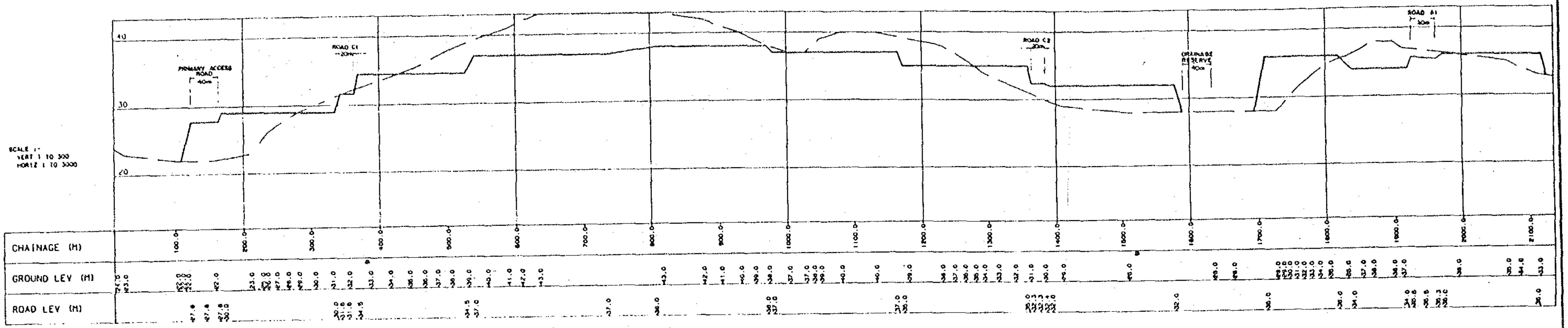
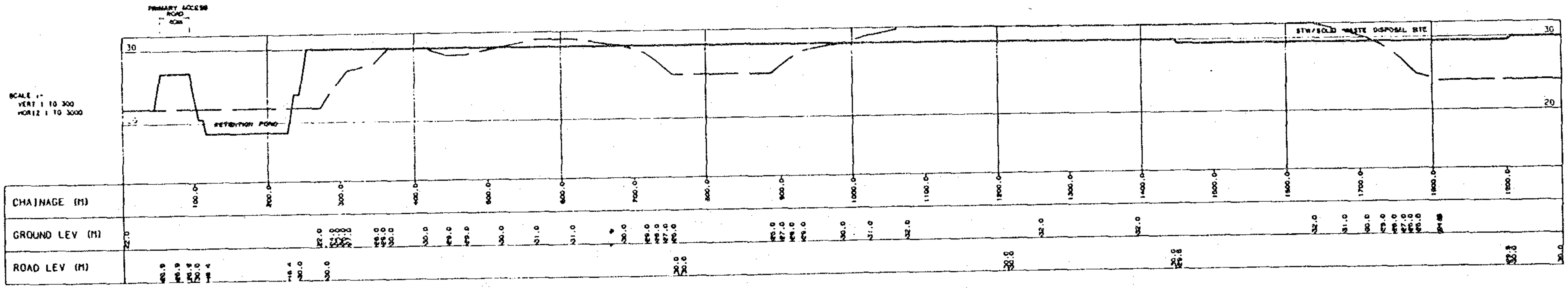
Fig. 5.1.3 (1)



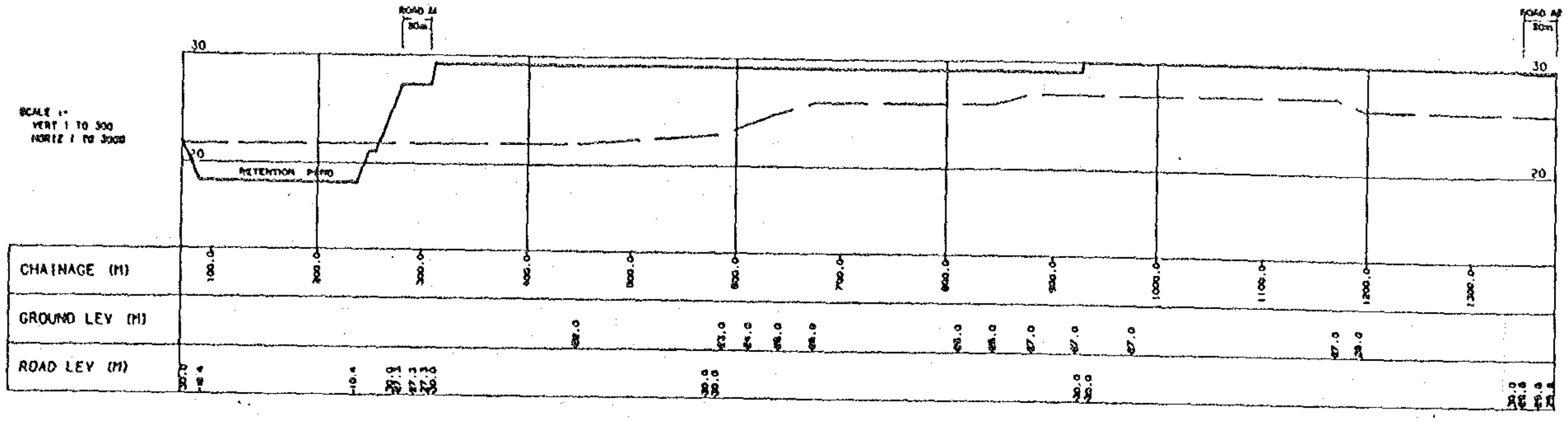
SECTION B-B



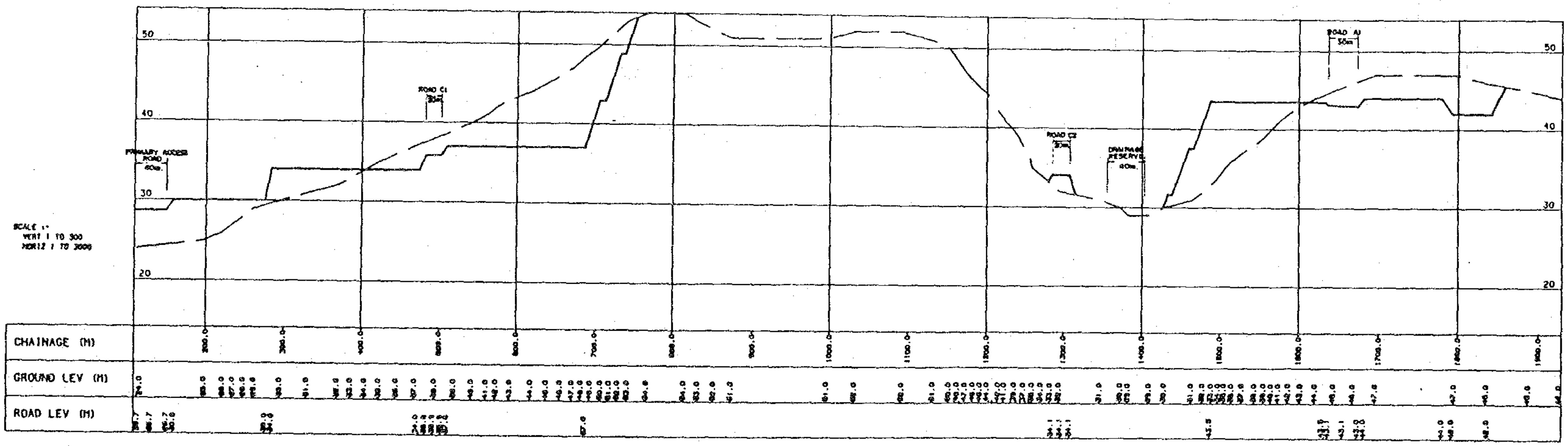
SECTION A-A

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **EARTHWORK CROSS-SECTIONS (SHEET1)**

Fig. 5.1.3 (2)



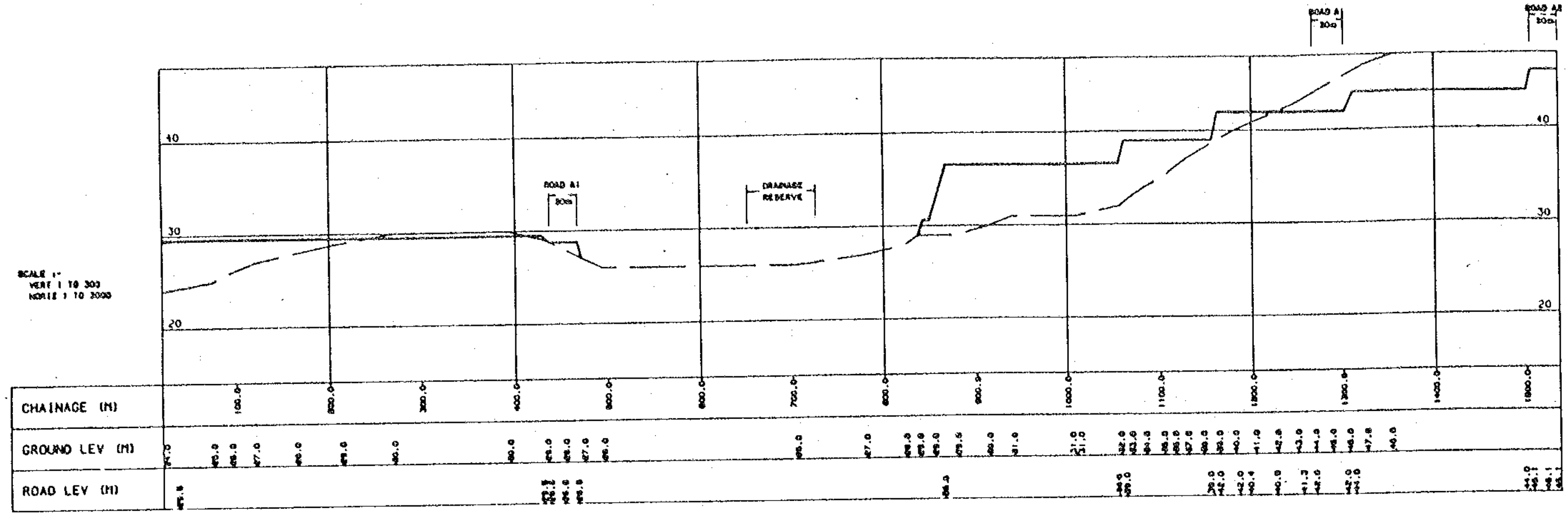
SECTION D-D



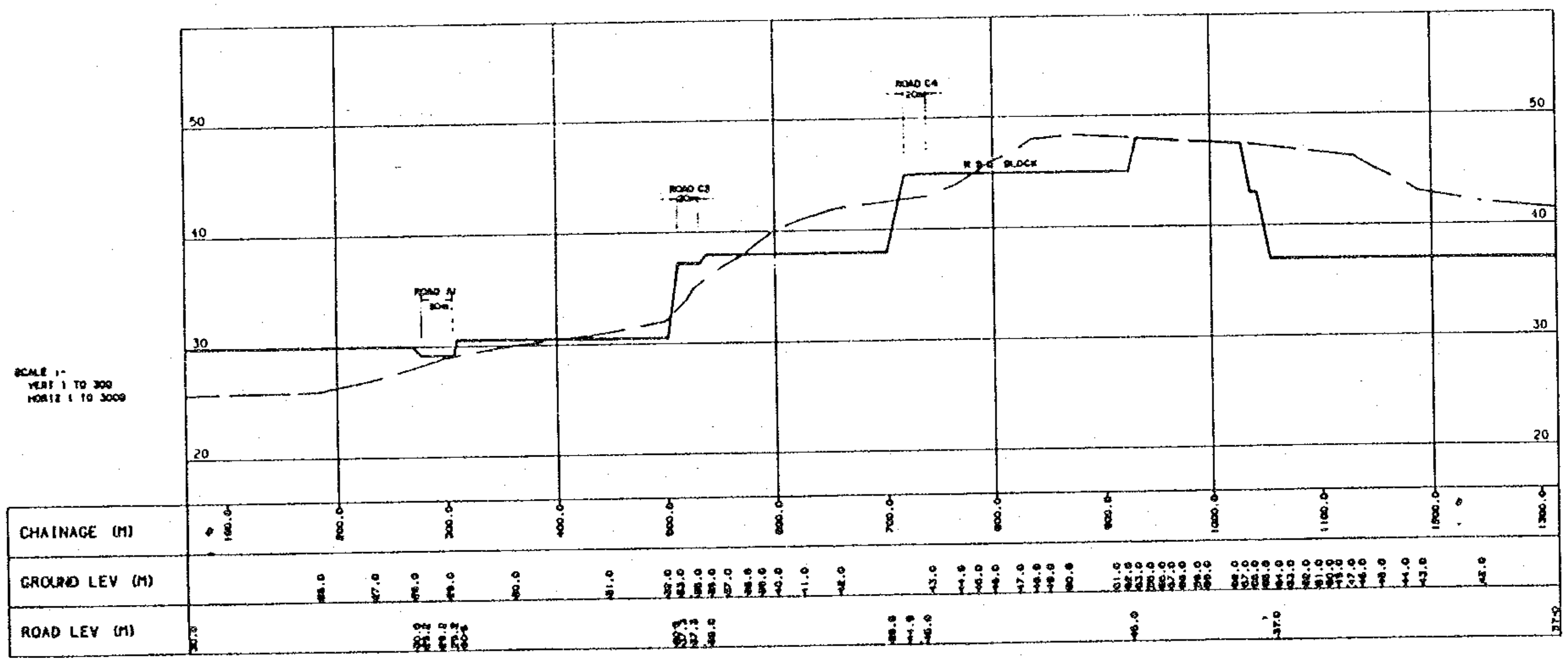
SECTION C-C

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE EARTHWORK CROSS-SECTIONS (SHEET2)

Fig. 5.1.3 (3)



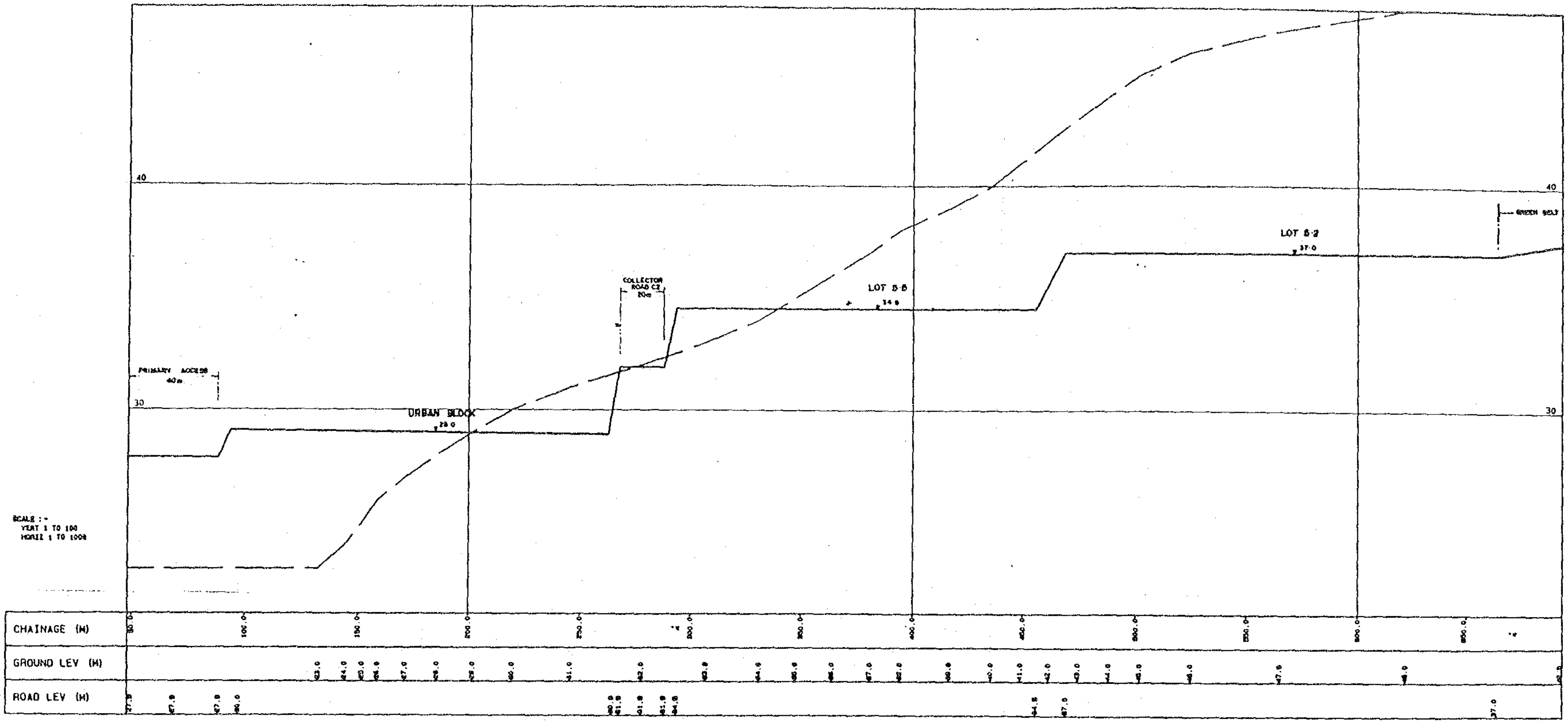
SECTION F-F



SECTION E-E

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **EARTHWORK CROSS-SECTIONS (SHEET3)**

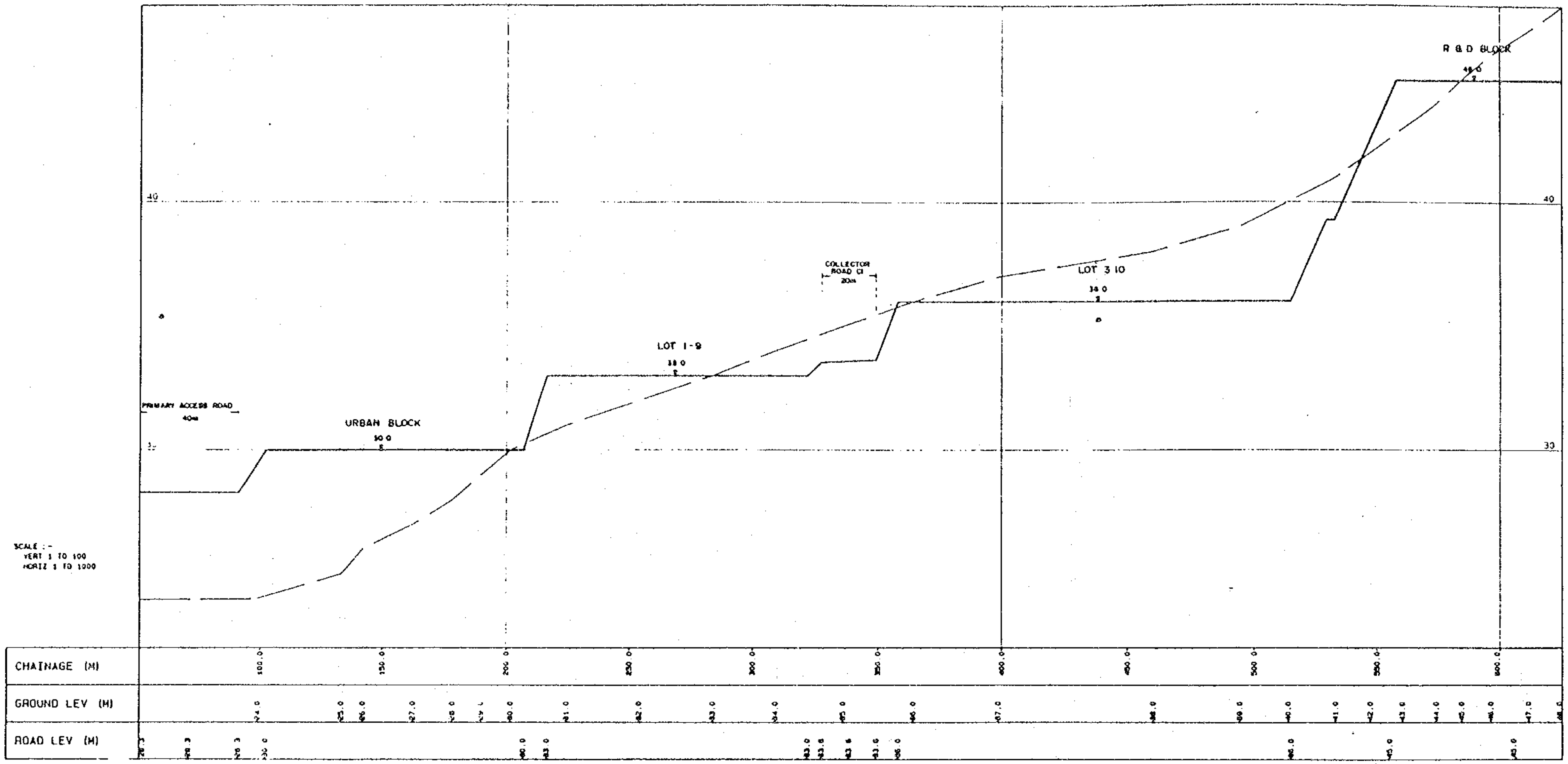
Fig. 5.1.3 (4)



SECTION G-G

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **EARTHWORK CROSS-SECTIONS (SHEET4)**

Fig. 5.1.3 (5)



SECTION H-H

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **EARTHWORK CROSS-SECTIONS (SHEET5)**

5.2 Road Network

5.2.1 Road Network outside the Industrial Zone

(1) Primary access road

A new primary access road to the Kulim Hi-Tech Industrial Park was recommended to be constructed from Kelang Lama to the East West Highway as shown in Fig. 5.2.1. The rough alignment of this new primary access road is recommended as shown in Fig. 5.2.2. The Malaysian side should undertake the design of the primary access road.

The daily traffic volume of the new primary access road in the year 2013 is estimated to be about 12,700 vehicles/day. The design standard of the new road is recommended to be the same as the East - West Highway (standard "R5", 4 lanes and 40 m reserve width).

The Study Team recommends the primary access road to be constructed as 2 lanes for the first phase as scheduled by JKR and to expand to 4 lanes by the year 2000 when daily traffic volume will exceed 9,000 vehicles/day which is critical for 2 lanes. Further detailed study on the implementation of lane expansion of the road will be done later by the Malaysian side confirming actual growth of traffic volume on the road. Two signal systems beside the Industrial Zone are recommended to be constructed at the same time of road expansion from 2 lanes to 4 lanes.

The whole primary access road is recommended to be divided into three segments (see Fig. 5.2.2) as follows:

(a) Outside the Hi-Tech Park (Segment "a")

The primary access road outside the Park will run from the north end point of the Industrial Zone to a point about 5 km from Lunas intersection of the East - West Highway. The road length of this part will be about 2.5 km, but detailed alignment of this part will be determined by JKR. The exact location and elevation of the road at the north end point of the Industrial Zone was reported to JKR through EPU. It is recommended that the road construction of this part should follow the construction schedule of the East - West Highway and be completed by end of 1993.

(b) Beside the Industrial Zone (Segment "b")

The primary access road beside the Hi-Tech Industrial Zone of the first phase will run from a point at the north end of the Zone to a point at the south end of the Zone and join to the existing state road No. K115. The road length of this part is approximately 1.4 km. The alignment and elevation of this part have been recommended and reported to the Malaysian side by the Study Team in the middle of September 1991. A typical cross section of the primary access road beside the Industrial Zone is shown in Fig. 5.2.3. The alightment and profile of the said road are referred to in Fig. 2.4.1 in Annex. The road construction of this part shall be completed by mid 1993.

(c) Other part inside the Hi-Tech Park (Segment "c")

The other part of the primary access road inside the Hi-Tech Industrial Park will run from the south end point of the Industrial Zone to a point about 1 km east from existing Kelang Lama intersection (cross point of state roads No. K21 and K115). The road length of this part will be about 4.2 km, but detailed alignment of this part will be determined by the Malaysian side. The road construction of this part is recommended to be completed by the end of 1993.

(2) East - West Highway

According to JKR, the dual lane part of the East - West Highway is scheduled to be expanded to a point about 2.5 km from Lunas intersection. However, it is recommended that the dual lane part should be expanded to a point about 5 km from Lunas intersection and connected to the above new primary access road for the Hi-Tech Industrial Park.

The Study Team has studied and reviewed the implementation schedule of road construction related to the Hi-Tech Industiral Park including East - West Highway. As a result, road width expansion of the East - West Highway from single lane to dual lane is to be conducted later, because the above design change will affect the implementation schedule of the East - West Highway.

Target year of the said expansion is assumed to be same as year 2000 of the lane expansion of the primary access road. However, further detailed study on the implementation of lane expansion of the East - West Highway is to be done later by the Malaysian side confirming actual growth of traffic volume on the road.

(3) Existing state road No. K115

A part of the existing state road inside the Hi-Tech Park is to be improved as the arterial road No.2 within the Industrial Zone, as shown in Progress Report (2).

The other part of the state road inside the Park is recommended to keep the present condition except for minor improvements and 30 m reserve width. In the future, this part will be used by the people living in the Housing Zone and local inhabitants nearby the Park.

This existing road will be used as an access road for the first phase construction of the Hi-Tech Industrial Park.

