5.2.2 Space Improvement Plan

(1) Basic Policy

Based on the problems and future outlook as described in the preceding paragraphs, the basic policy of the space improvement plan of Anyang Chong is determined as follows.

1) Improvement shall be proceeded with recovering and growing the nature, almost defunct nowadays, surrounding the river.

2) Since the major bed has the broader width which is enough to harbor sporting facilities therein, sporting and health control facilities will be provided for the residents.

3) In the area where a higher frequency of inundation is anticipated, arrangement and improvement preconditioned inundation shall be made.

5.2.3 Zoning and Improvement Plan of Each Zone

The established zone is divided into 2 types, i,e. sport/health control zone and family zone.

(1) Multi-purposes zone

Area to be improved: Left bank (L = 3.75 km)
Right bank (L = 5.6 km).

Improvement policy:

a. Walking road shall be provided to have the segment under plan keep a link with it.

b. The facilities shall be utilized by factory workers to have them enjoy sports or rest.

Major facilities: Walking road, sport ground, green plaza (provided with health increasing equipment and playthings),

resting park
(provided with bench and shelter).

(2) Family zone.

Area to be improved: Left bank (L = 8.8 km)
Right bank (L = 7.8 km) .

Improvement policy:

a. Walking road shall be provided to have the segment under plan keep a link with it.

b. On the banks, trees shall be planted in line.

c. Flowers shall be planted to beautify the major bed.

Major facilities: Walking road, sub-area park, flower bed, and green plaza.

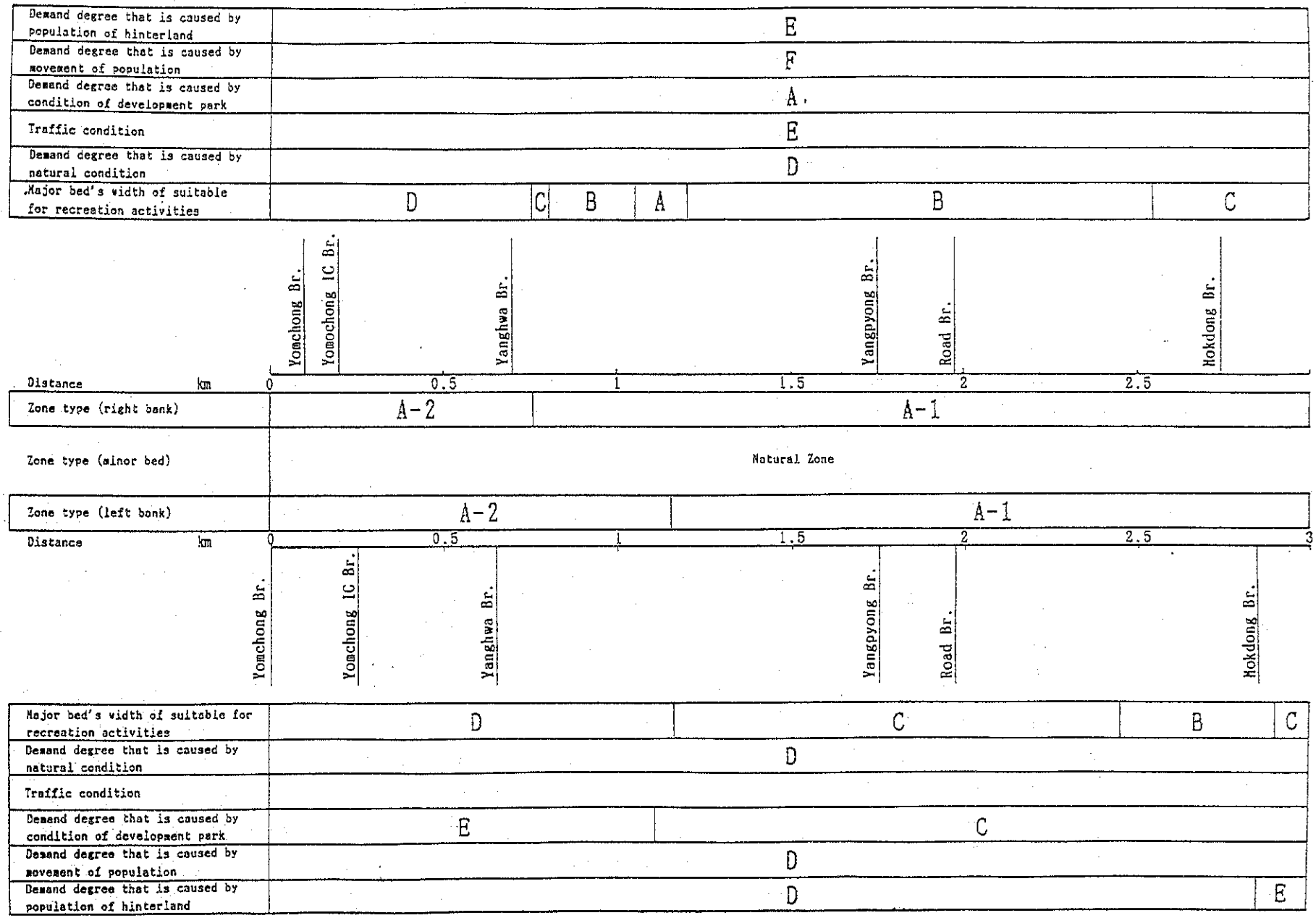


Fig.5.2.A-1 Inland Condition Survey Summary of Anyang Chong

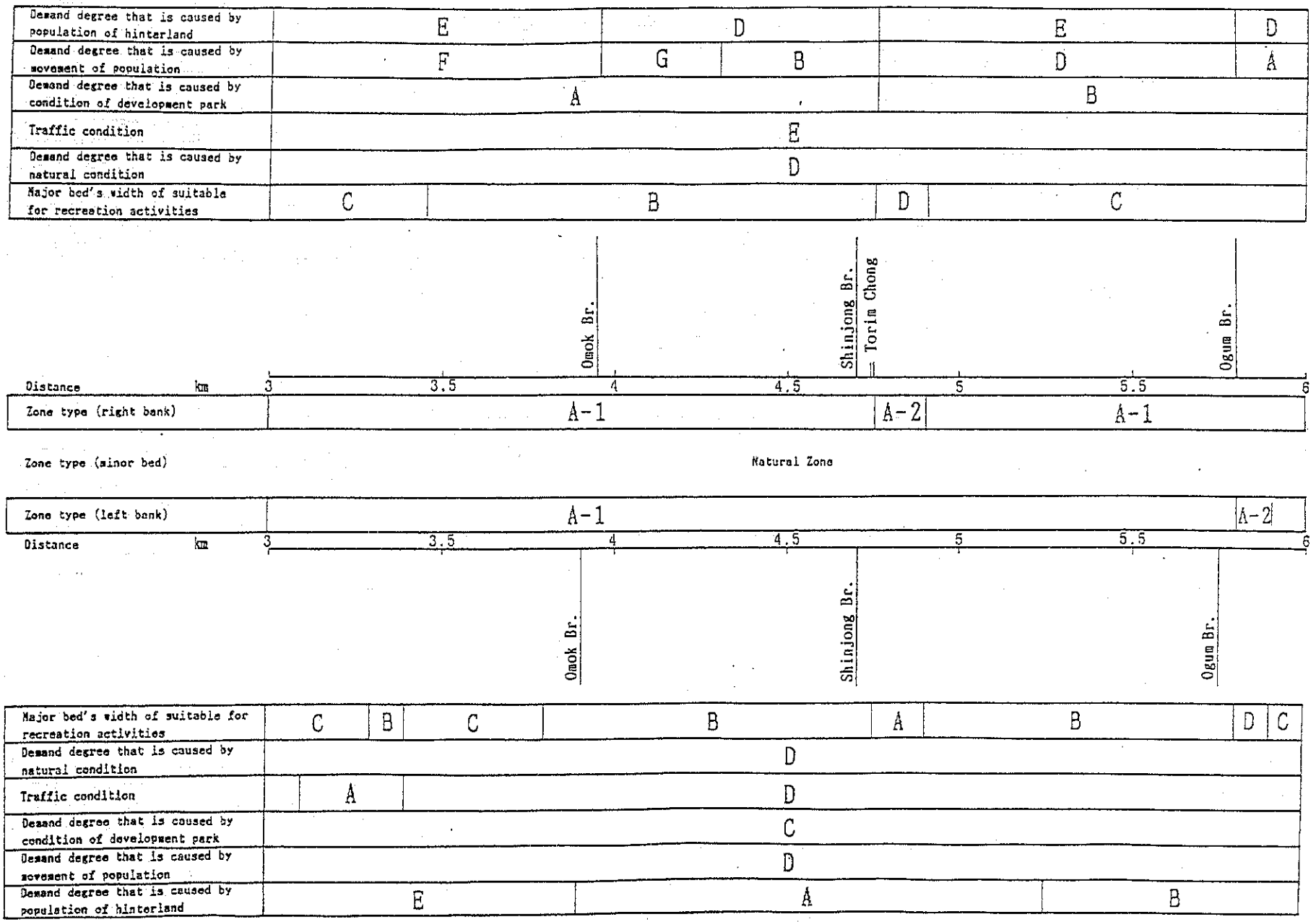


Fig.5.2.A-2 Inland Condition Survey Summary of Anyang Chong

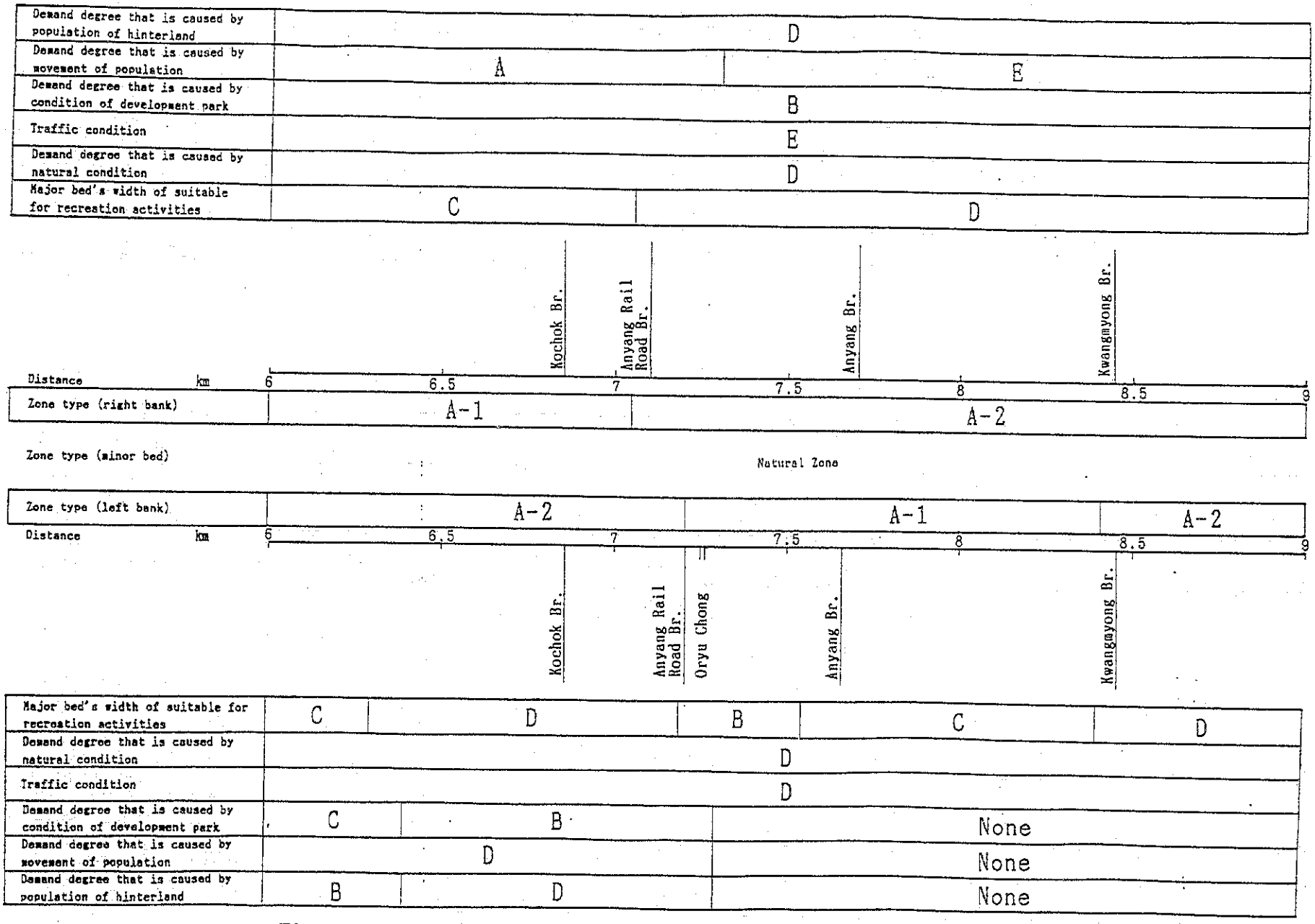
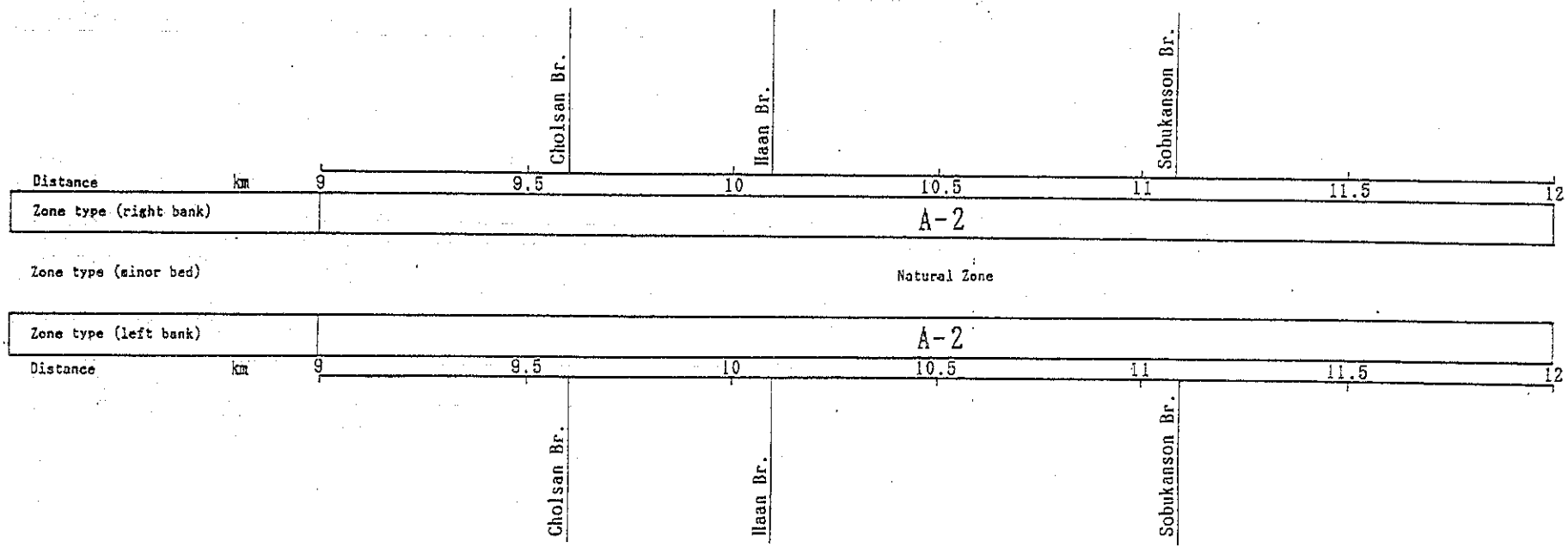


Fig.5.2.A-3 Inland Condition Survey Summary of Anyang Chong

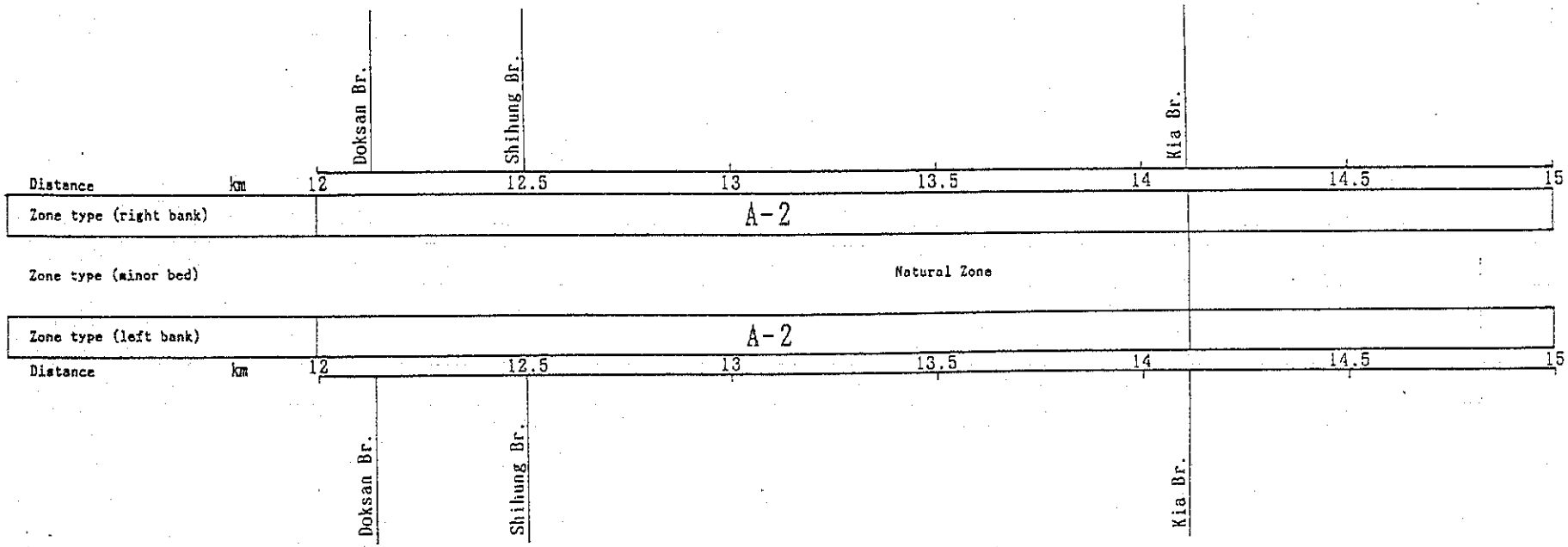
Demand degree that is caused by population of hinterland	D
Demand degree that is caused by movement of population	E
Demand degree that is caused by condition of development park	B.
Traffic condition	E
Demand degree that is caused by natural condition	D
Major bed's width of suitable for recreation activities	D



Major bed's width of suitable for recreation activities	D
Demand degree that is caused by natural condition	D
Traffic condition	D
Demand degree that is caused by condition of development park	None
Demand degree that is caused by movement of population	None
Demand degree that is caused by population of hinterland	None

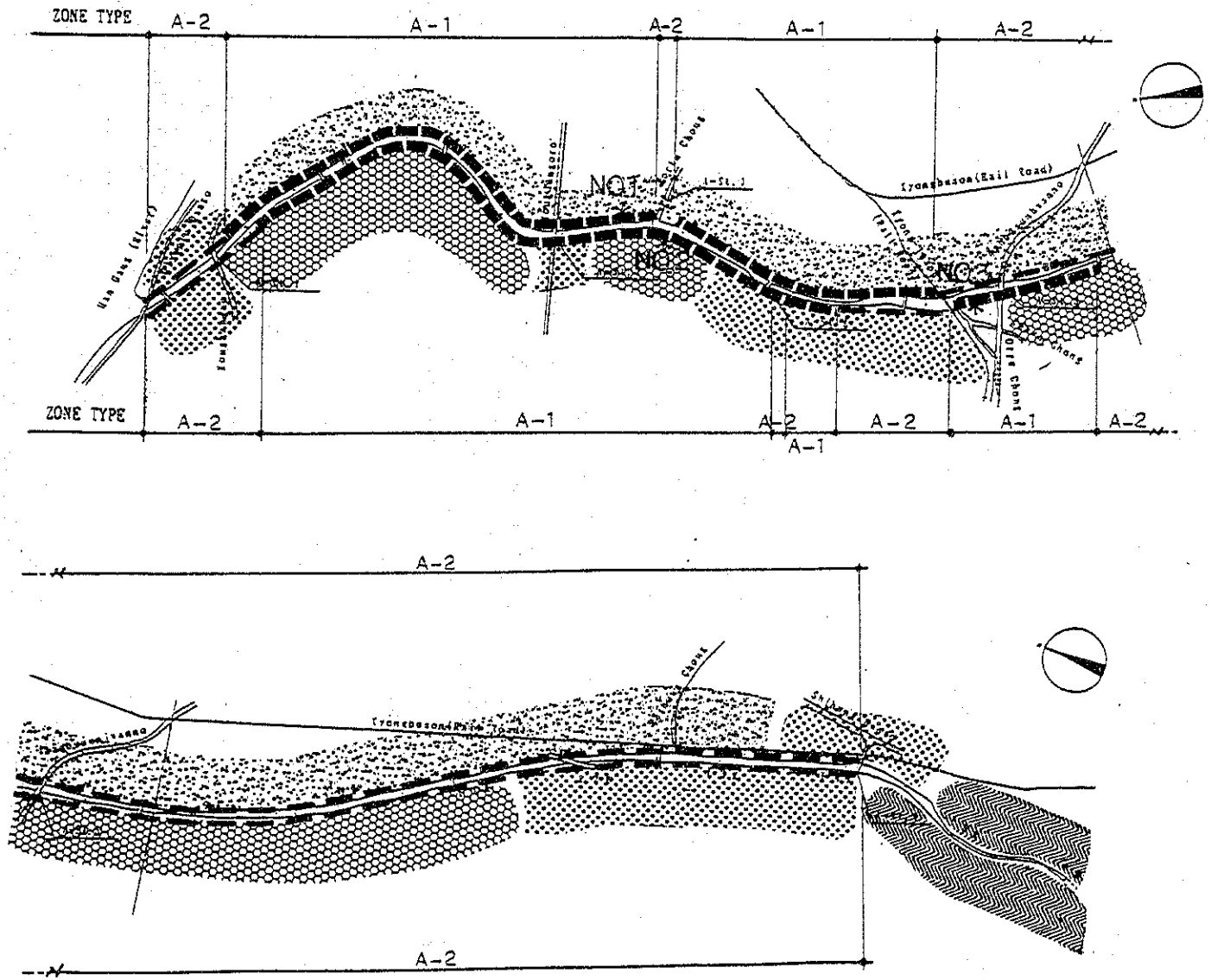
Fig.5.2.A-4 Inland Condition Survey Summary of Anyang Chong

Demand degree that is caused by population of hinterland	D
Demand degree that is caused by movement of population	E
Demand degree that is caused by condition of development park	D
Traffic condition	E
Demand degree that is caused by natural condition	D
Major bed's width of suitable for recreation activities	D



Major bed's width of suitable for recreation activities	D
Demand degree that is caused by natural condition	D
Traffic condition	D
Demand degree that is caused by condition of development park	None
Demand degree that is caused by movement of population	None
Demand degree that is caused by population of hinterland	None

Fig.5.2.A-5 Inland Condition Survey Summary of Anyang Chong



LEGEND

Improvement Type of River Space

A-1 Multi-using zone
A-2 Local-using zone
B Natural-using zone
C Natural zone
D Landscape zone
* Improvement model site

Present condition of inland

Industial zone
Commercial zone
Residential zone
Agricultural farm zone
Forest zone

