

Table J-7 SUMMARY OF WATER BALANCE STUDY (2/2)

| **** WATER BALANCE STUDY AGAINST C.I. OF 250 % BY PROSI CICINTIA IRRIGATION SCHEME ANNUAL VOLUME(CUM) | | | | | | | | | |
|--|------|-------|-------|-------|-------|------|--|------|--|
| | | HULK | | HWLC | | LWLC | | GRQ2 | |
| | | 67.50 | 46.00 | 76.50 | 66.50 | 8.00 | | | |
| YEAR | QNI | QI | QS | Q4R | Q4S | | | | |
| 1972 | 45.4 | 38.0 | 31.2 | 25.1 | -8.5 | | | | |
| 1973 | 69.9 | 31.8 | 42.6 | 4.7 | 0. | | | | |
| 1974 | 66.2 | 34.1 | 41.8 | 10.2 | 0. | | | | |
| 1975 | 58.6 | 36.0 | 35.2 | 13.2 | 0. | | | | |
| 1976 | 45.2 | 35.6 | 31.7 | 23.3 | -4.4 | | | | |
| 1977 | 45.0 | 33.8 | 28.9 | 18.7 | 0. | | | | |
| 1978 | 53.3 | 32.7 | 31.1 | 11.1 | 0. | | | | |
| 1979 | 47.0 | 33.8 | 28.5 | 16.1 | 0. | | | | |
| 1980 | 54.2 | 31.5 | 32.3 | 10.0 | 0. | | | | |
| 1981 | 73.5 | 31.3 | 45.0 | 3.0 | 0. | | | | |
| 1982 | 37.3 | 35.3 | 27.0 | 26.4 | -7.0 | | | | |
| 1983 | 48.5 | 35.6 | 27.1 | 15.0 | 0. | | | | |

Table J-8 DEPENDABILITY OF POWER GENERATION

| MAX. plant discharge (m ³ /s) | Installed capacity (Mw) | Power output duration | | | |
|---|----------------------------|-----------------------|------|--------|------|
| | | 75 % | 90 % | 92.5 % | 95 % |
| 6.00 | 1.95 | 1.95 | 1.31 | 0.0 | 0.0 |
| 8.00 | 2.60 | 2.60 | 1.74 | 0.0 | 0.0 |
| 10.00 | 3.25 | 3.25 | 2.18 | 0.0 | 0.0 |
| 12.00 | 3.90 | 3.90 | 2.62 | 0.0 | 0.0 |
| 14.00 | 4.55 | 4.55 | 2.99 | 0.0 | 0.0 |
| 16.00 | 5.20 | 5.10 | 3.22 | 0.0 | 0.0 |
| 18.00 | 5.86 | 5.56 | 0.0 | 0.0 | 0.0 |

Note: The case of the discharge more than 16.0 m³/s causes a water shortage under the calculation criteria.

Table J-9 ANNUAL ENERGY

Unit (GWh)

| Installed Capacity and Max. Plant Discharge | | | | | | | |
|---|-------|-------|-------|-------|-------|-------|-------|
| P (KW) | 1.95 | 2.60 | 3.25 | 3.90 | 4.55 | 5.20 | 5.86 |
| Q (m ³ /s) | 6.00 | 8.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 |
| 1972 | 10.28 | 13.71 | 17.14 | 20.57 | 23.99 | 27.42 | 30.85 |
| 1973 | 16.81 | 22.40 | 27.99 | 33.57 | 39.13 | 44.68 | 50.20 |
| 1974 | 17.10 | 22.80 | 28.49 | 34.19 | 39.89 | 45.59 | 51.29 |
| 1975 | 17.10 | 22.80 | 28.49 | 34.19 | 39.89 | 45.59 | 51.29 |
| 1986 | 13.41 | 17.79 | 21.18 | 25.27 | 29.31 | 33.30 | 36.58 |
| 1977 | 12.06 | 16.01 | 19.95 | 23.82 | 27.60 | 31.23 | 34.08 |
| 1978 | 16.31 | 21.74 | 27.16 | 32.58 | 37.99 | 43.37 | 48.71 |
| 1979 | 16.72 | 22.12 | 27.17 | 31.94 | 36.37 | 39.93 | 43.27 |
| 1980 | 17.14 | 22.86 | 28.57 | 34.19 | 39.72 | 45.21 | 50.64 |
| 1981 | 17.10 | 22.80 | 28.49 | 34.19 | 39.89 | 45.59 | 51.29 |
| 1982 | 12.42 | 16.51 | 20.58 | 24.62 | 28.60 | 32.39 | 35.23 |
| 1983 | 17.06 | 22.70 | 28.29 | 33.81 | 39.16 | 43.50 | 44.95 |
| Ave. | 15.29 | 20.35 | 25.29 | 30.25 | 35.13 | 39.82 | 44.03 |

Table J-10

MAJOR WORK QUANTITIES FOR DAMS AND TUNNELS (1/3)

| Work item | Unit | work quantity |
|--------------------------------------|-----------------|--------------------------|
| 1. Karian dam | | |
| 1.1 Diversion tunnel (L=471, 515 m) | | |
| Inlet & Outlet | Excavation | m ³ 101,000 |
| | Concrete | m ³ 3,100 |
| Tunnel | Excavation | m ³ 51,300 |
| | Lining concrete | m ³ 18,600 |
| | Plug concrete | m ³ 1,600 |
| Grouting | | m 10,000 |
| 1.2 Dam | | |
| Coffer dam | Embankment | m ³ 112,400 |
| Main dam | Excavation | m ³ 251,000 |
| | Embankment Core | m ³ 141,800 |
| | Filter | m ³ 128,300 |
| | Rock | m ³ 958,500 |
| | Total | m ³ 1,228,600 |
| Saddle dam | Excavation | m ³ 102,000 |
| | Embankment | m ³ 150,000 |
| Grouting | Blanket | m 10,300 |
| | Curtain | m 26,400 |
| 1.3 Spillway | | |
| Excavation | Common | m ³ 77,400 |
| | Rock | m ³ 180,600 |
| Concrete | | m ³ 24,000 |
| 1.4 Intake | | |
| Excavation | | m ³ 14,200 |
| Concrete | | m ³ 3,200 |
| 1.5 Metal works | | |
| gates, valves, trash racks, stoplogs | ton | 555 |

Table J-10 MAJOR WORK QUANTITIES FOR DAMS AND TUNNELS (2/3)

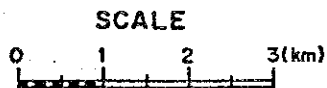
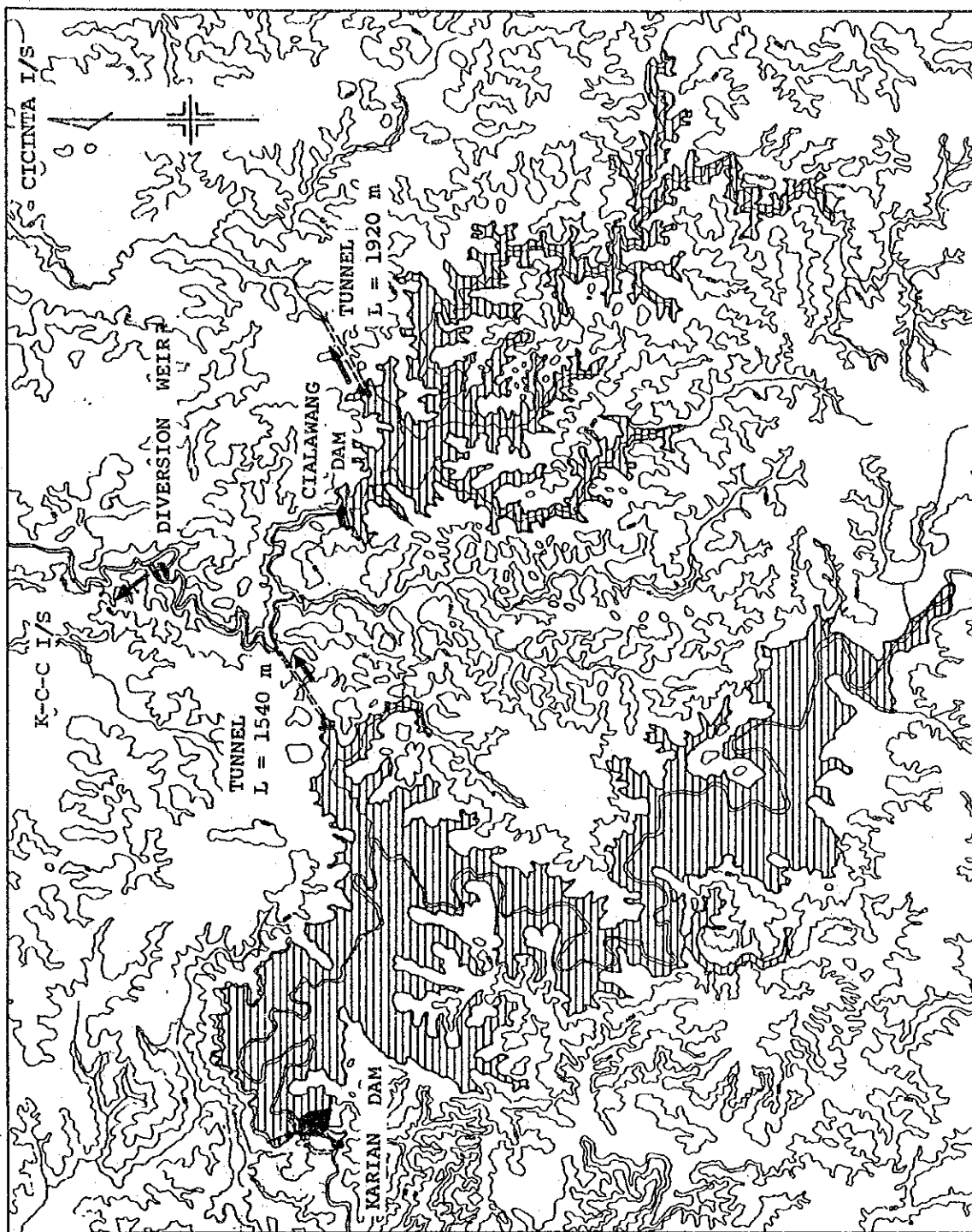
| Work item | Unit | work quantity |
|--------------------------------------|----------------|---------------|
| 2. Cilawang dam | | |
| 2.1 Diversion tunnel (l = 346 m) | | |
| Inlet & Outlet Excavation | m ³ | 47,000 |
| Concrete | m ³ | 2,500 |
| Tunnel Excavation | m ³ | 18,400 |
| Lining concrete | m ³ | 6,600 |
| Plug concrete | m ³ | 500 |
| Grouting | m | 3,600 |
| 2.2 Dam | | |
| Coffer dam Embankment | m ³ | 75,800 |
| Main dam Excavation | m ³ | 171,000 |
| Embankment Core | m ³ | 59,800 |
| Filter | m ³ | 55,600 |
| Rock | m ³ | 303,800 |
| Total | m ³ | 419,200 |
| Saddle dam Excavation | m ³ | 37,000 |
| Embankment | m ³ | 39,000 |
| Grouting Blanket | m | 5,800 |
| Curtain | m | 14,300 |
| 2.3 Spillway | | |
| Excavation Common | m ³ | 34,400 |
| Rock | m ³ | 80,200 |
| Concrete | m ³ | 29,900 |
| 2.4 Metal works | | |
| gates, valves, trash racks, stoplogs | ton | 308 |

Table J-10

MAJOR WORK QUANTITIES FOR DAMS AND TUNNELS (3/3)

| Work item | Unit | work quantity |
|------------------------------------|----------------|---------------|
| 3. Ciuyah tunnel ($l = 1,540$ m) | | |
| 3.1 Intake and Outlet | | |
| Excavation | m ³ | 3,400 |
| Concrete | m ³ | 250 |
| 3.2 Tunnel | | |
| Excavation | m ³ | 16,200 |
| Lining concrete | m ³ | 7,600 |
| Grouting | m | 7,260 |
| 3.3 Metal works | | |
| valves, trash racks | ton | 12 |
| 4. Cicinta tunnel ($l = 1,920$ m) | | |
| 4.1 Intake and Outlet | | |
| Excavation | m ³ | 7,600 |
| Concrete | m ³ | 600 |
| 4.2 Tunnel | | |
| Excavation | m ³ | 15,500 |
| Lining concrete | m ³ | 8,600 |
| Grouting | m | 9,000 |
| 4.3 Metal works | | |
| valves, trash racks | ton | 7 |

Fig.J-1

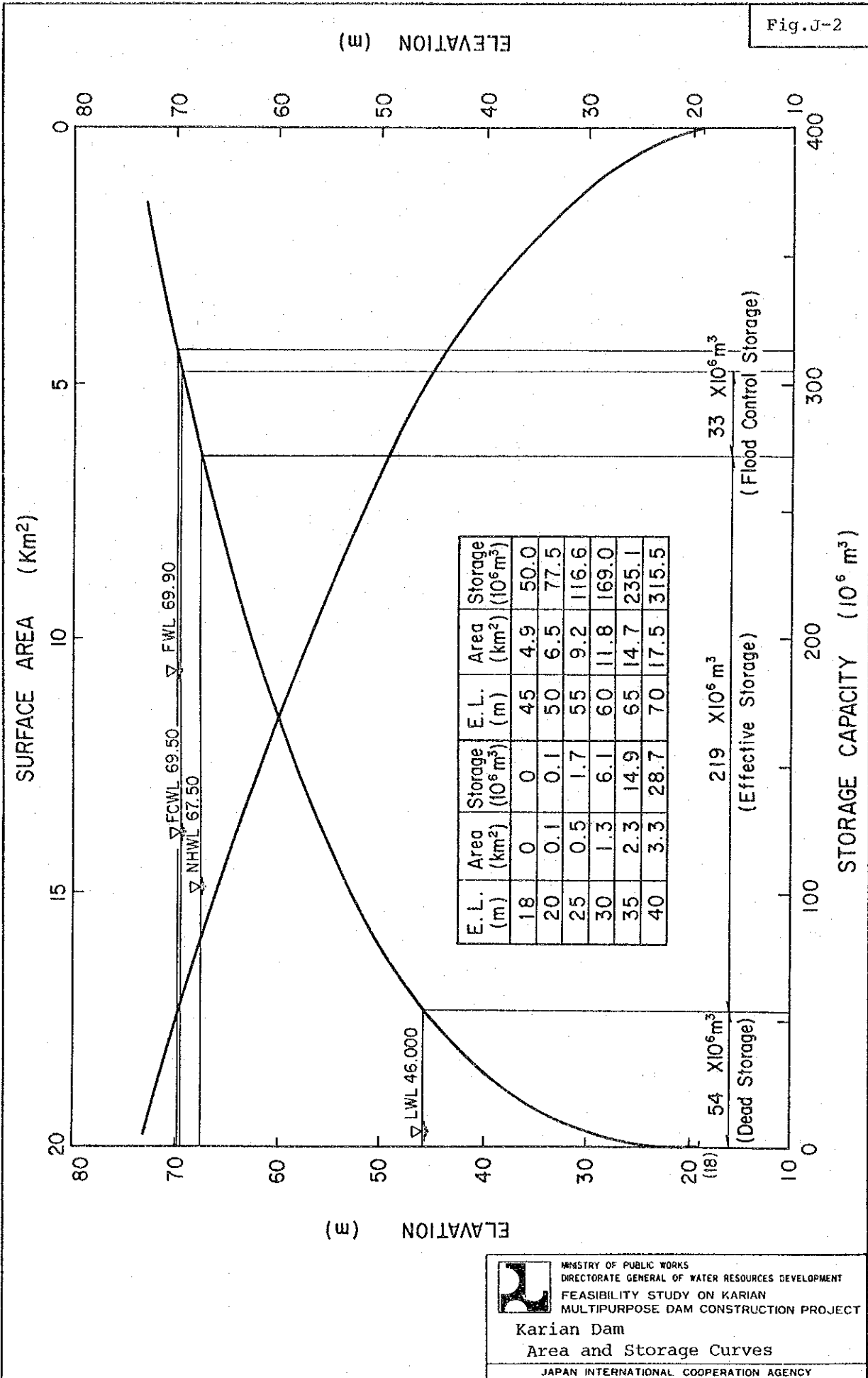


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FEASIBILITY STUDY ON KARIAN
MULTIPURPOSE DAM CONSTRUCTION PROJECT

General Map of
Karian and Cilawang Dams

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Fig.J-2




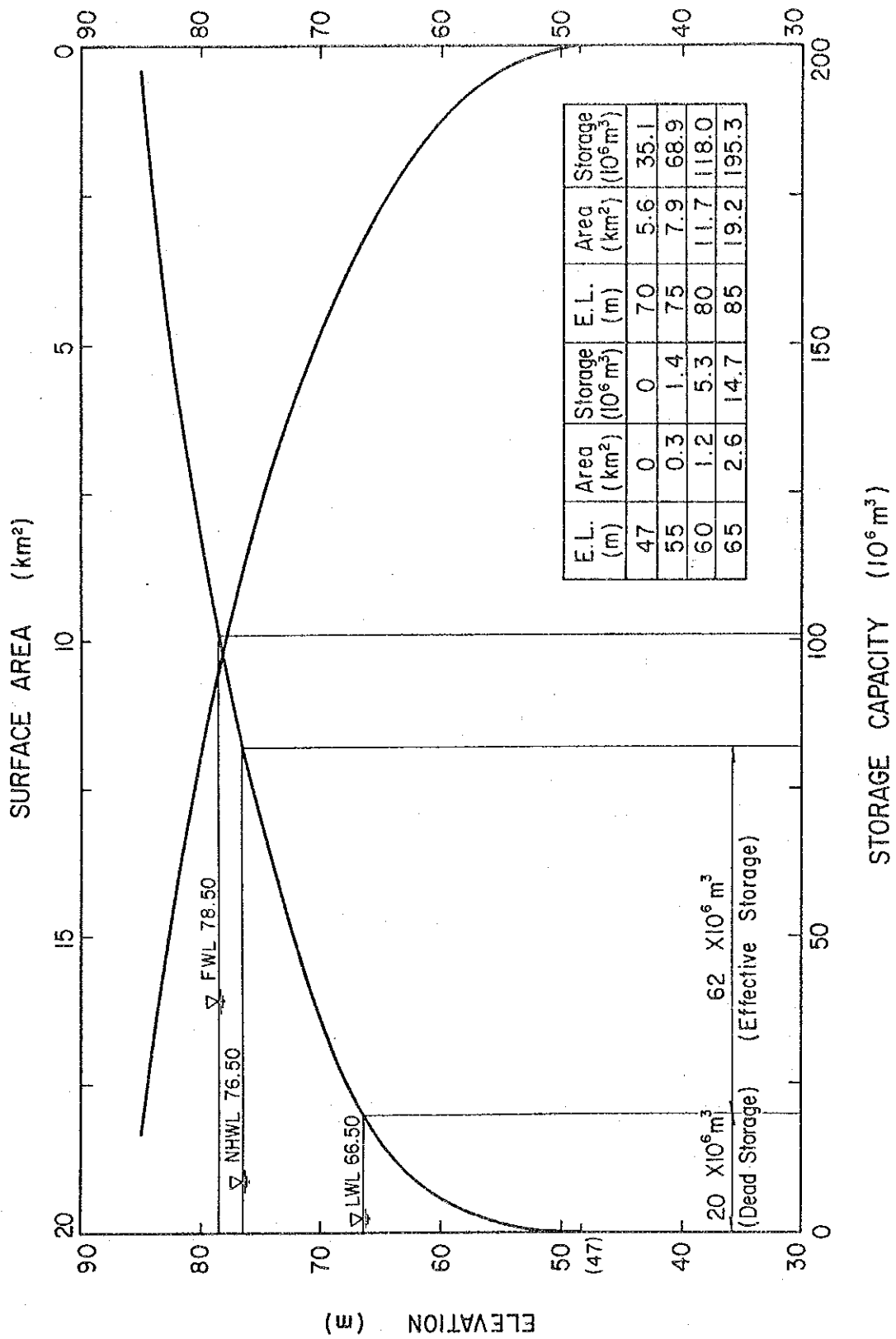

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Karian Dam
Area and Storage Curves
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Fig.J-3




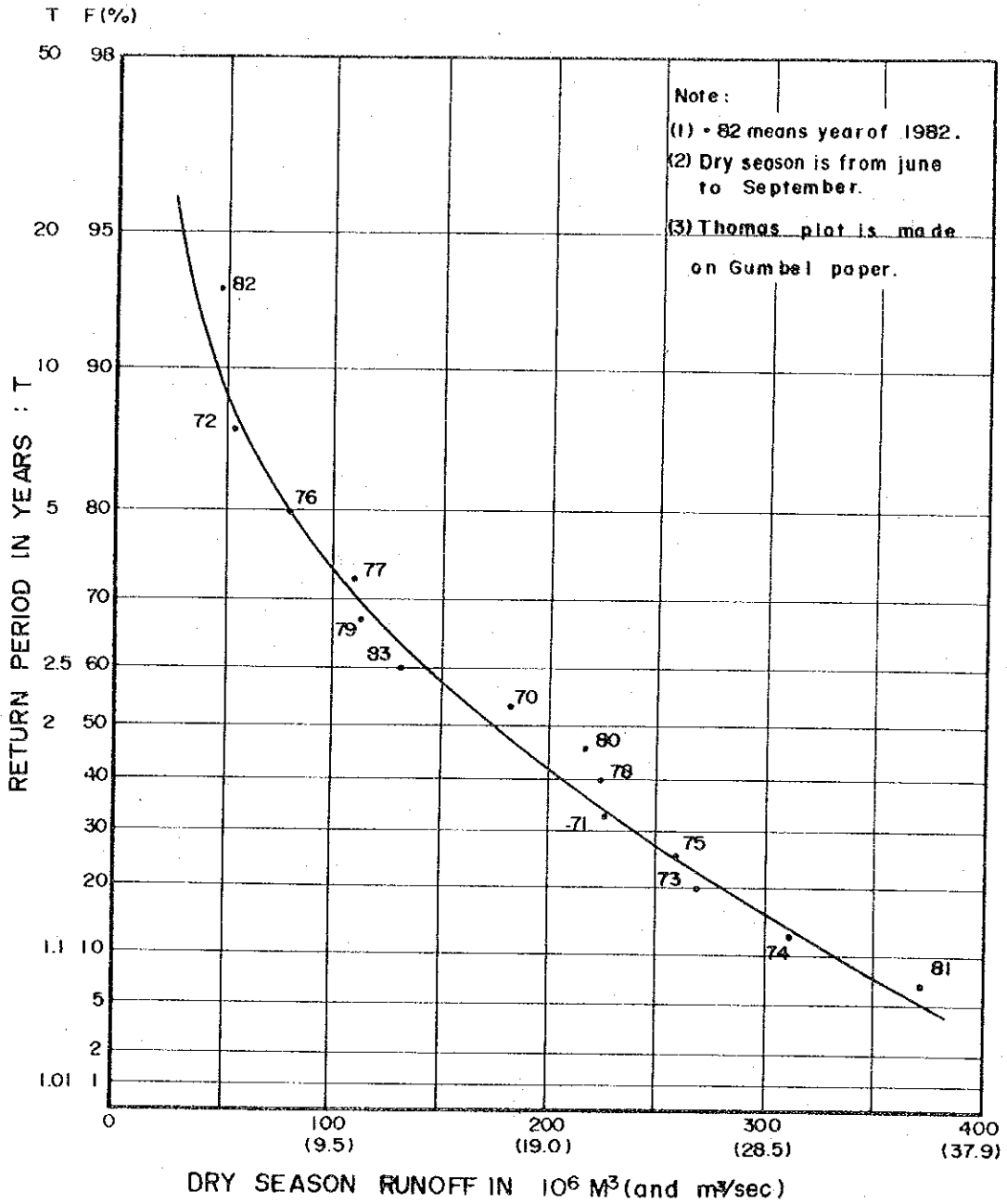

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Cilwang Dam
Area and Storage Curves
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Fig.J-4




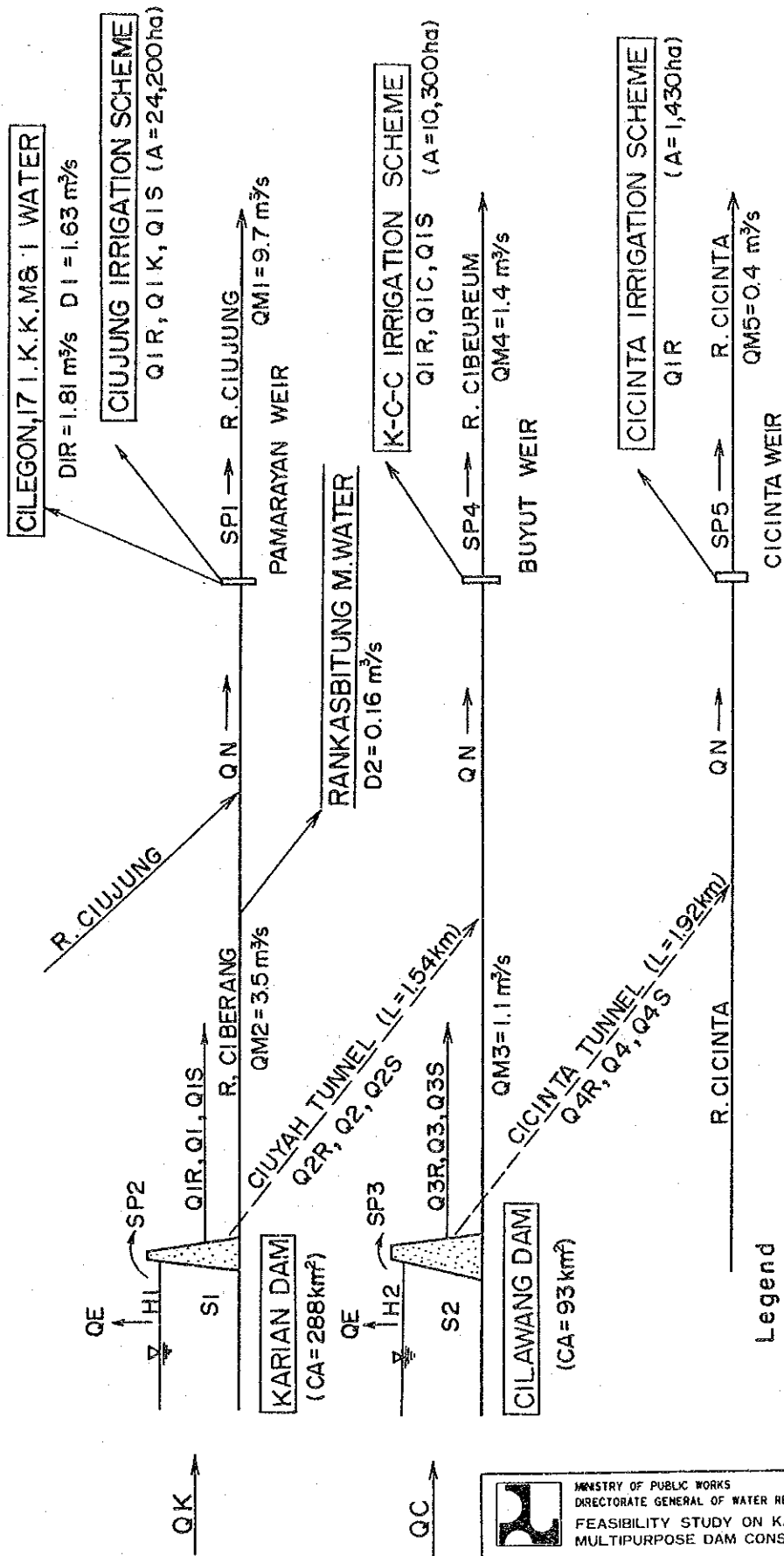


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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Dry Season Runoff
 at Karian Dam Site
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Fig. J-5



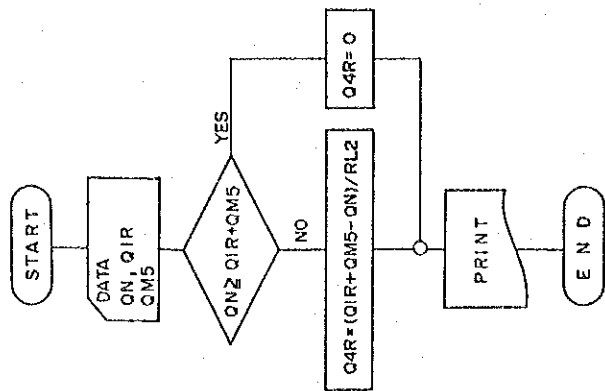
Legend

QM 1 ~ 5 : River maintenance flow QN : Natural flow
 SP 1 ~ 5 : Spill out discharge QK, QC : Reservoir inflow
 Q1, Q3 : Discharge through intake

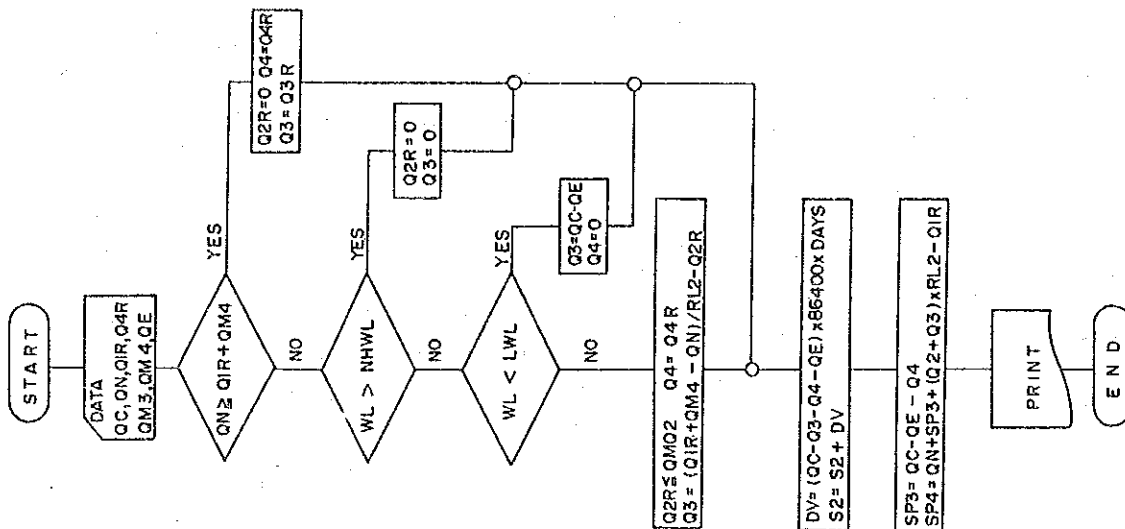

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Water Balance Study Model

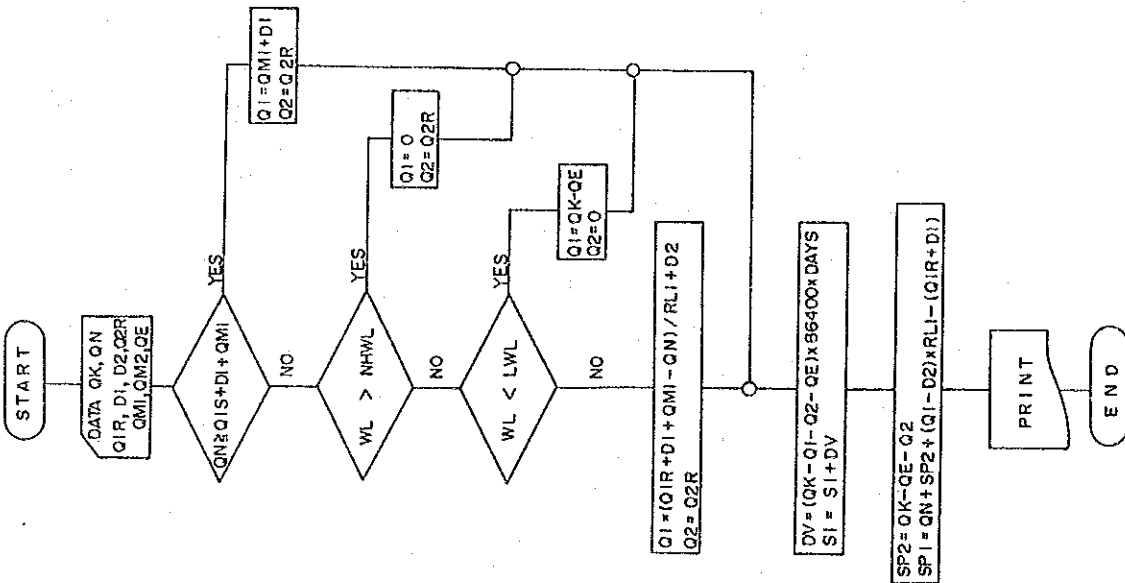
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CICINTA WEIR