(4) Other internal roads inside the Park

Other internal road network inside the Hi-Tech Industrial Park for first phase will be determined and designed by the Malaysian side during the master plan study for other zone of first phase. About 30 km of other internal roads inside the Park of first phase are assumed to be constructed.

5.2.2 Road Network within the Industrial Zone

(1) Layout Plan

Corresponding to the basic policy of layout plan within the Industrial Zone, basic design policy for the road network was established. Basic design policies for the road network within the Industrial Zone are as follows:

(a) To utilize the present geography as far as possible for road network alignment

(b) To minimize the total road length for saving construction costs

(c) Not to provide cross roads within the Industrial Zone for ensuring safe traffic control and efficient traffic flow (T-shape junctions only)

Based on the above basic design policy, road network within the Industrial

Zone was recommended in Progress Report (2) as shown in Fig. 5.2.4. Roads connected to the primary access road are arterials and the others are collector roads. All of factory lots face onto the arterial and collector roads. Elevation difference at entrance to factory lots from roads is less than 2 m. One front entrance to the Industrial Zone is located at the north end of the Urban Block along the primary access road. Three back entrances are located along the arterial road No. 2.

(2) Design Condition

Traffic demand forecast was carried out for road network design within the Industrial Zone as per the procedures shown in Fig. 5.2.5.

Total daily traffic volume from/to the Industrial Zone consists of freight traffic volume, commuting traffic volume, and business trip traffic volume.

(a) Freight traffic volume

Freight traffic volume is calculated from freight volume of materials carried in and product materials carried out. Freight volume is estimated based on the factory area of the targeted industries.

(b) Commuting traffic volume

Commuting traffic volume is estimated based on respective modal split of commuting ways of workers in the Industrial Zone.

(c) Business trip traffic volume

Business trip traffic volume is estimated based on the number of workers in the Industrial Zone.

Using the above procedures, the generated daily traffic volume within the Industrial Zone was estimated to be approximately 6,800 vehicles per day.

The distributed maximum traffic volumes on the arterial and collector roads were calculated at 3,900 and 1,000 vehicles/day respectively. Detailed forecast and calculations are shown in Chapter 2.4 of Annex.

Malaysian (JKR's) standards for road design were carefully reviewed by the JICA Study Team. The JKR standards were determined to be appropriate for road design of the Industrial Zone and are therefore used.

Based on the above estimated daily traffic volumes, design standards to be used for arterial and collector roads within the Industrial Zone were decided to be "U4" and "U3" of JKR standards respectively.

(3) Design Criteria

Design criteria to be applied for road network design of arterial and collector roads within the Industrial Zone are as follows:

	Item	Arterial	Collector
(a)	Design speed	60 km/h	50 km/h
(b)	Reserve width	30 m	20 m
(c)	Lane width	3.25 m (4 lanes)	20 m (2 lanes)
(d)	Shoulder width	3.00 m	2.50 m
(e)	Median width	2.50 m	–
(f)	Marginal strip width	0.25 m	–
(g)	Stopping sight distance	85 m	65 m
(h)	Passing sight distance	450 m	350 m
(i)	Minimum radius	200 m	150 m
(j)	Minimum length of spiral	35 m	32 m
(k)	Maximum superelevation (Ratio)	0.06	0.06
(l)	Maximum grade	4.0 %	5.0 %
(m)	Crest vertical curve (K)	15	10
(n)	Sag vertical curve (K)	15	12

In the above mentioned criteria, the values of minimum radius and maximum grade recommended are larger and gentler, respectively, than the Malaysian standards. However, those are judged to be necessary for road design of the Hi-Tech industrial park due to heavy traffic expected (semi-trailer class). The equivalent 8.16 ton standard axle load is to be used for the pavement design as per the Malaysian standard.

In addition to the above, the following manuals and guides by JKR shall be referred to for the design of roads in the Industrial Zone:

- A Guide on Geometric Design of Roads
- Manual on Pavement Design
- A Guide to the Design of At-Grade Intersection

(4) Basic Design

Based on the design conditions and criteria mentioned above, basic design of road network within the Industrial Zone was carried out. Typical cross sections of arterial and collector roads within the Industrial Zone are shown in Fig. 5.2.6 and 5.2.7, respectively. Alignments and profiles of arterial and collector roads within the Zone are referred to in Figs. 2.4.2 to 2.4.7 in the Annex.

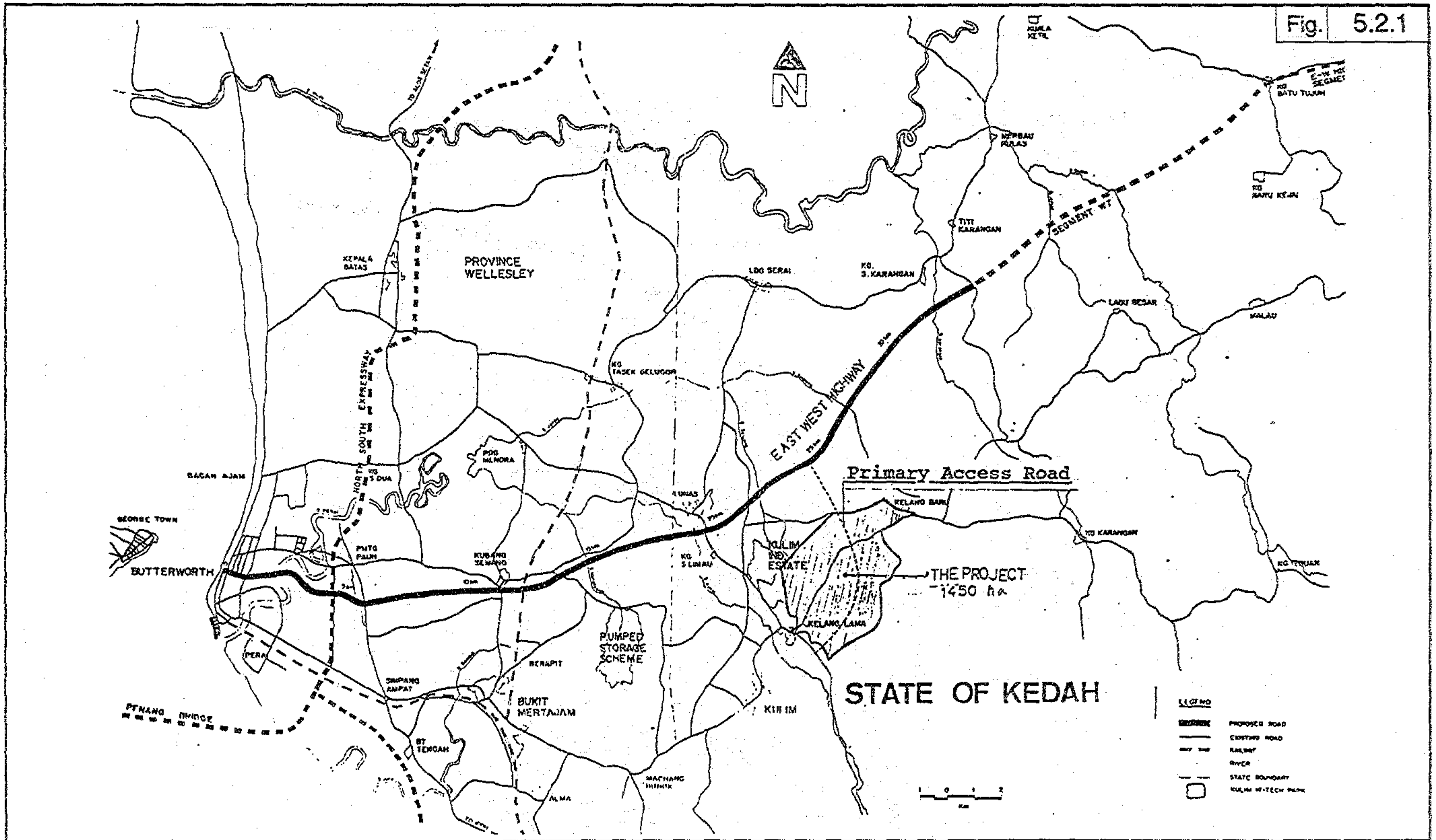
Typical cross section of roads consists of vehicle lane part including carriageway, median and shoulder, and sidewalk part including sidewalk, green belt and other open or underground utilities.

Two bridges, of which each span is 30 m and each width is 17 m, should be constructed on the arterial roads. Elevations of bridges is to be determined based on high water level of drainage channel design. Typical profile and section of the bridge are shown in Fig. 5.2.8.

Based on basic design policies for road network within the Industrial Zone, only T-shape junctions should be designed and constructed. Typical layout plans of road junctions are shown in Fig. 5.2.9.

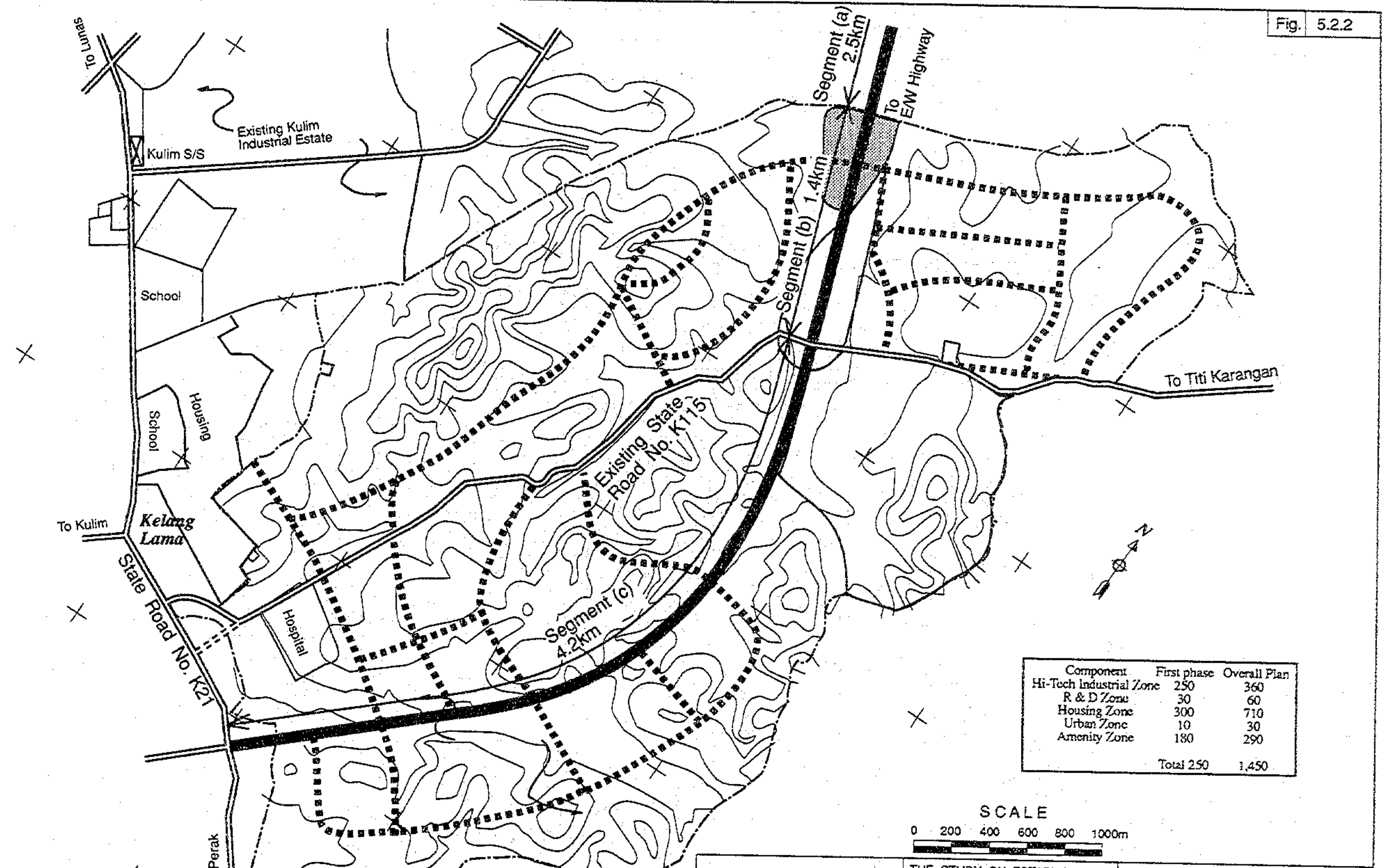
Road lengths of the arterial and collector roads are 4.586 km and 4.175 km, respectively. Total road length within the Industrial Zone is 8.761 km including 2 bridges with 30 m spans.

Fig. 5.2.1



THE GOVERNMENT OF MALAYSIA	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK	TITLE
ECONOMIC PLANNING UNIT	JAPAN INTERNATIONAL COOPERATION AGENCY	Road Network System around Kulim Hi-Tech Park

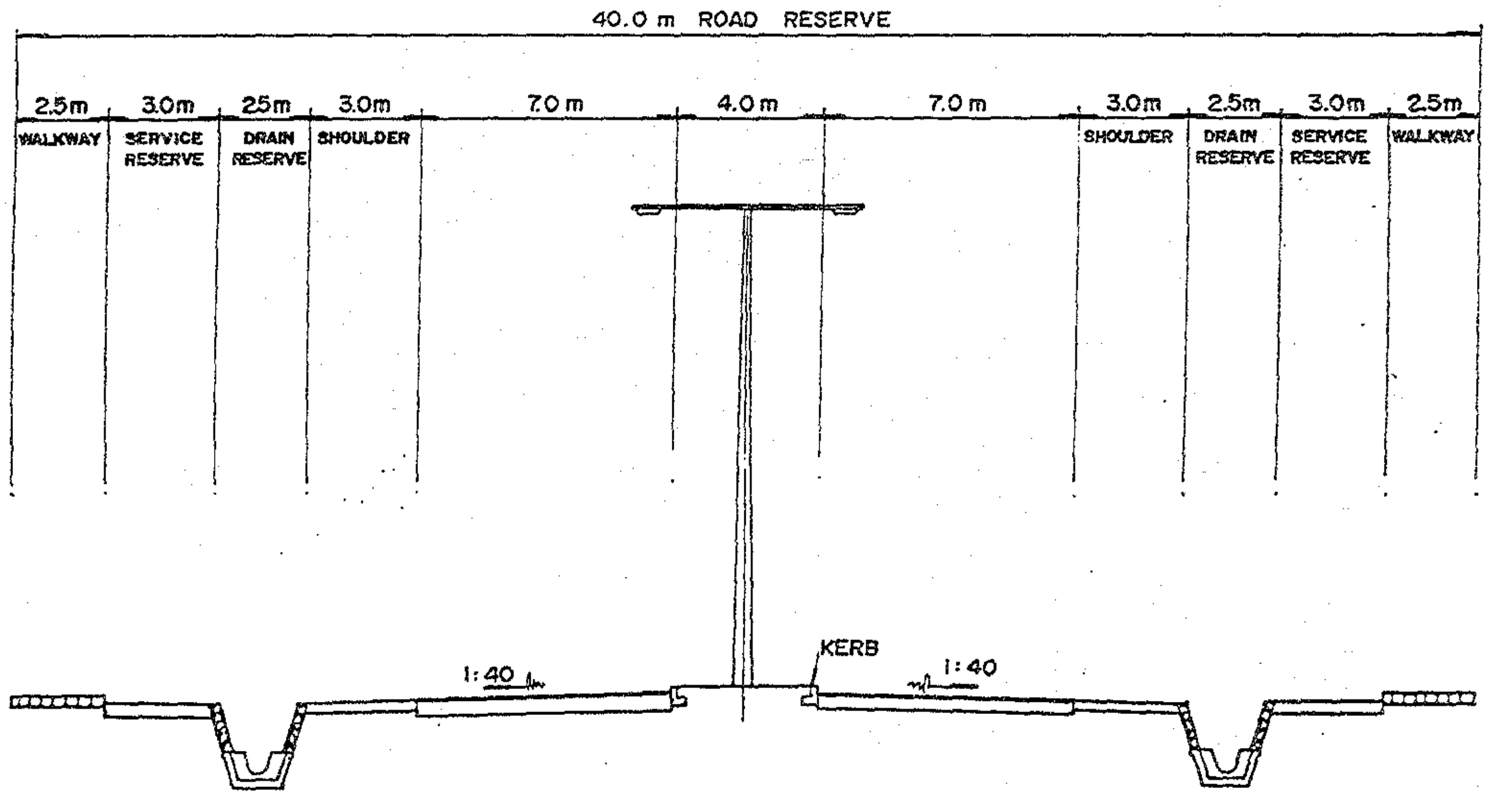
Fig. 5.2.2



Component	First phase	Overall Plan
Hi-Tech Industrial Zone	250	360
R & D Zone	30	60
Housing Zone	300	710
Urban Zone	10	30
Amenity Zone	180	290
	Total 250	1,450

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Plan of Primary Access Road

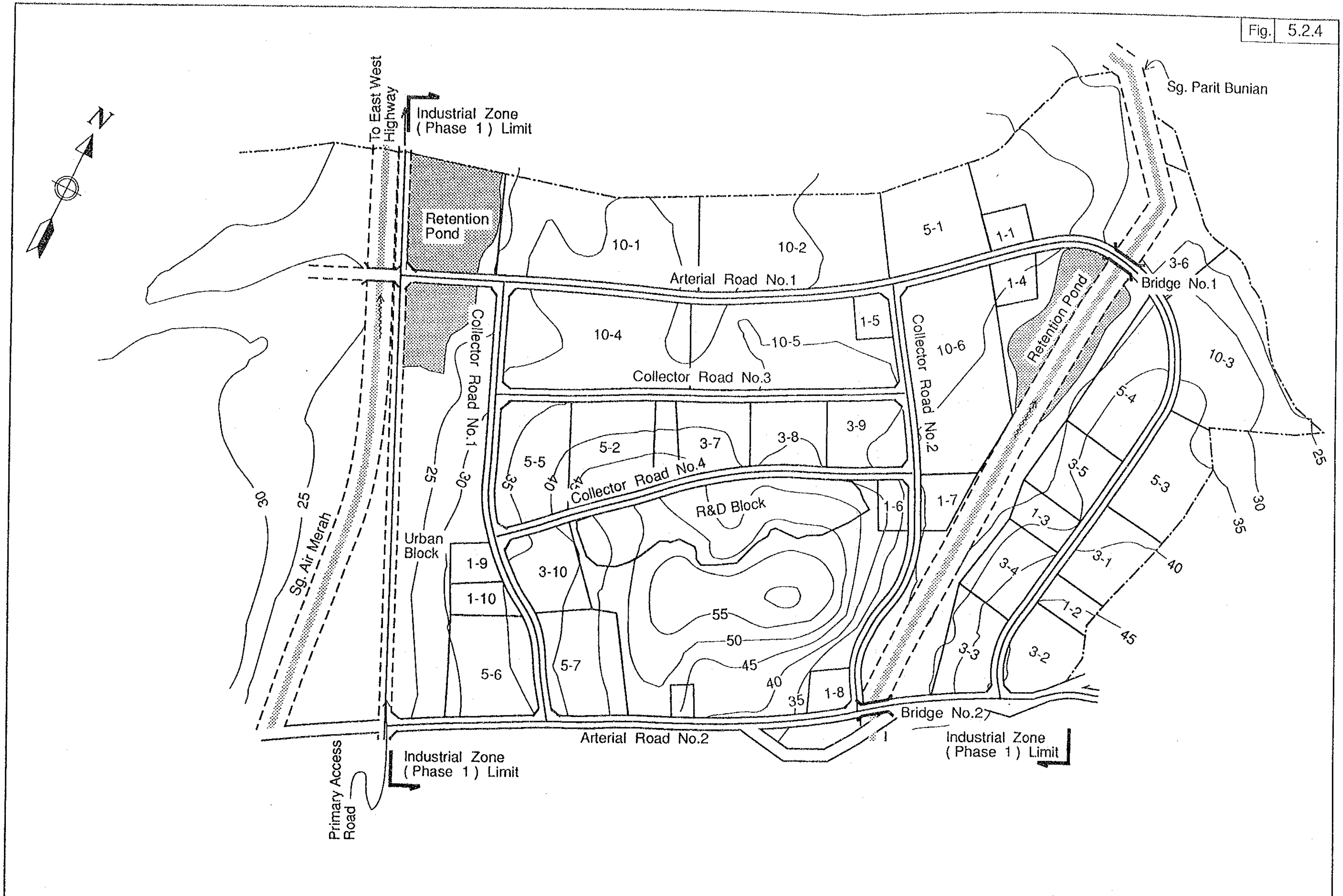
Fig. 5.2.3



40.0m ROAD RESERVE

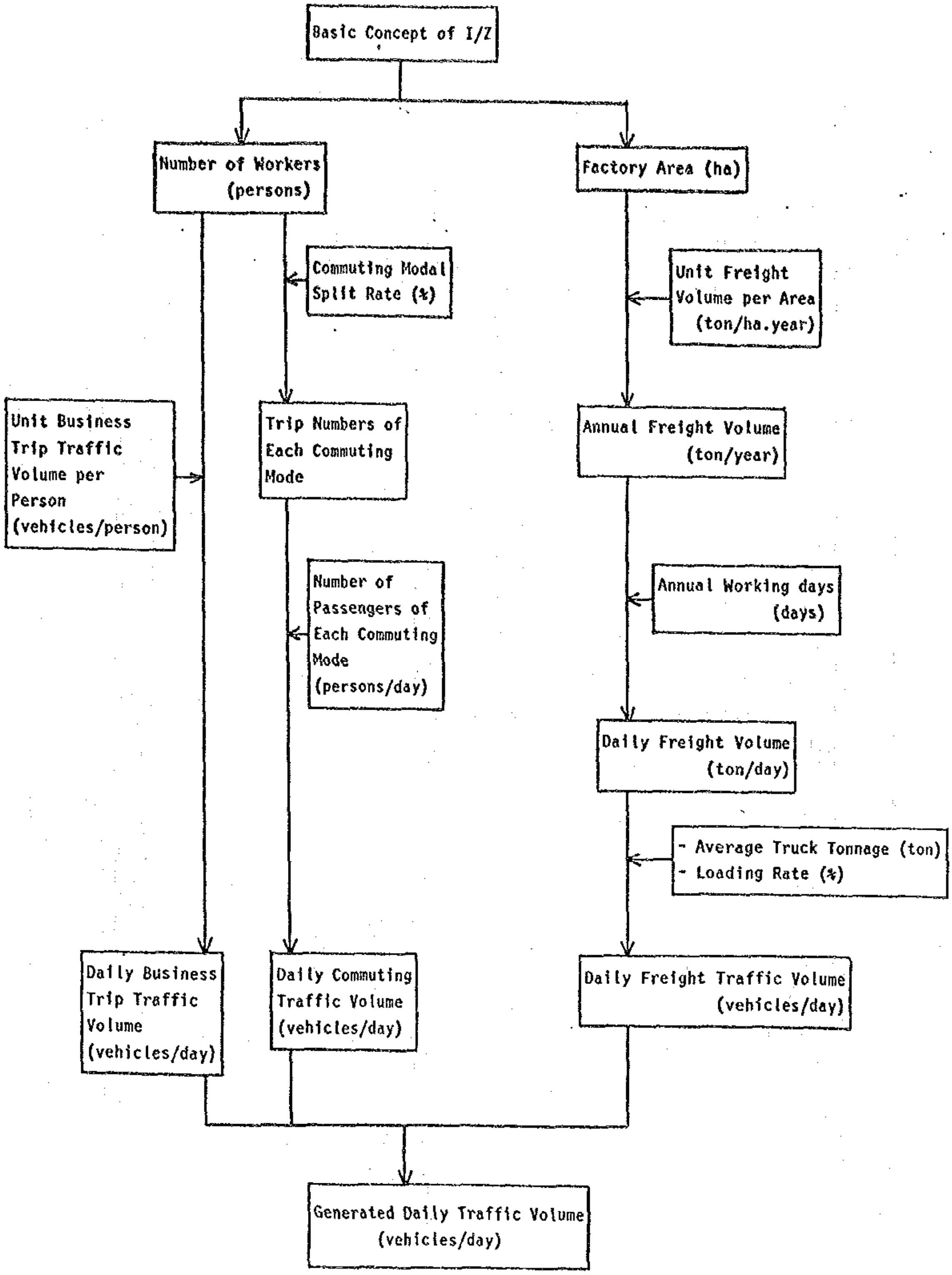
(SCALE : 1 : 200)

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Cross Section of Primary Access Road beside Industrial Zone