Fig.5.2.B Zoning Plan of Anyang Chong

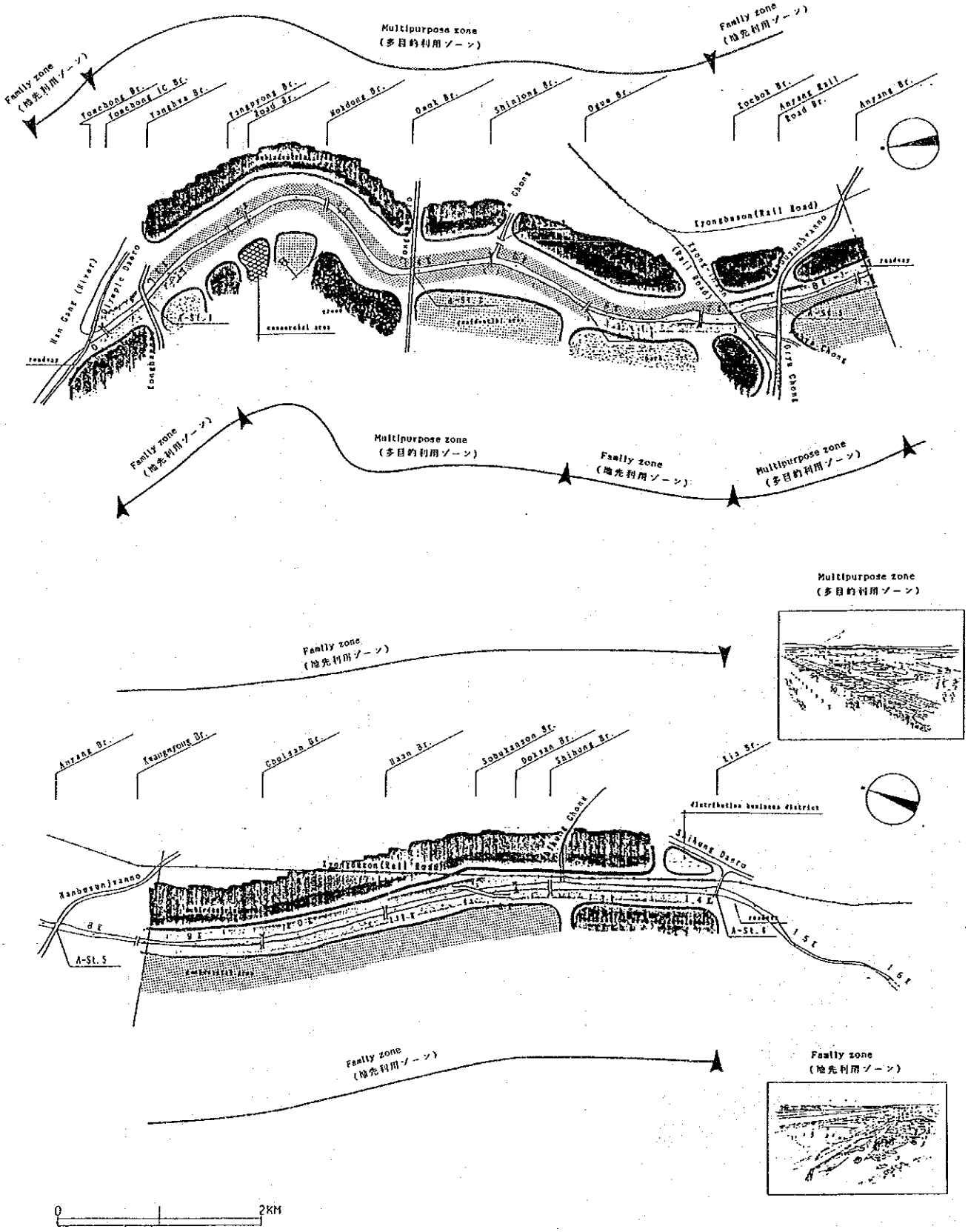


Fig.5.2.C Zoning Plan and Hinterland Condition of Anyang Chong

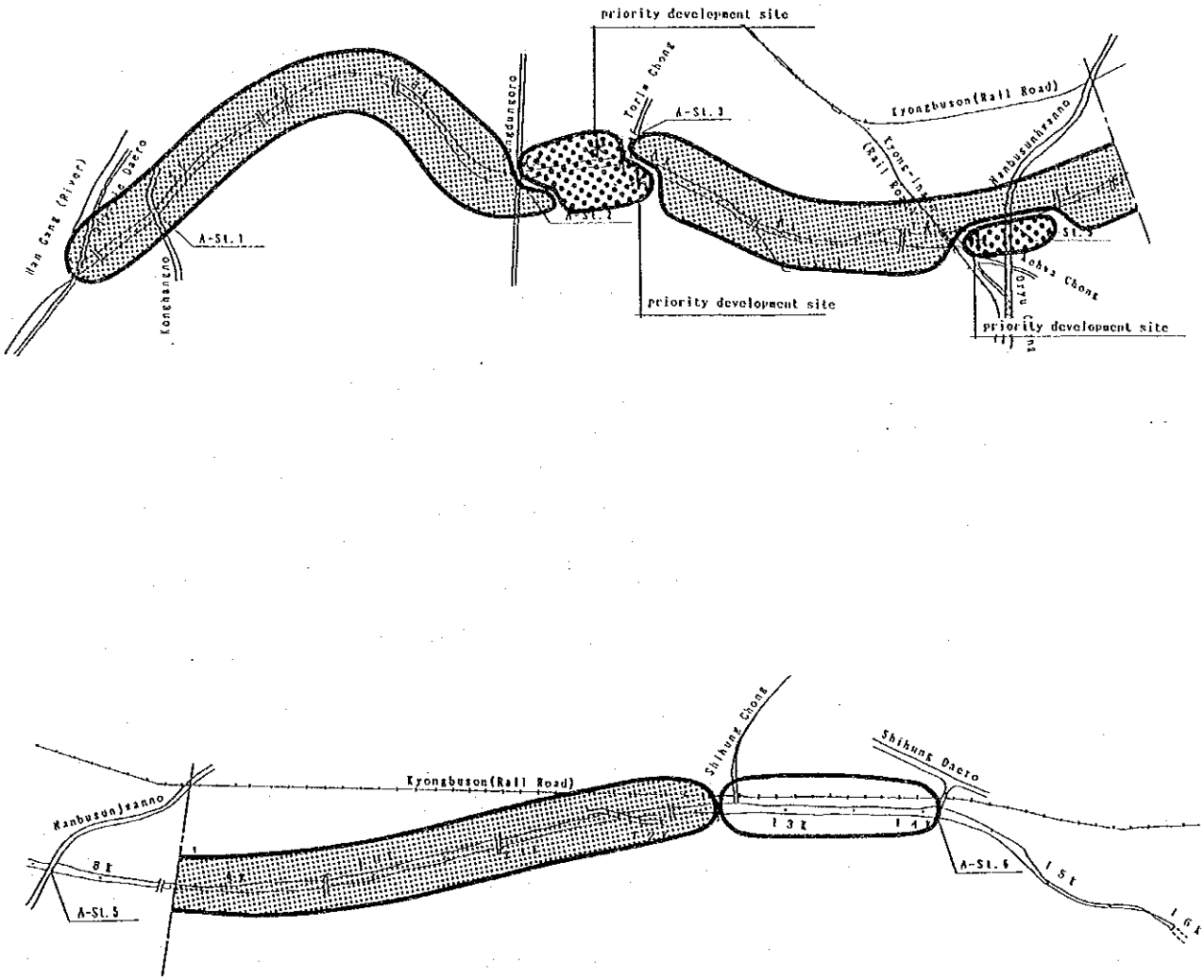


Fig.5.2.D Improvement Level of Zone of Anyang Chong

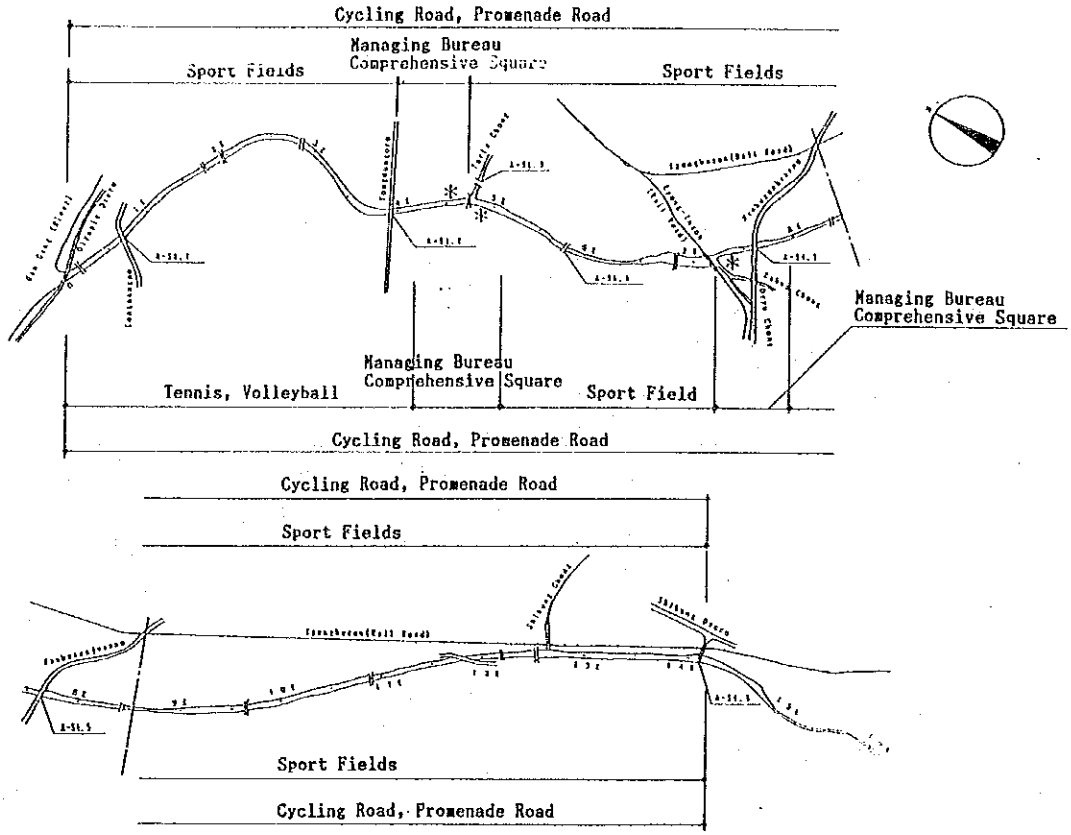


Fig.5.2.E Proposed Facility Plan of Anyang Chong

Network sources: Neighboring park (2.5ha)
Proposed facilities: Hiking course
Panorama square
Resting space
Cycling road

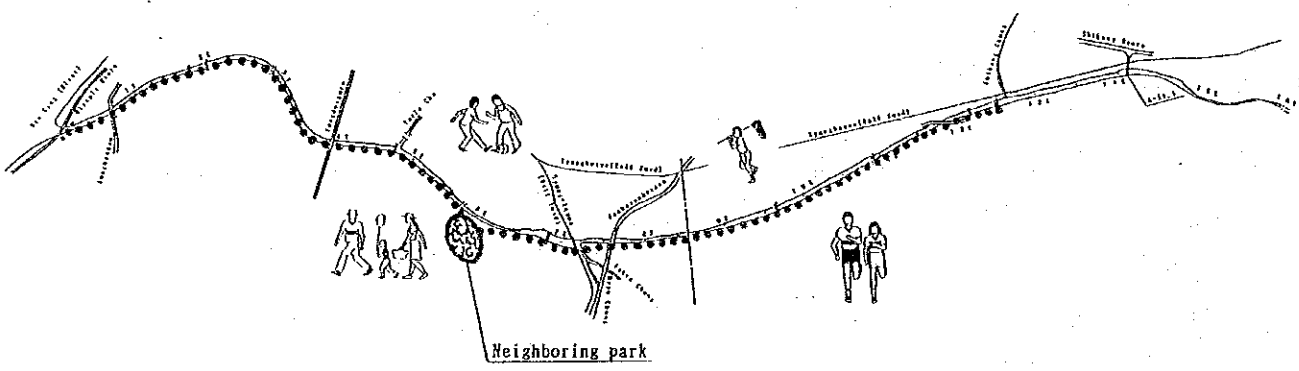


Fig.5.2.F Trail Network Plan of Anyang Chong

5.3 Zoning Plan of Yangjae Chong

5.3.1 Space Utilization

(1) In the downstream, the vicinity of river is reclaimed so the difference in height between the embankment and the major bed becomes 10 m or more where the depth is great and the gradient of slope becomes 1 : 0.5 or so. Up-and-down approach to the major bed via embankment would be danger.

(2) On the left bank between Yongtong 2 Bridge and Yongtong 6 Bridge, a vehicle road is running in parallel with the river. This makes the approach by the people living nearby to the river difficult.

(3) Since the exterior land at the confluence with Tan Chong has good conditions to have wild birds, insects and hygrophytes inhabit there. It is very desirous to keep such natural conditions for ever.

(4) It is not known if there is any plan to occupy the river space.

5.3.2 Space improvement plan

(1) Basic conception

Basing on the problems and future outlook as enumerated in the preceding paragraphs, the basic policy of space improvement plan of Yangjae Chong is defined as follows.

1) As the rich nature remains in the vicinity of the planning section compared to the other rivers, improvements shall be made with the utmost care of not damaging such a nature. Especially, creatures living around the riverside shall be kept and nurtured carefully so as to enable the inhabitants intimate with them.

2) Since the river water quality is relatively good, highly water familiarity will be provided.

5.3.3 Zoning and Improvement Plan of Each Zone

The provided zones are 3 types , i.e., natural zone utilizing nature and family zone.

(1) Natural zone

Area to be improved: 2 ha (L = 0.25 km x 2)

Improvement policy:

a. Walking road shall be provided in the segment under plan to have the segment keep a link with it.

b. On the banks, trees shall be planted in line.

c. Breed and nurture the creatures and plants around riverside paying attention to the natural ecosystem so as to make the spectacle of rich nature last long.

Major facilities: Walking road, planting,resting facilities and control facilities

(2) Zone utilizing nature

Area to be improved: 5 ha (L = 1.1 km x 2)

Improvement policy:

a. Walking shall be provided in the segment under plan to have the segment keep a link with it.

b. Existing natural environment shall be maintained.

c. Improvement having a link with the adjacent public park shall be made.Major facilities: Walking road, green plaza,planting, resting facilities and control facilities.

(3) Family zone

Area to be improved: Left bank 14 ha,
right bank 16 ha (L = 3.04 x 2)

Improvement policy:

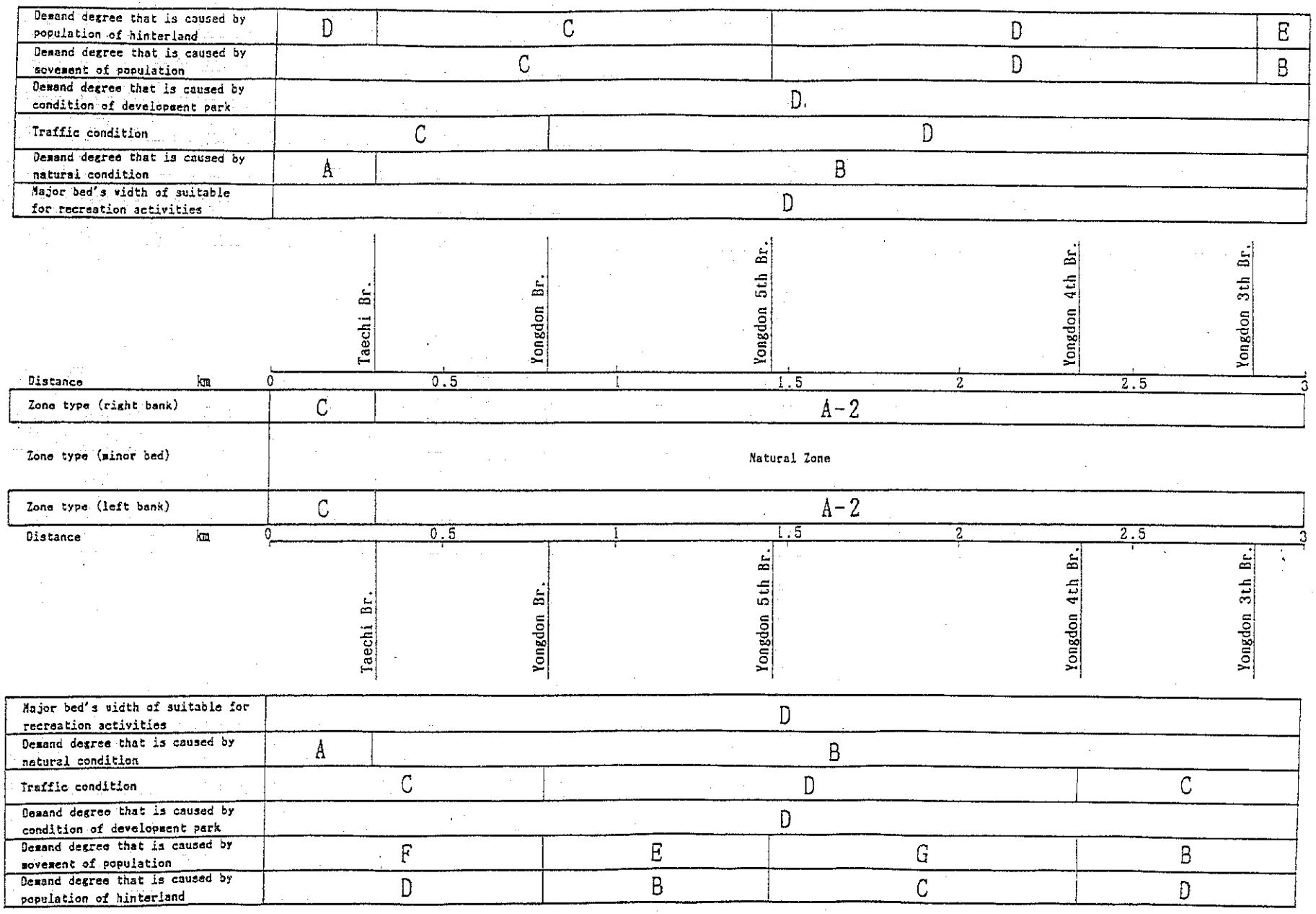


Fig.5.3.A-1 Inland Condition Survey Summary of Yangjae Chong

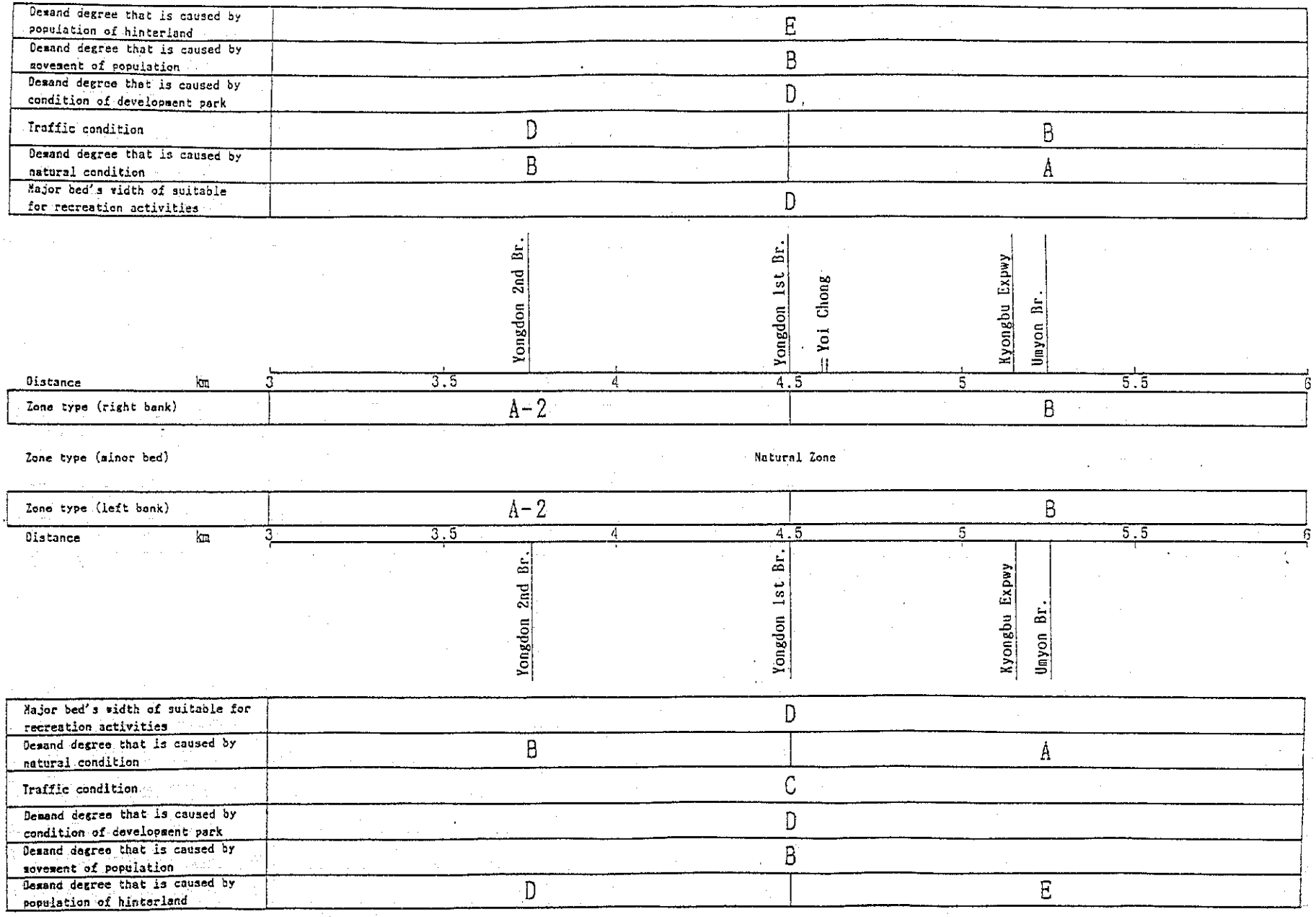
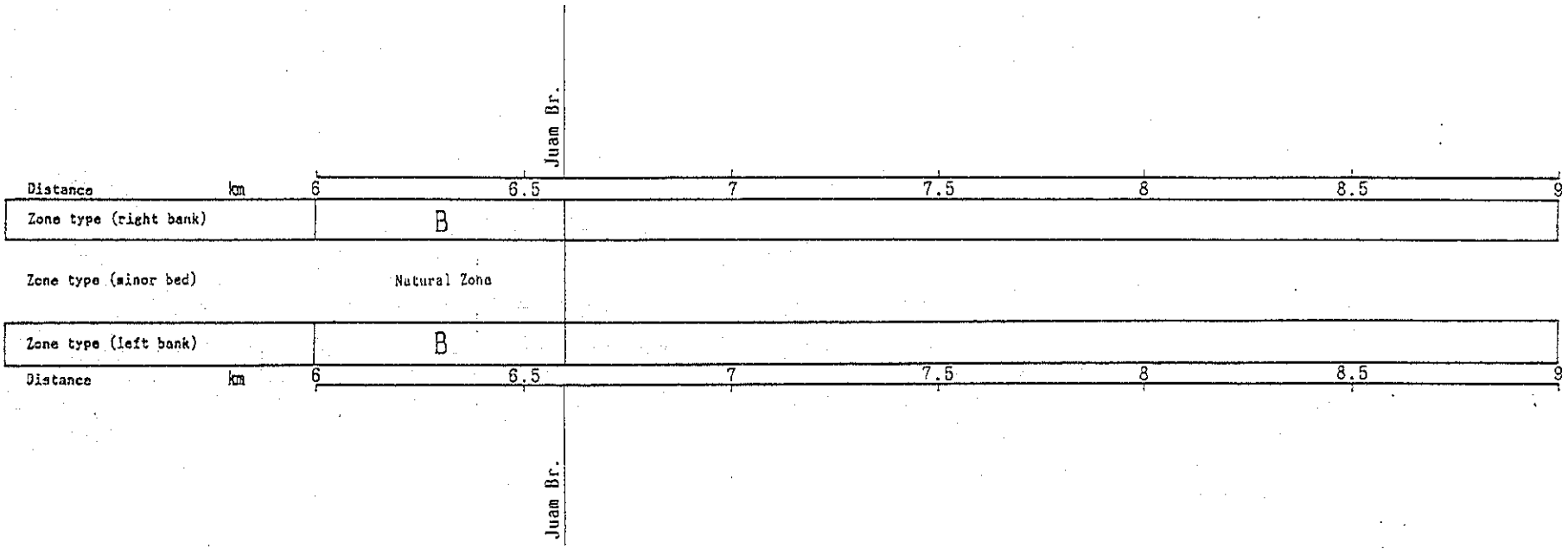


