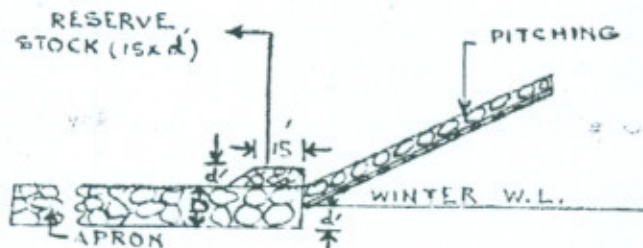


The scour depth can be estimated on basis of Lacey's or Kennedy's formula giving adequate margin for local concentration and turning. Generally apron is laid at winter water level to avoid pumping and excavation under water. It is however desirable that apron is laid as low as possible. In the present case the aprons of spurs R. D. 7, 10, 13 were laid 3 feet below winter water level. Low laid aprons have obvious advantage for protection against river attack. If however the apron is laid low the apron top will always remain under water in summer and when spur is under action it will not be possible to know about the extent and location of settlement. It would also be difficult to dump stone in correct position should excessive settlement occur. To overcome this difficulty the section shown in fig. 2 is recommended. This will ensure that 15 feet width of apron in prevalent summer discharges is under visual observation so that damage can be located and repaired in time. The 15 feet stone berm on the apron should preferably be provided as reserve.



Where diversion of a stream is necessary the topography and geological data should be observed and studied. Alignment should be chosen so that material will be moved easily by bed and surface erosion. Care should be taken to avoid old and dead creeks in the back water which may appear to reduce the earthwork. Such creeks have in bed stiff clay which cannot be disturbed even by velocities as high as 6 feet per second in short periods in which development is required. These dead creeks are also likely to be covered with thick plant growth.

In any diversion problem the labour and cost will be reduced by increasing the size of diversion cut. It is difficult and costly in time and effort to force a diversion. A cut capacity of 70% of total discharge to be diverted is recommended. With such a size and suitable conditions diversion can be effected with brushwood alone without heavy earth moving equipment. The diversion cuts are designed on Kutters formulae using diagrams. The value of rugosity co-efficient can be found through a few discharge observations at site.

The cuts should be sufficiently deep to attract the flow. The overall section should be such that mean velocity of flow exceeds regime velocity by over 50%. The bed level of cut at off-take should not be higher than effective bed level in the stream.

The mouth of cut should be preferably sited on concave bank of main stream. The main stream approach should be kept in most favourable position to mouth of cut and timely action if approach shows signs of deterioration.

APPENDIX
CONTENTS

Appendix A	...
Appendix B	...
Appendix C	...
Appendix D	...
Appendix E	...
Appendix F	...
Appendix G	...
Appendix H	...
Appendix I	...
Appendix J	...
Appendix K	...
Appendix L	...
Appendix M	...
Appendix N	...
Appendix O	...
Appendix P	...
Appendix Q	...
Appendix R	...
Appendix S	...
Appendix T	...
Appendix U	...
Appendix V	...
Appendix W	...
Appendix X	...
Appendix Y	...
Appendix Z	...

APPENDICES

APPENDIX I
STATEMENT OF

Sr. No.	Name of Work	Cost of Material	Earthwork	
			Machines	Contractor
1.	Constructing Spur R.D. 31045.	201480/-	30318/-	29462/-
2.	Constructing Spur R.D. 25045.	194621/-	—	27276/-
3.	Constructing Spur R.D. 22400.	68960/-	37836/-	17312/-
4.	Putting a Chap in Jammu Tawi to train it to flow along right.	21687/-	—	—
5.	Constructing Spur R.D. 19145.	256733/-	65713/-	35741/-
6.	Diverting Jammu Tawi into Ghag Nallah opposite R.D. 19145.	173507/-	243327/-	6000/-
7.	Cutting Lip of Bela.	—	2625/-	2565/-
8.	Constructing Spur R.D. 12811.	160840/-	166975/-	19100/-
9.	Constructing Spur R.D. 10000.	178982/-	50136/-	74224/-
10.	Constructing Spur R.D. 7000.	168159/-	135162/-	17744/-
11.	Digging Diversion cut below spur R.D. 19145.	15755/-	14376/-	127061/-
GRAND TOTAL :		1440724/-	746468/-	356485/-

COST OF WORKS

Total	Carriage	Labour	Land	Miscellaneous	Grand Total
59780/-	75127/-	6410/-	1000/-	3404/-	347200/-
27276/-	59724/-	6691/-	1550/-	2830/-	292692/-
55148/-	25233/-	4294/-	2000/-	3565/-	159200/-
—	7413/-	10558/-	—	1184/-	40842/-
101454/-	75591/-	9090/-	2700/-	1965/-	447533/-
249327/-	65854/-	105150/-	—	—	593838/-
5190/-	—	—	—	—	5190/-
186075/-	32015/-	27244/-	2200/-	20917/-	429291/-
124360/-	38457/-	19474/-	2100/-	18168/-	381541/-
152406/-	31169/-	19926/-	2000/-	19133/-	393293/-
141437/-	—	6712/-	—	—	163904/-
1102953/-	480583/-	215549/-	13550/-	71166/-	3254525/-

APPENDIX II
STATEMENT OF MAIN

S. No.	Name of Work	E/W with Lead 500, to 3000,	Stone Work Involving Car- riage 4 to 9 Mile from $\frac{1}{2}$ to 2 Miles Re- handling in River Bed
1.	Constructing Spur R.D. 31045 UMB.	1800000	290000
2.	Constructing Spur R.D. 25045 UMB.	1352000	302000
3.	Constructing Spur R.D. 22400 UMB.	1942000	127000
4.	Constructing Spur R.D. 19145 UMB.	3270000	444000
5.	Digging cut below spur R.D. 19145 UMB.	4832000	—
6.	Putting a Kahi Chap in Jammu Tawi to train it to flow along right bank to effect diversion.	—	15000
7.	Diverting Jammu Tawi in to Ghag Nallah opposite Spur R.D. 19145 UMB.	3100000	146000
8.	Constructing Spur R.D. 12811 UMB.	3807000	214000
9.	Constructing Spur R.D. 10000 UMB.	3760000	244000
10.	Constructing Spur R.D. 7000 UMB.	3500000	218000
11.	Cutting lip of bela opposite diversion bund.	250000	—
Total		27613000	2095000

QUANTITIES OF WORKS

Cutting & C/O Kahi 0-2 Miles in River Bed	Boring 8" Dia. in Running Water	Filling & Placing E. C bags & Gunny Bags	Driving Killas in River Bed	Installing Tubewells	Lonading Kahi Rolls Munj Trangars Filled with Stone
—	—	—	—	—	—
—	—	—	—	—	—
28800	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	18	—
67800	—	2000	1200	—	1200
354000	4500	23000	5500	—	3800
54000	—	—	—	—	—
48000	—	—	—	—	—
54000	—	—	—	—	—
—	—	—	—	—	—
660600	4500	25000	6700	18	5000

**APPENDIX
DESIGN DATA**

S. No.	Junction R.Ds.	LOCATION OF T-HEAD		Length of T.	
		R.D. of U.M.B.	Departure from U.M.B.	U/S	D/S
1.	7000 U.M.B.	8275	2900	200	50
2.	10000 U.M.B.	10750	2500	200	75
3.	12811 U.M.B.	13500	2500	205	50
4.	19145 U.M.B.	19235	3000	270	50
5.	22400 U.M.B.	22400	1720	MOLE	Head
6.	25045 U.M.B.	25135	1380	200	50
7.	31045 U.M.B.	31100	1580	240	40

