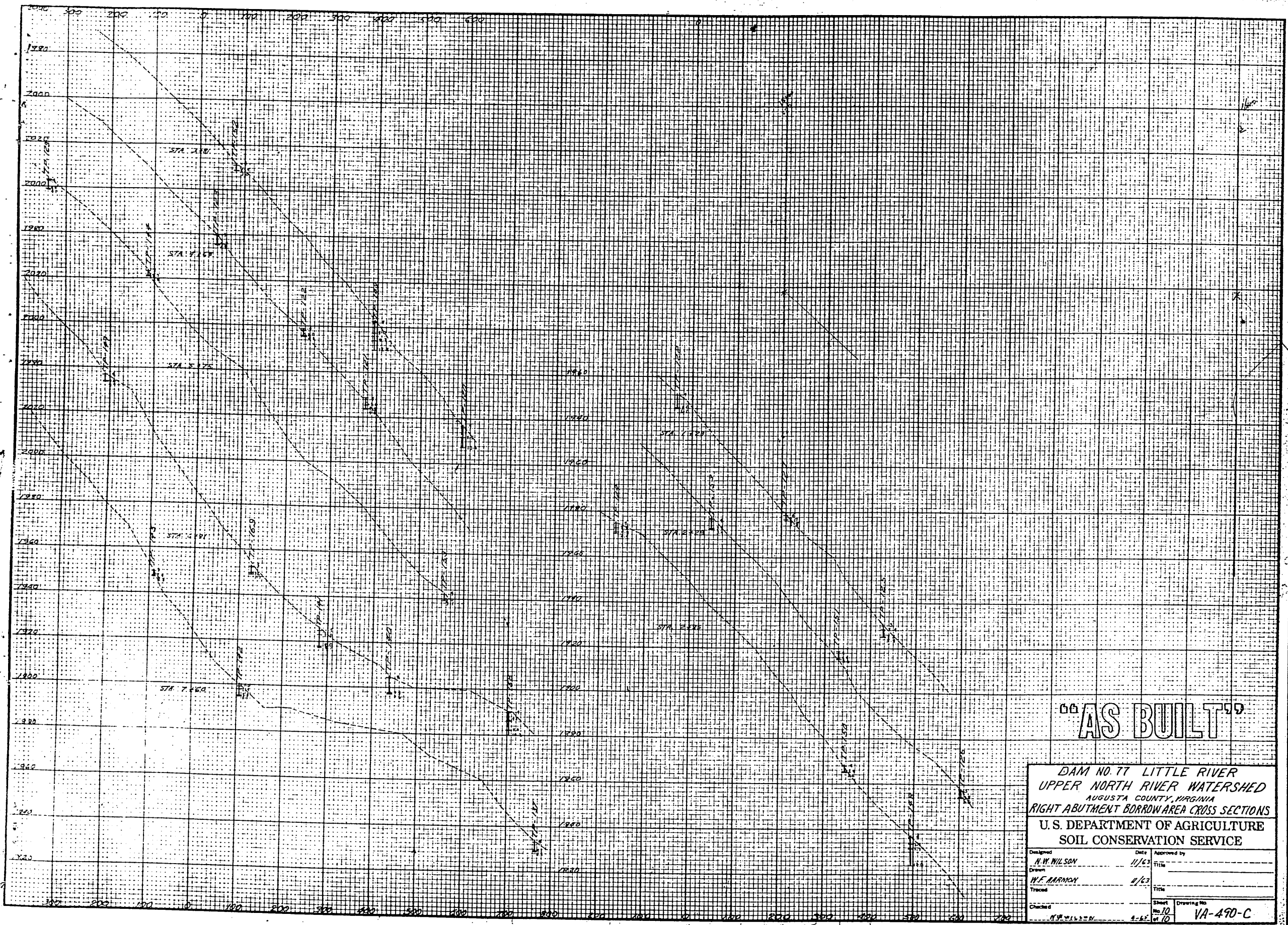
**"AS BUILT"**

**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
R.T. ABUT. - BORROW AREA CROSS SECTIONS**

**U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed <b>H. R. WILSON</b>	Date <b>11/63</b>	Approved by Title
Drawn <b>W. F. HARMON</b>	Date <b>11/63</b>	Title
Checked <b>H. R. WILSON</b>	Date <b>1-65</b>	Drawing No. <b>VA-490-C</b>





**"AS BUILT"**

**DAM NO. 77 LITTLE RIVER  
UPPER NORTH RIVER WATERSHED  
AUGUSTA COUNTY, VIRGINIA  
RIGHT ABUTMENT BORROW AREA CROSS SECTIONS  
U. S. DEPARTMENT OF AGRICULTURE  
SOIL CONSERVATION SERVICE**

Designed <b>N. W. WILSON</b>	Date <b>11/63</b>	Approved by _____
Drawn <b>W. E. ARMSTRONG</b>	Date <b>8/63</b>	Title _____
Checked <b>N. W. WILSON</b>	Date <b>9-63</b>	Title _____
Sheet No. <b>10</b> of <b>10</b>		Drawing No. <b>VA-490-C</b>