Fig.5.3.A-2 Inland Condition Survey Summary of Yangjae Chong

Demand degree that is caused by population of hinterland	E
Demand degree that is caused by movement of population	B
Demand degree that is caused by condition of development park	D
Traffic condition	B
Demand degree that is caused by natural condition	A
Major bed's width of suitable for recreation activities	D



Major bed's width of suitable for recreation activities	D
Demand degree that is caused by natural condition	A
Traffic condition	C
Demand degree that is caused by condition of development park	D
Demand degree that is caused by movement of population	B
Demand degree that is caused by population of hinterland	E

Fig.5.3.A-3 Inland Condition Survey Summary of Yangjae Chong

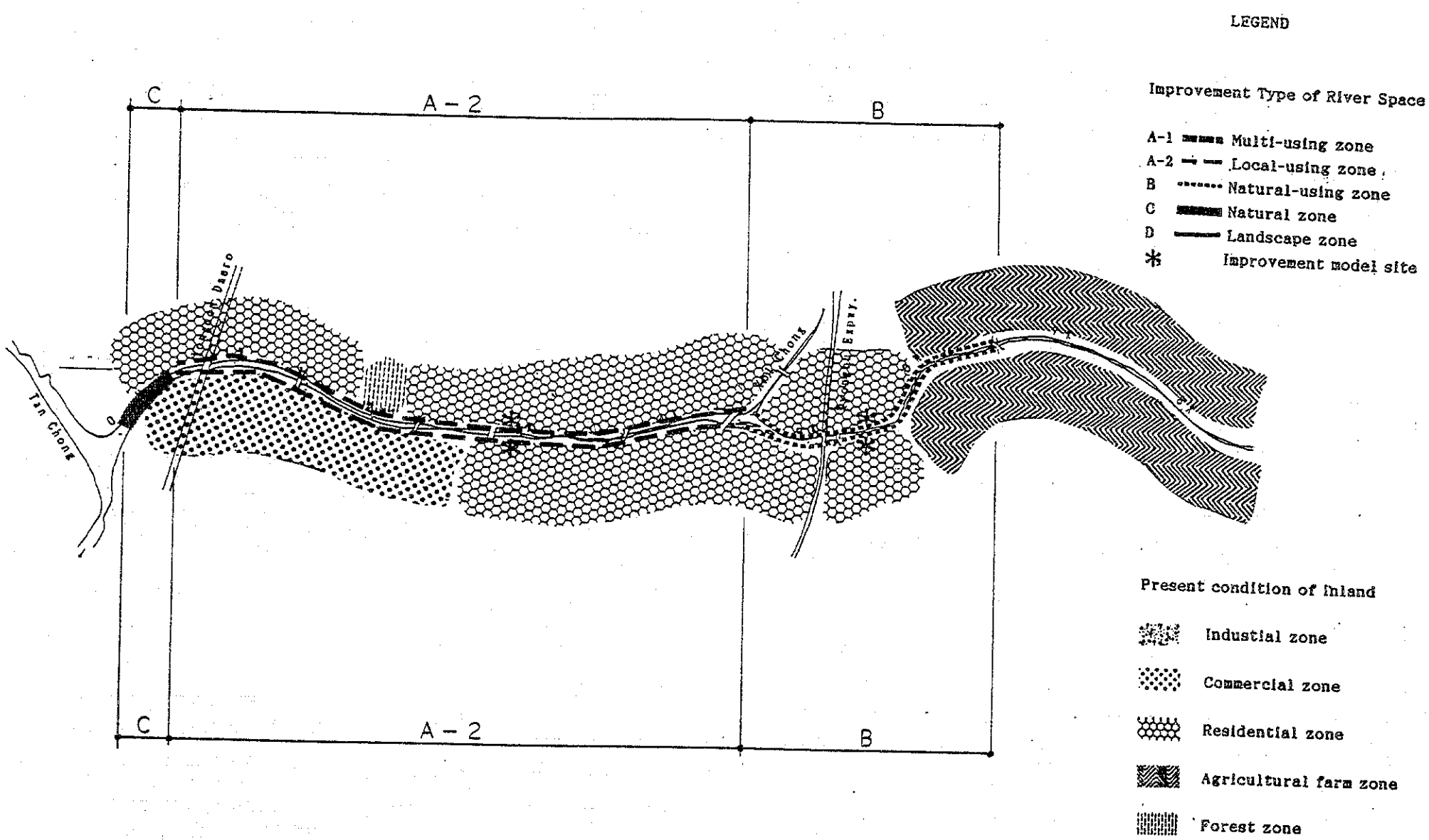


Fig.5.3.B Zoning Plan of Yangjae Chong

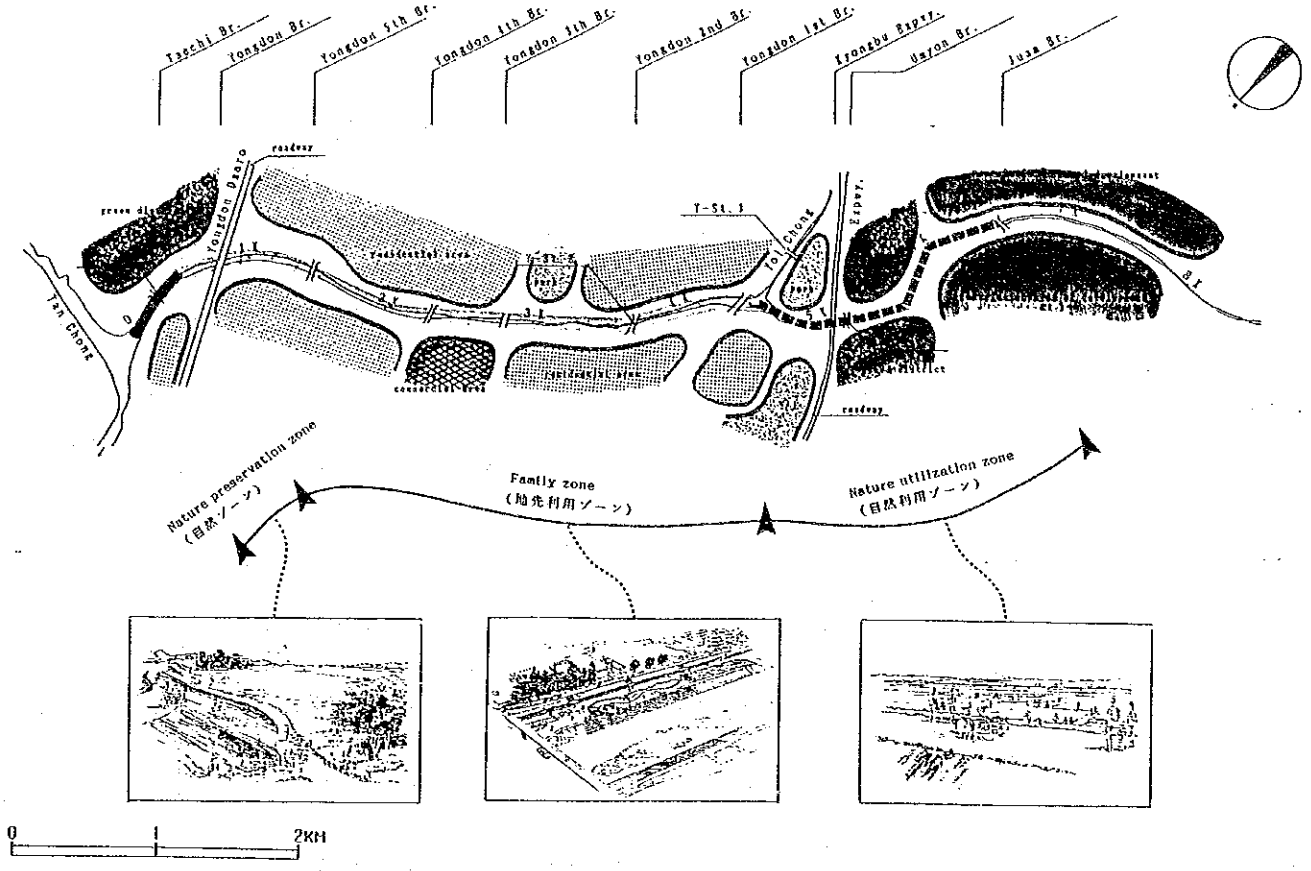


Fig.5.3.C Zoning Plan and Hinterland Condition of Yangjae Chong

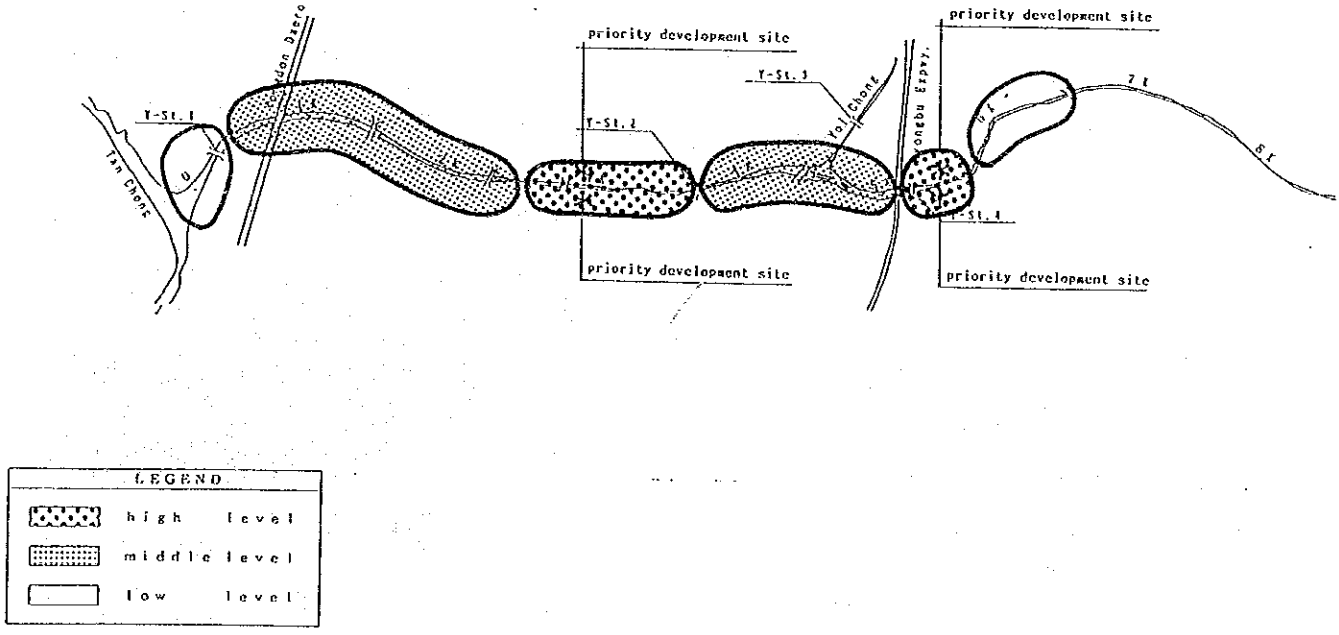


Fig.5.3.D Improvement Level of Zone of Yangjae Chong

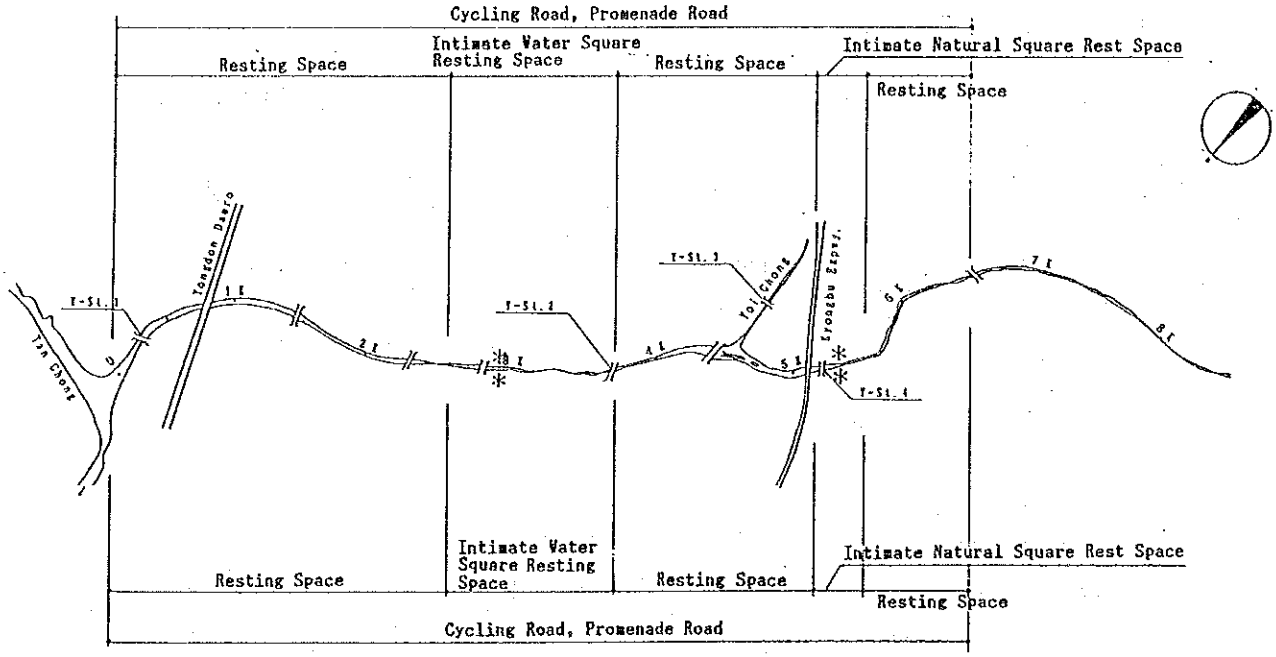
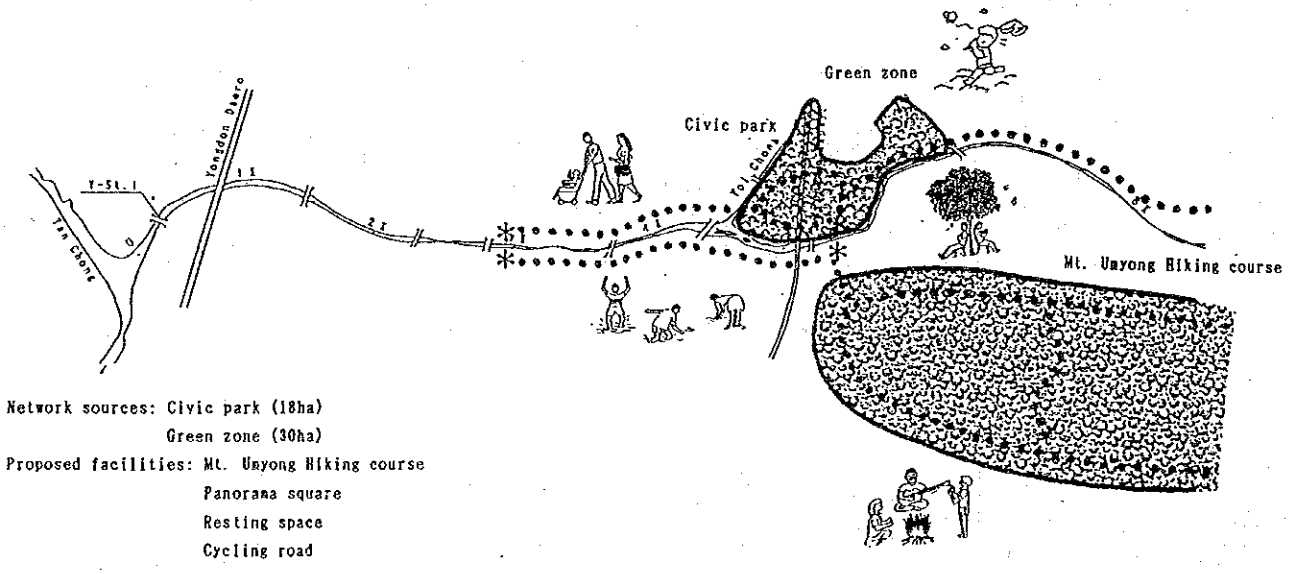


Fig.5.3.E Proposed Facility Plan of Yangjae Chong



Network sources: Civic park (18ha)
Green zone (30ha)
Proposed facilities: Mt. Umyong Hiking course
Panorama square
Resting space
Cycling road

Fig.5.3.F Trail Network Plan of Yangjae Chong

a. Walking shall be provided in the segment under plan to have the segment keep a link with it.

b. On the banks, plant trees in the line and maintain it with care.

c. Improve the facilities so as to enable the riverside people to take rest and increase health.

Major facilities: Walking road, green plaza, planting, resting facilities and control facilities.

5.4 Zoning Plan of Ui Chong

5.4.1 Space Utilization

(1) while the upstream is favored with relatively rich nature and excellent spectacles, no such natural environment and spectacles worthy to appropriate exist in the downstream. Also, in the downstream, many obstacles such as overhanging of road, parapet wall fence, etc. are preventing the approach to the exterior land.

(2) There is a plan to cover the river over 660 m to construct a parking lot in the vicinity of wolgye in Nowon-ku.

5.4.2 Space Improvement Plan

Basing on the points at issue and future outlook as referred to in the preceding paragraphs, we would define the basic policy of the space improvement plan of Ui Chong as follows.

(1) Improve the situation under which the residents of old and new communities formed in the upstream and downstream without any strong relation between them so as to make them associate each other through the river.

(2) The downstream basin having dreary look shall be improved modifying the spectacle.

