If the design discharge of the respective tributaries is below the value obtained from this study, it is considered that the main channel discharge may not become larger than the discharge of a flood with probability of occurence of once in forty years even in the case of concentrated rainfall in the remaining basin. However, there is an element of uncertainty that the main channel discharge may become higher than the design flood discharge.

In the river improvement plan of the Sala River, therefore, it is important to consider measures to cope with extraordinary floods.

The ideal shape of a river channel, generally is the one in which the design high-water level and the ground level are about the same, i.e., the so-called excavated river channel with levees raised to the height of freeboard. (Freeboard levee). Since the design riverbed levels of the estuary and down-stream channel, the tributaries at the respective confluence, the unimproved upstream section, etc., are determined by the field conditions of the respective downstream ends, construction of excavated river channels is not generally practicable. However, it is strongly recommended to construct excavated or semi-excavated river channels by lowering the design high-water level as much as possible. The lower the design high-water level is established, the less the flood damage caused by extraordinary floods would become.

5.4 CROSS SECTIONS

In the case of the discharge ruling the stability of the river, in other words, the discharge which is likely to cause riverbed changes, the frequency, besides their magnitude, may also have to be taken into consideration and the ruling discharge is generally far smaller than the design discharge. Therefore, it is practical to confine the ruling discharge into the low-water river channel. When the design low-water discharge is fixed below the ruling discharge, it is apt to cause scouring in the low-water river channel. On the contrary, when the design low-water discharge is fixed at above the ruling discharge, meandering will start in the low-water river channel which makes maintenance of the river channel more difficult.

Generally a river channel with a composit section is recommended, and taking the data below into consideration, the composit section has been introduced in the proposed river improvement plan of the Sala River.

1) Design Low-water Channel Discharge

Experience gained in Japan suggests that the discharge of a frequency of once a year 2/ is the basis of design discharge of low-water channel.

2/ The design discharge of the frequency of twice a year is being adopted in New Zealand.

Since no field survey data are available at the moment in regard to the rivers in Indonesia, it is considered most suitable, as a temporary measure, to use a flood discharge of a frequency of once in one or two years for the low-water channel design. For a future study subject, it is recommended to perform an actual investigation of rivers, except primitive rivers, in Indonesia for the stability of river channels of already undergone improvements, and to find out the most suitable design discharge for the low-water river channel.

For the Sala River Project, 900 m^3/s has been adopted as suitable, which is the flood discharge of a frequency of once in two years. The discharge of 600 m^3/s mentioned in the Master Plan or pre-Feasibility Study had first been regarded as the flood discharge of a frequency of occurrence of once a year, but it was confirmed later that it was of the frequency of occurrence of 2 to 4 times a year upon examination of the existing hydrological data collected at the survey carried out this time. The discharge of 900 m^3/s is, therefore, determined as the design discharge of the Sala River low-water river channel.

2) High-water River Channel Width

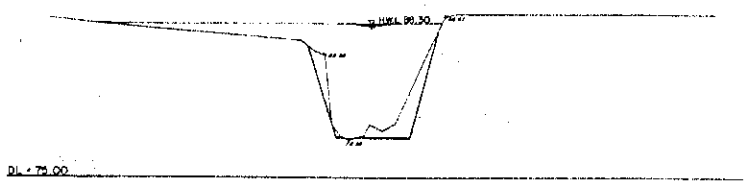
Levees are principally of earth embankment so they reveal an inherited weakness in side erosion. For cross sections with the levees not protected with revetments and groins, it is strongly recommended to allow a sufficient margin in the width of the high-water channel taking into consideration the length of the channel subject to erosion caused by one or two floods. As to the width of the high-water river channel to be scoured by the flood, it seems to have something to do with the river bed gradient, water depth, quality of the soil of the river bank, etc., however, no formula is readily available so far.

In larger rivers in Japan, it is now seldom to see the high-water river channel eroded over a length of 20 to 30 meters after a flood, and there are many cases in which the design high-water channel width of about 50 meters, equivalent to the length to be eroded by two floods is adopted. In the case of the Sala River having silt bank, the length subject to erosion seems much longer than that of the rivers in Japan. Therefore, except for the cross sections protected by revetments and groins, it is considered that the width of the high-water channel should be at least 50 meters, and a width of 80 to 100 meters, is recommended if possible.

As mentioned before, the scale of the Sala River improvement plan may be suitable for the time being but is not sufficiently large to meet the future requirements. As the level of income in the region will gradually get higher as the results of the proposed irrigation and river improvement projects. The individual income will also increase with the expected rise of the GNP, and it is assumed that the accumulated assets in the existing inundation area will also increase gradually. This may likely to call for the secondary improvement to grade up the safety factor of the Sala River. This is the natural and accepted way for promoting the river improvement to improve the safety factor of the river step by step. Therefore, the design river channel width, in other words, the high-water river channel width is recommended to be designed as wide as possible to allow a required margin for the future.

CROSS SECTION of BENGAWAN SALA ~ I

No. 1



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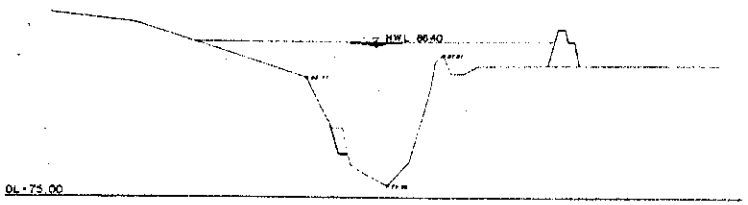

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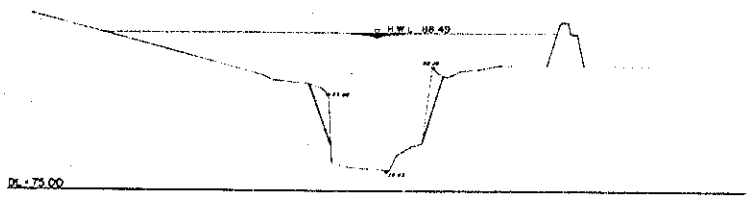

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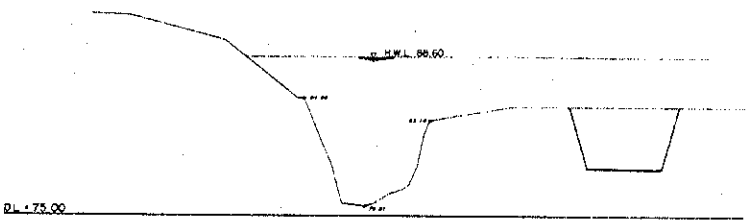

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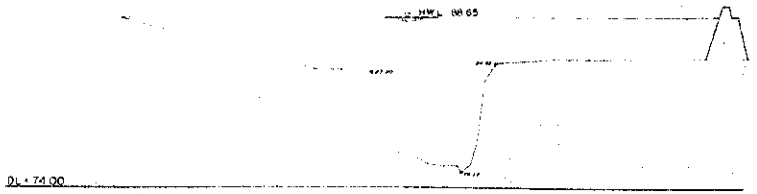

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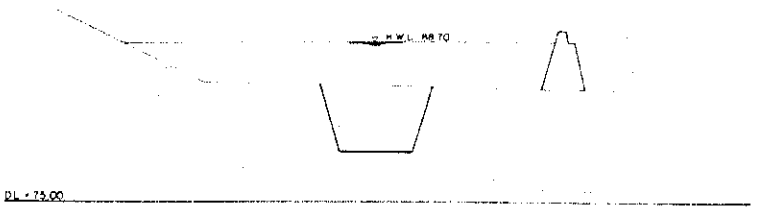

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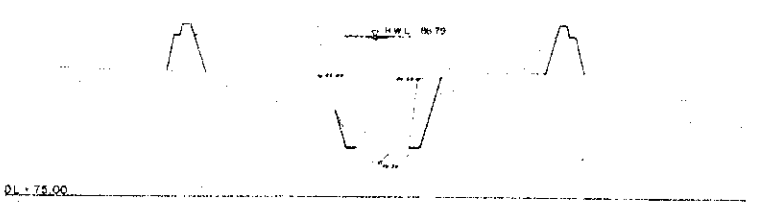

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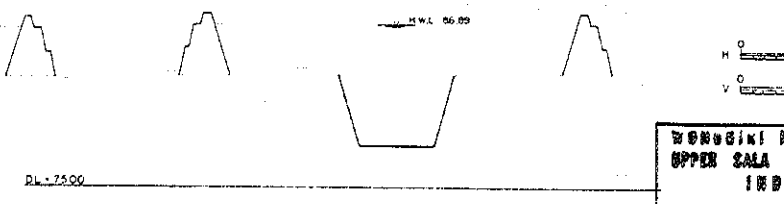

SCALE

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V 0 5 10 15 (m)

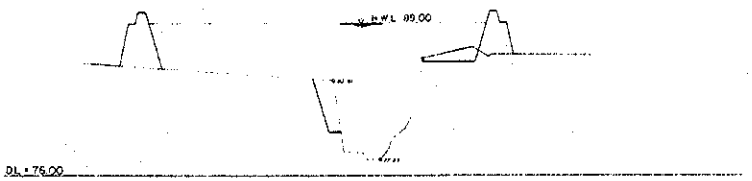
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ I

Date: June '78 | DWG. No. 18

CROSS SECTION of BENGAWAN SALA ~ 2

No. 9



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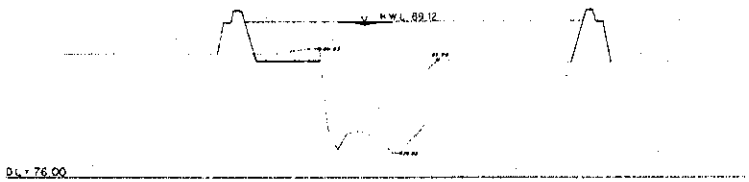

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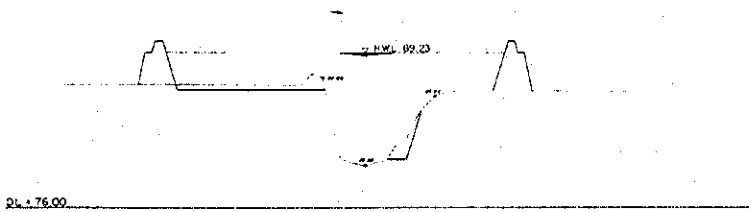

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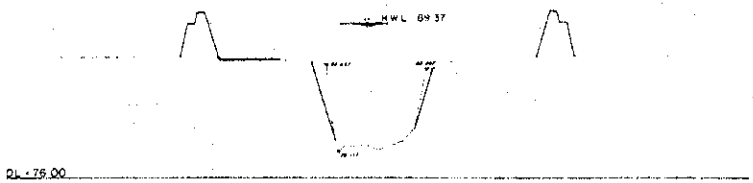

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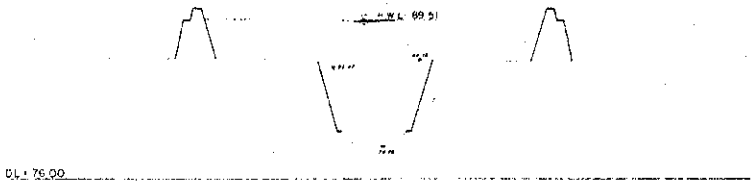

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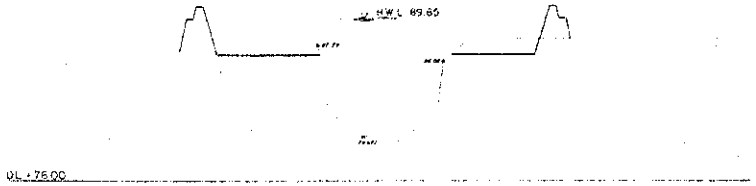

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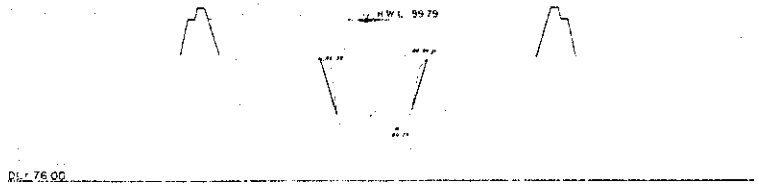

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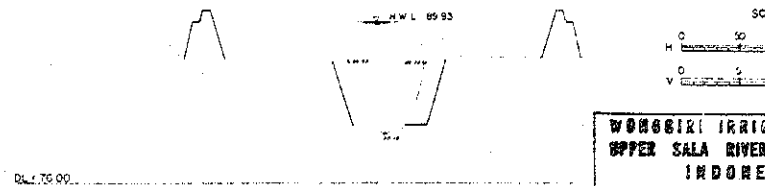


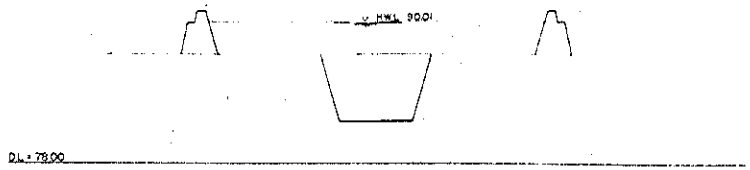
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of BENGAWAN SALA ~ 2

Sept. June 30, 1976 | DWG. No. WR. 19

CROSS SECTION of BENGAWAN SALA ~ 3

No. 17



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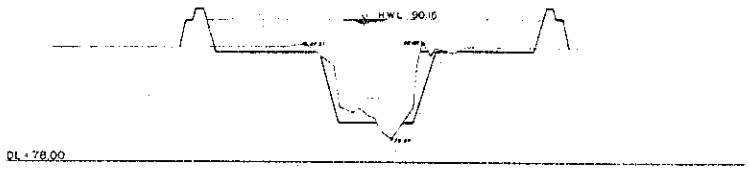

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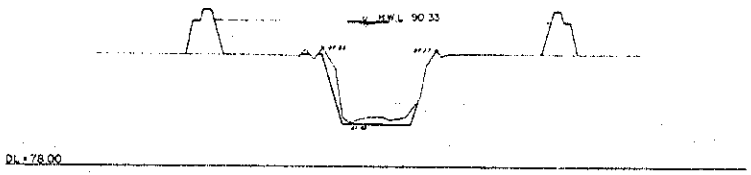

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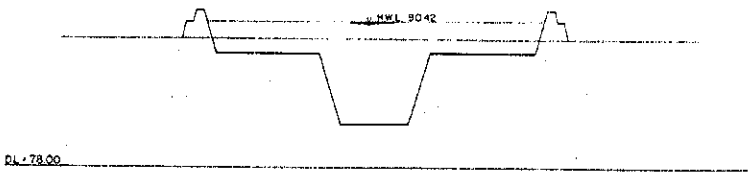

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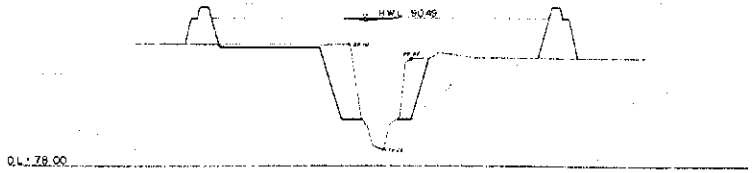

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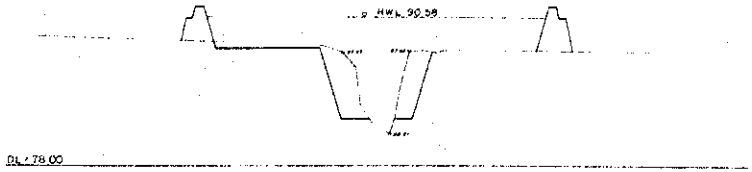

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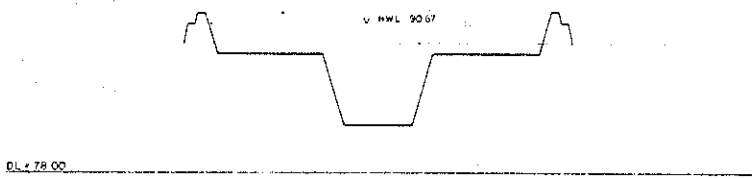

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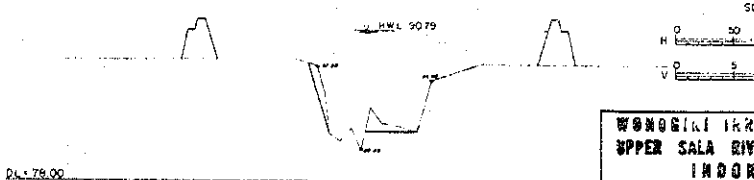

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V 0 5 10 15 (m)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

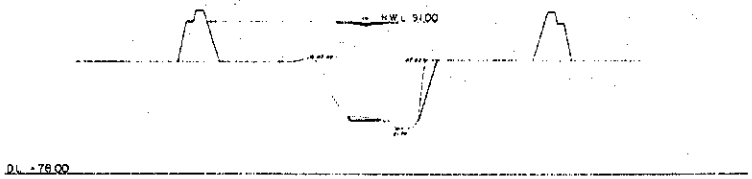
CROSS SECTION of BENGAWAN SALA ~ 3

Date: June 26, 1978 | DWG. No. W2 20

CROSS SECTION of BENGAWAN SALA ~4

No. 25

No. 26



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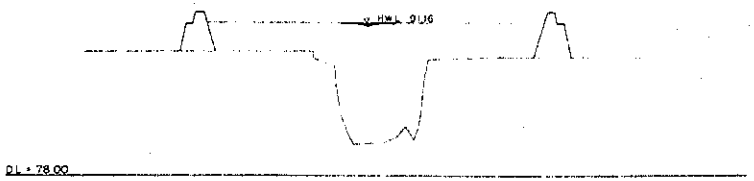

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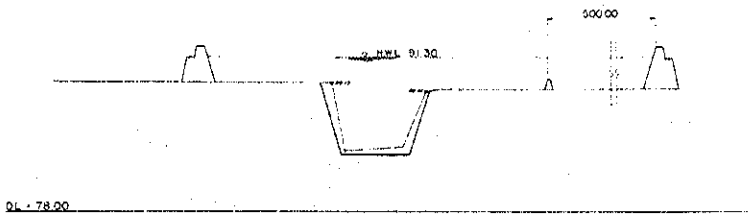

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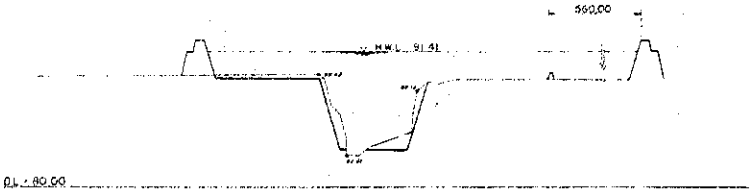