III
OF SPURS

Free Board	Apron Section U/S Nose	H.F.L.	R.L. of Bottom of Apron	Depth of Apron Bottom H.F.L.	Top Width of Shanks
3·0	40×4·5	822·90	807·0	15·9	15
3·0	40×4·5	823·50	807·5	16·0	15
3·2	40×4·5	824·10	808·2	15·9	15
3·0	60×4·5	826·70	813·5	13·2	20
3·0	40×4·5	828·30	816·3	12·0	20
3·0	40×4·5	829·80	817·6	12·2	20
3·0	60×4·5	833·60	821·4	12·2	20

APPENDIX IV
DETAILS OF WORKING OF EARTH MOVING EQUIPMENT

96

Month	Date	Motorized Scrapers	Motor Dozers	Crawler Scrapers & Dozers	Excavators 110' x 2½'	Remarks
February	21.2.60	49	26	—	—	
	22.2.60	38	28	—	—	
	23.2.60	55	14	—	—	
	24.2.60	42½	18	—	—	
	25.2.60	25	19	—	16	
	26.2.60	39	22	—	16	
	27.2.60	39	7½	—	14	
	28.2.60	—	19	—	16	
	29.2.60	34	13	—	15	
	Total	321½	166½	—	77	
March	1.3.60	52	42	—	2	
	2.3.60	57	43	—	13	
	3.3.60	76	37	2	16	
	4.3.60	64	35	—	8	
	5.3.60	84	40½	—	9½	
	6.3.60	84	26	13	12	
	7.3.60	79½	49	13	8	
	8.3.60	71½	65	13	8	
	9.3.60	31	36	—	12	

PAPER No 349

	10.3.60	40	24	—	—
	11.3.60	40	24	12	—
	12.3.60	43	50	—	4
	13.3.60	41½	8	13	4
	14.3.60	47	23	12	12½
	15.3.60	54	43	13	10
	16.3.60	54	27	15	16
	17.3.60	58	45	26	5
	18.3.63	73	38	26	11
	19.3.60	69	53	26	18
	20.3.60	71	56	26	16
	21.3.60	60	50	24	16
	22.3.60	84	70	24	16
	23.3.60	77	45	14	8
	24.3.60	76	11	14	12
	25.3.60	93	80	24	8
	26.3.60	112	93	55	18
	27.3.60	117	107	60	5
	28.3.60	99	82	40	—
	29.3.60	—	—	—	—
	30.3.60	42	14	42	—
	31.3.60	79	95	32	—
	Total	2,028½	1,411½	539	258
April	1.4.60	112	108	55	—
	2.4.60	124	118	55	—

DETAILS OF WORKING OF EARTH MOVING EQUIPMENT

98

Month	Date	Motorized Scrapers	Motor Dozers	Crawler Scrapers & Dozers	Excavators 110' x 2½'	Remarks
	3.4.60	94	100	60	—	
	4.4.60	85	76	39	—	
	5.4.60	94	60	34	—	
	6.4.60	96	60	41	—	
	7.4.60	96	76	54	—	
	8.4.60	104	80	40	—	
	9.4.60	102	88	43	—	
	10.4.60	63	77	45	—	
	11.4.60	29	20	24	—	
	12.4.60	76	26	24	—	
	13.4.60	68	30	24	—	
	14.4.60	64	30	27	—	
	15.4.60	32	15	32	—	
	16.4.60	2	2	—	8	
	17.4.60	24	7	—	5	
	18.4.60	22	4	—	—	
	19.4.60	30	5	—	—	
	20.4.60	16	12	—	12	
	21.4.60	—	—	—	12	
	22.4.60	—	—	—	—	

Paper No. 349

	23.4.60	—	—	—	—
	24.4.60	—	—	—	—
	25.4.60	—	—	—	—
	26.4.60	—	—	—	8
	27.4.60	—	—	—	6
	28.4.60	—	—	—	5½
	29.4.60	—	—	—	3⅝
	30.4.60	—	—	—	7¼
	Total	1,333	994	597	68½
May	1.5.60	—	—	—	14
	2.5.60	—	—	—	7
	3.5.60	—	—	—	8
	4.5.60	—	—	—	8
	5.5.60	—	—	—	—
	6.5.60	—	—	—	—
	7.5.60	—	—	42	—
	8.5.60	—	—	42	14
	9.5.60	—	—	40	10
	10.5.60	—	—	—	—
	11.5.60	—	—	—	—
	12.5.60	—	—	—	—
	13.5.60	—	—	—	—
	14.5.60	—	—	—	—
	15.5.60	—	—	—	—
	Total	—	—	124	61
	GRAND TOTAL	3,683	2,572	1,260	464½

Abstract

- | | |
|--|-------------------|
| (1) Total working hours of motorized scrapers and dozers | 6,255 |
| (3) Total working hours of crawler scraper & dozers | 1,260 |
| (4) Total working hours of excavators | 464 $\frac{1}{2}$ |