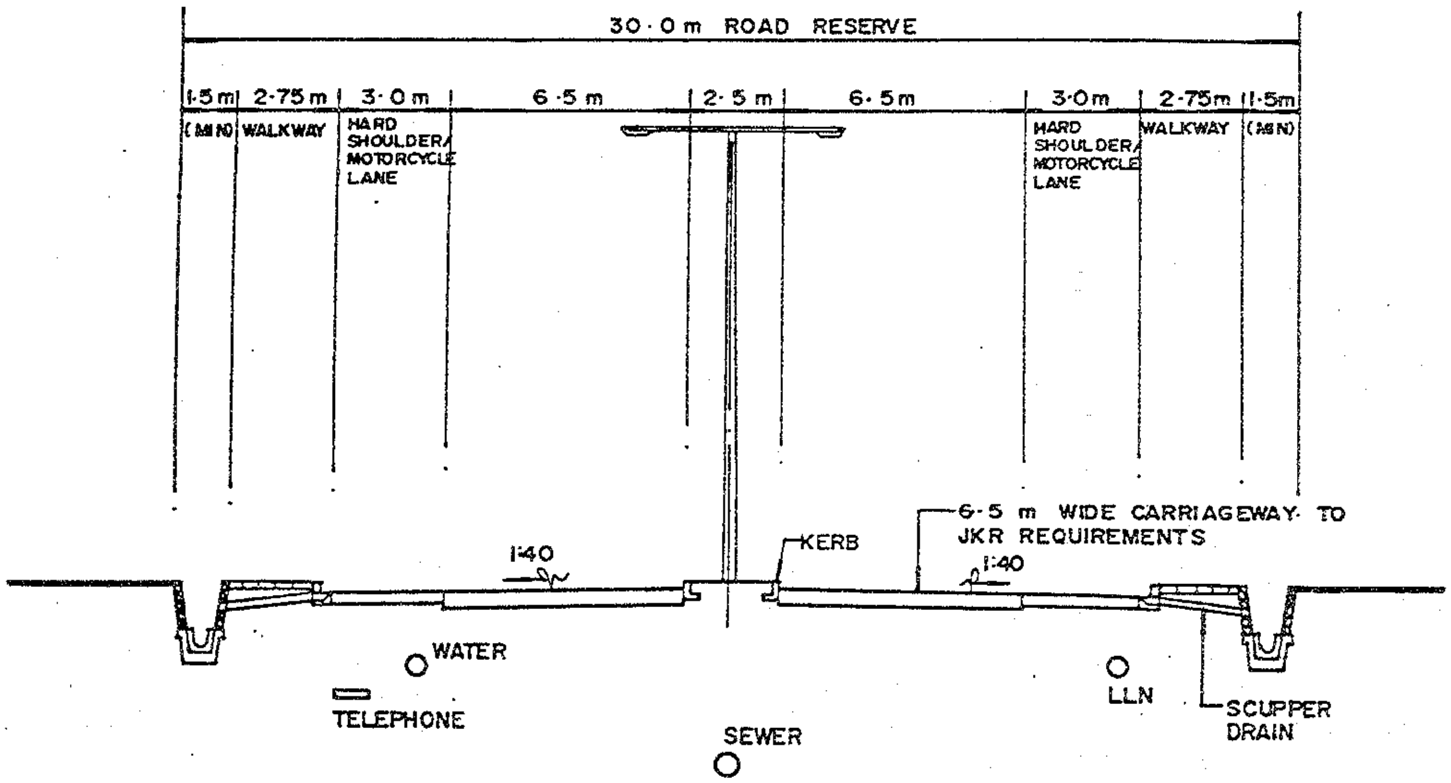
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Road Network Plan in Industrial Zone

Fig. 5.2.5



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Flow Chart of Traffic Demand Forecast in Industrial Zone

Fig. 5.2.6

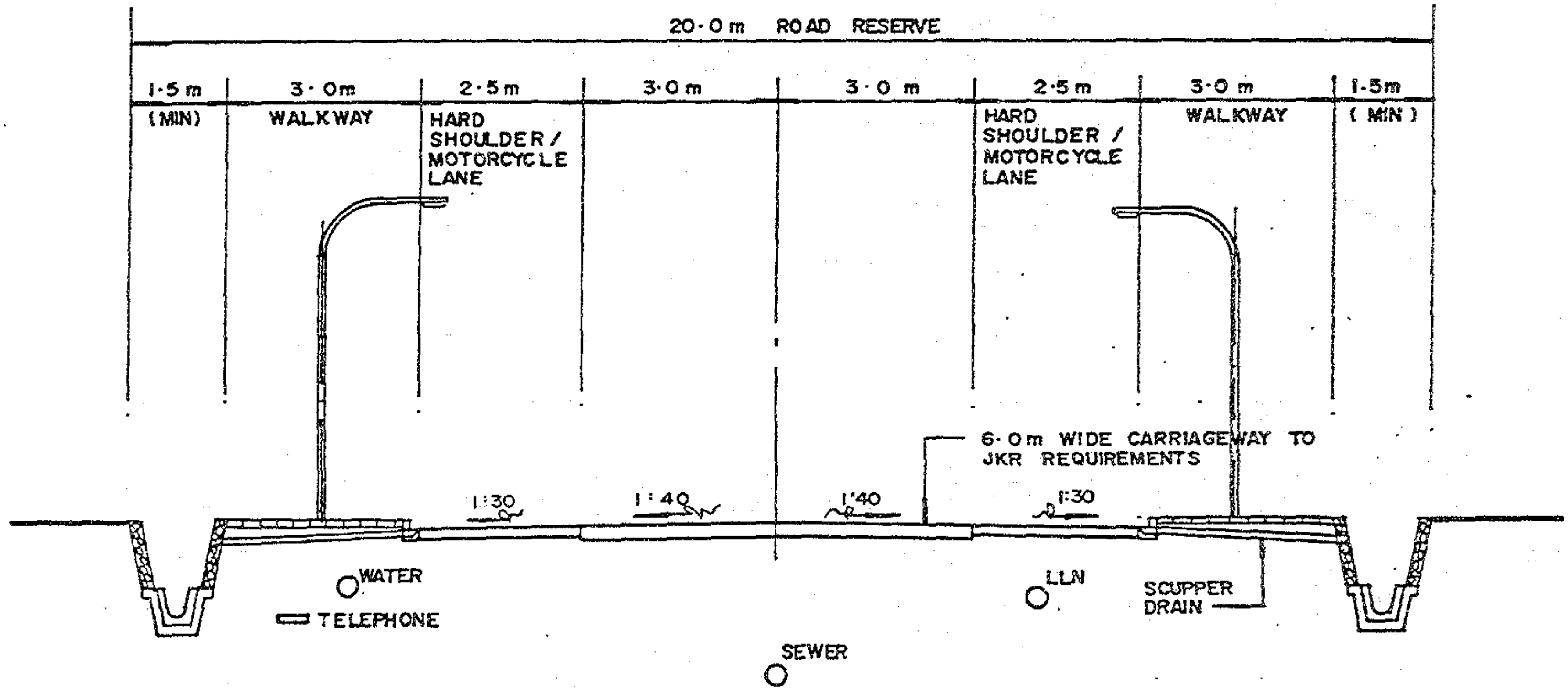


30·0m ROAD RESERVE

(SCALE : 1 : 200)

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Cross Section of Arterial Road

Fig. 5.2.7

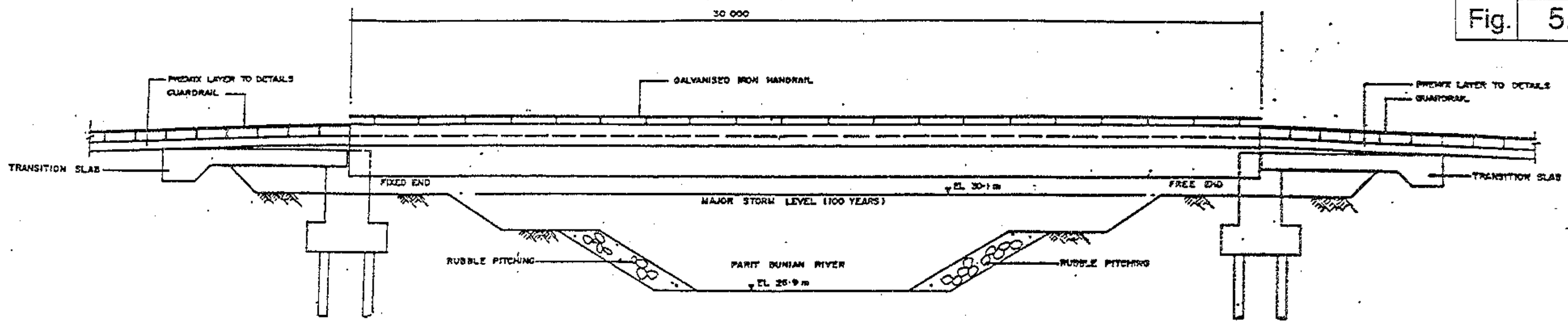


20·0 m ROAD RESERVE

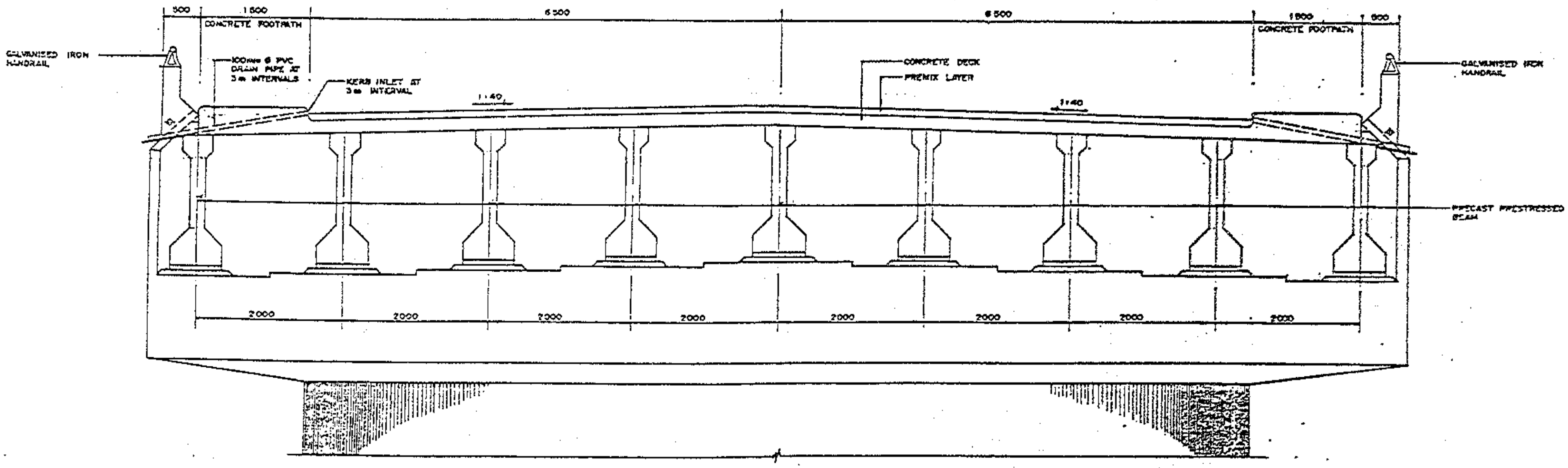
(SCALE : 1:100)

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Cross Section of Collector Road

Fig. 5.2.8



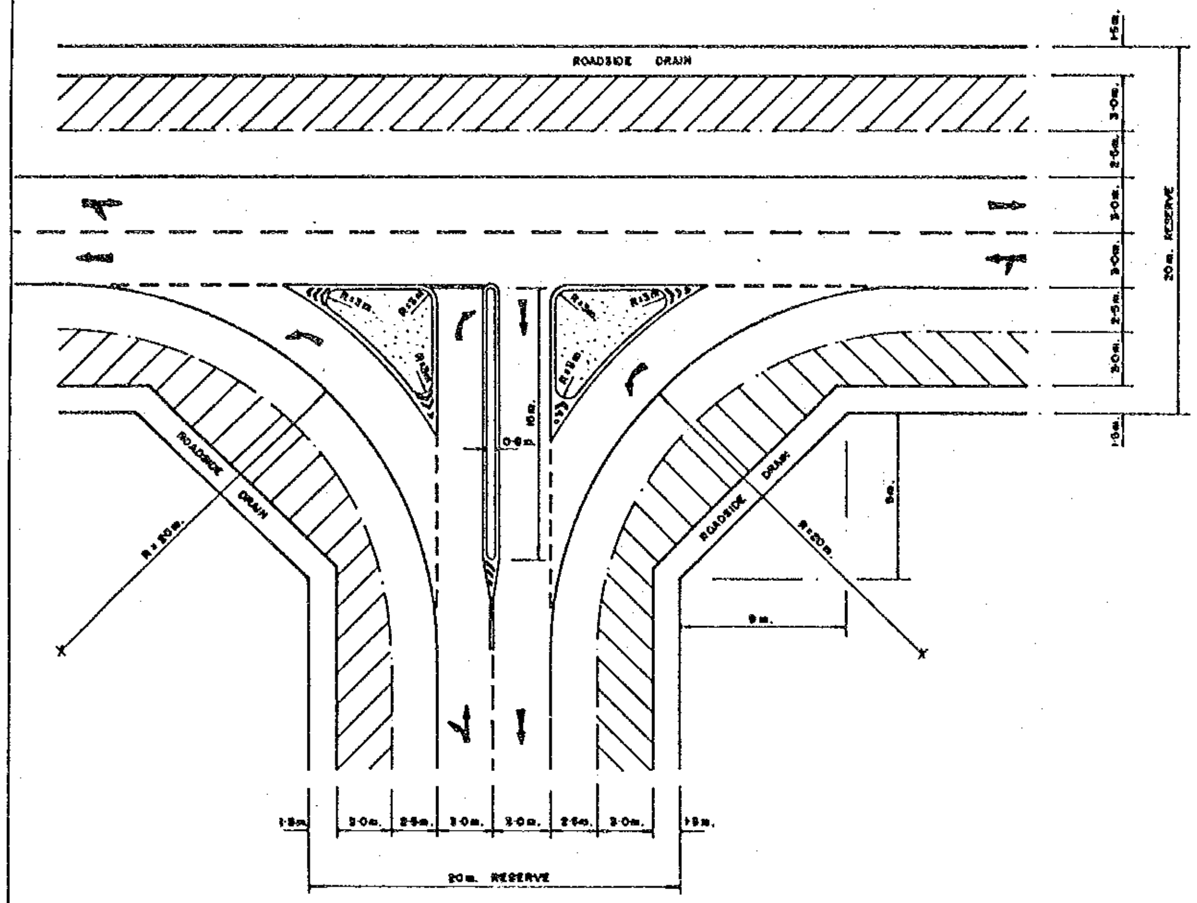
TYPICAL BRIDGE CROSSING 40m DRAINAGE RESERVE Scale 1 : 200



TYPICAL CROSS - SECTION OF BRIDGE Scale 1 : 80

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Profile and Section of Bridge

Fig. 5.2.9 (1)

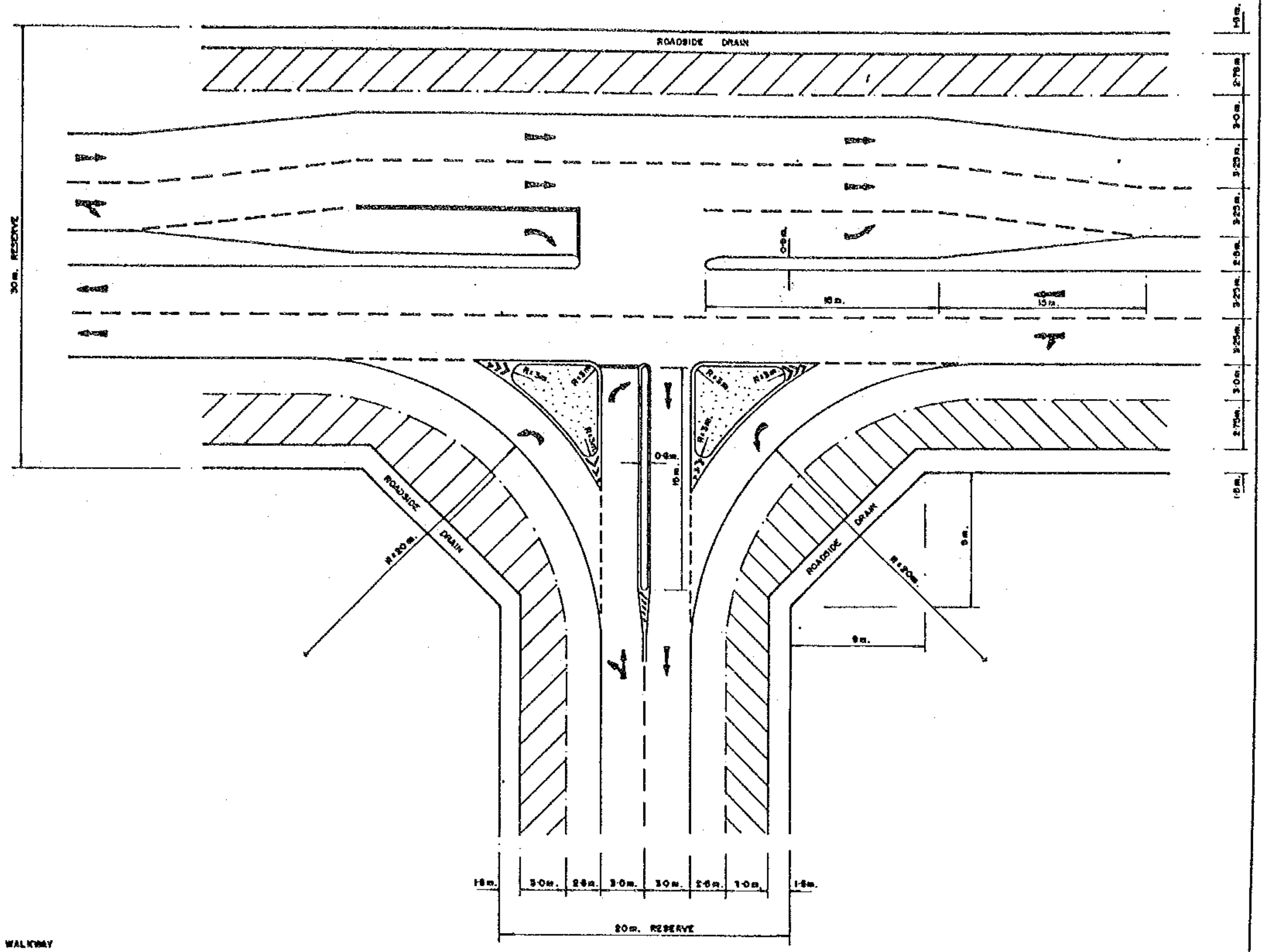


20m. AND 20m. ROAD JUNCTION LAYOUT

LEGEND:

WALKWAY

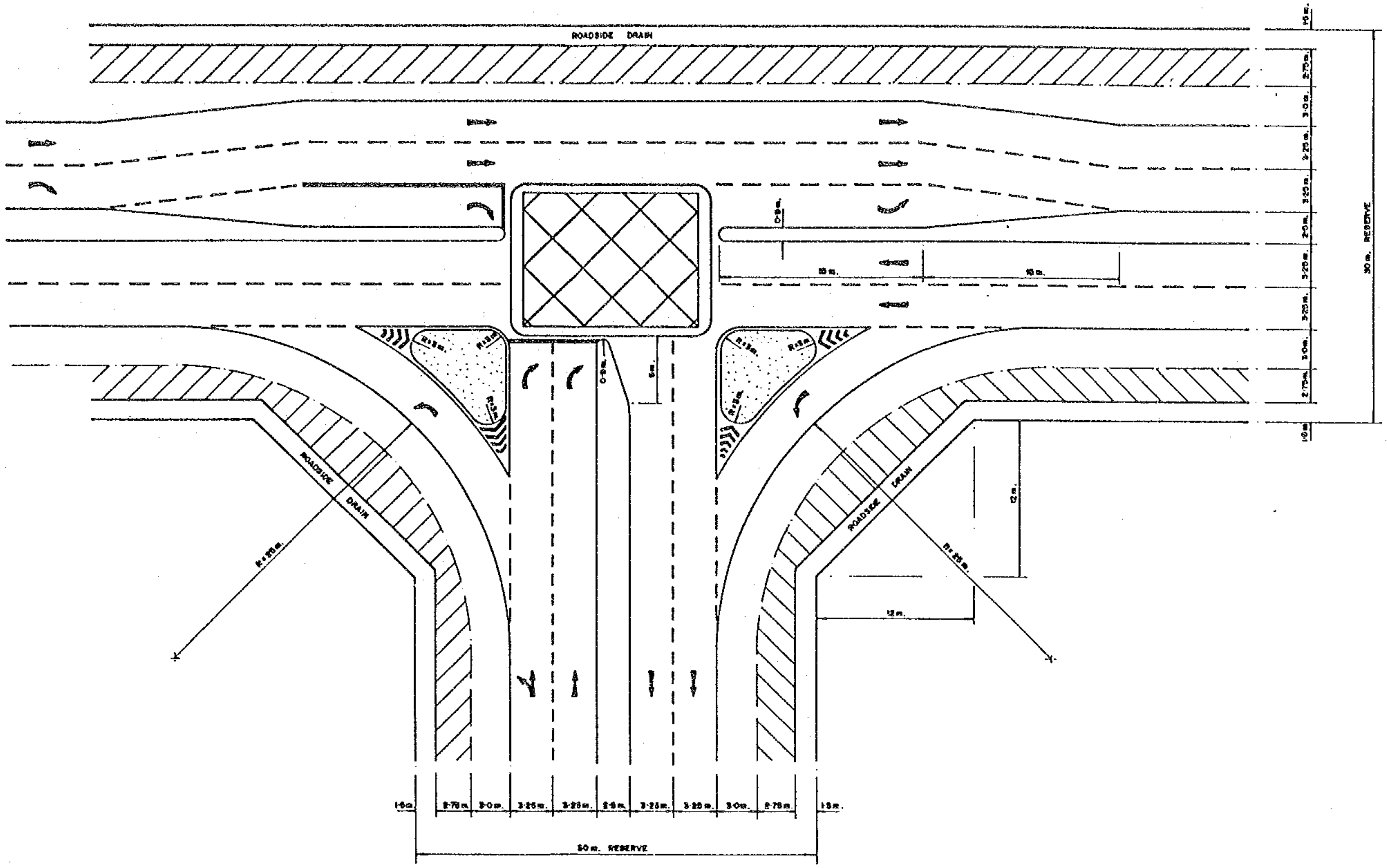
TRAFFIC ISLAND



20m. AND 30m. ROAD JUNCTION LAYOUT

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Layout Plan of Road Junction

Fig. 5.2.9 (2)



30 m. AND 30 m. ROAD JUNCTION LAYOUT

LEGEND :

WALKWAY

TRAFFIC ISLAND

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Typical Layout Plan of Road Junction

5.3 Power Supply System

5.3.1 General

The objective of the power supply system is to supply reliable and stable power to the important consumers in the Kulim Hi-Tech Industrial Park who use electronic appliances like computers and sensitive devices for manufacturing and development of commodities. In reply to their desire, a reliable and stable power supply system should be made for the project.

The UNIDO report revealed that the power source, transmission, substation and distribution network as well as power demand are to be secured for the project. Just after this, JICA reviewed and followed the system study.

This Report explains basic design conditions and criteria, power demand, basic plan and implementation plan. Details are described in the Annex.

5.3.2 Basic Design Conditions and Criteria

Basic design criteria and conditions which are essential and specific requirements for the Kulim Hi-Tech Park are as follows:

(1) Basic Design Conditions

(a) Sufficient power supply system
(b) High reliable power supply system
(c) Low irregulation of supplying voltage (high stability)
(d) Reduction of manpower for operation and maintenance
(e) Environmental harmony

(2) Basic Design Criteria

(a) Voltage regulation : +5% of rated voltage of 33kV and 11kV, distribution line for enhancing stability

(b) Power interruption : No long time power interruption for enhancing reliability

(c) Output capacity of substation : 180 MVA
(Refer to power demand forecast)

(d) Regulation and standard : TEN's regulation, IEC standard for equipment design

5.3.3 Power Demand

From the Technical Meeting on June 13, 1991, the land use plan of industrial zone for the First Phase was agreed. From this, power demand for the Kulim Hi-Tech Park is estimated for basic design as given below. Detailed computation is shown in the Annex.

Table 5.3.1 Power Demand Forecast

	Industrial Zone	Housing Zone	Others	Total
Phase 1	55 MVA	14.3 MVA	14.5 MVA	83.8 MVA
Phase 2	40 MVA	19 MVA	14.5 MVA	73.5 MVA
Total	95 MVA	33.3 MVA	29 MVA	157.3 MVA

Therefore, 180 MVA substation is recommended in consideration of 5% allowance due to distribution loss and voltage drop.

5.3.4 Basic Plan

Basic planning for construction of transmission, substation and distribution network was studied referring to the power demand forecast and specific requirements of the Kulim Hi-Tech Park.

This basic plan consists of primary power supply (transmission line), substation and secondary power supply (distribution line). Overall power supply system diagram is shown in Fig.5.3.1 and explained below.

(1) Transmission line

The available power source, currently, is only TEN's Power Grid. The nearest power tapping point from the TEN's Power Grid is the Kulim substation, which is located 6 km away from the proposed Industrial Zone. This Kulim substation is functioning mainly to supply power for the existing Kulim Industrial Estate and city service. The power for the existing Kulim substation is transmitted from the Bukit Tengah substation located near Butterworth city approximately 15 km by 132kV transmission line, consisting of 2 circuits which has 140 MVA sending capacity per circuit. It has enough capacity for power supply to the project area, because the existing load is 33MVA at maximum and power demand in Phase 1 is estimated as 84 MVA.

Therefore, power for the Kulim Hi-Tech Park should be supplied from the Kulim substation by construction of a new 132kV transmission line. The new 132kV transmission line may be mostly constructed as an overhead line. However, in the Industrial zone, 132kV underground power cable line should be applied for environmental harmony and security of factories.