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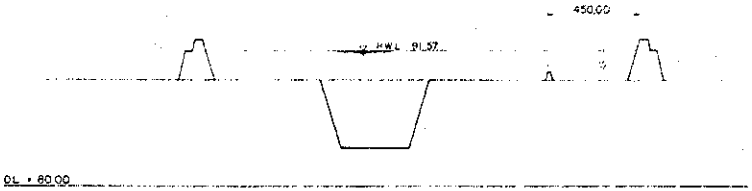

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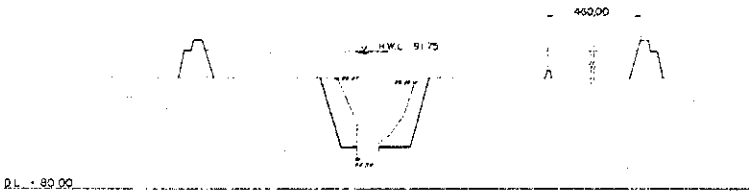

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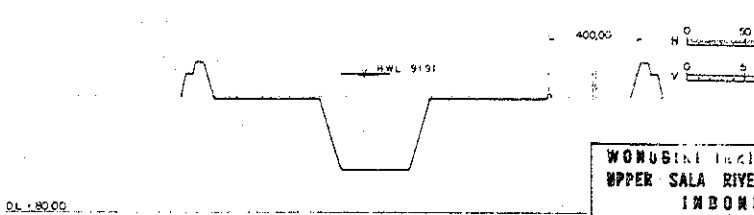

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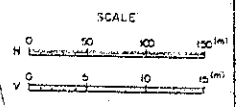


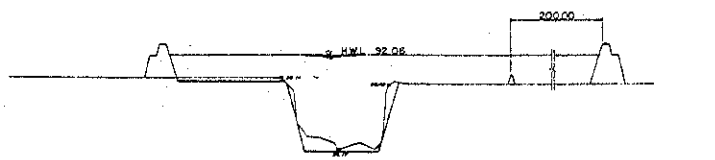
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of BENGAWAN SALA ~ 4

Date: June 24, 1975 | DWG. No. WR. 21

CROSS SECTION of BENGAWAN SALA ~ 5

No. 33



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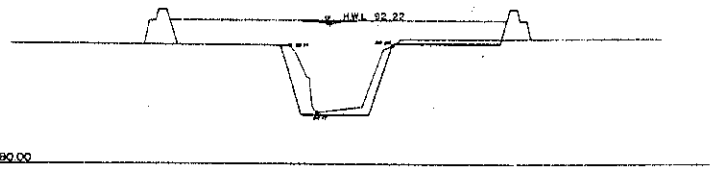

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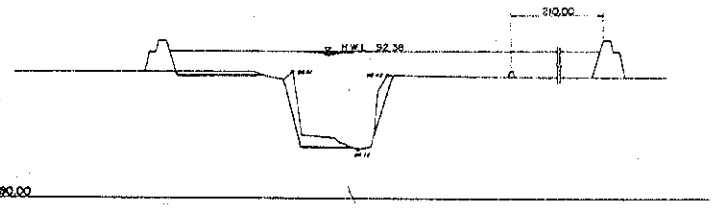

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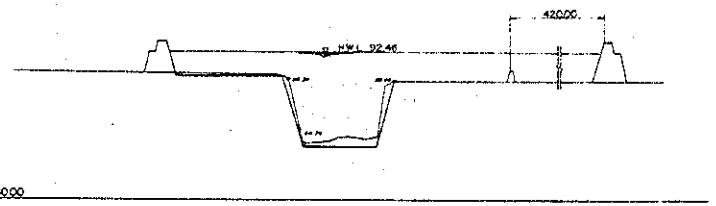

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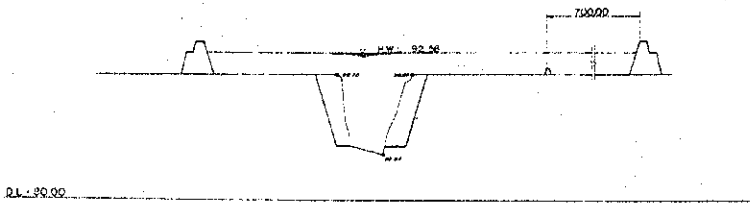

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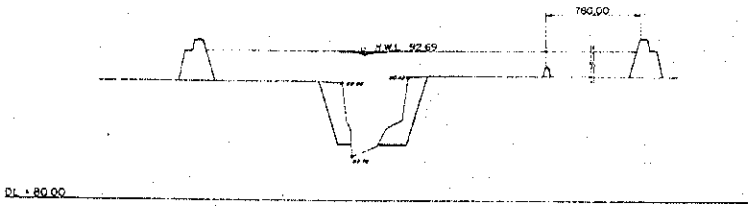

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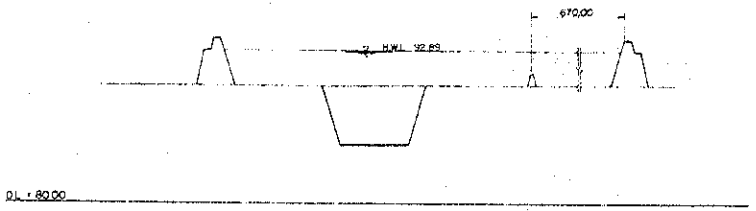

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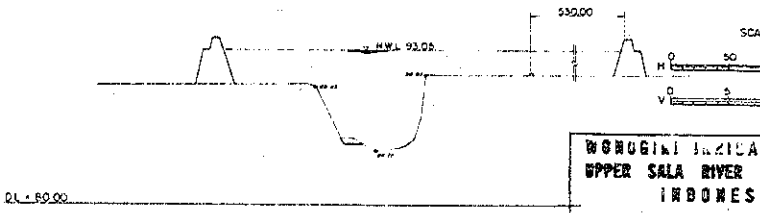

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V 0 5 10 15 (m)

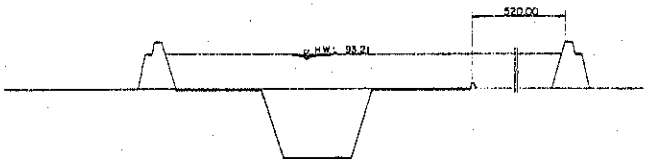
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ 5

Date: June 30, 1976 | DWG. No. 02. 22

CROSS SECTION of BENGAWAN SALA ~ 6

No. 41



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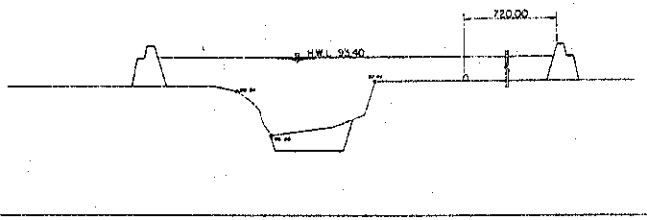

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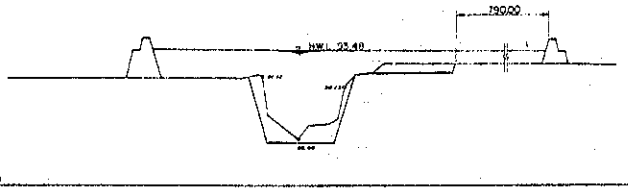

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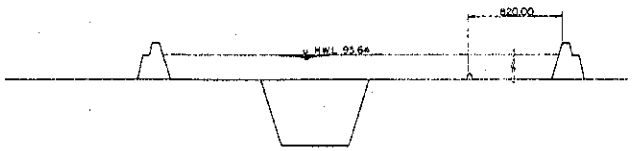

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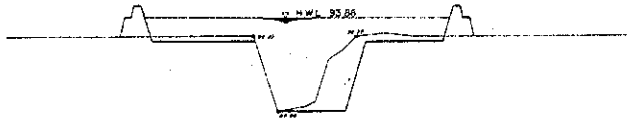

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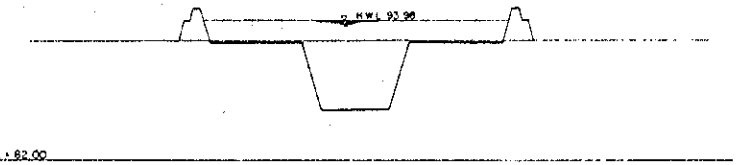

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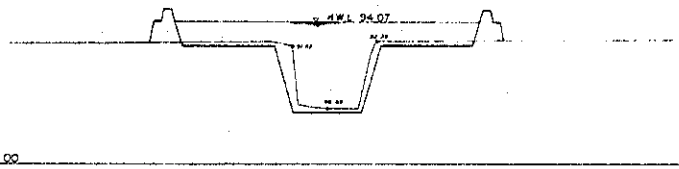

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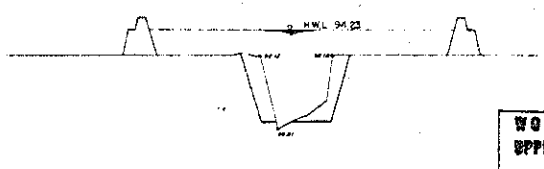
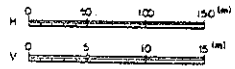


SCALE



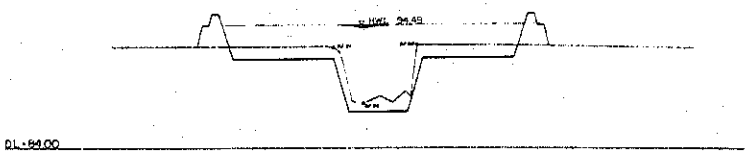
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ 6

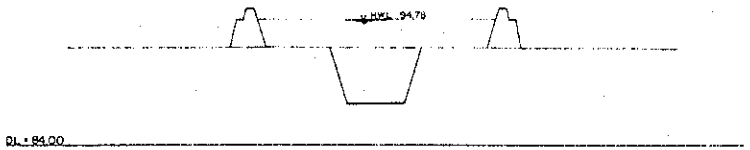
Date: June 30, 1976 | DWG. No. NO. 23

CROSS SECTION of BENGAWAN SALA ~ 7

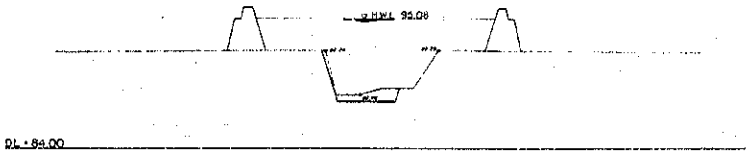
No. 49



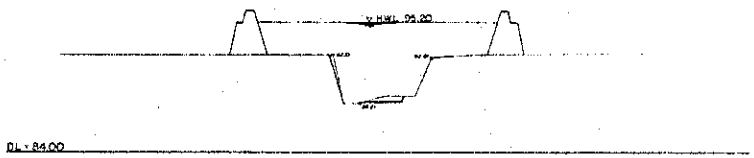
No. 50



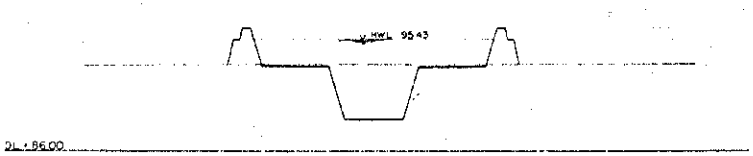
No. 51



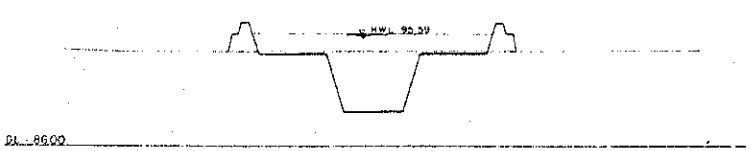
No. 52



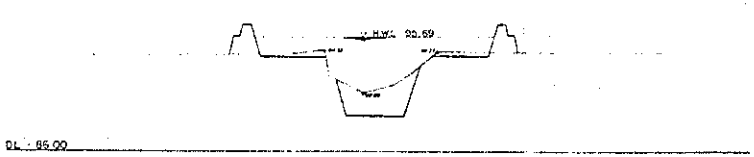
No. 53



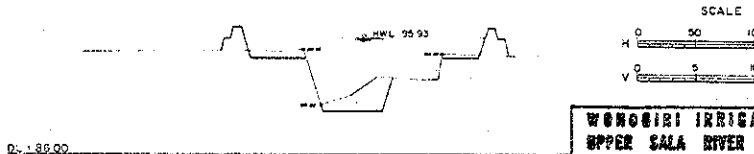
No. 54



No. 55



No. 56



SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

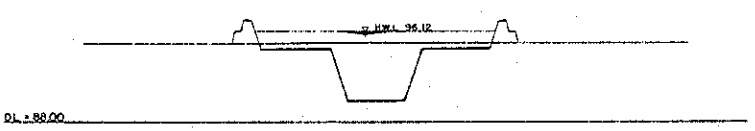
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of BENGAWAN SALA ~ 7

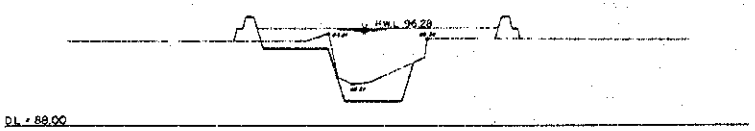
Date: June 26, 1976 | SWL No. WL 24

CROSS SECTION of BENGAWAN SALA~8

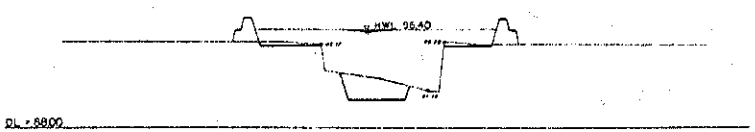
No.57



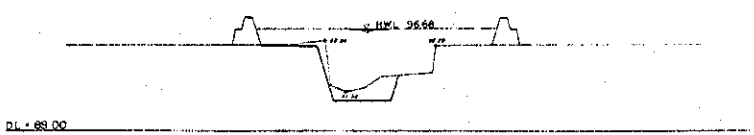
No.58



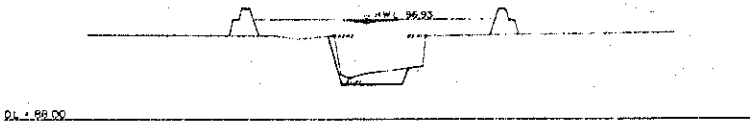
No.59



No.60

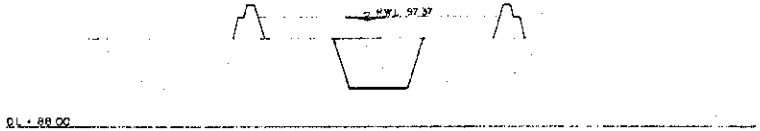


No.61

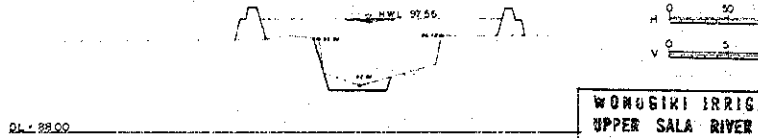


No.62

No.63



No.64



SCALE

H 0 50 100 150(m)

V 0 5 10 15(m)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

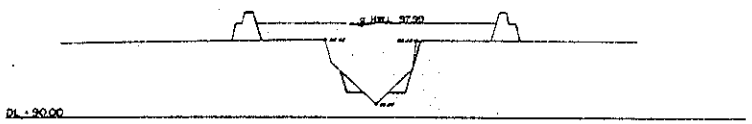
CROSS SECTION of BENGAWAN SALA~8

Date: June 30, 1975 | DWG. No. WR. 25

CROSS SECTION of BENGAWAN SALA ~ 9

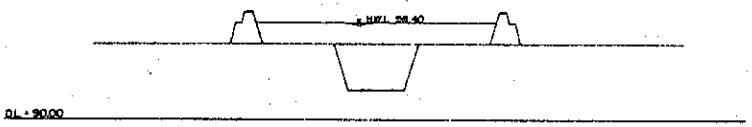
No. 65

No. 66

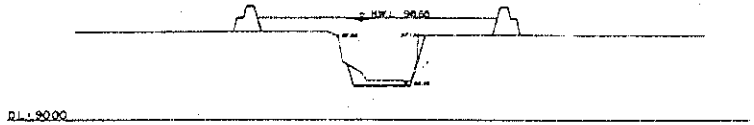


No. 67

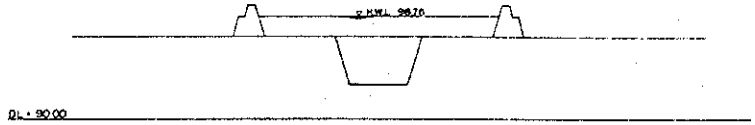
No. 68



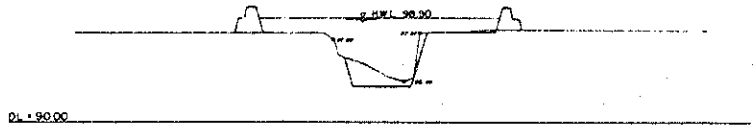
No. 69



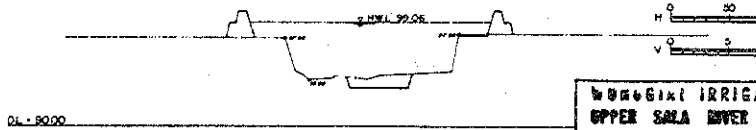
No. 70



No. 71



No. 72



SCALE

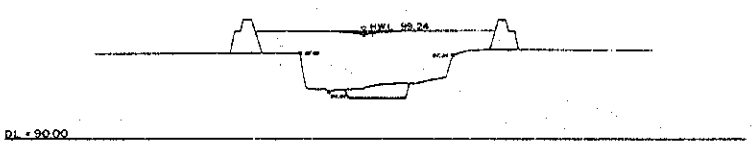
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ 9