PAPER No. 349

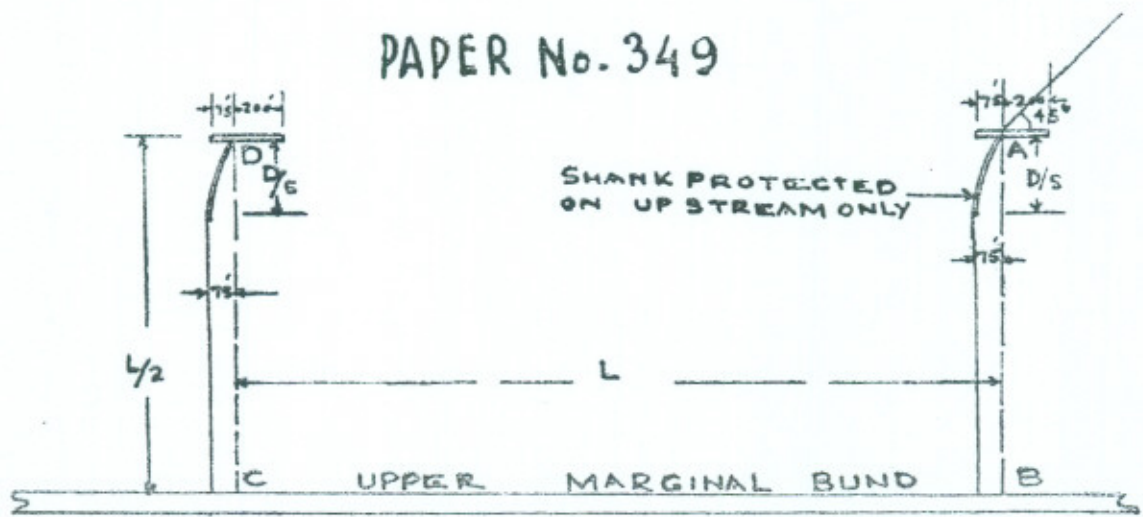
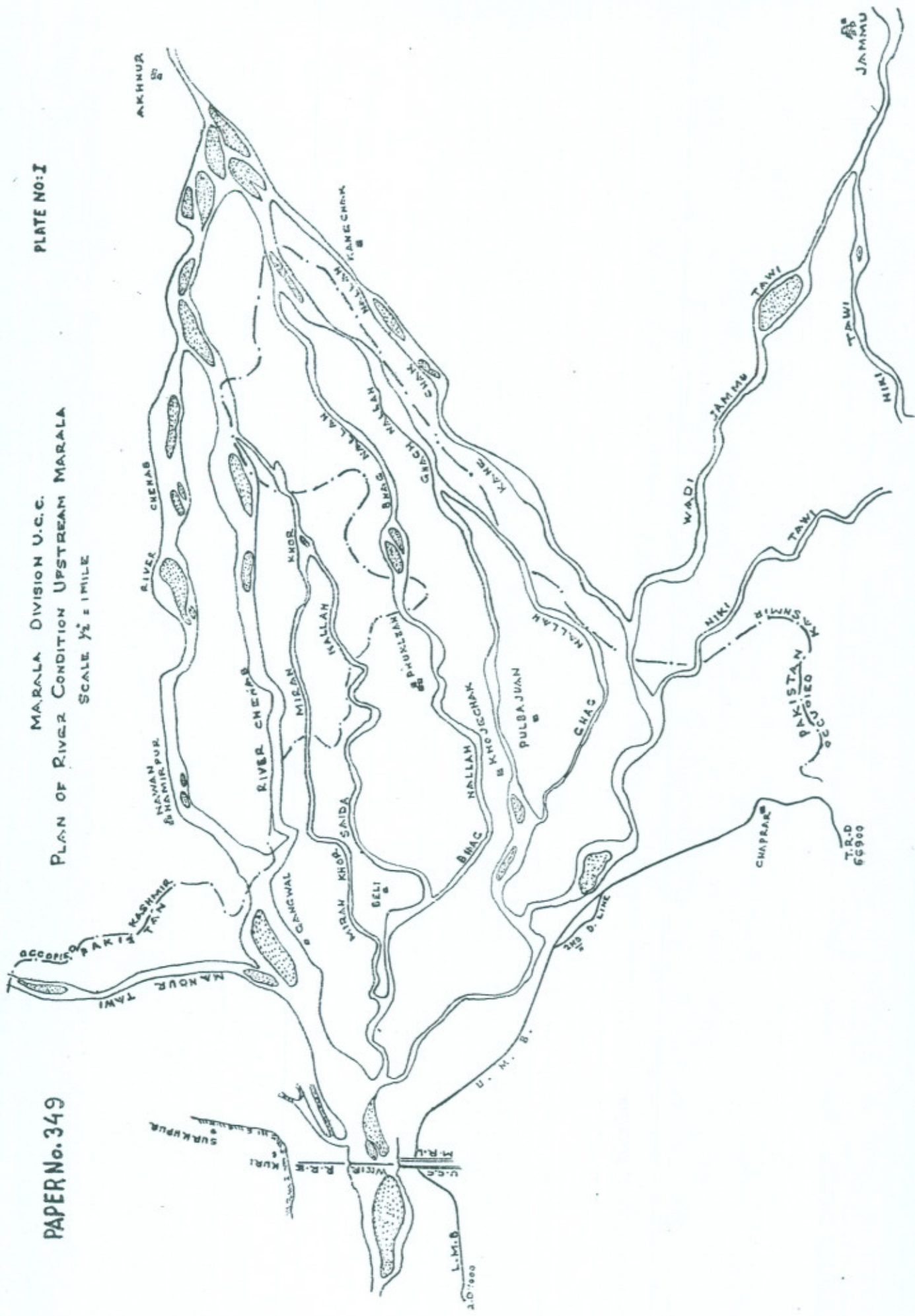