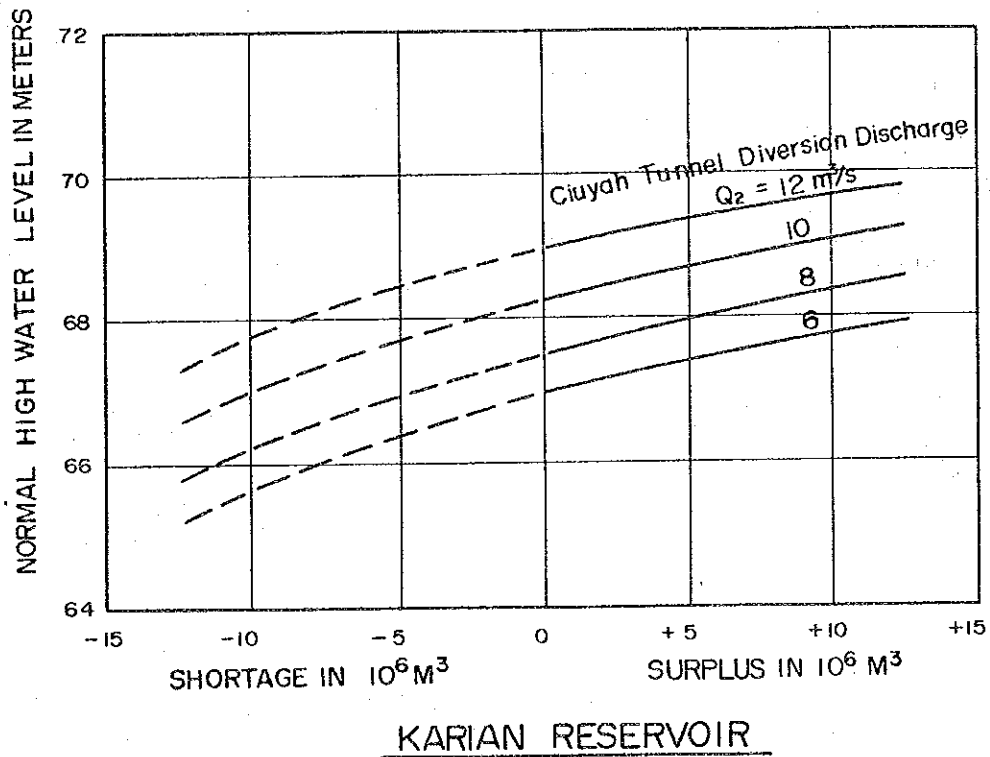
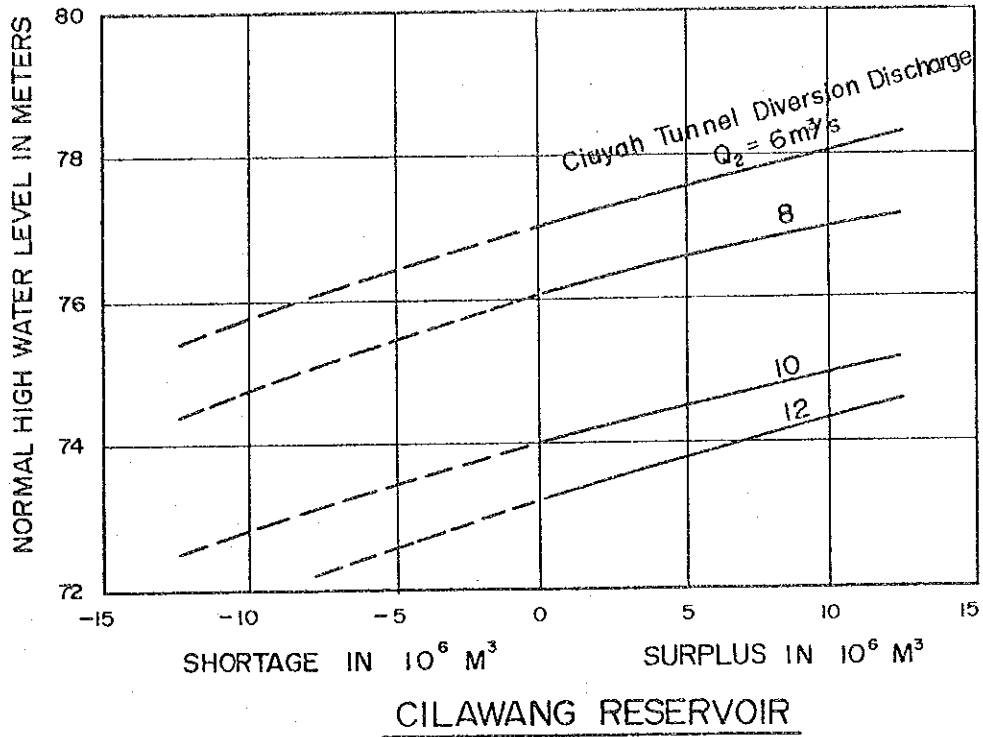
CILAWANG RESERVOIR




KARIAN RESERVOIR

Note: Variables in the above figure for the water balance study are defined in Table J-2

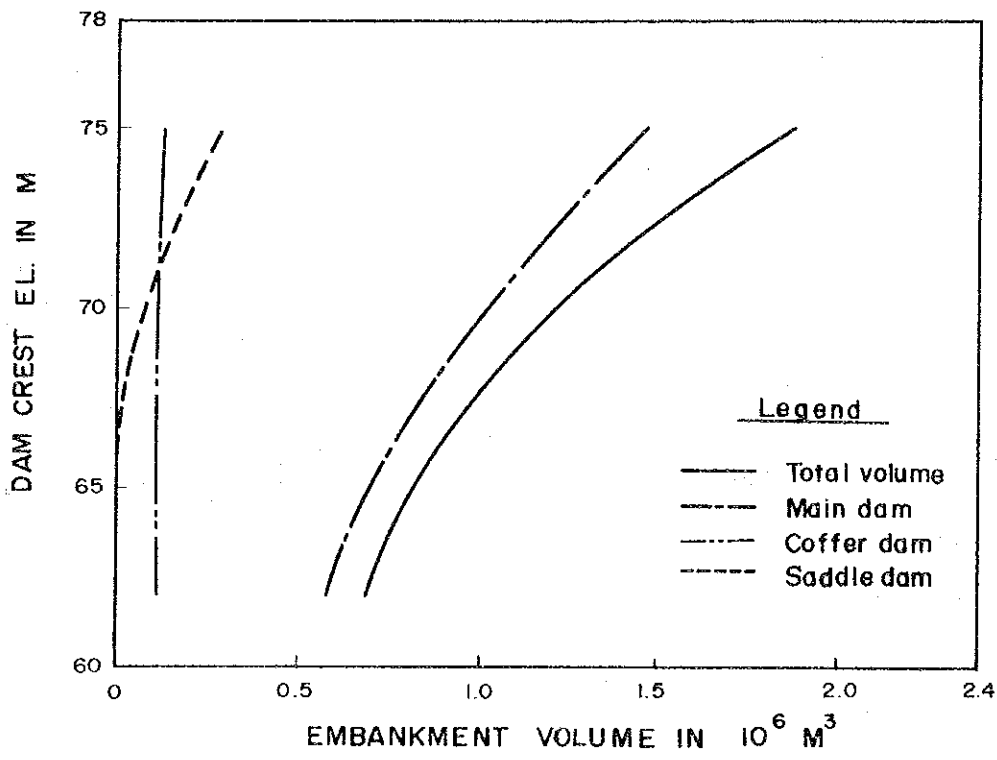
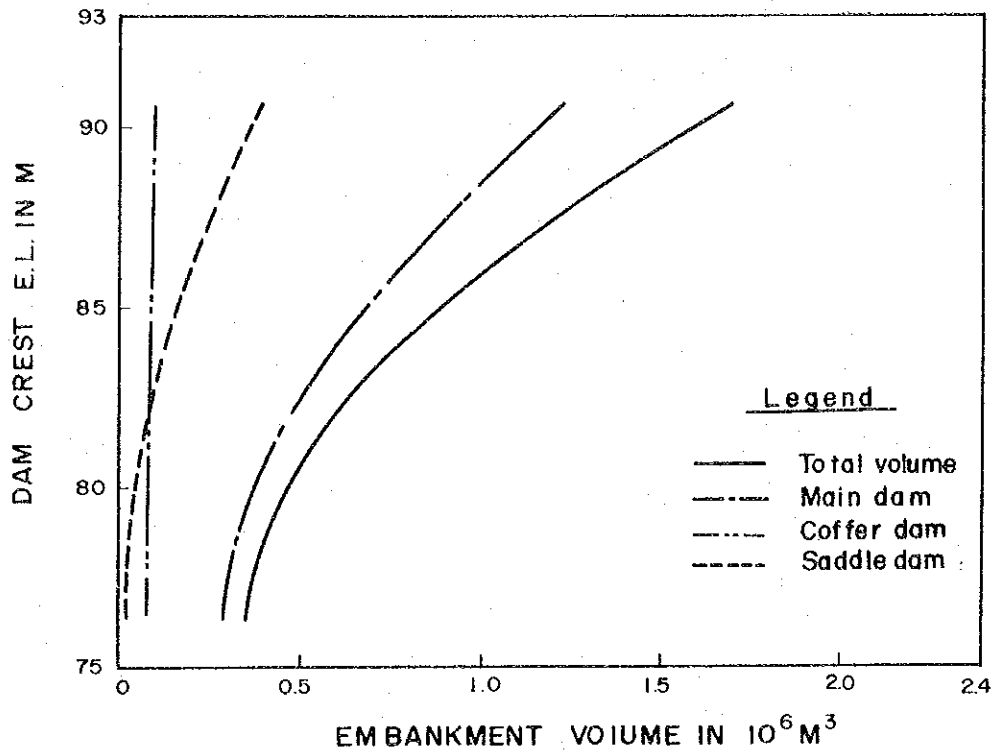

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Flow Chart of Water Balance Study
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 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Water Balans Study Results

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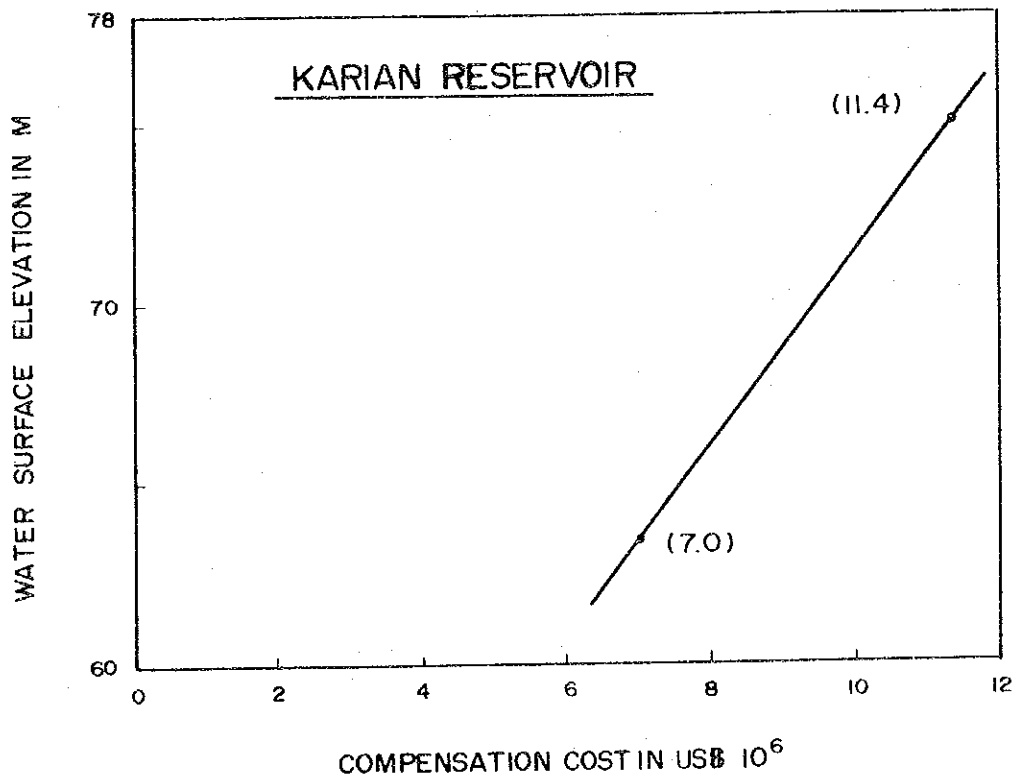
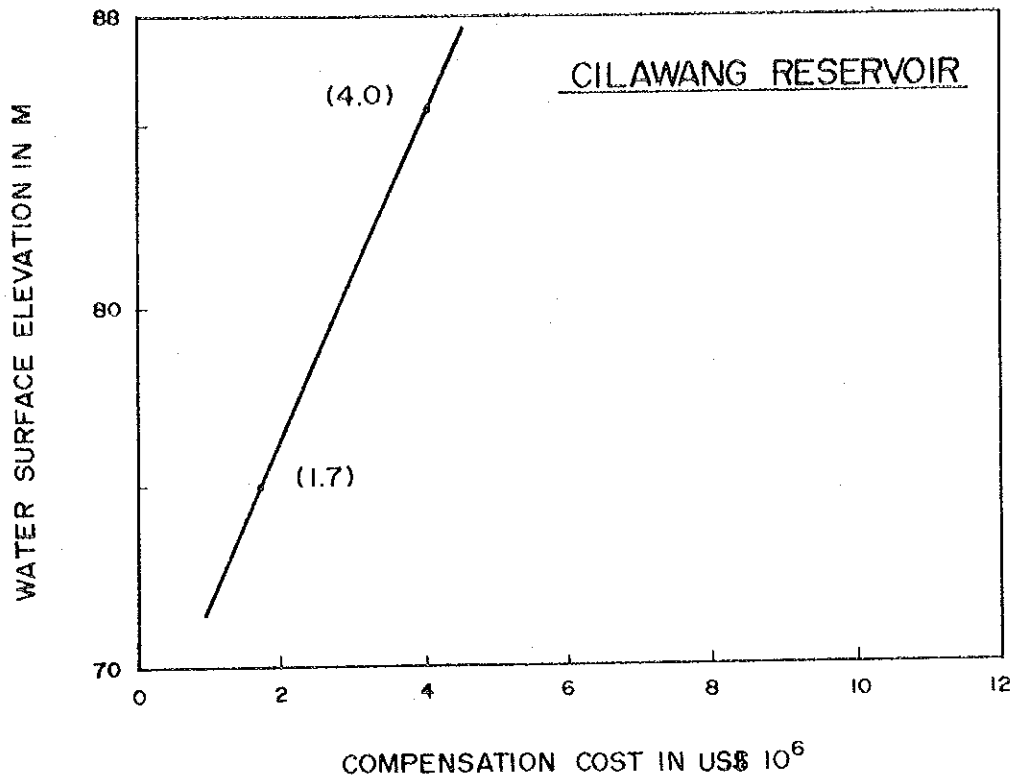




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 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Dam Embankment Volume

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Fig.J-9

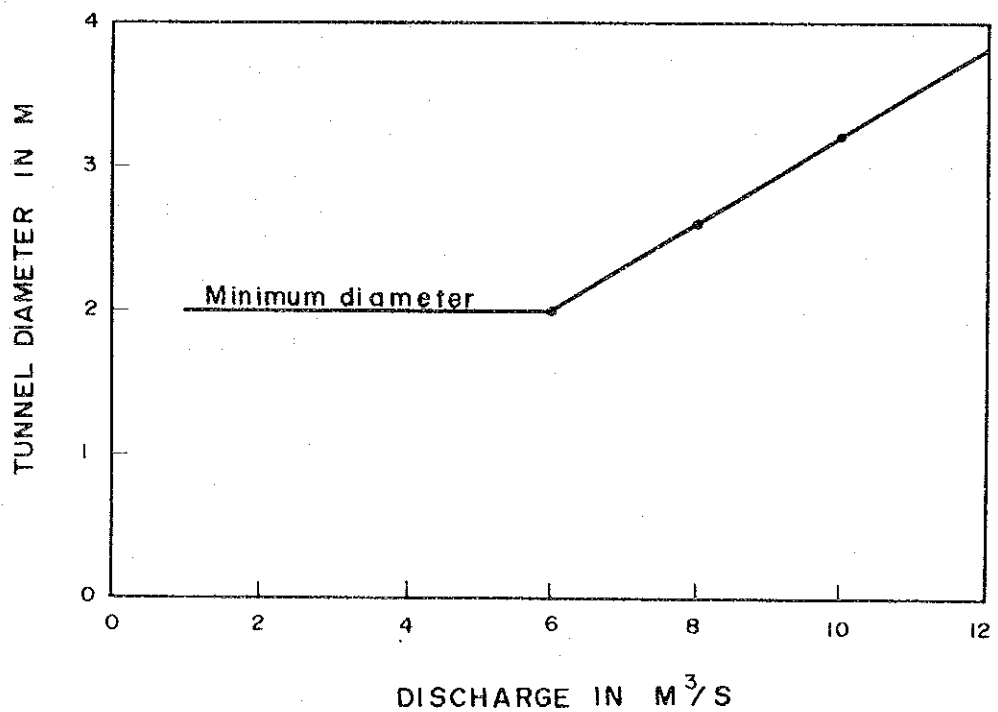
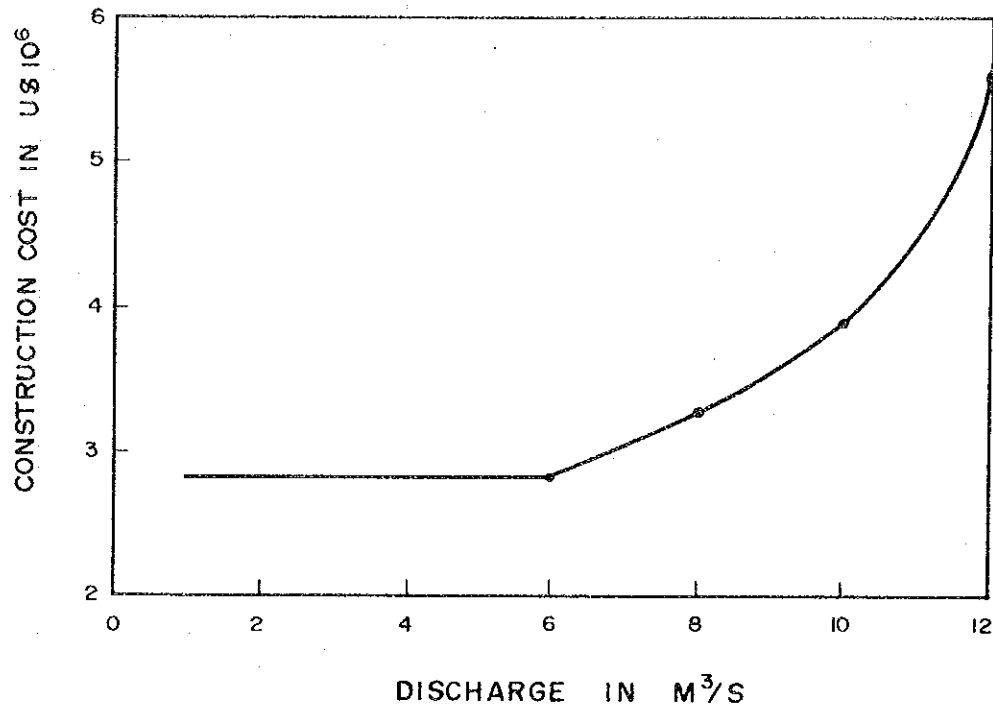



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MULTIPURPOSE DAM CONSTRUCTION PROJECT

Reservoir Compensation Cost

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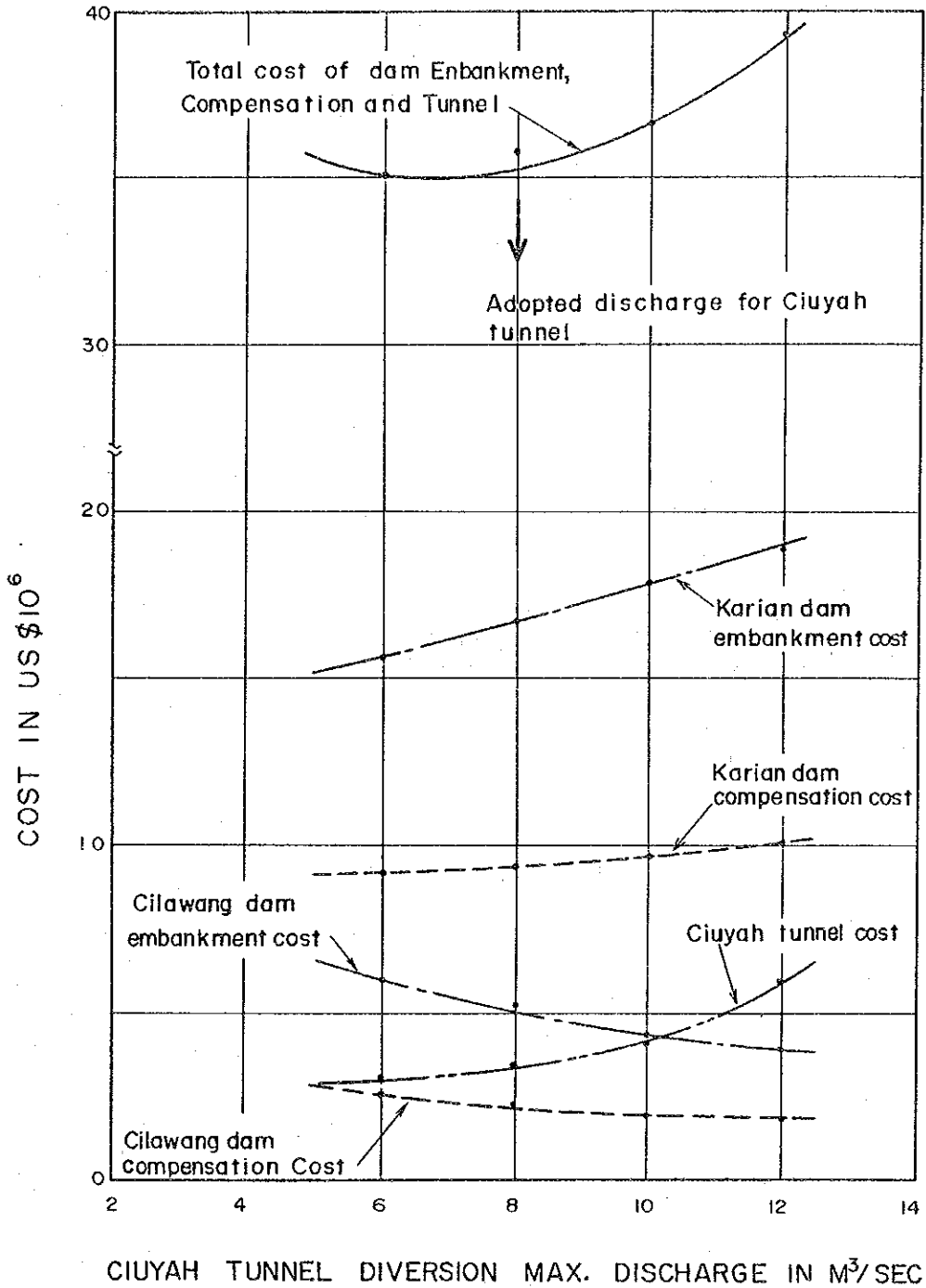
Fig.J-10




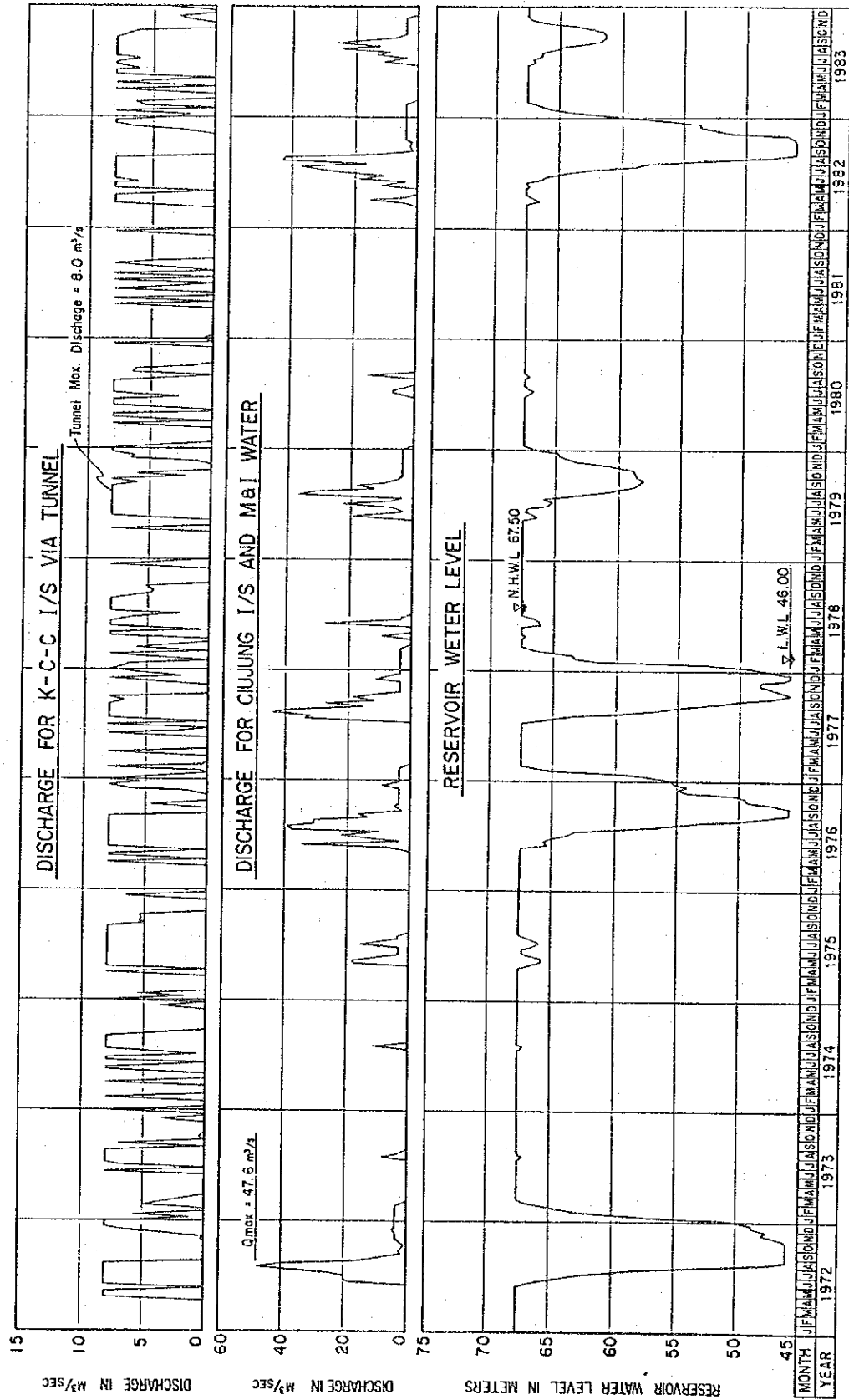
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MULTIPURPOSE DAM CONSTRUCTION PROJECT

Ciuyah Tunnel Diameter and Cost

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Dam and Tunnel Cost Comparison
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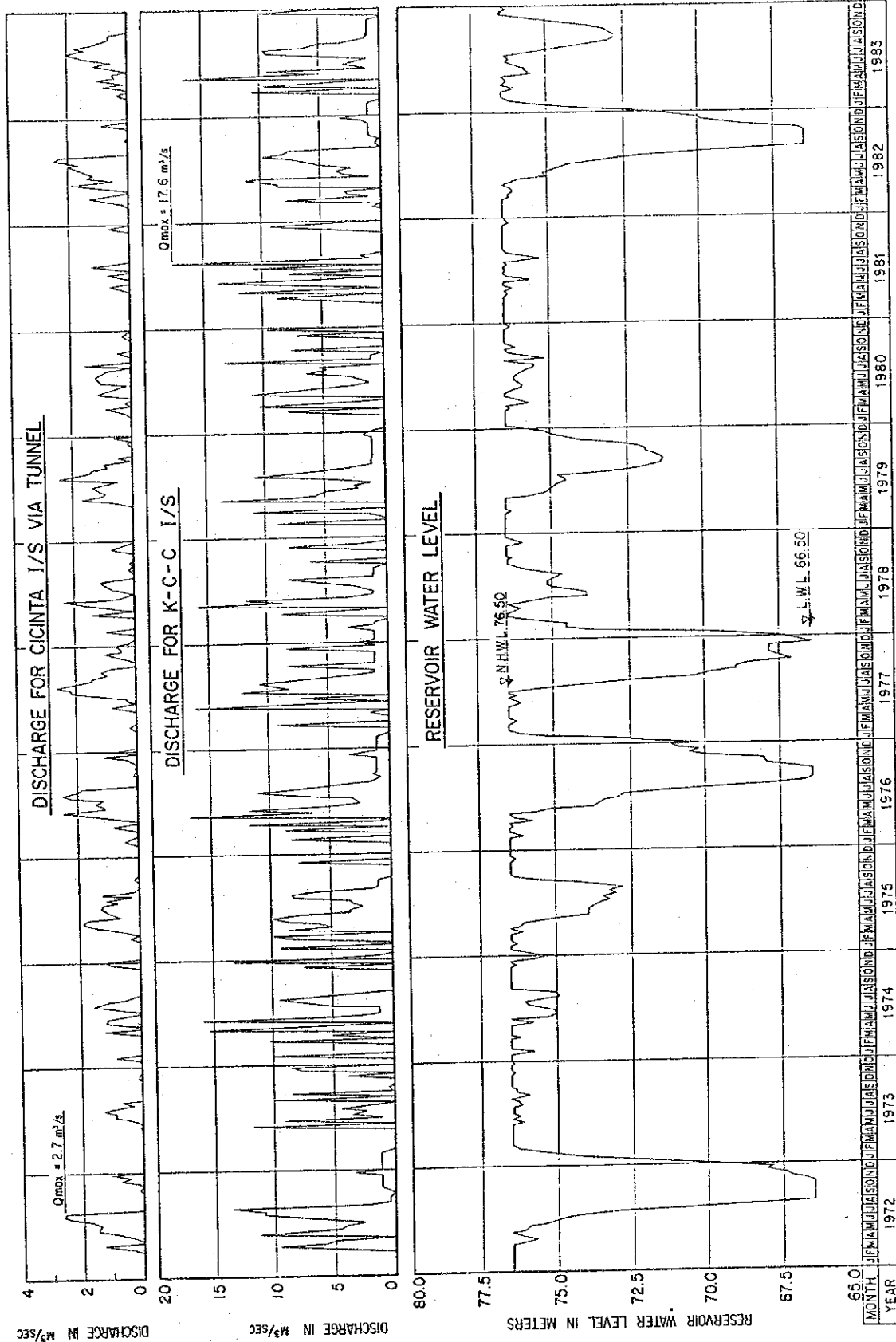

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Karian
 Reservoir Operation Study
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Fig. J-13

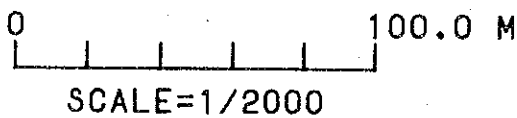
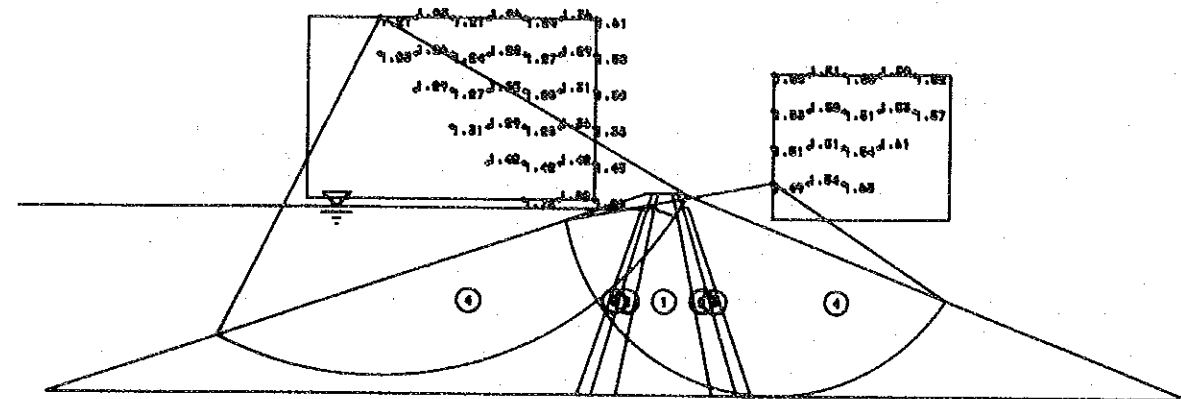


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 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Cirawang
 Reservoir Operation Study


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KARIAN DAM, STABILITY ANALYSIS

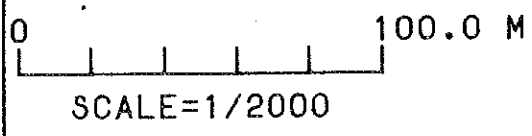
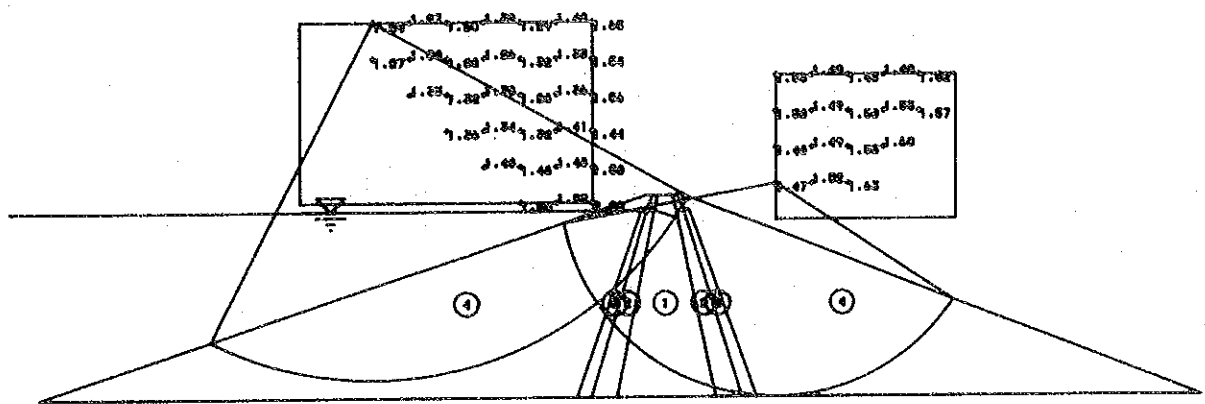


| MATERIAL | COHESION (T/M ²) | FRICTION (DEG) | W(WET) (T/M ³) | W(SAT) (T/M ³) | W(SUB) (T/M ³) |
|----------------------------|---------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|
| 1 | 2.00 | 21.00 | 1.84 | 1.91 | 0.91 |
| 2 | 0.00 | 35.00 | 1.90 | 2.00 | 1.00 |
| 3 | 0.00 | 35.00 | 1.80 | 2.00 | 1.00 |
| 4 | 0.00 | 37.50 | 1.80 | 2.00 | 1.00 |
| ACCELERATION OF EARTHQUAKE | | | | 0.150 | |

| MINIMUM SAFETY FACTOR (SEISMIC) | | |
|---------------------------------|----------------|------------------|
| | UP STREAM SIDE | DOWN STREAM SIDE |
| NORMAL | 2.619 | 2.523 |
| SEISMIC | 1.205 | 1.494 |