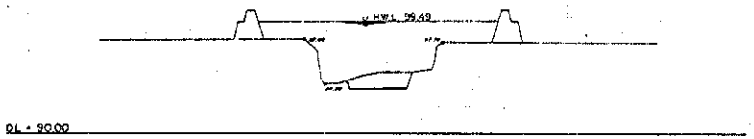
Date: June 24, 1976 | DWG. No. WR 26

CROSS SECTION of BENGAWAN SALA ~ IO

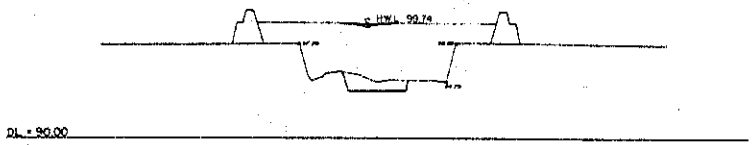
No. 73



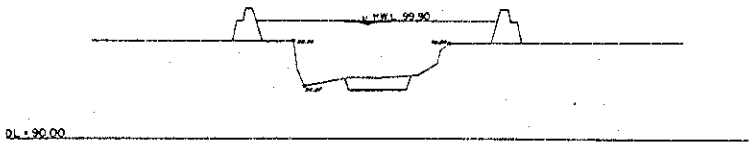
No. 74



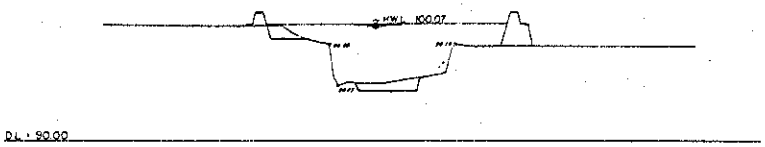
No. 75



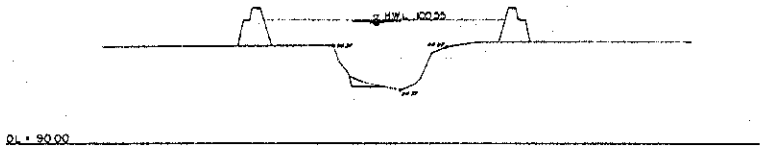
No. 76



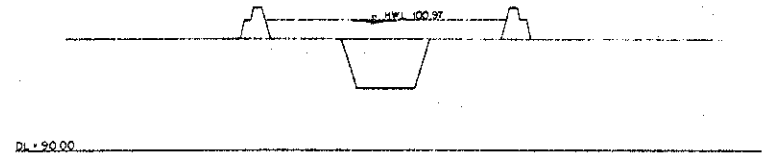
No. 77



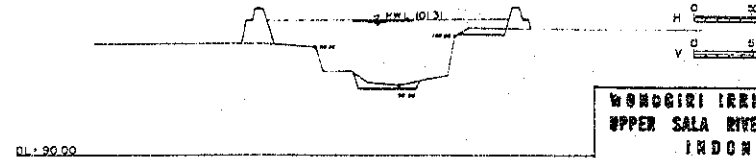
No. 78



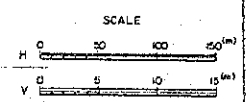
No. 79



No. 80



SCALE



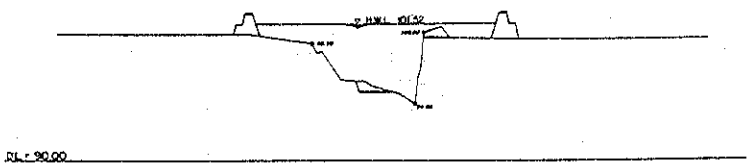
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ IO

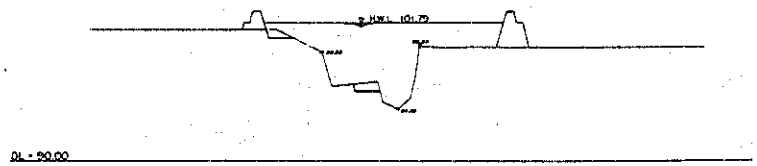
Date: June 24, 1975 | DWG. No. NR. 27

CROSS SECTION of BENGAWAN SALA ~ II

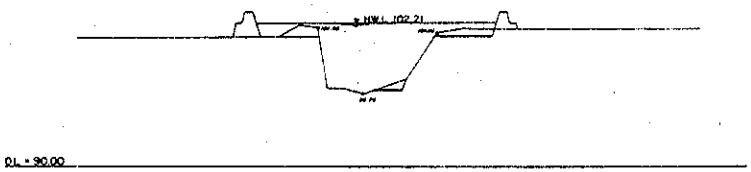
No. 81



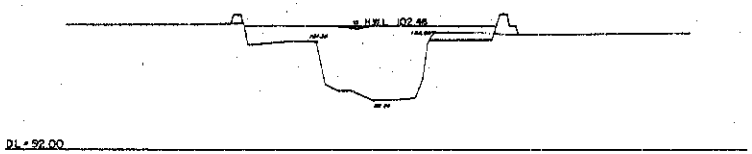
No. 82



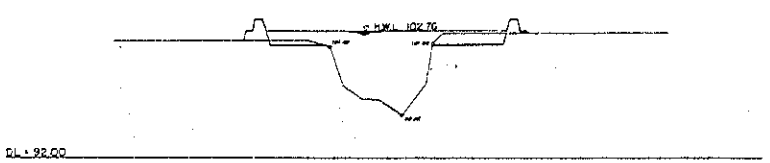
No. 83



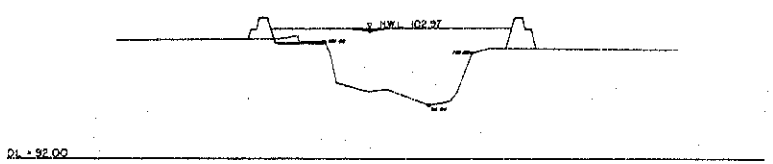
No. 84



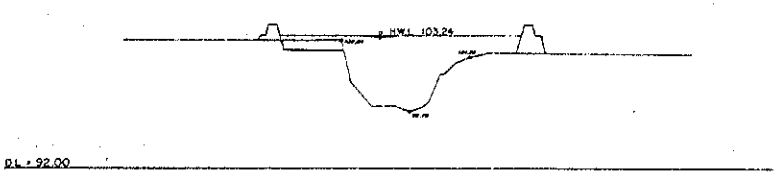
No. 85



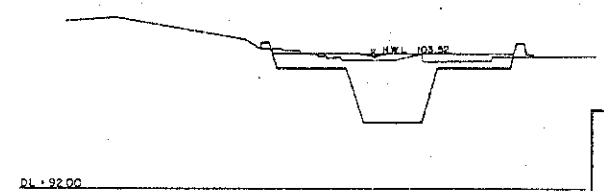
No. 86



No. 87



No. 88



SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

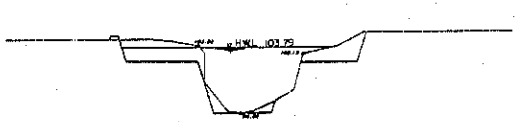
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of BENGAWAN SALA ~ II

Date: June 14, 1978 | DWG. No. 82 28

CROSS SECTION of BENGAWAN SALA ~ 12

No. 89



D.L. + 95.00

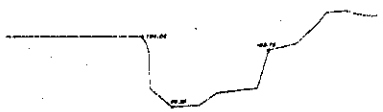
No. 90

D.L. + 95.00

No. 91

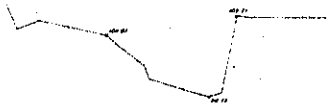
D.L. + 95.00

No. 92



D.L. + 95.00

No. 93



D.L. + 95.00

SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

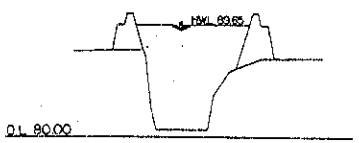
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION
of BENGAWAN SALA ~ 12

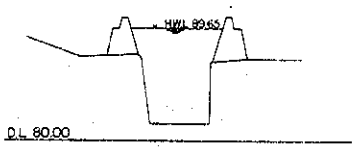
Date: June 26, 1975 | DWG. No. WR 29

CROSS SECTION of K.WINGKO

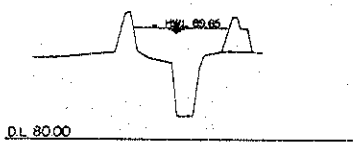
No. 0



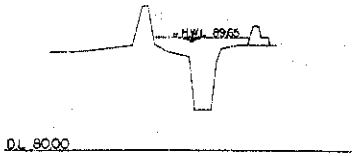
No. 1



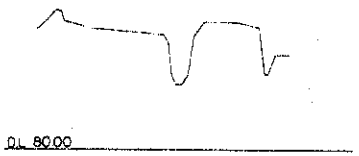
No. 2



No. 3



No. 4



SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

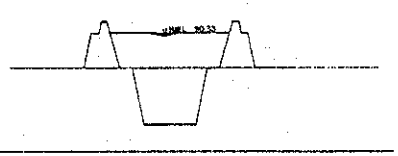
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of K.WINGKO

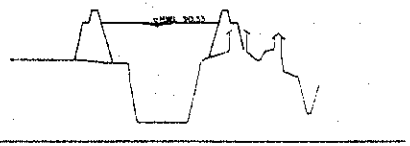
Date: June 26, 1978 | DWG. No. 02 30

CROSS SECTION of K.SAMIN

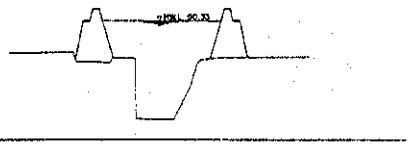
No. 0



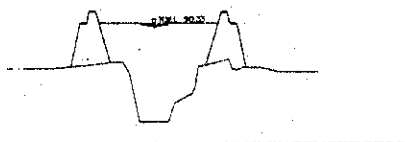
No. 1



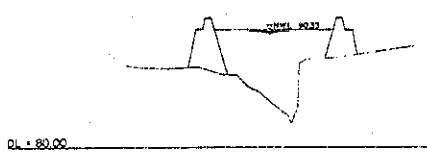
No. 2



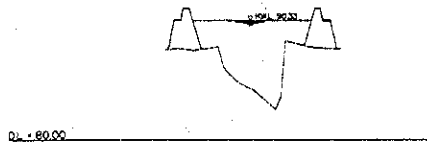
No. 3



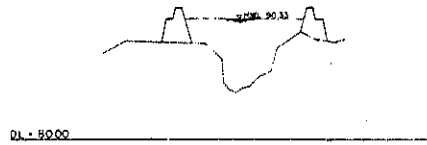
No. 4



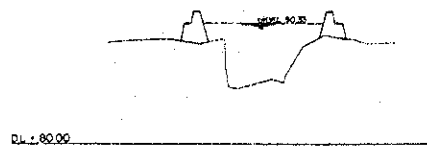
No. 5



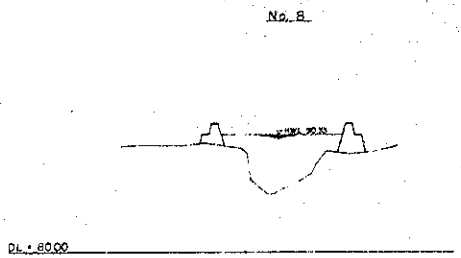
No. 6



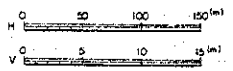
No. 7



No. 8



SCALE



WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of K.SAMIN

Date: June 30, 1976 | DWG. No. W2. 31

CROSS SECTION of K.KEMBANGAN

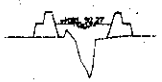
No. 0

DL. = 80.00

No. 1

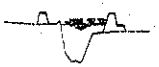
DL. = 80.00

No. 2



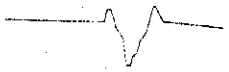
DL. = 85.00

No. 3



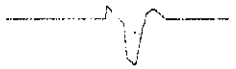
DL. = 85.00

No. 4



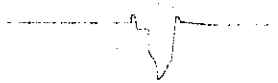
DL. = 85.00

No. 5



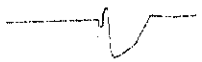
DL. = 85.00

No. 6



DL. = 90.00

No. 7

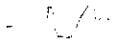


DL. = 90.00

Jemb Baki

DL. = 90.00

No. 8



DL. = 90.00

SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

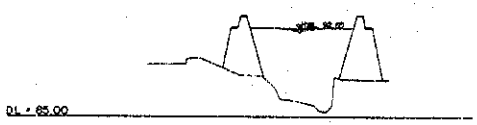
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of K.KEMBANGAN

Date: June 28, 1974 | DWG. No. WL 32

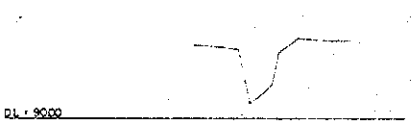
CROSS SECTION of K.BRAMBANG

No. 0

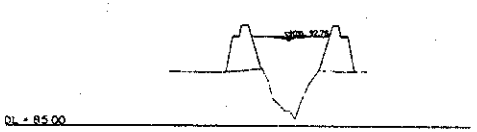


No. 4

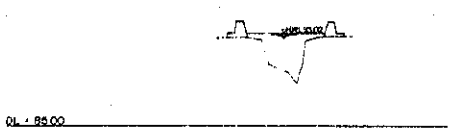
No. 8



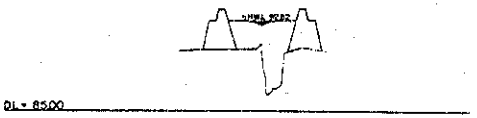
No. 1



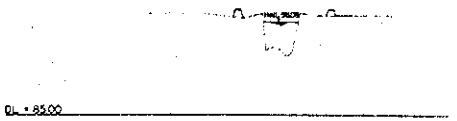
No. 5



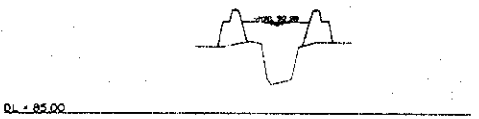
No. 2



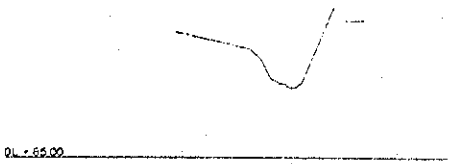
No. 6



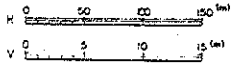
No. 3



No. 7



SCALE



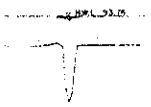
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION of K.BRAMBANG

Date: June 30, 1976 | DWG. No. WI. 33

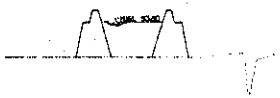
CROSS SECTION of K.BUNTUNGAN

No. 0



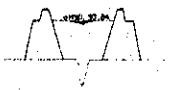
DL + 85.00

No. 1



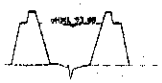
DL + 85.00

No. 2



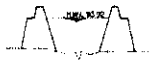
DL + 85.00

No. 3



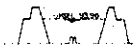
DL + 85.00

No. 4



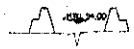
DL + 85.00

No. 5



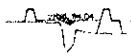
DL + 85.00

No. 6



DL + 85.00

No. 7

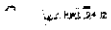


DL + 85.00

No. 8

DL + 85.00

No. 9



DL + 90.00

No. 10

DL + 90.00

SCALE

H 0 50 100 150 (m)

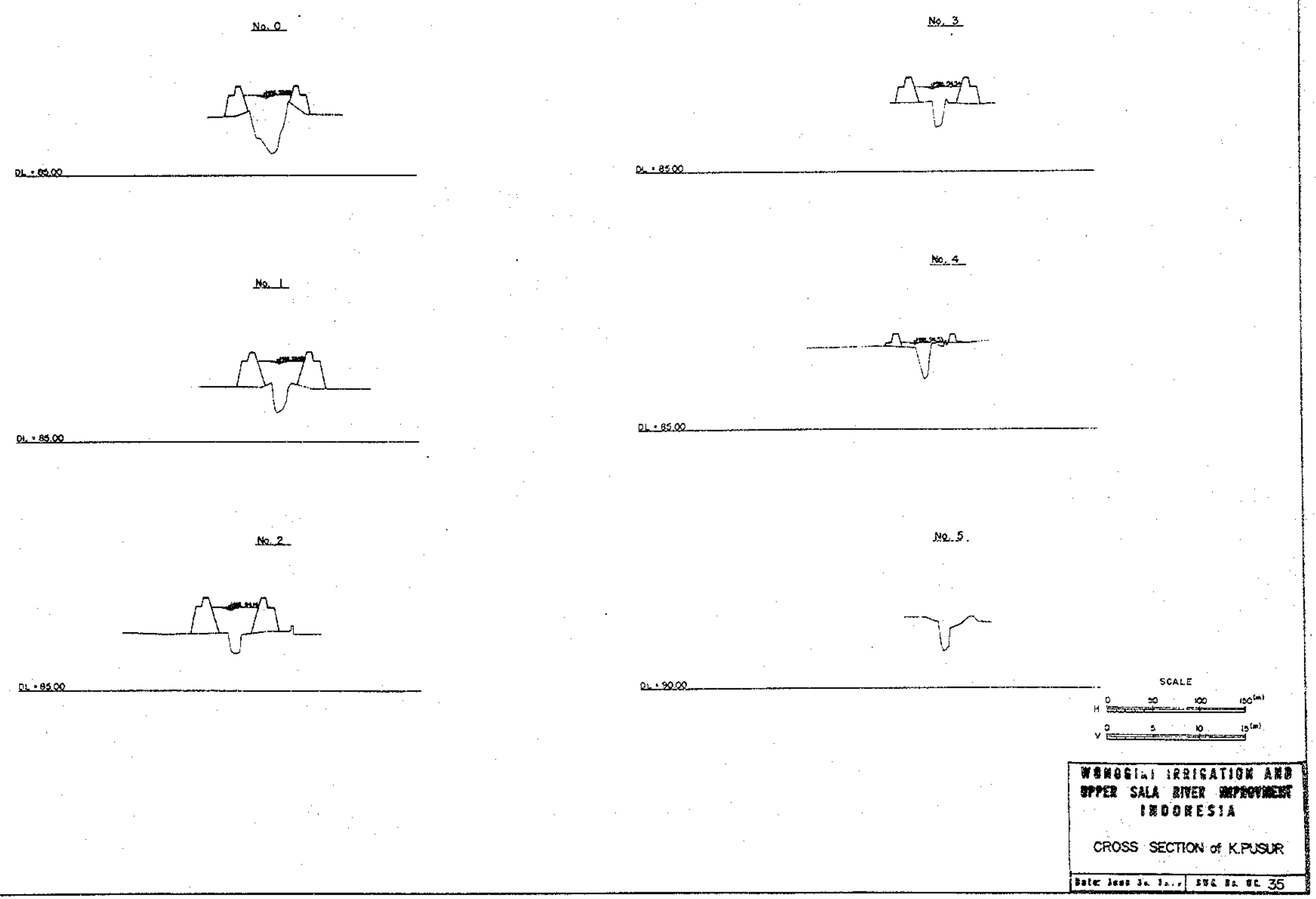
V 0 5 10 15 (m)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of K.BUNTUNGAN