In order to enhance the reliability of power supply, one more new 132kV transmission line should be constructed between the TEN's power grid substation and new substation. From the power demand forecast, 157 MVA capacity is required for the Kulim Hi-Tech Industrial Park after completion of Phase 2.

As mentioned above, the existing 132kV transmission line between Bukit Tengah substation and Kulim substation is utilized for power demand of the project, and in and around Kulim city. As seen in the TEN's national power grid diagram, Kulim substation is a terminal station. In case that the new transmission line is not constructed and power supply is shut down due to line fault or damage, all the consumers in and around the Kulim area will suffer serious damage. Since the Kulim Hi-Tech Park is one of the most important consumers, new 132kV transmission line should be constructed from TEN's grid substation (other than the Bukit Tengah substation) to the new substation during the Phase 1 Industrial Zone construction.

The Sungai Petani substation, which is the second nearest point in the TEN's power grid located 30 km away from the Industrial Zone, is proposed to be interconnected with the new substation by the new 132 kV transmission line.

Consequently, the 132kV transmission line will be interconnected with the TEN's power grid by ring formation (Ref. Fig. 5.3.1).

The route map of 132 kV transmission line is as shown in Fig. 5.3.2. The basic design of new 132kV transmission line is as follows:

Kulim S/S ~ New S/S

(a)	Line voltage	:	132 kV
(b)	No. of circuit	:	2 circuits
(c)	Line length	:	Approximately 6 km, overhead line
(d)	Conductors	:	– ACSR 300 mm^2 for overhead line – GSW 55 mm^2 for overhead earth line

Sungai Petani S/S ~ New S/S

(a)	Line voltage	:	132 kV
(b)	No. of circuit	:	2 circuits
(c)	Line length	:	Approximately 30 km, overhead line
(d)	Conductors	:	– ACSR 300 mm^2 for overhead line – GSW 55 mm^2 for overhead earth line

For interconnection of these 132 kV transmission lines, expansion of outgoing feeder bay is required at the Kulim and Sungai Petani substations.

(2) Substations

For effective use of electric energy, new substations are planned to be constructed for power distribution. New substations are composed of 3 substations in Phase 1 (Fig. 5.3.3), because sending capacity and length of distribution lines are limited by their voltages of 33kV and 11kV and reducing cable loss. One is the main substation which receives power from 132kV transmission lines and distribute power to the consumers. The other two are distribution substations which distribute power to the consumers directly. These substations are interconnected to each other by 33kV sub-transmission line for ring formation.

Location of substations is selected at the center of electric loads to reduce the length of distribution cables from the substations to the consumers as much as possible.

3 distribution substations are to be constructed in Phase 2 additionally.

Single line diagrams of new substations are shown in Fig. 5.3.4. The basic design of new substations is given below:

(a) Type : Indoor GIS (132kV side)

(b) Capacity : 180 MVA
- 90 MVA for Phase 1
- 90 MVA for Phase 2

(c) Arrangement and composition of switchgear:

– 132 and 33kV bus	:	double bus
– 33 and 11kV switchgear	:	indoor metal-clad type
– Protective relaying	:	high speed type
– Power transformer	:	Outdoor type with OLTC

(3) Distribution line

In order to distribute power to the respective consumers, 33kV and 11kV distribution lines are planned in accordance with the following TEN's policy:

1) Applied line voltage for power supply to consumer:

– 4 MW to 15 MW	:	33kV line
– 1 MW to 4 MW	:	11kV line
– small consumer	:	415/240V line

2) Applied ring form connection for important consumers

On the basis of the above TEN's policy and specific requirements coming from hi-tech industries, 33kV and 11kV distribution lines are planned as follows:

33kV and 11kV distribution lines are designed as ring formation and double circuits in order to secure the reliable power supply and to increase the line capacity.

In addition to the above, automatic line sectionalizer should be arranged at the respective consumers on the line to avoid long time power stop and to minimize the power stoppage section.

Fig. 5.3.5 shows 33 and 11 kV distribution lines. Basic design of 33 and 11kV distribution lines are as follows:

(i) 33 kV distribution line

(a) Line voltage : 33 kV

(b) No. of line : 12 lines at main substation (Phase 1)

12 lines at distribution substation (Phase 1)

4 lines at main substation (Phase 2)

8 lines at distribution substation (Phase 2)

(c) Conductor : 33 kV XLPE 300 mm^2

(d) Operation system : Low speed autoclosing system

(ii) 11 kV distribution line

(a) Line voltage : 11 kV

(b) No. of line : 12 lines at main substation (Phase 1)
32 lines at distribution substation (Phase 1)
0 lines at main substation (Phase 2)
26 lines at distribution substation (Phase 2)

(c) Conductor : 11kV XLPE 300 mm^2 or 180 mm^2

(d) Operation system : Low speed autoclosing system

Fig. 5.3.6 to 5.3.9 show operation sequence of power distribution system, processing outline of operating system and block diagrams of the system.

5.3.5 Implementation Plan

Taking into account the tight schedule for the implementation and the funds available, this report explains the basic plan adequate for the urgent completion of transmission substation and distribution network for the Kulim Hi-Tech Park as stage-wise implementation based on the UNIDO report, site surveys and discussion with Malaysian officials.

The implementation of Phase 1 works for the Kulim Hi-Tech Park is as follows:

(1) 132kV transmission line between the existing Kulim substation and New substation —— 6 km

(2) 132kV new transmission line between the Sungai Petani substation and New substation —— 30 km

(3) New substation, 132/33/11kV indoor type switchgear 90 MVA output capacity with: —— 1 set
  - (a) Four feeders of 132 kV incoming line (2 alternative lines)
  - (b) Twelve feeders of 33 kV outgoing line
  - (c) Twelve feeders of 11 kV outgoing line
  - (d) Two 45 MVA power transformers
  - (e) Two 15 MVA power transformer

(4) New substation, 33/11kV indoor type switchgear 30 MVA output capacity with: —— 2 sets
  - (a) Two feeders of 33 kV incoming line
  - (b) Thirty-two feeders of 33 kV outgoing line
  - (c) Two feeders of 33 kV tie line
  - (d) Two 15 MVA power transformers

(5) 33kV distribution lines, twenty-four feeders —— 28 km

(6) 11kV distribution lines, forty-four feeders —— 138 km

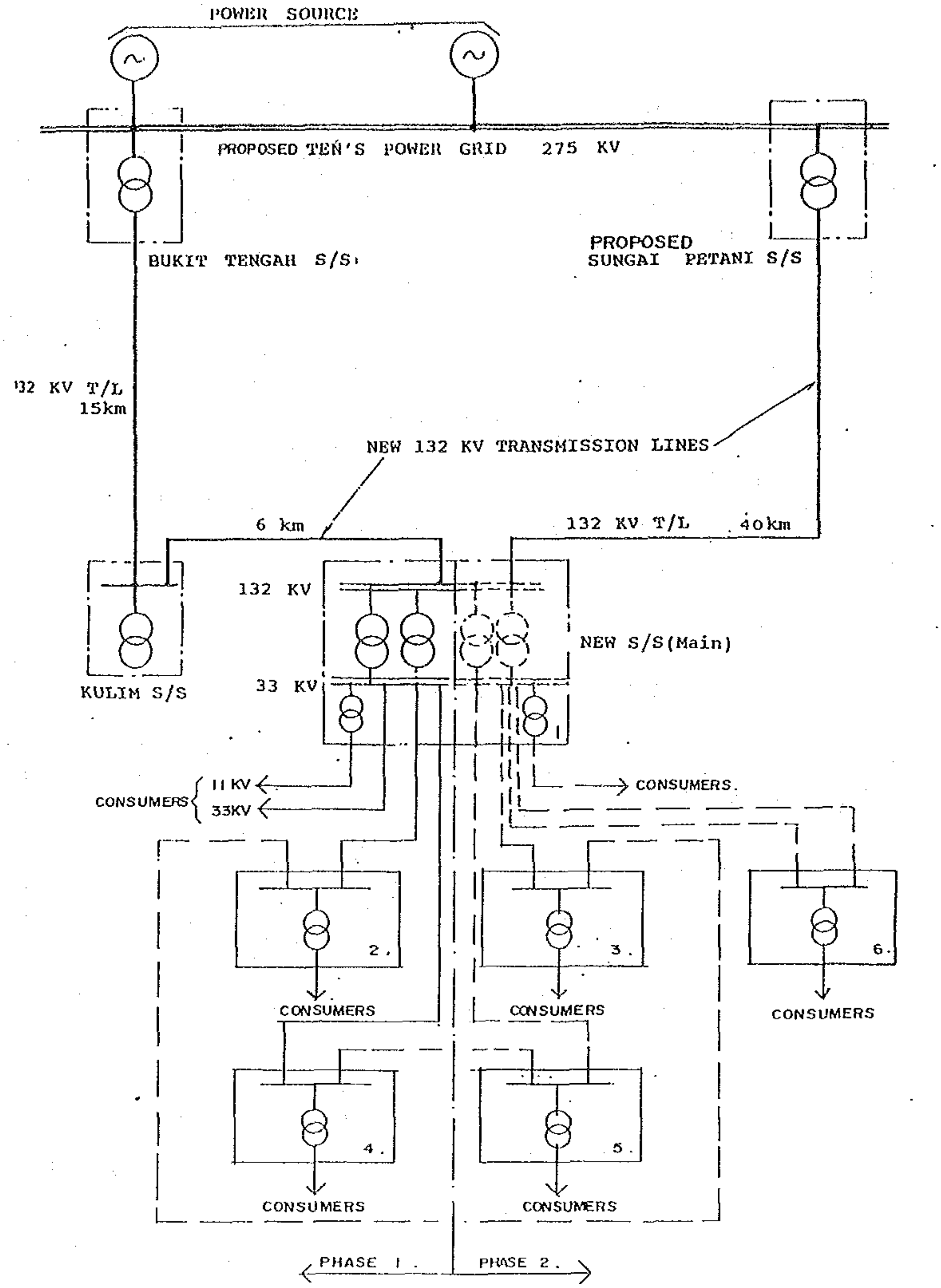
(7)	Extension of 132kV feeder bay for outgoing line of 132kV transmission line at the Kulim Substation including its control and protection system, 2 feeder bays	——	1 lot

Even if available fund may not be allowed in due time of the implementation or construction period will not be sufficient by taking normal contractual procedure, any facility of the total system should not be reduced.

The implementation of Phase 2 works is as follows:

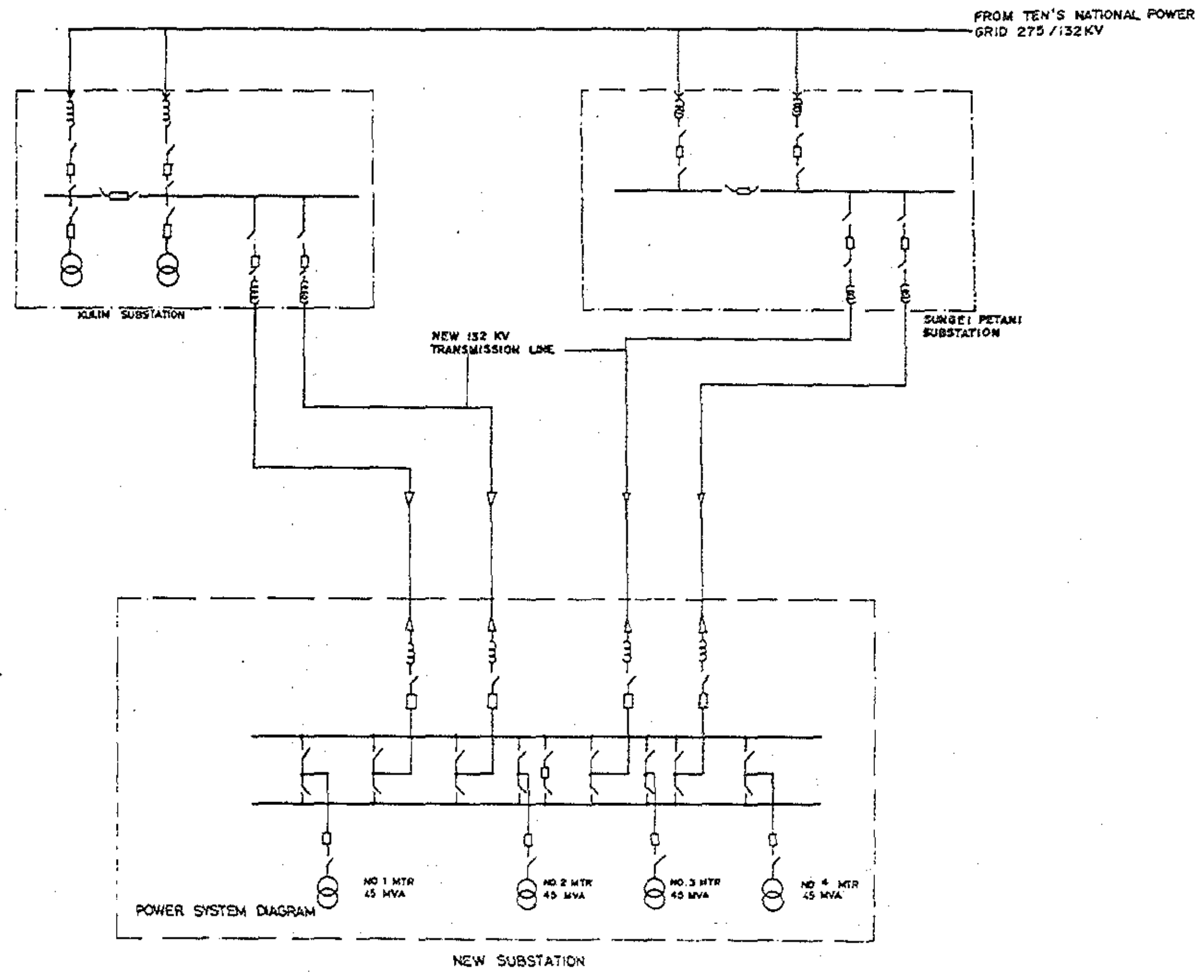
(1)	Augmentation of new substation, 132/33/11kV indoor type switchgear 90 MVA output capacity with a spare bank	——	1 set
(2)	New substation, 33/11kV indoor type switchgear 30 MVA output capacity	——	3 set
(3)	33kV distribution lines, twelve feeders	——	54 km
(4)	11kV distribution lines, twenty-six feeders	——	84 km
(5)	Extension of 132kV feeder bay for outgoing line of 132kV transmission line at the Sungai Petani substation including its control and protection system, 2 feeder bays	——	1 lot

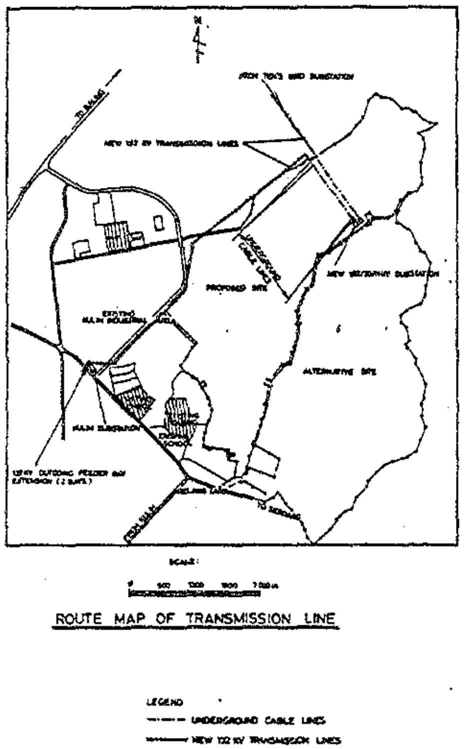
Fig. 5.3.1



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Overall Power Supply System Diagram

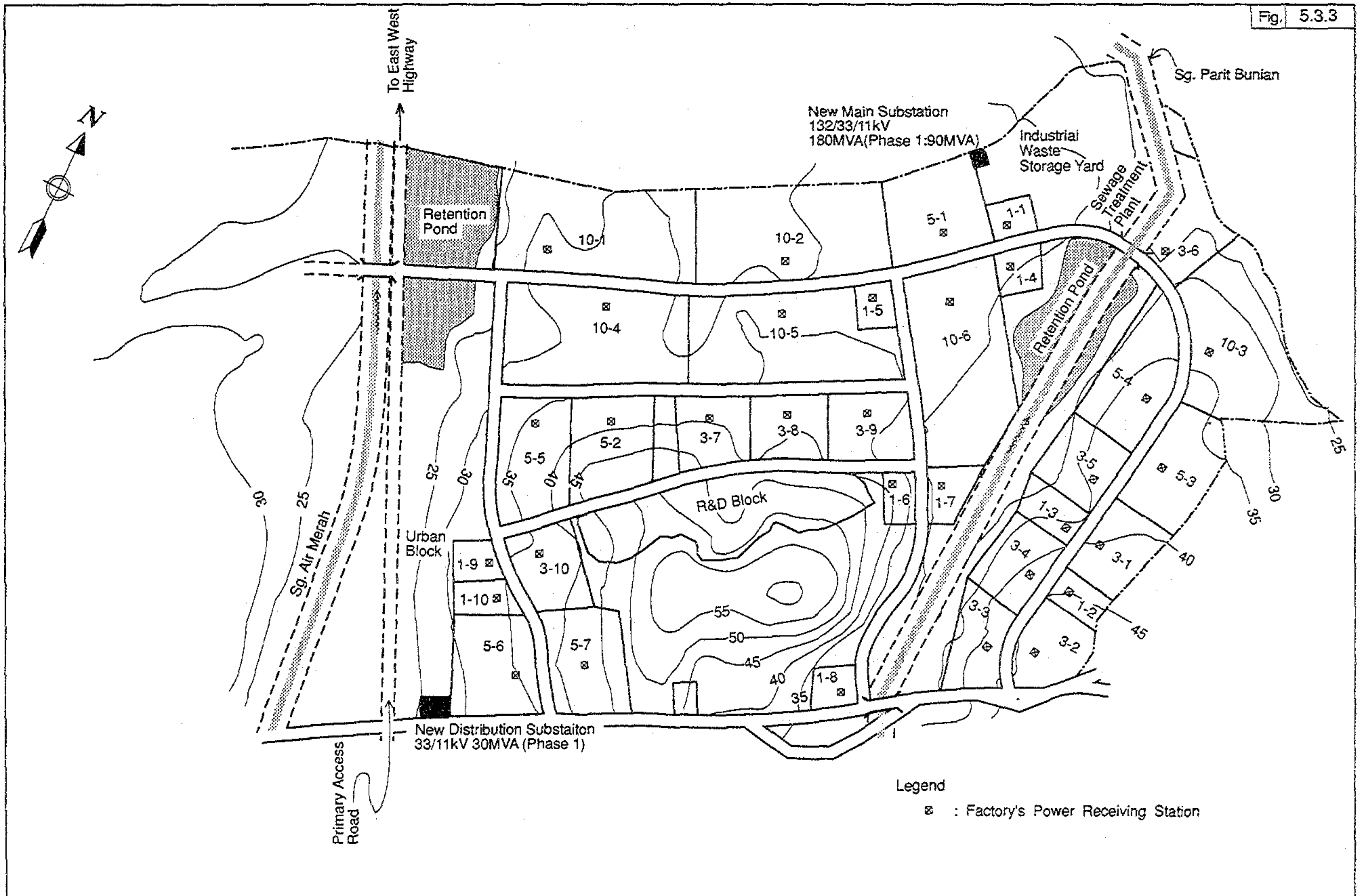
Fig. 5.3.2





ROUTE MAP OF TRANSMISSION LINE

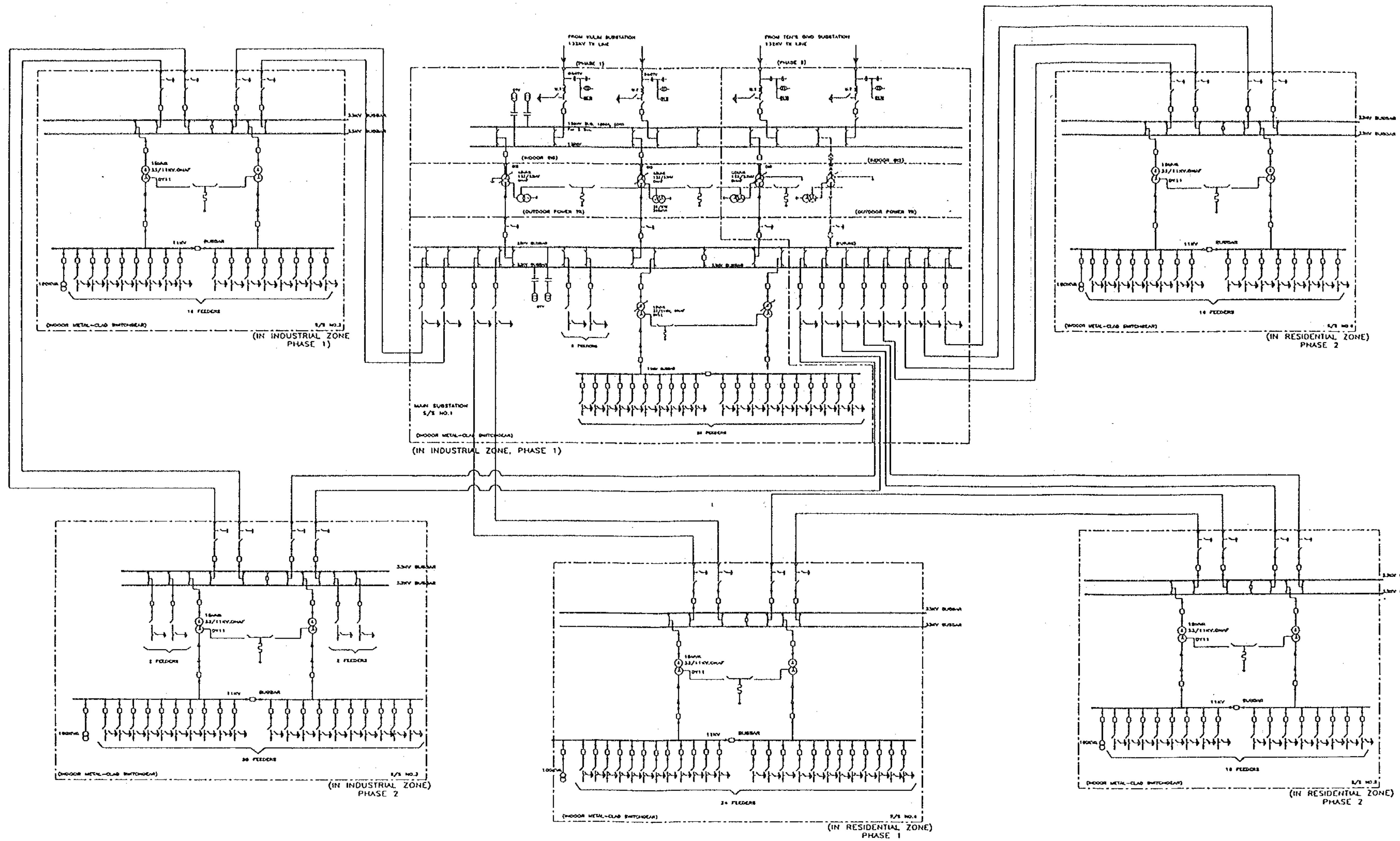
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE POWER SYSTEM DIAGRAM AND ROUTE MAP OF TRANSMISSION LINE