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 Karian Dam
 Slope Stability Analysis Case-1
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KARIAN DAM, STABILITY ANALYSIS

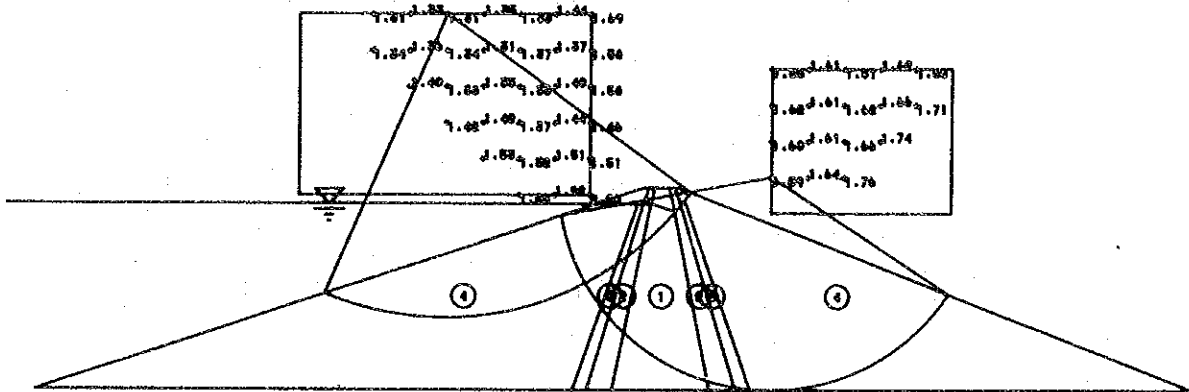


| MATERIAL | COHESION (T/M ²) | FRICTION (DEG) | W(WET) (T/M ³) | W(SAT) (T/M ³) | W(SUB) (T/M ³) |
|----------------------------|---------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|
| 1 | 2.00 | 21.00 | 1.84 | 1.91 | 0.91 |
| 2 | 0.00 | 35.00 | 1.90 | 2.10 | 1.10 |
| 3 | 0.00 | 35.00 | 1.80 | 2.10 | 1.10 |
| 4 | 0.00 | 37.50 | 1.80 | 2.10 | 1.10 |
| ACCELERATION OF EARTHQUAKE | | | | 0.150 | |

| MINIMUM SAFETY FACTOR (SEISMIC) | | |
|---------------------------------|----------------|------------------|
| | UP STREAM SIDE | DOWN STREAM SIDE |
| NORMAL | 2.651 | 2.467 |
| SEISMIC | 1.244 | 1.472 |

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Karian Dam
Slope Stability Analysis Case-2
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KARIAN DAM. STABILITY ANALYSIS



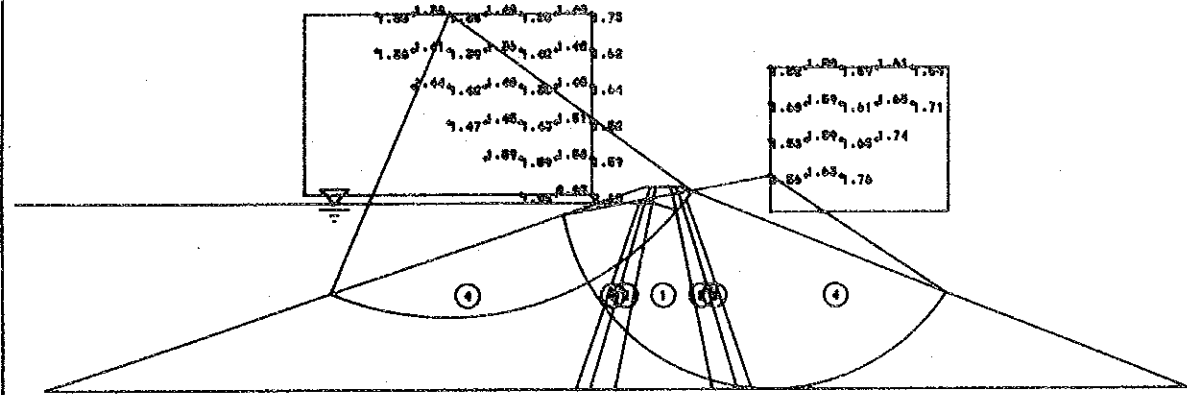
0 100.0 M
SCALE=1/2000

| MATERIAL | COHESION (T/M ²) | FRICTION (DEG) | W(WET) (T/M ²) | W(SAT) (T/M ²) | W(SUB) (T/M ²) |
|----------------------------|---------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|
| 1 | 2.00 | 21.00 | 1.84 | 1.91 | 0.91 |
| 2 | 0.00 | 35.00 | 1.90 | 2.00 | 1.00 |
| 3 | 0.00 | 35.00 | 1.80 | 2.00 | 1.00 |
| 4 | 0.00 | 40.00 | 1.80 | 2.00 | 1.00 |
| ACCELERATION OF EARTHQUAKE | | | | 0.150 | |

| MINIMUM SAFETY FACTOR (SEISMIC) | | |
|---------------------------------|----------------|------------------|
| | UP STREAM SIDE | DOWN STREAM SIDE |
| NORMAL | 2.773 | 2.678 |
| SEISMIC | 1.306 | 1.586 |


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KARIAN DAM, STABILITY ANALYSIS



SCALE=1/2000

| MATERIAL | COHESION (T/M ²) | FRICTION (DEG) | W(WET) (T/M ³) | W(SAT) (T/M ³) | W(SUB) (T/M ³) |
|----------------------------|---------------------------------|-------------------|-------------------------------|-------------------------------|-------------------------------|
| 1 | 2.00 | 21.00 | 1.84 | 1.91 | 0.91 |
| 2 | 0.00 | 35.00 | 1.90 | 2.10 | 1.10 |
| 3 | 0.00 | 35.00 | 1.80 | 2.10 | 1.10 |
| 4 | 0.00 | 40.00 | 1.80 | 2.10 | 1.10 |
| ACCELERATION OF EARTHQUAKE | | | | 0.150 | |

| MINIMUM SAFETY FACTOR (SEISMIC) | | |
|---------------------------------|----------------|------------------|
| | UP STREAM SIDE | DOWN STREAM SIDE |
| NORMAL | 2.629 | 2.613 |
| SEISMIC | 1.351 | 1.563 |

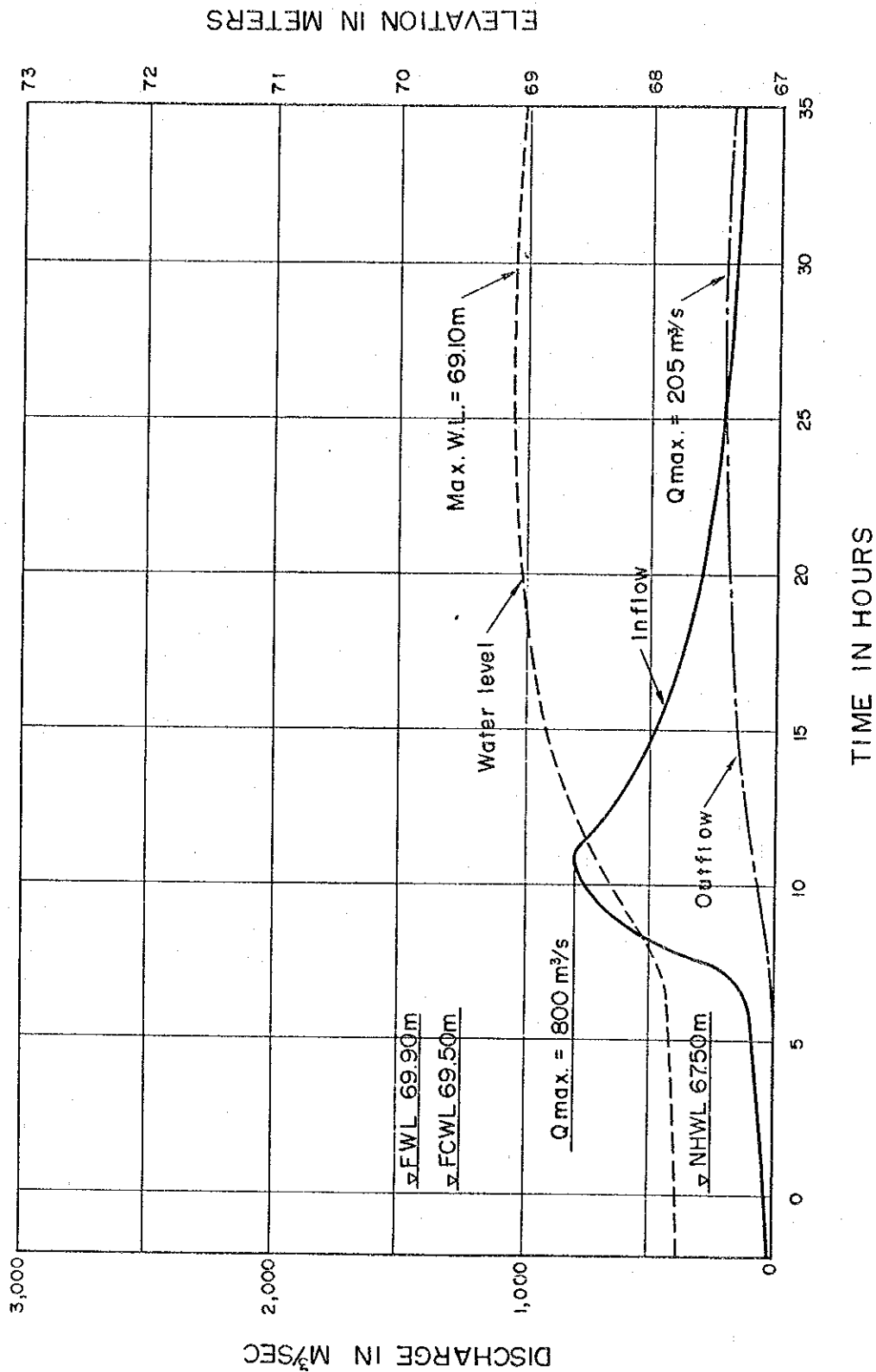


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MULTIPURPOSE DAM CONSTRUCTION PROJECT

Karian Dam
Slope Stability Analysis Case-4

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Fig.J-18




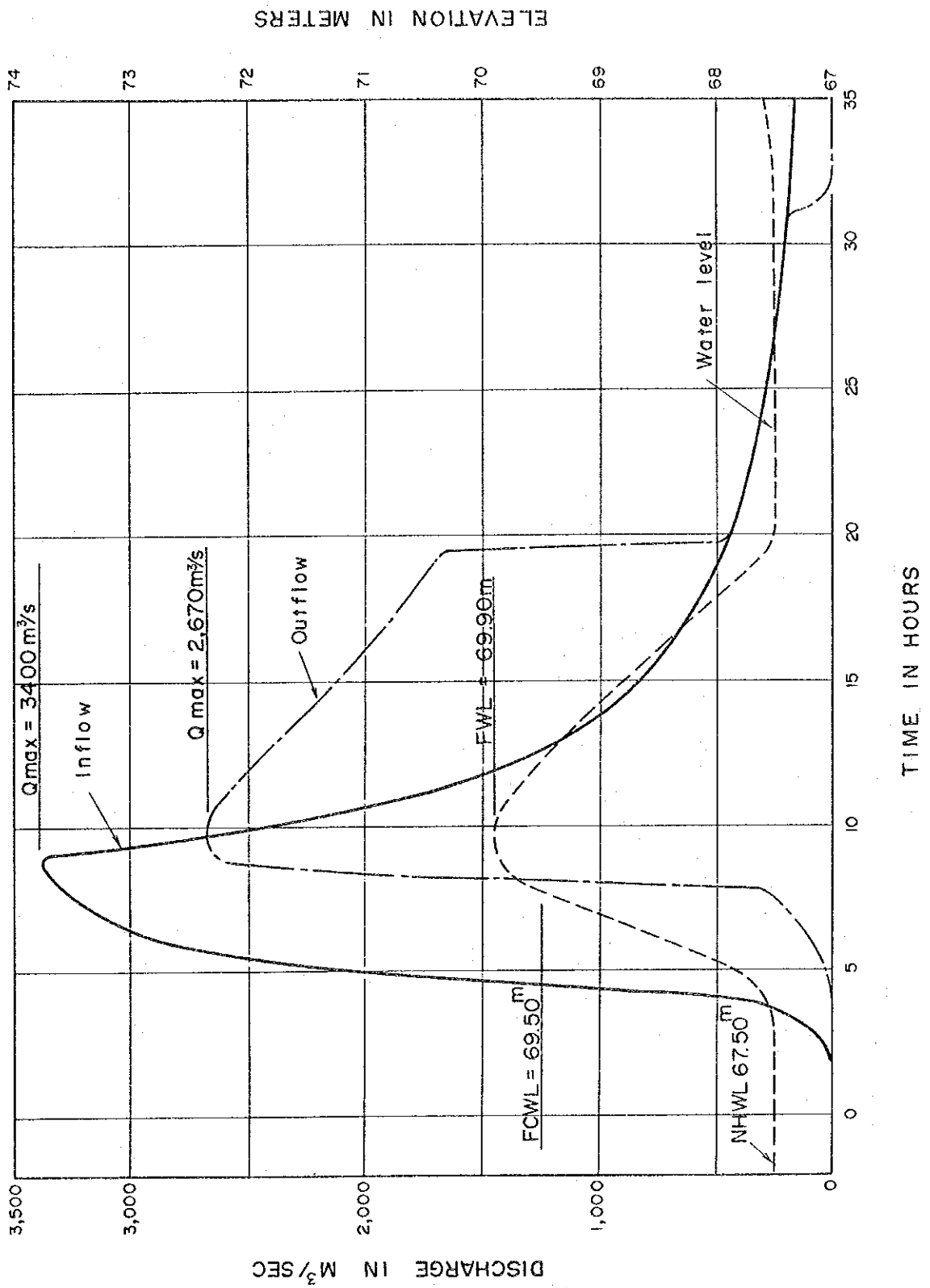

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Karian Dam Spillway
Outflow Discharge (50-yr Flood)
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Fig.J-19




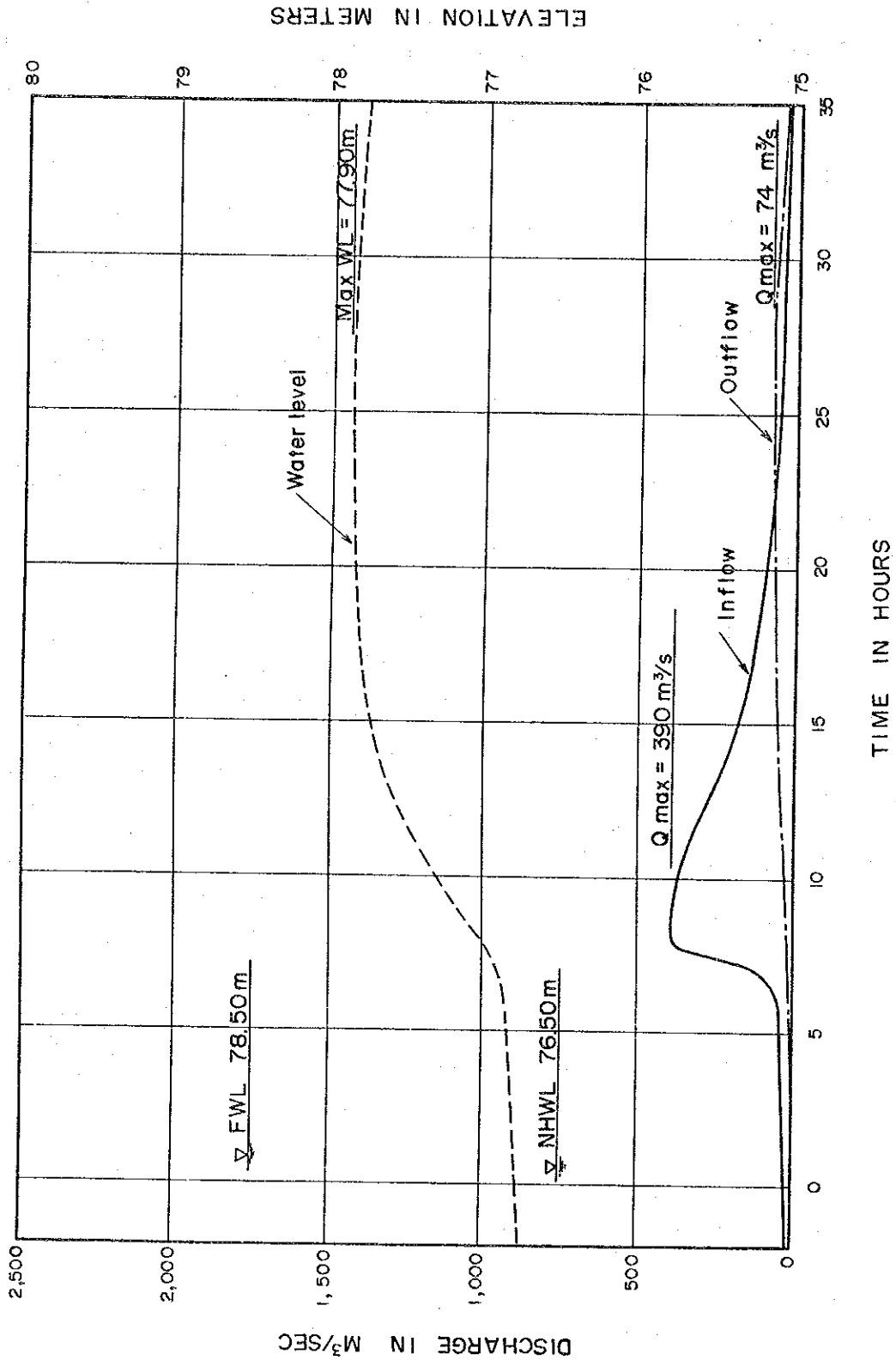

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Karian Dam
Spillway Outflow Discharge (PMF)
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Fig.J-20




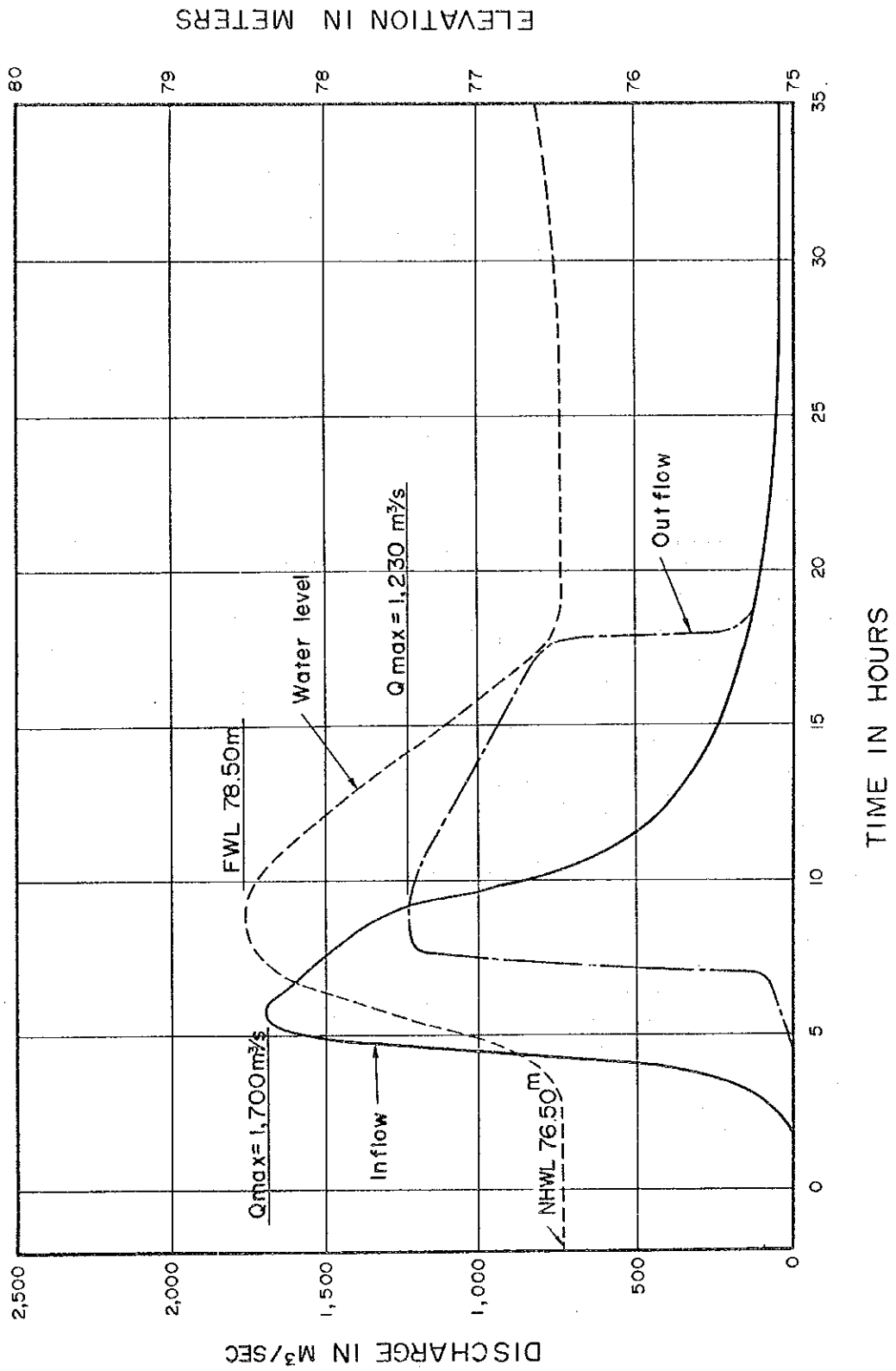
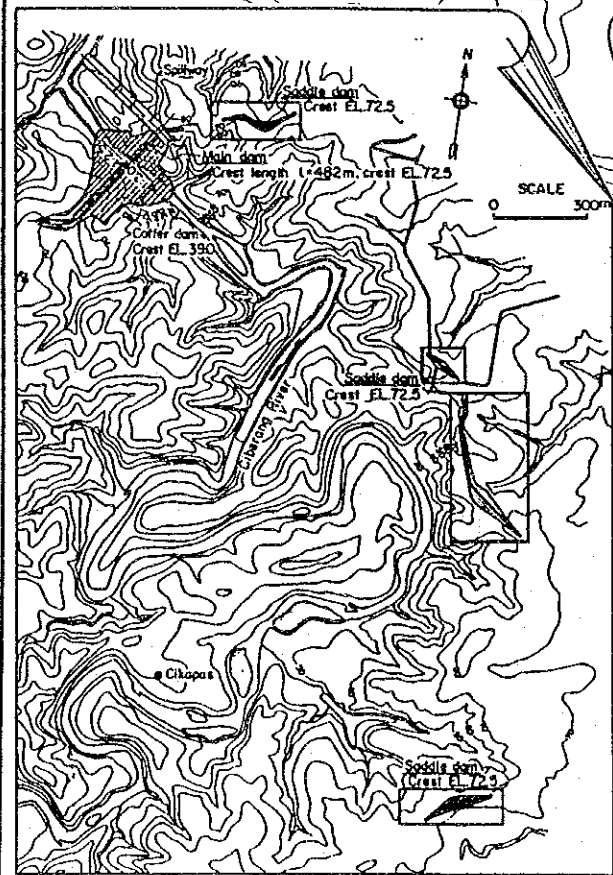

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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Cilawang Dam Spillway
Outflow Discharge (50-yr Flood)
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Fig.J-21

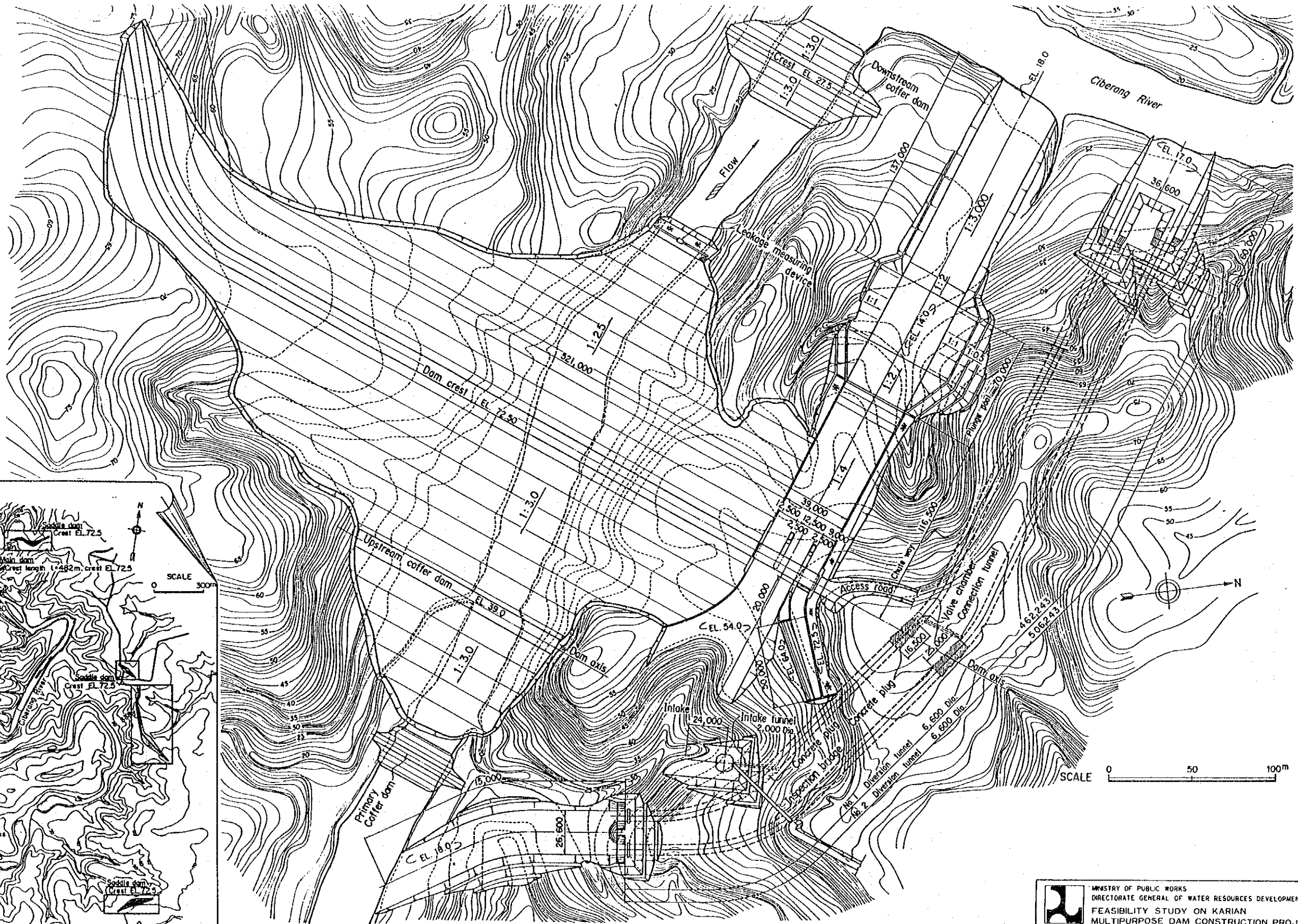



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FEASIBILITY STUDY ON KARIAN
MULTIPURPOSE DAM CONSTRUCTION PROJECT
Cilawang Dam
Spillway Outflow Discharge (PMF)
JAPAN INTERNATIONAL COOPERATION AGENCY

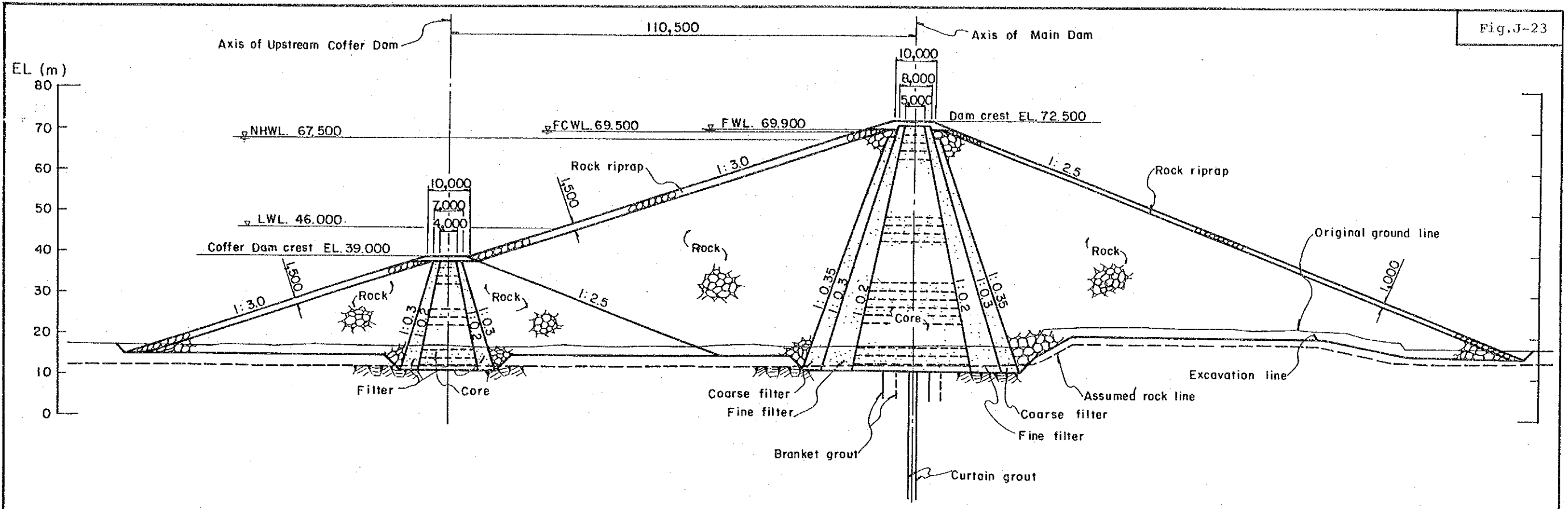
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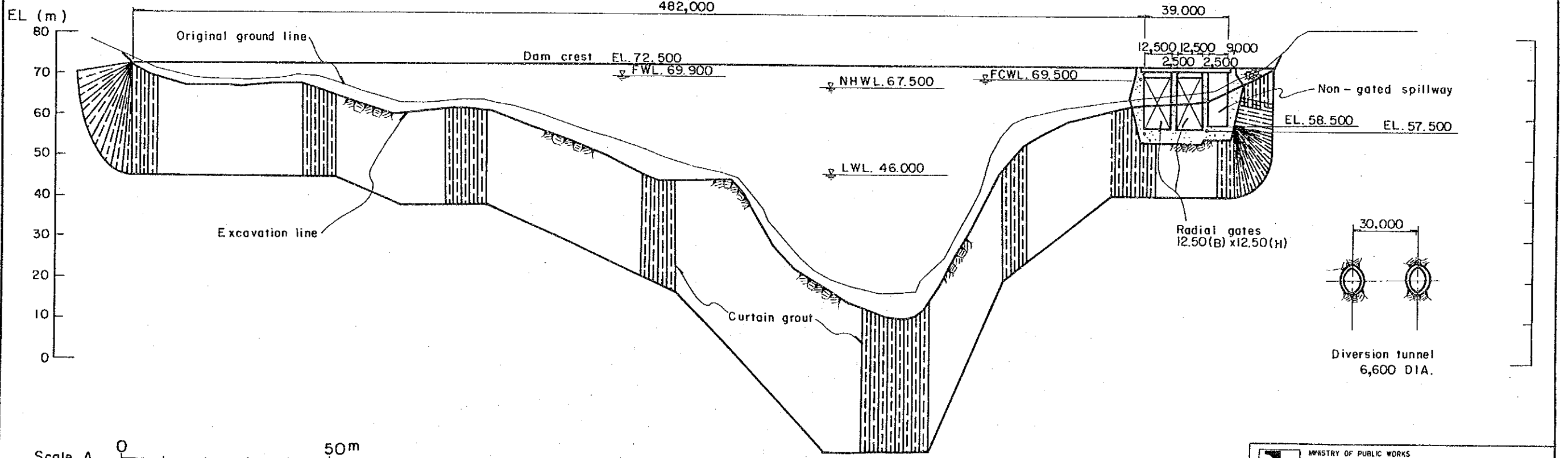
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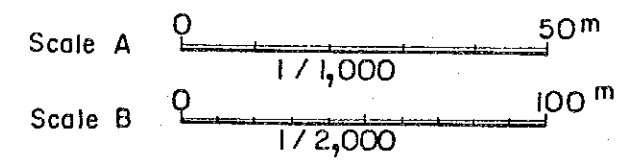