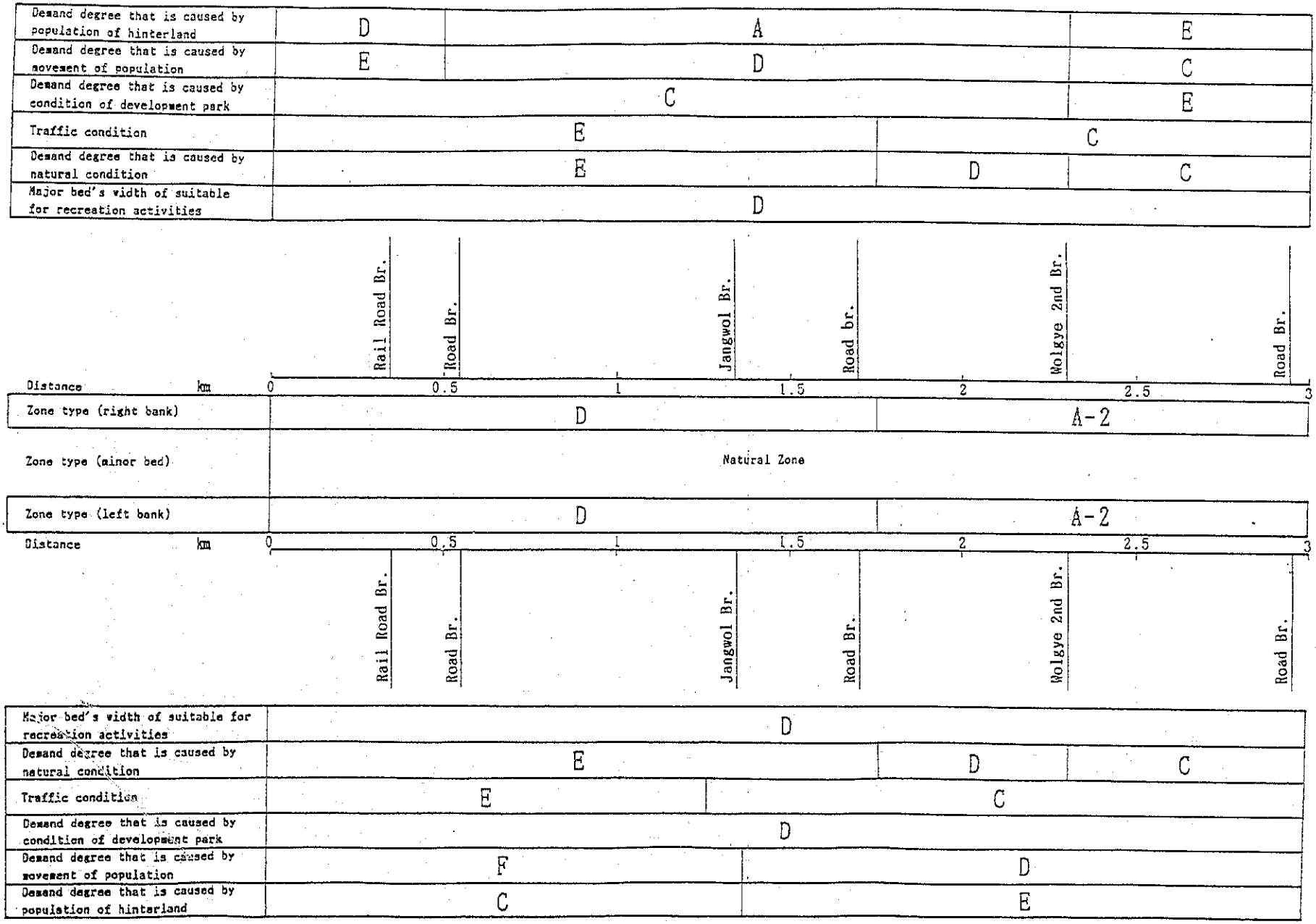


Fig.5.4.A-1 Inland Condition Survey Summary of Ui Chong

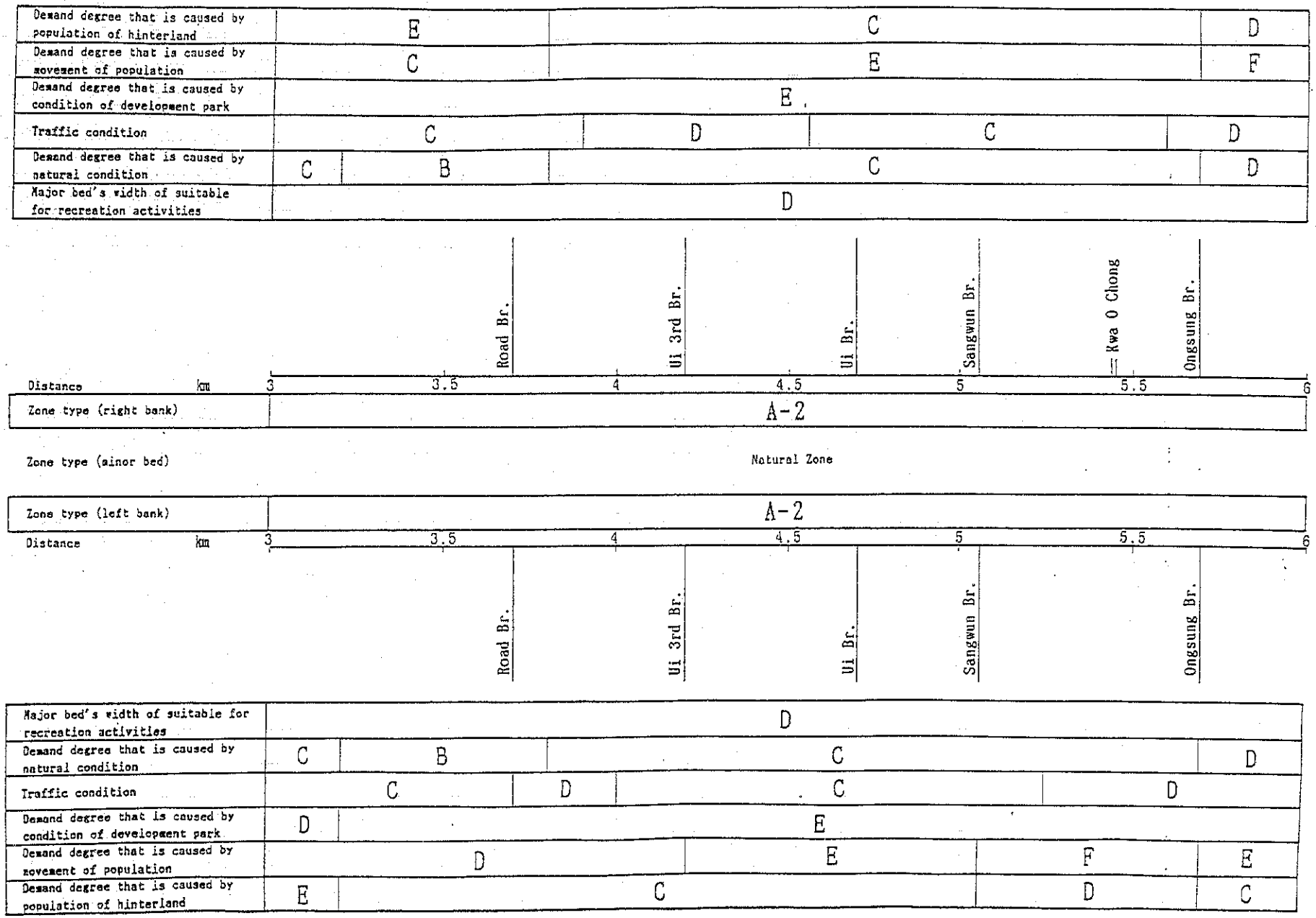


Fig.5.4.A-2 Inland Condition Survey Summary of Ui Chong

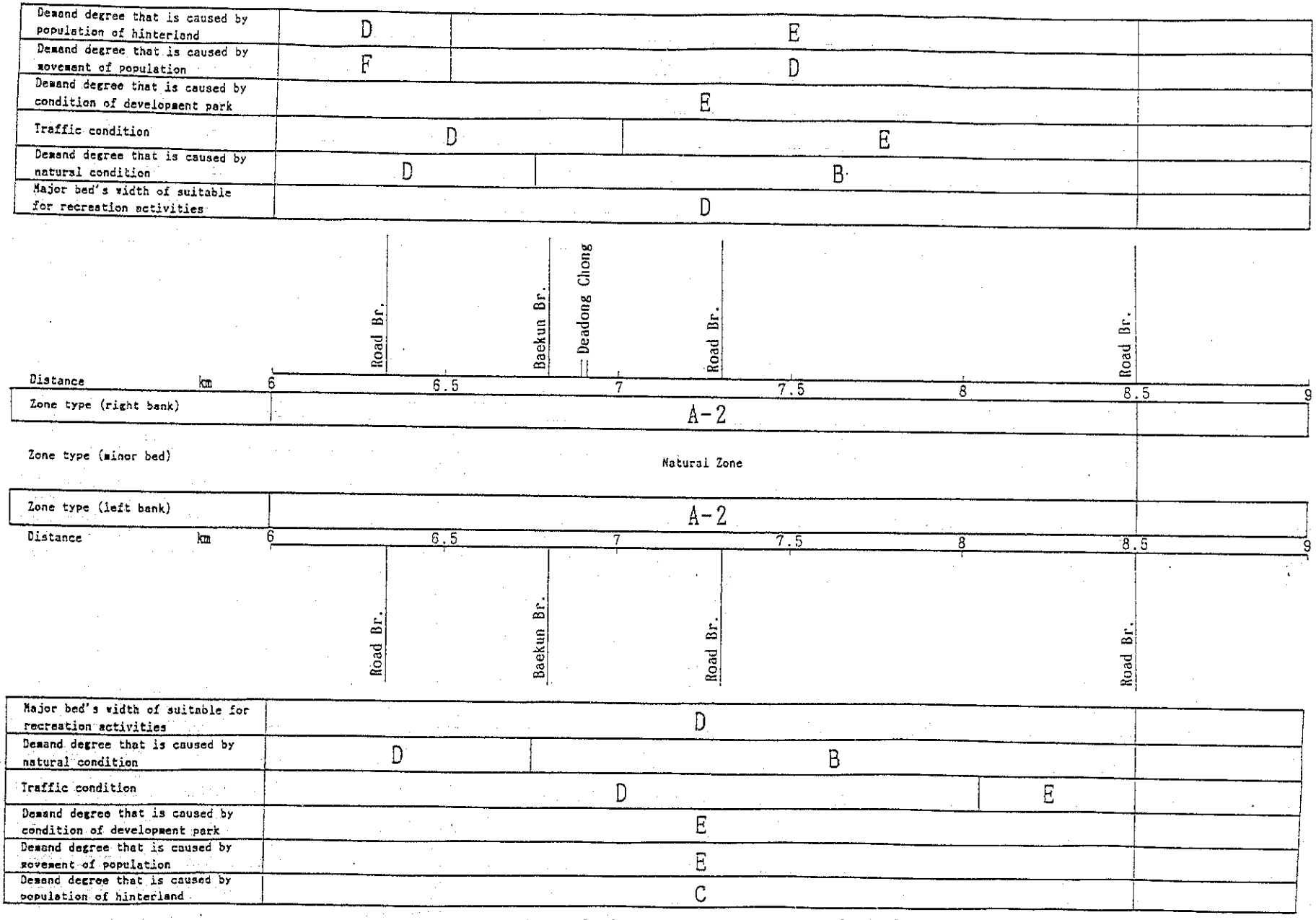
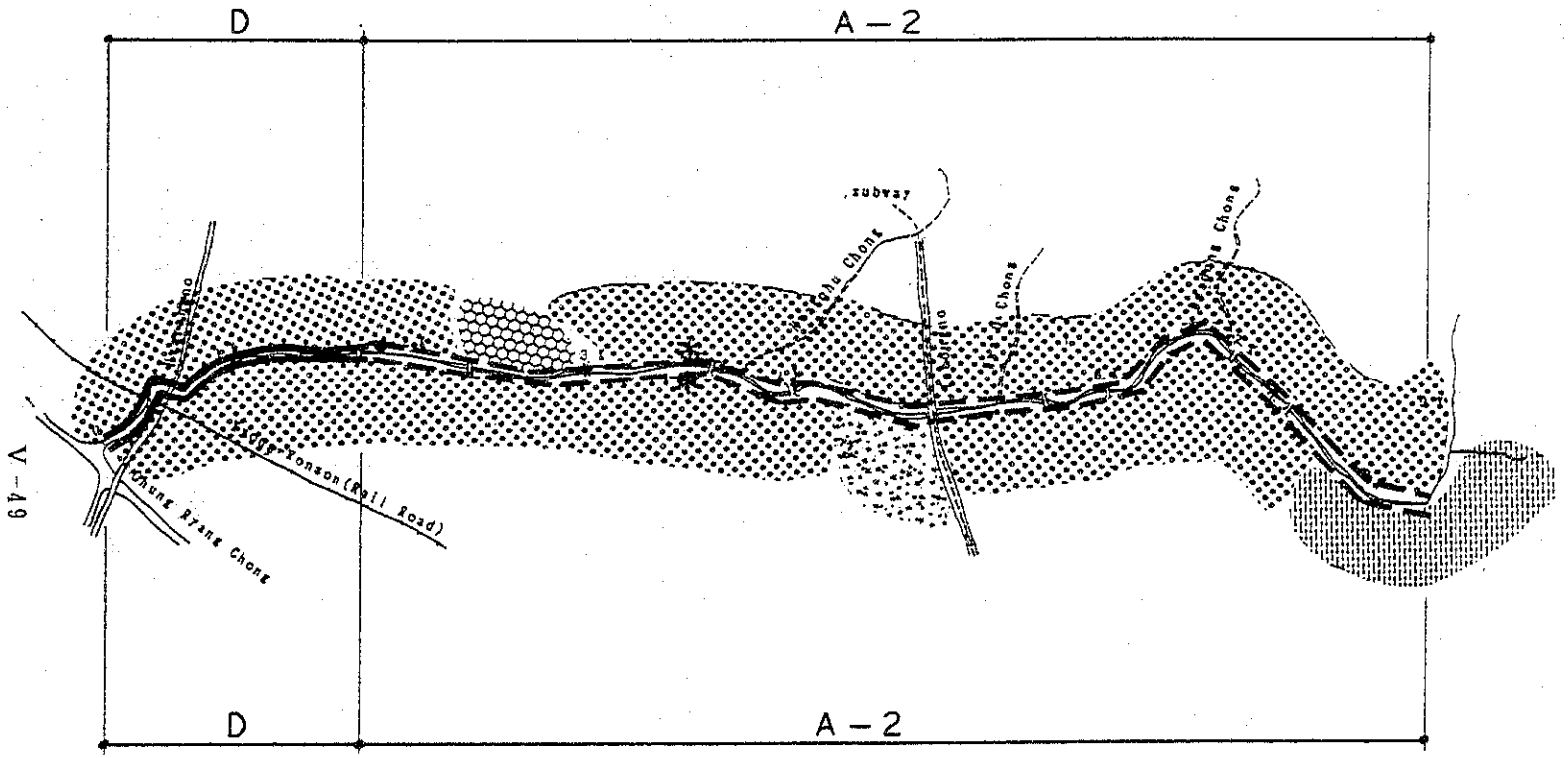


Fig.5.4.A-3 Inland Condition Survey Summary of Ui Chong



LEGEND

Improvement Type of River Space

A-1 Multi-using zone
A-2 Local-using zone
B Natural-using zone
C Natural zone
D Landscape zone
✻ Improvement model site

Present condition of inland

Industial zone
Commercial zone
Residential zone
Agricultural farm zone
Forest zone

Fig.5.4.B Zoning Plan of Ui Chong

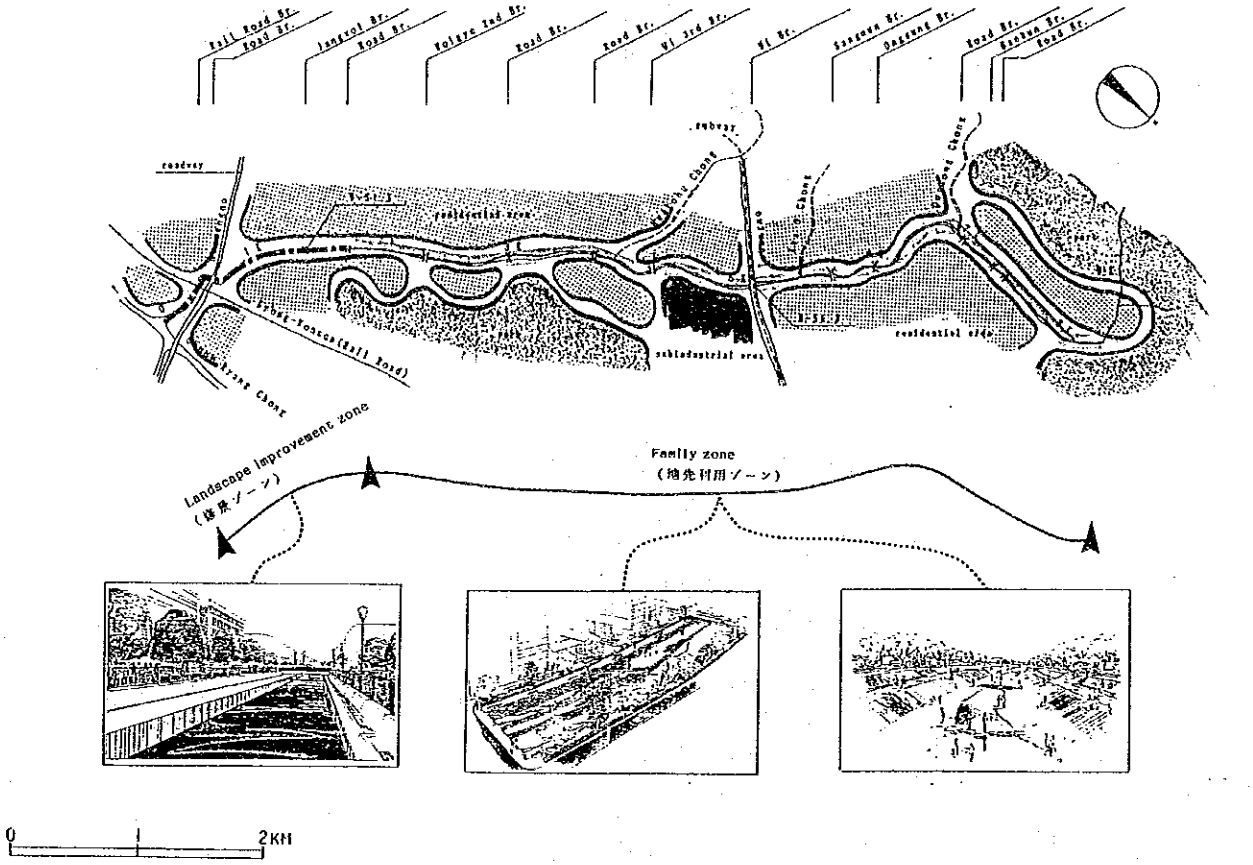


Fig.5.4.C Zoning Plan and Hinterland Condition of Ui Chong

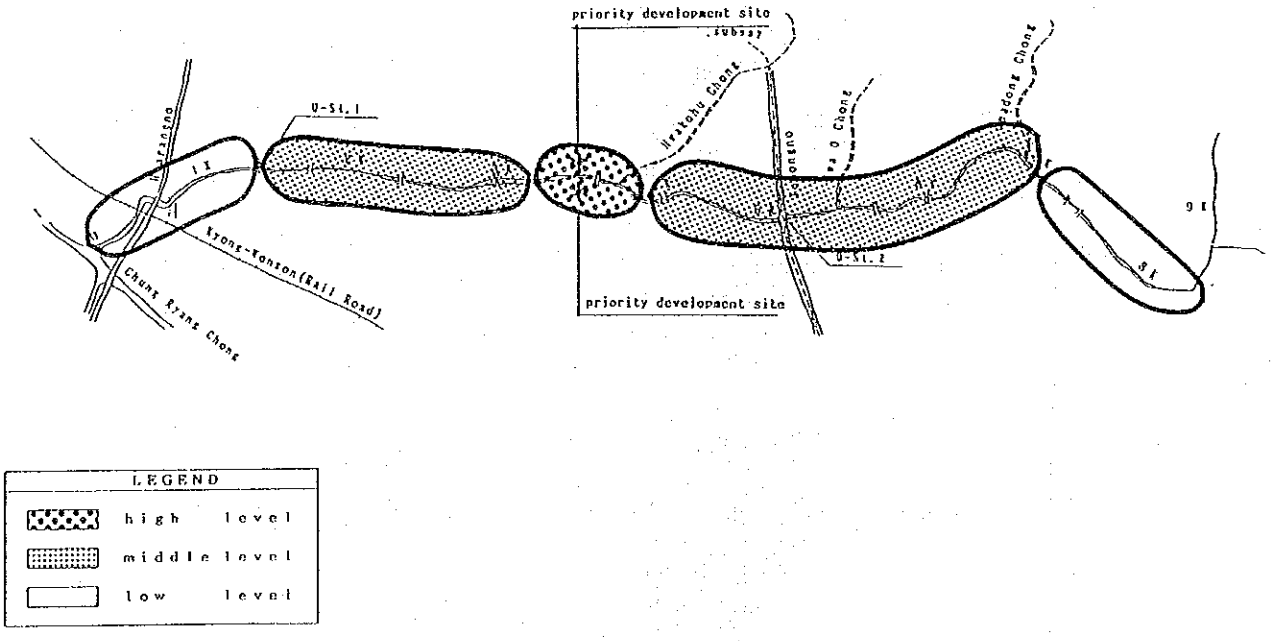


Fig.5.4.D Improvement Level of Zone of Ui Chong

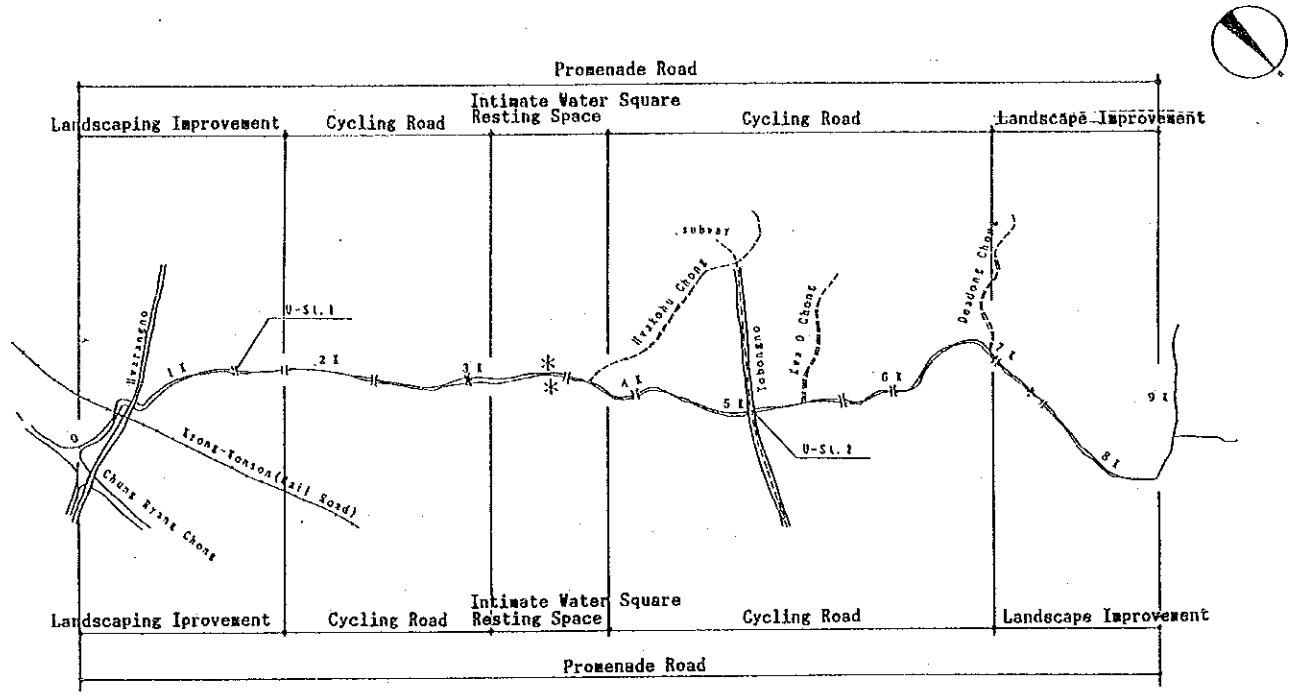


Fig.5.4.E Proposed Facility Plan of Ui Chong

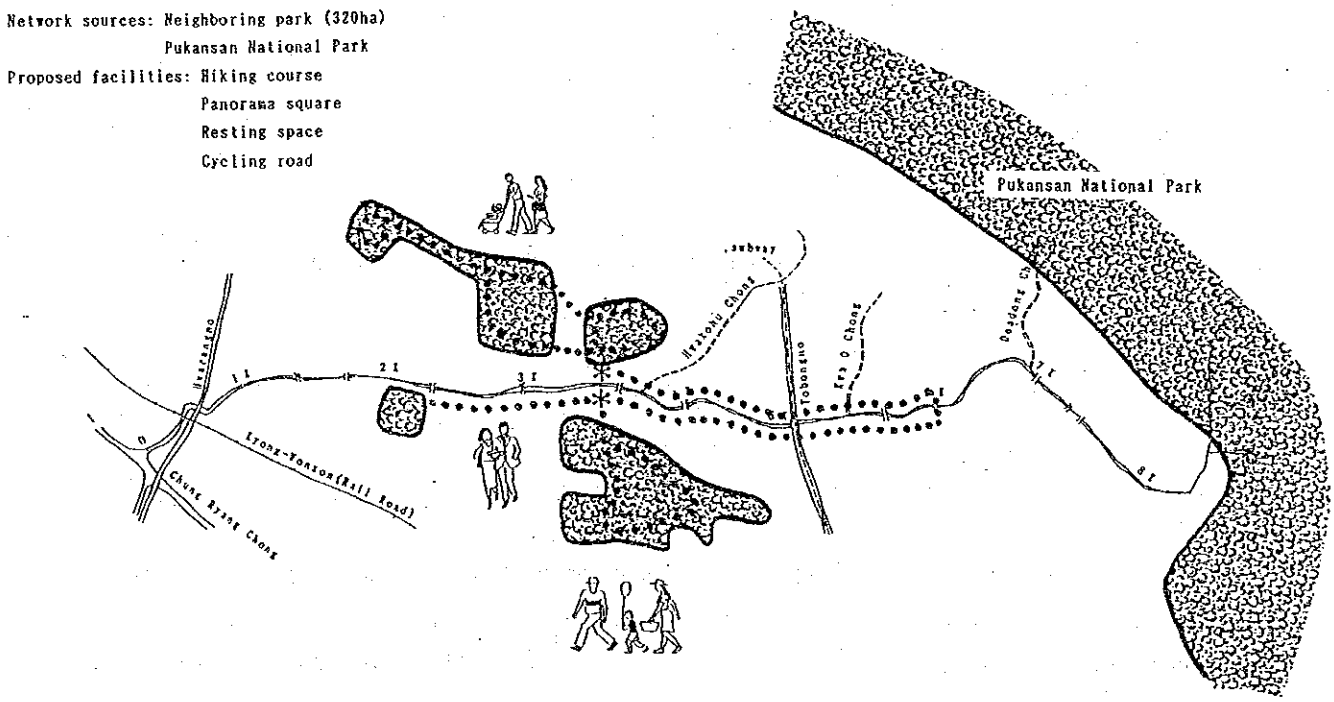


Fig.5.4.F Trail Network Plan of Ui Chong

5.4.3 Zoning and Improvement Plan of Each Zone

The established zones are family zone and modified spectacle zone.

(1) Family zone

Improvement Area: 9 ha (L=4.55 km x 2)

Improvement policy:
Provide a walking road for the embankment and low water channel in the exterior land.

Major facilities: Hydrophile plaza, low water channel, walking road, control facilities, resting facilities and planting.

(2) Modified spectacle zone

Area to be improved: 4 ha (1.75 km x 2)
Improvement policy:
Cover the perpendicular embankment exposing bare concrete with plants so as to improve the spectacle.

Major facilities: Modified spectacle of the perpendicular embankment.

5.5 Zoning Plan of Chungroung Chong

5.5.1 Space Utilization

(1) Since the river space itself constitutes a vital urban axis and the nucleus of the community, many people utilize small roads along the river as their back yards. And, many people are participating in the cleaning of the river bed.

(2) However, low-storied houses line on the both banks from the upstream down, along with the facility transshipping trash, give no charm to the spectacle of the river and makes it monotonous.

(3) The flow of the river becomes less as it downs the stream and there are segments completely lack of water in the river. Also considerable volume of surplus soil from the construction site are dumped, together with the trash, in the river. Besides, sludge deposited around the exit of culvert could be seen. This makes the river bed of many segments look dreary.

(4) The construction plan of a highway (No. 6 line) utilizing the river space and Wolgok in Nowon-gu is under way (Construction period will be July 1991 - December 1993).
Besides, at there is a plan to cover up the river over the length of 800 m or more to construct a parking lot on it. The execution of such a plan may bring a number of problems such as noise, scanty sun shine, worsening spectacles, etc. while the utilization of the river space intended to recover and make the best use of the hydrophile function would become all the more difficult.

5.5.2 Space Improvement Plan

Basing on the problems and future outlook as referred to in the preceding paragraphs, the basic policy of space improvement plan of Chungroung Chong is defined as follows:

(a) As there are a number of segments having dreary spectacles, this should be improved.