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Location of New Substation

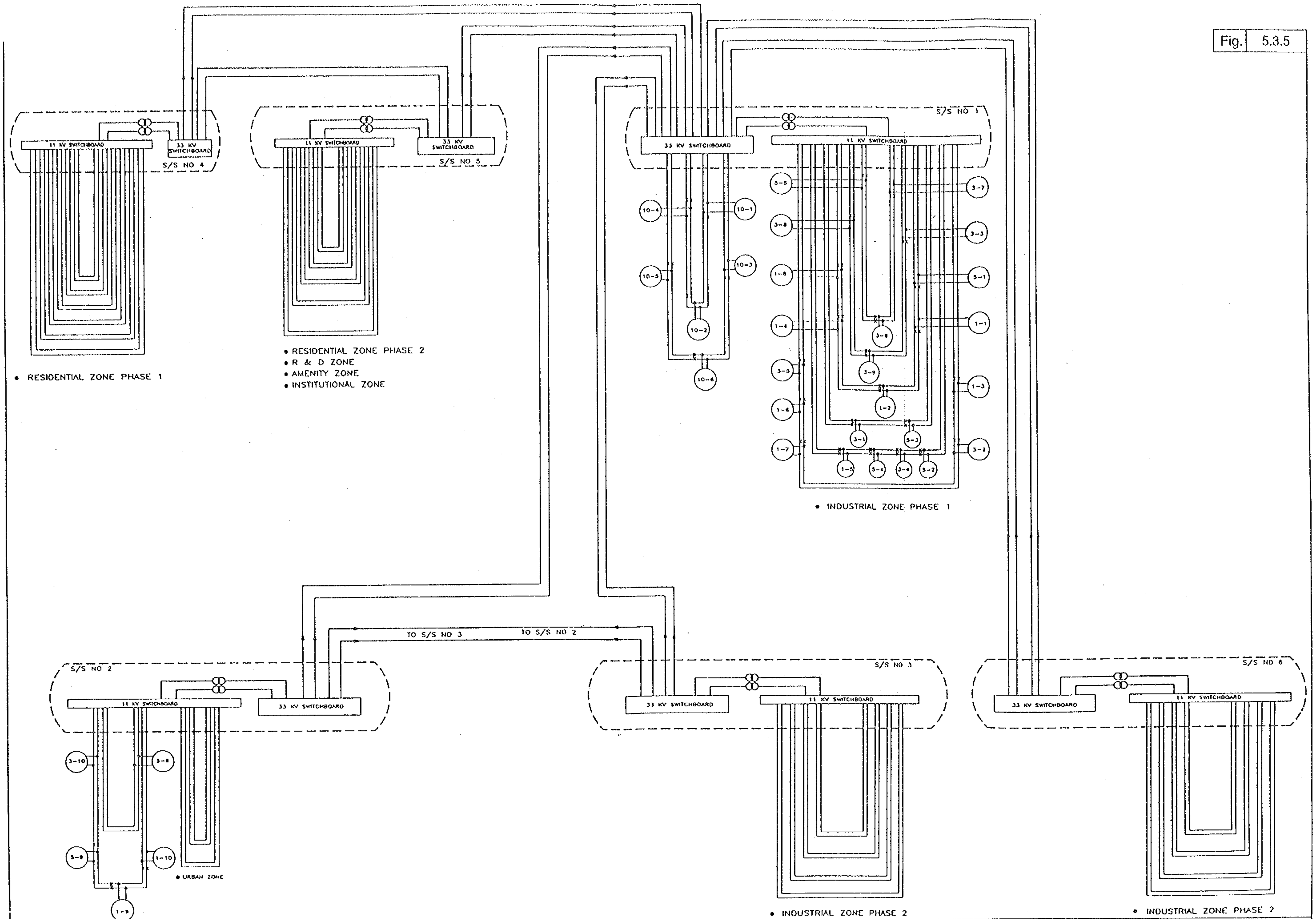
Fig. 5.3.3

Fig. 5.3.4

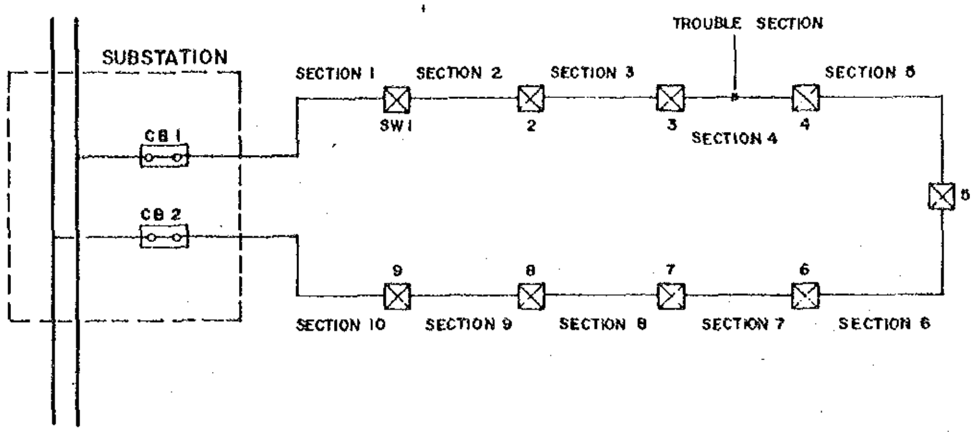


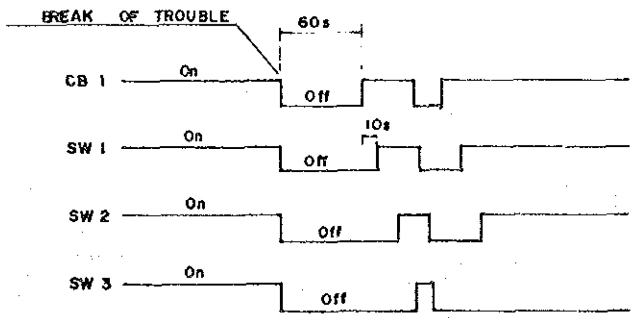
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Power Supply System Diagram

Fig. 5.3.5



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Block diagram of 33/11kV Distribution Lines



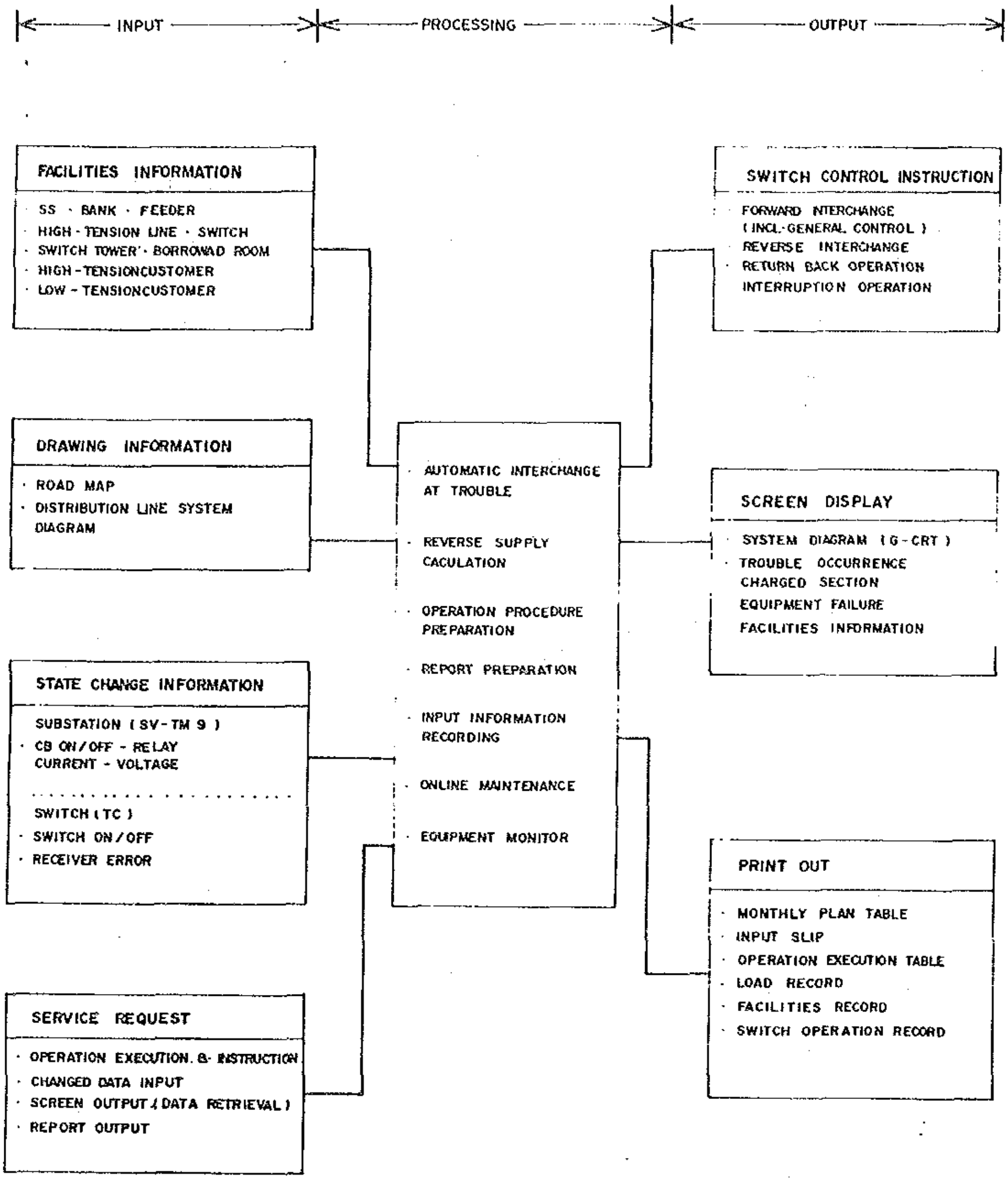


Step 1	Break Out Of Trouble
Step 2	CB 1, 2 : Off, Line Sectionalizer . 1 - 9 : Off
Step 3	CB1 : On (Enforce Distribution)
Step 4	Line Sectiondizer . On
Step 5	Line Sectionalizer : On
Step 6	Line Sectionalizer : On
Step 7	CB1 : Off, Line Sectionalizer 1 - 3 : Off .
Step 8	Line Sectionalizer 3, 4 : Lock .
Step 9	CB 1 , 2 On
Step 10	Line Sectionalizer 1 - 2 , 5 - 9 : On
Step 11	Power Supply

※ Operation Time Of Step 1 ~ 11 Is About 3 Min.

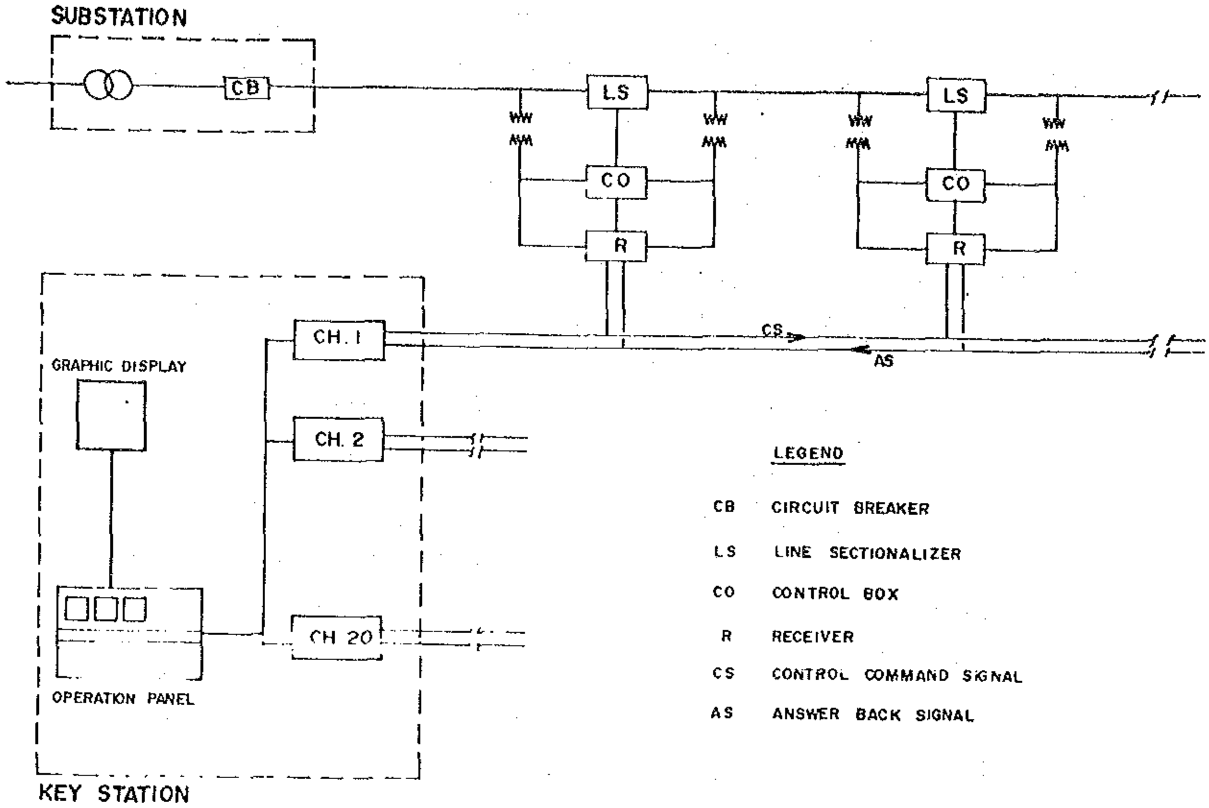
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE OPERATION SEQUENCE

Fig. 5.3.7



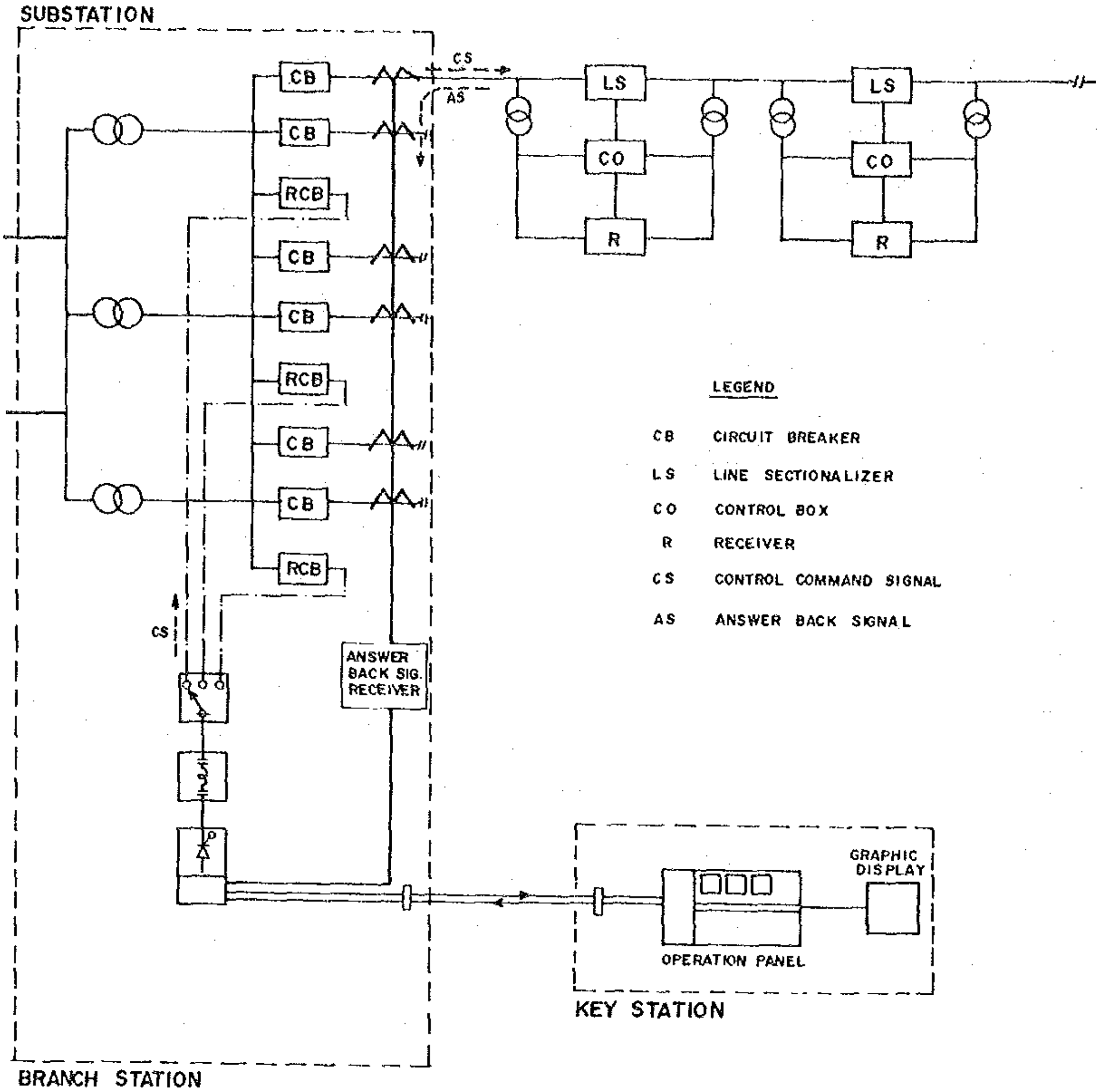
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE **PROCESSING FLOW**

Fig. 5.3.8



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE PULSE CODE MODULATION SYSTEM

Fig. 5.3.9



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RIPPLE CONTROL SYSTEM

5.4 Water Supply System

5.4.1 General

The scope of study for water supply system by the JICA Study Team is as follows:

- to show the location of water supply facilities such as service reservoirs, distribution network and other necessary facilities for the Hi-tech Industrial Zone,
- to provide the design values of water supply facilities,
- to advise on the development plan of the whole Park to be carried out by the Malaysian side (EPU/KSDC) and
- to advise on the water supply development outside the Park which is to be carried out by the JKR.

JKR is going to carry out the Kulim Water Supply Phase 2 Scheme as follows:

Objective	:	to formulate extension of water supply system and to construct a new water treatment plant, reservoirs, distribution and reticulation network.
Service Area	:	Kulim, Junjong, Lunas, Padang Serai, Sg. Karangan areas and north bank of the Sg. Muda at Sidam Kanan as well as proposed Kulim Hi-Tech Industrial Park (1,450 ha)
Water demand	:	to be projected up to the year of 2010.
Agency	:	JKR

The construction is expected to be completed by the end of 1994. The water for the Industrial Zone will be supplied from the existing system until its completion.

Design conditions and design criteria are prepared based on the following basic policy:

- To ensure stable water supply
- To locate service reservoir near the demand centre

"DESIGN CRITERIA & STANDARDS FOR WATER SUPPLY SYSTEMS" are published in three volumes by the Water Supplies Branch, JKR. These design criteria and standards were compared with the Japanese design criteria and standards for application to the design of Industrial Zone. Malaysian design criteria and standards are mainly applied to the basic design since Malaysian Standards are more conservative than Japanese Standards.

5.4.2 Design Conditions

(1) Water demand projection for the whole Park

In accordance with the agreed minutes of technical committee meeting on 21st January 1992, water demands were modified from the Draft Final Report, in which they were estimated based on the overall plan prepared by the JICA Study Team. Water demand of the first phase Industrial Zone was estimated by the JICA Study Team and those of the other zones were estimated by the Malaysian Master Plan study team in their progress report 2 in January 1992. They are as shown below.

1)	Water demand estimated by the JICA Study Team		
(a)	First Phase Industrial Zone	:	27,372 m^3/d
2)	Water demand estimated by the Master Plan study team		
(a)	Second Phase Industrial Zone	:	12,134 m^3/d
(b)	R & D/Urban Zone	:	4,082 m^3/d
(c)	Housing Zone	:	21,741 m^3/d
(d)	Amenity Zone	:	2,989 m^3/d
3)	Total water demand	:	68,318 m^3/d
4)	Unaccounted for water	:	15%
5)	Water requirement from JKR water supply system	:	80,400 m^3/d = 68,318/(1-0.15)

(2) Water supply systems

<u>Outside Park</u>

Water source	: Muda river and Kulim river
Treatment plant (T/P)	: to be constructed by JKR
Pumping station	: to be constructed by JKR

Transmission main	: to be constructed by JKR
Design discharge to the Park	: 80,400 m^3/d (to be studied on phased development)

<u>Inside Park</u>

Service reservoir	: 3 units (i.e. R1, R2 and R3)
R1 Reservoir	
Location	: on Bukit Jelutong
Service area	: R&D/Urban, Housing and Amenity Zones
R2 Reservoir	
Location	: on the hill in 2nd phase Industrial Zone
Service Area	: 1st phase Industrial Zone
R3 Reservoir	
Location	: on the hill in 2nd phase Industrial Zone
Service Area	: 2nd phase Industrial Zone
Distribution trunk main	: from R1 to R2
Length	: 4,000 m
Material	: steel pipe or equivalent
Distribution/reticulation network	: 1st phase Industrial Zone

Pipe materials and diameters : >100 mm

- Cast iron; (nominal diameter)
  150, 200, 250, 300, 350, 400, 450, 500, 600 mm

- Ductile iron; (nominal diameter)
  150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, 1000, 1100, 1200, 1400, 1600 mm

- Steel; (nominal diameter)
  150, 200, 250, 300, 350, 400, 450, 500, 600, 650, 700, 750, 800, 850, 900 mm

- High density polyethylene; (outside diameter)
  125, 140, 160, 180, 200, 225, 250, 280, 315, 355, 400, 450, 500, 560, 630, 710, 800 mm

- Other materials should be considered if necessary.

5.4.3 Basic Design Criteria

Design criteria in this section is prepared for the Industrial Zone.

(1) Water quality : WHO standard (ref.Tables 5.4.1 & 5.4.2)

(2) Water Consumption :

(a) Daily average water consumption (DAWC)
= Daily water demand/(1 - Unaccounted for water)

(b) Daily maximum water consumption (DMWC)
= DAWC x 1.2 (peak factor)
(There is slight fluctuation through the year according to JKR.)

(c) Design discharge for distribution trunk main
= DMWC

(d) Hourly maximum water consumption (HMWC)
= DMWC/24 x 2.5 (peak factor)
(Applied for distribution network)

(e) Design discharge for distribution/reticulation network
= HMWC

(3) Distribution System : Network System

(a) Service reservoir : R1 and R2
- Capacity : daily water demand
- Drawdown : 3 to 6 m
- Freeboard : more than 30 cm
- Dead water depth : more than 15 cm

(b) Distribution main : from R1 to R2
- material : steel pipe
- Velocity : $0.6 \text{ m/s} < V < 2.6 \text{ m/s}$

(c) Flow calculation : Hazen Williams Formula

$$V = 0.35464 \times C \times D^{0.63} \times (h/L)^{0.54}$$

where, C : coefficient for the future of 20 years

D : internal diameter in m

h : head loss in m

L : distance in m

(d) Residual pressure : Min.= 15 meters
Max.= 60 meters

5.4.4 Basic Design

Basic design were also modified from the Draft Final Report taking into account the modified water demands. It is required that JKR will supply treated water for the whole Industrial Park at the rate of 80,400 m^3/d taking into account the unaccounted for water in the Park. It should be supplied by stage development in accordance with the development of the Park.

Fig. 2.4.3 and Fig. 5.4.1 show the basic layout of water supply system. The service reservoir R1, where water will be pumped up by JKR water supply system, will be located on Bukit Jelutong above El.270 ft. The capacity of the service reservoir R1 is estimated at 33,900 m^3 of daily water demand for the R&D/Urban zone, housing zone and amenity zone. Figs. 5.4.2 and 5.4.3 show layout of R1 reservoir. The reservoir R1 will be connected with the service reservoirs R2 and R3 in the 2nd phase Industrial Zone by the distribution trunk main. The reservoir R3 should be designed at the time of second phase implementation.

The capacity of the service reservoir R2 and R3 is estimated at 32,000 m^3 and 14,000 m^3 respectively. Figs. 5.4.4 and 5.4.5 show layout of R2 reservoir. The reservoir R2 is located at the ground El.210 ft. The reservoir R3 is assumed to be at the same El.210 ft. The distribution trunk main which connects the reservoirs R1 and R2 is made of steel pipe to avoid leakage. The length is estimated at 3,940 m and the diameter is determined at 750 mm from hydraulic calculation. The alignment of distribution trunk main should be reviewed and finalized based on the results of the Master Plan of the Park.

The distribution network in the first phase Industrial Zone is laid under the ground along the roads. The material of the distribution pipe recommended is high quality steel pipe, uPVC or high density polyethylene. The pipe diameter is determined as shown in Fig.5.4.6 based on the result of net flow calculations.