Date: June 30, 1976 | DWG. No. 72. 34

CROSS SECTION of K.PUSUR



CROSS SECTION of K.DENGKENG ~ 1

No. 0

DL + 85.00

No. 1

DL + 85.00

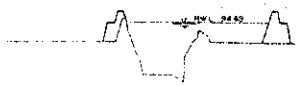
No. 2

DL + 85.00

No. 3

DL + 85.00

No. 4



DL + 85.00

No. 5

DL + 85.00

SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION of K.DENGKENG~1

Date: June 30, 1976 | DWG. No. WR 36

CROSS SECTION of K.DENGKENG ~ 2

No. 6

DL + 85.00

No. 7

DL + 85.00

No. 8

DL + 85.00

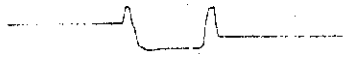
No. 9

DL + 85.00

No. 10

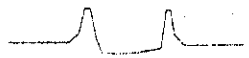
DL + 85.00

No. 11



DL + 85.00

No. 12



DL + 85.00

SCALE

H 0 50 100 150 (m)

V 0 5 10 15 (m)

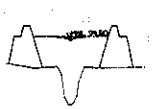
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

CROSS SECTION of K.DENGKENG ~ 2

Date: June 1, 1976 | DWG. No. 37

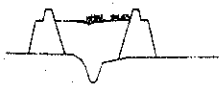
CROSS SECTION of K.GAWE

No. 0



DL. +85.00

No. 1

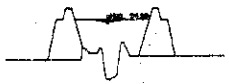


DL. +85.00

No. 2

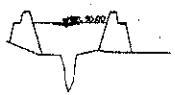
DL. +85.00

No. 3



DL. +85.00

No. 4



DL. +85.00

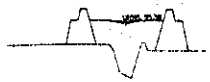
No. 5

DL. +85.00

No. 6

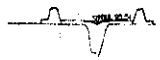
DL. +85.00

No. 7



DL. +85.00

No. 8



DL. +90.00

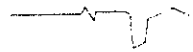
No. 9

DL. +90.00

No. 10

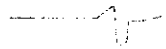
DL. +90.00

No. 11



DL. +90.00

No. 12

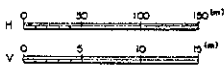


DL. +90.00

No. 13

DL. +90.00

SCALE



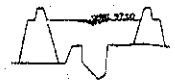
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

CROSS SECTION of K.GAWE

Date: June 30, 1975 | DWG. No. WR. 38

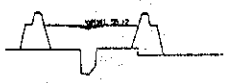
CROSS SECTION of K.JLANTAH

No. 0



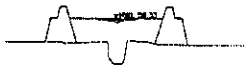
DL = 90.00

No. 1



DL = 90.00

No. 2



DL = 90.00

No. 3

DL = 90.00

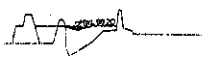
No. 4

DL = 90.00

No. 5

DL = 90.00

No. 6



DL = 90.00

道路橋

DL = 90.00

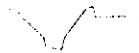
道路橋

DL = 90.00

No. 7

DL = 95.00

No. 8



DL = 95.00

No. 9

DL = 95.00

SCALE

H 0 50 100 150 (m)

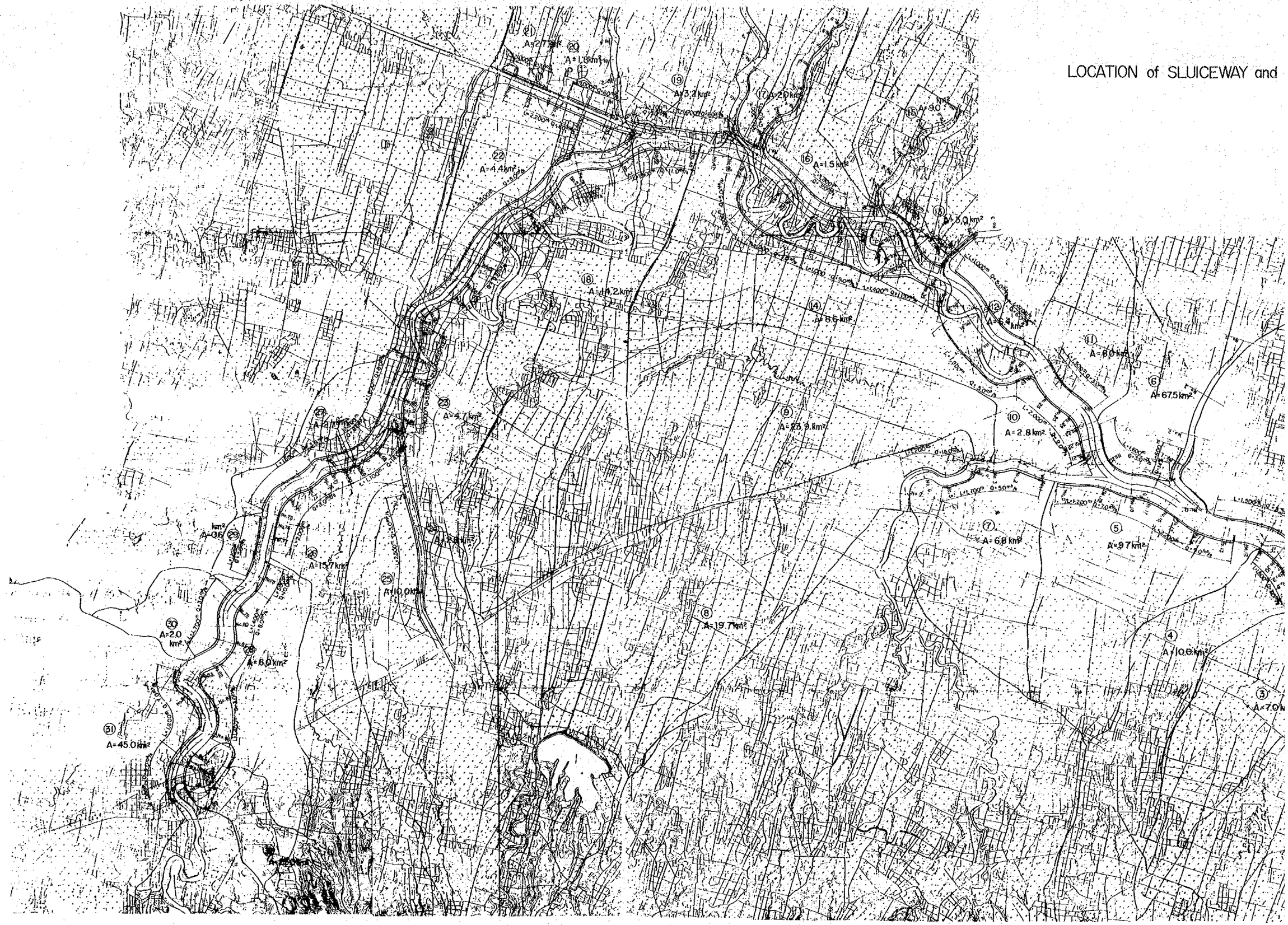
V 0 5 10 15 (m)

WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

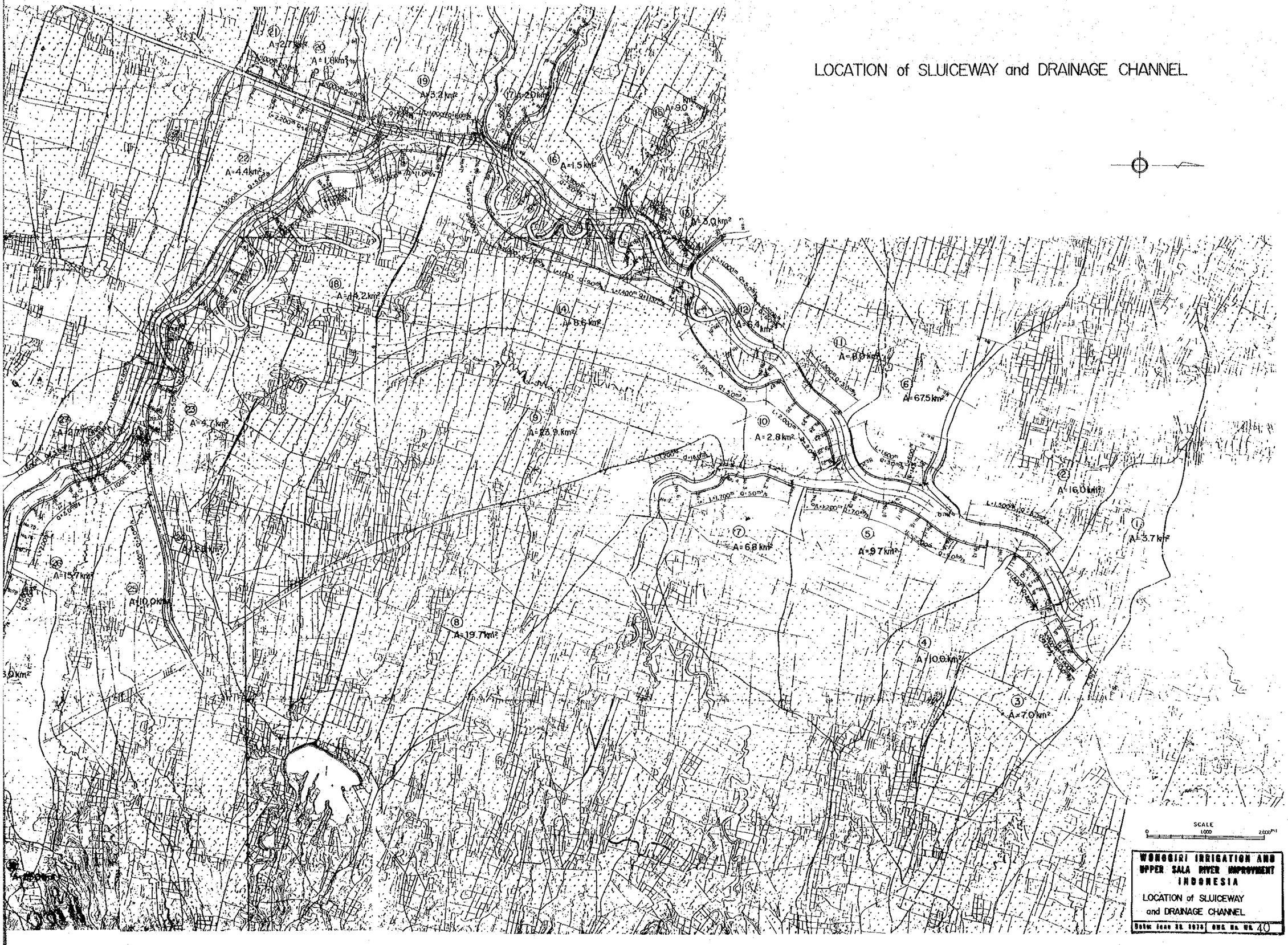
CROSS SECTION of K.JLANTAH

Date: June ... 1...5 | DWG. No. 開 39

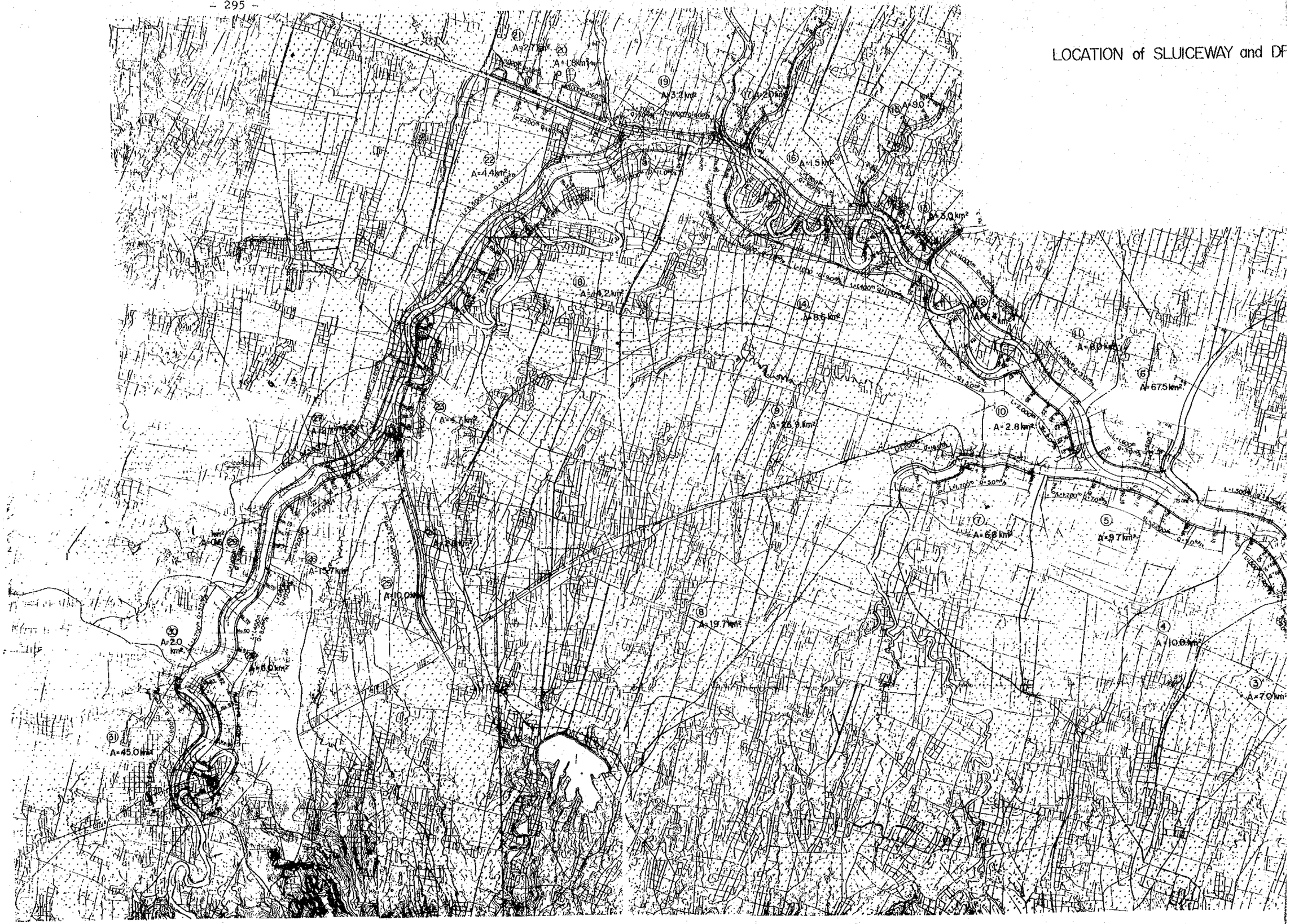
LOCATION of SLUICEWAY and



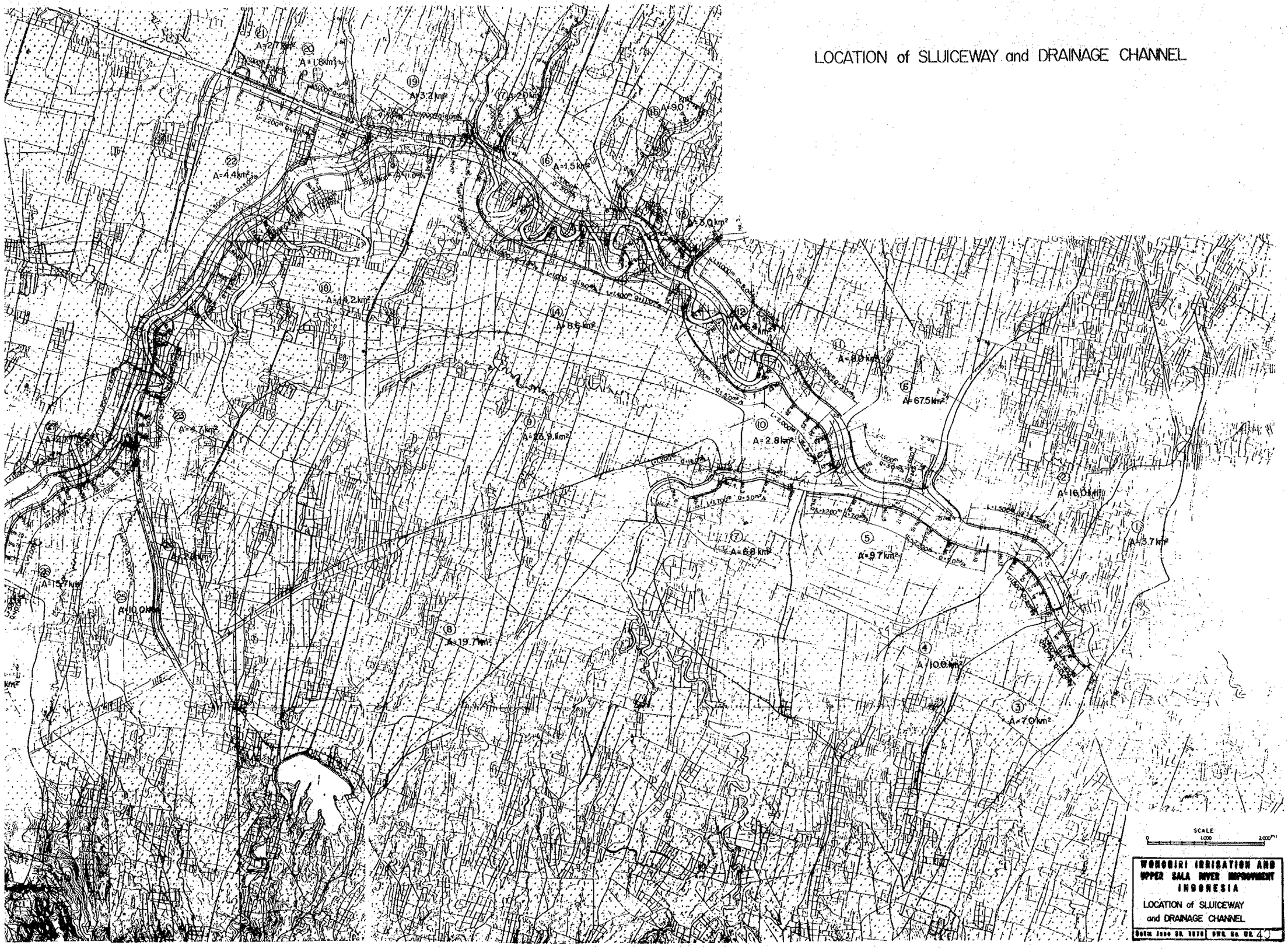
LOCATION of SLUICEWAY and DRAINAGE CHANNEL