(b) Even now, the bond between the inhabitants and river is strong. Further efforts shall be made to enhance the easy association between the inhabitants through river.

5.5.3 Zoning and Improvement Plan in each Section

The established zone is only spectacle zone.

(1) spectacle zone

Area to be improved: 1 ha (3.4 km x 2)

Improvement policy:

a. Cover the perpendicular embankment exposing bare concrete with plants to improve the spectacle.

b. Improve the walking road so as to have the segment keep a link with it.

Major facilities: Park roads, improving-spectacle facilities (planting, plant box), control facilities (staircase, trash bins)

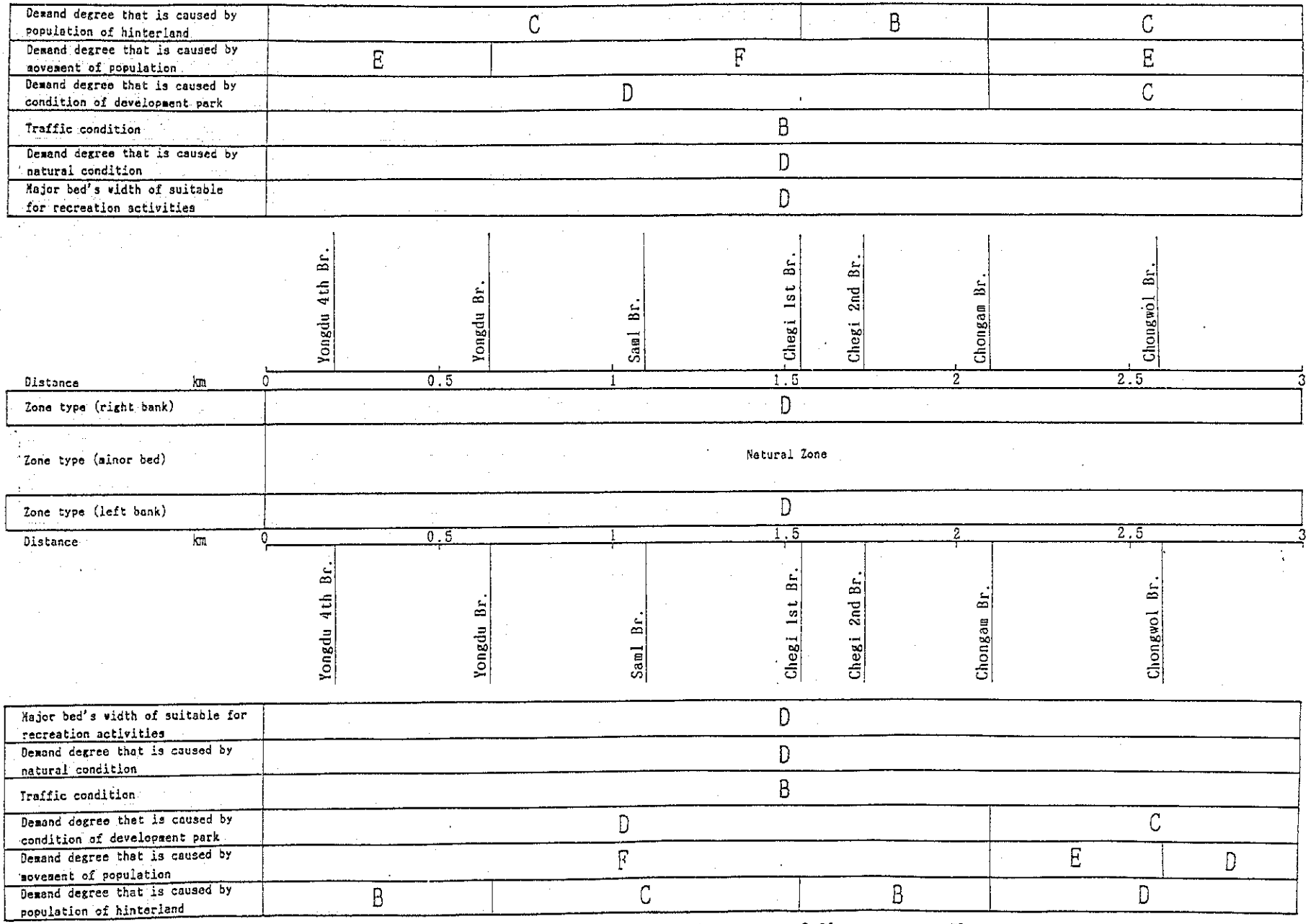
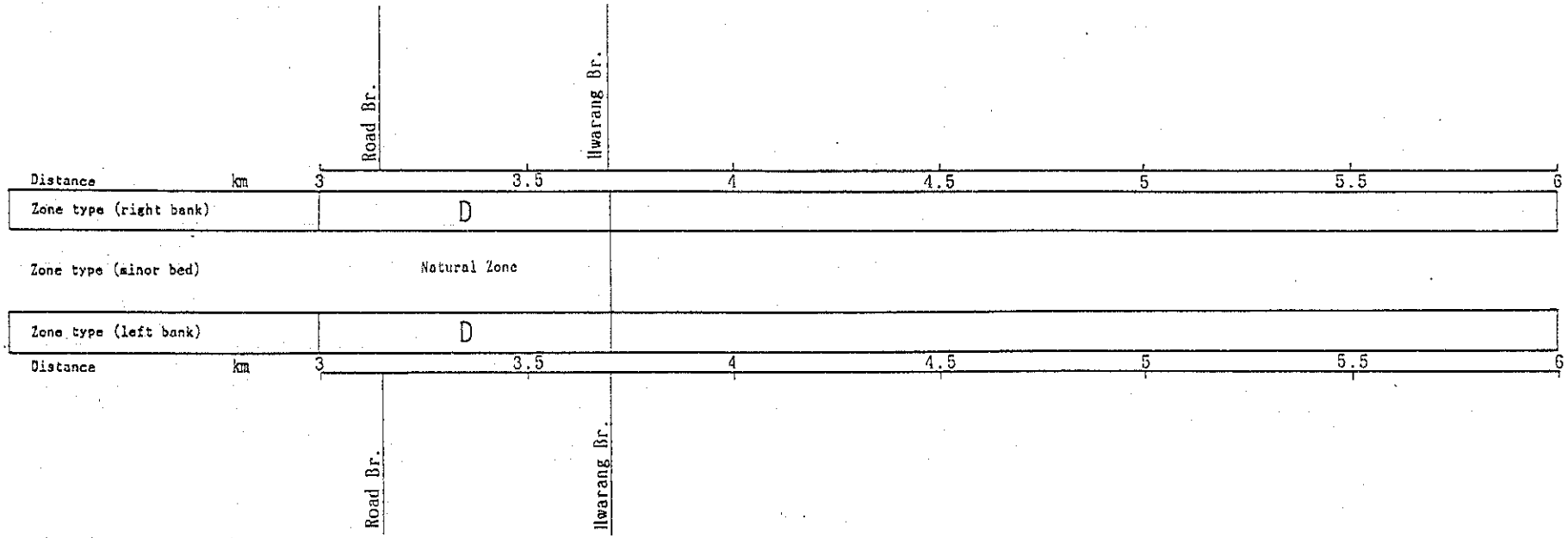


Fig.5.5.A-1 Inland Condition Survey Summary of Chungroung Chong

Demand degree that is caused by population of hinterland	C	
Demand degree that is caused by movement of population	E	
Demand degree that is caused by condition of development park	C	
Traffic condition	B	
Demand degree that is caused by natural condition	D	
Major bed's width of suitable for recreation activities	D	



Major bed's width of suitable for recreation activities	D	
Demand degree that is caused by natural condition	D	
Traffic condition	B	
Demand degree that is caused by condition of development park	C	
Demand degree that is caused by movement of population	D	E
Demand degree that is caused by population of hinterland	D	C

Fig.5.5.A-2 Inland Condition Survey Summary of Chungroung Chong

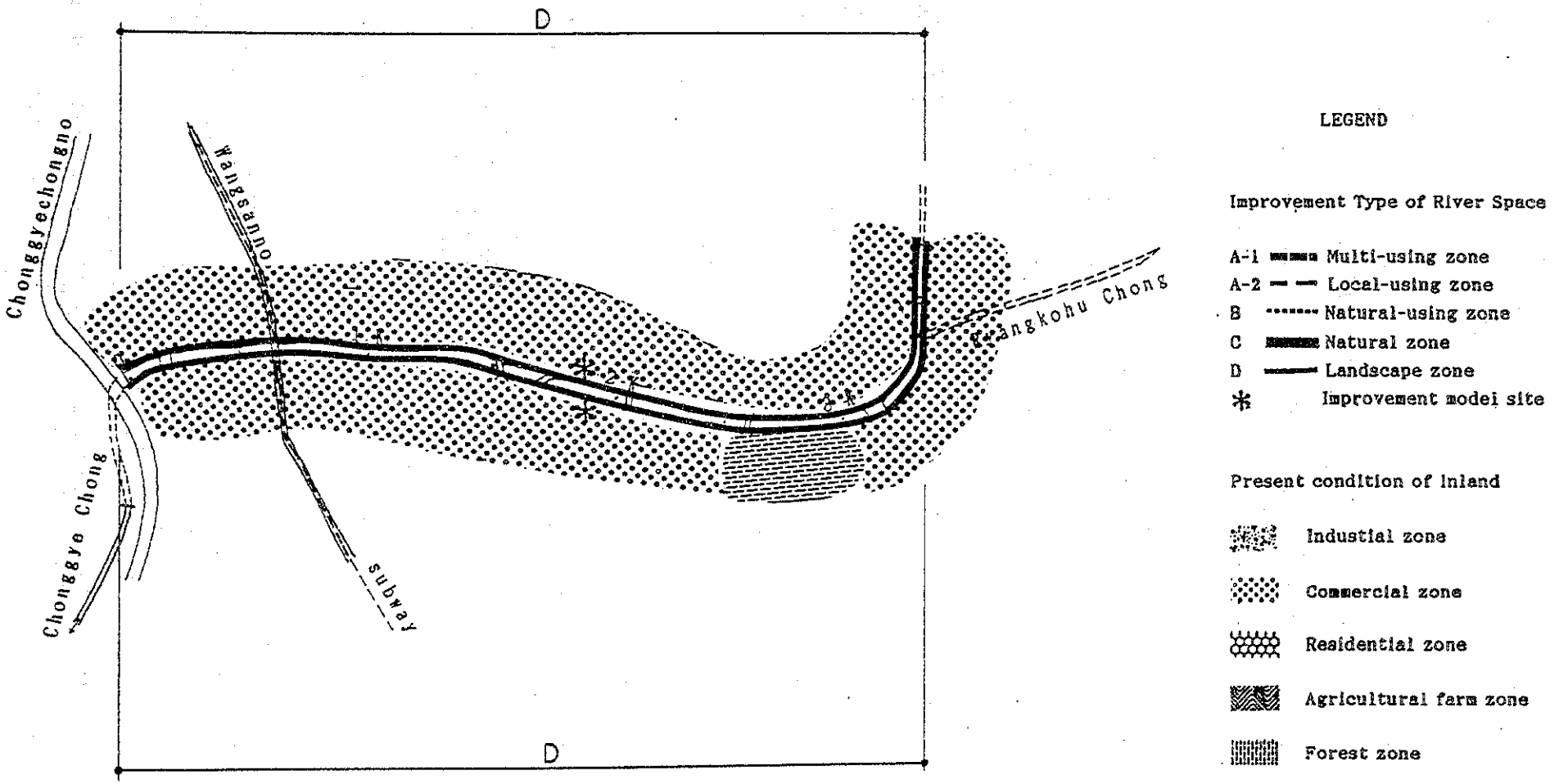


Fig.5.5.B Zoning Plan of Chungroung Chong

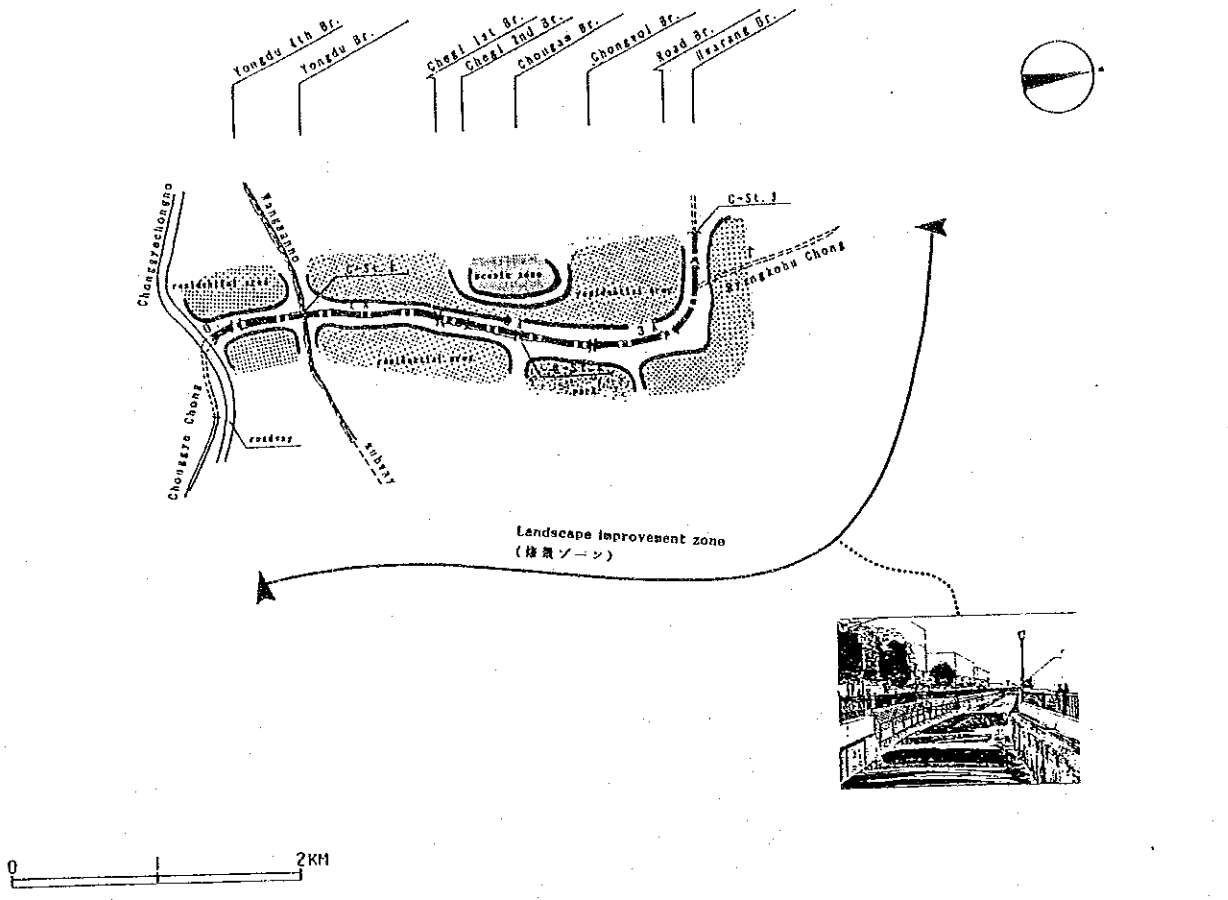


Fig.5.5.C Zoning Plan and Hinterland Condition of Chungroung Chong

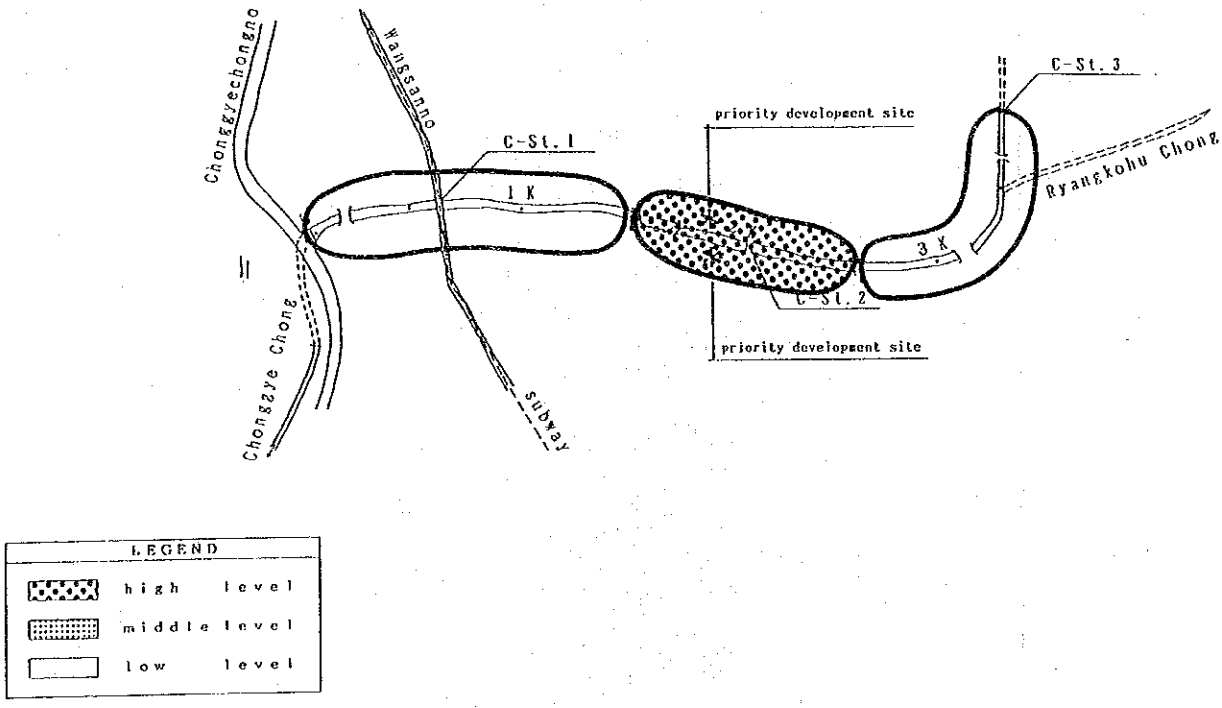


Fig.5.5.D Improvement Level of Zone of Chungroung Chong

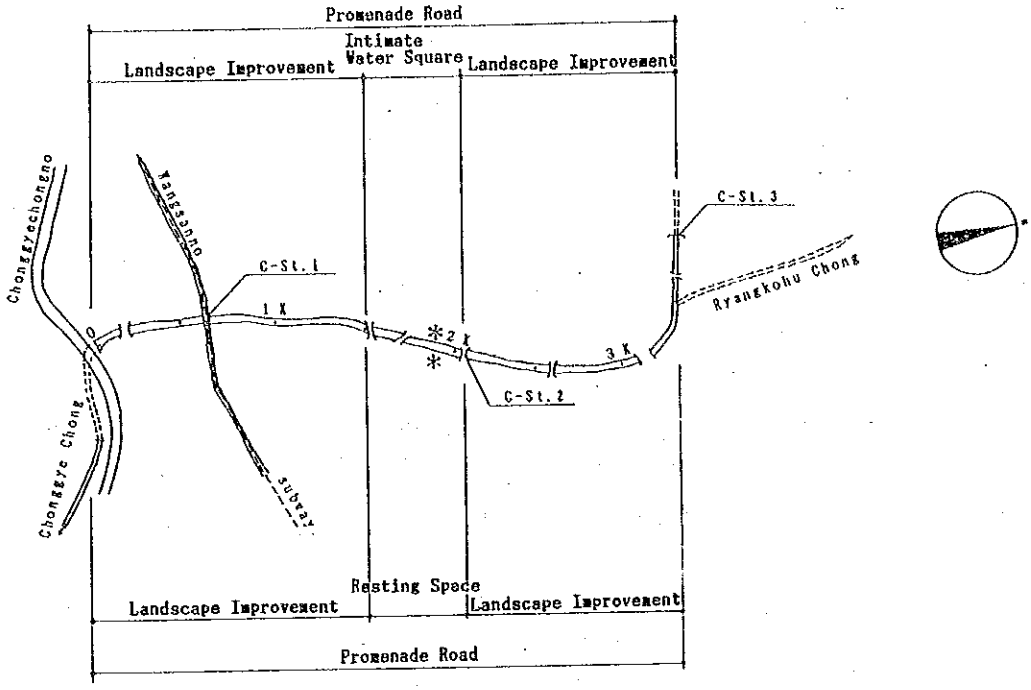


Fig.5.5.E Proposed Facility Plan of Chungroung Chong

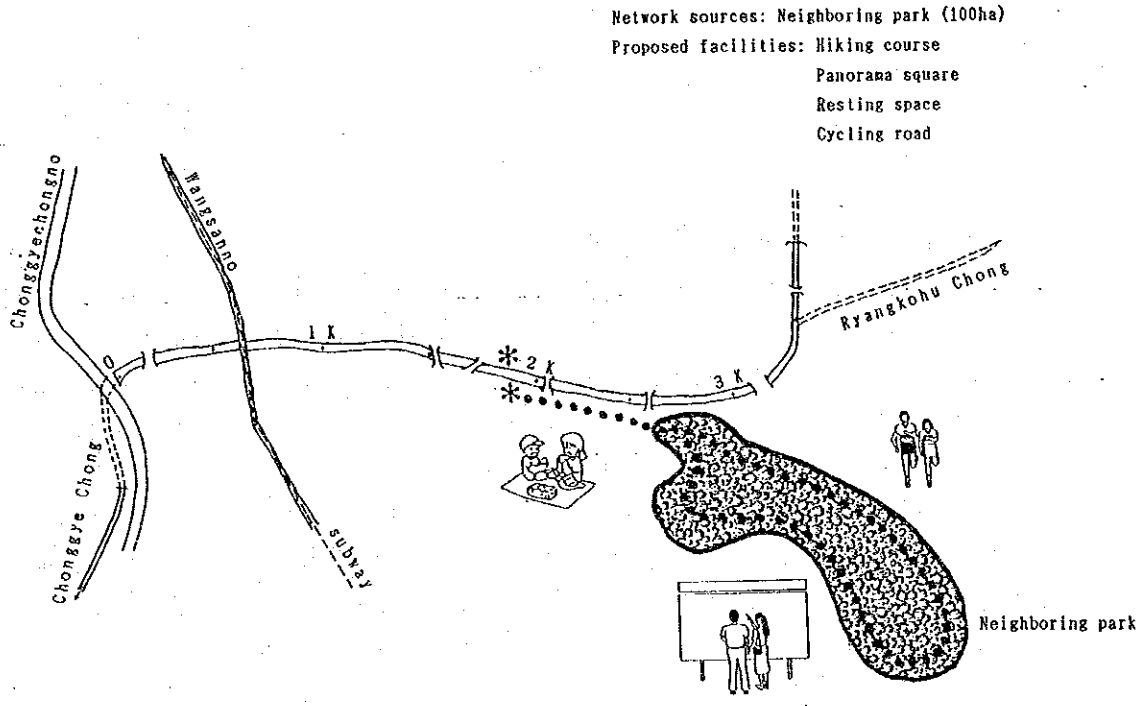


Fig.5.5.F Trail Network Plan of Chungroung Chong

Chapter 6 Attentive Matter for River Space Improvement

6.1 Flooding Frequency and Major Bed Utilization

While the major bed is covered with water at the time of flooding, the frequency of inundation and inundated condition of the major bed largely affect the growth of plants and maintenance and management of various kinds of facilities. Therefore, the utilizing form and maintaining and managing methods of the major bed must be studied by paying attention to the frequency and condition of inundations. The general relations between inundation and plants between the inundation and park facilities are described here.

(1) Inundation and plant growing environment

The distribution of riverside vegetation are controlled by the physical and chemical properties (water content, granular variation, humid content, etc.,) of the soil and the flooded condition of plants.

A flood not only washes away plants and buries plants with earth and sands transported from the upstream side by the flood, but also affects the soil in such way that inundated soil becomes to contain excessive water and is lowered in air-permeability, resulting in root humus of plants which are not highly water resistive.