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FEASIBILITY STUDY ON KARIAN
MULTIPURPOSE DAM CONSTRUCTION PROJECT
Karian Dam Plan
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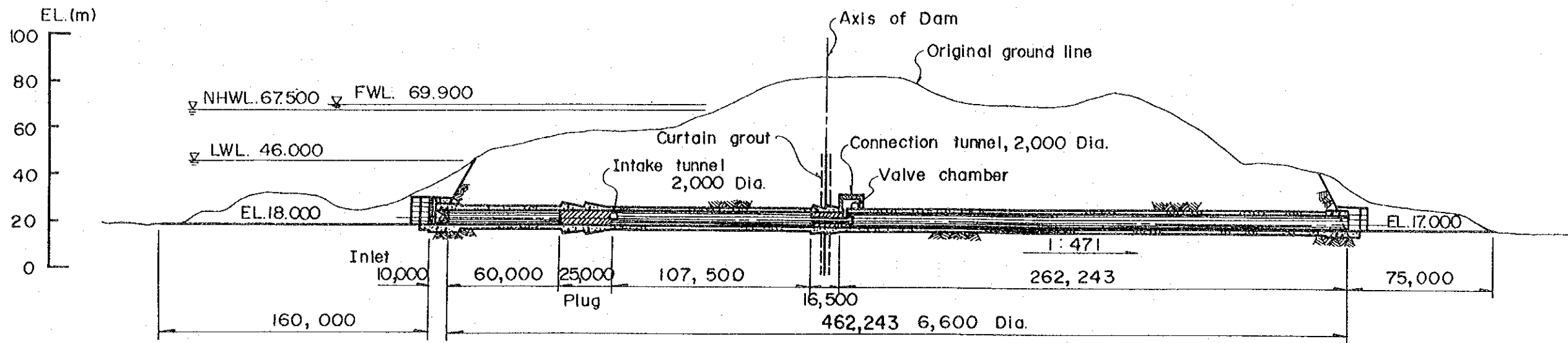
TYPICAL CROSS SECTION OF MAIN DAM
(Scale A)



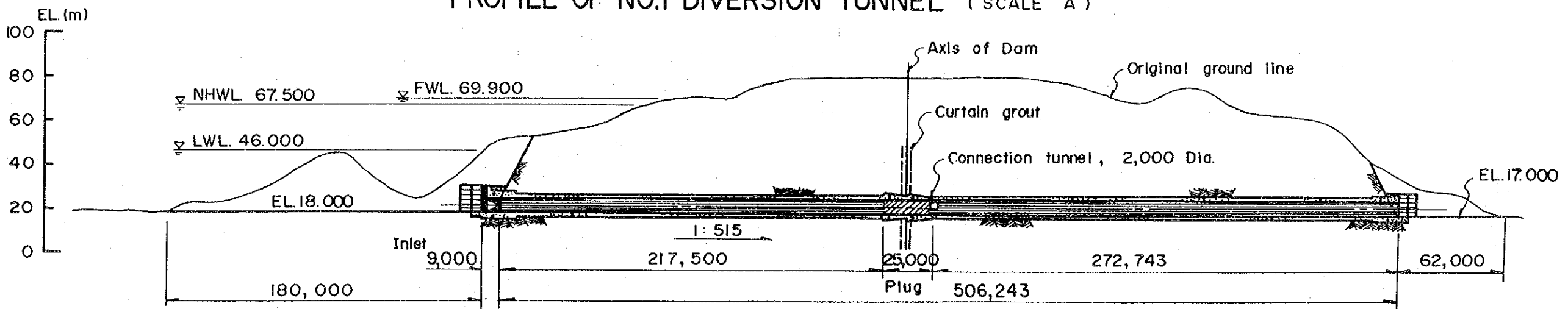
PROFILE OF DAM
(Scale H: 1/2,000; V: 1/1,000)



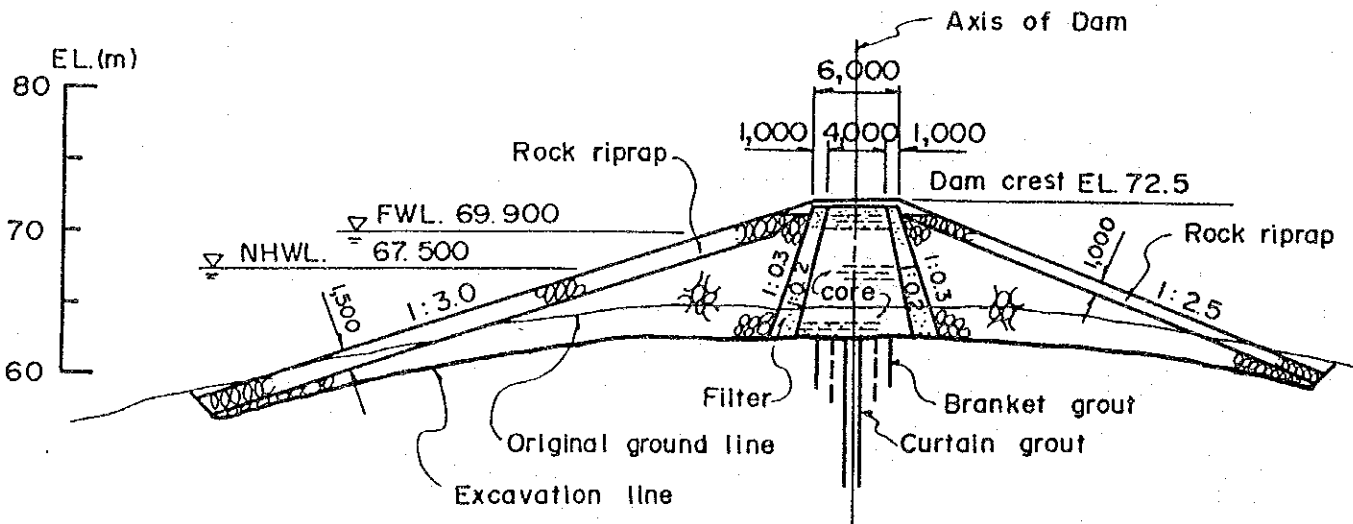

MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Karian Dam
 Dam Cross Section and Profile
 JAPAN INTERNATIONAL COOPERATION AGENCY



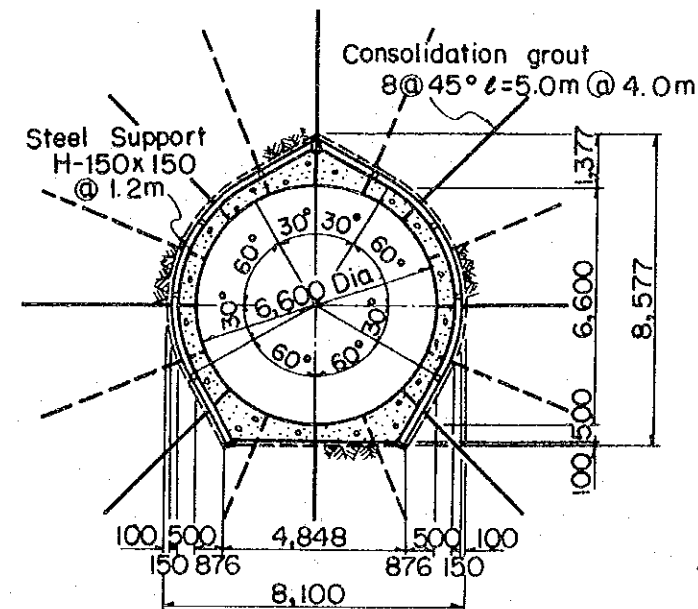
PROFILE OF NO.1 DIVERSION TUNNEL (SCALE A)



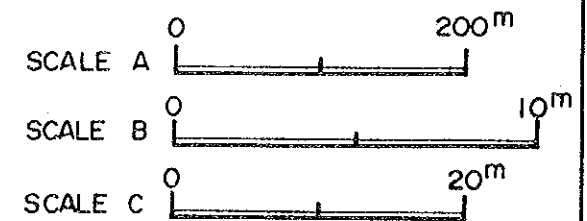
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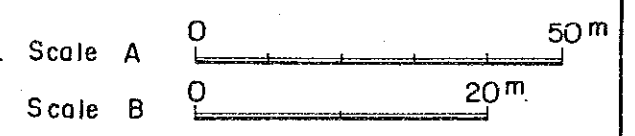
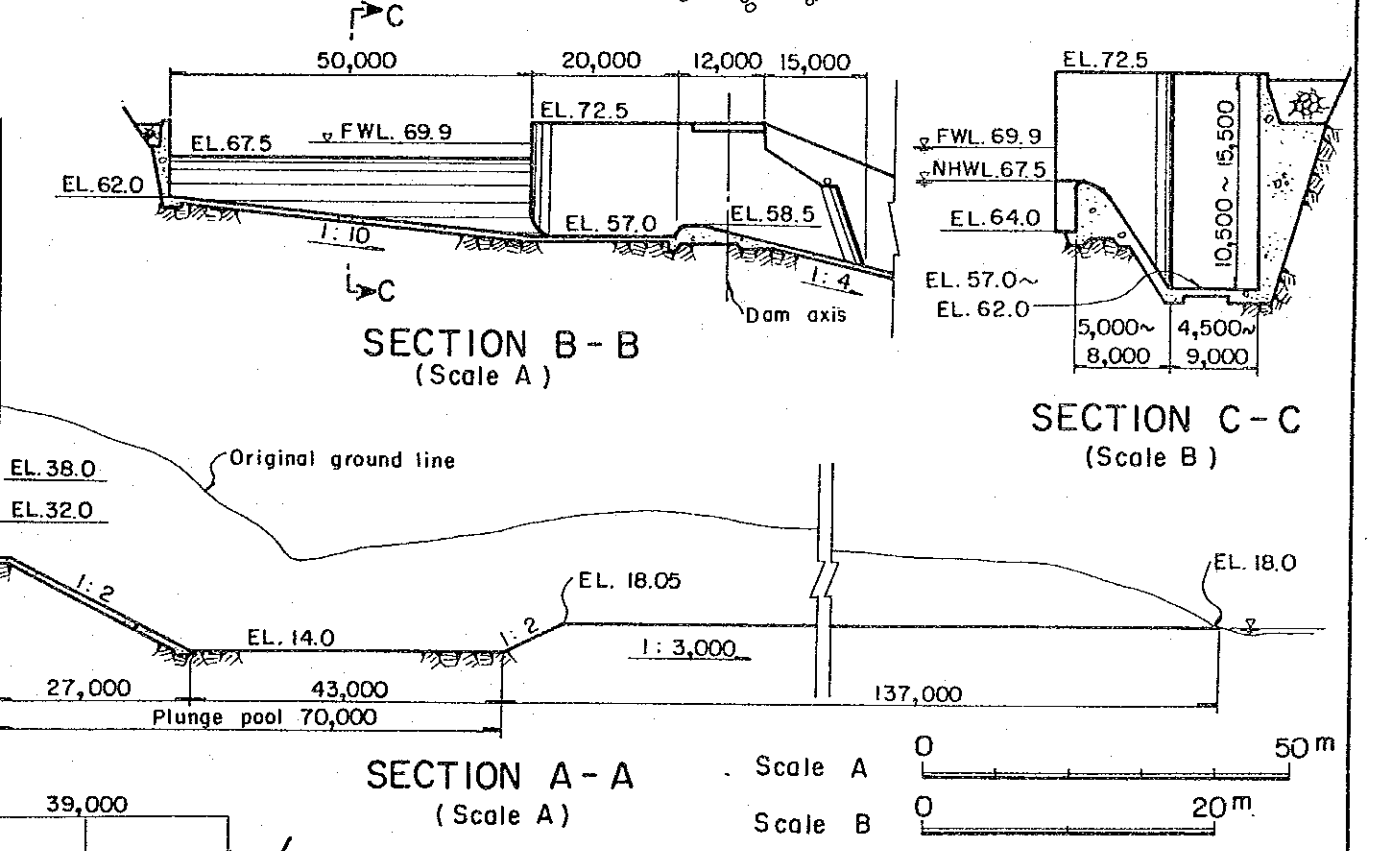
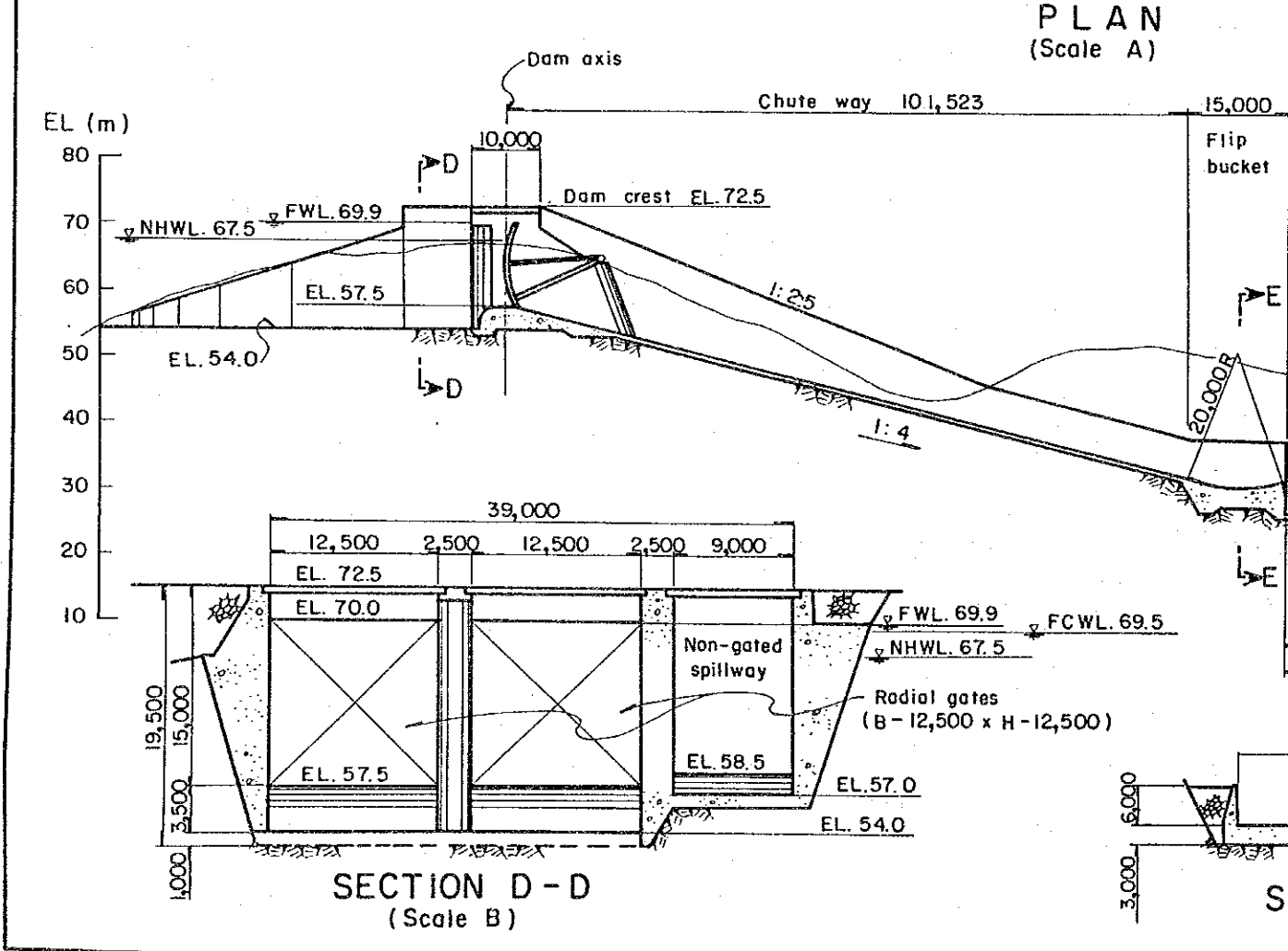
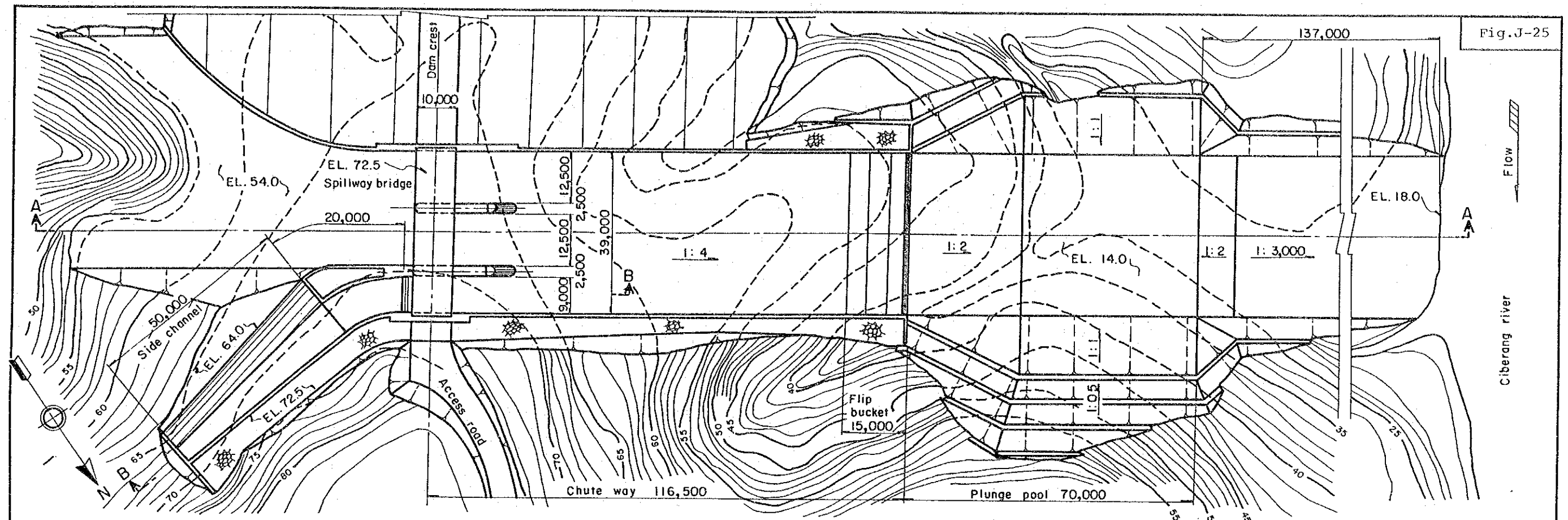
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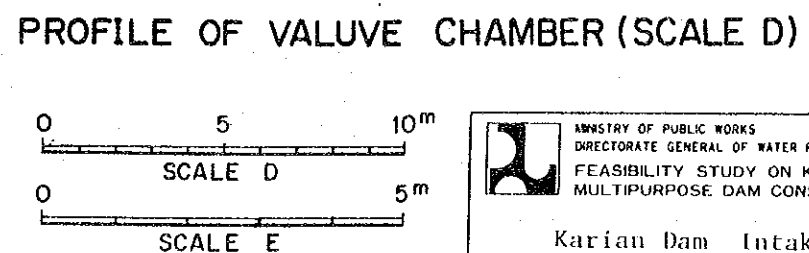
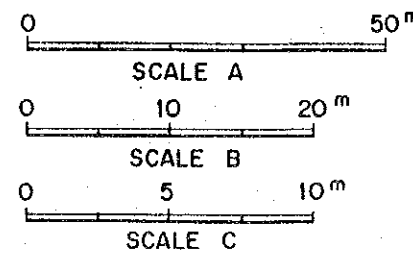
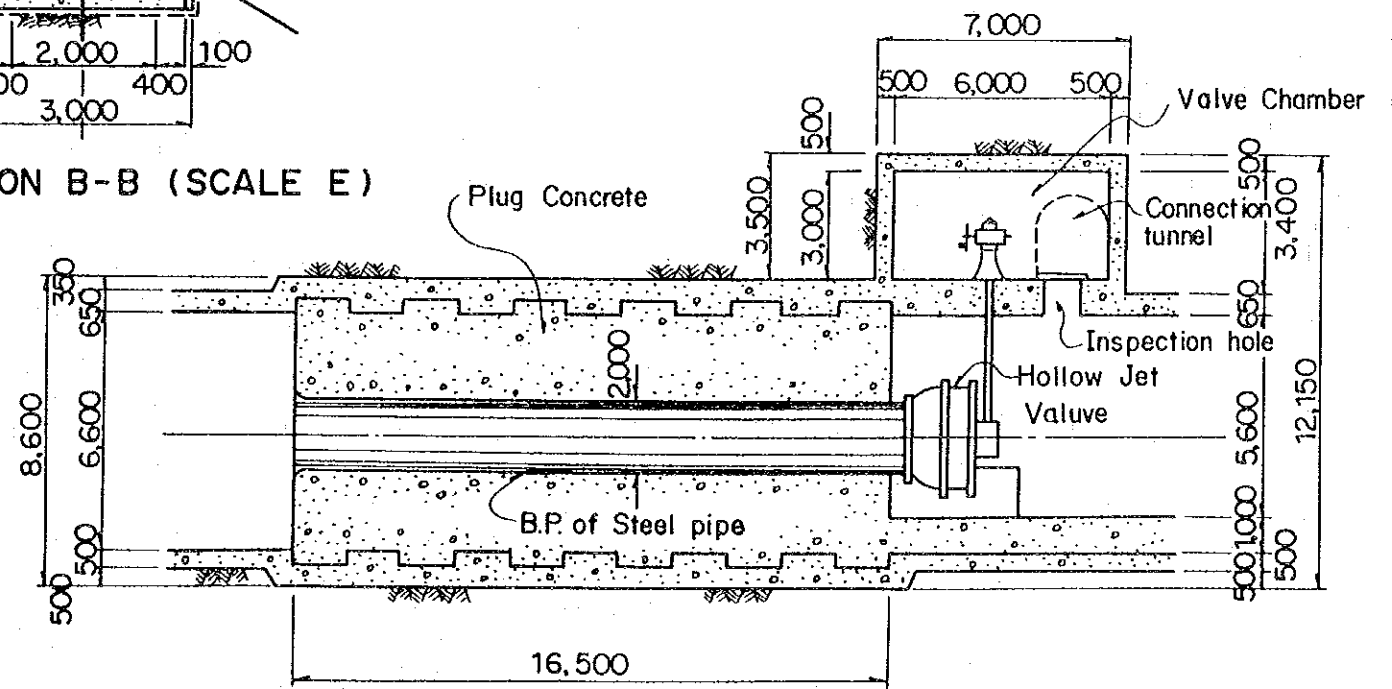
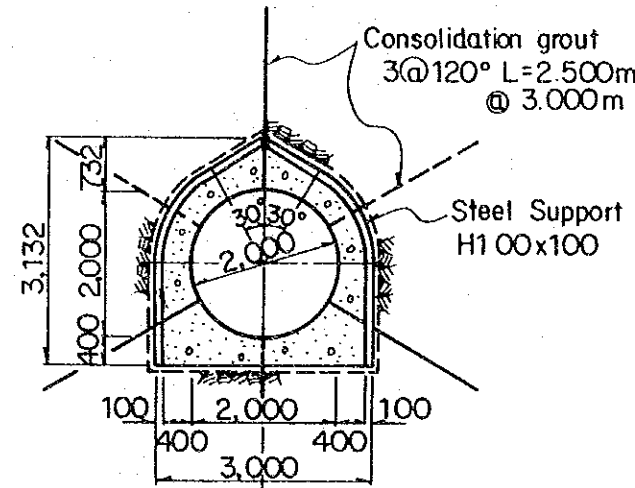
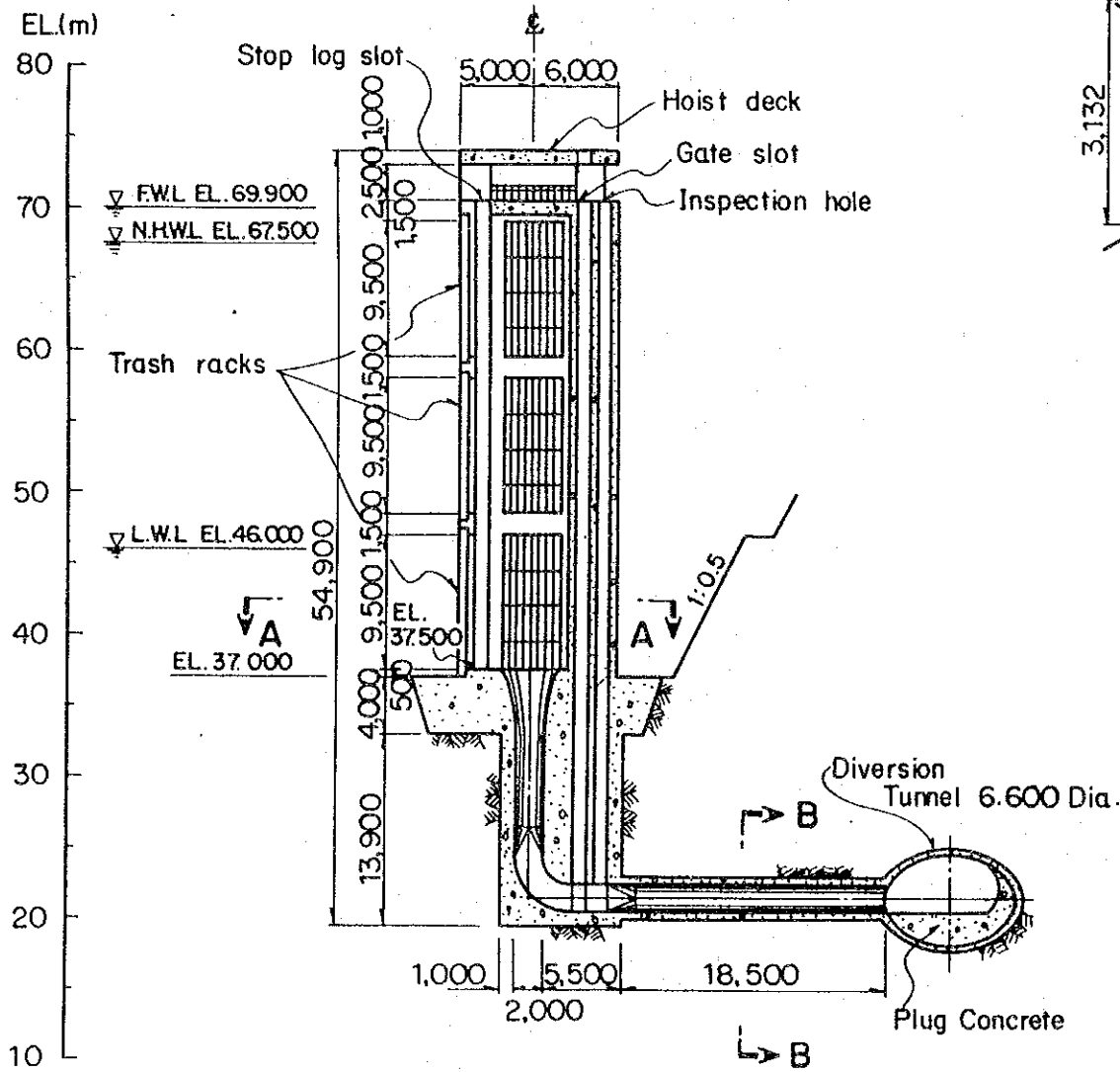
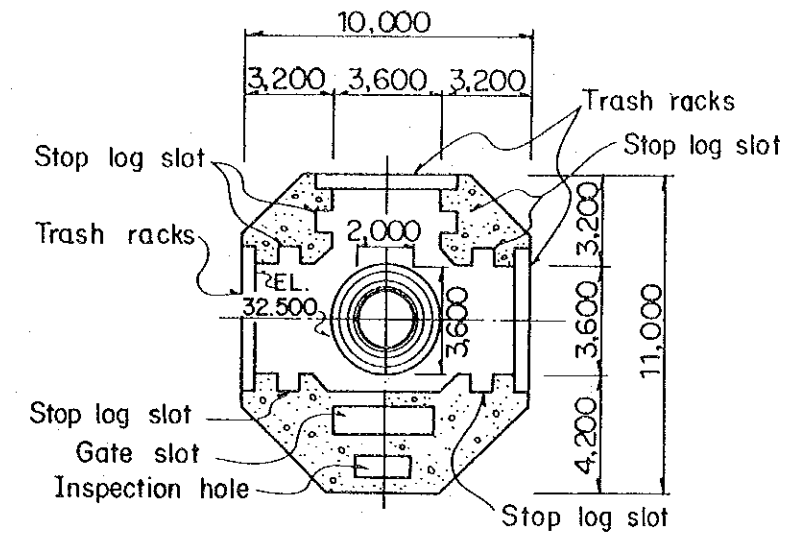
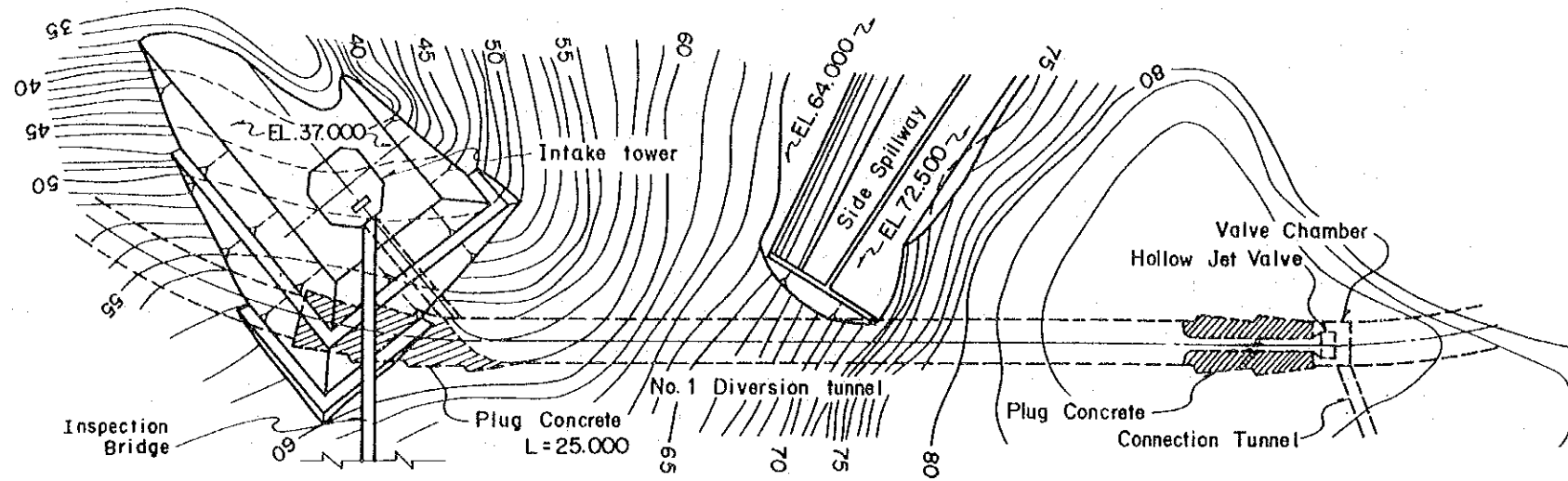
TYPICAL SECTION OF TUNNELS (SCALE B)

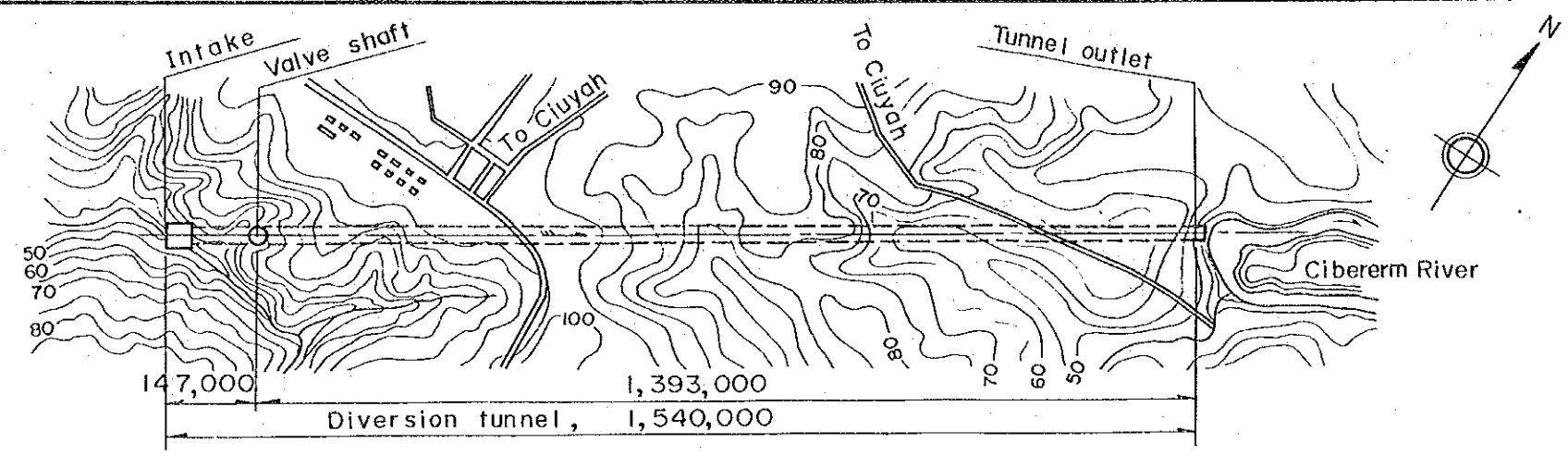



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 Karian Dam
 Diversion Tunnel and Saddle Dam
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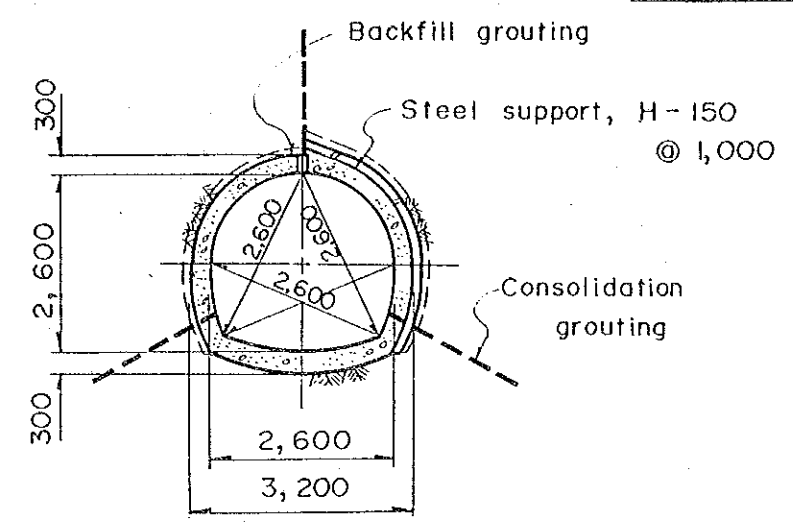