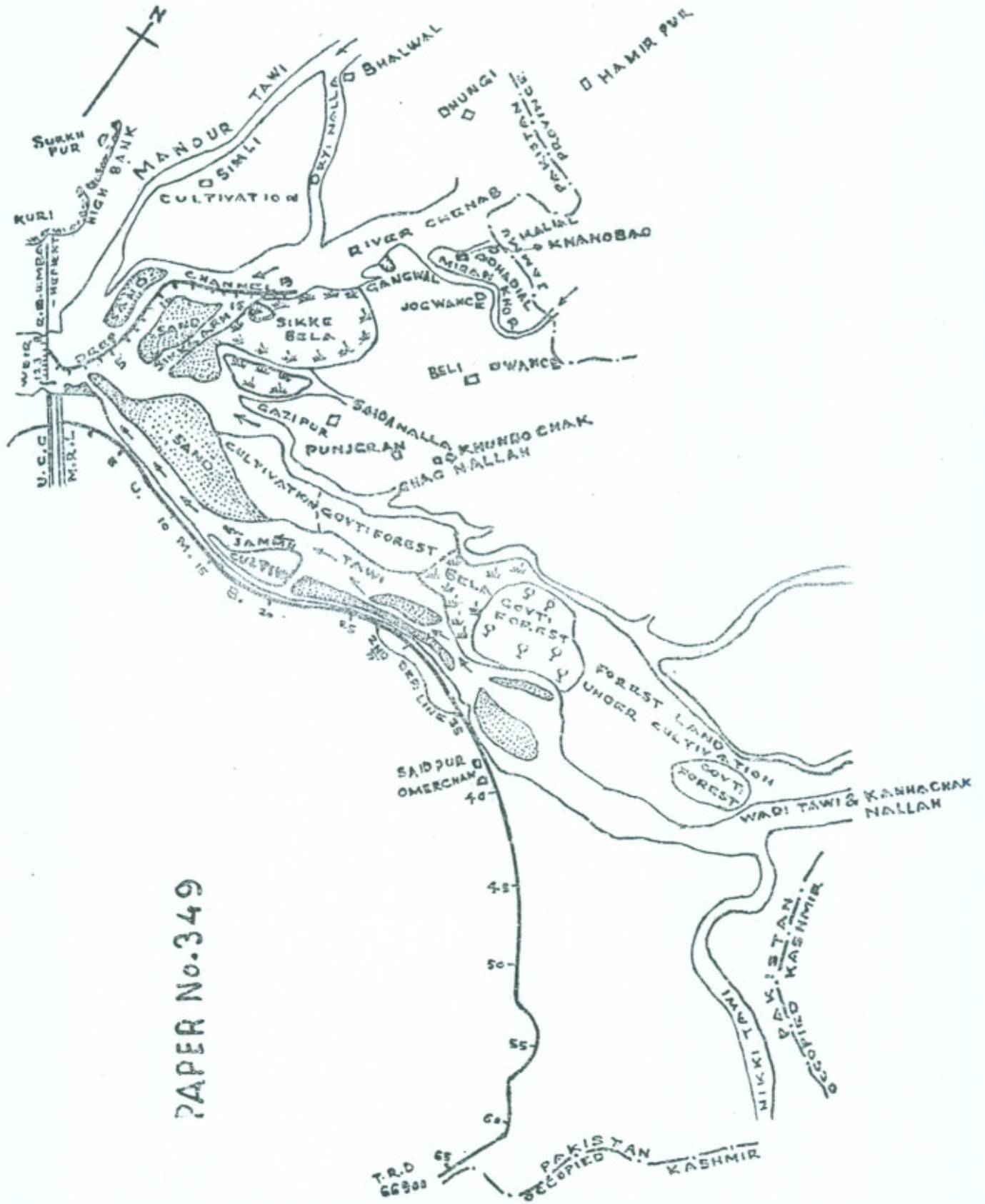
PLATE NO: I

MARALA DIVISION U.C.C.
PLAN OF RIVER CONDITION UPSTREAM MARALA
SCALE 1/2" = 1 MILE



PAPER No. 349

MARALA DIVISION U.C.C. PLATE NO. II
 SURVEY PLAN OF RIVER CHENAB AT MARALA
 SCALE 1/2" = 1 MILE



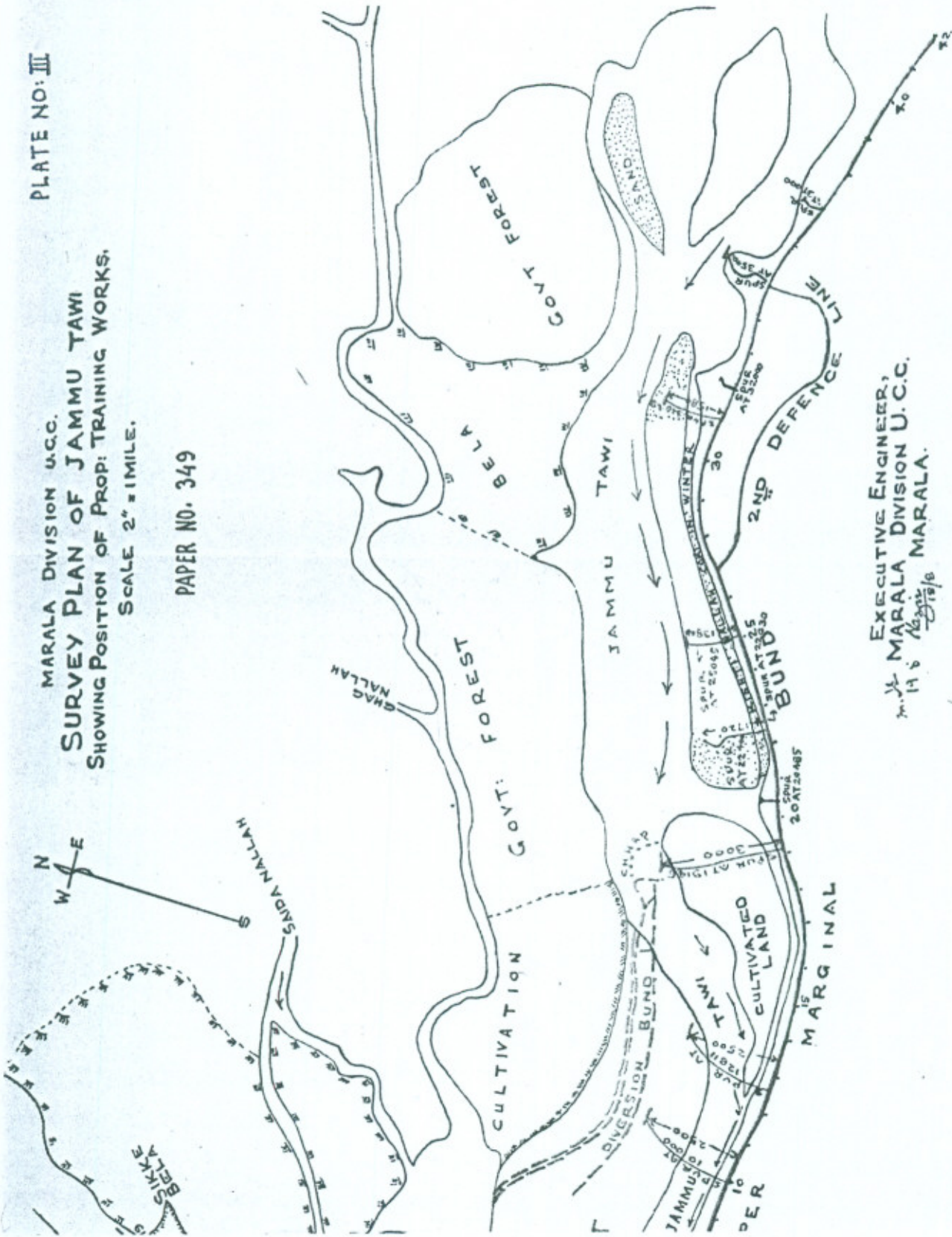
PAPER No. 349

T.R.D. 66803 PAKISTAN OCCUPIED KASHMIR

PLATE NO: III

MARALA DIVISION U.C.C.
SURVEY PLAN OF JAMMU TAWI
SHOWING POSITION OF PROP: TRAINING WORKS,
SCALE 2" = 1 MILE.

PAPER NO. 349



EXECUTIVE ENGINEER,
MARALA DIVISION U.C.C.
14/6
19/6
MARALA.