It is said that the period until the gravity water drained from the soaked soil and air-permeability of the soil is restored after an inundation is several hours for sandy soil, 24 hours for well-drainable soil, and several days for clay soil. Therefore, when a major bed is planted with trees, moisture resistive plants which are suitable for the soil of the major bed must be planted in places which are not subject to floods.
On the broadleaf trees widely distributed in the Seoul Metropolitan area and its vicinity, the aspen, poplar, acasia, liriodendron, elm (Ulmas Davidians var. japonica), azalcas can be considered to be higher in moisture resistance and applicable to the sections to be planned.

In addition, water resistive flowering plants include the California poppy,

Komachi-sou, red poppy, cosmos, cornflower, Harusha-giku, Ookinkei-giku, babies'-breath, pechunia, scarlet sage, marigold, wild pink, etc.

(2) Inundation and facility improvement

Inundation limit space utilizing extents and states. Generally speaking, as the frequency of inundation increases, natural preserving facilities become more suitable than artificial facilities, linear facilities become more suitable than planar facilities, and static facilities become more suitable than dynamic facilities.

The facilities listed on Table 4.7-1 can be considered as concrete examples of the facilities.

Where the frequency of inundation is high, in addition, it is desirable to use removable or movable facilities made of water resistant or decay resistant materials and to arrange the facilities in a pattern where deposited earth and sands can be removed easily.

Table 6.1-1 Frequency of Inundation and Applicable Facility

Frequency of inundation	Applicable facility
Low	Sporting facilities : Football ground, tennis court, volleyball court,
	Playing facilities : Trapezes, slides, seesaws, ladders
	Resting facilities : Resting places, benches, outdoor tables
	View improving facilities: Trees, flower gardens
high	Nature protective facilities: Nature watching parks, aquatic zoos

6.2 River Space Improvement Plan

The space utilization form of each river is decided in accordance with the characteristics of the areas classified on the basis of the present (natural and social conditions) and present improved and utilized condition of each basin. In addition, areas which are discriminated to be large in utilizing demand and suitability will be improved preferentially.

In general, the utilization of a river space must be verified from the safety of flood regulation, but, such verification was practically impossible, because the records of river profile and section was never stocked and even profile and sectional survey performed in this investigation could not confirm actual river features by many water works constructed in the river channel. Therefore, the river space improvement plan shall be established on the assumption of the safety for the flooding is completely confirmed. And, the major bed utilization plan, which makes big land alternation and reduction of flow capacity, will be unemployed.

Besides, the flexible utilization style and facilities having little damage by flooding shall be applied on the major bed judged disastrous part of inundation, in consideration with the results of Section 4.7.2.

Chapter 7 Improvement Plan of the Model Site

7.1 Anyang Chong

Based on the comprehensive evaluation made with regard to the utilization demand and the degree of adaptability of each section, 3 sites shall be improved as the priority sites.

(1) M1 area (Right bank No. 79 - 95)

Area to be improved: 12 ha (L = 800m)
Improvement policy:
a. To provide facilities to have people improve health while playing sports.
b. To provide a plaza to have people hold events

Major facilities: Plaza (1), tennis court (5), volleyball court (3), green plaza (1), walking road, resting facilities (bench - 30, shelter - 2), lavatory (2 points), control facility (staircases - 3 places, trash bins in 5 points), gardening (tall tree - 240)

(2) M2 area (Left bank No. 84 - 102)

Area to be improved: 12 ha (L = 900m)

Improvement policy:
a. To provide facilities to have people improve health while playing sports
b. To provide a plaza to have people hold events

Major facilities: Plaza (1), soccer coat (1), tennis court (2), volleyball court (1), green plaza (1), flower bed, resting facilities (bench - 30,

shelter - 2), lavatory (2 points),
control facility (staircases - 3 places,
trash bins in 5 points)

(3) M3 area (Left bank No. 146 - 159)

Area to be improved: 5 ha (L = 650m)

Improvement policy:

a. To nurture the natural environment utilizing a variety of plants comprising trees around the riverside.

b. To arrange and improve the area to enable people to enjoy walking or rest in the natural environment.

Major facilities: Natural walking road (1,100 m),
natural embankment (630 m),
planting (taller trees 150),
resting facilities (bench - 24),
lavatory (2 points), control facility
(trash bins in 6 points)

(4) Facility plan

In the facility plan, the following points shall be considered specifically.

(a) Precast concrete and plastics shall compose the major part of facility and material used therefore, to minimize the damage due to inundation.

(b) Lavatory, control structure and sporting facility shall be of portable construction in consideration of the time of inundation

(c) facilities must be easily maintainable and controllable.

(5) Planting plan

In the planting, the following points shall be considered specifically.

(a) For the embankment where trees can be planted, plant taller trees to have them make lines.

(b) When growing flowers on the major bed, flowers inhabiting around the riverbank shall be transplanted for the sake of the maintenance of nature.

(c) For the major bed that would suffer inundation, plant flowers which could easily beatify the surrounding, less expensive, highly anti-hygro prytic, selecting the kinds capable to bloom even under haphazard control.

7.2 Yangjae Chong

In accordance with the comprehensive evaluation made with regard to the demand for utilization and aptitude level of each segment, the segments shall be given the priorities in the improvement of segments under scheme of Yangjae Chong.

(1) M1 area (No. 49 - 73)

Area to be improved: 11 ha (L = 2.4)

Improvement Policy:
Improve the space so as to enable the people to take rest on the river bed comfortably at any time as it is located close to the residence area.

Major facility:

Hydrophile plaza (2), green plaza (30,500) ha),
walking road (total extension 3,600 m),
health increasing equipment (30),
resting (bench - 30, shelter - 40),
control facilities (staircases - 6 places),
trash bins in 6 and plant (tall tree - 520)

(2) M2 Area (No. 100 - 120)

Area to be improved: 7 ha (L = 2 km)
Improvement Policy:

(a) Improve the park road to enable the riverside people and the residents to the adjacent park to enjoy walking and rest.
(b) Improve the facilities to enable the people to enjoy sports readily.

Major facilities: Hydrophile plaza (2),natural walking road (9)hydrophyte garden (6,000 m2), health increasing equipment (15), resting facilities (bench - 15, shelter - 4control facilities stair case - 10, trash bins in 10 and plant (tall tree - 200)

(3) Facility plan

(a) Any type of facility and the materials used therefore shall be such that would suffer less damage even under the flood.
(b) Only materials giving natural feeling shall be used to harmonize them with the surrounding natural environment.
(c) Facilities shall be such that are easily maintained and controlled.

(4) Planting plan

(a) In the natural zone and the zone utilizing the nature, transplant the types of trees growing by the riverside.

(b) On the embankment in the family zone, plant taller trees so that a good green belt would be made without interruption and plant the flowers having hydrophile properties in the major bed.

7.3 Ui Chong

In accordance with the comprehensive evaluation made with regard to the demand for utilization and aptitude level of each segment, 1 area shall be given the priority and improved as the base area, in the segments under plan of Ui Chong.

(1) M1 area (No. 59 - 73)

Area to be improved: 4 ha (L = 0.7 km x 2)

Improvement policy:

a. Improve the embankment with lines of tree.s

b. In order to create a water-surface, provide a removable weir and improve its vicinity as a hydrophile space full of amenities.

Major facilities: Hydrophile plaza (2), resting facilities (bench - 16, shelter - 4), control facilities (staircases - 8 places, trash bins in 8 points) and planting (tall tree - 200).

(2) Facility plan

a. Any type of facility and the materials used shall be such that would suffer less damage under the flood.

b. Facilities shall be such that are easy to maintain and control.

c. Only material having natural touch shall be used.

(3) Planting plan

Improve the embankment with taller trees to have them form a green axis having continuity.

7.4 Chungroung Chong

In accordance with the comprehensive evaluation made with regard to the demand for utilization and aptitude level of each segment, one section shall be given the priority in the improvement of segments of Chungroung Chong.

(1) M1 area (No. 35 - 45)

Area to be improved: 1 ha (L = 1 km)

Improvement policy:

a. To create hydrophile spaces, wall-fountain utilized the perpendicular embankment shall be provided

b. To modify the perpendicular embankment exposing bare concrete, place plant boxes, provide tree planted enclosures and juxtapose natu ral stones.

Major facilities: Well-fountain (1), resting facilities (bench - 14), control facilities (staircases - 5 places, trash bins in 5 points), planting (tall tree -70, bush 840, and plant box- 340) and modified embankment spectacle (2,400 m2)

(2) Facility plan

a. Any type of facility and the materials used therefore shall be such that would suffer less damage under the flood.
b. Facilities shall be such that are easily maintained and con- trolled.
c. Only material having natural touch shall be used.

(2) Planting plan

a. The perpendicular embankment shall be covered with ivy and hedera.

SUPPORTING REPORT Ⅵ

CONSTRUCTION PLANNING AND CONSTRUCTION EXPENSES

CONTENTS

List of Table

List of Table

Chapter 1 Introduction

1.1 Purpose of this Study

This study is to determine the appropriate construction planing in conformity with the each actual site condition and to compute the required project expenses for the reference of the project evaluation and the implementation plan.

1.2 Method of the Study

The technology level and the construction capacity of the Korean construction company were surveyed in order to determine the appropriate construction methods.
The proposed construction site conditions were surveyed in order to grasp the restriction on the construction works.
Based on the aforesaid conditions, we planned the appropriate construction method and program.

The common material prices, labor rates, machinery costs, taxes and general expenses were investigated in order to compute the estimated project prices. Based on the designed construction method and program, using surveyed prices, we estimated the project expenses. The total project expenses were distributed to each year so that the annual required budget of these projects could be understood.

Chapter 2 Construction Planing

2.1 Construction Planning

The construction plan was formulated on the basis of the following assumptions, and this shall be reviewed based on the detailed survey prior to the implementation.

1) Common construction methods are only adopted for civil works including underground structures.

2) Sheet Piling with Strut method is adopted for excavation works of underground structure constructions. Groundwater is drained up with a water pump.

3) A special wastewater treatment plants for river bed dredging works is not included in this plan. We assumed that dredged materials may be disposed within 10 km of the dredging site.

4) Construction roads are provided within the river land, and in the certain parts a temporary bridge made of H beam is provided where land is limited.

5) Common construction equipment is only employed.

6) We assumed that the construction materials are easily obtained in Korea.

7) Since the geological survey was not conducted in this study, the soil conditions at the proposed facility sites were assumed as follows.

- Bearing capacity is sufficient.
- Driving and extracting piles can be easily done.
- Stability of piles can be sufficiently obtained in case the penetration depth is 1.5 times of the excavation depth.

- Drain water works can be done with water pumps.

2.2 Water Quality Improvement Facility

(1) Aeration Contact Oxidation with Cobble Tank

1) Earthwork

After driving piles around the outside of the contact oxidation with cobble tank, excavation will be carried out. Walings and struts are installed where necessary.

2) Structure Works

After excavation works, the ground surface is fully compacted and then lean concrete is placed. On the lean concrete reinforcement works, form works and concrete works are carried out. Concrete works and curing works are carried out in full attention. After the completion water proof tests shall be conducted to confirm leakage.

3) Placing Cobble Works

Diffuser pipes are placed on the slab after structure works and then cobble is carefully placed in order not to damage diffuser pipes and obtain a void ratio of over 0.45.

4) Machinery and Conduit Works

The proposed locations of pipes crossing concrete are opened with a sleeve pipes, etc.

5) Electric Works

Conduits are installed in concrete, however conduits are placed in visible areas as much as possible.

(2) Pre Aeration Contact Oxidation with Cobble Plant

1) Outline of Facility

This facility has sheet pile walls with a concrete bottom slab filled

with cobble with a void ratio of 0.45. This facility does not have any machineries and pipes inside.

2) Construction Planning

New sheet piles shall be used for this work because it functions as a part of a permanent structure.

(3) Pre Aeration Tank

1) Outline of Facility

This facility has a reinforced concrete tank 7 meters deep and the blower machine room. High water proof is required for this structure.

2) Construction Planning

Excavation works, structure works, machinery and pipe works and electric works are carried out in the same way as the aeration contact oxidation with cobble tank.

(4) Sedimentation Tank

1) Outline of Facility

This facility has a function of separating sludge from water. It has a reinforced concrete water tank 7 meters deep and the machine room to remove sludge. High water proof is required for this structure.

2) Construction Planning

Excavation works, structure works, machinery and pipe works and electric works are carried out in the same way as the aeration contact oxidation with cobble tank.

(5) Grit Chamber

1) Outline of Facility

This facility has a function of separating sand from raw water and it has the equipment to remove sand.

2) Construction Planning

Excavation works, structure works, machinery and pipe works and electric works are carried out in the same way as the aeration contact oxidation with cobble tank.

(6) Distribution Tank

1) Outline of Facility

This facility functions to divide raw water into two, water for treatment and for non-treatment. High water proof is required for this structure.

2) Construction Planning

Excavation works, structure works, machinery and pipe works and electric works are carried out in the same way as the aeration contact oxidation with cobble tank.

(7) Water Intake Facility

1) Outline of Facility

This facility functions to introduce river water into the plant and it consists of a rubber dam and a water intake.

2) Construction Planning

The rubber dam is set up across the river. The construction of the rubber dam shall be executed keeping the water channel, during the dry season.

2.3 Flow-regime Improvement Facility

(1) Movable Weir

This facility is a rubber dam to collect water for the purpose of creating a water face.

(2) Water Introduction Works

1) Outline of Facility

This facility functions to divert clean water from the upstream to the downstream in order to supply water to the river space improvement model site. This facility consists of a water intake and a water conveyance pipe.

2) Construction Planning

The rubber dam is set up across the river. The construction of the rubber dam shall be executed, keeping the water channel during the dry season. The conveyance pipes are set up on the concrete foundation tightly.

2.4 Implementation Schedule

The implementation schedule was proposed in Chapter 10 of Main Report in account of the various conditions. The implementation schedule is shown in Table 2-1

Table 2-1 Implementation Schedule

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Construction of Water Quality & Flow Regime Improvement Facility																			
Anyang Chong									St. 6			St. 5			St. 4		Dredging	St. 2	
Yangjae Chong						St. 2													
Ui Chong									Flow Regime										
Chongroung Chong					St. 3														
Construction of River Space Improvement Facility																			
Anyang Chong		M1		M2						M3									
Yangjae Chong						M2	M1												
Ui Chong								M1											
Chongroung Chong									M1										
Basic & Detail Design Schedule																			
Anyang Chong																			
Yangjae Chong																			
Ui Chong																			
Chongroung Chong																			
Monitoring (Water Quality & Discharge)																			
Remarks	←Phase I→																		
	←Basic Plan→																		

※ ≈≈≈ :Water Quality & Flow Regime Improvement Plan —— :River Space Improvement Plan

Chapter 3 Estimation of Project Expenses

The project expenses was computed based on the following assumptions.

1) The standard project expenses are computed using unit price indicated on "Comprehensive Construction Material and Equipment Price Information Book published in July 1991".

2) Landscape works are computed as civil works.

3) Machineries for water quality improvement facilities are estimated based on "Machinery Price List for Water Quality Improvement Facility". Machineries for parks and exercises are estimated based on "Comprehensive Construction Material and Equipment Price Information Book published in July 1991".

4) The general expenses which are consist of the overhead and the related taxes are assumed in 38% of the direct construction cost.

5) The land acquisition cost is not included because this project was planned in only the government land.

The estimated project expenses is shown in Table 3-1 and 3-2.
The annual investment schedules are shown in Table 3-3, 3-4 and 3-5.

Table 3-1 Summary of Project Expenses

Project	Location	Amount M.won	BQ No.
Water Quality Improvement	Anyang St.6	42,195	1/19
	Anyang St.5	84,528	2/19
	Anyang St.4	62,175	3/19
	Anyang St.2	78,741	4/19
		12,630	5/19
	Yangjae St.2	7,557	6/19
	Chungroung St.3	3,066	7/19
	sub-total	290,837	
Flow Regime Improvement	Channel Works	3,140	8/19
	Water Introduction	230	8/19
	Movable Weir	174	8/19
	sub-total	3,544	
River Space	Anyang M1	2,918	9/19
	Anyang M2	2,534	10/19
	Anyang M3	2,820	11/19
	Anyang, other	35,198	12/19
	Yangjae M1	4,366	13/19
	Yangjae M2	5,849	14/19
	Yangjae, other	9,105	15/19
	Ui M1	2,098	16/19
	Ui, other	12,392	17/19
	Chungroung M1	1,604	18/19
	Chungroung, other	1,584	19/19
	sub-total	80,468	
	total	374,849	

Table 3-2 PRICED BILL OF QUANTITIES (1/19)

Facility Name : Aeration contact oxidation with cobble plant
Location : Anyang Chong St.6

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W01	Rubber dam	m^2	173	4,900	847
W02	Foundation work	LS	1		210
W03	Revetment work	m^2	144	70	10
W04	Major bed protection work	m^2	460	70	32
W05	Grit Chamber & Distributiion	LS	1		438
W06	Cobble tank	LS	1		22,463
W07	Electrical Facility	m^2	200	525	105
W08	Sand washing yard	m^2	80	350	28
	[Machinery work]				
W09	Screen W1.0xL5.0	set	3	160	1
W10	Weir gate W1.0xH2.0	set	2	4,500	9
W11	Gate W1.0xH1.5	set	6	450	3
W12	Sand water pump 0.13m^3/min	set	3	1,425	4
W13	Blower 18m^3/min	set	21	10,440	219
W14	Diffuser 1=9m SUS	set	784	1,290	1,011
W15	Sand washer 0.5m^3/h	set	1		263
W16	Miscellaneous	LS	1		755
W17	Piping work	LS	1		1,132
W18	[Electrical work]	LS	1		1,586
W19	[Preparatory works]	LS	1		1,460
	sub-total				30,576
	Overhead and tax 38%				11,619
	total				42,195

Table 3-2 PRICED BILL OF QUANTITIES (2/19)

Facility Name : Aeration contact oxidation with cobble plant
Location : Anyang Chong St.5

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W01	Rubber dam	m^2	192	4,900	941
W02	Foundation work	LS	1		403
W03	Revetment work	m^2	600	70	42
W04	Major bed protection work	m^2	2,760	70	193
W05	Grit Chamber & Distributiion	LS	1		725
W06	Cobble tank	LS	1		37,503
W07	Electrical Facility	m^2	800	525	420
W08	Sand washing yard	m^2	200	350	70
	[Machinery work]				
W09	Screen W2.5xL4.5	set	4	250	1
W10	Weir gate W3.0xH2.0	set	2	3,600	7
W11	Gate W2.5xH2.0	set	8	5,550	44
W12	Sand water pump 0.13m^3/min	set	3	1,425	6
W13	Blower 12m^3/min	set	72	7,020	505
W14	Diffuser l=9m SUS	set	3,600	1,290	4,644
W15	Sand washer 0.5m^3/h	set	1		263
W16	Miscellaneous	LS	1		2,735
W17	Piping work	LS	1		4,102
W18	[Electrical work]	LS	1		5,744
W19	[Preparatory works]	LS	1		2,904
	sub-total				61,252
	Overhead and tax 38%				23,276
	total				84,528

Table 3-2 PRICED BILL OF QUANTITIES (3/19)

Facility Name : Aeration contact oxidation with cobble plant
Location : Anyang Chong St.4

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W20	Pump station	LS	1		2,854
W21	Pre-aeration tank	LS	1		1,743
W06	Cobble tank	LS	1		13,213
W07	Electrical Facility	m^2	600	525	315
W08	Sand washing yard	m^2	300	350	105
	[Machinery work]				
W22	Pump station	LS	1		7,030
W13	Blower 41.6m^3/min	set	7	17,460	122
W14	Diffuser l=9m SUS	set	54	1,290	70
W15	Sand washer 0.5m^3/h	set	1	263	263
W16	Miscellaneous	LS	1		3,742
W17	Piping work	LS	1		5,613
W18	[Electrical work]	LS	1		7,859
W19	[Preparatory works]	LS	1		2,125
	sub-total				45,054
	Overhead and tax 38%				17,120
	total				62,120

Table 3-2 PRICED BILL OF QUANTITIES (4/19)

Facility Name : Aeration contact oxidation with cobble plant
Location : Anyang Chong St.2

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W20	Pump station	LS	1		3,682
W21	Pre-aeration tank	LS	1		4,090
W06	Cobble tank	LS	1		23,030
W07	Electrical Facility	m^2	600	525	315
W08	Sand washing yard	m^2	300	350	105
	[Machinery work]				
W22	Pump station	LS	1		6,346
W13	Blower $30m^3/min$	set	13	27,540	358
W14	Diffuser l=9m SUS	set	36	1,290	46
W15	Sand washer $0.5m^3/h$	set	1	263	263
W16	Miscellaneous	LS	1		3,506
W17	Piping work	LS	1		5,259
W18	[Electrical work]	LS	1		7,363
W19	[Preparatory works]	LS	1		2,696
	sub-total				57,059
	Overhead and tax 38%				21,682
	total				78,741

Table 3-2 PRICED BILL OF QUANTITIES (6/19)

Facility Name : Aeration contact oxidation with cobble plant

Location : Yangjae Chong St.2

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W01	Rubber dam	m^2	15	4,900	74
W02	Foundation work	LS	1		105
W03	Revetment work	m^2	125	70	9
W04	Major bed protection work	m^2	920	70	64
W05	Grit Chamber	LS	1		33
W21	Pre-aeration tank	LS	1		329
W22	Settling basin	LS	1		1,475
W06	Cobble tank	LS	1		2,862
	[Machinery work]				
W09	Screen W1.0xL3.0	set	2	1,100	2
W10	Weir gate W1.0xH1.0	set	2	1,800	4
W11	Gate W1.0xH1.0	set	4	1,750	7
W12	Sand water pump 0.13m^3/min	set	2	1,425	3
W23	Sludge pump	set	6	1,100	7
W24	Weir plate SUS	set	144	8	1
W25	Skum skimer l=5m	set	3	720	2
W13	Blower 10.9m^3/min	set	4	6,322	25
W14	Diffuser l=4m SUS	set	28	640	18
W15	Sand washer 0.5m^3/h	set	1		11
W16	Miscellaneous	LS	1		40
W17	Piping work	LS	1		60
W18	[Electrical work]	LS	1		84
W19	[Preparatory works]	LS	1		261
	sub-total				5,476
	Overhead and tax 38%				2,081
	total				7,557

Table 3-2 PRICED BILL OF QUANTITIES (7/19)

Facility Name : Aeration contact oxidation with cobble plant
Location : Chungroung Chong St.3

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	[Structure work]				
W01	Rubber dam	m^2	22	4,900	107
W06	Cobble tank	LS	1		1,564
W07	Electrical Facility	m^2	100	525	53
	[Machinery work]				
W10	Weir gate W1.0xH1.0	set	2	1,800	4
W13	Blower 10.9m^3/min	set	3	6,322	19
W14	Diffuser l=9m SUS	set	76	1,290	98
W16	Miscellaneous	LS	1		60
W17	Piping work	LS	1		79
W18	[Electrical work]	LS	1		110
W19	[Preparatory works]	LS	1		128
	sub-total				2,222
	Overhead and tax 38%				844
	total				3,066

Table 3-2 PRICED BILL OF QUANTITIES (8/19)

Facility Name : Flow Regime Improvement Work

Location : Ui Chong

Item No.	Description of Works	Unit	Quantity	Unit Price 1000 won	Amount mil. won
	[Channel Improvement]				
	Revetment work	m^2	32,700	65.7	2,148
					2,148
	[Water Introduction]				
	Daedong Chong				
	Pipe work d=250mm	m	850	35	30
	Concrete work (intake)	m^3	132	250	33
	[Kwao Chong]				
	Pipe work d=250mm	m	1,650	35	58
	Concrete work (intake)	m^3	94	250	24
	[Hwakohu Chong]				
	Pipe work d=200mm	m	2,400	30	72
	Concrete work (intake)	m^3	90	250	23
					240
	[Movable Weir]				
	Rubber dam H=1m, L=8m	LS	1		63
	Concrete work (foundation)	m^3	220	195	43
	Restoration of revetment	m^2	200	370	74
					180
	sub-total				2,568
	Overhead and tax 38%				976
	total				3,574