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 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
 Karian Dam Spillway
 JAPAN INTERNATIONAL COOPERATION AGENCY

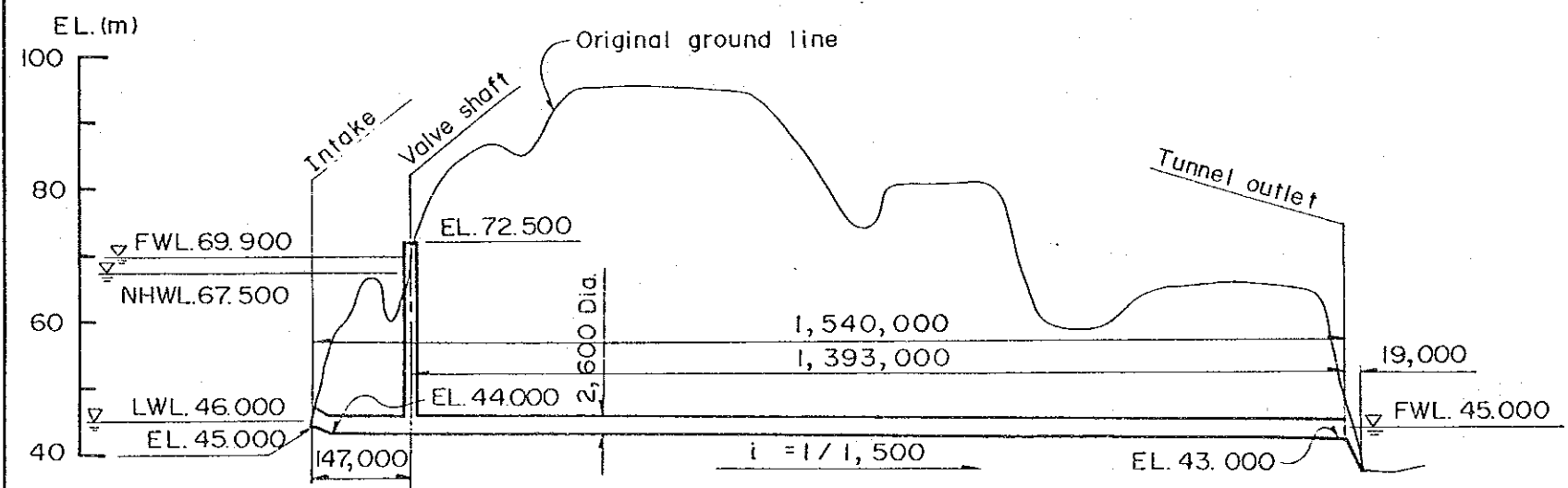




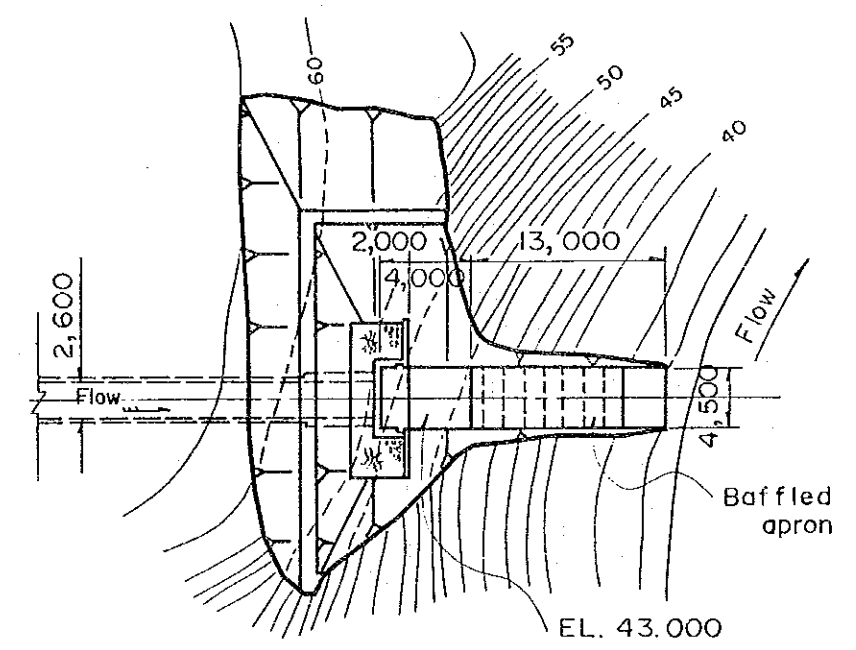
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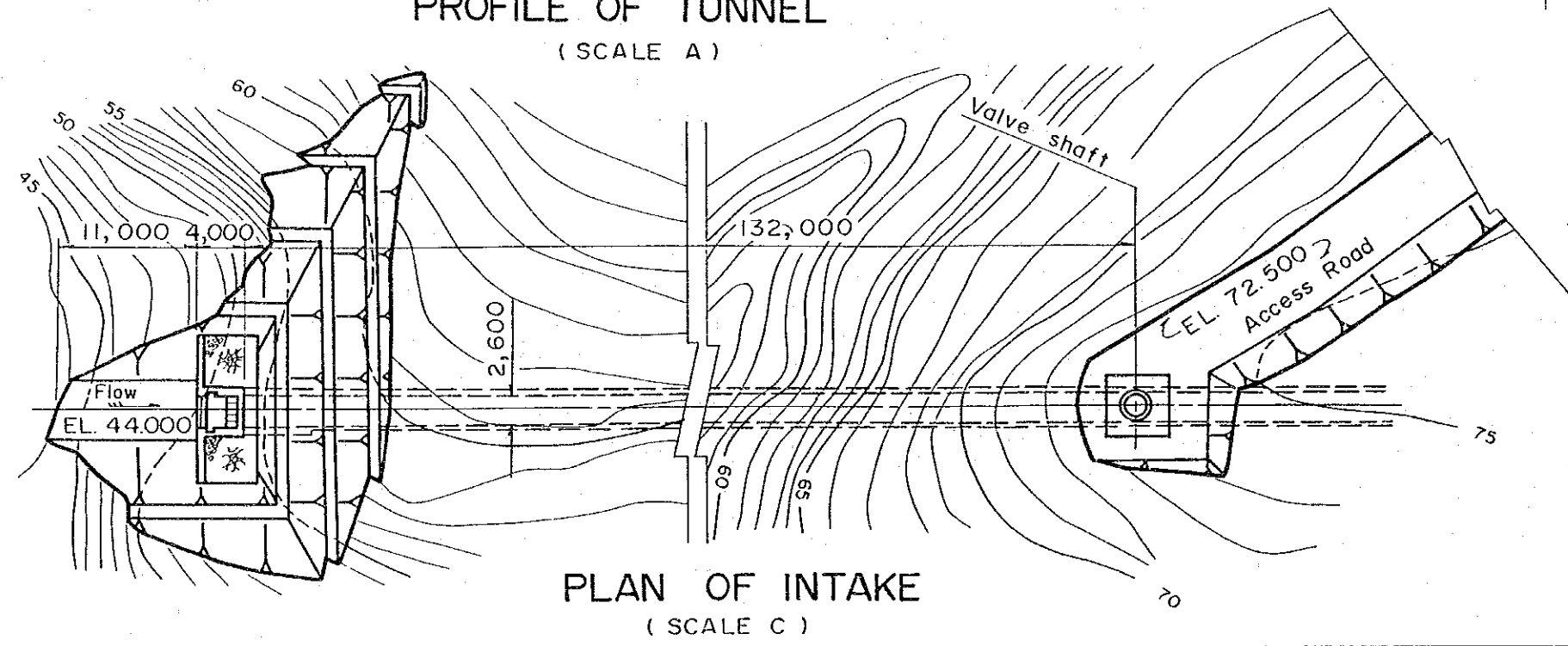
TYPICAL CROSS SECTION OF TUNNEL (SCALE B)



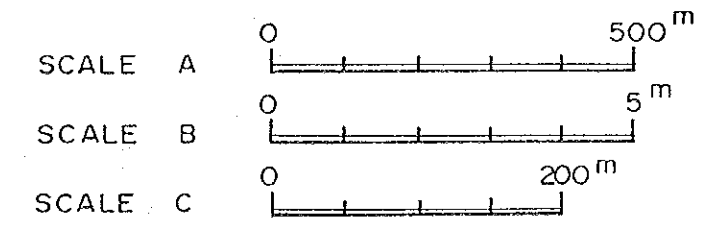
PROFILE OF TUNNEL (SCALE A)



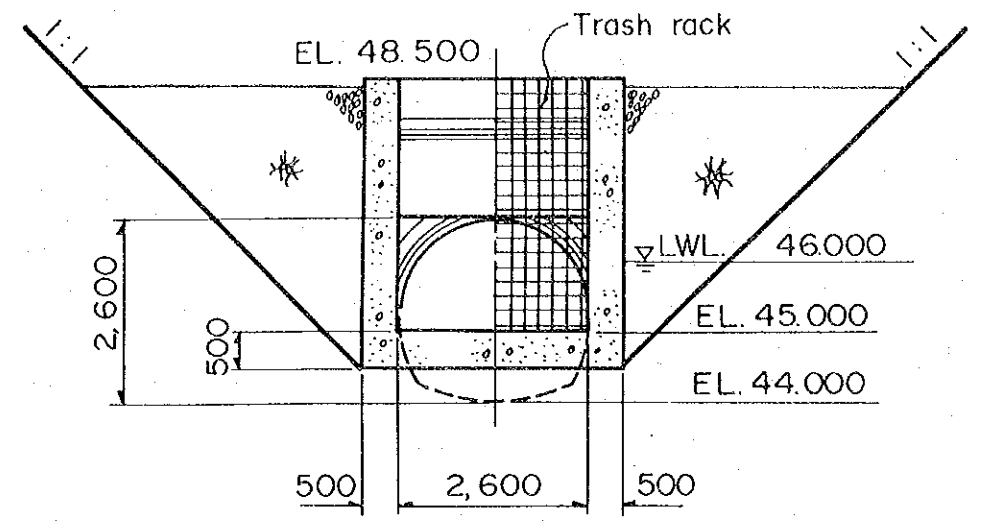
PLAN OF OUTLET (SCALE C)



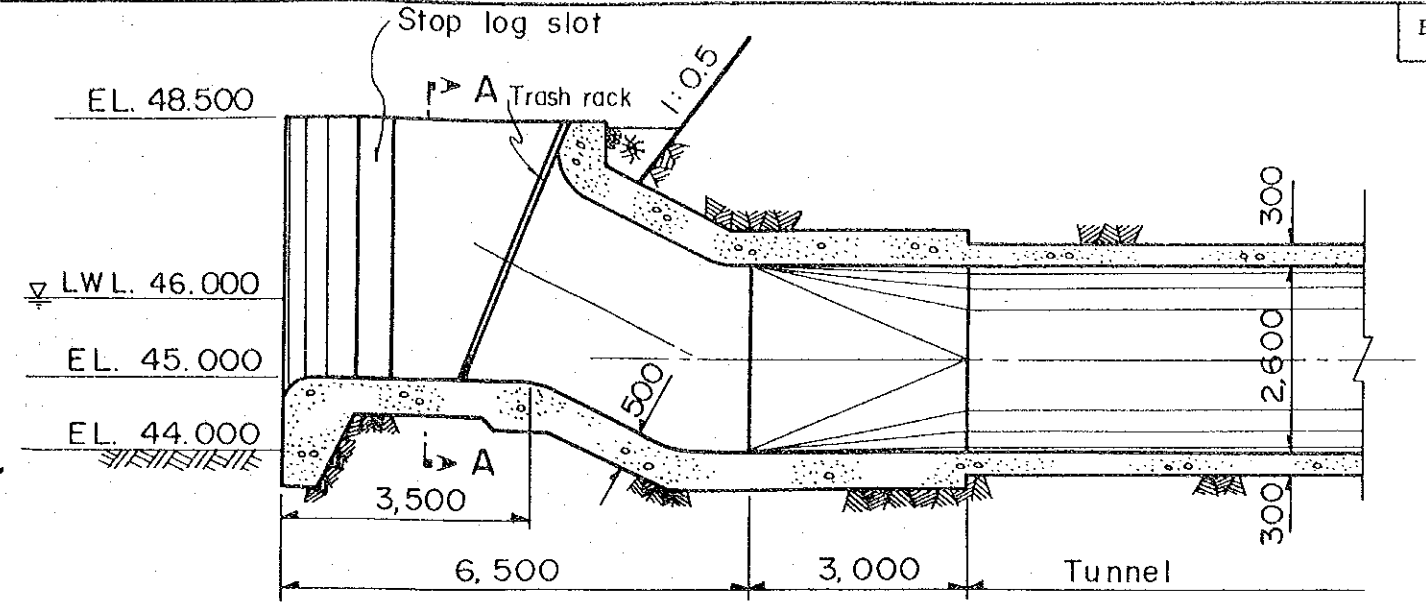
PLAN OF INTAKE (SCALE C)



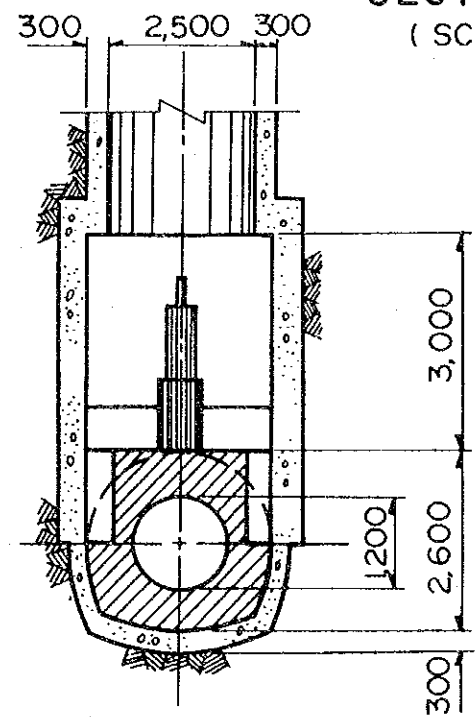
MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
 Ciuyah Trans-basin Tunnel
 Plan and Section
 JAPAN INTERNATIONAL COOPERATION AGENCY



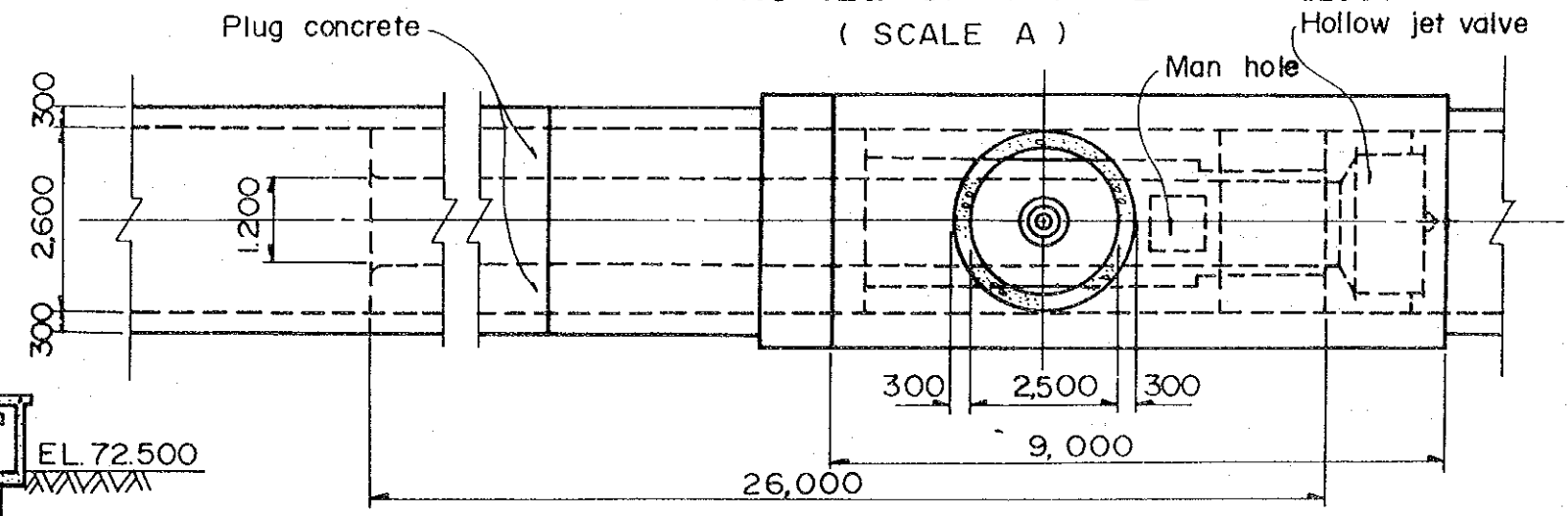
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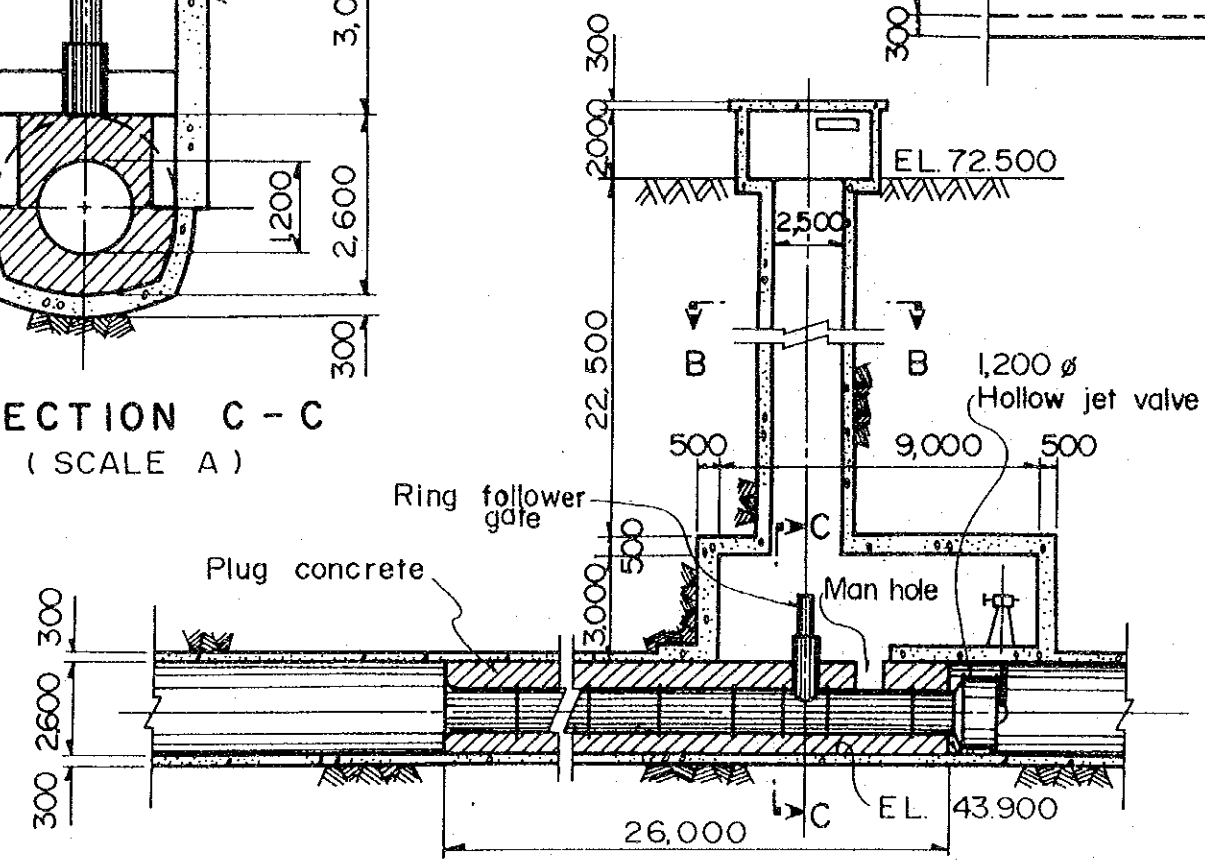
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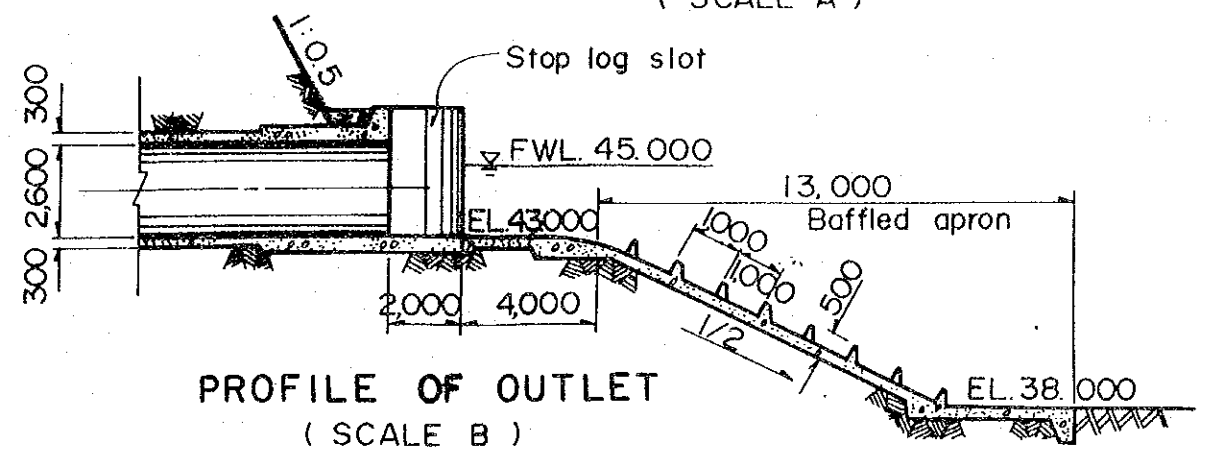
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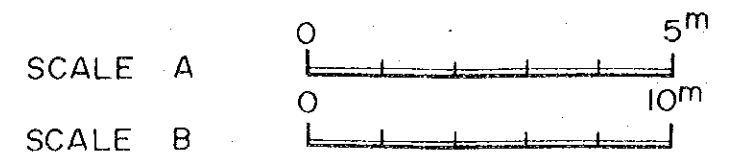
SECTION B - B
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PROFILE OF SHAFT
(SCALE B)



PROFILE OF OUTLET
(SCALE B)




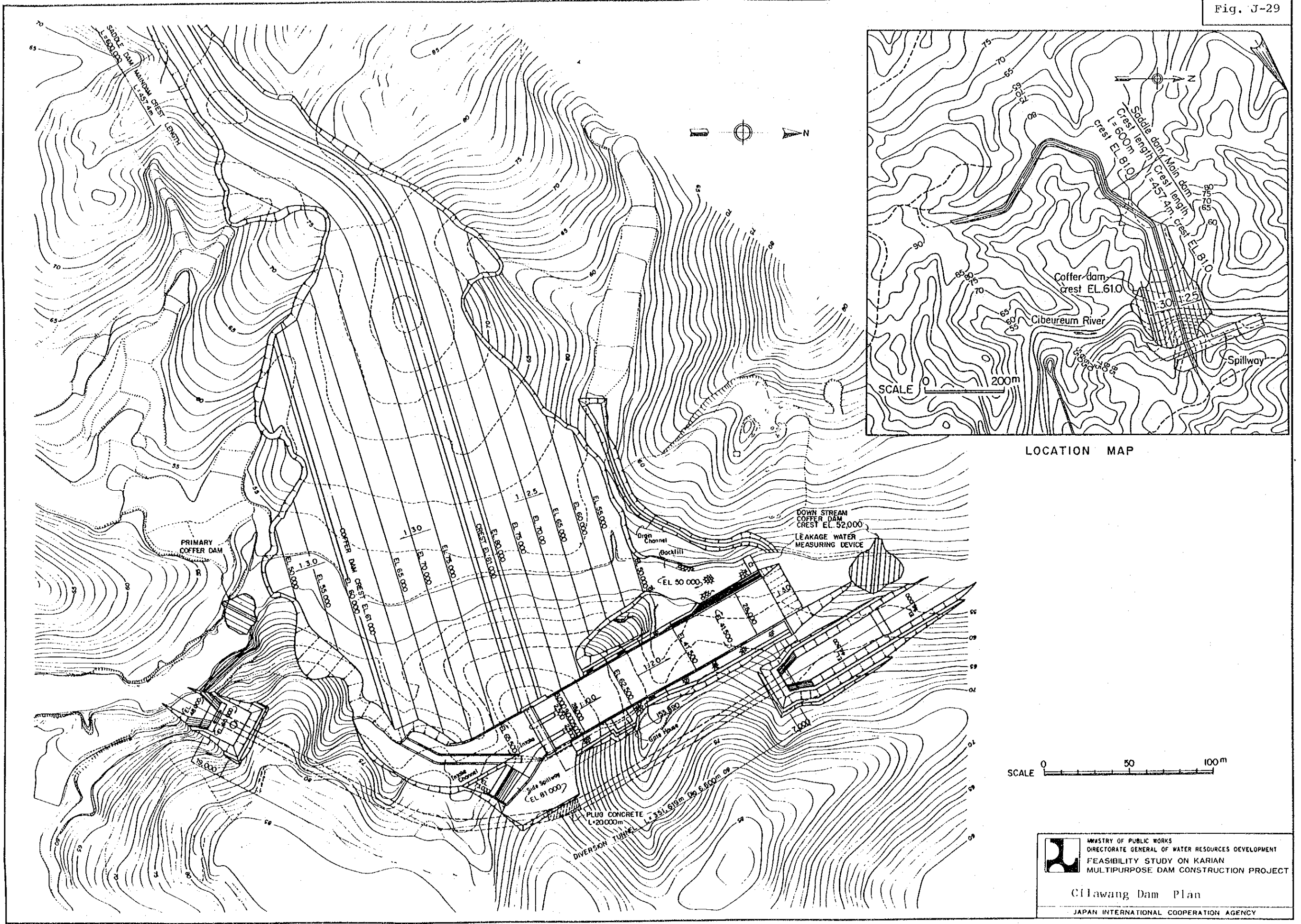
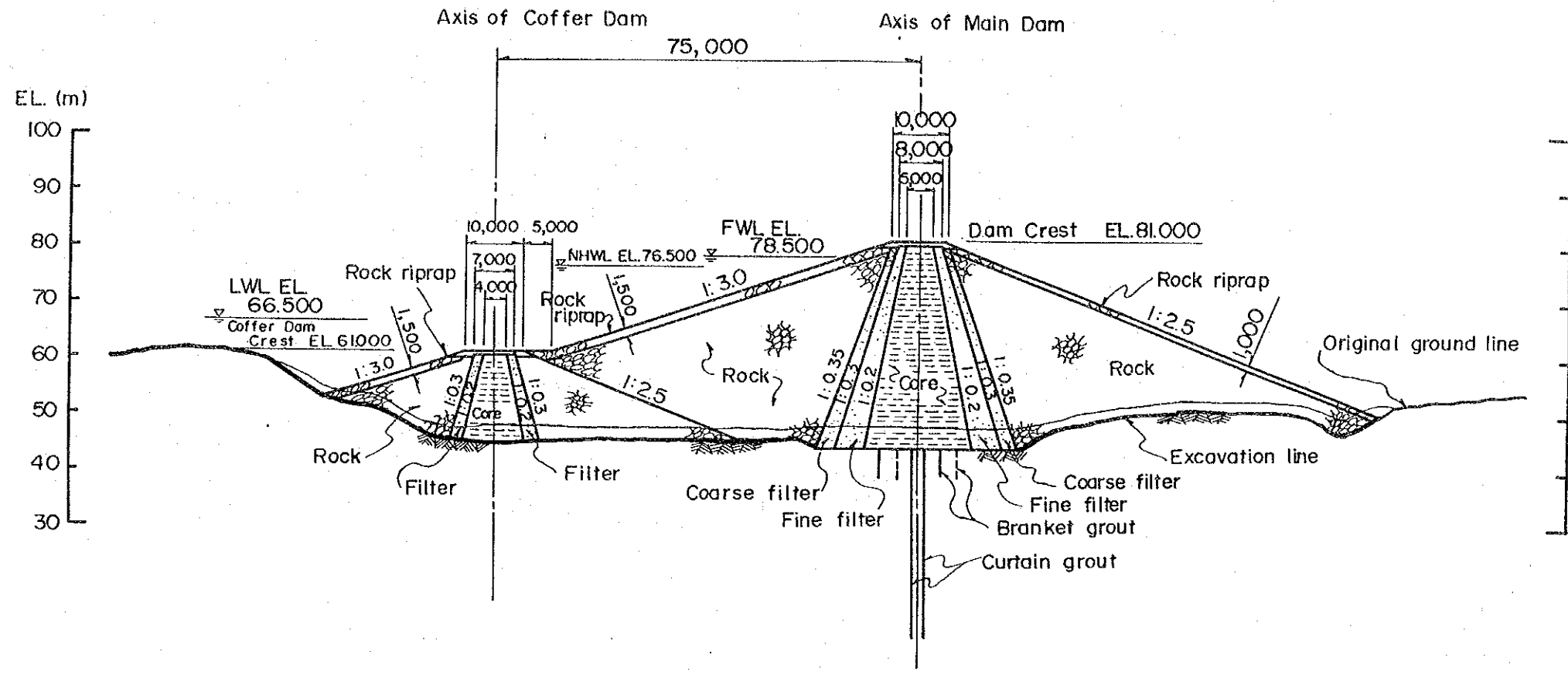
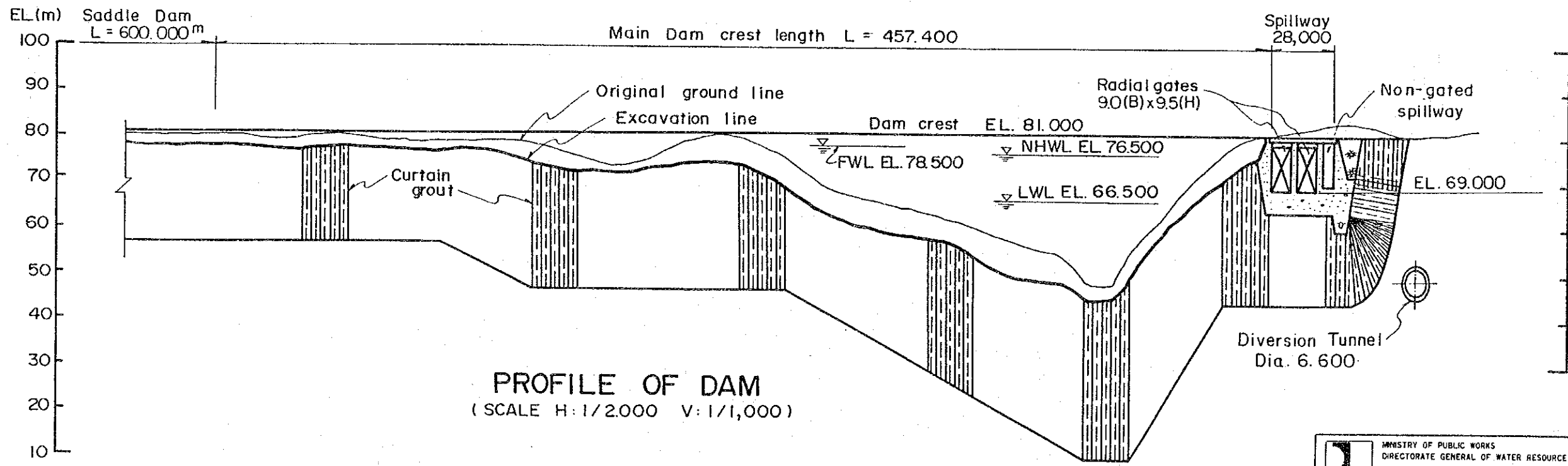

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 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
 Ciuyah Trans-basin Tunnel
 Details
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. J-29