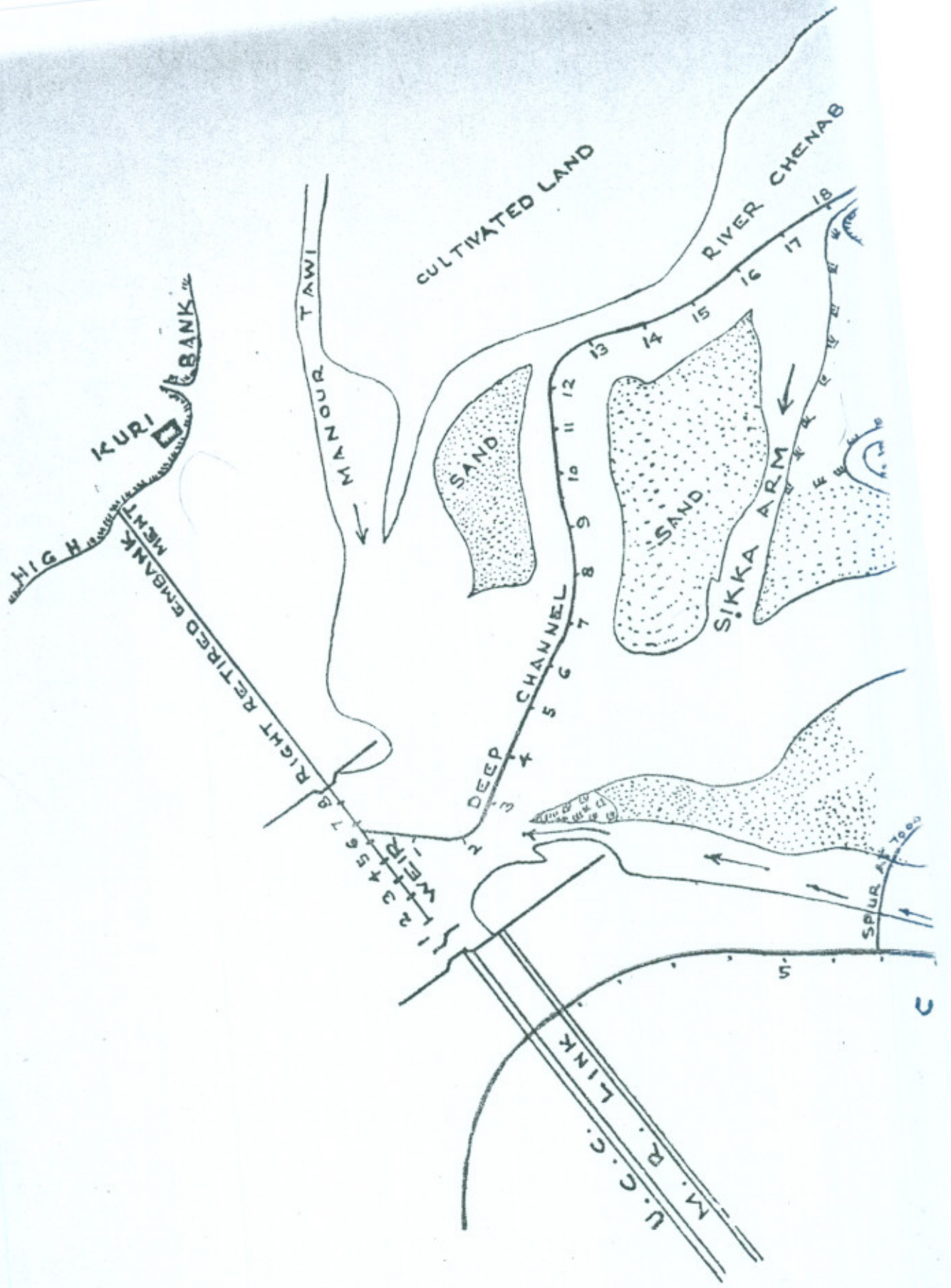
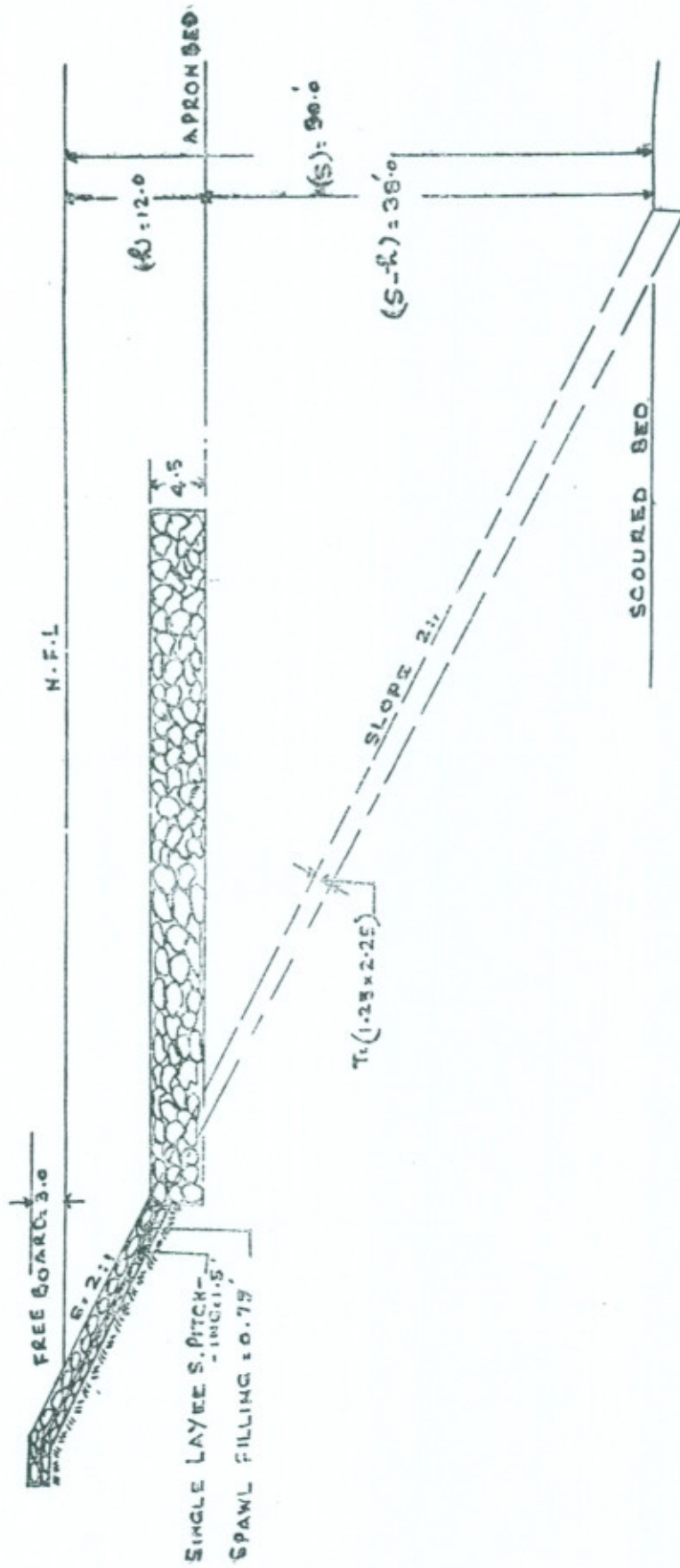


PLATE NO: IV

MARALA DIVISION U.C.C.
DESIGN FOR STONE PITCHING & APRON OF SPURSON U.M.B.
SCALE 1/200

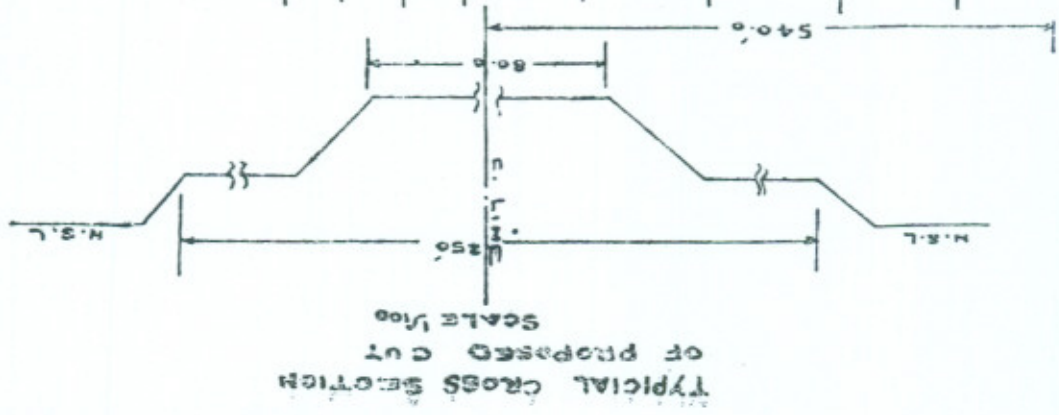
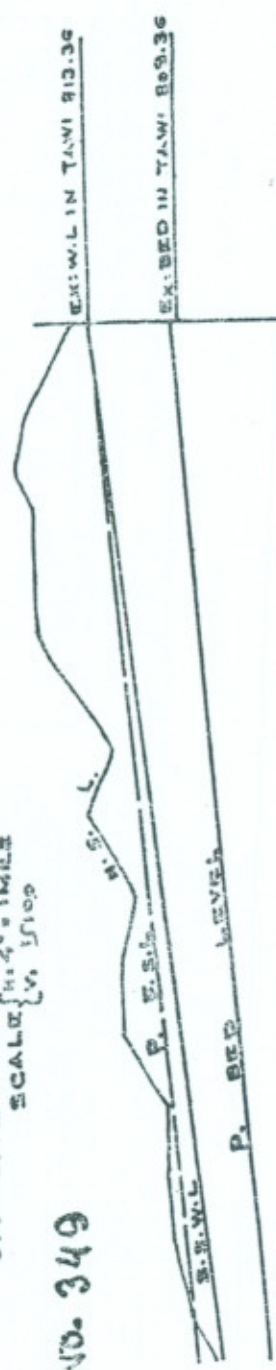
PAPER No. 349



LATE NO: V

MARALA DIVISION U.G.C
 LONG SECTION OF PROP: CUT
 OPPOSITE R.D. 12000 U.M.B.
 SCALE: 1/4" = 100'