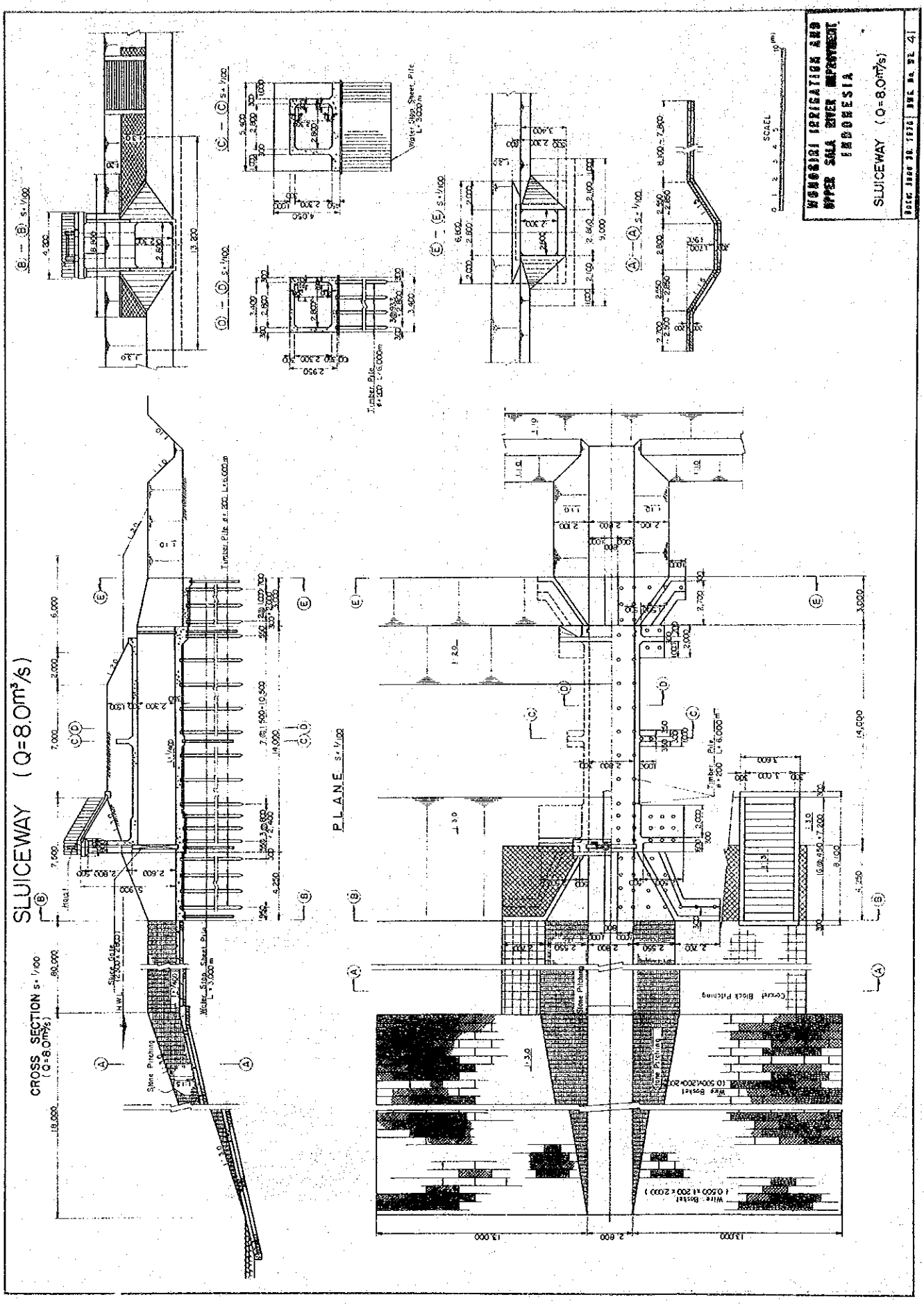


LOCATION of SLUICEWAY and DF



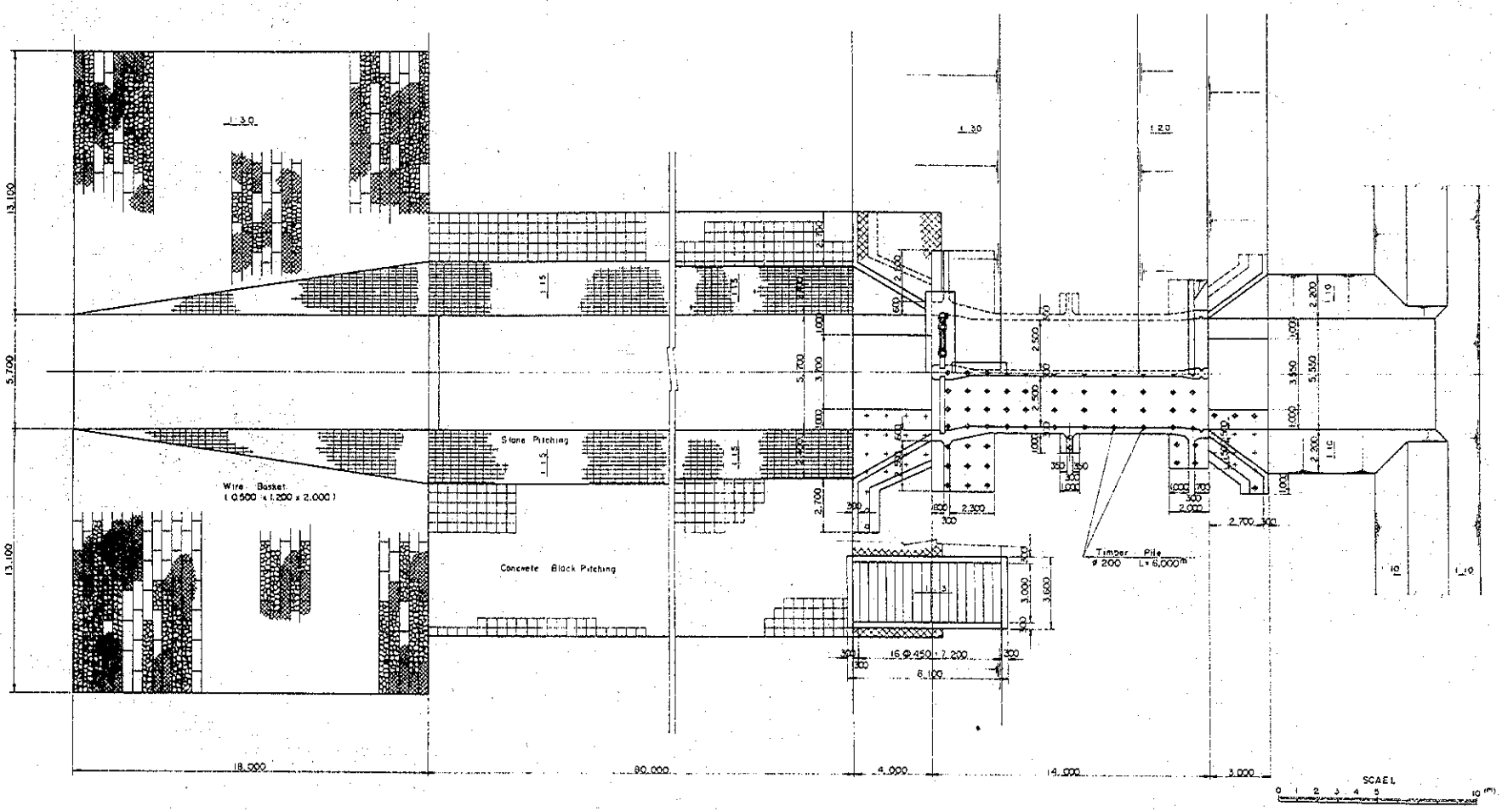
LOCATION of SLUICEWAY and DRAINAGE CHANNEL



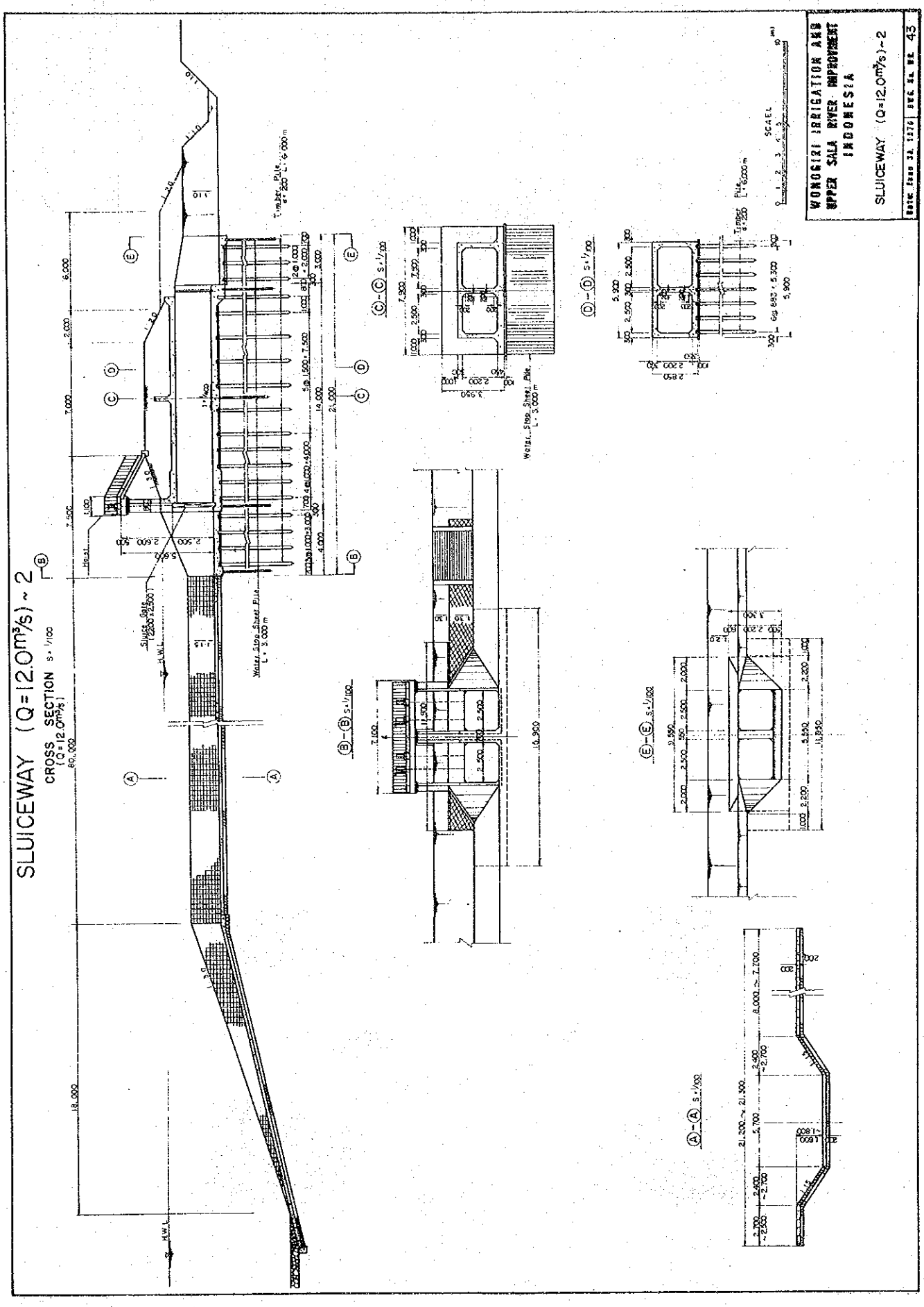

SLUICEWAY (Q=8.0m³/s)
CROSS SECTION
PLANE
SLUICEWAY (Q=8.0m³/s)

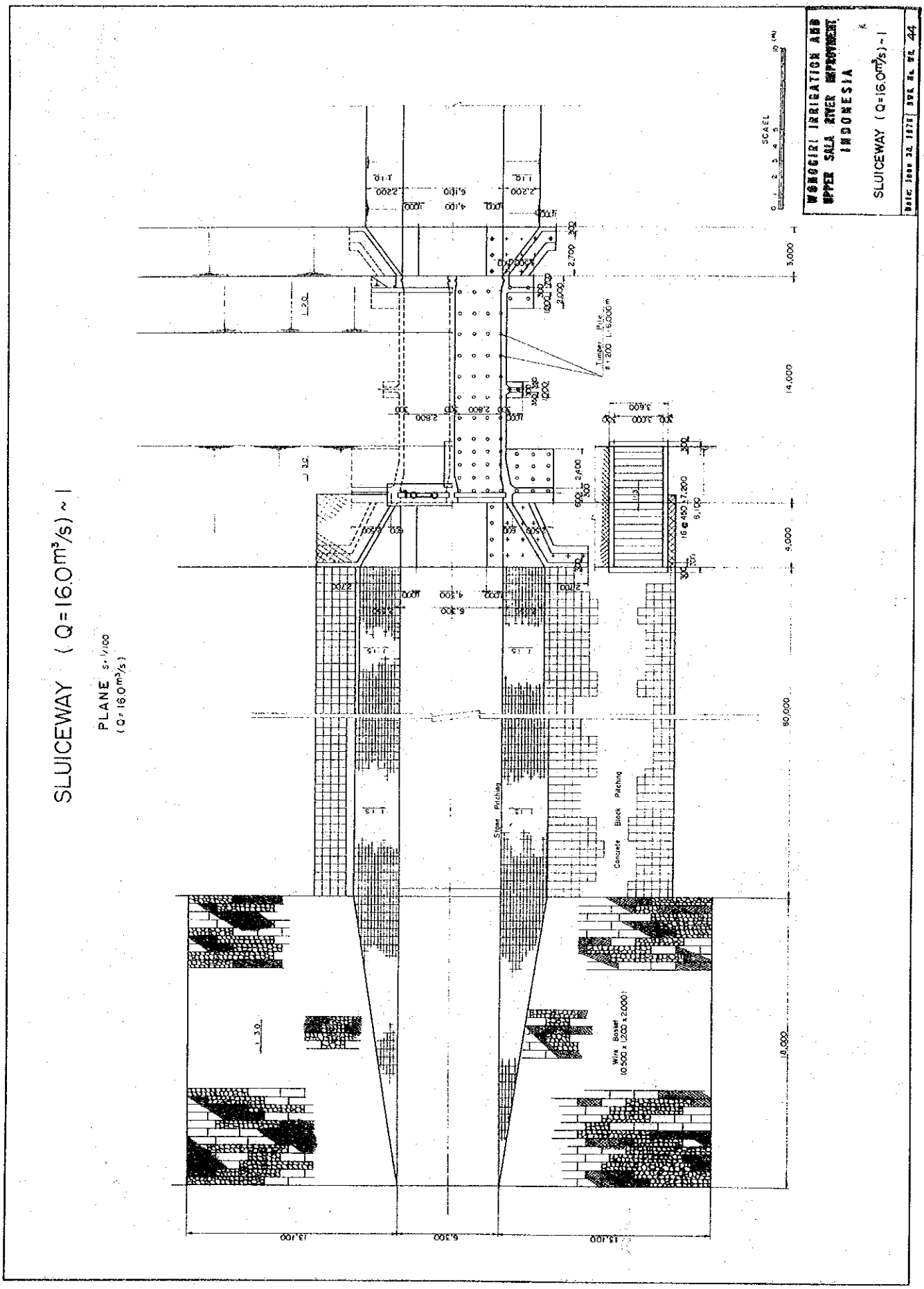
SLUICEWAY (Q=12.0m³/s) ~ I

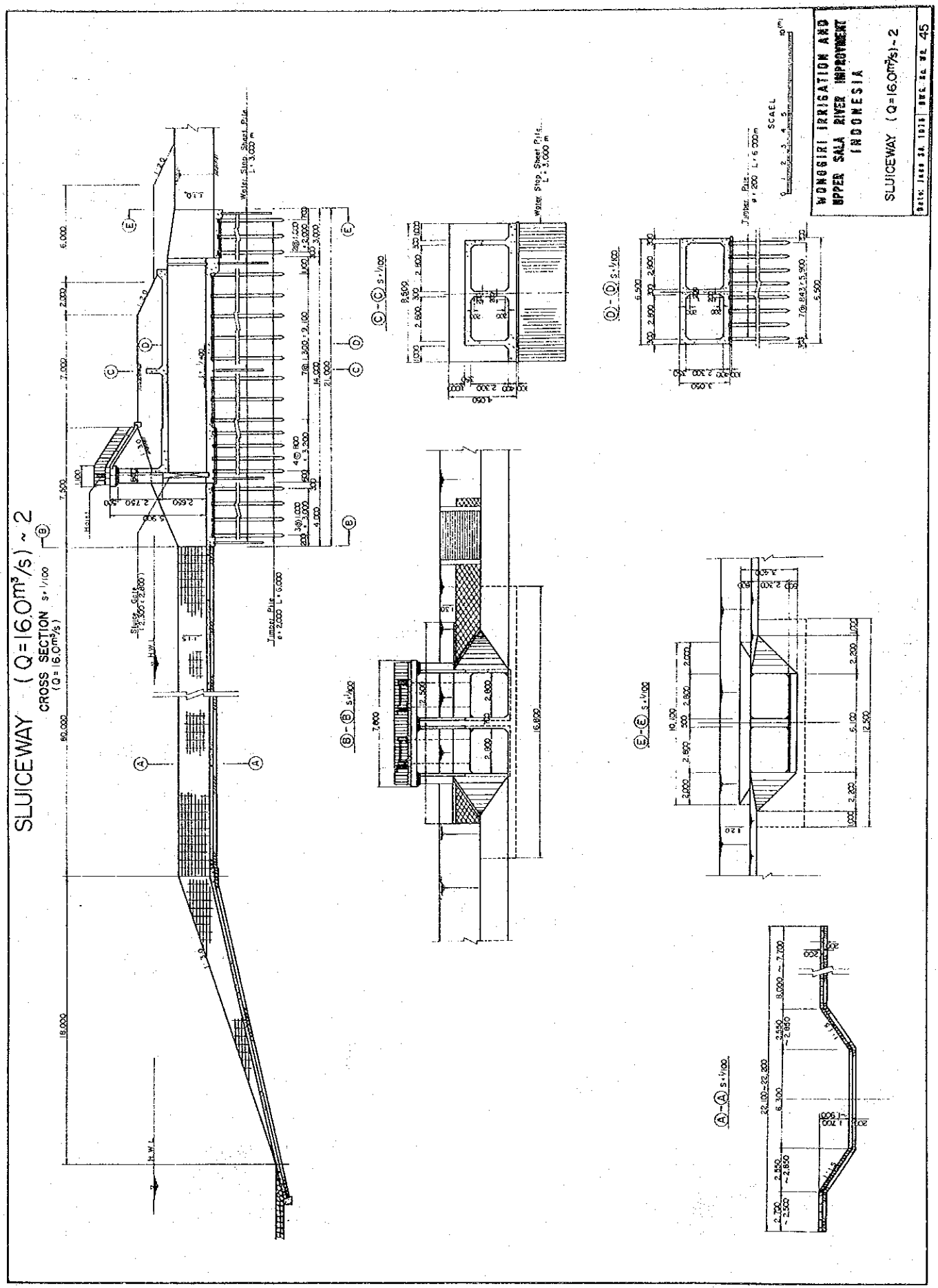
PLANE S= 1/100
(Q=12.0m³/s)



WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA
SLUICEWAY (Q=12.0m³/s) ~ I
Date: June 28, 1970 | DWG. No. GR. 42

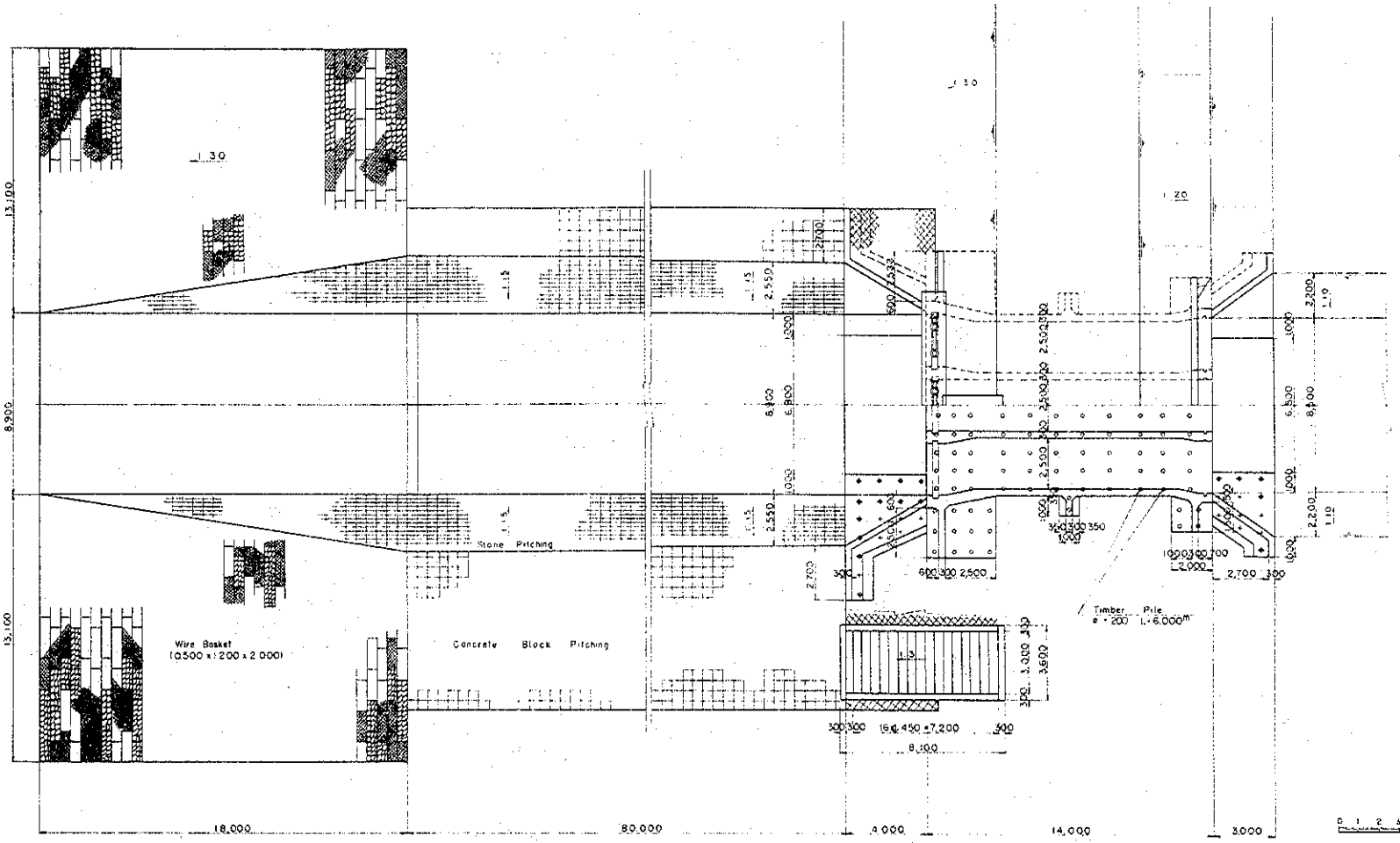

SLUICEWAY (Q=12.0m³/s)-2
CROSS SECTION (Q=12.0m³/s)
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
SLUICEWAY (Q=12.0m³/s)-2
Timber Pile
Water Stop Sheet Pile
L=3.000m
Sluice Gate
(2500x2500)
H.W.L
L.W.L
(B)-(B) S=1/100
(C)-(C) S=1/100
(D)-(D) S=1/100
(E)-(E) S=1/100
(A)-(A) S=1/100


SLUICEWAY (Q=16.0m³/s) ~ I
PLANE
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
SLUICEWAY (Q=16.0m³/s) ~ I
SCALE
Stone Pitching
Concrete Block Pitching
Wire Basket
Timber Pile


SLUICEWAY (Q=16.0m³/s) ~ 2
CROSS SECTION S=1/100
(Q=16.0m³/s)
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
SLUICEWAY (Q=16.0m³/s)-2
Water Stop Sheet Pile
L=3.000 m
Timber Pile
φ=200 L=6.000m
Sluice Gate
2.300×2.800
H.W.L
Hoist
C-C S=1/100
D-D S=1/100
B-B S=1/100
E-E S=1/100
A-A S=1/100
SCALE

SLUICEWAY (Q=20.0m³/s) - I

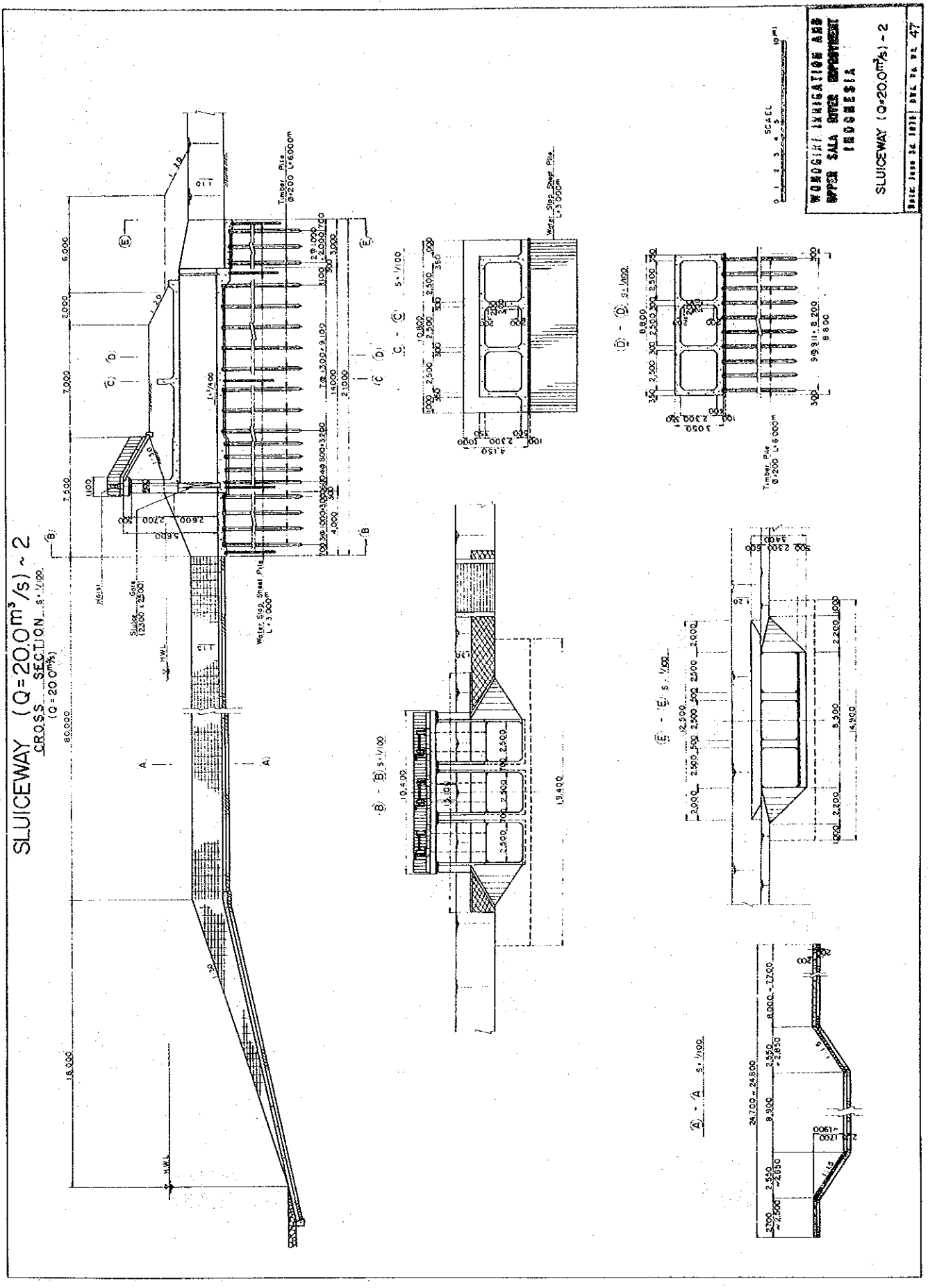
PLANE S=1/100
(Q=20.0m³/s)

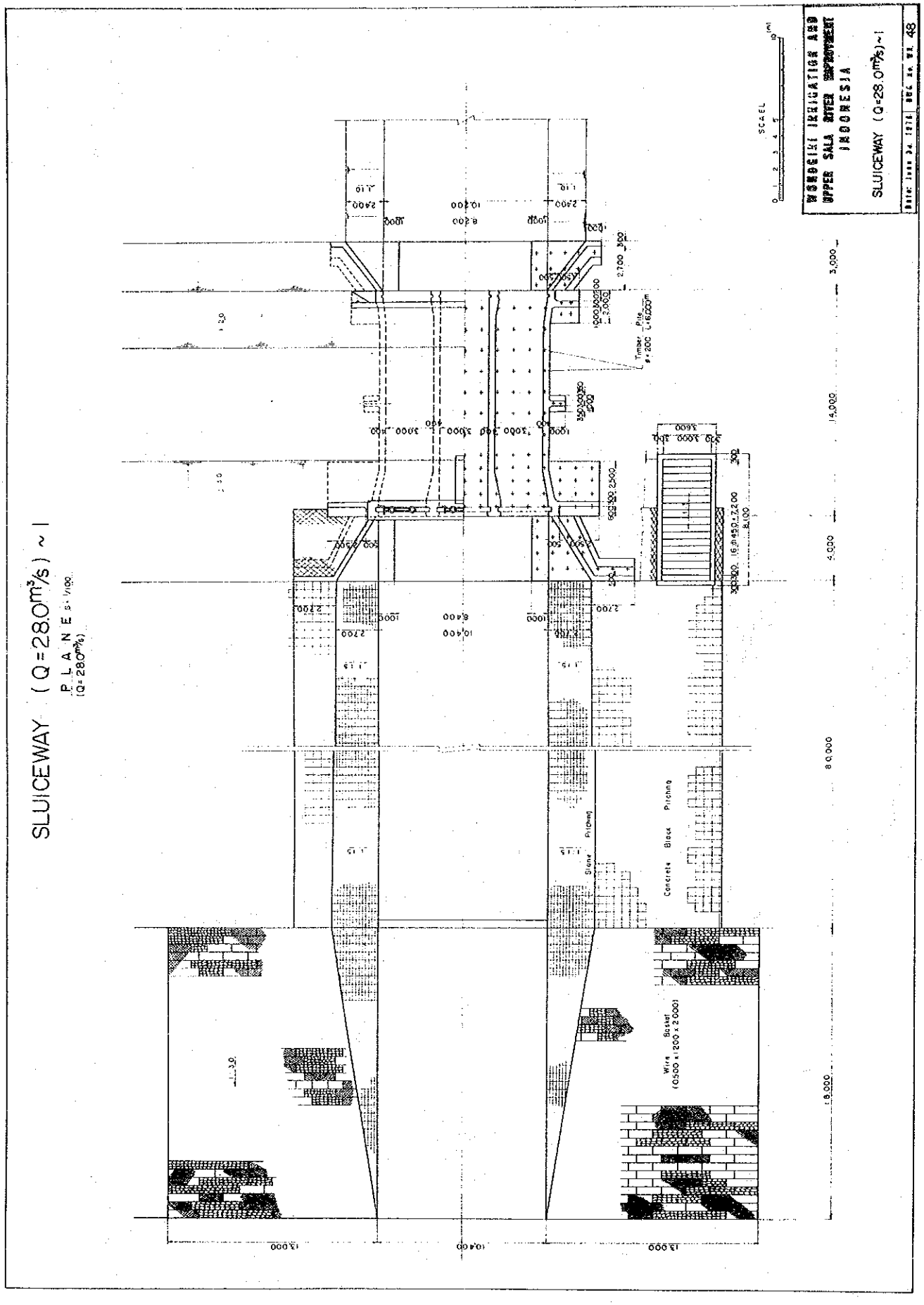


WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

SLUICEWAY (Q=20.0m³/s) - I

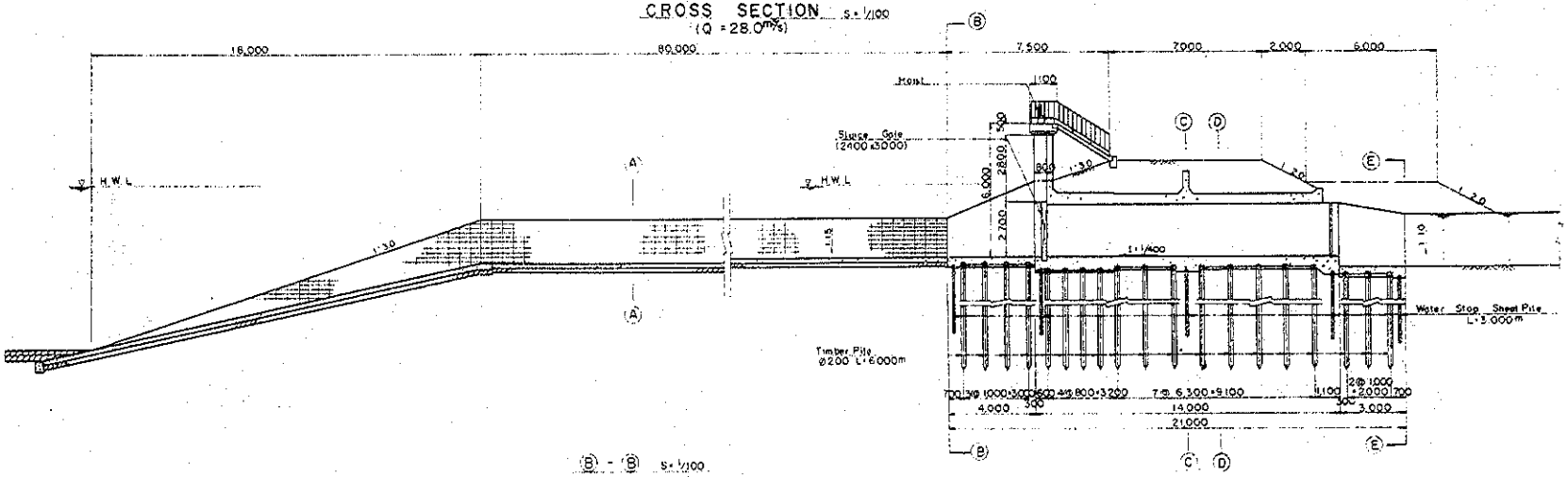
DATE: JAN. 26, 1978 | DRG. No. NE 46


SLUICEWAY (Q=20.0m³/s) - 2
CROSS SECTION
(Q = 20.0m³/s)
SCALE
WONOGIRI IRRIGATION AND
UPPER SALA RIVER DEVELOPMENT
INDONESIA
SLUICEWAY (Q=20.0m³/s) - 2
Timber Pile
Water Stop Sheet Pile
Gate
Hoist
H.W.L
L.W.L

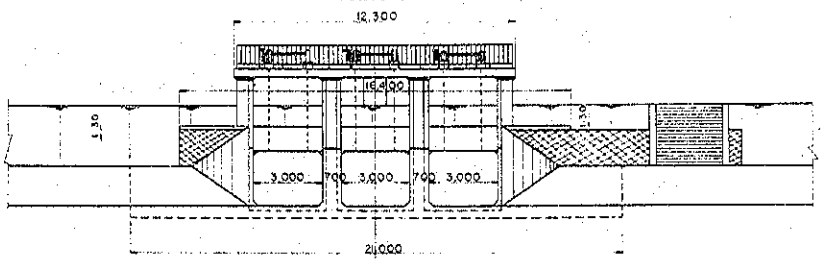

SLUICEWAY (Q=28.0m³/s) ~ I
PLAN
(Q=28.0m³/s)
SCALE
WORKSHOP IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
SLUICEWAY (Q=28.0m³/s)~I
Concrete Block Pitching
Stone Pitching
Wire Basket
(0.500 x 1.200 x 2.000)
Timber Pile
φ=200 L=6.000m

SLUICEWAY (Q=28.0m³/s) ~ 2

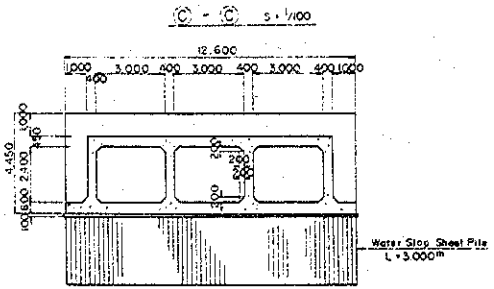
CROSS SECTION S = 1/100
(Q = 28.0m³/s)