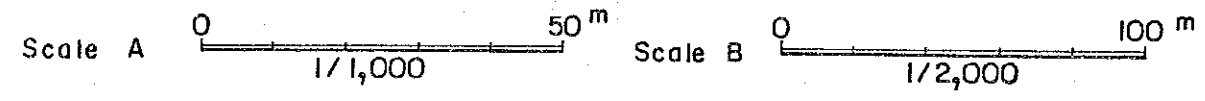





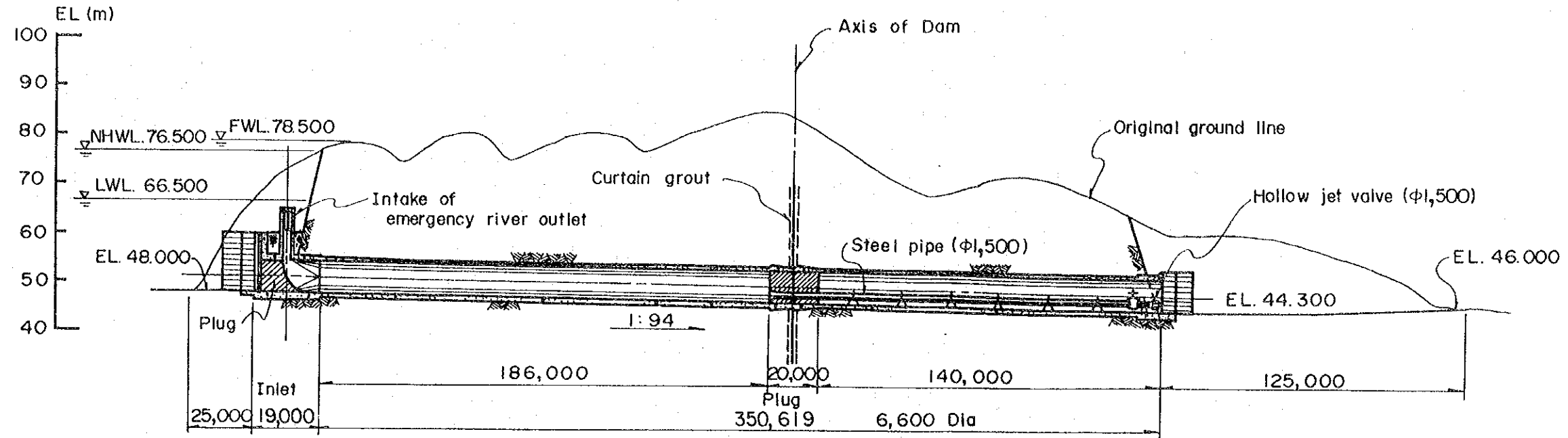
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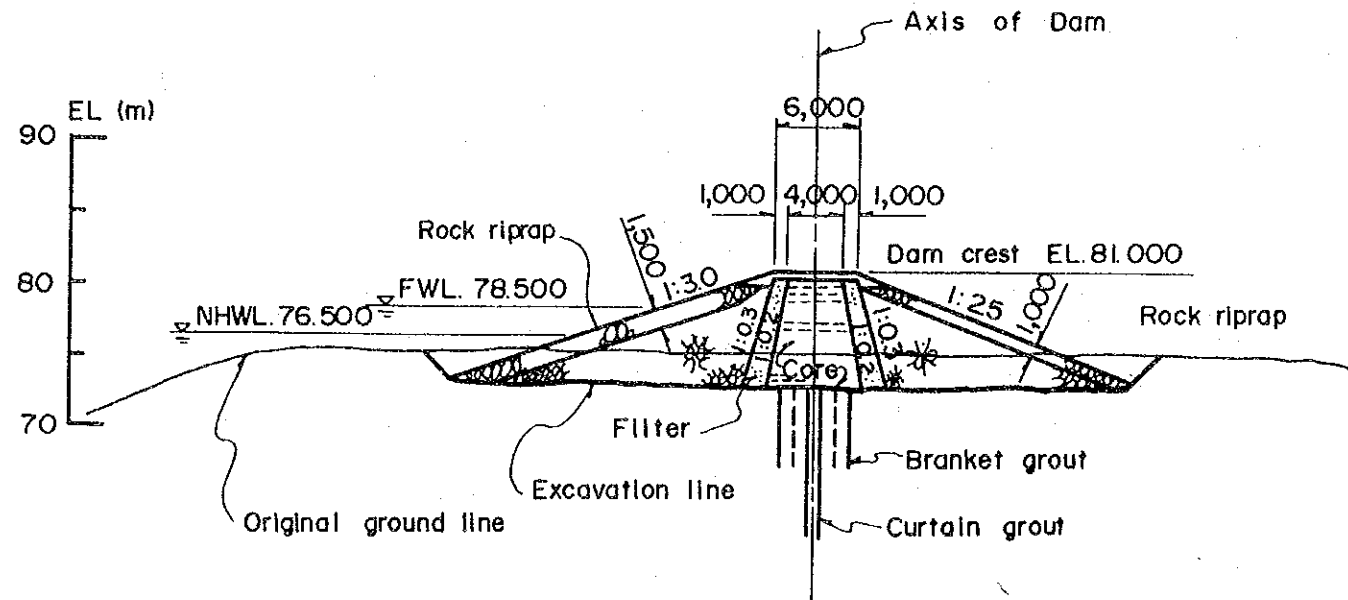
PROFILE OF DAM
(SCALE H: 1/2,000 V: 1/1,000)



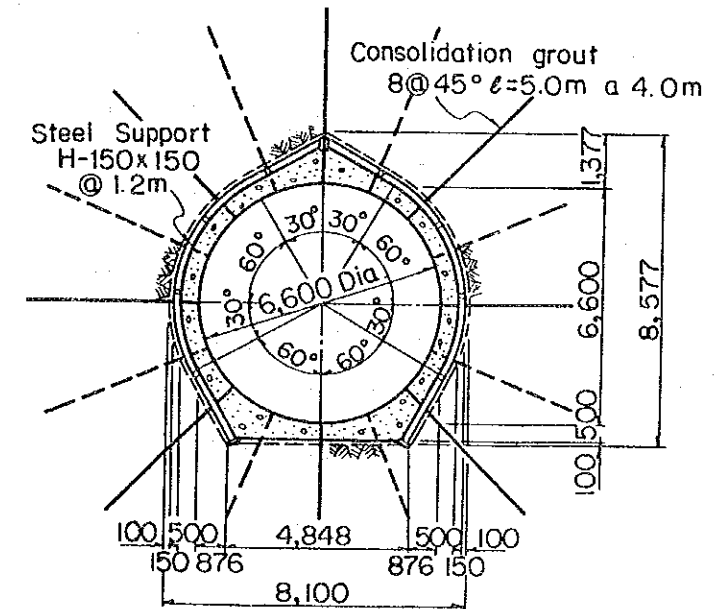

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 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Cilawang Dam
 Dam Cross Section and Profile
 JAPAN INTERNATIONAL COOPERATION AGENCY



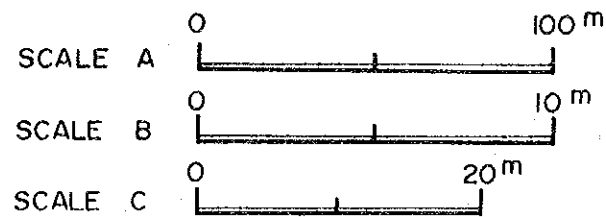
PROFILE OF DIVERSION TUNNEL (H - SCALE A)

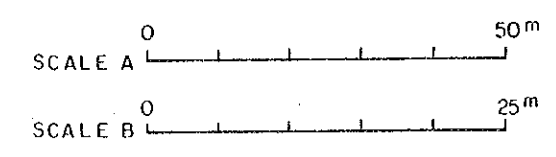
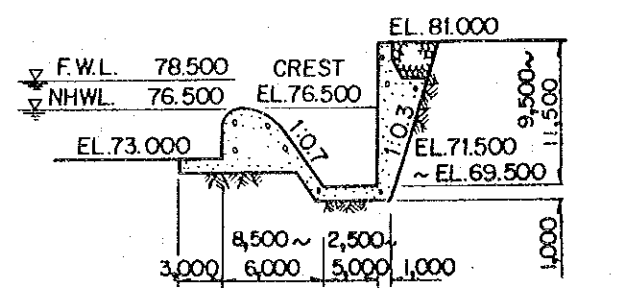
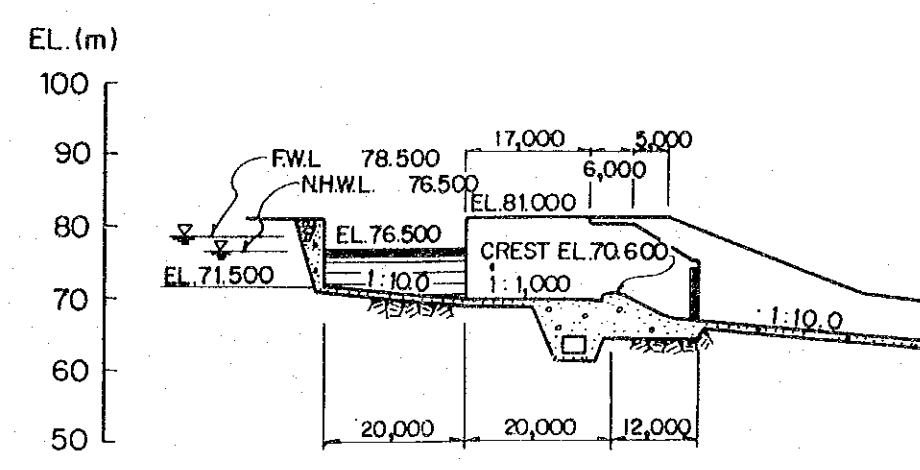
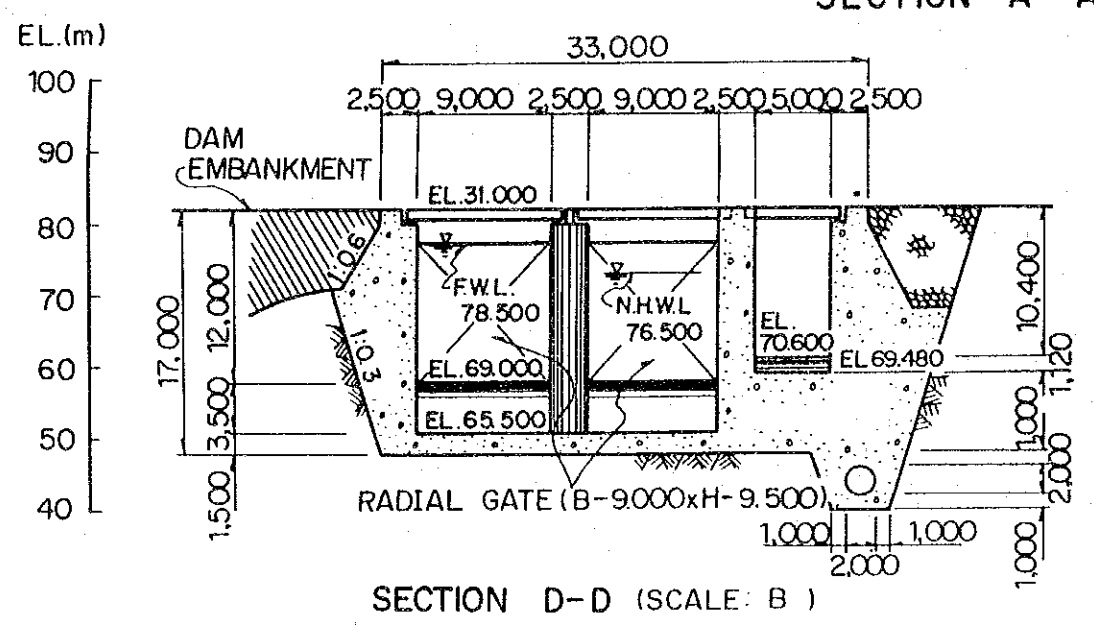
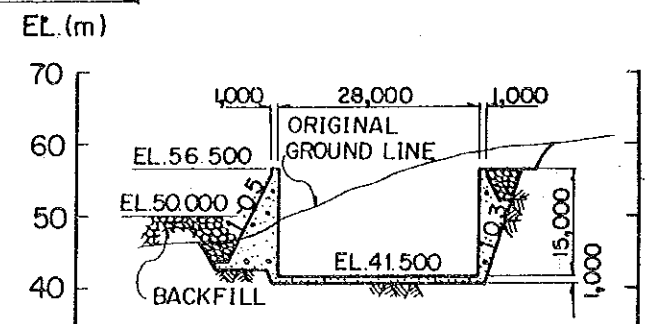
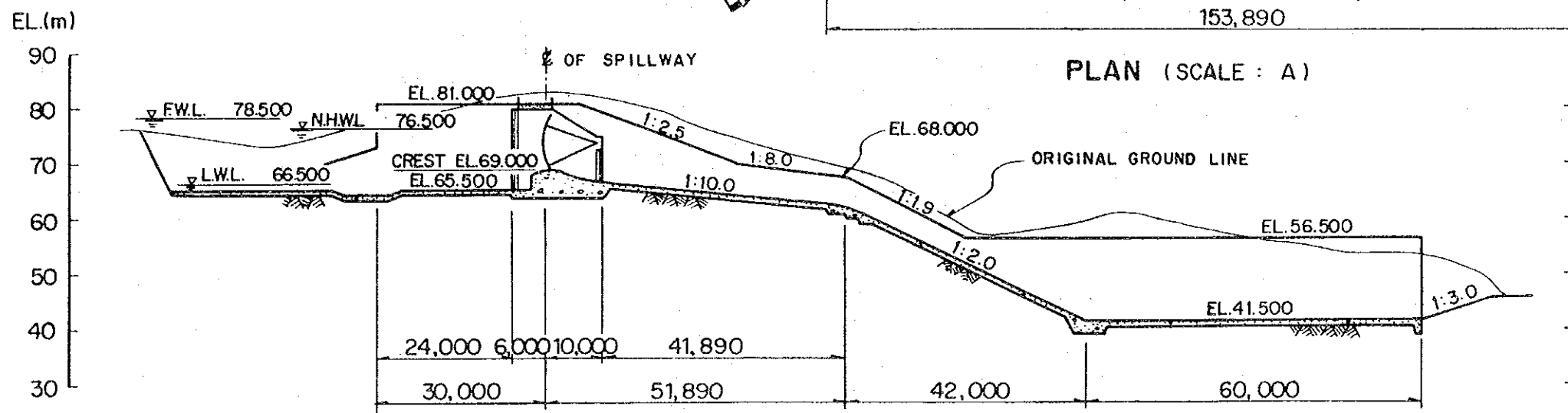
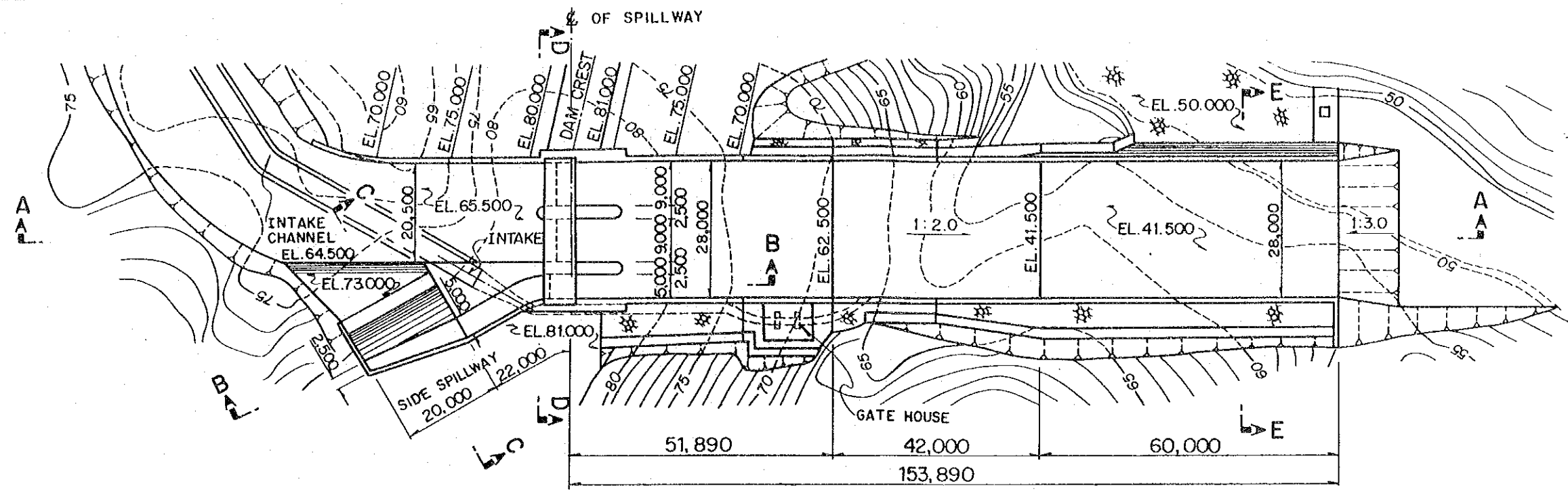


TYPICAL CROSS SECTION OF SADDLE DAM
(SCALE C)

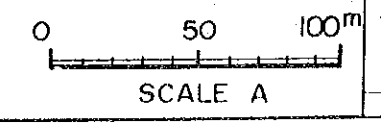
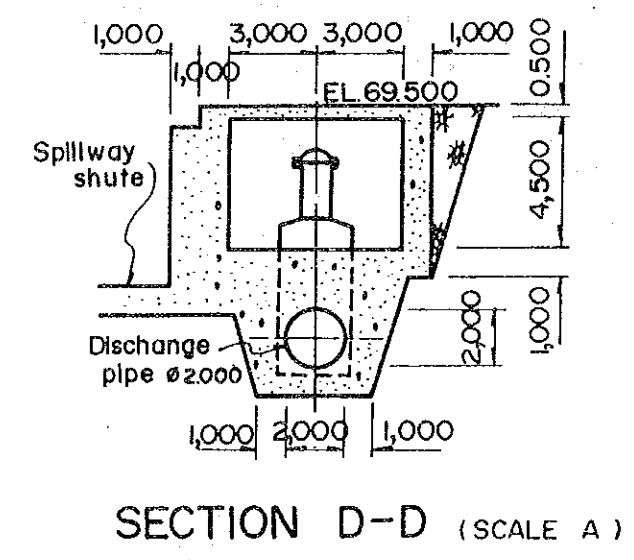
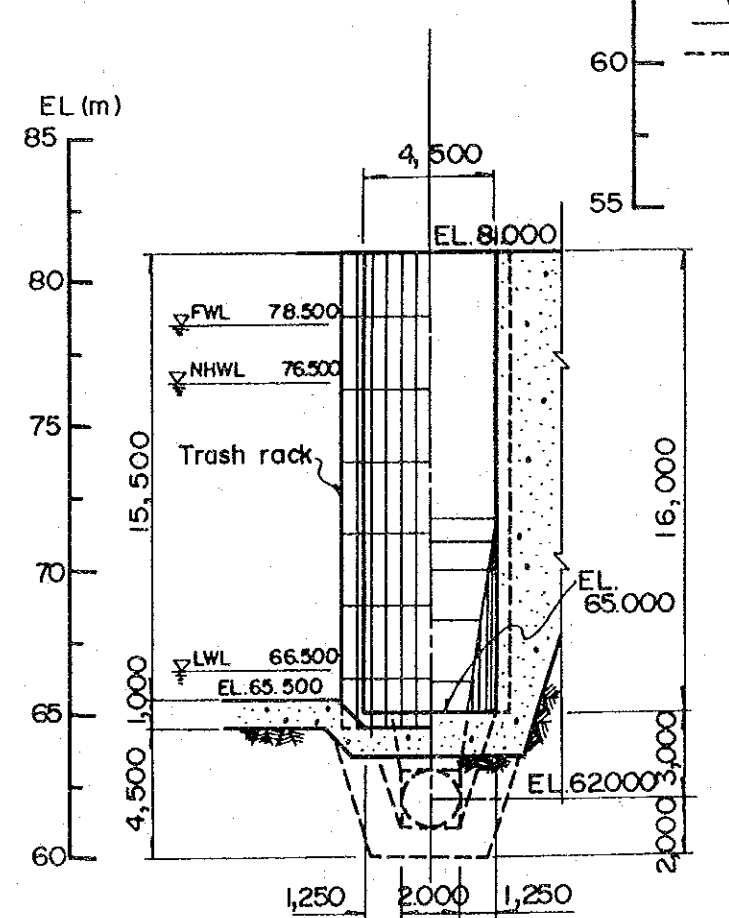
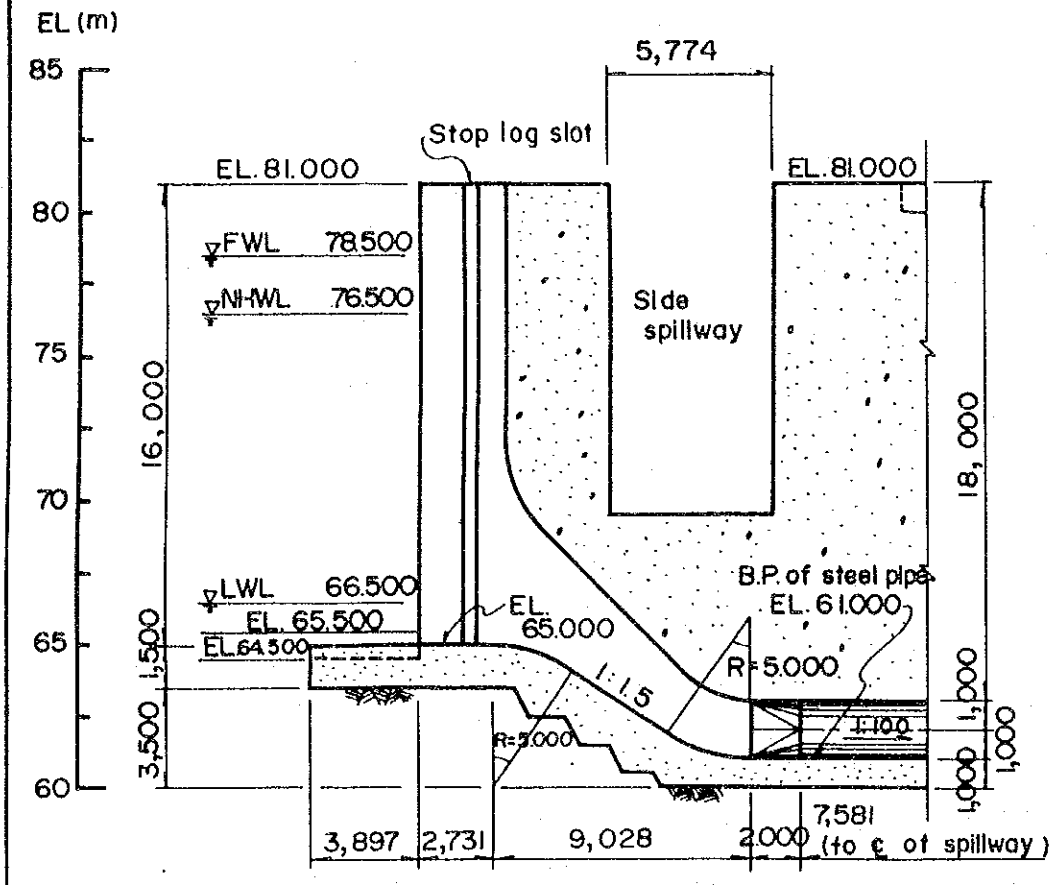
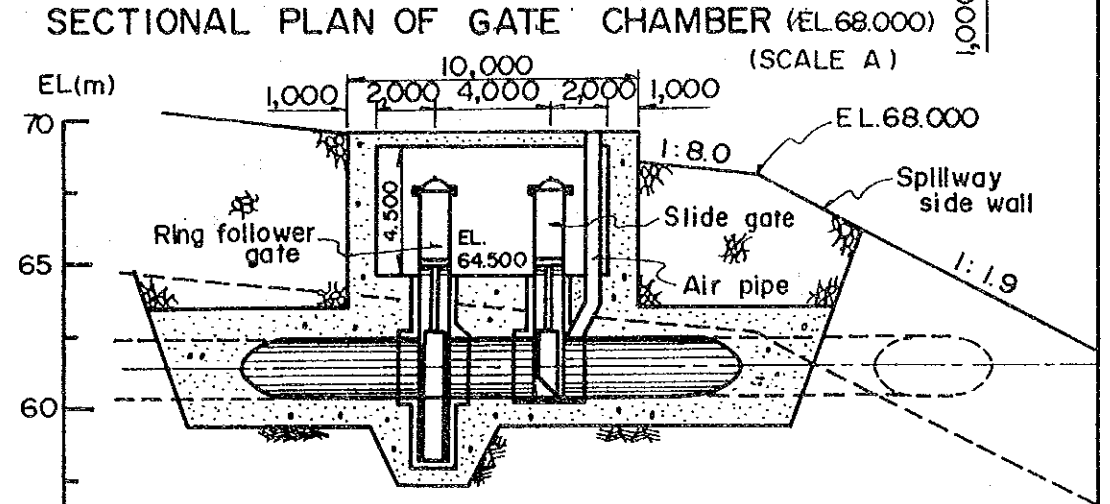
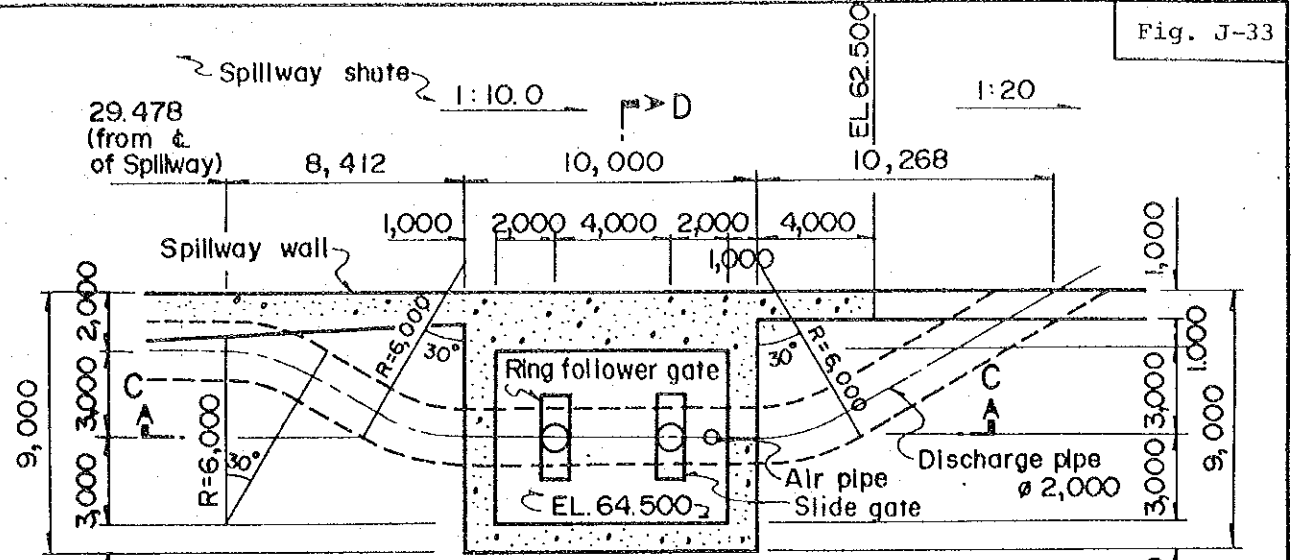
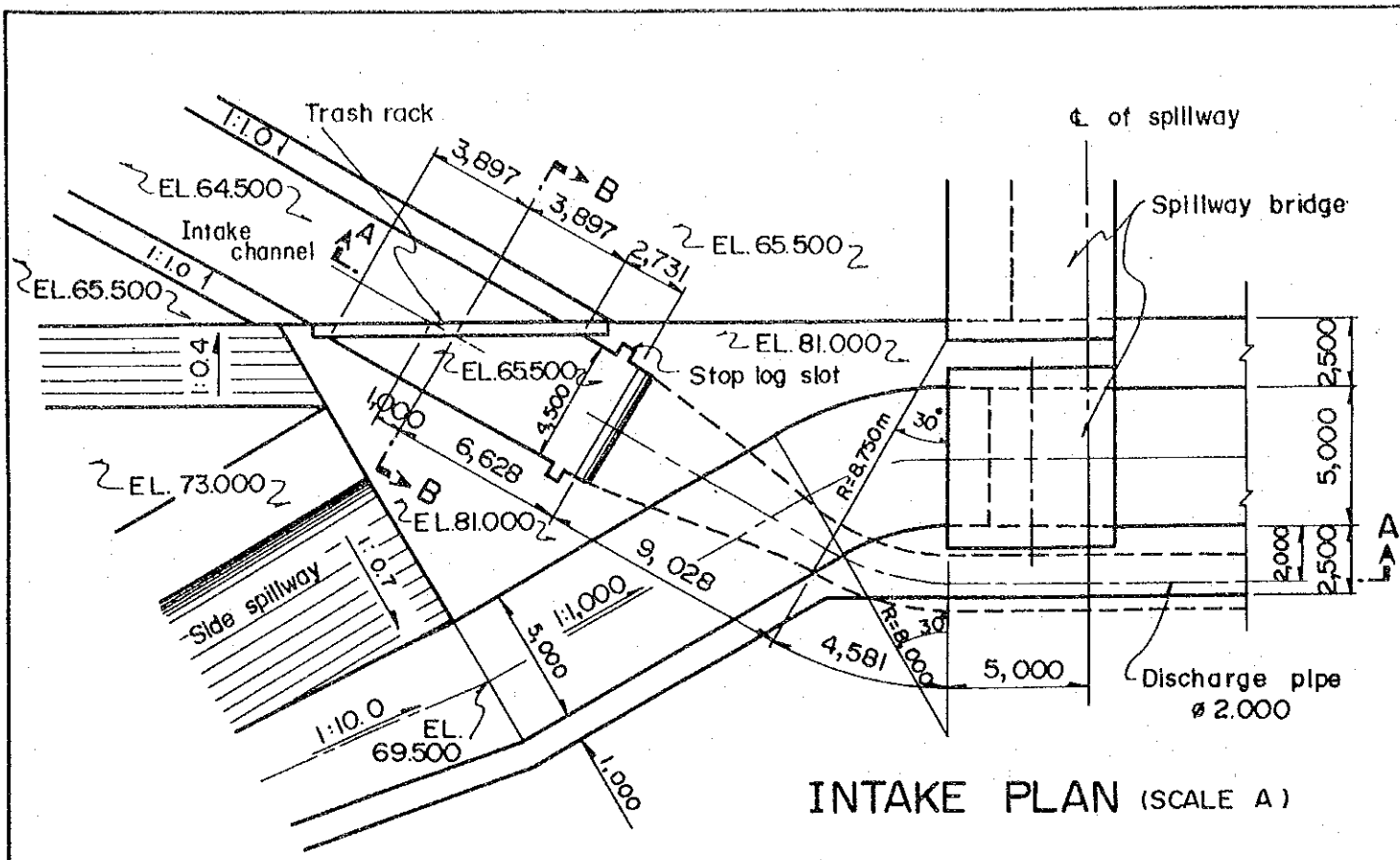


TYPICAL SECTION OF TUNNELS
(SCALE B)





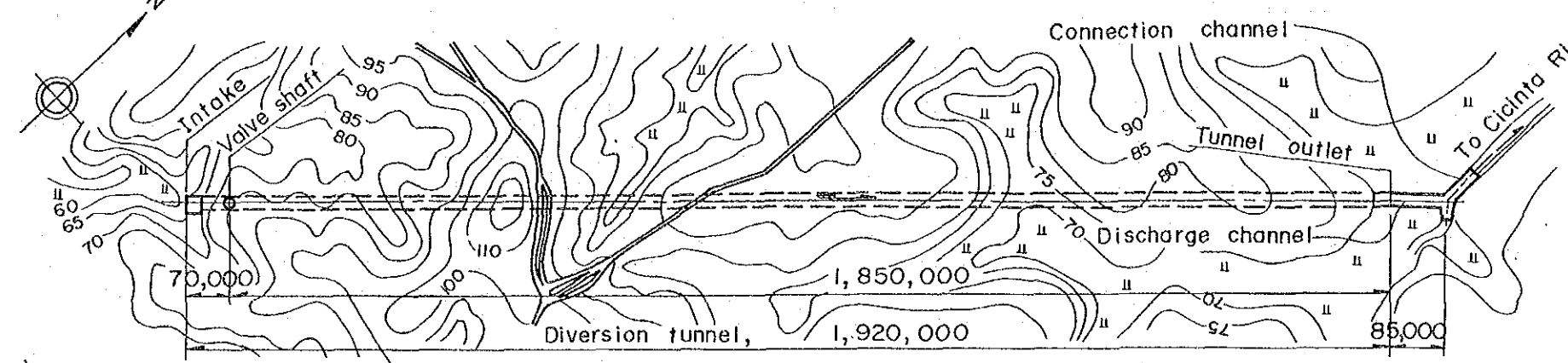
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 MULTIPURPOSE DAM CONSTRUCTION PROJECT
 Gilawang Dam Spillway
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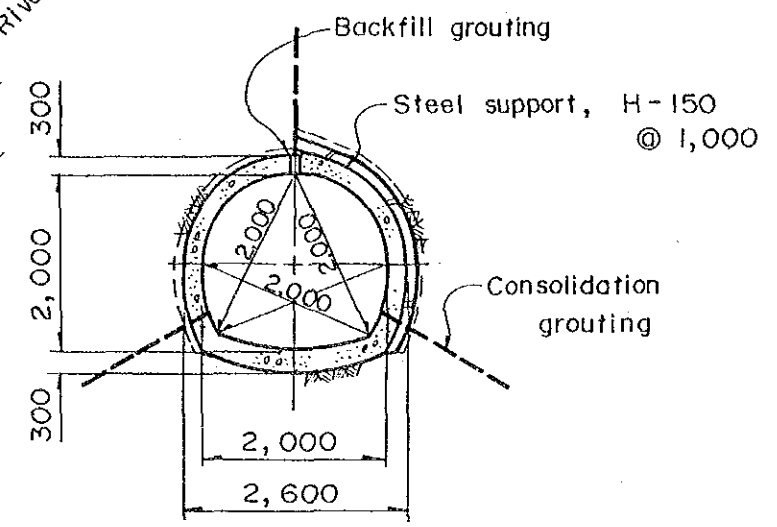
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 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Cilawang Dam Intake