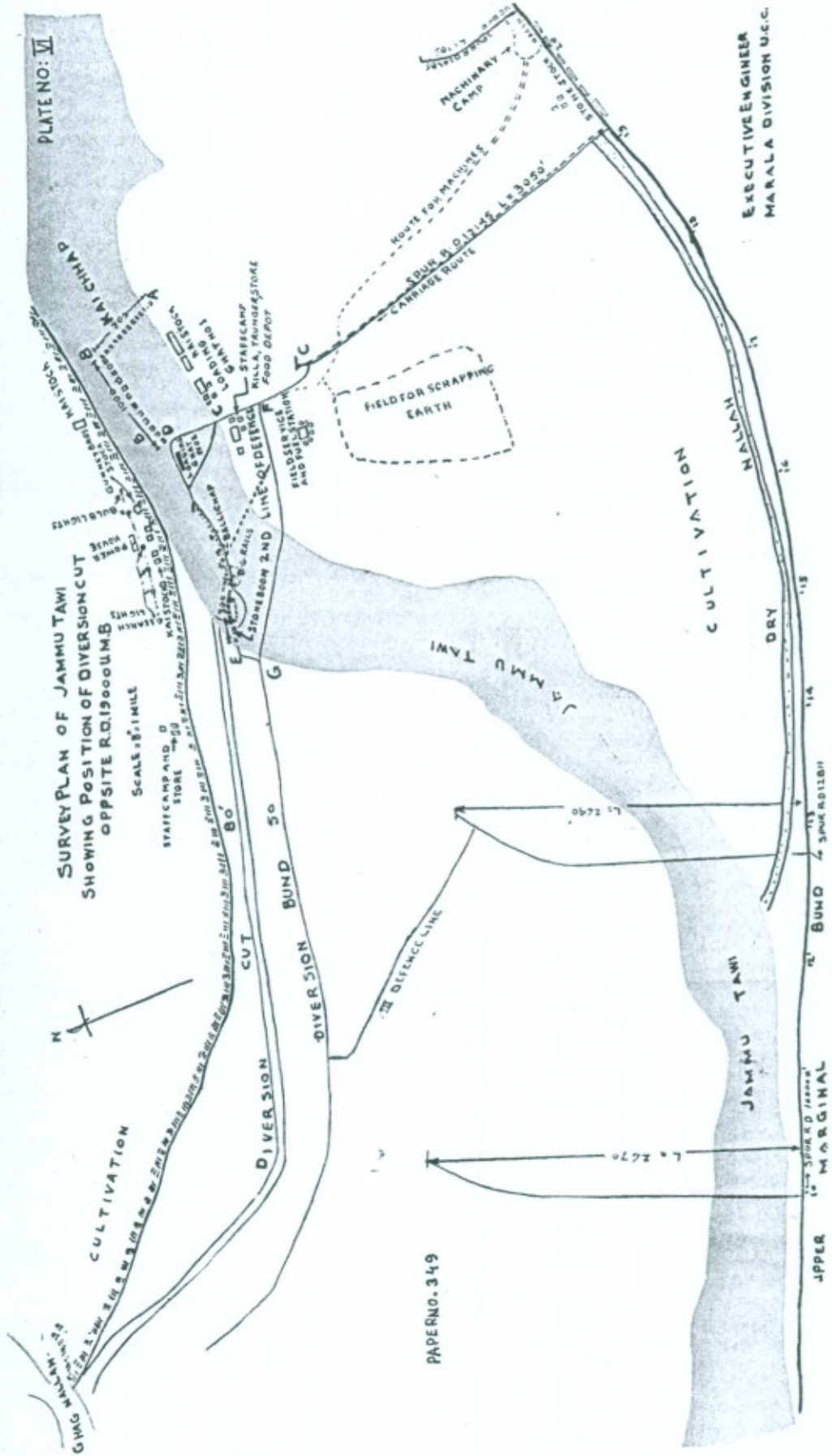
PAPER NO. 349



DATA: 1.800.0	
SIDE SLOPE	1:1
BED WIDTH	BELOW WATER LEVEL 80' ABOVE W.L. 250'
SLOPE	0.5 IN 100'
F. S. LEVEL	
BED LEVEL	
WATER LEVEL	
N. S. L.	
R. D. 9	
809.66	809.91
809.41	809.93
808.16	808.91
809.52	810.18
807.89	809.44
807.39	808.89
810.14	809.61
811.14	810.52
807.64	812.25
811.39	810.27
808.13	812.30
811.83	811.00
811.88	811.27
812.12	808.38
812.37	811.88
812.62	808.62
812.87	812.12
812.87	809.87
812.87	812.37
812.87	809.12
812.87	812.37
812.87	811.88
812.87	812.37
812.87	809.37
812.87	812.70
812.87	815.82
812.87	812.87
812.87	815.76
812.87	813.02
812.87	809.61
812.87	813.11
812.87	813.36

PLATE NO: VI

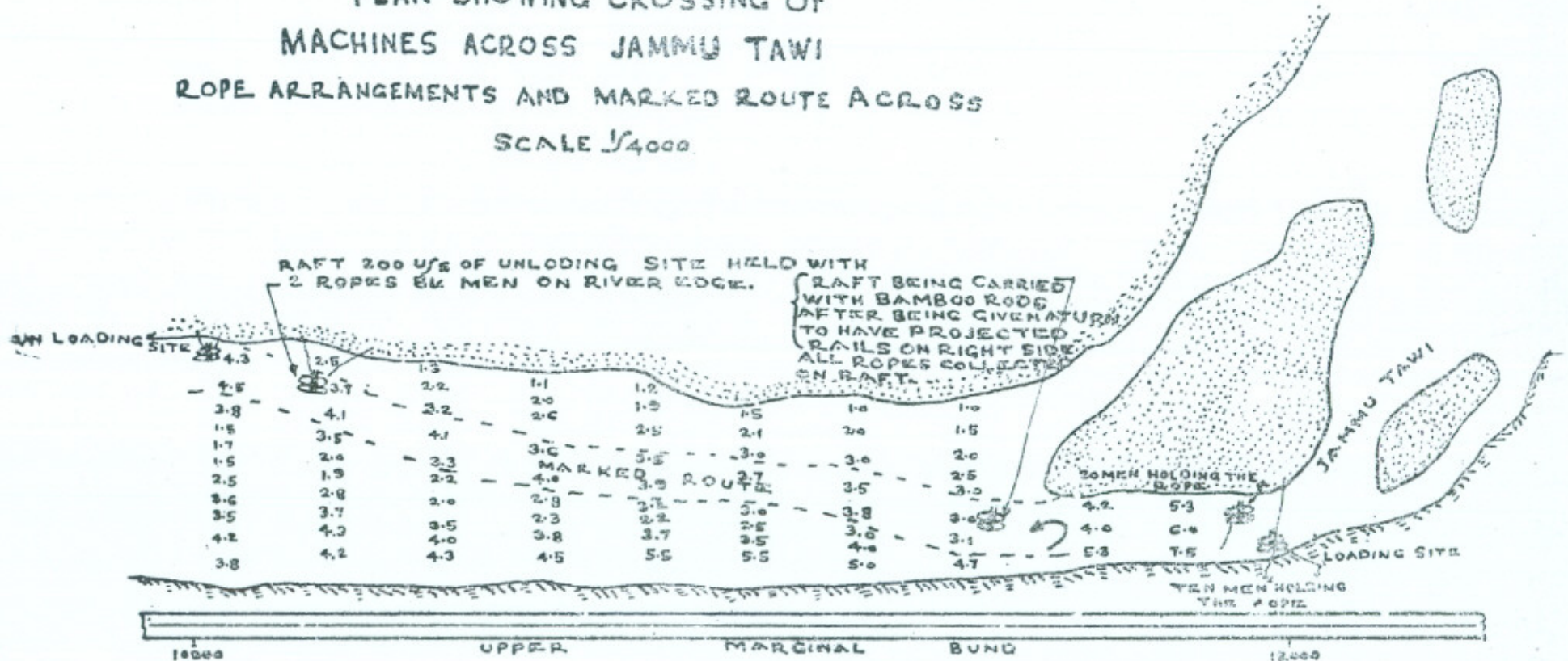
SURVEY PLAN OF JAMMU TAWI
SHOWING POSITION OF DIVERSION CUT
OPPOSITE ROAD NO. 19