The summary of water supply system is as follows:

Service Reservoirs

R1 Reservoir

Location	:	on Bukit Jelutong
Service area	:	R&D/Urban, Housing and Amenity Zones
Design capacity	:	33,900 m^3
Area of reservoir	:	5,600 m^2 (53 m x 53 m x 2 units)
High water level	:	295 ft. (90 m)
Low water level	:	275 ft. (84 m)
Design discharge to service area	:	4,238 m^3/h

R2 Reservoir

Location	:	on the hill in the 2nd phase Industrial Zone
Service Area	:	1st phase Industrial Zone
Design capacity	:	32,000 m^3
Area	:	5,400 m^2 (49 m x 55 m x 2 units)
High Water Level	:	230 ft. (71 m)
Low Water Level	:	213 ft. (65 m)
Design discharge to service area	:	4,025 m^3/h

R3 Reservoir

Location	:	on the hill in 2nd phase Industrial Zone
Service Area	:	2nd phase Industrial Zone
Design capacity	:	14,000 m^3
Area of ewawecoie	:	2,400 m^2 (40 m x 30 m x 2 units) type is to be reviewed.
Design discharge to service area	:	1,784 m^3/h

Distribution trunk main

Location	:	from R1 to R2
Design discharge	:	0.645 m^3/s
Length	:	3,940 m
Material	:	steel pipe
Diameter	:	750 mm

Distribution network

Location : 1st phase Industrial Zone

Material : steel pipe, uPVC or high density poly-ethylene pipe

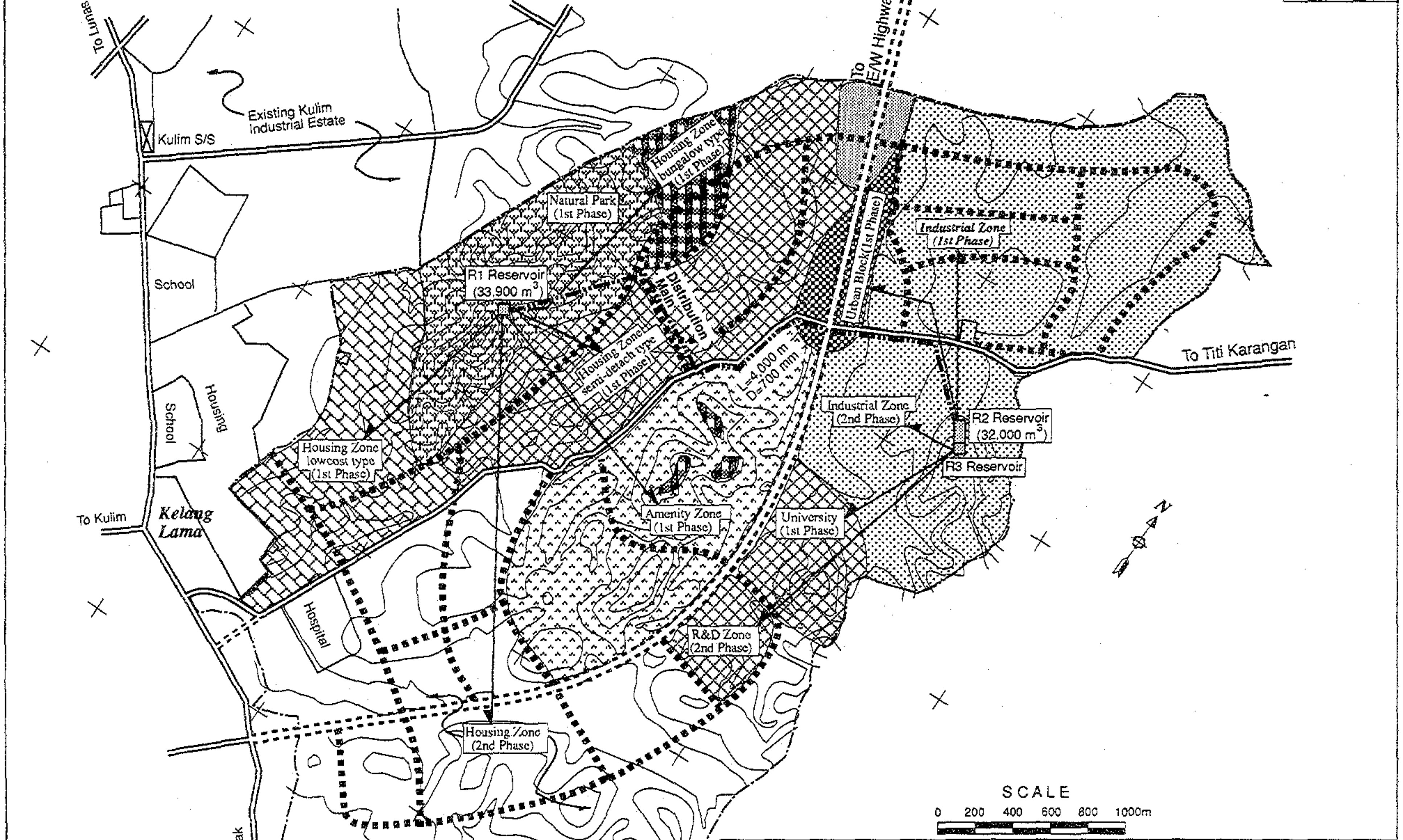
Table 5.4.1 Standard of Raw Water Quality

Parameters	ACCEPTABLE VALUE (mg/l)
Coliform organism	less than 5,000
Turbidity (NTU)	1,000
Colour (HAZEN)	300
pH	5.5 - 9.0
Total dissolved solid	1,500
Biological Oxygen Demand (BOD)	6.0
Ammonia NH4	0.5
Anionic Detergent MBAS	1.0
Arsenic (As)	0.05
Cadmium (Cd)	0.01
Chloride	100
Chromium (Cr)	0.05
Copper (Cu)	1.5
Cyanide (Cn)	0.05
Fluoride	1.5
Hardness as $CaCO_3$	500
Iron (Fe)	1.0
Lead (Pb)	0.1
Manganese (Mn)	0.2
Magnesium & Sodium Sulfate	1,000
Mercury (Hg)	0.001
Nitrate NO_3	25
Phenol	0.002
Selenium (Se)	0.01
Silver (Ag)	0.05
Sulfate	400
Total Nitrogen N (NO_3)	1.0
Zinc (Zn)	1.5

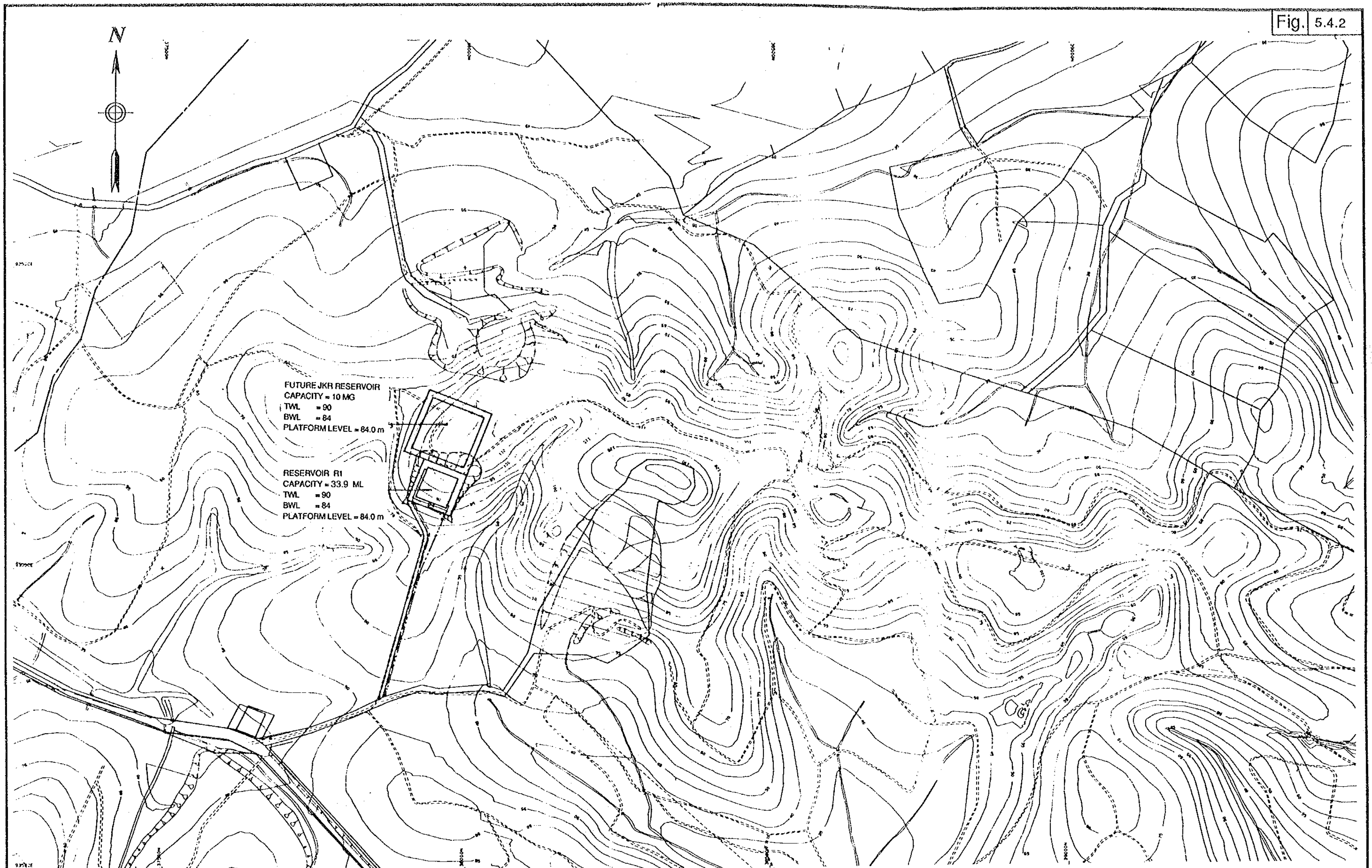
Table 5.4.2 Standard of Treated Water Quality

Parameters	Unit	Reference Value
Inorganic constituent of health significance		
Antimony (Sb)	mg/l	0.01
Arsenic (As)	do.	0.05
Cadmium (Cd)	do.	0.005
Chromium (Cr)	do.	0.05
Cyanide (Cn)	do.	0.05
Fluoride (F)	do.	0.6 - 0.8
Lead (Pb)	do.	0.05
Mercury (Hg)	do.	0.001
Nickel (Ni)	do.	0.05
Nitrate NO_3	do.	25
Selenium (Se)	do.	0.01
Organic constituent of health significance		
Pesticides and related products		
Individually	do.	0.0001
in total	do.	0.0005
Polynuclear aromatic hydrocarbons (PAH)	do.	0.0002
Other organochlorine compounds additional to pesticides etc.	do.	0.001
Other characteristics		
Colour	(HAZEN)	300
Odour		Inoffensive
Taste		Inoffensive
Turbidity	(NTU)	2
pH		6.5 - 8.5
Aluminum (Al)	mg/l	0.1
Ammonia NH4	do.	0.05
Calcium (Ca)	do.	75
Chloride (Cl)	do.	100
Copper (Cu)	do.	0.05
Hydrogen Sulfide (H_2S)	do.	Not detectable
Iron (Fe)	do.	0.1
Magnesium (Mg)	do.	30
Manganese (Mn)	do.	0.05
Potassium (K)	do.	10
Sodium (Na)	do.	100
Sulfate (SO_4)	do.	200
Zinc (Zn)	do.	5
Anionic Detergent	do.	0.2
Mineral oil	do.	0.01
Phenolic compounds	do.	0.001
Total dissolved solids	do.	500
Total hardness as $CaCO_3$	do.	100

Fig. 5.4.1

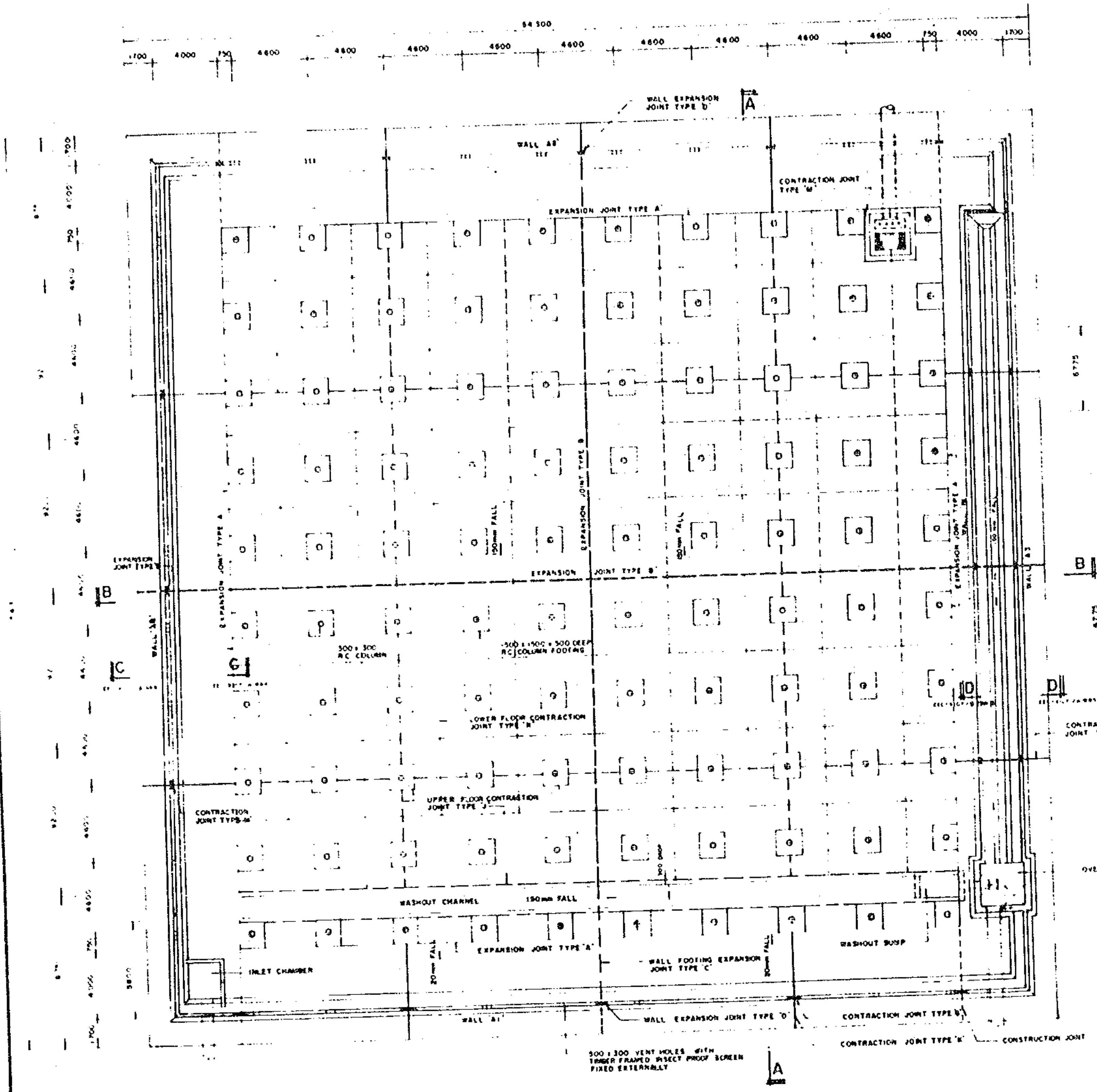


THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE	Basic Layout of Water Supply System



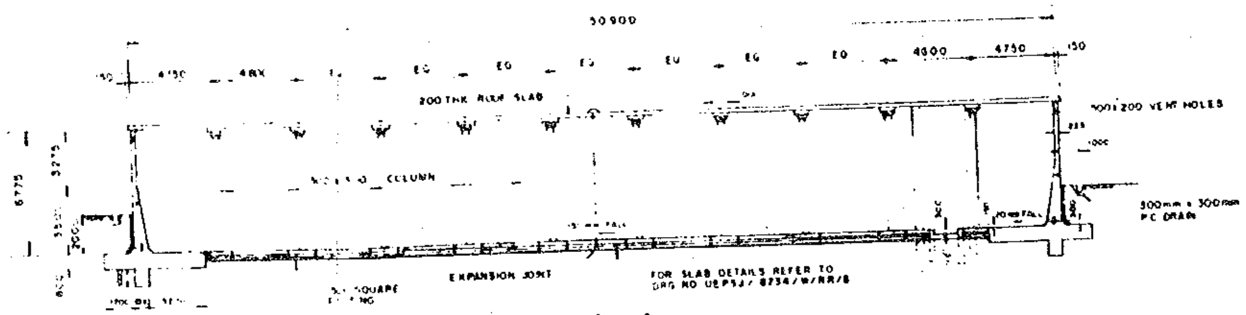
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE R1 Service Reservoir,

Fig. 5.4.3



GROUND LAYOUT PLAN

SCALE 1 : 150



SECTION A - A

SECTION B - B

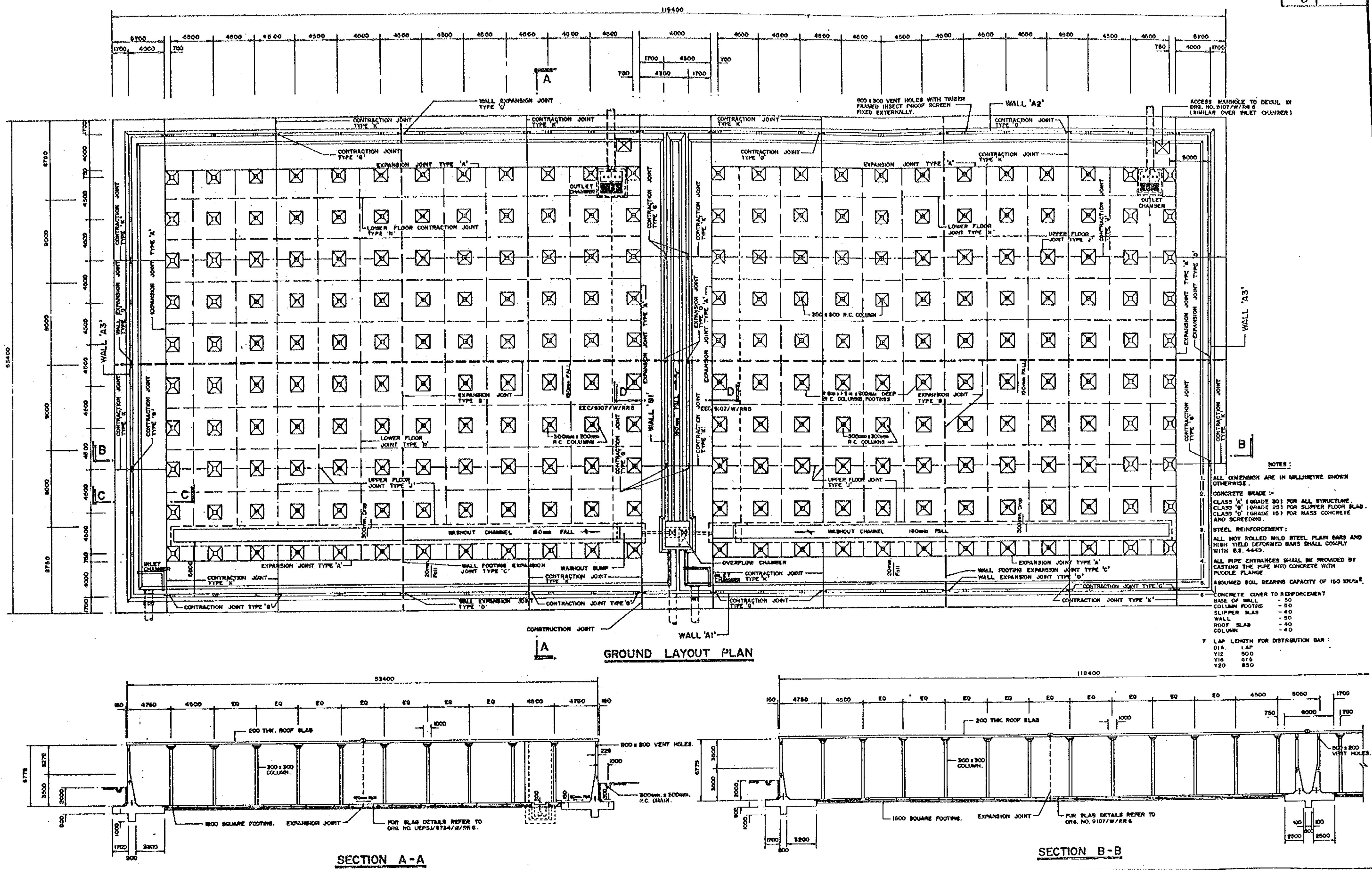
NOTES

1. ALL DIMENSION ARE IN MILLIMETRE SHOWN OTHERWISE
2. CONCRETE GRADE
   CLASS 'A' (GRADE 30) - FOR ALL STRUCTURE
   CLASS 'B' (GRADE 25) - FOR SLIPPER FLOOR SLAB
   CLASS 'C' (GRADE) - FOR MASS CONCRETE AND SCREEDING
3. STEEL REINFORCEMENT
   ALL HOT ROLLED MILD STEEL PLAIN BARS AND HIGH YIELD DEFORMED BARS SHALL COMPLY WITH BS 4449
4. ALL PIPE ENTRANCES SHALL BE PROVIDED BY CASTING THE PIPE INTO CONCRETE WITH PUDDLE FLANGE
5. ASSUMED SOIL BEARING CAPACITY OF 150 KN/m²

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE R1 Service Reservoir, Plan & Section

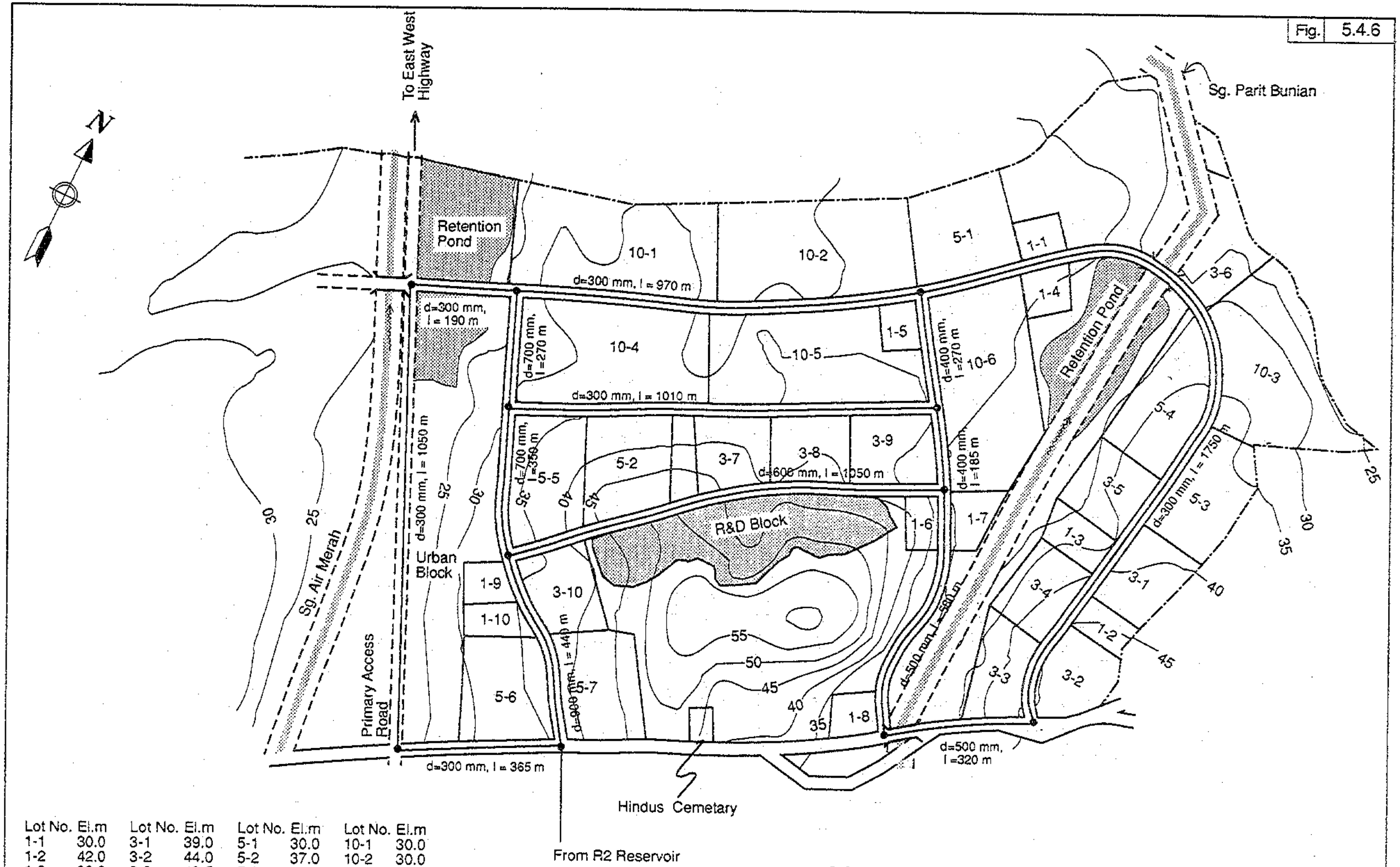
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE R2 Service Reservoir, Layout

Fig. 5.4.5



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE R2 Service Reservoir, Plan & Section

Fig. 5.4.6



Lot No.	El.m	Lot No.	El.m	Lot No.	El.m	Lot No.	El.m
1-1	30.0	3-1	39.0	5-1	30.0	10-1	30.0
1-2	42.0	3-2	44.0	5-2	37.0	10-2	30.0
1-3	39.0	3-3	43.5	5-3	36.0	10-3	33.0
1-4	31.0	3-4	42.0	5-4	34.0	10-4	30.5
1-5	30.5	3-5	36.5	5-5	34.5	10-5	30.5
1-6	33.0	3-6	30.5	5-6	35.0	10-6	32.0
1-7	33.0	3-7	38.0	5-7	37.0		
1-8	34.5	3-8	37.0				
1-9	33.0	3-9	35.0				
1-10	34.0	3-10	36.0				

SCALE
0 100 200 300 400 500m

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Distribution Network

5.5 Telecommunication System

5.5.1 Basic Design Policy

(1) General

Telecommunication system should have responsibility to meet not only ordinary telephone demand, but also the special demands such as high speed digital data-communication for Hi-Tech Industries.

This concept requires that the above high level demand be met, and the system should connect up well to the national and international network. These requirements will be satisfied by the following systems which are described in the Annex :

(a) FOKUS (Fiber optics long transmission line plan)

For nation wide and international telecommunication

(b) Fiber optics junction (Fiber optics short distance transmission between telephone offices)

For connection between the Kulim Hi-Tech Industrial Park and Kulim telephone office

(c) Digitalization of switch and transmission line (Replacement of analog equipment)

To carry digital information including computer data-communication

(2) Demarcation of scope of work

KSDC is responsible for procurement of the site for a telephone office and construction of underground ducts.

STM is responsible for construction of a telephone office building, installation of telecommunication equipment and cable laying. Maintenance of the underground ducts facilities also falls under the responsibility of STM.

This demarcation will be adopted for all zones. The installation of wiring within individual buildings or houses is the responsibility of the respective subscriber.

The JICA Study Team is responsible for the basic design of duct laying plan in the Industrial Zone, and advice on the telecommunication system to be developed for the Hi-Tech Park.