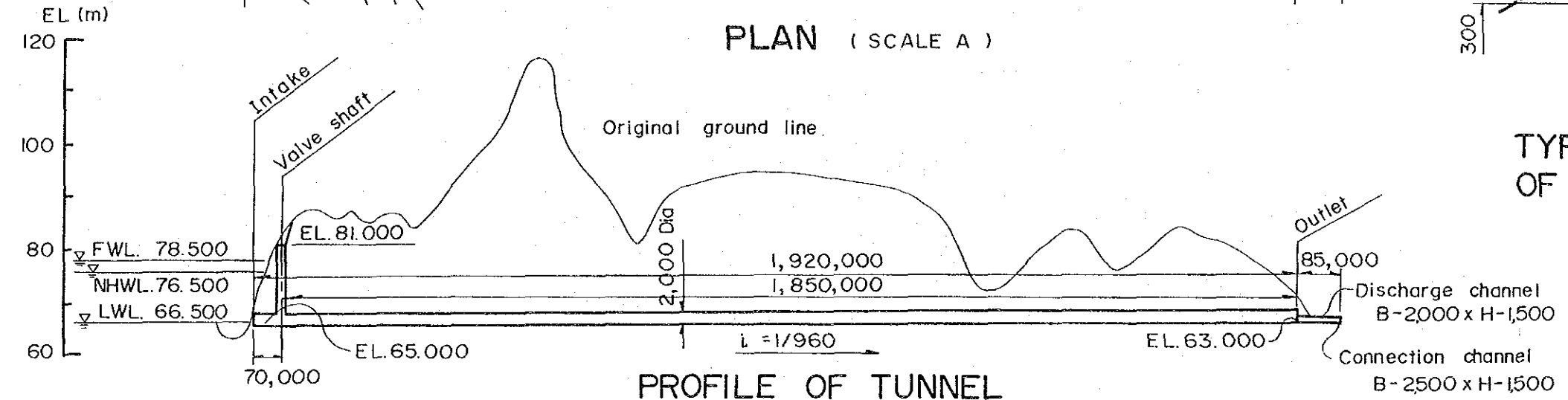
JAPAN INTERNATIONAL COOPERATION AGENCY



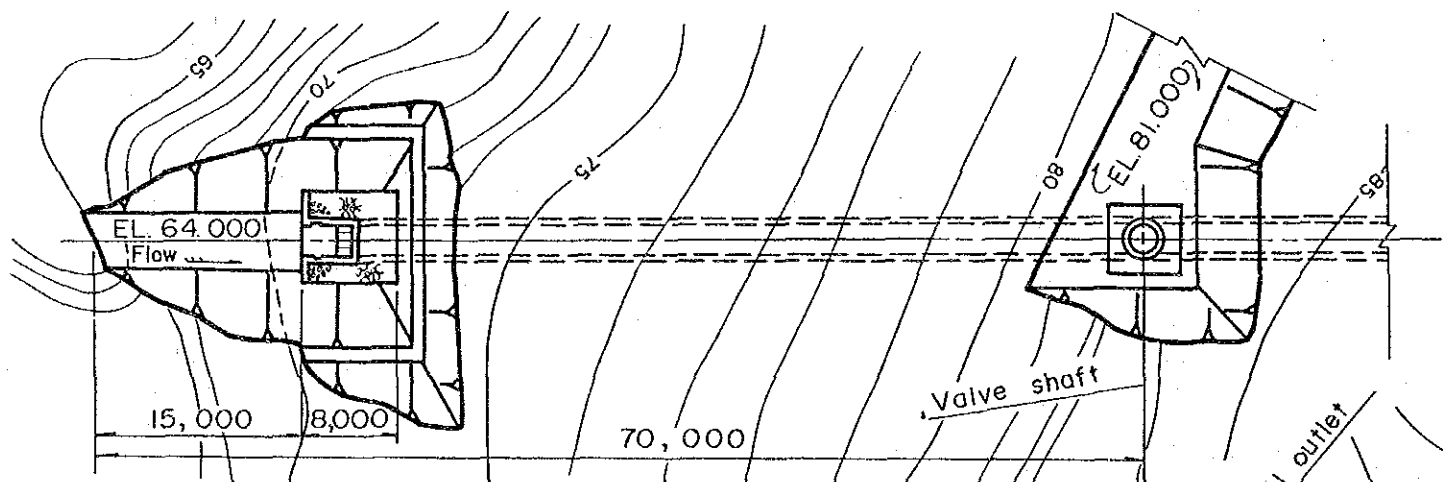
PLAN (SCALE A)



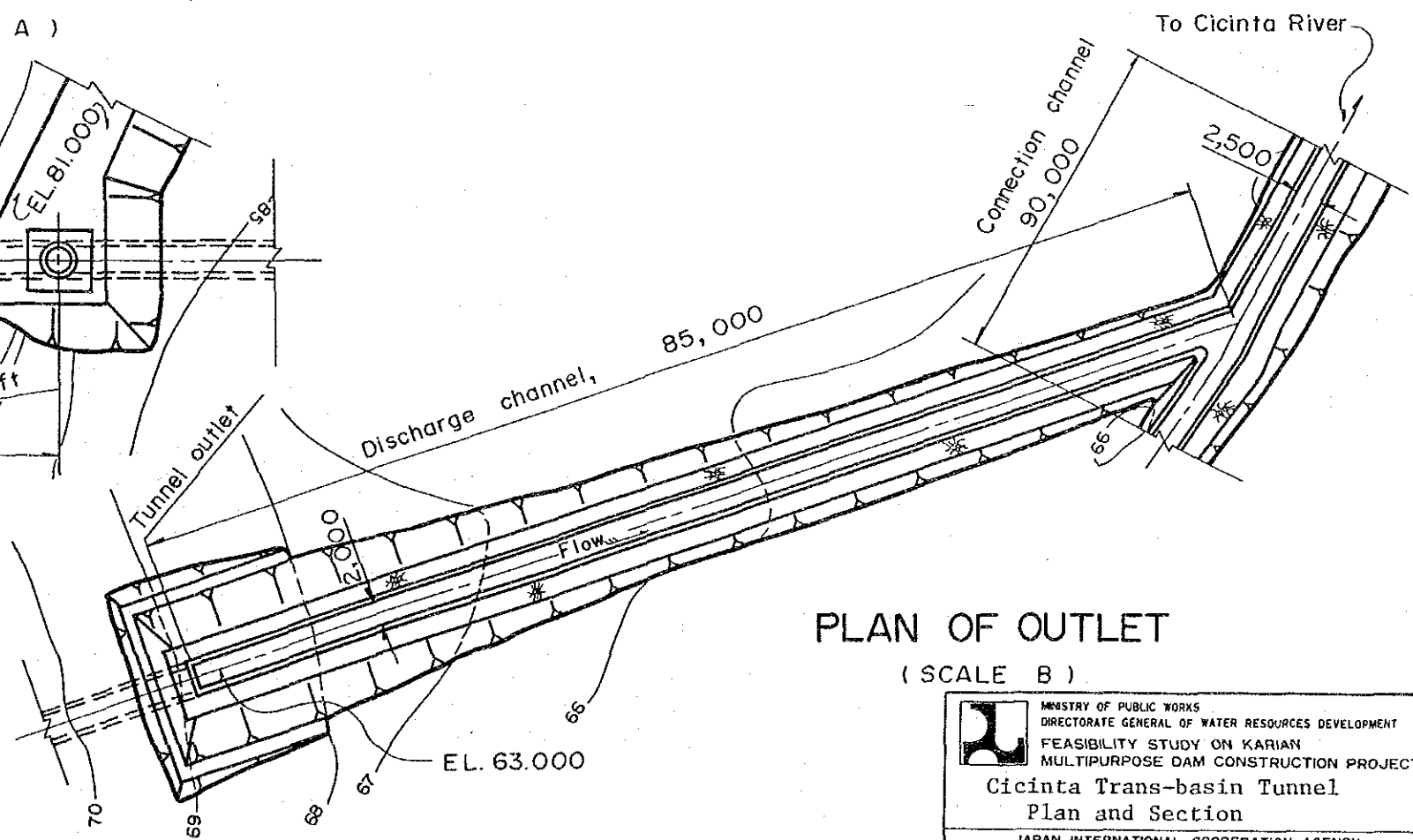
TYPICAL CROSS SECTION OF TUNNEL (SCALE C)



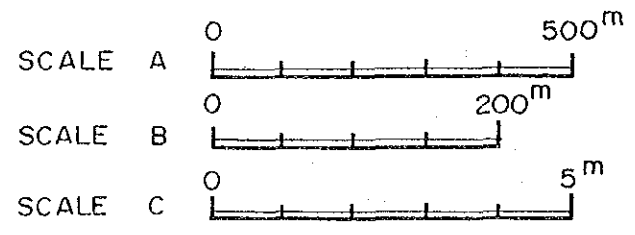
PROFILE OF TUNNEL (SCALE A)




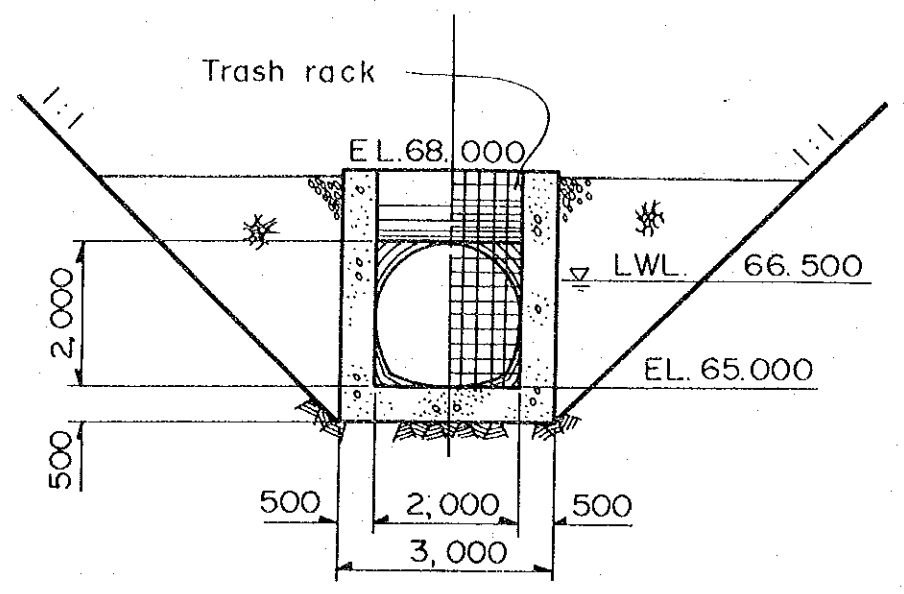
PLAN OF INTAKE (SCALE B)



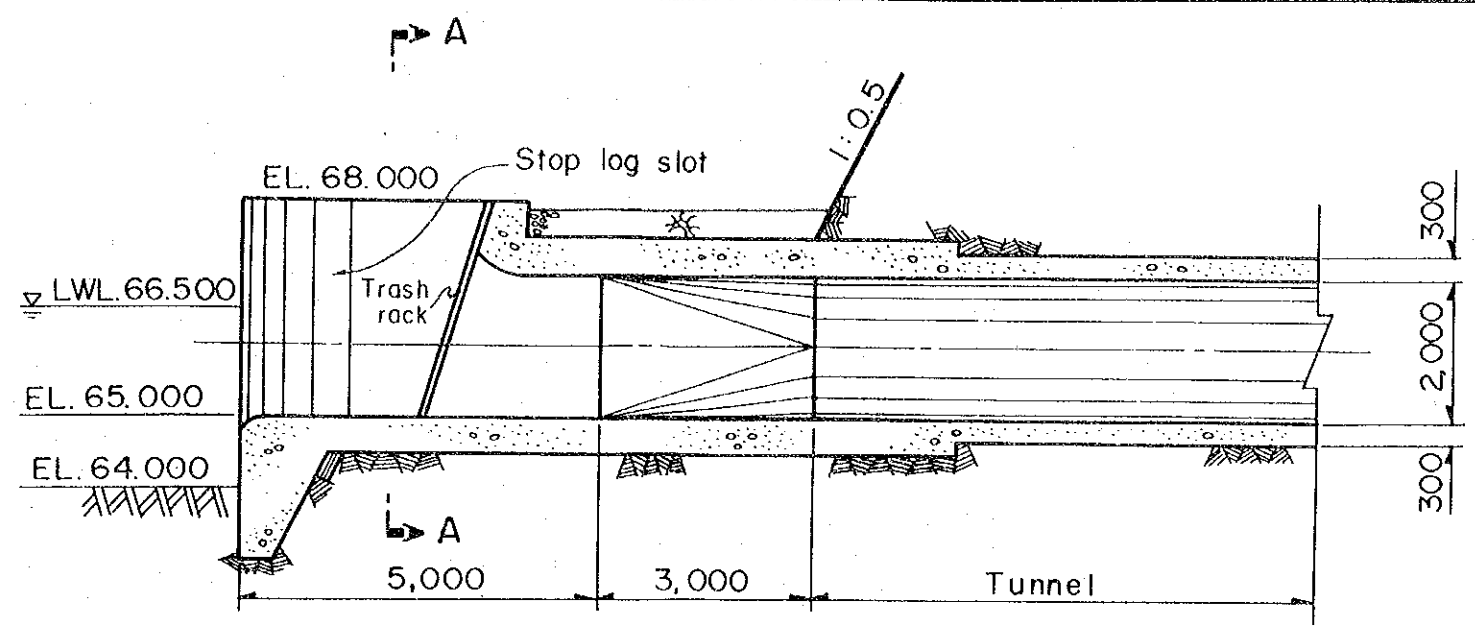
PLAN OF OUTLET (SCALE B)



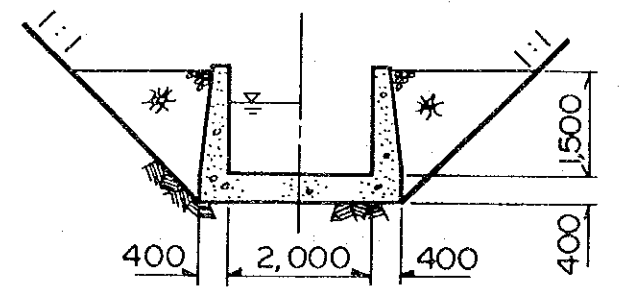

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 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
Cicinta Trans-basin Tunnel
 Plan and Section
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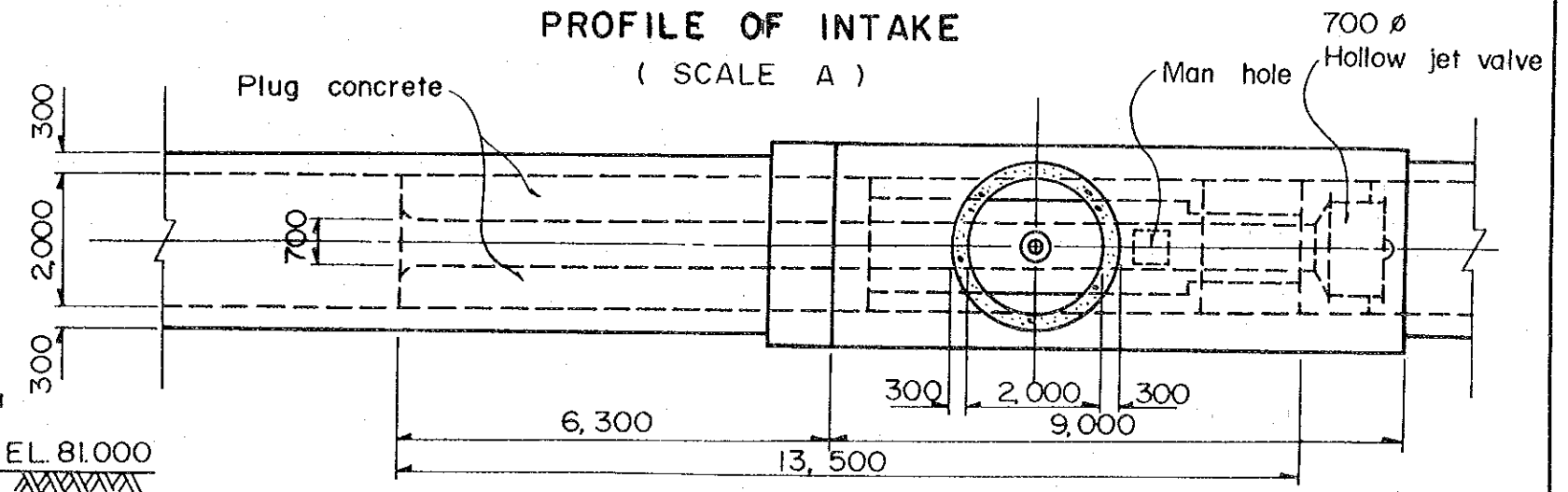
SECTION A - A
(SCALE A)



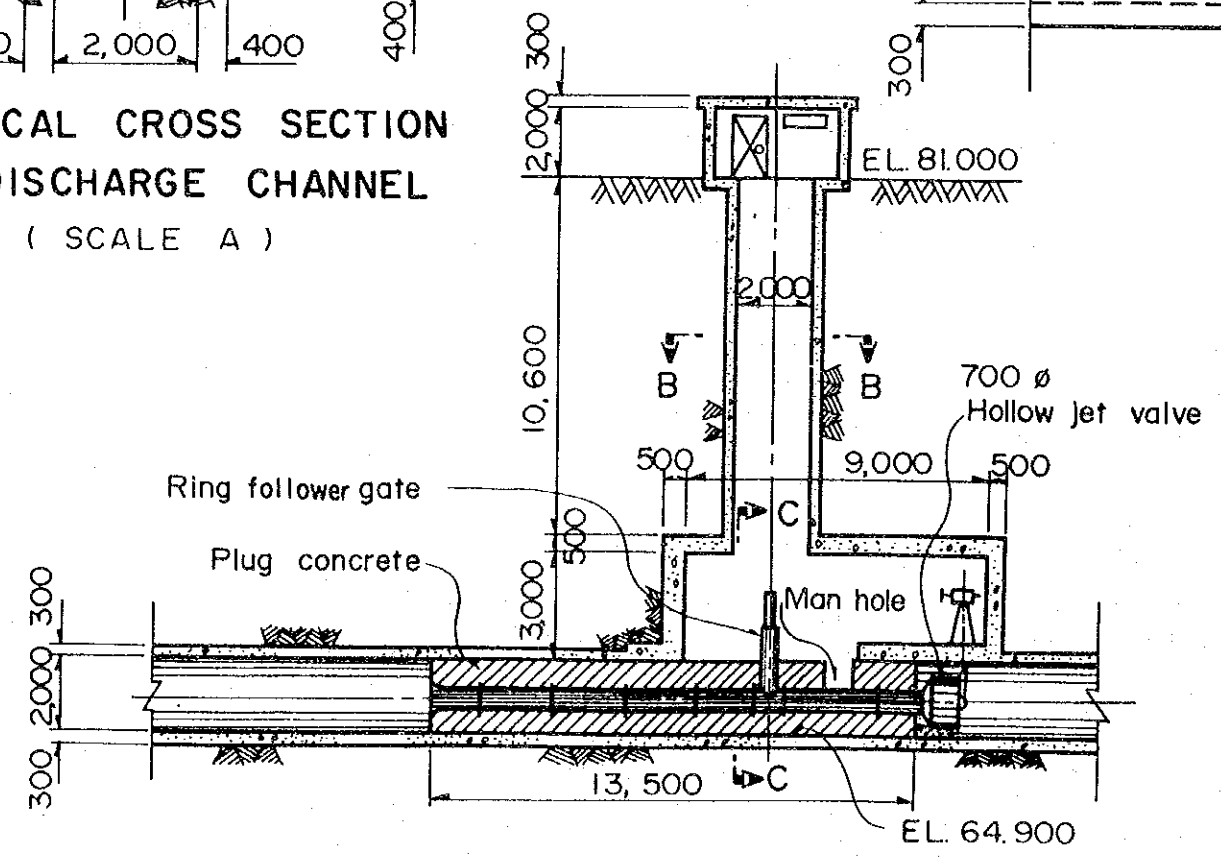
PROFILE OF INTAKE
(SCALE A)



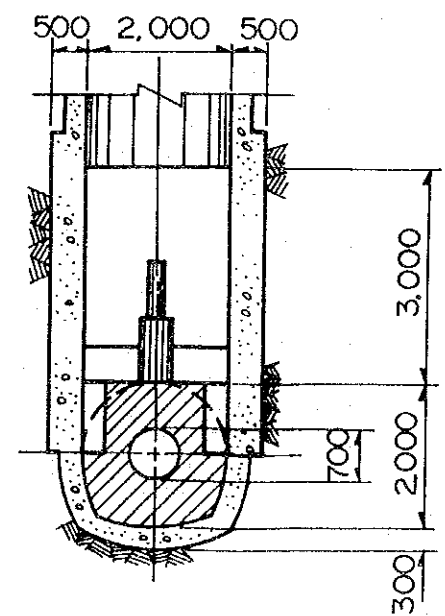
TYPICAL CROSS SECTION
OF DISCHARGE CHANNEL
(SCALE A)



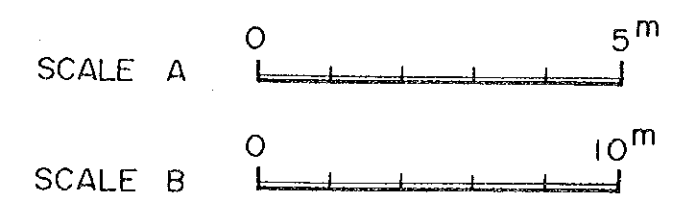
SECTION B - B
(SCALE A)




PROFILE OF SHAFT
(SCALE B)



SECTION C - C
(SCALE A)




 MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
 Cicinta Trans-basin Tunnel
 Details
 JAPAN INTERNATIONAL COOPERATION AGENCY

A P P E N D I X - K

ORGANIZATION AND MANAGEMENT

APPENDIX - K

ORGANIZATION AND MANAGEMENT

TALBE OF CONTENTS

| | <u>Page</u> |
|---|-------------|
| 1. ORGANIZATION FOR PROJECT IMPLEMENTATION | K-1 |
| 1.1 Project Construction Office | K-1 |
| 1.2 Staffing and Expatriate Assistance | K-2 |
| 2. OPERATION AND MAINTENANCE OF THE PROJECT | K-2 |
| 2.1 Existing Organization for Operation and Maintenance | K-2 |
| 2.2 Proposed Organization and Management | K-5 |
| 2.2.1 Proposed Organization | K-5 |
| 2.2.2 Management Plan of Operation and Maintenance | K-6 |
| 2.2.3 Staffing | K-8 |
| 2.2.4 Operation and Maintenance Facilities | K-8 |
| 3. WATER USERS' ASSOCIATION | K-9 |
| 3.1 General | K-9 |
| 3.2 Association in the Project Area | K-10 |

LIST OF TABLES

| | <u>Page</u> |
|---|-------------|
| Table K-1 REQUIRED NUMBER OF PROJECT STAFF IN CONSTRUCTION STAGE | K-11 |
| Table K-2 REQUIRED NUMBER OF EXPERTS | K-13 |
| Table K-3 EXISTING IRRIGATION SCHEME | K-14 |
| Table K-4 REQUIRED NUMBER OF STAFF IN PROPOSED SERANG IRRIGATION SECTION | K-16 |
| Table K-5 OPERATION AND MAINTENANCE FACILITIES | K-18 |

LIST OF FIGURES

| | <u>Page</u> |
|--|-------------|
| Fig. K-1 ORGANIZATION OF PROJECT CONSTRUCTION OFFICE | K-20 |
| Fig. K-2 ORGANIZATIONAL STRUCTURE OF SERANG IRRIGATION SECTION | K-21 |
| Fig. K-3 AREA MANAGED BY SERANG IRRIGATION SECTION | K-22 |
| Fig. K-4 PROPOSED ORGANIZATIONAL STRUCTURE OF SERANG IRRIGATION SECTION | K-23 |
| Fig. K-5 GENERAL CONCEPT OF RADIO TELEPHONE SYSTEM | K-24 |

APPENDIX-K

ORGANIZATION AND MANAGEMENT

1. ORGANIZATION FOR PROJECT IMPLEMENTATION

1.1 Project Construction Office

The water resources development projects in Indonesia are implemented under the responsibility of the Directorate General of Water Resources Development (DGWRD) of the Ministry of Public Works (PU). In most cases, big projects are implemented by DGWRD through the project construction offices and transferred to Provincial Government for their operation and maintenance. For the Karian Multipurpose Dam Construction Project also, it is proposed to establish the Project Construction Office under DGWRD. The proposed organization structure of the office is as shown in Fig. K-1. Main functions of the office are as follows:

- 1) Financial arrangement needed for construction of all project facilities such as the Karian dam, the Cilawang dam, irrigation and drainage facilities for the K-C-C scheme, flood control works,
- 2) Design and construction supervision of all the project works down to tertiary canals,
- 3) Assistance to farmers in construction of quaternary system, and
- 4) accounting and management of construction works.

The Project Construction Office will consist of one main office and six branch offices. It is proposed to establish the main office at Rangkasbitung before getting into the major construction works for the project. The branch offices will be constructed at the Karian dam site, the Cilawang dam site, the Buyut diversion works site and major towns in the K-C-C area such as Kopo, Cikande and Carenang in keeping with the progress of the project construction works.

The main office will have two working divisions; Technical Division and Administrative Division. The Technical Division will be responsible for all the engineering matters relating to construction of the project facilities. The Division will consist of three Sub-divisions of Design, Construction and Equipment. The Administrative Division will be responsible for financing, accounting, administrative affairs and procurement for the implementation, operation and maintenance of the Project. This division will consist of four Sub-divisions; Finance, Personnel, Administrative and Security.

1.2 Staffing and Expatriate Assistance

The staff of the project construction office will be appointed by PU. The number of required staff is estimated paying due attention to the working quantities, implementation method and schedule, and is summarized in Table K-1.

To cope with the shortage of experienced personnel in PU, some specialists would have to be engaged from engineering consultant firms throughout the design and construction stages. The required number of the experts to be invited for both design and construction stages are as shown in Table K-2.

2. OPERATION AND MAINTENANCE OF THE PROJECT

2.1 Existing Organization for Operation and Maintenance

Operation and maintenance of irrigation systems in Indonesia are conducted under the responsibility of the provincial governments. As the executing agency of operation and maintenance works, an irrigation section (Seksi Pengairan) has been established under the Provincial Public Works at Kabupaten level. Most of the Project area is covered by the Serang Irrigation Section and some parts; Karian and Cilawang dams, diversion works and about 200 ha of irrigable area, are covered by the Pandeglang/Rangkasbitung Irrigation Section.

Fig. K -2 shows the present organizational structure of the Serang Irrigation Section. A Chief of the Section (Kepala Seksi Pengairan Serang)

has a full responsibility of overall supervision and direction of operation and management of the systems in Kabupaten Serang.

Under the chief there are three divisions, ten sub-sections and Institute of Research and Study.

For the purpose to coordinate all irrigation activities in the Kabupaten, Irrigation Board has been established according to President Instruction No. 1/1969¹. Irrigation Board is composed of a chairman, a secretary and six members who are the representatives of the organizations relating to village development, agriculture, police, land use, forestry and fishery. The Board is in charge of coordination in plan, design, execution of O & M works.

Major management works of the Serang Irrigation Section consist of planning of irrigation schedule, control of irrigation water delivery, maintenance and repair, assistance to water users' associations in technical and administrative matters. In addition, the Section has a function of executing office for small scale irrigation projects such as tertiary system development and simple irrigation development.

Actual field works of operation and maintenance are carried out by the Sub-sections. The area managed by each Sub-section is shown in Fig. K-3, and the irrigation schemes included in each Sub-section area are listed in Table K-3.

Two technical divisions and ten Sub-sections have the following duties and tasks.

Operation, Maintenance and Rehabilitation Division

- 1) estimation of water requirements and preparation of water supply schedule based on the cropping schedule obtained from the water users' association through the Sub-sections,

/1: Instruksi President Republik Indonesia No.1 Tahun 1969 Tentang Pelaksanaan Pengelolaan Pengairan (Pengaturan Air Dan Pemeliharaan Jaringan Irigasi)

- 2) regular contact with Sub-sections regarding water supply schedule,
- 3) supply of information on water supply management to the Sub-sections,
- 4) periodical and routine inspection,
- 5) preparation of the program for routine and periodical maintenance and emergency repair,
- 6) tender for repair works and supervision of the works, and
- 7) assistance and advice to water users' association in maintenance works of tertiary canals down to terminal facilities.

Construction Division

- 1) survey, planning, design and construction supervision of the small scale irrigation project,
- 2) assistance and advice to farmers' organization in design of construction works of tertiary canals to the terminal facilities, and
- 3) management of workshop and construction and O & M equipment.

Sub-sections

- 1) collection of information of cropping schedule from the water users' associations and transfer of it to the main office,
- 2) supply of information on water supply schedule to the water users' associations,
- 3) gate operation according to the water supply schedule prepared by the main office,

- 4) maintenance of the project facilities in the commanding area,
- 5) preparation of report on field conditions including yield, damage of facilities, canal discharge measurement, rainfall data and so on by every two weeks, and
- 6) provision of periodical consultation to water users' association on operation and maintenance of tertiary canals down to terminal facilities.

2.2 Proposed Organization and Management

2.2.1 Proposed Organization

After completion of the construction works, all the project facilities will be transferred to the Serang Irrigation Section for their operation and maintenance. In order to control the water management including the reservoir operation of two dams, Dam Operation Sub-division will newly be organized in the Operation, Maintenance and Rehabilitation Division. Other Divisions and Sub-divisions will be left as they are. For the operation and maintenance works of the Karian dam, Cilawang dam and Buyut diversion works, three Sub-sections will additionally be established under the chief of the Serang Irrigation Section; namely (i) Sub-section XI for Karian Dam, (ii) Sub-section XII for Cilawang Dam and (iii) Sub-section XIII for Buyut Diversion Works.

The irrigation and drainage facilities of the K-C-C scheme and flood control facilities will be operated and maintained by the present Sub-sections as follows;

1. K-C-C Irrigation Scheme

- | | |
|--------------------|-----------------|
| i) Kopo Area | Sub-section IV |
| ii) Cikande Area | Sub-section II |
| iii) Carengan Area | Sub-section III |

2. Flood Control Facilities Sub-section IV

Although some portions of the K-C-C scheme and flood control works are located in the jurisdiction of the Pandeglang/Rankasbitung Irrigation Section their operation and maintenance are proposed to be done by the Sub-section IV of the Serang Irrigation Section, aiming at the compatible operation of the system as a whole.

The proposed organizational structure of the Serang Irrigation Section is presented in Fig. K-4.

2.2.2 Management Plan of Operation and Maintenance -----

All the present operation and maintenance works of the Serang Irrigation Section will be expanded to cover the new project system. Among the major management works mentioned in Section 2-1, the procedure of planning for irrigation schedule and control of irrigation water delivery will be improved in order to establish the proper water management system.

1) Planning of Irrigation Schedule

A plan of irrigation schedule will be prepared for three stages as follows:

a) Long-term Plan

The long-term irrigation plan will be prepared once every three to four years. This plan will define the targets such as total irrigated area, irrigation efficiency, crop production and specific targets for maintenance.

b) Yearly Plan

Before start of the wet season, usually from August to October, the yearly plan will be prepared for the coming wet and dry seasons in accordance with the long-term plan. Several alternative and statistical studies will be included in this planning procedure. The alternative studies will be made, for example, for combinations of irrigated crop area and irrigation schedule against a drought

year, a normal year and a rainy year of appropriate probability.

c) Seasonal Plan

A seasonal plan for the wet season will be included in the said yearly plan. A seasonal plan for the dry season will be prepared in line with the yearly and long-term plans.

Annual operation report will be prepared including the results of actual irrigation practices, its evaluation in comparison with above plans, and statistical analysis for previous seasons.

2) Control of Irrigation Water Delivery

For the proper water management, the dams, diversion works and irrigation canals are to be operated as an organic whole. In order to ensure the efficient management of irrigation water delivery, introduction of a radio telephone system and the establishment of operation rule are recommended.

A radio telephone system will be established connecting the main office of the Serang Irrigation Section, two dam operation offices (Sub-section XI and XII), three diversion works operation offices (Pamarayan, Buyut and Cicinta) and several major field offices. The general concept of a radio telephone system is illustrated in Fig K-5.

The control of irrigation water delivery through a radio telephone system is expressed by the following work flow:

a) Data Collection

The data required for the operation are farming activity and hydrological data such as rainfall, river water level, canal water level, gate opening, reservoir water level and inflow/

outflow from the Karian and Cilawang dams. All data are informed to the Dam Operation Sub-division by a radio telephone system as soon as possible.

b) Data Processing

Based on the above data, hydrologist and operation engineer estimate the irrigation water requirements at the diversion works and at the major turnout points. Furthermore the volume of water to be released from the dams are estimated by deducting available natural discharges at diversion points from irrigation water requirements.

c) Operation and Monitoring

The value estimated in the above is informed to gate operator of each field station by a radio telephone system, and gates will be operated in accordance with the value. After that field water level and canal water level are observed and analyzed whether they are right condition or not.

2.2.3 Staffing

The staff required for the proposed Serang Irrigation Section are estimated at 545 persons as shown in Table K -4. In comparison with the present staffing, 97 persons will be newly employed, and the experienced hydrologists should be appointed to the Dam Operation Division for the purpose of proper water management.

2.2.4 Operation and Maintenance Facilities

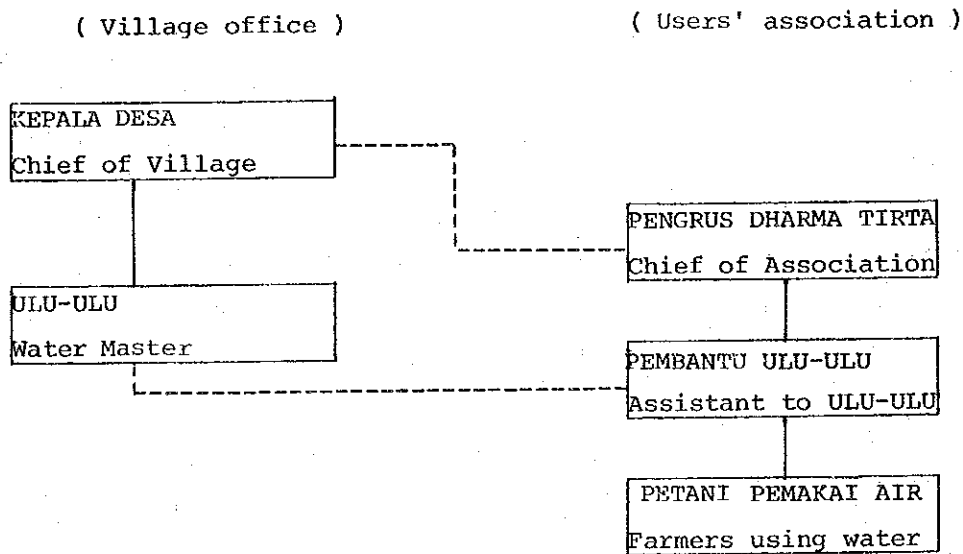
In order to operate and maintain the dams, irrigation/drainage system and flood control works efficiently, operation and maintenance facilities are required in this project. These facilities comprise the project office, mortar pool and equipment for O & M works.