PAPER NO. 349

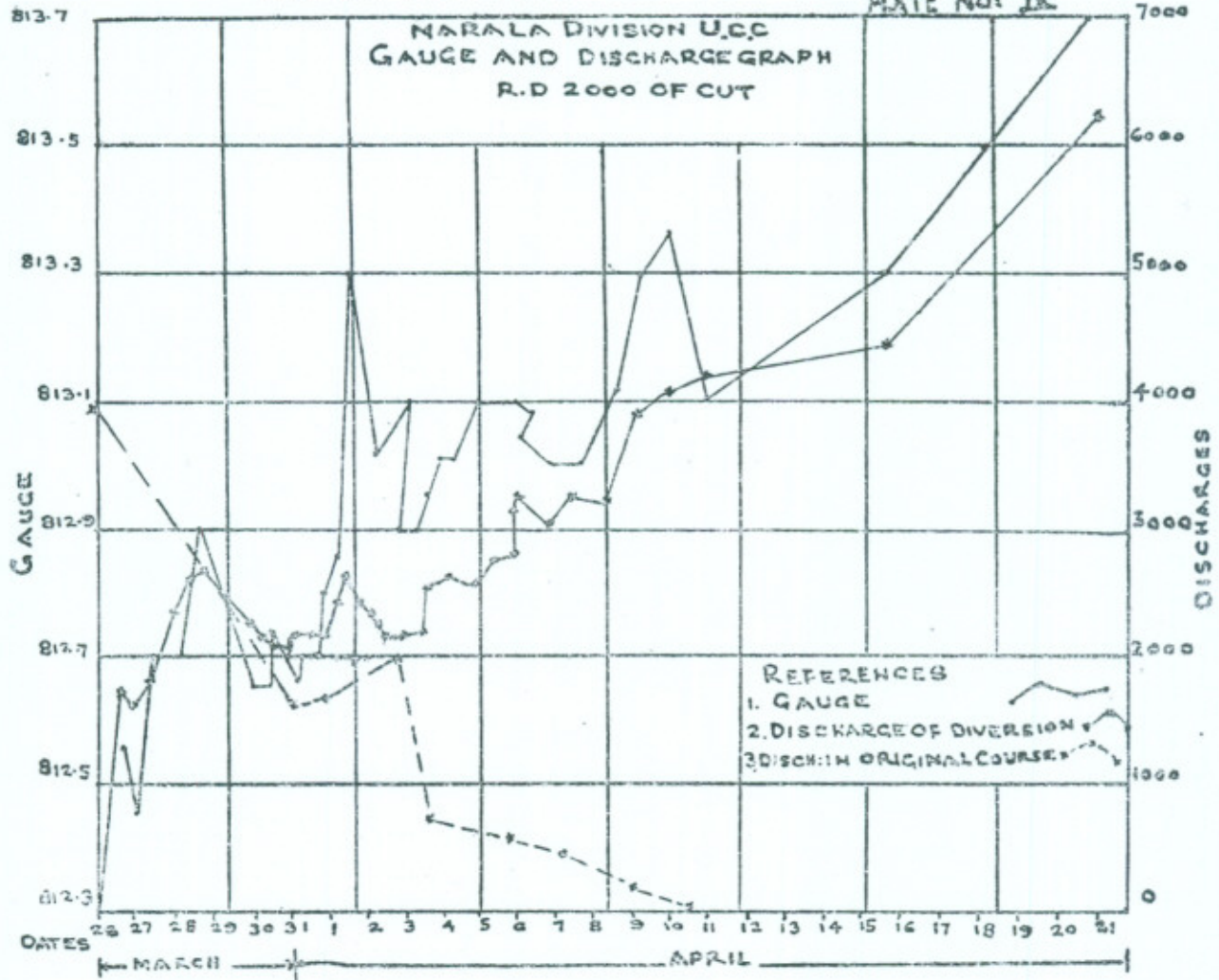
EXECUTIVE ENGINEER
MARALA DIVISION U.C.C.

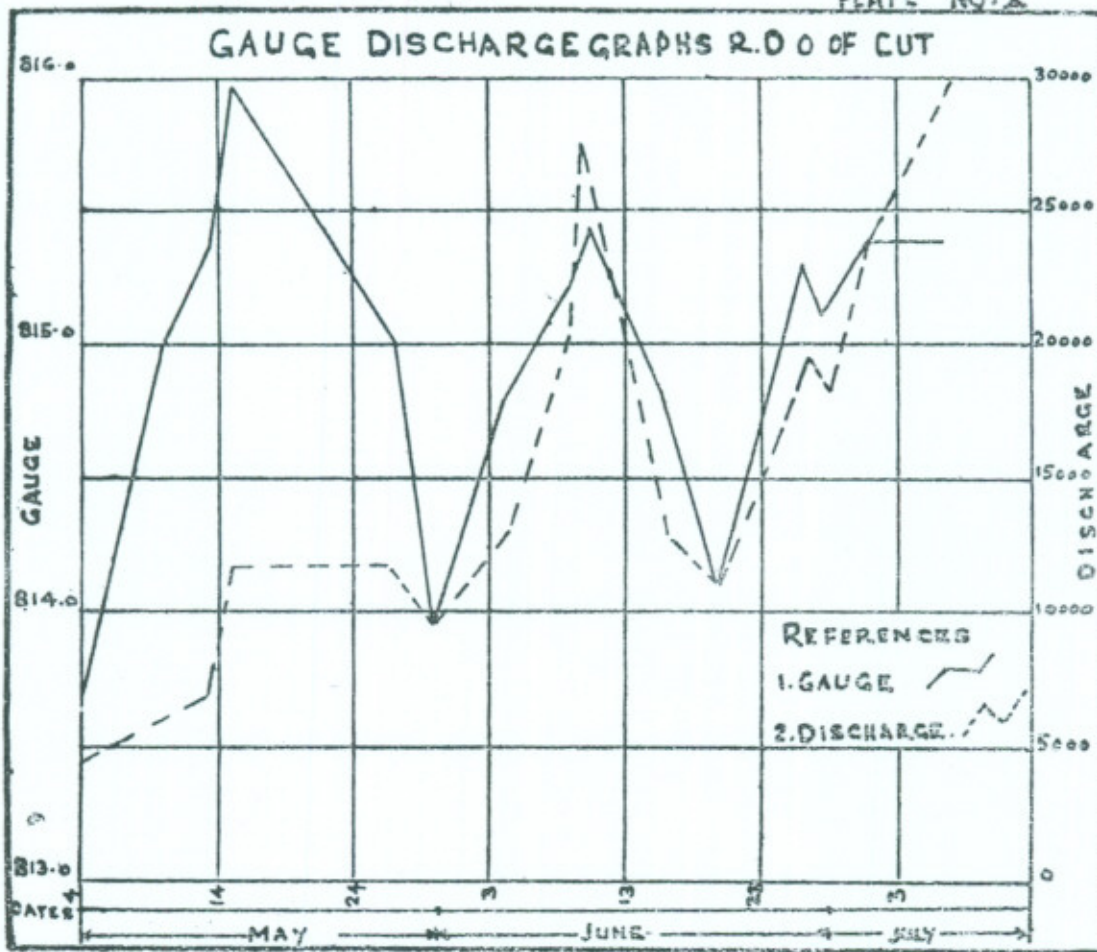
MARALA DIVISION U.C.C.
 PLAN SHOWING CROSSING OF
 MACHINES ACROSS JAMMU TAWI
 ROPE ARRANGEMENTS AND MARKED ROUTE ACROSS
 SCALE 1/4000