Table 3-2 PRICED BILL OF QUANTITIES (5/19)

Work Item : Dredging bed sediment
Location : Anyang Chong

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
	*River Length to be dredged 14,120 m *Depth to be removed 0.5 m *Average water level 1.0 m *Average river width 60 m *Area dredged 771,000 m^3 *Removed sediment volume 385,200 m^3				
	Direct work cost	m^3	385,200	23,760	9,152
	sub-total				9,152
	Overhead and tax 38%				3,478
	total				12,630

Table 3-2 PRICED BILL OF QUANTITIES (9/19)

Facility Name : River space improvement work of the model site
Location : Anyang Chong M-1

Item No.	Description of Works	Unit	Quantity	Unit Price 1000 won	Amount mil. won
S01	Tennis court 5 courts	m^2	5,180	48.8	253
S02	Soccer field	m^2			
S03	Volleyball court 3 courts	m^2	4,515	56.0	253
S04	Multipurpose field	m^2	13,000	13.7	178
S05	Natural sodding field	m^2	58,000	12.2	706
S06	Natural walkway	m^2	8,000	62.3	498
S07	Paved area on embankment	m^2	2,400	27.5	66
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	3	24,000	72
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	240	266,600	64
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		24
	sub-total				2,114
	Overhead and tax 38%				804
	total				2,918

Table 3-2 PRICED BILL OF QUANTITIES (10/19)

Facility Name : River space improvement work of the model site
Location : Anyang Chong M-2

Item No.	Description of Works	Unit	Quantity	Unit Price 1000 won	Amount mil. won
S01	Tennis court 2 courts	m^2	1,330	86.5	115
S02	Soccer field 1 court	m^2	6,660	29.6	197
S03	Volleyball court 1 court	m^2	504	89.3	45
S04	Multipurpose field	m^2	2,500	12.8	32
S05	Natural sodding field	m^2	73,000	11.7	854
S06	Natural walkway	m^2	14,000	39.7	556
S07	Paved area on embankment	m^2			
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos			
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos			
S17	Wall for view improvement	m			
S18	Flower pot	m	300	50	15
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		22
	sub-total				1,836
	Overhead and tax 38%				698
	total				2,534

Table 3-2 PRICED BILL OF QUANTITIES (11/19)

Facility Name : River space improvement work of the model site
Location : Anyang Chong M-3

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court	m^2			
S02	Soccer field	m^2			
S03	Volleyball court	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2			
S06	Natural walkway	m^2	2,750	672.4	1,849
S07	Paved area on embankment	m^2	1,890	58.7	111
S08	Natural revetment	m	630	36.5	23
S09	Garden	m^2			
S10	Stairs	nos			
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	150	260	39
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		21
	sub-total				2,043
	Overhead and tax 38%				777
	total				2,820

Table 3-2 PRICED BILL OF QUANTITIES (12/19)

Facility Name : River space improvement work
Location : Anyang Chong, other area

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court	m^2			
S02	Soccer field	m^2			
S03	Volleyball court	m^2			
S04	Multipurpose field	m^2	100,000	18.87	1,887
S05	Natural sodding field	ha	100		12,118
S06	Natural walkway	m^2			
S07	Paved area on embankment	m^2	63,000	69.7	4,393
S08	Natural revetment	m			
S09	Garden	m^2	200,000	13.1	2,625
S10	Stairs	nos	45	22.9	1,033
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	4,800	262.3	1,259
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m	400	2,075	830
S20	Grading for other areas	m^2	300,000	3,523	1,057
S21	Utility facilities	LS	1		304
	sub-total				25,506
	Overhead and tax 38%				9,692
	total				35,198

Table 3-2 PRICED BILL OF QUANTITIES (13/19)

Facility Name : River space improvement work of the model site
Location : Yangjae Chong M-1

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court	m^2			
S02	Soccer field	m^2			
S03	Volleyball court	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2	30,500	21.8	666
S06	Natural walkway	m^2	60,000	5.2	309
S07	Paved area on embankment	m^2	8,400	81.4	684
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	6	34,000	204
S11	RC wall	m^2			
S12	Waterside square	m^2	3,400	113.5	386
S13	Paved area on major bed	m^2	15,000	40	600
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	520	386.5	201
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m	30	3,233	97
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		16
	sub-total				3,164
	Overhead and tax 38%				1,202
	total				4,366

Table 3-2 PRICED BILL OF QUANTITIES (14/19)

Facility Name : River space improvement work of the model site
Location : Yangjae Chong M-2

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court	m^2			
S02	Soccer field	m^2			
S03	Volleyball court	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2	9,600	27	260
S06	Natural walkway	m^2	5,400	162.8	879
S07	Paved area on embankment	m^2			
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	10	34,100	341
S11	RC wall	m^2			
S12	Waterside square	m^2	1,700	107.6	183
S13	Paved area on major bed	m^2	8,000	269.4	2,155
S14	Aquatic garden	m^2	6,000	46.7	280
S15	Natural grass yard	m^2			
S16	Planting trees	nos	200	390	78
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m	15	3,200	48
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		15
	sub-total				4,239
	Overhead and tax 38%				1,610
	total				5,849

Table 3-2 PRICED BILL OF QUANTITIES (14/19)

Facility Name : River space improvement work
Location : Yangjae Chong, other area

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court	m^2			
S02	Soccer field	m^2			
S03	Volleyball court	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2	86,000	17.2	1,482
S06	Natural walkway	m^2	800	963.8	771
S07	Paved area on embankment	m^2	17,700	181.6	3,215
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	14	33,714	472
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	830	385.5	320
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m	100	3,060	306
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		32
	sub-total				6,598
	Overhead and tax 38%				2,507
	total				9,105

Table 3-2 PRICED BILL OF QUANTITIES (16/19)

Facility Name : River space improvement work of the model site
Location : Ui Chong M-1

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court 5 courts	m^2			
S02	Soccer field	m^2			
S03	Volleyball court 3 courts	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2			
S06	Natural walkway	m^2			
S07	Paved area on embankment	m^2			
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	6	19,666	118
S11	RC wall	m^2			
S12	Waterside square	m^2	6,000	62	372
S13	Paved area on major bed	m^2	15,000	65	976
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	200	230	46
S17	Wall for view improvement	m			
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		8
	sub-total				1,520
	Overhead and tax 38%				578
	total				2,098

Table 3-2 PRICED BILL OF QUANTITIES (17/19)

Facility Name : River space improvement work
Location : Ui Chong, other area

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court 5 courts	m^2			
S02	Soccer field	m^2			
S03	Volleyball court 3 courts	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2			
S06	Natural walkway	m^2			
S07	Paved area on embankment	m^2			
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	30	20,000	600
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2	120,000	64.4	7,732
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	400	230	92
S17	Wall for view improvement	m	2,550	2,550	523
S18	Flower pot	m			
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		33
	sub-total				8,980
	Overhead and tax 38%				3,412
	total				12,392

Table 3-2 PRICED BILL OF QUANTITIES (18/19)

Facility Name : River space improvement work of the model site
Location : Chungroung Chong M-1

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court 5 courts	m^2			
S02	Soccer field	m^2			
S03	Volleyball court 3 courts	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2			
S06	Natural walkway	m^2			
S07	Paved area on embankment	m^2			
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	5	18,400	92
S11	RC wall	m^2	2,350	225	529
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2	5,925	67.5	400
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	910	33	30
S17	Wall for view improvement	m			
S18	Flower pot	nos	330	50	17
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		35
S22	Wall cascade	m^2	60	983	59
	sub-total				1,162
	Overhead and tax 38%				442
	total				1,604

Table 3-2 PRICED BILL OF QUANTITIES (19/19)

Facility Name : River space improvement work
Location : Chungroung Chong, other areas

Item No.	Description of Works	Unit	Quantity	Unit Price won	Amount mil. won
S01	Tennis court 5 courts	m^2			
S02	Soccer field	m^2			
S03	Volleyball court 3 courts	m^2			
S04	Multipurpose field	m^2			
S05	Natural sodding field	m^2			
S06	Natural walkway	m^2			
S07	Paved area on embankment	m^2	11,056	50.5	558
S08	Natural revetment	m			
S09	Garden	m^2			
S10	Stairs	nos	20	18,350	367
S11	RC wall	m^2			
S12	Waterside square	m^2			
S13	Paved area on major bed	m^2			
S14	Aquatic garden	m^2			
S15	Natural grass yard	m^2			
S16	Planting trees	nos	5,265	34.5	182
S17	Wall for view improvement	m			
S18	Flower pot	nos	240	50	12
S19	Equipment for exercise and child playing	m			
S20	Grading for other areas	m^2			
S21	Utility facilities	LS	1		29
	sub-total				1,148
	Overhead and tax 38%				436
	total				1,584

Table 3-3 Annual Investment Plan (overall)

unit:million won

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Sub-total	2003	2004	2005	2006	2007	2008	2009	2010	Sub-total	Total	2011
Construction Cost																							
Anyang		1,459	1,459	1,267	1,267				14,065	15,475	15,475	50,467	35,216	35,216	35,216	27,765	27,763	51,182	30,457	30,457	273,272	323,739	
Yanjgae						9,628	8,144					17,772							4,553	4,552	9,105	26,877	
Ui								5,642				5,642						6,196	6,196		12,392	18,034	
Chongroung					3,066				1,604			4,670					792	792			1,584	6,254	
Sub-total		1,459	1,459	1,267	4,333	9,628	8,144	5,642	15,669	15,475	15,475	78,551	35,216	35,216	35,216	27,765	28,555	58,170	41,206	35,009	296,353	374,904	
Monitoring	200	200	200	200	200	200	200	200	200	200	200	2,200	200	200	200	200	200	200	200	200	1,600	3,800	200
Design	436			245	1,422		452	3,504	226		2,816	9,101			7,411	127	991	5,601			14,130	23,231	
Sub-total	636	200	200	445	1,622	200	652	3,704	426	200	3,016	11,301	200	200	7,611	327	1,191	5,801	200	200	15,730	27,031	200
Total	636	1,659	1,659	1,712	5,955	9,828	8,796	9,346	16,095	15,675	18,491	89,852	35,416	35,416	42,827	28,092	29,746	63,971	41,406	35,209	312,083	401,935	200
Maintenance Cost																							
Anyang			18	36	51	66	66	66	66	66	66	501	1,332	1,416	1,500	4,120	4,204	4,288	6,319	6,319	29,498	29,999	8,894
Yanjgae							70	349	349	349	349	1,466	349	349	349	349	349	349	349	404	2,847	4,313	459
Ui									25	25	25	75	25	25	25	25	25	25	99	99	348	423	99
Chongroung						92	92	92	92	111	111	590	111	111	111	111	111	121	131	131	938	1,528	131
Mainte Total			18	36	51	158	228	507	532	551	551	2,632	1,817	1,901	1,985	4,605	4,689	4,783	6,898	6,953	33,631	36,263	9,583
Total	636	1,659	1,677	1,748	6,006	9,986	9,024	9,853	16,627	16,226	19,042	92,484	37,233	37,317	44,812	32,697	34,435	68,754	48,304	42,162	345,714	438,198	9,783

Table 3-4 Annual Investment Program

(Water Quality and Flow Regime Improvement)

unit:million won

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Sub-total	2003	2004	2005	2006	2007	2008	2009	2010	Sub-total	Total	2011
Construction Cost																							
Anyang									14,065	14,065	14,065	42,195	28,176	28,176	28,176	20,725	20,725	51,182	30,457	30,457	238,074	280,269	
Yanjgae						3,779	3,778					7,557										7,557	
Ui								3,544				3,544										3,544	
Chongroung					3,066							3,066										3,066	
Sub-total					3,066	3,779	3,778	3,544	14,065	14,065	14,065	56,362	28,176	28,176	28,176	20,725	20,725	51,182	30,457	30,457	238,074	294,436	
Monitoring	200	200	200	200	200	200	200	200	200	200	200	2,200	200	200	200	200	200	200	200	200	1,600	3,800	200
Design				245	605		284	3,376				4,510			7,411			4,873			12,284	16,794	
Sub-total	200	200	200	445	805	200	484	3,576	200	200	200	6,710	200	200	7,611	200	200	5,073	200	200	13,884	20,594	200
Total	200	200	200	445	3,871	3,979	4,262	7,120	14,265	14,265	14,265	63,072	28,376	28,376	35,787	20,925	20,925	56,255	30,657	30,657	251,958	315,030	200
Maintenance Cost																							
Anyang													1,266	1,266	1,266	3,802	3,802	3,802	5,833	5,833	26,870	26,870	8,408
Yanjgae								227	227	227	227	908	227	227	227	227	227	227	227	227	1,816	2,724	227
Ui																							
Chongroung						92	92	92	92	92	92	552	92	92	92	92	92	92	92	92	736	1,288	92
Mainte Total						92	92	319	319	319	319	1,460	1,585	1,585	1,585	4,121	4,121	4,121	6,152	6,152	29,422	30,882	8,727
Total	200	200	200	445	3,871	4,071	4,354	7,439	14,584	14,584	14,584	64,532	29,961	29,961	37,372	25,046	25,046	60,376	36,809	36,809	281,380	345,912	8,927

Table 3-5 Annual Investment Program (River Space Improvement)

unit:million won

	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	Sub-total	2003	2004	2005	2006	2007	2008	2009	2010	Sub-total	Total	2011
Construction Cost																							
Anyang		1,459	1,459	1,267	1,267					1,410	1,410	8,272	7,040	7,040	7,040	7,040	7,038				35,198	43,470	
Yanjgae						5,849	4,366					10,215							4,553	4,552	9,105	19,320	
Ui								2,098				2,098						6,196	6,196		12,392	14,490	
Chongroung									1,604			1,604					792	792			1,584	3,188	
Sub-total		1,459	1,459	1,267	1,267	5,849	4,366	2,098	1,604	1,410	1,410	22,189	7,040	7,040	7,040	7,040	7,830	6,988	10,749	4,552	58,279	80,468	
Design	436				817		168	128	226		2,816	4,591				127	991	728			1,846	6,437	
Sub-total	436				817		168	128	226		2,816	4,591				127	991	728			1,846	6,437	
Total	436	1,459	1,459	1,267	2,084	5,849	4,534	2,226	1,830	1,410	4,226	26,780	7,040	7,040	7,040	7,167	8,821	7,716	10,749	4,552	60,125	86,905	
Maintenance Cost																							
Anyang			18	36	51	66	66	66	66	66	66	501	66	150	234	318	402	486	486	486	2,628	3,129	486
Yanjgae							70	122	122	122	122	558	122	122	122	122	122	122	122	177	1,031	1,589	232
Ui									25	25	25	75	25	25	25	25	25	25	99	99	348	423	99
Chongroung										19	19	38	19	19	19	19	19	29	39	39	202	240	39
Mainte Total			18	36	51	66	136	188	213	232	232	1,172	232	316	400	484	568	662	746	801	4,209	5,381	856
Total	436	1,459	1,477	1,303	2,135	5,915	4,670	2,414	2,043	1,642	4,458	27,952	7,272	7,356	7,440	7,651	9,389	8,378	11,495	5,353	64,334	92,286	856

SUPPORTING REPORT VII

SOCIO-ECONOMY

CONTENTS

List of Table

List of Table

Chapter 1 Introduction

1.1 Purpose of the Study

The purpose of this study is to summarize the socio-economic trends of Seoul Metropolitan and the evaluation method of the proposed environment project.

1.2 Method of the Study

In order to understand the characteristics of the Socio-economic state of Seoul Metropolitan, the existing records and the statistical data were collected and analyzed.

The future projection and the benefit by the project were estimated based on these data and some assumptions.

In addition, the qualitative analysis and an evaluation matrix were examined to judge the priority of sub-projects, because of the difficulty to measure the effects by the project.

Chapter 2 Seoul Economy and Financial Operation of S.M.G.

2.1 Economic Trends in Seoul

2.1.1 Movement of Seoul's Economy

Seoul's economy shows the characteristics of the Central Management Function. Tertiary industries occupy 80% of GRDP while the primary industries occupy only 0.8%. The finance, insurance, and real estate businesses especially have about a 60 percent share in the GNP of Korea.

Table 2.1.1-1 Industrial Structure of Seoul

unit: billion won in 1980 constant prices

	GRP			GNP	GRP/GNP
	1982	1987	1987/1982		
Agriculture,foresty & fishing	121.6	126.1	1.037	7,766.8	1.62
Mining & quarrying	36.2	40.5	1.119	817.9	4.95
Manufacturing	2,531.7	4,347.3	1.717	22,963.9	18.93
Electricity, gas & water	226.5	515.0	2.274	2,408.2	21.39
Construction	1,084.0	2,130.2	1.965	5,701.8	37.36
Wholesale & retail trade, restaurants & hotels	2,802.8	4,543.2	1.621	9,264.4	49.04
Transport, storage & communication	1,087.2	1,844.3	1.696	5,076.7	36.33
Financing, insurance real estate & business service	2,538.4	4,925.7	1.940	8,166.3	60.32
Community, social & personal services	611.2	940.0	1.538	1,994.3	47.14
Input bank services charge	-760.0	-1,660.2	2.184	-3,104.4	53.48
Sub-total	10,279.6	17,752.1	1.727	61,055.2	29.08
Others	1,209.6	1,851.9	1.531	6,764.9	27.38
Total	11,489.2	19,604.0	1.706	67,820.1	28.91

Source: Seoul Statistic Year Book, 1989

In general, the primary industries are expected to decrease. The number of farmers' houses slightly increased after 1986 and the farm area maintains 2,800 ha. As for the secondary industry, since Seoul was designated as "a removal encouragement area", the restriction of the industrial facility concentration and the movement of factories to out of the town are actively being implemented.
Hereafter the secondary industry is expected to change to pollution-free industry which can harmonize with the life of the citizens of Seoul.

Seoul Metropolitan aims to be an international city through the reorganization of its industries and the development of its information, communication and knowledge industries. With his objective, the tertiary industry is expected to increase its weight more and more.

2.1.2 Change of Consumption Patterns

The Seoul's GRDP per capita largely exceeds the average of the country. The personal consumption has substantially and extensively increased because of the income growth. The statistical figures show the decrease of expenditures for food, clothing and shelter. On the other hand, the expenditures for leisure, education, transportation and tele-communication is increasing. The steep rise of real-estate prices since last year and the increase of the rate of inflation have become social problems in Seoul.

Imports increased rapidly in spite of the sluggish exports. For example, the import of meat and meat products was 0.7% in the first half of 1988, but reached 7.0% in the first half of 1989. Concurrent with the improvement of the life standard, the preference for foreign products gradually intensifies.

The number of car owners are rapidly increasing, and it is predicted that life - styles will change in the future.
In such a situation, the weight of the consumption for leisure activities has increased through the 1980s.

2.2 Finance of SMG

2.2.1 Budget System

The budget system of Seoul Metropolitan consists of an "Ordinary Account" and a "Special Account". The special account distributes special revenues to special expenses, and has 15 financial items including water supply, subway, hospital and sewage disposal.
The general account gets revenues from local tax and other non-tax revenues, and is distributed to the general works of the city government. These change are shown in Table 2.2.1-1.

Table 2.2.1-1 Trend of Budget

	Ordinary Account	Special Account	Total	GRP	Total/ GRP (%)
1977	226,297	104,863	331,160		
1978	315,607	147,615	463,222		
1979	402,760	248,341	651,101		
1980	469,555	335,814	805,369		
1981	535,535	467,669	1,003,204		
1982	663,926	668,260	1,332,186	14,322,100	9.3
1983	840,084	955,181	1,795,265	16,943,000	10.3
1984	979,071	1,195,238	2,174,309	19,204,900	11.3
1985	1,028,781	1,290,223	2,319,004	21,577,600	12.1
1986	1,046,309	1,467,608	2,513,917	24,918,900	10.1
1987	1,146,591	1,337,337	2,483,928	29,213,500	8.5
1988*	1,139,437	1,433,345	2,572,783		
1989	1,534,732	1,317,870	2,906,732		
1990**	1,827,485	2,476,287	4,303,772		

Source: Seoul Statistical Year Book, 1989
* Seoul Administration, 1989
** Seoul Administration, 1990

The autonomy of the Gu started in 1988. Though the local tax was divided into two, SMG and Gu, which can operate their own budgets by themselves, the largest expenditure of the ordinary account of SMG were aids to the Gu which had about 38.9 percent of total expenditure.

2.2.2 Revenue

Revenue of the General account depends mainly on Local tax shown in Table 2.2.2-1. Local tax includes Cigarette consumption tax from 1989 fiscal year when local autonomy system was introduced. Cigarette consumption tax occupies about 25 percent share in Local tax and 30 percent of this is distributed to the Education budget managed by Education committee.

Table 2.2.2-1 Revenue of General Account

Unit: million won

	'90 Budget	'89 Final Budget	'89 Budget	'88 Budget
Total	1,827,485	1,716,761	1,534,862	1,139,437
Local tax	1,623,950	1,266,064	1,266,064	750,210
Non tax				
Current revenue	36,594	44,283	44,283	53,669
Transitory revenue	134,555	345,237	194,676	303,960
Dependence revenue	32,386	61,177	29,839	31,598

Source: Seoul Administration 1990,1989

The revenue of the special account consists of business revenue (1,459 billion won), local bond (470 billion won), transfer from ordinary account (248 billion won), subsidy from National government (121 billion won) and others (178 billion won) in 1990.
The largest account is Urban development, which aims to build low-cost houses and to develop residential lands and has a 1,319 billion won budget. Sewage disposal account has 101 billion won budget in 1990 which is less than the 1989 final budget. The revenue of the sewage

disposal account consisted of business revenues (69 percent), carried over and miscellaneous accounts (16 and 15 percent respectively).

2.2.3 Priority of Projects in Seoul Metropolitan

In Seoul, the rank of priority projects is first, a transportation system, second, housing and third, environment. The explosive increase of automobiles and shortage of mass transportation capacity in condition of weak infrastructure makes traffic conditions in Seoul worse. On the one hand, low-cost houses and stabilization of life of low-income citizens are asked, on the other hand, development of Seoul Metropolitan is wanted. The Urban city of Seoul will multiply in accordance with to the construction of transportation network shown.

In this situation, the consciousness of the citizens for the environment will grow like the "Recovery movement of Mt. Namsan's nature and figure" and various companies against water pollution. The increase of income causes strong demand for park space for leisure activities and facilities. However, there is no successful project of improving river environment except for the Han river citizen parks, which was necessary for the success of the 1988 Olympics.

2.2.4 Budget of Environment Improvement Plan

The budget of flood control and fire fighting is 139 billion won and has 2.8 percent share of total expenditure budget. That of cleansing and environment is 238 billion won (4.7 percent) and that of park and green space is 238 billion won (2.2 percent). The distribution to environmental projects including cleansing and fire fighting is 489 billion won and has 9.7 percent share of SMG budget. The budget per capita is estimated at 4,600 won under the assumption of a 1,060 population in Seoul.

The budget of flood control is 86 billion won, which is as same as that of the green zone. While the budget of green zone has rapidly

increased, that of flood control has tended upward slightly in proportion to the up trend of the ordinary budgets.

The budget of the environment improvement plan is shown in Table 2.2.4-1.

Table 2.2.4-1 The Budget of Environmental Improvement Plan

unit: million won

	1991	1990 Final	1990 Initial	1988
[Ordinary account]				
River control	85,758	94,473	51,195	55,245
Flood control	44,457	52,709	?	?
Han River Management	21,510	32,251	?	10,154
Environment & Green Space	85,699	69,832	32,469	28,757
Park Management	56,296	48,889	15,064	13,106
Park Office	21,108	14,984	12,849	11,000
Green Space	6,802	5,264	4,303	4,638
Environment Management	1,493	642	201	?
[Special Account]				
Sewage Disposal	?	100,611	124,903	85,685
[Gu]				
River Control	21,348	14,721	9,970	16,140
Park Management	24,866	8,227	5,896	3,265
Total	217,671	287,864	224,813	189,092

Note:Above data were offered from a department of SMG.