(3) Capacity of exchange

The capacity of the proposed exchange should be determined after examination of the forecasted demand of the whole Hi-Tech Industrial Park (1,450 ha).

(4) Reliability

The Kulim Hi-Tech Industrial Park requires high reliability of communication, which is satisfied by multi-routing with the existing national network.

(5) Teleport

The concept of teleport is the regional development with telecommunication infrastructure. Description on teleport is made in the Annex. For Kulim Hi-Tech Industrial Park, initially, the teleport will be the same as the telephone office and be developed with full equipment after the implementation of the second phase development.

In telecommunication network, the teleport is same as the telephone office. A telephone office is desirable to locate in the "gravity center" of telephone demands. But in the case of teleport, "Urban Zone" is better than gravity center in order to inform latest news and instruct new services to people.

For city activity and future extension of telecommunication, the site area should be large enough to extend the system, such as an earth station, exhibition room, seminar room, and TV conference room.

(6) Toll junction line

This Park itself will be a Local Telephone Area (LA), which is to be connected to the national network with toll junction lines in telecommunication hierarchy. The nearest Group Switching Center (GSC) of the national network is Kulim Telephone Exchange, approximately 6 km away from Kulim Hi-Tech Industrial Park.

To ensure reliability of the transmission system, provision of two transmission routes is recommended, one by optical fiber digital transmission system and the other by radio system. The radio system to connect Kulim new telephone exchange to Pinang via Bukit Mertajam Hill (for example) is desirable.

The telephone office building and the antenna tower for the radio system should be constructed such that, there is good harmony with the surrounding environment.

5.5.2 Demand Forecast

(1) Total number of main telephone lines

Total number of main telephone lines (subscribers) in the whole Park (1,450 ha) will be about 9,060 lines in 2003. The summary is shown in Table 5.5.1 and the calculation process is presented in the Annex. However, the required number of lines is to reviewed after the master plan study.

The ratio of public telephone is less than 2% of total number of telephones. The demand is, therefore, included in the overall telephone demand.

Table 5.5.1 Telephone Demand of Whole Park

Unit : Number of subscribers

	Phase 1 in 2003	Phase 2 in 2008
1. Industrial Zone	1,310	600
(1) Factory Area	1,200	600
(2) Administration centre	110	–
2. R & D/Urban Zone	480	20
(1) City Centre	390	–
(2) R & D	90	–
– university	90	20
– private R & D	–	20
3. Housing Zone	5,200	2,260
(1) House	5,000	2,200
(2) School	80	20
(3) Community	120	40
4. Amenity Zone	20	–
5. Total	7,010	2,880

(2) Demand growth by year

The following steps are assumed for demand growth.

- 1993 ; About 25% of Phase 1 demand (in Table 5.5.1)
- 1996 ; 100% of Phase 1
- 1998 ; About 25% of Phase 2
- 2003 ; 100% of Phase 2
- 7% is assumed as annual growth rate of demand.

The results are shown in Table 5.5.2.

Table 5.5.2 Demand Growth by Year

	Phase 1	Phase 2	Total
1993	890	–	890
1996	4,380	–	4,380
1998	5,010	370	5,380
2003	7,010	2,050	9,060
2008	9,860	2,880	12,700

(3) Demand for Other Telecommunication Services

(a) Telex

The number of telex subscribers is decreasing by absorption of new services.

(b) Telefax

The demand is included in the demand of main telephone line.

(c) Maypac, Maysis, Datel

These are for data transmission,and the demand is increasing rapidly. Maypac is the most important system for digital data transmission such as computer communication, so service should be provided from the initial stage of Phase 1.

(d) Leased circuit

IBS (Intelsat Business Service) is a leased circuit service using satellite telecommunication. Transmission rate of the service is 64 kb/s, 128 kb/s and 2 Mb/s.

The service will be required from the initial stage for the Industrial Park in accordance with the demand of the factories who intend to come this Park.

(e) Car telephone

The number of subscribers of car telephones by STM is increasing rapidly and presently number 54,000, which is about 3% of telephone subscribers on service. The initial service for Kulim Hi-Tech Industrial Park will be provided by the existing system.

5.5.3 Design Conditions and Criteria

(1) Exchange capacity

(a) Both conditions satisfying (1) demand of subscriber after 5 years and (2) demand as 60% in using ratio (subscriber/exchange line) are considered to determine exchange capacity. Design exchange capacity (number of exchange lines) is adopted from the larger values in the above conditions as follows:

Year	1993	1998	2003
Design Capacity	5,000	8,000	12,000 lines

(b) A exchange building with 4 storeys and 1,000m^2 (total) including some teleport rooms will cover the demand of the year 2008.

(2) Toll junction line

(a) Traffic

The facility which will be installed in 1993, 1998, 2003 shall satisfy the traffic in 1998, 2003 and 2008 respectively.

The calculated traffic via toll trunk circuit is as follows:

Year	1993	1998	2003	
Traffic	210	310	470	Erlang

(b) Number of circuits

The number of circuits is calculated by assuming an efficiency ratio of 60% and the transmission capacity is forecasted as follows:

Year	1993	1998	2003
No. of Circuit	350	550	770 lines (*)
Transmission Capacity	14	22	30MB (Mega Bit)

(*) : outgoing and incoming

(c) Transmission system

- Optical fiber system

In the future, three (3) systems are needed and six (6) core optical fiber cable is required as junction cable. One system is between Kulim Hi-Tech Industrial Park and old Kulim telephone office (Kulim GSC), and another one is straightly for long distance and one more system is spare, and 140 MB transmission capacity system is recommended.

- Micro-wave system

Digital Micro-wave system (for example: 2 GHz, 24 MB) is considered to improve reliability of transmission in the future.

(3) Cable and duct

(a) Cable pair distribution plan

- Direct distribution method (No Cross-connection Cabinet) shall be applied to the area in which exchange is near and/or comparatively stable demand is expected.

- Cross-connection cabinet area shall be so sized for 300-600 subscribers in order to minimize the cost of primary cables.

- Direct distribution method is applied to the Industrial Zone and cross-connection cabinet method is applied to the Housing Zone.

- Cable pair is designed as 1.4 times the demand in 2003 for direct distribution area, and 1 time for cross-connection cabinet area.

- The following relationship between factory lot area and demand is applied.

Area	Demand/Lot	Cable Pair/Lot
10 ha	50	70
5 ha	40	60
3 ha	30	50
1 ha	30	40

(b) Transmission loss

- Transmission loss standard is 8db from local exchange to subscriber.
- Marginal distance by transmission loss

0.4 mm (1.81 db/km) : 4.4 km (295 ohm/km)
0.5 mm (1.43 db/km) : 5.6 km (187 ohm/km)
Both are less than 1500 ohm (Marginal resistance)

(c) Cross connecting cabinet

The capacity of cross connection cabinet is assumed as follow:

Primary : 600 pr
Secondary : 800~900 pr
Capacity : 1,600 pr

(d) Duct

- Duct is designed to satisfy the year 2008's demand.
- Number of ducts shall be estimated as follows:

$$D = S \times 1.4 + J + P + B$$

S : No. of subscriber cable for year 2008's demand
J : No. of optical fiber cable
P : One spare duct
B : Spare for "Even number of duct"

- Duct size: 100 mm diameter PVC

(e) Manhole

- STM standard is applied in the design.
- For optical fiber connection, no handhole is desirable.

(4) New service and teléport

(a) For the demand of new service it is important to forcast the size of basic plant which should cover long term requirements from the initial stage.

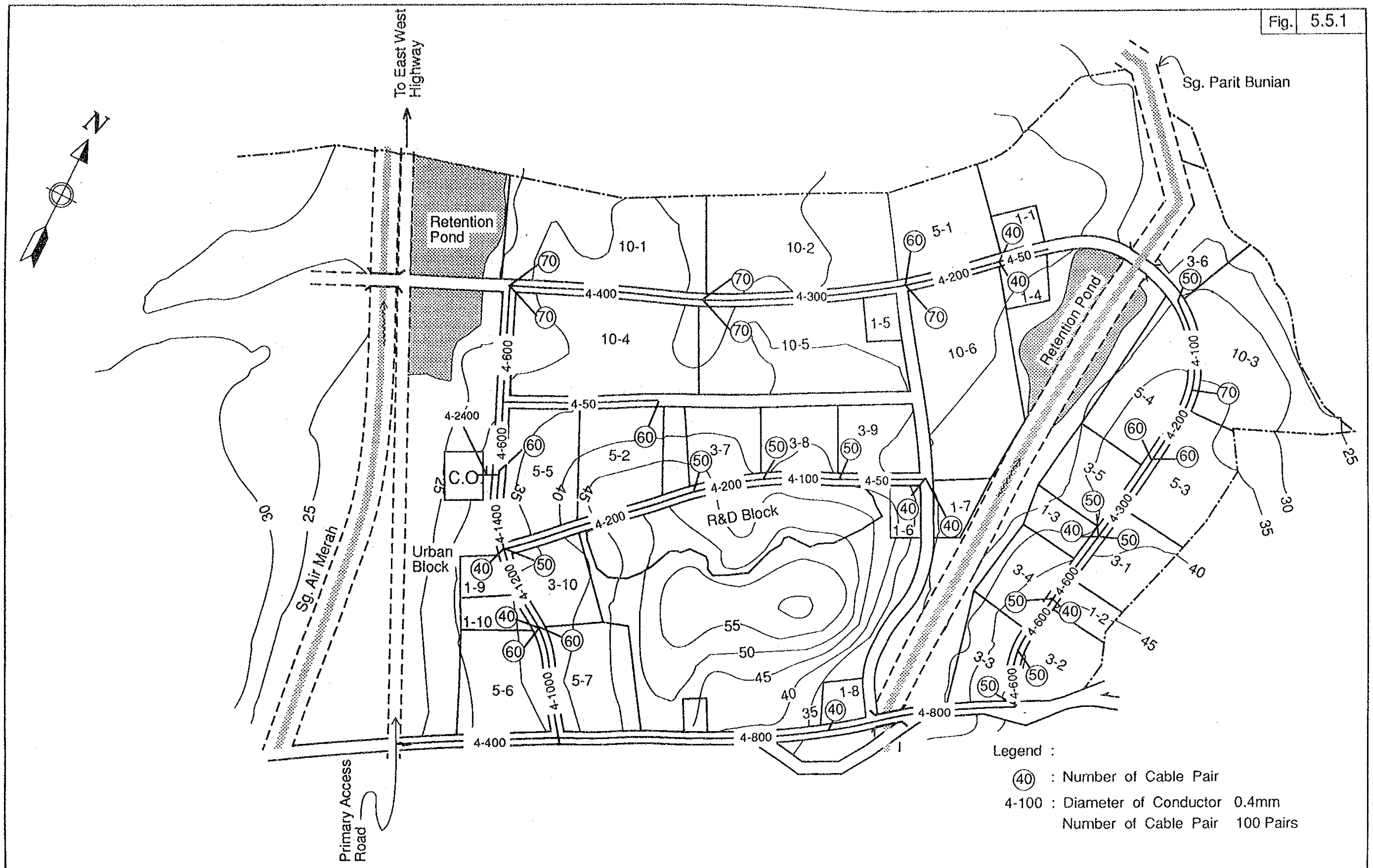
(b) Digital technology supplies many services by mono-media like ISDN (Integrated Service of Digital Network), then additional 10% of telephone subscriber demand will cover the future new service demand of the basic plant.

(c) Teleport: Optical fiber LAN (Local Area Network) will be required in the next stage. So one additional duct for optical fiber cable is planned. The area of telephone office building (1000m^2) includes rooms for the teleport function.

5.5.4 Basic Design

The following is basic design value of the telecommunication facilities which should be consulted by 1993. Figs. 5.5.1 and 5.5.2 show the cable plan and duct plan, respectively of the Industrial Zone in Phase 1.

Location of telephone office	:	in the urban block
Site area	:	1 ha
Floor area	:	1,000m^2
Exchange capacity	:	5,000 lines
Toll junction system	:	Kulim telephone office to new telephone office
Cable	:	Optical fiber, 6 core
Length	:	6 km
Transmission system	:	1 system + stand by in 1993 2 systems + stand by in 1998
Radio system	:	New telephone office to Penang
Type	:	Microwave, 2GH_2, 24 MB
Relay station	:	At Bukit Mertajan hill
Teleport	:	To be considered in future

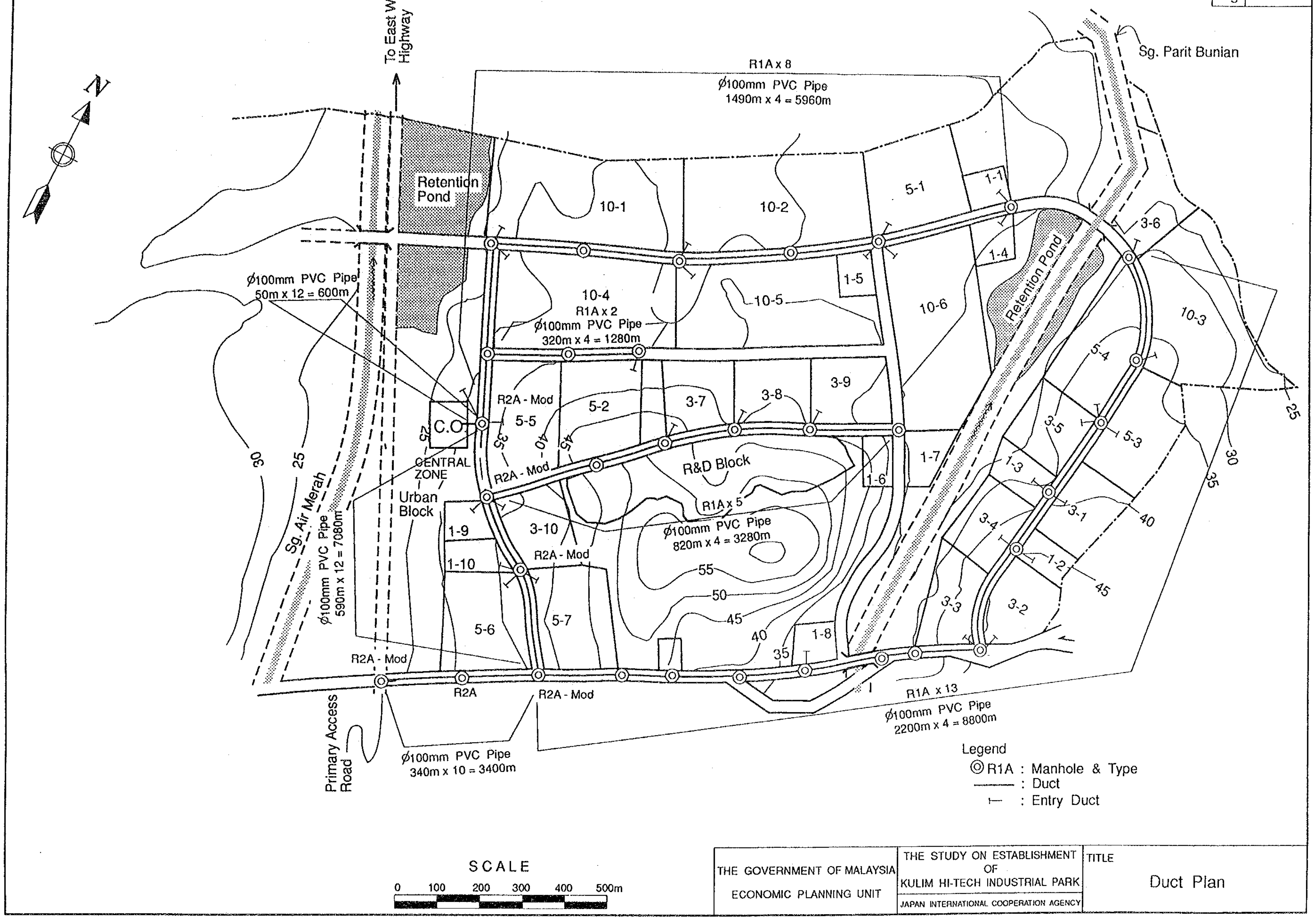


SCALE

0 100 200 300 400 500m

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Cable Plan

Fig. 5.5.2



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Duct Plan

5.6 Drainage and Sewerage System

Basic flow sheet of drainage and sewerage system for the industrial zone of the park is shown in Fig.5.6.1. The flow sheet was decided on the basis of the following basic design policy and conditions:

5.6.1 Outside of Industrial Zone of first phase

The followings are JICA's recommendation on the drainage and sewerage design from the engineering and economical points of view which will be considered in the master plan study.

(1) Industrial Zone for the second phase

(a) Drainage and retention pond should be prepared within the Industrial Zone for the second phase.

(b) Rain fall should be discharged to the Ayer Merah river.

(c) Bio-degradable Waste water should be treated by the central waste water treatment plant that is located in the first phase area. (see Fig.5.6.3)

(d) The area for the waste water treatment plant for the second phase, should be secured within the total area of central waste water treatment plant.

(2) Other Zones

(a) Drainage and retention pond should be prepared within each zone in consideration of geographical features

(b) Waste water should be treated by a treatment plant located at an adequate point in consideration of the implementation schedule.

5.6.2 Basic Design Policy

Basic design policy of drainage and sewerage system within the Industrial Zone is decided as follows:

(1) To emphasize scenic beauty by integrating reservoirs with park.

(2) To take adequate countermeasures against flood.

(3) Agreement for environmental pollution control must be exchanged between KSDC and each factory.

(4) To utilize the land effectively with suitable landscaping.

(5) The individual treatment plant at each factory must be set up according to the Pollutants' pay principle.

(6) Adequate monitoring and maintenance system must be established.

(7) To apply the following regulations and standards correspondingly;

- Environmental quality act, 1974 (ACT 127) in Malaysia
- Urban drainage design standards and procedures for Peninsular Malaysia
- Sewerage Law in Japan
- Basic Law for Environmental Pollution Control in Japan
- Manual & Standards adopted by the Technopolis in Japan
- Guidelines/Recommendations for sewerage requirements for Housing in Malaysia

5.6.3 Recommendation of Effluent Limits of the Hi-Tech Industrial Zone

Table 5.6.1 compares the standard of effluents in Malaysia with the effluent limits of a typical technopolis in Japan, and thereafter the effluent limits for the Hi-Tech Industrial Park in Kulim are recommended. Although Standard B must be legally adapted, the effluent limits of the Industrial Zone are recommended to be more strict than Standard B as shown in Table 5.6.1, considering the increment in future pollution that will be caused in the area due to expected increase in population.

5.6.4 Design Condition

The system is designed based on the following design conditions:

(1) The Ayer Merah river and Parit Bunian river collect the discharged water.

(2) The site of the Ayer Merah river and Parit Bunian river within the Industrial Zone should be secured, for improvement of the river by DID in the future corresponding to the peak flow for a return period of 100 years (cf. Fig. 5.6.9).

(3) The both rivers belong to the Jarak Basin.

(4) Present return period of the rivers is 2 years.

(5) The Jarak Basin is utilized only for the purpose of irrigation.

(6) Water quality of final effluent should be corresponding at least to standard 'B' legislation of DOE, Malaysia. (Water quality standard will be finally decided according to the result of EIA.)

(7) Land level after development is shown in Fig. 5.1.1

(8) The central waste water treatment plant and retention ponds are located in the downstream area in order to collect sewerage by gravity flow of effluents (Figs.5.6.2 & 5.6.3).

5.6.5 Design Criteria

Design criteria for drainage and sewerage system within the Industrial Zone is decided as follows:

(1) Drainage

(a)	Direction of prevailing storm	:	Fig. 5.6.2
(b)	Layout of drainage system	:	Fig. 5.6.2
(c)	Return period for ditch	:	20 years
(d)	Return period for pond	:	100 years
(e)	Rainfall intensity = I_{20}	:	I=11,534/(t+40.7)
	I_{100}	:	I=14,625/(t+36.8)
	I_2	:	I=5,357/(t+38.7)
			cf. Fig. 5.6.5
(f)	Arrival time to inlet	:	7 min.

(g)	Mean velocity	:	cf. Table 2.8.3 (1) of Annex
(h)	Concentration time	:	-ditto-
(i)	Peak flow	:	Rational formula cf. Table 2.8.3 (1) of Annex
(j)	Run-off coefficient after development	:	0.65 (Overall run-off development coefficient) cf. Table 2.8.3 (1) of Annex
(k)	Ditch slope	:	cf. Table 2.8.3 (2) of Annex
(l)	Ditch shape	:	Trapezoid cf. Fig. 5.6.9 & Table 2.8.3 (2) of Annex
(m)	Materials for ditch	:	Concrete/stone masonry
(n)	Drainage discharge	:	Manning's formula cf. Table 2.8.3 (1) & (2) of Annex
(o)	Allowable flow velocity	:	0.8 m/s - 3.0 m/s
(p)	Poundage (multi-purpose use)	:	13.5 ha cf. Fig. 5.6.6 & 5.6.7
(q)	Treated industrial waste water flow	:	24,745 m^3/d (Volume of water supply)
(r)	Necessary close section of the rivers	:	cf. Fig. 5.6.8 & Chapter 2.8.5 of Annex
(s)	Profile of Main drainage	:	Figs. 5.6.11 ~ 5.6.15

(2) Sewerage

(a) Daily average waste water (DAWW)

	First phase		
	– Miscellaneous (organic matter)	:	2,627 m^3/d
	– Infiltration 10 %	:	263 m^3/d
	– Total	:	2,890 m^3/d
	Second phase		
	– Miscellaneous	:	900 m^3/d
	– Infiltration 10 %	:	90 m^3/d
	– Total	:	990 m^3/d
(b)	Daily max. waste water (DMWW)	:	125 %of DAWW
	– First phase	:	3,613 m^3/d
	– Second phase	:	1,238 m^3/d
(c)	Hourly max. waste water(HMWW)	:	150 % of DMWW
	– First phase	:	205.25 m^3/hr
	– Second phase	:	77.38 m^3/hr
(d)	Flow calculation	:	Manning's formula cf. Table 2.8.5 of Annex
(e)	Pipe materials	:	Hume/concrete
(f)	Roughness coefficient	:	0.015
(g)	Allowable flow	:	0.8 m/s - 2.6 m/s
(h)	Standard slope	:	By economical velocity
(i)	Minimum covering		
	– For grand surface	:	1.1 m
	– For premix road	:	1.8 m from grand level up to bottom of pipe
(j)	Minimum size of pipe	:	225 mm
(k)	Distance between manholes		
	– Diameter of pipe < 300 mm	:	less than 50 m
	– 300 - 600	:	75 m
	– > 600	:	100 m
(l)	Layout of waste water collection	:	cf. Fig.5.6.3

system

(m) Design flow for facilities

- Collection pipe : Hourly max. flow
- Grit chamber : - ditto -
- Equalization tank : - ditto -
- pump station : - ditto -
- Treatment plant : Daily max. flow

(n) Profile of Main Sewer : cf. Fig. 5.6.16 ~ 5.6.18

(3) Central waste water treatment plant

(a) Volume of waste water

- For first phase : 3,613 m^3/d
- Foe second phase : 1,238 m^3/d

(b) Characteristics of waste water influent

- Temperature : 40°C
- pH : 5.5 - 9.0
- BOD : 200 mg/l
- SS : 250 mg/l
- Total nitrogen : 10 mg/l
- Heavy metals : None
- Toxic matter : None

(c) Effluent water quality : Based on Standard 'B' . cf. Table 5.6.1

(d) Removal ratio of BOD : 90 %

(e) Treatment method : Activated sludge process (Oxidation Diech Process or equivalent)

(f) Sludge treatment : Thickener and Dry bed

(g) Location : Fig.5.6.3 & 5.7.2

(h) Flow diagram : Fig.5.6.4

(4) Monitoring system (cf. Fig. 5.6.1)

Monitoring system for industrial waste water is as follows;

(a) Inspection Pond with Fish set by each factory
(b) Water sampling pit (33 pits)
(c) Laboratory with monitoring equipments (cf. Fig. 5.6.10)
- Water sampling equipments
- PH meter
- DO (Dissolved Oxygen) meter
- MLSS (Mixed Liquor Suspended Solids) meter
- ORP (Oxidation-Reduction Potential) meter
- Conductivity meter
- Thermometer
- Flow meter

(d) Retention pond with Fish (3 ponds)

(e) Jeep for a patrol

Monitoring system is described in more detail in Chapter 9.2.