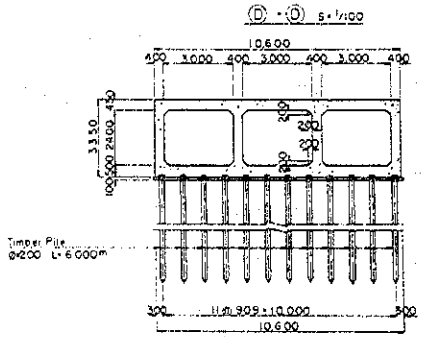
Ⓑ - Ⓑ S = 1/100



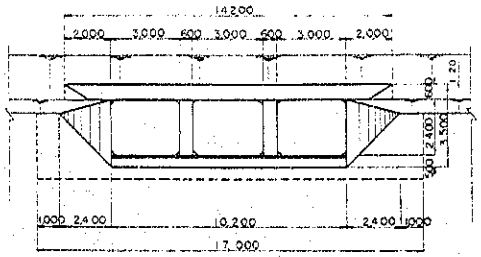
Ⓒ - Ⓒ S = 1/100



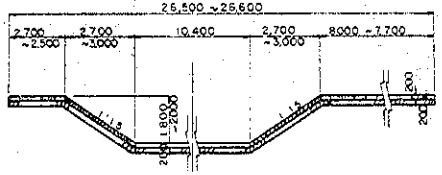
Ⓓ - Ⓓ S = 1/100



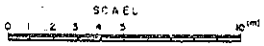
Ⓔ - Ⓔ S = 1/100



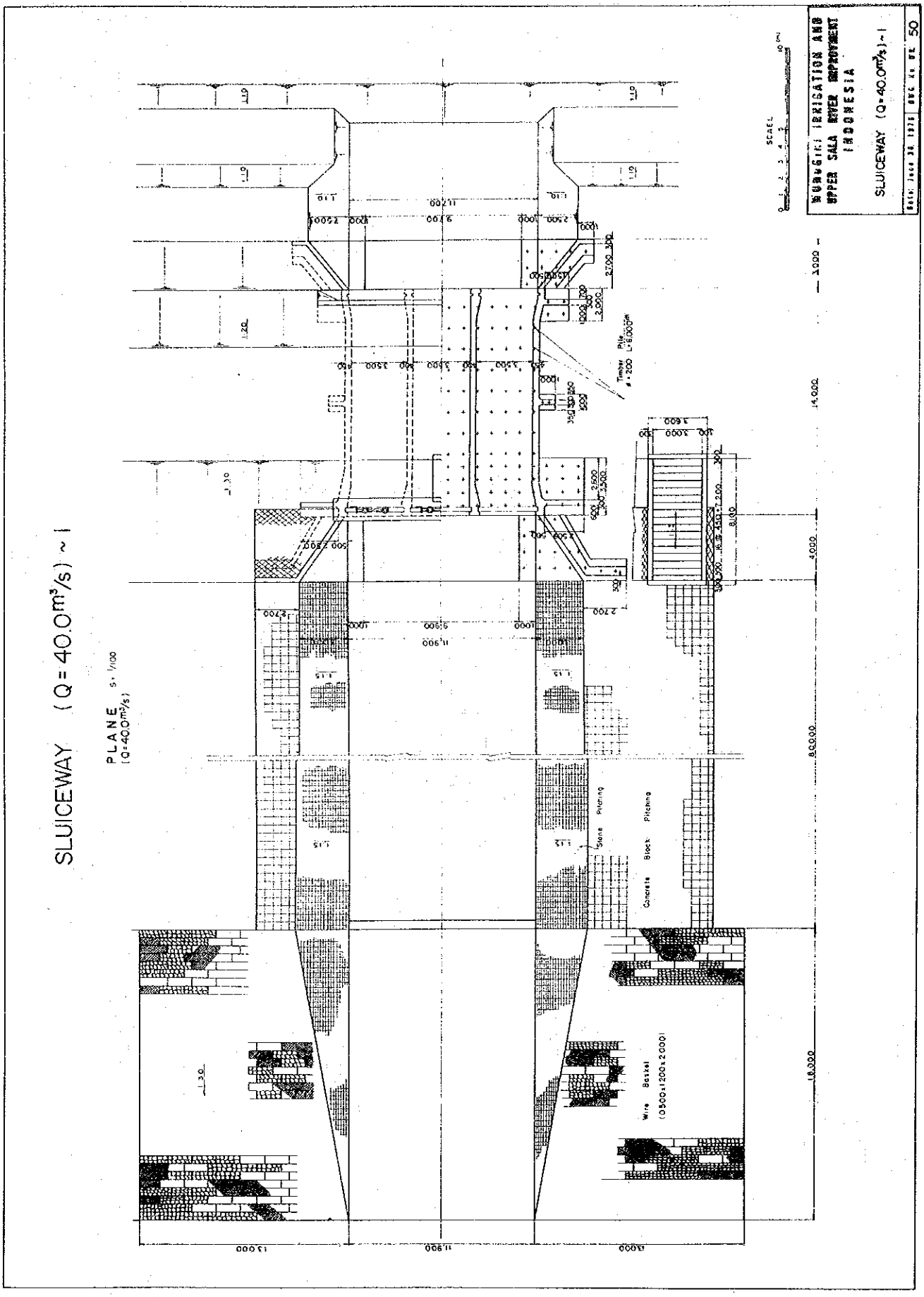
Ⓐ - Ⓐ S = 1/100



SCALE

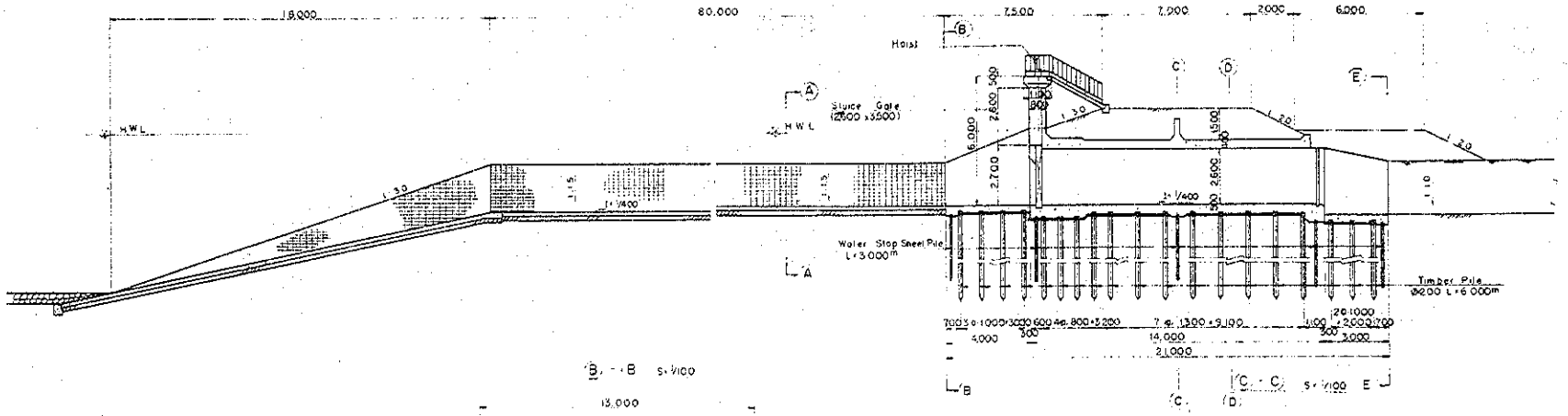


WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA
SLUICEWAY (Q=28.0m³/s)~2
Date: June 30, 1976 | DWG. No. WR. 49

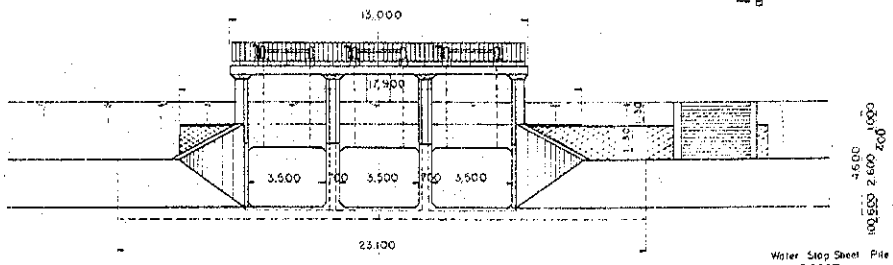

SLUICEWAY (Q=40.0m³/s) ~ I
PLANE (Q=40.0m³/s) S=1/100
SCALE
Timber Pile
Stone Pitching
Concrete Block Pitching
Wire Basket
(0.50×1.20×2.00)
13,000
11,900
13,000
18,000
8,000
14,000
4,000
2,000
SLUICEWAY (Q=40.0m³/s)~I
50

SLUICEWAY (Q=40.0m³/s)~2

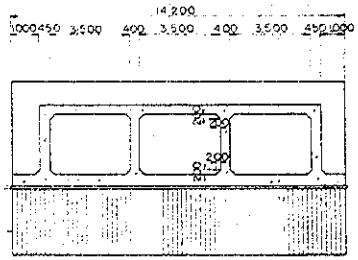
CROSS SECTION (Q = 40.0m³/s) S = 1/100



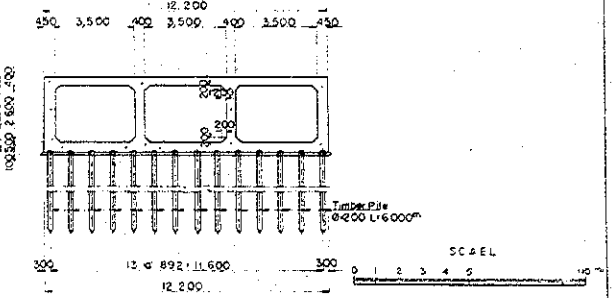
B - B S = 1/100



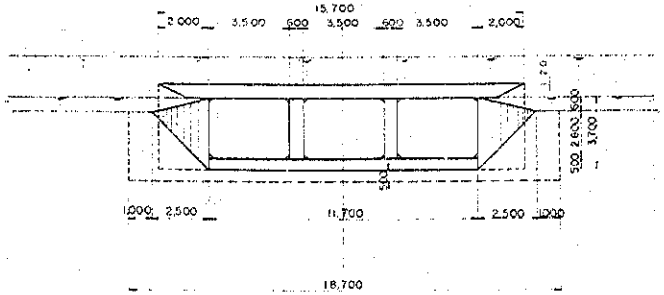
C - C S = 1/100



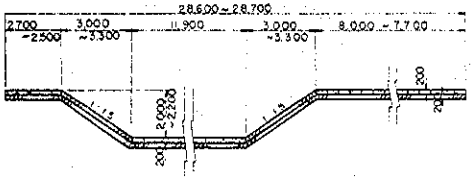
D - D S = 1/100



E - E S = 1/100



A - A S = 1/100



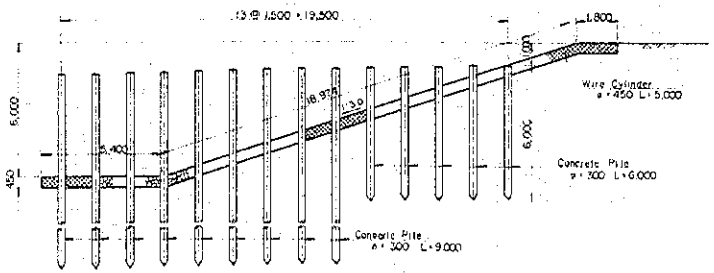
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

SLUICEWAY (Q=40.0m³/s)~2

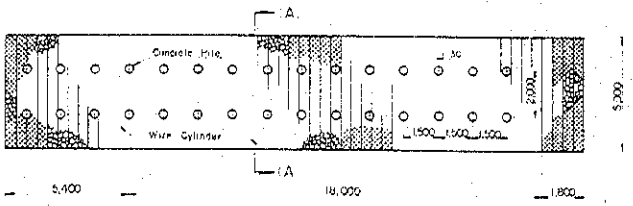
Date: June 26, 1975 | DWG. No. NK 51

GROYNE (H=6.00m)

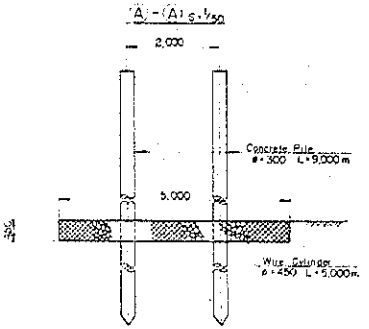
GROYNE A-TYPE CROSS SECTION s=1/100



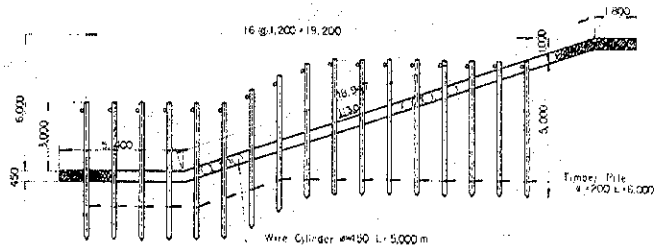
PLANE s=1/100



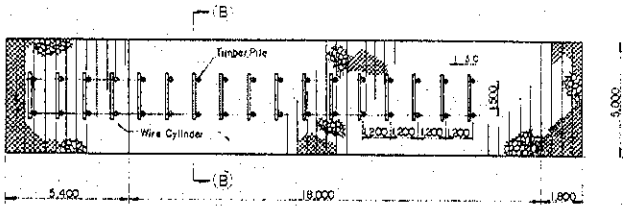
A - A s=1/50



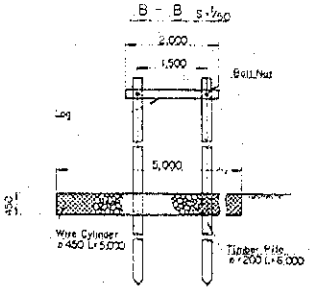
GROYNE B-TYPE CROSS SECTION s=1/100



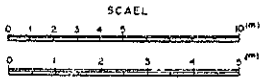
PLANE s=1/100



B - B s=1/50



SCAEL



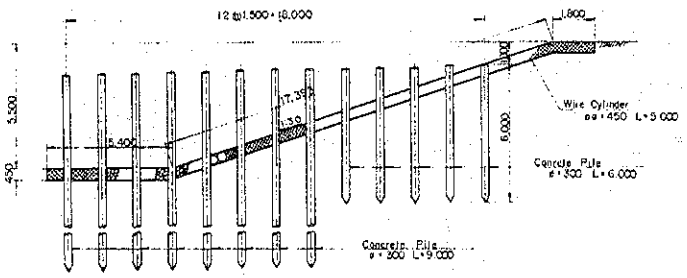
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVMENT INDONESIA

GROYNE (H=6.00m)

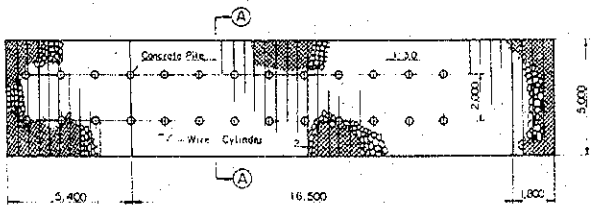
Note: Jica Ja. 1974 [illegible] 52

GROYNE (H=5.50 m)

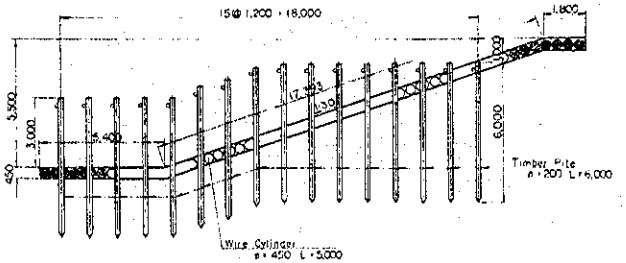
GROYNE A-TYPE CROSS SECTION S=1/100



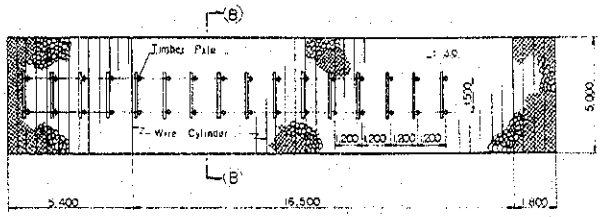
PLANE S=1/100



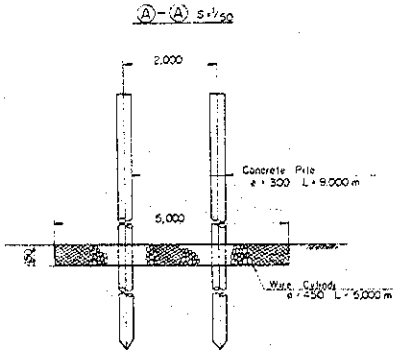
GROYNE B-TYPE CROSS SECTION S=1/100



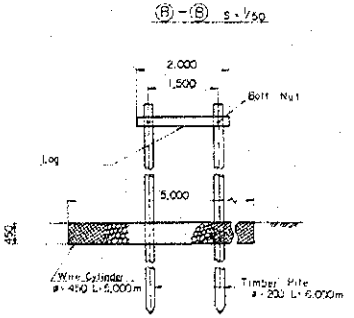
PLANE S=1/100



A-A S=1/50



B-B S=1/50



SCALE

0 1 2 3 4 5 10 (m)

0 1 2 3 4 5 (m)

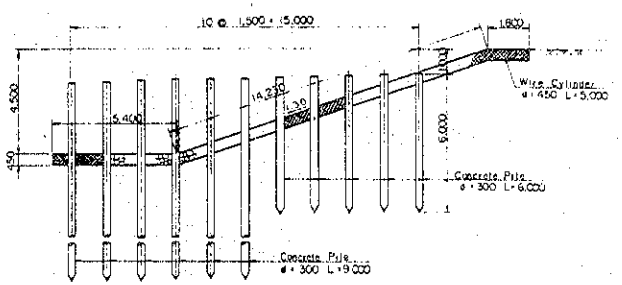
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVMENT INDONESIA

GROYNE (H=5.50 m)

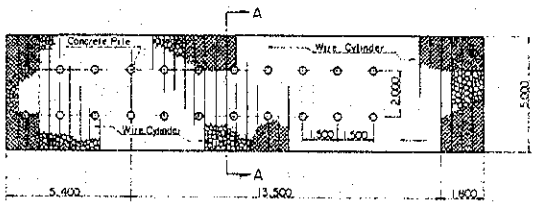
Date: June 30, 1975 | DWG. No. NO. 53

GROYNE (H = 4.50 m)

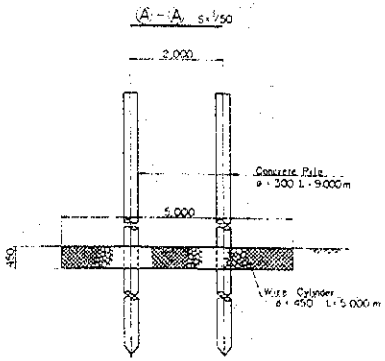
GROYNE - A - TYPE CROSS SECTION S. 1/100