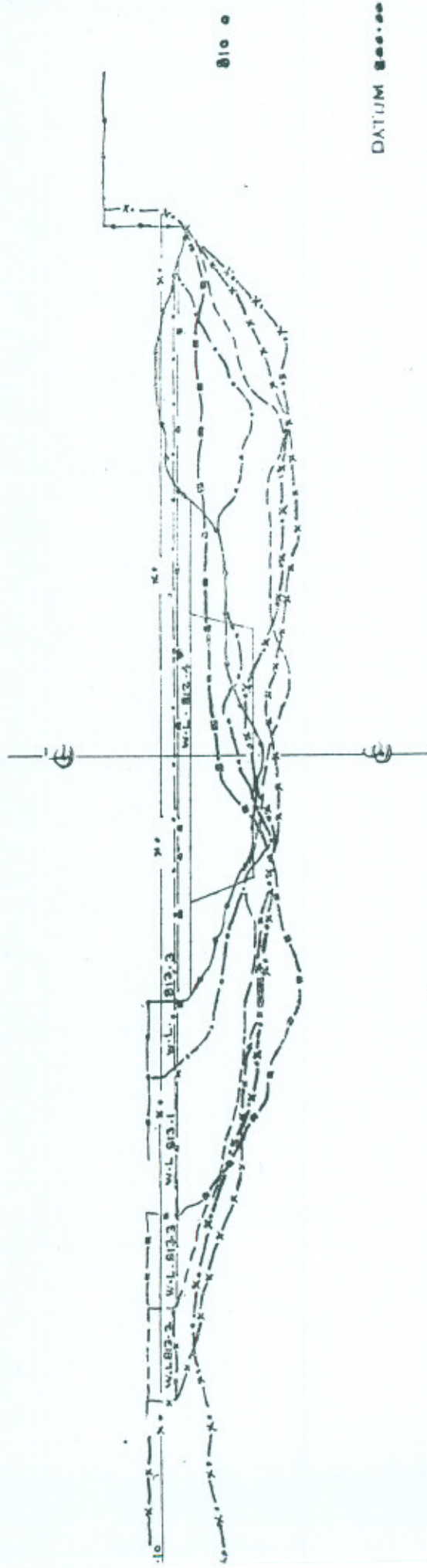
PAPER No. 349

PLATE NO: IX





CROSS SECTION OF DIVERSION CUT R.P.D. 2000



REFERENCES

NO.	DESCRIPTION	DATE	REMARKS
1.	DESIGNED CROSS SECTION		
2.	CROSS SECTION OBSERVED ON	26.3.60	
3.	"	"	2.4.60
4.	"	"	7.4.60
5.	"	"	15.4.60
6.	"	"	28.4.60
7.	"	"	22.5.60

EXECUTIVE ENGINEER
MARALA DIVISION U.C.C
MARALA

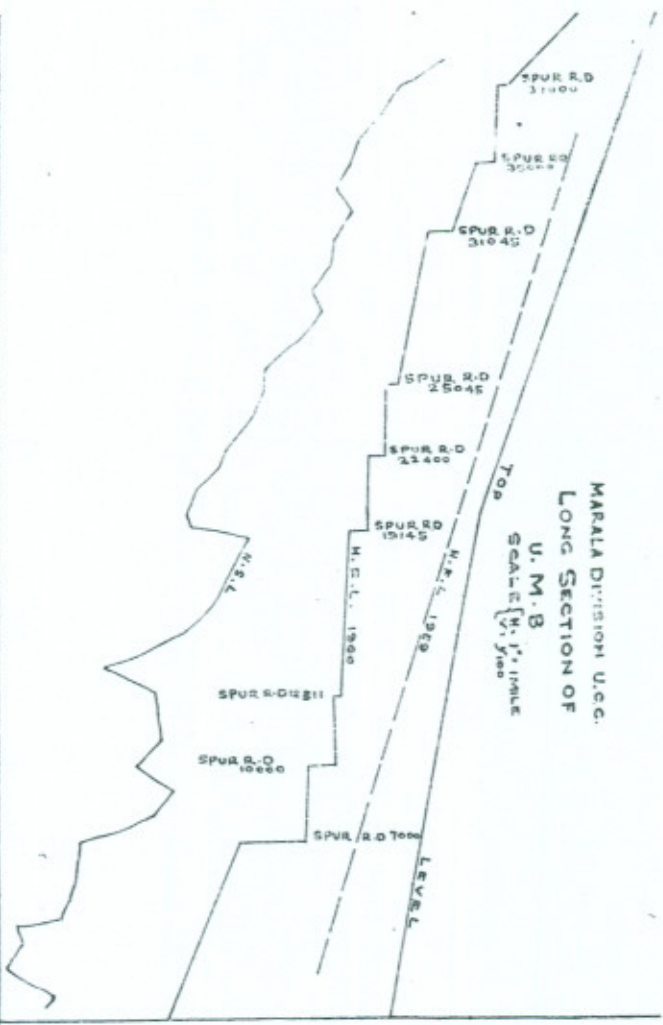
CROSS SECTION OF DIVI

PAPER No. 349



REFERENCE

1.	DESIGNED CROSS SECTION	
2.	CROSS SECTION OBSERVED ON	
3.	"	"
4.	"	"
5.	"	"
6.	"	"
7.	"	"



Station	Left Elevation	Right Elevation	Other Elevation	Notes
40	815.76	840.94		
39	824.91	839.56		
38	821.03	835.08		
37	824.08	836.68		
36	823.57	836.12		
35	822.21	837.64	835.45	
34	821.82	837.10		
33	820.52	836.60		
32	821.88	836.20	834.20	
31	820.63	835.72		
30	820.61	835.24		
29	819.32	834.64		
28	819.51	834.04		
27	818.54	833.44		
26	816.43	832.04		
25	816.25	832.24	829.80	
24	815.76	831.64	829.27	
23	814.38	831.24	828.72	
22	813.77	829.64	828.17	
21	812.59	829.84	827.62	
20	811.47	829.24	827.07	
19	811.88	829.10		
18	810.60	828.50	823.44	
17	810.34	828.08	821.15	
16	810.53	828.40		
15	810.51	828.12		
14	810.33	827.84	824.58	
13	809.44	827.28		
12	809.53	827.00	820.91	
11	809.96	826.72	820.20	
10	808.94	826.44	822.52	
9	810.53	826.16	820.11	
8	805.38	825.88	818.75	
7	804.94	825.60	818.55	
6	804.80	825.32	814.64	
5	804.07	825.04		
4	803.83	824.76	828.85	
3	801.26	824.48	819.00	
2	800.38	824.20		
1	800.21	823.92	816.00	
0	802.93	823.78		

DATUM B.S.C

HIGH FLOOD LEVEL IN 1950

HIGH FLOOD LEVEL IN 1951

OUTER SLOPE

INNER SLOPE

TOP WIDTH

TOP LEVEL

N.S. LEVEL

R.D.S

PLATE NO: XIV

MARALA DIVISION U.C.C.
SURVEY PLAN OF JAMMU TAWI
YEAR 1960
SCALE 1" = 1 MILE

PAPER NO. 349