Table 5.6.1 PARAMETER LIMITS OF EFFLUENT STANDARDS

	Parameter	Unit	A	B	OTHERS	hi-tech	Kanagawa Science Park in Japan
(i)	Temperature	C	40	40	45	40.00	38
(ii)	pH value	-	6.0-9.0	5.5-9.0	5.0-9.0	6.0-9.0	6.5-7.5
(iii)	BOD at 20C	mg/1	20	50	400	20.00	8.00
(iv)	COD	mg/1	50	100	1000	50.00	
(v)	Suspended Solids	mg/1	50	100	400	50.00	10.00
(vi)	Mercury	mg/1	0.005	0.05	0.10	0.05	0.002
(vii)	Cadmium	mg/1	0.01	0.02	1.0	0.02	0.05
(viii)	Chromium, Trivalent	mg/1	0.05	0.05	2.0	0.05	0.20
(ix)	Arsenic	mg/1	0.05	0.1	2.0	0.10	0.20
(x)	Cyanide	mg/1	0.05	0.1	2.0	0.10	1.00
(xi)	Lead	mg/1	0.10	0.5	2.0	0.50	0.50
(xii)	Chromium, Trivalent	mg/1	0.20	1.0	10	1.00	1.00
(xiii)	Copper	mg/1	0.20	1.0	10	1.00	0.50
(xiv)	Manganese	mg/1	0.20	1.0	10	1.00	0.50
(xv)	Nickel	mg/1	0.20	1.0	10	1.00	0.50
(xvi)	Tin	mg/1	0.20	1.0	10	1.00	
(xvii)	Zinc	mg/1	1.0	1.0	10	1.00	0.50
(xviii)	Boron	mg/1	1.0	4.0	-	4.00	
(xix)	Iron	mg/1	1.0	5.0	50	5.00	2.00
(xx)	Phenol	mg/1	0.001	1.0	5.0	1.00	1.00
(xxi)	Free Chlorine	mg/1	1.0	2.0	-	2.00	
(xxii)	Sulphide	mg/1	0.50	0.5	2.0	0.50	
(xxiii)	Oil and Grease	mg/1	Not Detec table	10.0	100	10.00	

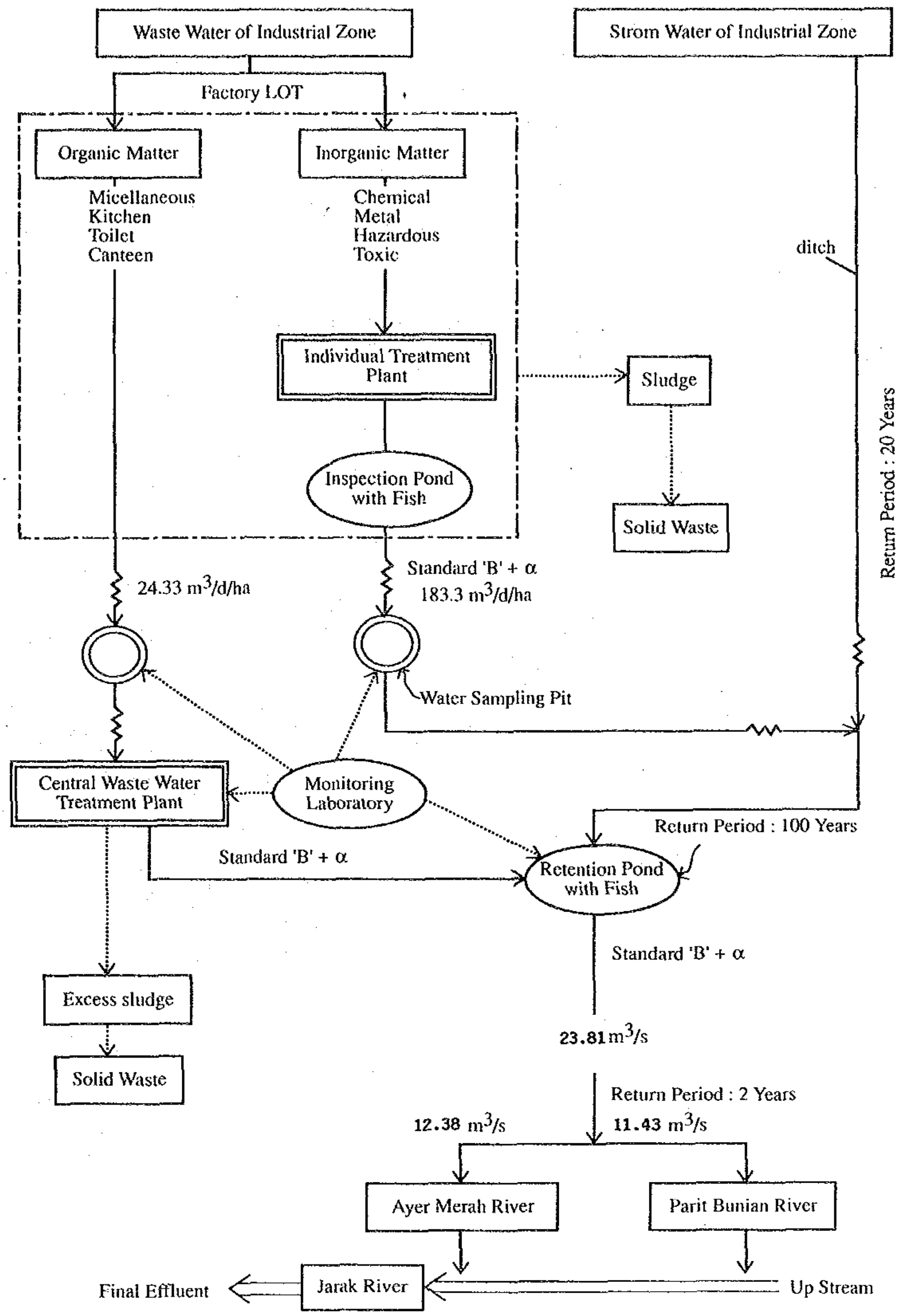
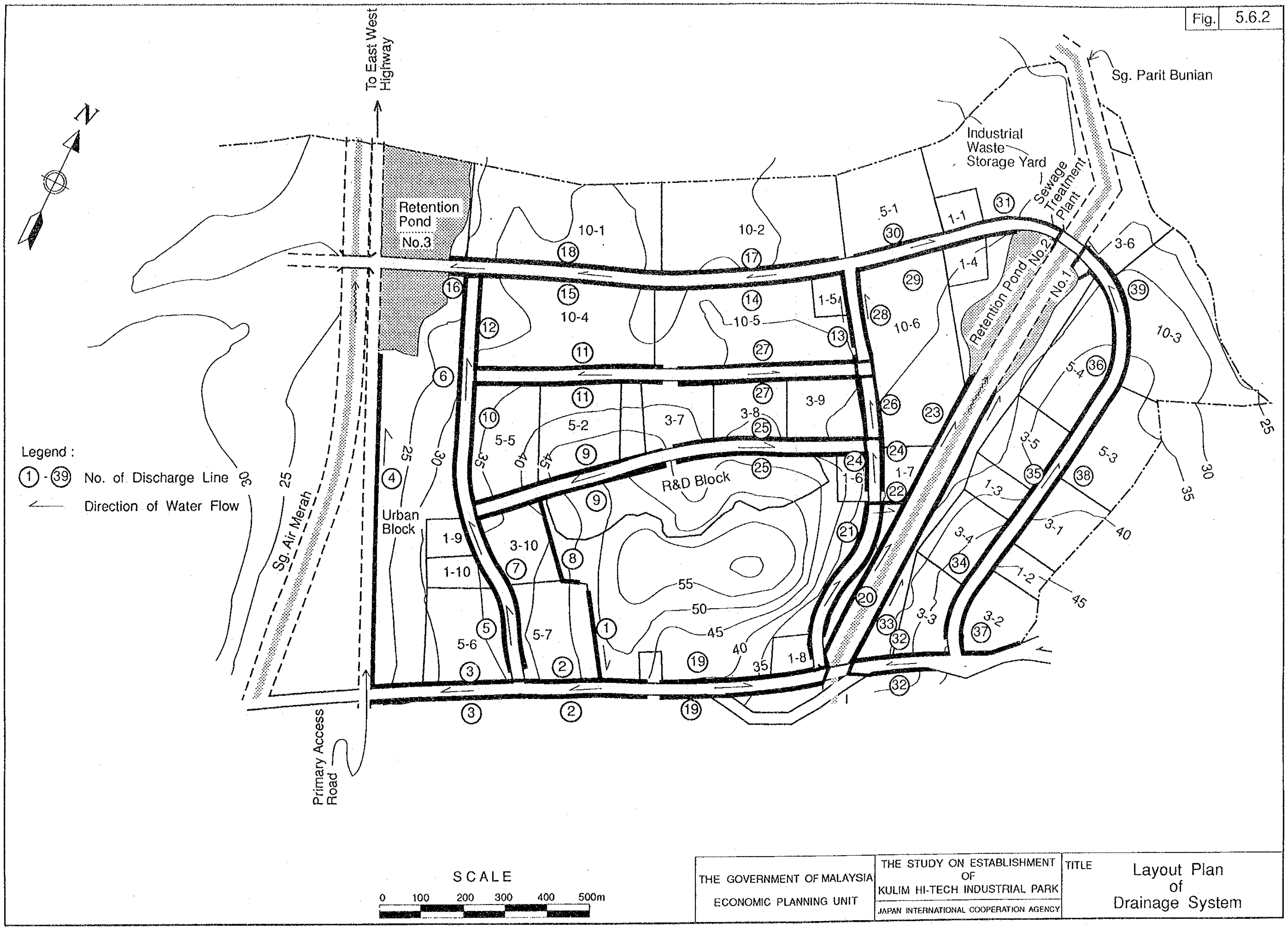


Fig. 5.6.1 Flow Sheet of Separate Sewerage System

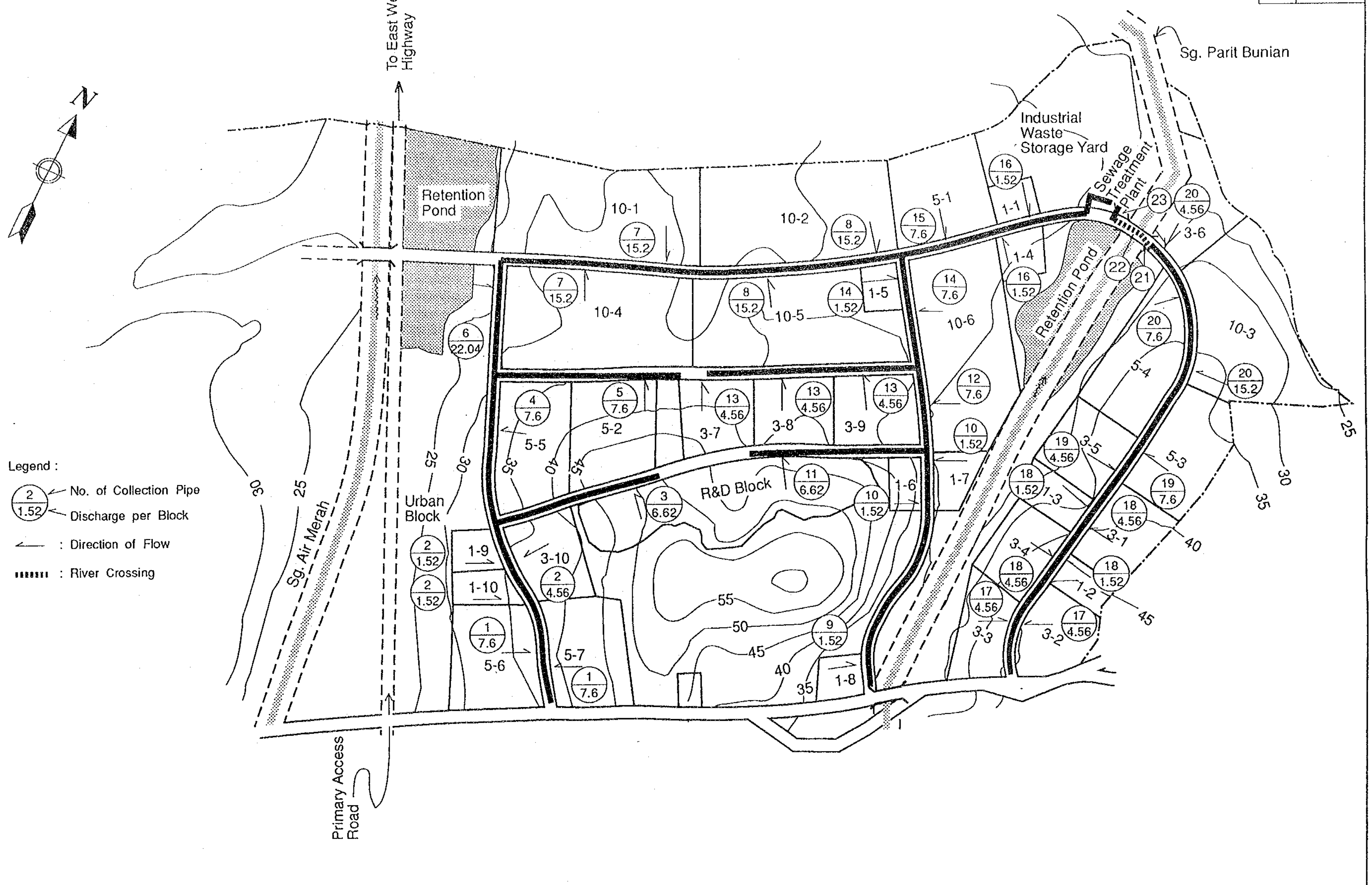
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Flow Sheet of Separate Sewerage System

Fig. 5.6.2



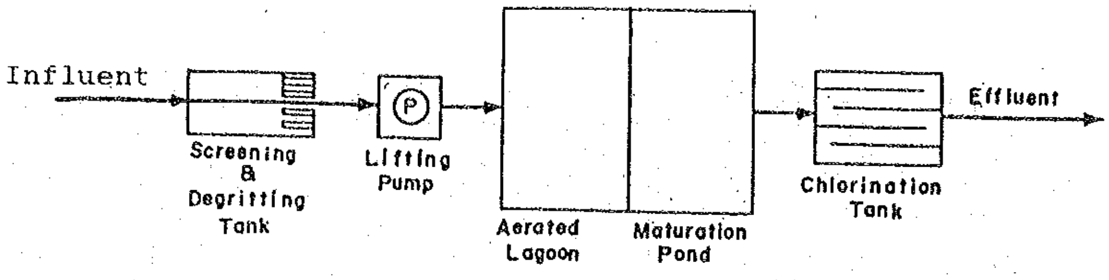
THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE	Layout Plan of Drainage System

Fig. 5.6.3

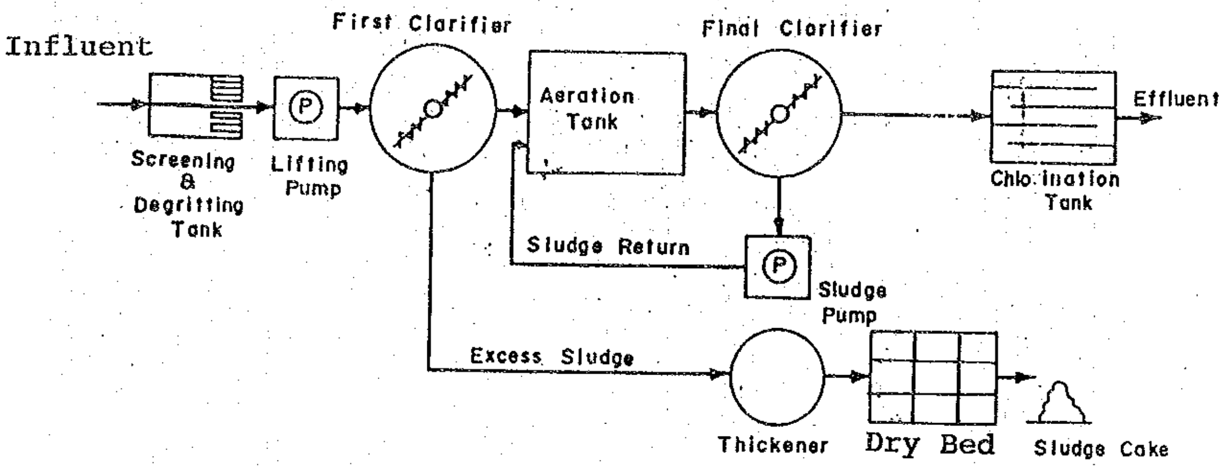


THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE	Layout & Block Plan of Waste Water Collection System

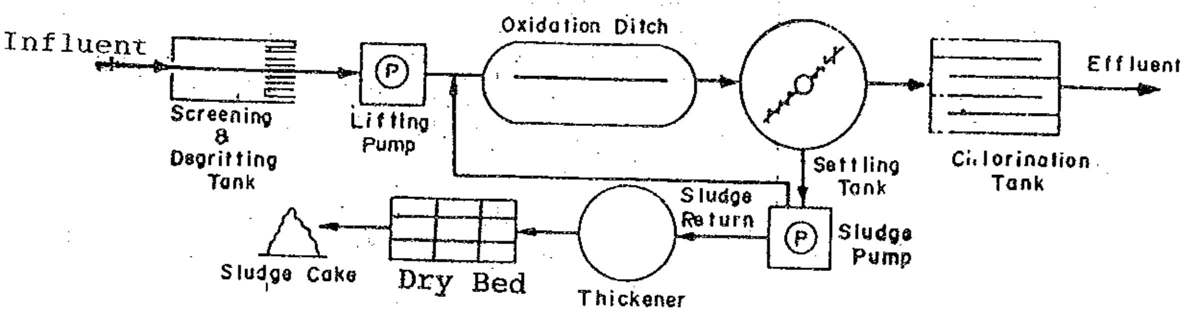
Fig. 5.6.4



(Aerated Lagoon)



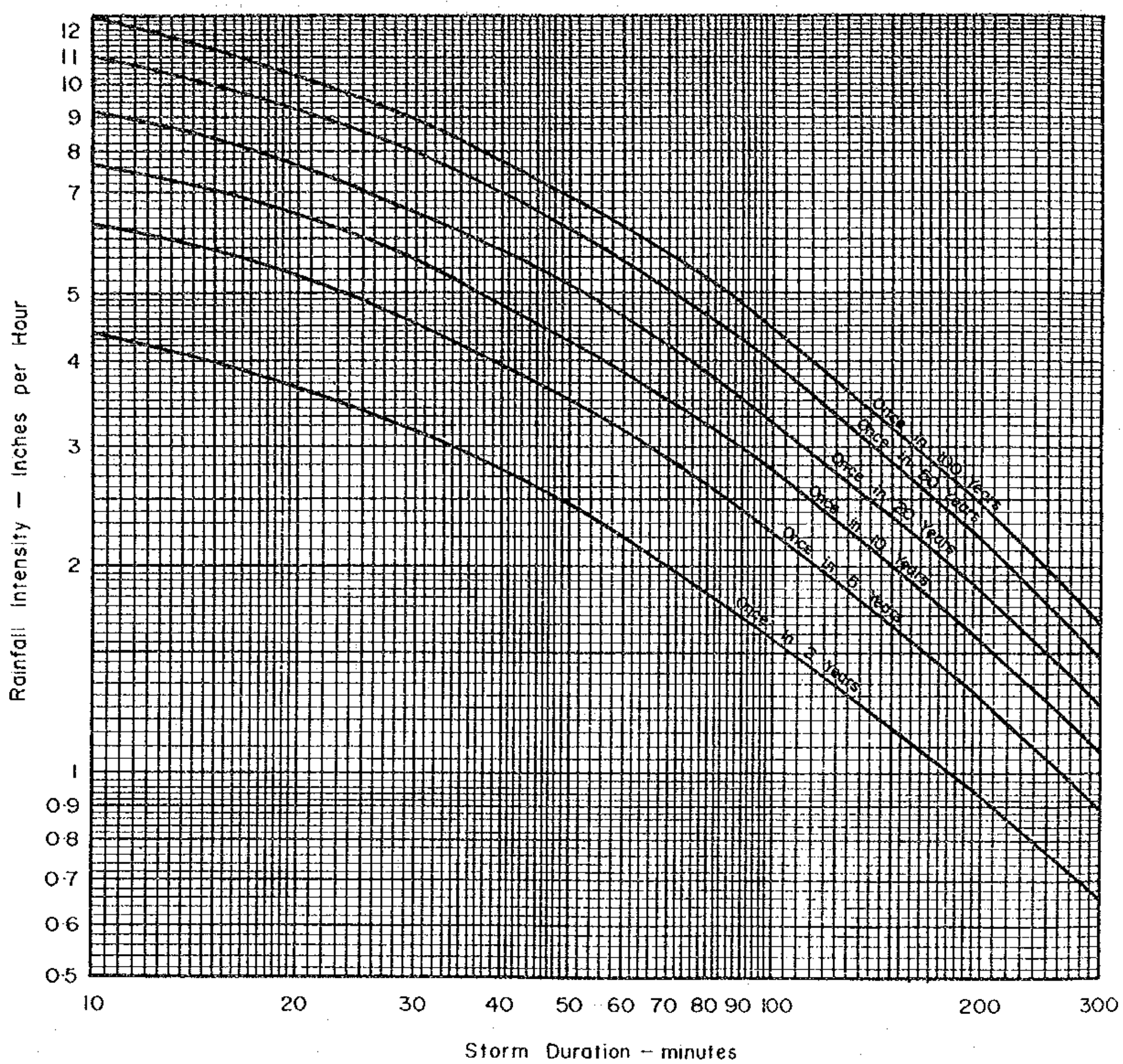
(Standard Activated Sludge)



(Oxidation Ditch)

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE Flow diagram

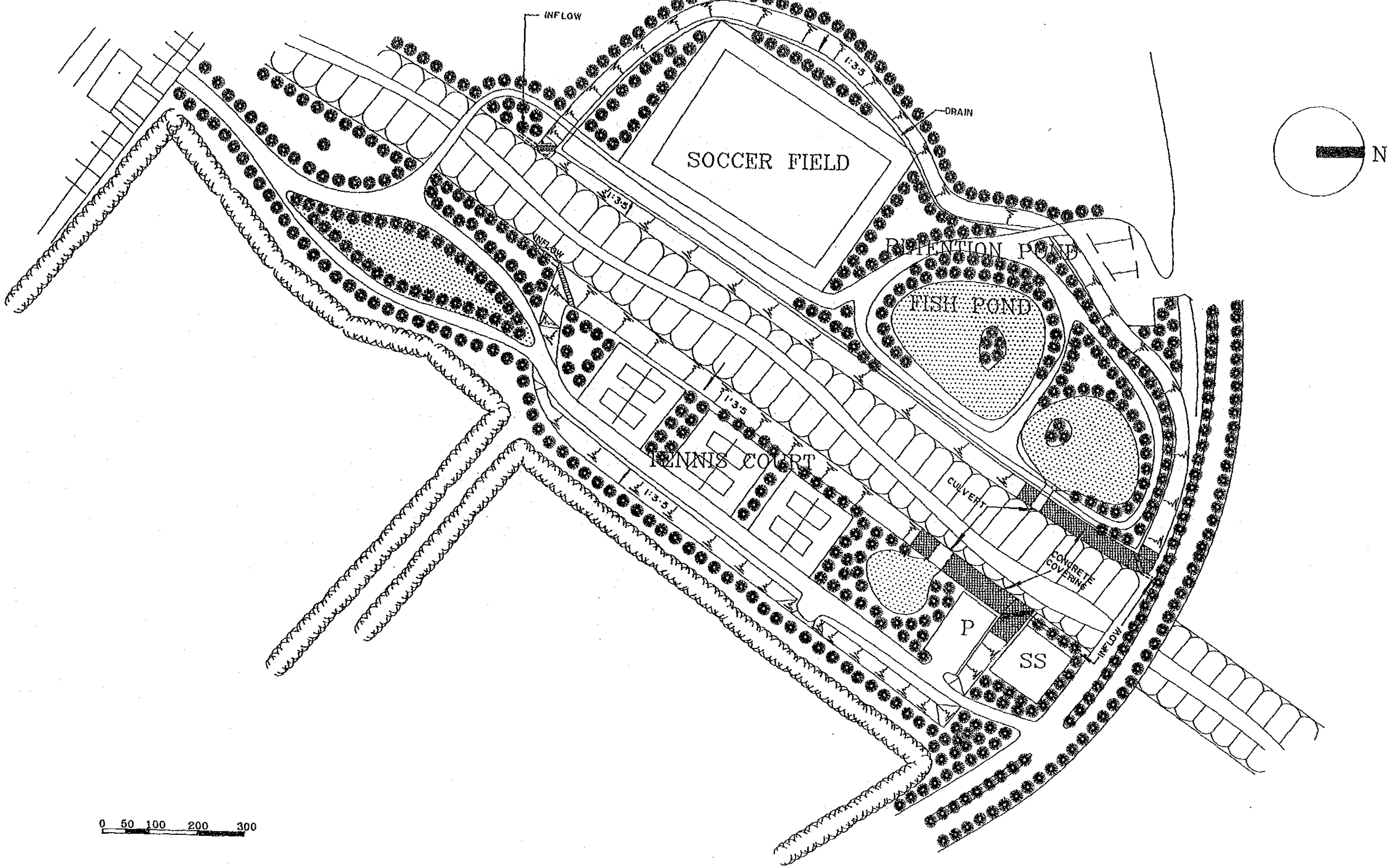
Fig. 5.6.5



Rainfall Intensity — Duration — Frequency Relationship — Kulim

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF KULIM HI-TECH INDUSTRIAL PARK JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RAINFALL INTENSITY AT KULIM

Fig. 5.6.6



THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RETENTION POND NO. 1 & 2

Fig. 5.6.7

THE GOVERNMENT OF MALAYSIA ECONOMIC PLANNING UNIT	THE STUDY ON ESTABLISHMENT OF HIGH TECHNOLOGY AND ELECTRONIC INDUSTRIAL ESTATE IN KULIM JAPAN INTERNATIONAL COOPERATION AGENCY	TITLE RETENTION POND NO. 3