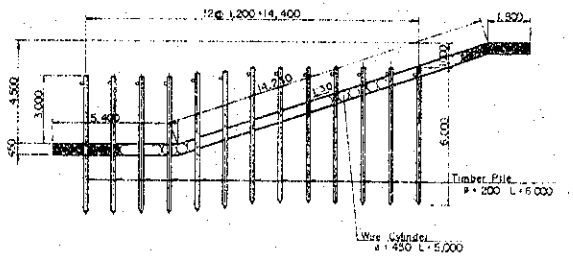
PLANE S. 1/100



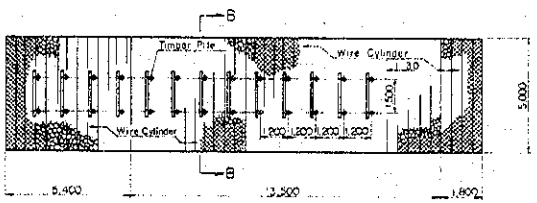
A - A S. 1/50



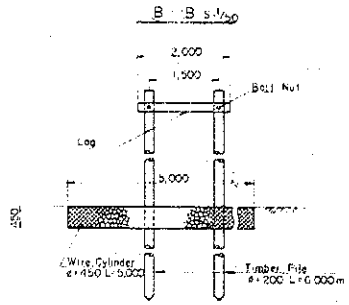
GROYNE B-TYPE CROSS SECTION S. 1/100



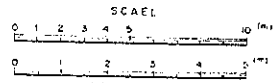
PLANE S. 1/100



B - B S. 1/50



SCALE



WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

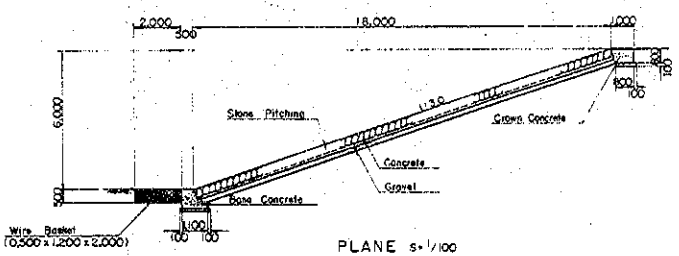
GROYNE (H = 4.50 m)

Date: June 30, 1976 | DWG. No. WR. 54

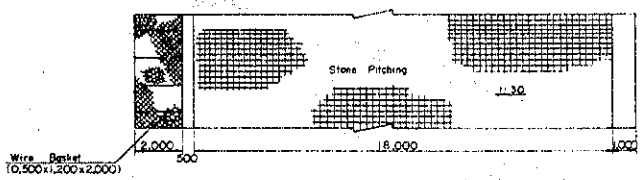
STONE PITCHING REVETMENT and GROUNDSILL

STONE PITCHING REVETMENT

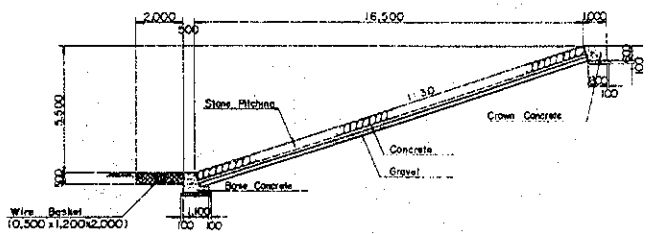
CROSS SECTION s=1/100



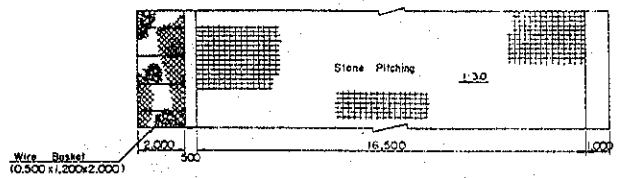
PLANE s=1/100



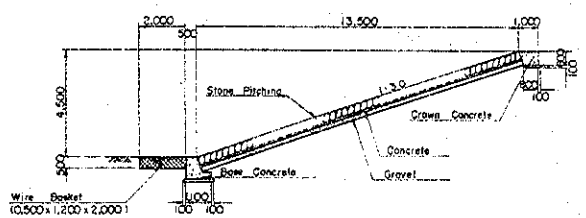
CROSS SECTION s=1/100



PLANE s=1/100

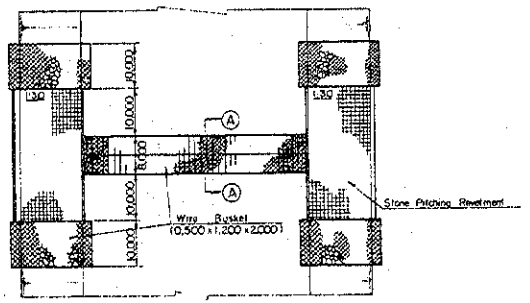


CROSS SECTION s=1/100

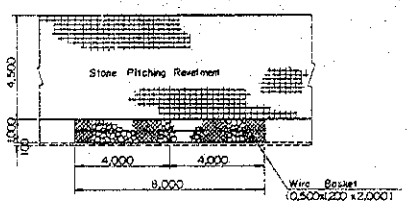


GROUNDSILL (I)

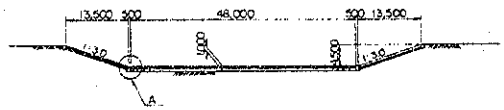
PLANE s=1/500



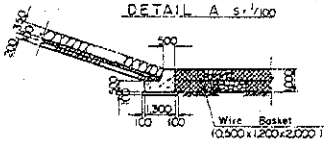
Ⓐ~Ⓐ s=1/100



CROSS SECTION s=1/500

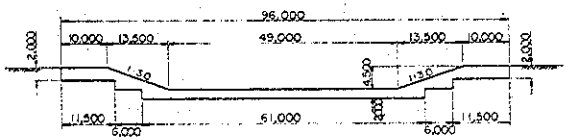


DETAIL A s=1/100

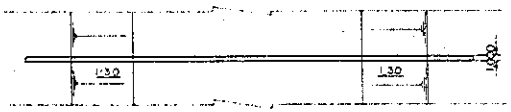


GROUNDSILL (II)

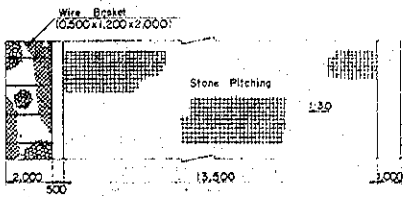
GROSS SECTION s=1/500



PLANE s=1/500



PLANE s=1/100



SCALE

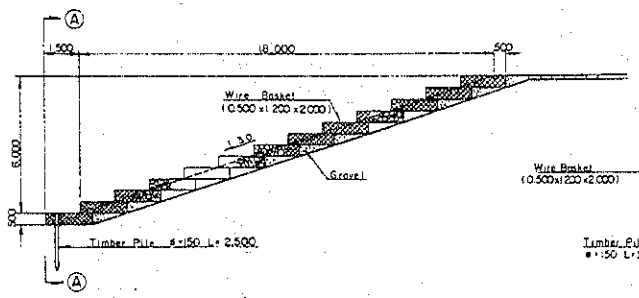
WONOGIRI IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

STONE PICHING REVETMENT and GROUNDSILL

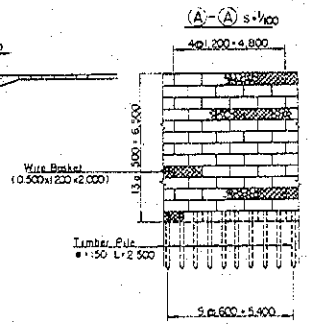
Date: June 28, 1976 | DWG. No. WR. 55

WIRE BASKET REVETMENT

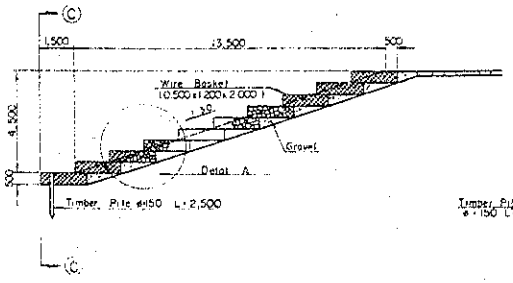
CROSS SECTION S.1/100

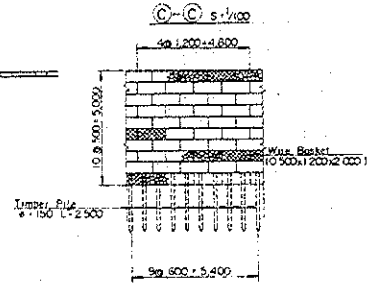


WIRE BASKET REVETMEN

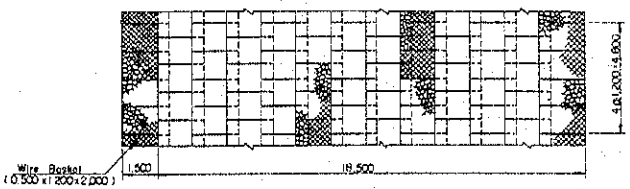


CROSS SECTION S.1/100

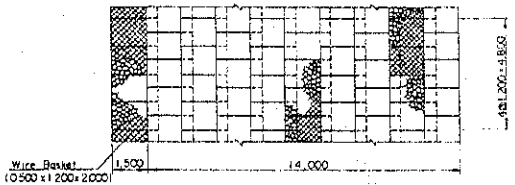




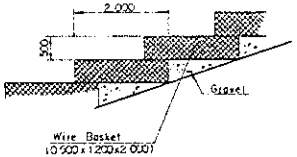
PLANE S.1/100



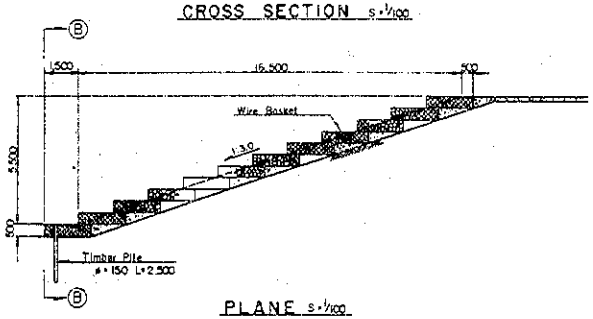
PLANE S.1/100

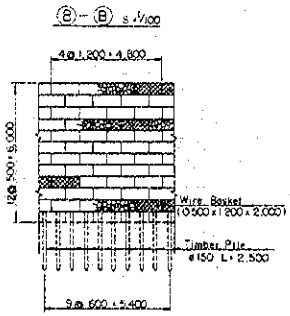


DETAIL – A S.1/50

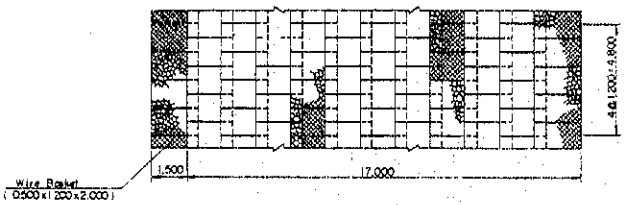


CROSS SECTION S.1/100

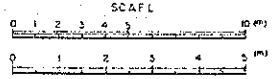




PLANE S.1/100



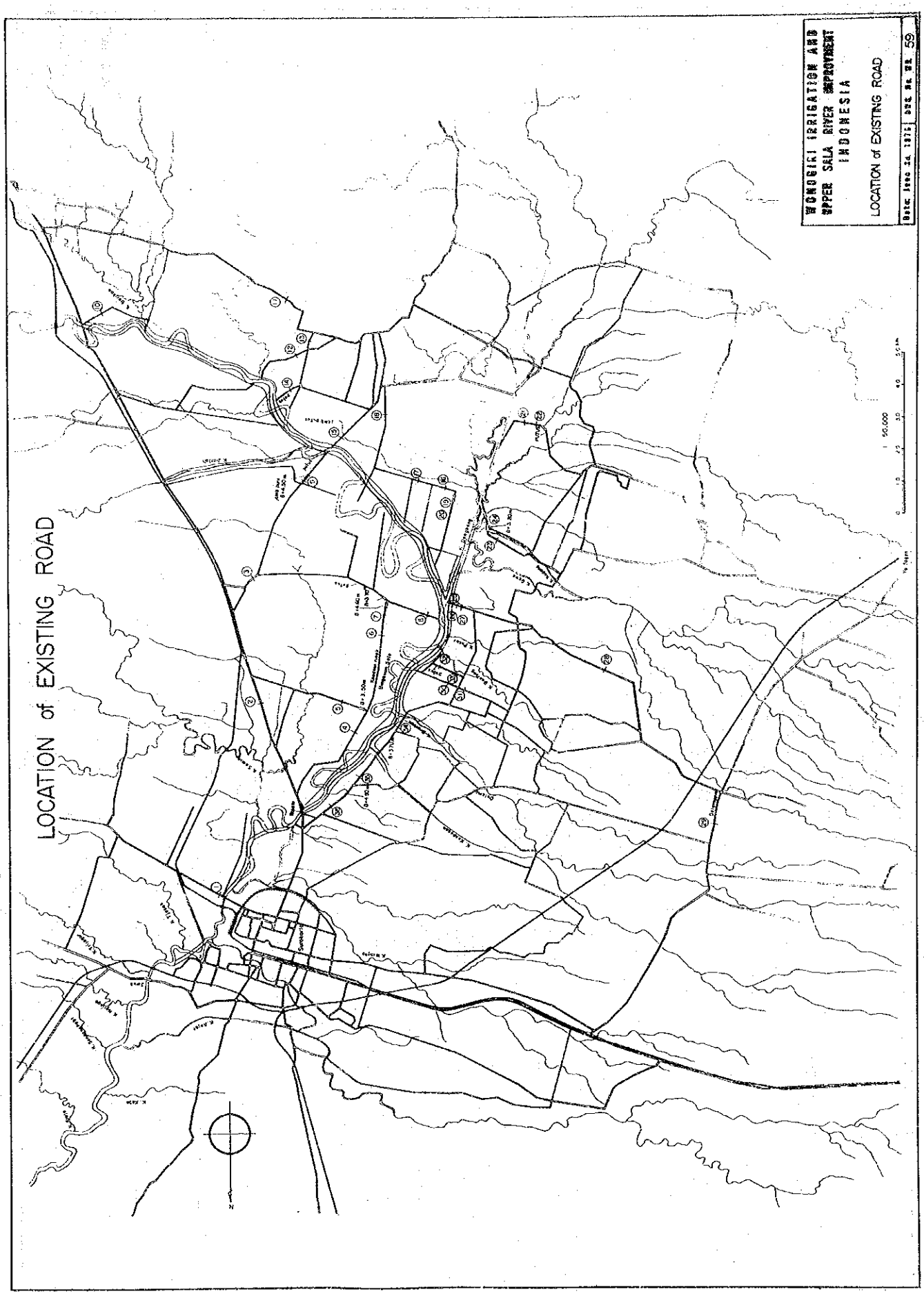
SCALE



WORLD BANK IRRIGATION AND UPPER SALA RIVER IMPROVEMENT INDONESIA

WIRE BASKET REVETMENT

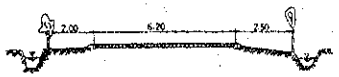
Date: June 30, 1978 | DWG. No. VII. 56


LOCATION of EXISTING ROAD
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA
LOCATION of EXISTING ROAD
59

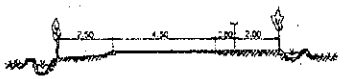
CROSS SECTION of EXISTING ROAD

NO. 1

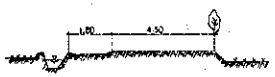
NO. 2



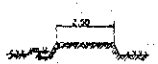
NO. 3



NO. 4

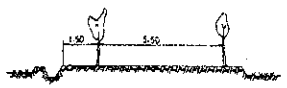


NO. 5

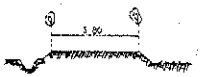


On this road there is a little bridge with wide B = 5.50m

NO. 6

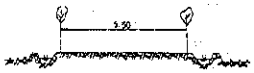


NO. 7

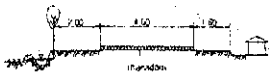


Wide of little bridge B = 4.80m

NO. 8

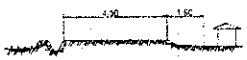


NO. 9

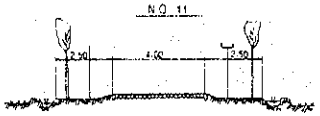


Wide of new bridge B = 6.50m

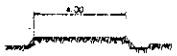
NO. 10



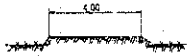
NO. 11



NO. 12

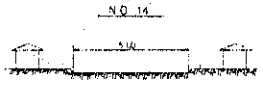


NO. 13



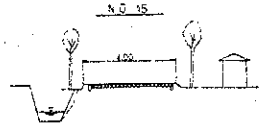
Village road

NO. 14

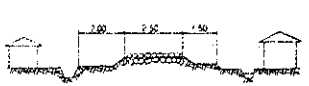


Village road

NO. 15

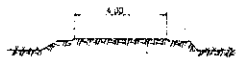


NO. 16



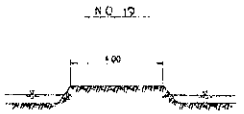
NO. 17

NO. 18



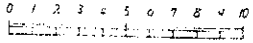
Wide of little bridge B = 5.40m

NO. 19



SCALE

0 1 2 3 4 5 6 7 8 9 10 (m)



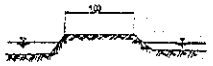
WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA.

CROSS SECTION of EXISTING ROAD

Date: June 24 1975 | DRG. NO. WR 60

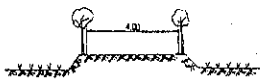
LOCATION of EXISTING RIPARIAN STRUCTURE

NO 20

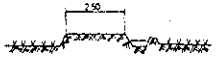


wide of little bridge 6 ×4.00

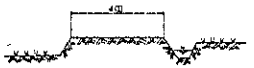
NO 21



NO 22

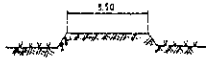


NO 23

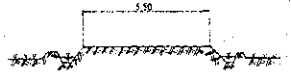


wide of little bridge 6 × 3.20m

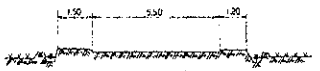
NO 24



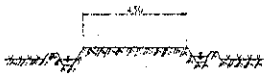
NO 25



NO 26

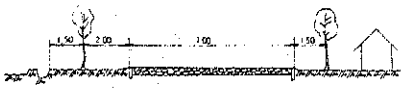


NO 27

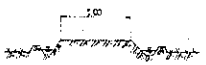


NO 28

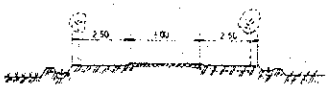
NO 29



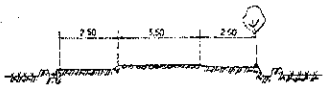
NO 30



NO 31

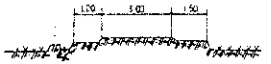


NO 32

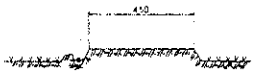


wide of little bridge 8×10 m

NO 33

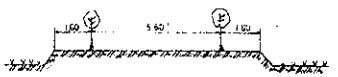


NO 34



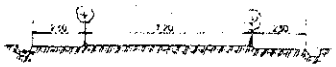
Bridge Stal beam
wide 5.70 m

NO 35

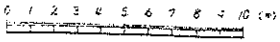


Bridge Concrete beam
wide 4.50 m

NO 36



SCALE



WONOGIRI IRRIGATION AND
UPPER SALA RIVER IMPROVEMENT
INDONESIA

LOCATION of EXISTING RIPARIAN STRUCTURE

Date: Jan 31 1.31 | Dwg. No. 61