The facilities required for operation and maintenance works are listed in Table K - 5.

3. WATER USERS' ASSOCIATION

3.1 General

The water users' association (Perkumpulan Petani Pemakai Air = P3A) will be established based on the President Instruction No.1/1969. The village office, together with the water users' association, would be responsible for O & M irrigation facilities below the tertiary level. The outline of the village organization is illustrated as below:



The ULU-ULU is a village officer who is in charge of water management and maintenance of the tertiary system within the village. The works of ULU-ULU are very wide and cover all the irrigation services within the village consisting of water distribution, maintenance, monitoring, advisory services to the water users' association and so forth.

The water users' association has a board which consists of a Chief, Secretary, Treasurer, assistants to ULU-ULU, etc. The chief of the board elected from and by the members will manage the association. The treasurer is responsible for financial administration. Assistants to ULU-ULU

(Pembantu ULU-ULU) are engaged in water management and maintenance of irrigation facilities under the guidance of ULU-ULU. Since the number of ULU-ULU is quite limited in contrast to the wide scope of his works, he needs assistants to fulfil his obligation. Generally, ULU-ULU is responsible for the tertiary canal, whereas Pembantu ULU-ULU is in charge of the quaternary canal which usually covers 10 to 25 ha of irrigation area. Usually one quaternary canal needs one Pembantu ULU-ULU.

3.2 Association in the Project Area

In the Ciujung irrigation scheme area, water users' association has been established in every quaternary canal area of 20 -25 ha on an average. One association consists of 40 -50 farmers on an average. In general, the association acts as not only the operation and maintenance body for the quaternary canal but also a communication body for new agricultural technics and procurement body for fertilizer and agricultural chemicals.

Before completion of the construction works of the K-C-C irrigation scheme, the water users' association should be established under the initiation of each village chief, Camat and Bupati with a guidance of and consultation with the Serang Irrigation Section and agricultural office.

The activities of ULU-ULU and Pembantu ULU-ULU are important for proper water management at farm level and for the project as well. They are required to have a certain technical knowledge for water supply management of the project as well as farm level. They will therefore be trained by the staff of the Serang Irrigation Section.

Table K-1 REQUIRED NUMBER OF PROJECT STAFF
IN CONSTRUCTION STAGE

| <u>Project Staff</u> | <u>Number</u> |
|-----------------------------|---------------|
| (Project Office) | (2) |
| Project Manager | 1 |
| Clerk/Secretary | 1 |
| (Technical Division) | (3) |
| Civil Engineer | 1 |
| Clerk | 1 |
| Typist | 1 |
| (Design Sub-division) | (24) |
| Civil Engineer | 1 |
| Irrigation Engineer | 1 |
| Design Engineer | 3 |
| Hydrologist | 1 |
| Junior Design Engineer | 6 |
| Soil-mechanical Engineer | 1 |
| Surveyor | 3 |
| Draftman | 6 |
| Typist | 2 |
| (Construction Sub-division) | (26) |
| Civil Engineer | 1 |
| Dam Engineer | 1 |
| Construction Engineer | 4 |
| Electrical Engineer | 1 |
| Building Engineer | 1 |
| Field Supervisor | 12 |
| Draftman | 4 |
| Typist | 2 |

(to be continued)

| <u>Project Staff</u> | <u>Number</u> |
|-------------------------------|---------------|
| (Equipment Sub-division) | (22) |
| Mechanical Engineer | 1 |
| Mechanic | 4 |
| Electrician | 1 |
| Operator | 5 |
| Driver | 10 |
| Typist | 1 |
| (Administrative Division) | (2) |
| Administrative Officer | 1 |
| Clerk/Secretary | 1 |
| (Financial Sub-division) | (7) |
| Financial Officer | 1 |
| Accountant | 1 |
| Others | 5 |
| (Personel Sub-division) | (4) |
| Personnel Management Officer | 1 |
| Others | 3 |
| (Administrative Sub-division) | (6) |
| Administrative Officer | 1 |
| Others | 5 |
| (Security) | (6) |
| Security Officer | 1 |
| Watchman | 5 |
| (Branch Office) | (72) |
| Chief | 6 |
| Officer | 6 |
| Others | 60 |
| Total | 174 |

Table K-2 REQUIRED NUMBER OF EXPERTS

| Experts | Number of Personnel | |
|-----------------------------------|---------------------|--------------------|
| | Design Stage | Construction Stage |
| 1. Project Director | 1 | 1 |
| 2. Team Leader | 1 | 1 |
| 3. Co-Leader | 1 | 1 |
| 4. Dam Engineer | 2 | 1 |
| 5. Civil Engineer | 1 | 1 |
| 6. River Engineer | 1 | 1 |
| 7. Irrigation Planning Engineer | 1 | 1 |
| 8. Design Engineer | 6 | 3 |
| 9. Hydrologist | 1 | 1 |
| 10. Hydraulic Structural Engineer | 3 | - |
| 11. Geologist | 1 | - |
| 12. Soil Mechanical Engineer | 1 | 1 |
| 13. Mechanical Engineer | 1 | 1 |
| 14. Construction Planner | 1 | - |
| 15. Topographic Surveyor | 3 | 2 |
| 16. Construction Engineer | - | 3 |
| 17. Quantity Measurement Engineer | - | 2 |
| 18. Metal Work Engineer | - | 1 |
| 19. Procurement Engineer | - | 1 |
| 20. Guidance Engineer | - | 2 |
| 21. Other Specialist | L.S. | L.S. |

Table K-3 EXISTING IRRIGATION SCHEME

| No. | Scheme Name | DPU SCHEME (ha) | | | Non DPU Scheme (ha) | Sub-Section |
|-----|----------------------|-----------------|-------------------|---------------------|------------------------|----------------------------------|
| | | Technical | Semi Technical | Simple Technical | | |
| 1 | GEREM | | 92 | | | VIII |
| 2 | KEDUNG INGAS | | 96 | | | VIII |
| 3 | CIBEBER | | 125 | | | VIII |
| 4 | CIKADUWEUN | | 214 | | | VIII |
| 5 | HARJATANI | | | 92 | | VIII |
| 6 | JAKUNG | | 33 | | | VIII |
| 7 | CIPAAS | | | 350 | | VIII |
| 8 | CIWAKA CABLIK KRESEK | 1,825 | | | | X |
| 9 | SIBUGANG JELAWE | | 405 | | | X |
| 10 | CIPARI CIWUNI | | 1,846 | | | X |
| 11 | CIKEUSAL | | | 89 | | IV |
| 12 | CIUJUNG | 24,296 | | | | I, II, III, IV, V, VI, VII, VIII |
| 13 | CICINTA | 1,434 | | | | IV |
| 14 | CISANGU | 1,441 | | | | IV |
| 15 | KADUGENEP KRAJANEN | | 397 | | | IX |
| 16 | CIKULUR | | | 166 | | VII |
| 17 | CIBANTEN | 2,203 | | | | VII |
| 18 | CIPELEM CILAKU | | 378 | | | IX |
| 19 | NAGARA PADANG | | | 106 | | " |
| 20 | CIPARI ATAS | | 172 | | | " |
| 21 | CIWAKA ATAS | | 193 | | | " |
| 22 | CITAMAN | | | 96 | | " |
| 23 | CILESUNG | | | 215 | | " |
| 24 | RAMPONES | | | 125 | | " |
| 25 | SINDANG MANDI | | | 109 | | " |
| 26 | CIBANTEN ATAS | | 84 | | | " |
| 27 | CIBULAKAN | | | 395 | | " |
| 28 | CISUAR | | | 138 | | " |
| 29 | TELEGA WANGSA | | 145 | | | " |
| 30 | CIKONENG | | | 424 | | " |
| 31 | CITASUK CIKALUMPAN | 1,139 | | | | " |
| 32 | CIBOJONG | | | 223 | | " |
| 33 | CIKURAY | | | 351 | | " |
| 34 | CILAMPIR | | | 100 | | " |
| 35 | LEUWI PASEH | | | 23 | | " |
| 36 | RANCA SERANG | | | | 137 | |
| 37 | PETIR | | | | 100 | |
| 38 | PADASUKA REGOL | | | | 226 | |
| 39 | CIBALA | | | | 100 | |
| 40 | DANUNGGULAN | | | | 100 | |
| 41 | SINDANG SARI | | | | 100 | |
| 42 | PUDAR | | | | 145 | |
| 43 | CIKARANG | | | | 65 | |
| 44 | CIRANGKONG | | | | 116 | |
| 45 | BINONG | | | | 75 | |

| No. | Scheme Name | DPU SCHEME (ha) | | | Non DPU Scheme (ha) | Sub-Section |
|-----|-------------|-----------------|-------------------|---------------------|------------------------|-------------|
| | | Technical | Semi Technical | Simple Technical | | |
| 46 | SINGKAYAP | | | | 100 | |
| 47 | CIBONGOR | | | | 60 | |
| 48 | CIDAMPUL | | | | 70 | |
| 49 | PENGARENGAN | | | | 35 | |
| 50 | UKIRSARI | | | | 135 | |
| 51 | CIPASAURAN | | | | 9 | |
| 52 | CISIRIH | | | | 47 | |
| 53 | CIPELEM | | | | 40 | |
| 54 | CIAWI | | | | 60 | |
| 55 | KADUBEUREUM | | | | 150 | |
| 56 | CIRAHAB | | | | 60 | |
| 57 | CIKAMASAM | | | | 40 | |
| 58 | LEUWI LIMUS | | | | 75 | |
| 59 | CIMARSA | | | | 200 | |
| | Total | 31,199 | 5,260 | 3,002 | 2,245 | |

Table K-4 REQUIRED NUMBER OF STAFF IN PROPOSED
SERANG IRRIGATION SECTION

| <u>Staff</u> | <u>Number</u> |
|--|---------------|
| 1. Chief of Section | 1 |
| (Operation, Maintenance & Rehabilitation Division) | (28) |
| 2. Civil Engineer | 2 |
| 3. Irrigation Engineer | 2 |
| 4. Dam Operation Engineer | 1 |
| 5. Hydrologist | 3 |
| 6. River Engineer | 1 |
| 7. Construction Engineer | 3 |
| 8. Field Supervisor | 4 |
| 9. Design Engineer | 4 |
| 10. Others | 8 |
| (Construction Division) | (31) |
| 11. Civil Engineer | 1 |
| 12. Design Engineer | 3 |
| 13. Irrigation Planning Engineer | 1 |
| 14. Surveyor | 5 |
| 15. Hydrologist | 1 |
| 16. Agronomist | 1 |
| 17. Economist | 1 |
| 18. Geologist | 1 |
| 19. Soil Mechanical Engineer | 1 |
| 20. Mechanical Engineer | 1 |
| 21. Mechanic | 5 |
| 22. Electrician | 1 |
| 23. Operator | 5 |
| 24. Others | 6 |

(to be continued)

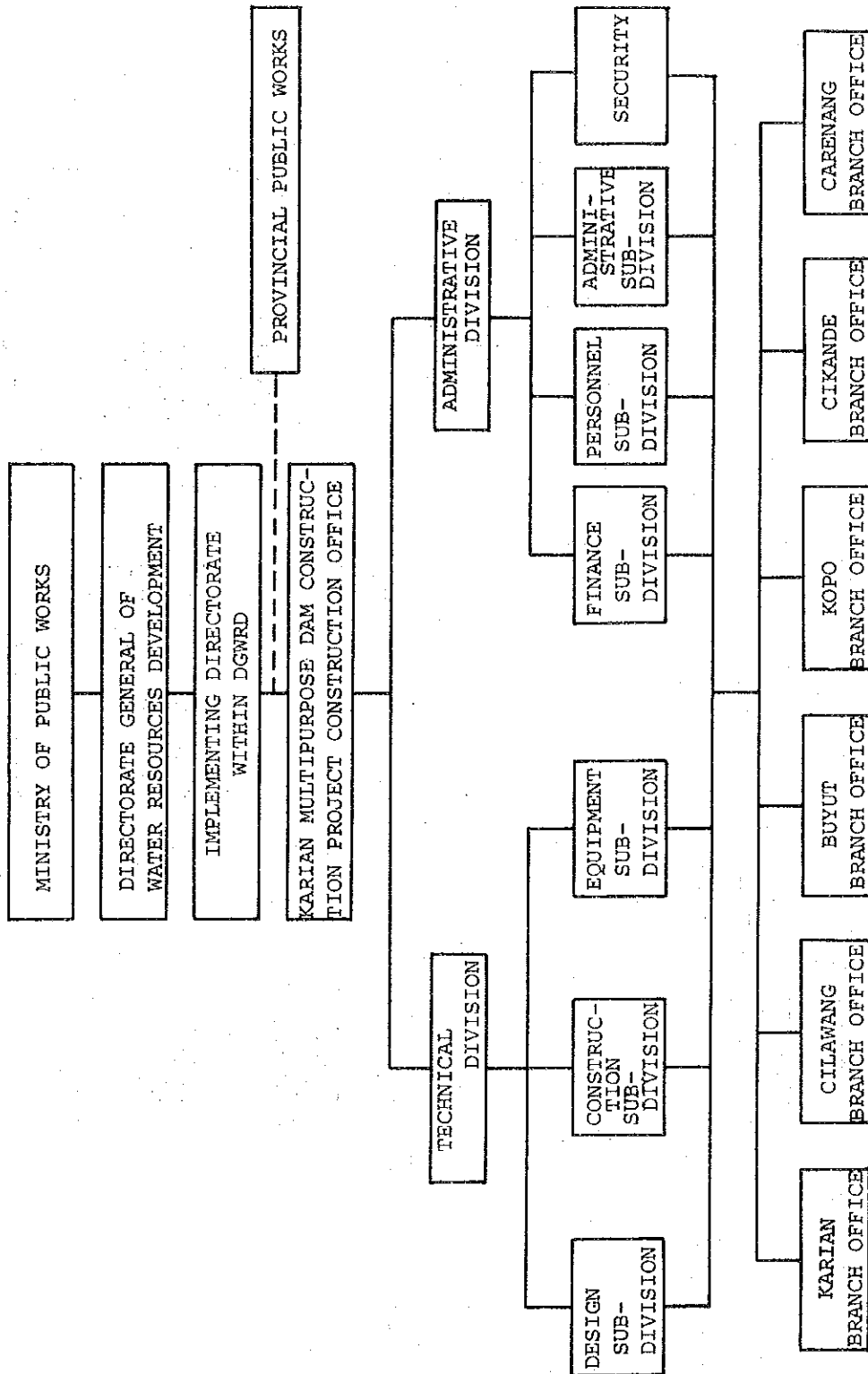
| <u>Staff</u> | <u>Number</u> |
|--|---------------|
| (Administrative Division) | (39) |
| 25. Administrative Officer | 1 |
| 26. Accountant | 1 |
| 27. Cashier | 1 |
| 28. Financial Officer | 1 |
| 29. Personnel Officer | 1 |
| 30. Clerks/Typists | 10 |
| 31. Security Officer | 1 |
| 32. Store Keeper | 3 |
| 33. Others | 20 |
| (Sub-Sections) | (446) |
| 34. Chief | 13 |
| 35. Staff-Administration | 13 |
| " -Technician | 13 |
| " -Agriculture | 10 |
| 36. Expert-Irrigation | 40 |
| -Gate Keeper | 90 |
| -Road | 7 |
| 37. Dams and Diversion Works Gate Keeper | 10 |
| 38. Labour | 250 |
| Total | 545 |

Table K-5 OPERATION AND MAINTENANCE FACILITIES

| Facilities | Required Area or Number | | |
|--|-------------------------|--------------|---------------------|
| | K-C-C Scheme | Other Scheme | Total |
| I Office & Motor Pool | | | |
| 1. Sub-Section Office (200m ² x 13) | 600 | 2,000 | 2,600m ² |
| 2. Motor Pool (600m ² x 4) | 600 | 1,800 | 2,400m ² |
| II Equipment & Vehicle | | | |
| 1. Dragline, 0.8m ³ | 1 | 3 | 4 Nos. |
| 2. Backhoe, 0.6m ³ | 2 | 6 | 8 " |
| 3. Backhoe, 0.3m ³ | 2 | 6 | 8 " |
| 4. Bulldozer, 11 ton | 2 | 6 | 8 " |
| 5. Wheel loader, 1.0m ³ | 2 | 6 | 8 " |
| 6. Motor grader, 11 ton | 1 | 3 | 4 " |
| 7. Water tanker, 5m ³ | 1 | 3 | 4 " |
| 8. Tire roller, 8-10 ton | 1 | 3 | 4 " |
| 9. Tamper, 80 kg | 3 | 9 | 12 " |
| 10. Portable concrete mixer, 0.2m ³ | 2 | 6 | 8 " |
| 11. Submersible pump, ø150 | 2 | 6 | 8 " |
| 12. Dump truck, 11 ton | 2 | 6 | 8 " |
| 13. Dump truck, 2 ton | 3 | 9 | 12 " |
| 14. Cargo truck w/crane, 8 ton | 1 | 3 | 4 " |
| 15. Cargo truck w/crane, 2 ton | 2 | 6 | 8 " |
| 16. Ordinary truck, 6 ton | 3 | 9 | 12 " |
| 17. Truck, 1 ton pick-up type | 3 | 9 | 12 " |
| 18. Jeep, four wheel drive | 4 | 12 | 16 " |
| 19. Sedan, 6 persons | 1 | 3 | 4 " |
| 20. Motor cycle | 25 | 65 | 90 " |
| 21. Repair shop tools | - | - | L.S. |
| 22. Spare parts | - | - | L.S. |
| III Others | | | |
| 1. Radio Telephone System | - | - | 1 set |
| 2. Automatic Rain Gauge | 5 | 15 | 20 sets |

(to be continued)

| Facilities | Required Area or Number | | |
|--------------------------------|-------------------------|-----------------|---------|
| | K-C-C Scheme | Other Scheme | Total |
| 3. Automatic Water level Gauge | - | - | 3 sets |
| 4. Current Meter | 3 | 9 | 12 sets |
| 5. Walkie-Talkie | 5 | 15 | 20 sets |




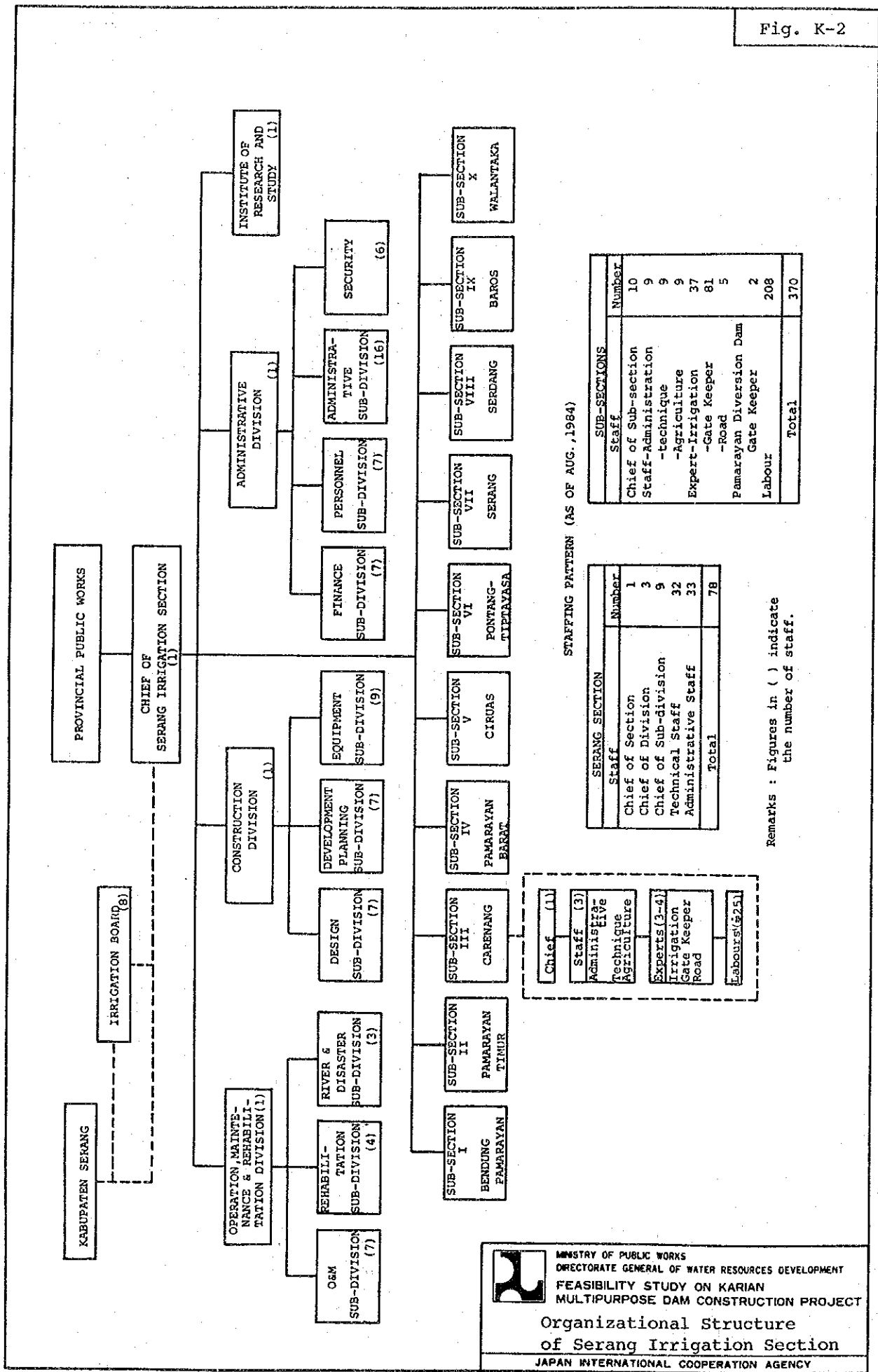
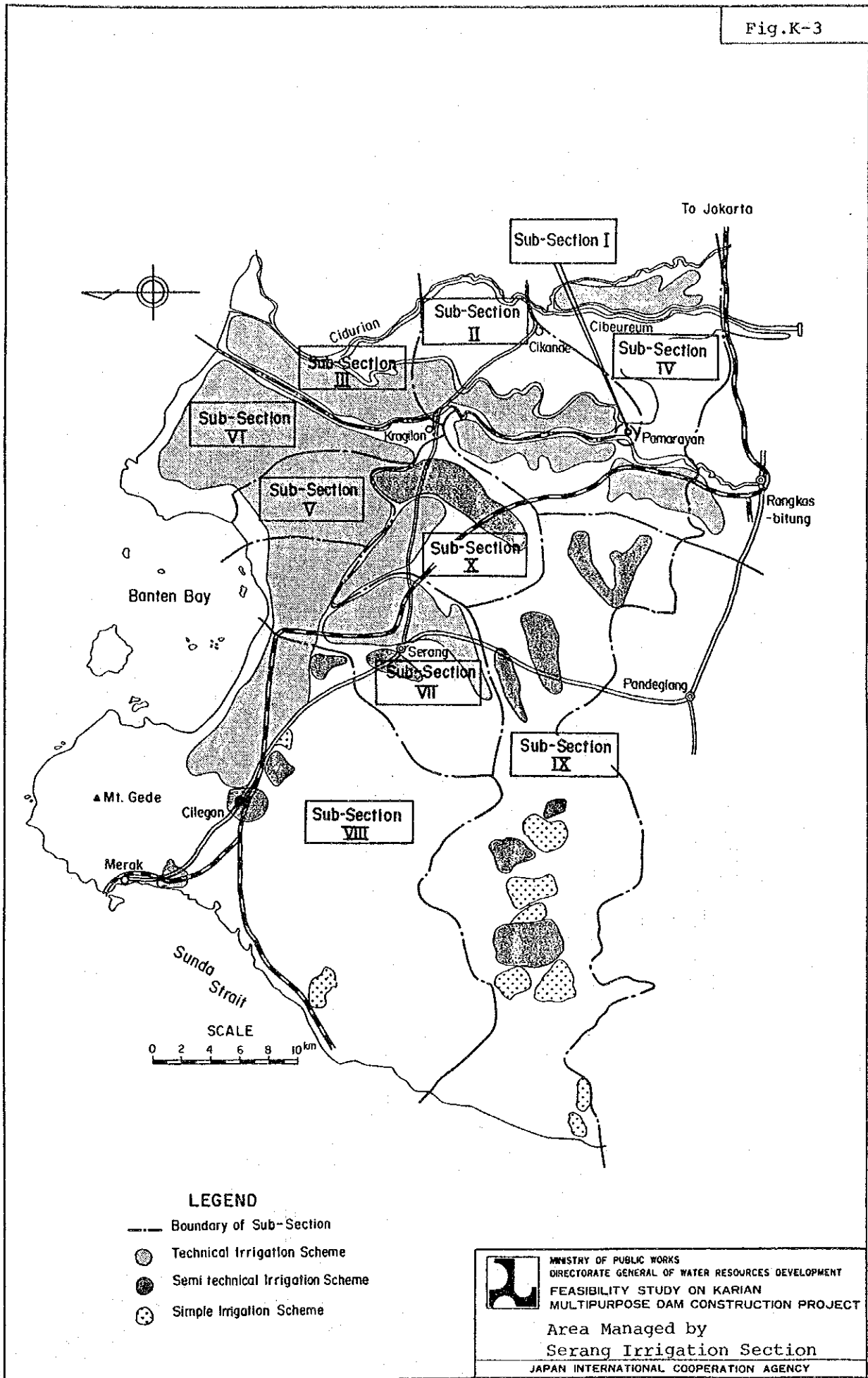

 MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT
**Organization of Project
 Construction Office**
 JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. K-2





LEGEND

- Boundary of Sub-Section
- Technical Irrigation Scheme
- Semi technical Irrigation Scheme
- ⊙ Simple Irrigation Scheme

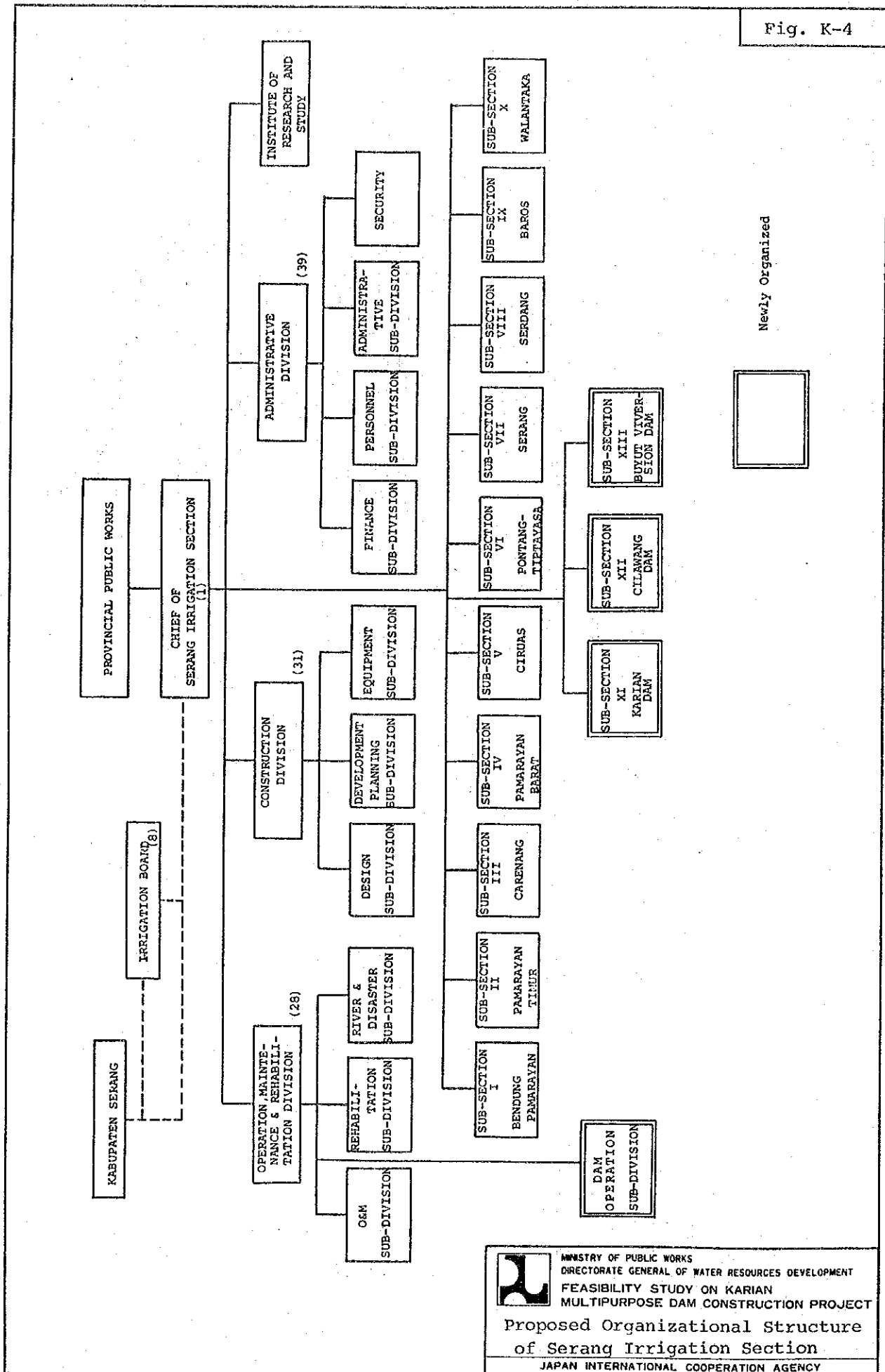


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 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Area Managed by
Serang Irrigation Section

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. K-4



Newly Organized

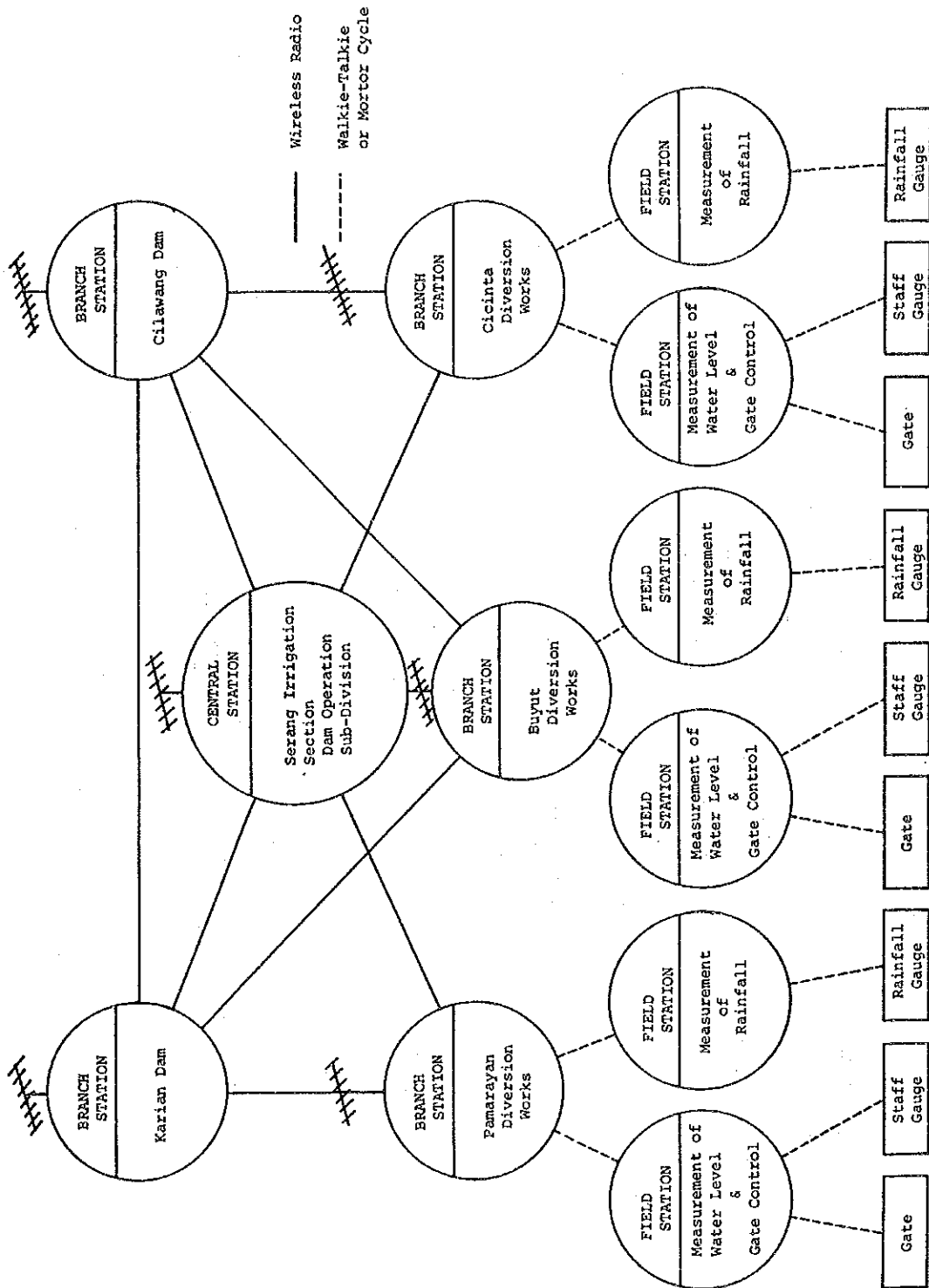



MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
 FEASIBILITY STUDY ON KARIAN
 MULTIPURPOSE DAM CONSTRUCTION PROJECT

Proposed Organizational Structure
 of Serang Irrigation Section

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. K-5




MINISTRY OF PUBLIC WORKS
 DIRECTORATE GENERAL OF WATER RESOURCES DEVELOPMENT
FEASIBILITY STUDY ON KARIAN
MULTIPURPOSE DAM CONSTRUCTION PROJECT
 General Concept of Radio Telephone System
 JAPAN INTERNATIONAL COOPERATION AGENCY

JICA