The above mentioned figure does not show the actual expenditure of the environmental project. In the Mok-dong development project, 5.2 kms along Anyang Chong was improved including a low water route, high water front, and a sports facility.

In the medium range plan of flood control, some projects for a river environment improvement are examined, but it is very difficult to get a practical budget because other flood control projects have priority.

Chapter 3 Change of Seoul Society and Recreation Demands

3.1 Change of Seoul Society

3.1.1 Culture on Water in Seoul

There are several historical stages in the relationship between the citizens of and the rivers. The ideology concerning nature in Korea prefers mountains in the back and water in front of urban areas and houses. Flood experiences too have made people wary of allocating their houses too near the rivers.

Seoul is the most suitable place for this ideology. In the old days, the representative river of Seoul was Chong Ge Sa Chon which flowed into the center of Seoul. Since willows were constructed on in the 18th century, the river has been the space of citizens' daily life. The Korean people used to play in the nature filled areas, eat and drink enjoying the river view.

In 20 centuries, Seoul was expanded and some rivers were covered and transformed. Since river spaces were important to the people for swimming and skating, after the independence, people concentrated to Seoul. The streams in the city became drainages and from 1957 to 1961, almost all the rivers in the old town of Seoul were covered.

The expansion of the urban area to Kang-nam made Han river recognized symbolic river of Seoul. The successful works on the Han river improvement at the time of the 1988 Olympics have made the river useful again. Nowadays, the civil parks are used for the marine sports center.

3.1.2 Movement of Regional Residents

In Korea, there is a traditional custom to be regionally sufficient called Semaul activities. This started in the villages and expanded to the urban areas. There are about 500 bodies of Semaul movements
in Seoul, executing the following activities.

a- nature preservation
b- helping neighbors and welfare activities
c- maintaining their neighboring hills

In 1988, the Olympic Semaul activity campaigned to educate about 520 thousand people on morality and maintenance of the urban environment. However, this movement had the tendency to be under the control of the government, and that disturbed their independent and autonomous activities.

The major programs in 1989 is listed as follows;

a - Creating a society with the existence of mutual prosperity
  - Aids to the small regional businesses
  - Operating book mobiles
  - Inspecting city operation

b - Creating more a comfortable urban life
  - Improving urban environment
  - Clean-up campaign in Seoul
  - Clean-up campaign along the railways
  - Creating a movement for nature preservation

c - Education program for citizens

In these programs, the clean-up activity is very popular in the study areas, therefore it is very important to consider their activities in formulating the river environment improvement plan.

3.1.3 Upgrading of Life and Social Change

The economic growth contributed to the increase of real wages, which caused the increase in the number of car owners, in caloric intake and meat consumption. The economic growth, strengthening competition and stress on the work force caused the evils of a high-technology society, but did not contribute to the diminishment of working hours.

In view of Japanese experiences about the said economic growth, it is predicted that these tendencies would rapidly increase the social cost of welfare and medical care since the society would be mainly composed of elderly people. From a survey, about 70 percent of the respondents do not perform any exercise for their health care. In such a situation, the social significance of leisure activities will increase in order to keep the society active. Therefore, it is necessary to make programs to promote leisure and health care.

Another important tendency of the Seoul society is the distance of houses from the center of Seoul, which causes various conflicts between new and old residents. New developments of the Semaul movement and rebirth of regional festival and events will play a large role in harmonizing the relationship of the people in maintaining social integration.

3.2 Recreation Demands

3.2.1 Social Background of the Increment of Demands

The rapid industrialization and urbanization of Korean society causes the increment of leisure demands. The socio-economic factors of leisure demands are summarized below.

- free time
- income
- sense of life value

The forecast of free time is shown below.

Table 3.2.1-1 Work time and free time (hours per week)

	work time		free time	
	case1	case2	case1	case2
1983	53.7	53.7	45.0	45.0
1991	44.6	44.7	49.6	49.5
1996	42.6	42.9		
2001	40.0	42.3	53.0	50.7

Source : "Analysis of actual condition and countermeasure on the leisure life of people" (1985)

The forecast of income is shown below.

Table 3.2.1-2 GNP per capita (US $ in 1984 constant price)

	case1	case2	reference period of Japan
1983	1,884	1,884	
1984	1,978	1,978	
1991	3,020	2,791	1966(=2,659) - 1968(=3,249)
1996	4,041	3,660	1969(=3,606) - 1971(=3,917)
2001	5,408	4,852	1972(=5,166) - 1974(=5,606)

Source : same as Table 3.2.1-1

The consumption expenditure forecast is shown below.

Table 3.2.1-3 Forecast of Consumption

	GNP per capita	expenditure		
		private consume	culture & amusement	leisure
1983	1,884	1,200	49	
1984	1,978			
1991	3,020	1,786	96	161
1996	4,041	2,269	136	227
2001	5,408	2,911	189	291

Source: same as Table 3.2.1-1

These forecasts point out that Korean society will transform into a post-industry society in near future.

3.2.2 Present Situation of Leisure Activities

The main way of using leisure time at the present is "rest and relaxation". The percentage of participants into "sports and travel" is only 11 percent. The women, in particular, prefer "rest and relaxation" to "sports and travel".

The leisure activities with high rates of the participation are "TV watching", "walking and strolling" and "visiting friends and relatives". Within the top 20 items of leisure activities, only "soccer" is the listed sport. In contrast with this, the participation rate of outdoor recreation, such as "fishing" and "climbing", is high.

The comparison between present leisure activities and the expected leisure activities show that the demand for sports, hobbies and culture will increase instead of the present demands for social intercourse.

Table 3.2.2-1 Present leisure activities and expecting leisure activities

	present activity number of answer(A)	%	expecting activity number of answer(B)	%	increasing rate (B/Ax100)
outing & travel	3,957	90.0	4,100	102.3	113.7
social inter-course	4,681	116.8	1,650	41.2	35.3
appreciation & admission	3,548	88.5	2,119	52.9	59.8
sports	1,604	40.0	4,666	116.4	291.0
hobbies & culture	3,104	77.4	5,139	128.2	165.6
game & amuse-ment	992	24.5	577	14.4	58.3
others	1,481	37.0	208	5.2	14.1
Total	4,008	100.0	4,008	100.0	-

Source: same as Table 3.2.1-1

3.2.3 Satisfaction on Space and Facilities

A survey on leisure environment showed that the satisfaction on public facilities around house was less than those on other facilities like as house, working place and its neighbor and out-door.

Table 3.2.3-1 Satisfaction on Leisure Environment

	very satisfy	satisfied	ordinary	dissatisfied	very dis-satisfy
Housing	4.1	23.5	47.3	20.1	5.0
Public facilities around houses	0.5	5.6	25.4	50.2	18.3
Private facilities around houses	1.7	7.3	35.0	40.7	16.3
Working place & its surrounding facilities	0.9	11.3	42.2	34.2	11.4
Out-door leisure environment	1.3	12.3	46.1	31.1	9.2

Source: same as Table 3.2.1-1

The following are the most short-spaced areas.

1) community park in Dong
2) promenade
3) children's park
4) natural park
5) zoo and botanical garden

There is a shortage of the following facilities:

1) library
2) swimming pool
3) school for hobbies
4) museum
5) theater
6) athletic stadium
7) gymnasium

The major sports in the neighborhood are walking, calisthenics, jogging and badminton. Therefore, major facilities used in the neighborhood are the promenade for walking and jogging, rest spots and grounds. The expected facilities are sport facilities for group activities and rest spots. The most popular access time to facilities is from 10:00 to 20:00.

These figures show the demand for such spaces as grounds and a promenade supplied by the river environment improvement plan.

Chapter 4 Analysis of Land Price Component

4.1 Objective of the Analysis

In this chapter, the effect of improving residential environment expected by the project is investigated on a trial approach to estimate the economic benefit of environmental improvement. In general, environmental goods have no market price to estimate the benefit. Therefore, property price is usually picked up for the surrogate price. In a study in the U.S.A., the value of property has increased 8 percent in minimum, and 25 percent in maximum in accordance with the improvement of river water quality.
There is no report on this matter in Korea. It is difficult to get the actual market price of property with limited data and a limited study year, therefore this investigation is only one sample of how to investigate these matter. The increment of property value is analyzed here as a general relation between a gazetted price of land value and a residential environment.

This chapter summarized the methods of analyzing the relation and calculating the result. More continuous study is expected.

4.2 Analytical method

The quantitative method 1, which is the method to quantify qualitative data when objective variables given as numerical data, is used to analyze the factors forming the land price. The gazetted price of land value in 1990 is used as the object variable.
The explaining variables, which are supposed to form land value, are listed below.

a. environment conditions	1. good, 2. ordinary, 3. bad
b. distance from the center of Seoul	1. within the 5 km area 2. within the 10 km area 3. more than 10 km area

c. traffic accessibility	1. within 400 m from a station
	2. within 1 km from a station
	3. more than 1 km from a station
d. population density	1. high, 2. moderate, 3. low
e. land use	1. housing, 2. commerce,
	3. industry, 4. agriculture
	5. others

4.2.1 Outline of Quantitative Analysis Method 1

On the basis of some independent variables, the analytical method to predict the value of objective variables is called a regression analysis, in which each variable is supposed to be a quantity. In the field of psychology and sociology, the explaining variables are used to express whether attributes belong to a certain category or not. The quantitative methods are devised to apply a kind of data, and are done by allotting dummy variables of 0 or 1 to category varieties.
In the case where the category variety is 1, the object variable (hereafter "out-criteria" is used) can be expressed by the category variables xj and the weighted coefficient aj as below;

$$y = a1x1+a2x2+ \ldots\ldots +ajxj+ \ldots\ldots +anxn$$

(n is a number of the category variables)

The optimum weighted coefficient a1, a2, ... aj, ... an can be calculated by applying the method of multi-regression analysis.
In the case of this study, the explaining varieties are five varieties; a) environmental condition, b) distance from the center of Seoul, c) traffic accessibility, d)population density, e) land-use, therefore, the relations can be expressed by the following equation.

$$y = a1E1+a2E2+a3E3+b1D1+b2D2+b3D3+c1T1+c2T2+c3T3 +d1P1+d2P2+d3P3+e1L1+e2L2+e3L3+e4L4+e5L5$$

(y is land price, E,D,T,P,L are varieties, a,b,c,d,e are category coefficients, and 1,2,3,4,5 are category numbers.)

For example, a sample is if that the environmental condition is 2, the distance from the center is 1, the traffic accessibility is 2, the population density is 3, land-use is 5; E1=0, E2=1, E3=0, D1=1, D2=0, D3=0, T1=0, T2=1, T3=0, P1=0, P2=0, P3=1, L1=0, L2=0, L3=0, L4=0, L5=1 are allotted to each variable, and the weighted coefficients a1, a2, a3, b1, b2, b3, c1, c2, c3, d1, d2, d3, e1, e2, e3, e4, e5 can be calculated.

4.2.2 Sample Data

The total of 525 samples; 155 cases in Kangnam-gu, 125 cases in Chongno-gu, 106 cases in Tongdaemun-gu, and 139 cases in Kuro-gu, are calculated.

The environmental condition was set on the basis of both the information on "Guide price of land value" and the spot investigation in the first survey in Seoul.

The distance from the center of Seoul was measured from a "Present map of river in the Seoul Metropolitan".

The traffic accessibility was judged by drawing concentric circle on each station of the subway and that of the national railway linked to the subway. The difficult points to judge were referred the information on "Guide price of land value" and "Tourist attars : Seoul".

The population density was based on the "Travel map in Seoul" and "Present map of river in the Seoul Metropolitan".

The land-use was judged from the situation of land utilization mentioned in "Guide price of land value".

Table 4.2.2-1 showed the number of samples allotted to each category.

Table 4.2.2-1 Number of Samples and Average of Out-criteria

variables	category	number of samples (%)	average of out-criteria (1000 won)
environmental	E1	86 (16.38)	4,030
condition	E2	389 (74.10)	1,772
	E3	50 (9.52)	689
distance from	D1	142 (27.05)	2,445
the center	D2	203 (38.67)	2,466
	D3	180 (34.29)	1,237
traffic	T1	134 (25.52)	3,122
accessibility	T2	226 (43.05)	1,773
	T3	165 (31.43)	1,524
population	P1	68 (12.95)	2,355
density	P2	411 (78.29)	2,121
	P3	46 (8.76)	837
Land-use	L1	335 (63.81)	1,186
	L2	154 (29.33)	4,314
	L3	11 (2.10)	579
	L4	6 (1.14)	209
	L5	19 (3.62)	60
Total		525 (100.0)	2,039

4.2.3 Result of Calculation

The result of the calculation is shown in Table 4.2.3-1.
Studying the combined figures, the multiple correlation coefficient is 0.724525, which is relatively persuasive as the result of Qualification method 1.
Table 4.2.3-1

4.3 The Effect of Environment Improvement

The range between the highest category and lowest category is 2 million won per square meter, which is more than the average price. This result was affected by the condition of the commercial zone. By the data of residential zones alone, the multiple correlation coefficient becomes worse. The range of the environment on the residential land is 900 thousand won, though other items have a big effect. Totaling the range of each item and calculating the portion of these items, the effect of environment is estimated as 31 percent. Since the contribution of improving river environment to the residential environment is not clearly examined in this report one sixth of the effect is considered as the benefit of the river improvement project.

Chapter 5 Project Evaluation

5.1 Method of Project Evaluation

There is no settled way to evaluate environmental projects such as the improvement of water quality. There are many arguments to quantify these benefits such as the monetary measure, though the environment assessment method has been formulated. Therefore, in this study, the qualitative analysis and diverse criteria are considered when the quantitative analysis is adopted in a trial calculation of benefit.

In general, the least-cost method is adopted for economic evaluation of the environment improvement plan. The method is to select the least-cost system from those which attain an priori level of the quality of environment. The method is adopted to select and to arrange the water quality improvement facilities. The consensus should be necessary when this method is adopted, that the benefit expected overcomes the total cost.

There are some trial investigations to measure these benefit. One is a quantified technique to estimate the environmental deterioration. The second is to estimate the benefit of environment improvement using some models and marketed goods as environment-surrogates. The third is to regard the willingness-to-pay of dwellers as benefit of environment improvement. There are rare cases which have marketed price on environment services and goods, because pure air, fine view and a comfortable atmosphere are public goods and cannot be exclusive possessions. In this case, the technique using marketed goods as environmental surrogates is used popularly to estimate potential value of environmental goods and services.

In this study, the opportunity cost is used to calculate the benefits of the effect of the increment of the parks. The environmental surrogates technique is adopted to estimate the benefit of the effect of the living environment improvement using the gazetted price of land. There are some constraints on the model and the data in figuring the actual benefit, therefore more investigations are necessary from the Korean side.

5.2 Evaluation of Social Losses by River Environment Deterioration

In order to evaluate the economical value of the river environment, especially river water quality, a method which measures the amount of damage to the utilization of water (not only the use of water itself but the environmental aspect) in case of deterioration of water quality is under consideration. In this study, this technique is not adopted because there is no special water usage in the study area, though social loss caused by environmental deterioration of river will be investigated to clarify the necessity to improve river environment.

In general, quality of river water has economic value in the aspect of water usage, which consists of water utilization for economic activities and the environmental atmosphere mentioned in Table 5.2-1.

Table 5.2-1 Usage of River Water

Item	Description	Use form	User
Water use	water supply	daily life	family
		business	enterprise
	industrial water supply	materials washing & cooling	factory
	agricultural	use for irrigation	farmer
Environment	fishery	fishing for cultivation	fisherman
	recreation	swimming or playing in water/river water sport	player
	tourism	viewing or walking	tourist
	space use	rest, play, jogging & cycling playing sports	player
	residential environment	cofetability	residence
	living thing in nature	special species	natural watcher
	others		

River environment deterioration appears to have changed for the worse. Though there is no special usage of the water supply in the study area, agricultural use remains at the downstream of the Han river. If the water quality is polluted as much as it damage to agriculture or fishery at down stream or in the sea, the damage can be estimated by the change-in-productivity. If it is necessary to move some of the intake to a higher place, the construction cost of a new intake is considered as a damage.

More pollution of the river environment obstructs recreational usage. Swimming in river is prohibited because of insanitation. It is difficult for fish to live in more polluted river, therefore fishing is given up. Less use of river space makes it dangerous to access the

water front. The river changes to a dumping space of solid waste, that worsens the condition of the water and causes discomfort to the residents. At that stage, the river is said to be dead and is expected to be covered and the space utilized in another way. In each stage, damage of pollution can be estimated by the cost to recover or that of alternative means of settling. But sometimes, it is recognized that the rivers are necessary for human beings after it is too late to recover them.

5.3 Evaluation of Social Benefit by River Environment Improvement

The social benefits of the river environment improvement project shall be the inverted representation of the social demerits caused by environmental deterioration. This study proposes the improvement of water quality and discharge and space improvement as projects. The water quality and discharge and space improvement as projects. The water quality improvement project, however, shall have limited effects due to its restricted scope as a river project. Despite of such facts, this project was still able to consider the following 5 times as social benefits.

1. Increase in park area and number of parks
2. Improvement in Housing Environment
3. Activation of Society
4. Education Benefits
5. Against Natural Disasters

Benefit (1) shall be the result of the space improvement projects, although this project shall generally have the following effects on the respective aspects.

1)	Existence/Life	Prevention of Disaster, Reduction of environmental pollution, Increase of greeneries

2)	Living/Livelihood	Preservation of Natural Environment, Increase in Recreational Opportunities, Amenity Improvement, Air Purification, Land Use Restrictions
3)	Cultural Aspect	Preservation of Historical and Cultural Properties and Natural Monuments
4)	Preservation of Nature	Water Preservation, Animal and Plant Existence
5)	Educational Aspect	Increase in Educational Opportunities concerning the Environment and Nature
6)	Economical Aspect	Increase of Land Value, Restriction of Medical Expenses

The polluted state of the river shall drive people away from the riverside and shall deprive people of the benefits they have gained from the river. To cope with these, the river's water quality and discharge should be improved to maintain the potentials of river space. The functions of the river space shall be restored with the improvement of river water quality and discharge.

Generally, the implementation of public projects induce production and employment. In Japan, park construction expenses induced a production rate of 1.90 (main park of a ward), 1.89 (city main park), 1.87 (large parks), and 1.89 (others). The total project expenses induced a production rate (1.35, 1.23, 1.20, 1.28) which is different from the land rates which differ according to the park classification.

On the other hands, it is estimated that the residents shall demands a higher standard of living as the rate of income increases. According to the Survey in America, the real estate value of land along the river has increase in land value is somehow certainly reflected in the improved living environment.

The improvement of the river environment shall result to more greeneries and water familiarity functions creating a place for recreation and relaxation. Various events shall be held in the improved areas to improve the relationship of the old and the young generation or the new and the old residents in order to strengthen their attachment to the area and feelings of solidarity. Furthermore, this will also reduce the immigratory movements of improvement expenses as well as become one of the benefits of the improvement of the living environment.

The water quality improvement effects which are led by the installation of the water quality improvement facilities makes the citizens paying more attention to the environment preservation. This will be the nice opportunity of the environmental education.

In addition, the river water treated by the water quality improvement facilities is able to be used for the emergency water, also the improved major beds are able to be used for a refuge place and also the telecommunication facility is able to be used in the emergency time. The construction expenses to lead these benefits can be deemed to be a part of the disaster prevention budget.

The expected effects can be summarized by water quality and flow-regime improvement project and by the river space improvement project as follows.

Table 5.3-1 Effects of the River Environment Improvement Project

aspects of / project effect of /	water quality and flow-regime	river space
existence	water to live and fire-fighting in time of disaster	place of refuge
daily life	removing smells and discomforts	rest place safe play spot promoting health & leisure activities
	possibility of familiarity to water	increment of familiarity to water base of communication of community increment of number & area of park
culture	creating activity	various scenes
conservation of nature	increment of species of living things recovering purifying capacity	concentrating efforts to preserve
education	encouraging consciousness to conservation	promoting self-supporting and group consciousness
economy		activating service industry raising up property value
	encouraging water use downstream	

The benefits to be gained from the increase in the number and area of park is 464.3 billion won, and the benefits to be gained from the

improvement of the living environment is 119.71 billion won. These benefits exceeds the projects expenses of Phase 1 project. There may be many benefits, which cannot be calculated except these, gained. It is, therefore, judged to be feasible to implement this project.

5.4 Evaluation Matrix

In this chapter, the evaluation matrix is investigated to evaluate the project from a synthetic viewpoint, though the project has been evaluated as feasible in the main report. The Korean side shall rank the sub projects when the weight of the criteria is changed.

The first item is the project cost and the second item is the safety of flood control. Other items are water quality improvement, flow-regime improvement and river space improvement, which are the objects of the project. Familiarity to water is the result of the above mentioned items and is given importance in the synthetic criteria.

In general, the project cost is expected to induce new investment and to produce materials. But in this evaluation, less cost has priority from the least cost method.

Safety of flood control is considered whether the project work makes it necessary to re-embank or not while the size of work is necessary, it is necessary to re-embank.

Water quality improvement is evaluated from both aspect; necessity and effect. On the aspect of necessity, the present situation of water pollution and necessity when the sewage system is improved are considered. Effect wise, BOD removed, length to be benefited and limitation of upper stream are considered.

a - more polluted points have priority
b - the spot which is necessary in the completion of the sewage system is improvement has priority because the total cost is expected to be less.
c - facilities with more BOD to be removed have priority
d - length to be benefited is that of the river where BOD is expected less than 10ppm when a water quality improvement facility is constructed. longer lengths have priority.
e - limitation of the upper stream means the dependence of water quality and planned spots on the upper stream. if the quality of

the upper stream is worse than the capacity of purification planned, it is judged better and more effective to construct another purifier at a higher upper point.

On the effect of flow-regime improvement, the necessity is evaluated on the spot where improvement is done on the river space and on the water surface during the season.

Space improvement is evaluated from both aspect; necessity and effect. Necessity-wise, the present situation of park space and the possibility to get alternative space are considered. Effect-wise, park space to be constructed in the project and the beneficiary are considered.

a - less park area per capita has priority
b - difficult place to get alternative space because of high density has priority
c - more park space to be constructed has priority
d - beneficiary is estimated by the access distance and usable population which depend on the size and quality of park space.

Mutuality of project means relationship of water quality improvement, flow-regime improvement and river space improvement. complex places have priority.

Familiarity to water is evaluated by the water quality whether it is possible to enter the river or not.
Other effects are added if there is a characteristic point.

Each item is roughly classified as shown in Table 5.4-1.

Table 5.4-1 Criteria and Rank

Criteria/Rank	unit	A	B	C	D	E
*Project Expense	B.won	below 5	5 - 10	10 - 30	30 - 100	over 100
*Safety of flood control		no conservation work	little conservation work	large conservation work		
*Water pollution	ppm	over 80	80 - 50	50 - 30	30 - 10	below 10
*Necessity after Sewage Improvement		necessary	not necessary			
*BOD removed	%	over 80	80 - 50	50 - 30	below 30	
*Length to be benefited	km	over 10	10 - 5	below 5		
*Limitation of upper stream		no	one	over 2		
*Necessity of stream improvement		necessary	not necessary			
*Park area	m2/p	below 1	1 - 3	ober 3		
*Possibility to get alternative space		difficult	easy			
*Area to be constructed	ha	over 10	10 - 5	5 - 1	below 1	
*Beneficiary	1000	over 150	150 - 100	100 - 50	50 - 20	below 20
*Mutuality		exist	not exist			
*Familiarity	ppm of BOD	below 1	1 - 3	3 -5	5 - 10	over 10

Table 5.4-2 Evaluation of Alternative Plan

River	Project	Location	Project Cost	Safety Factor of Flood Control	Water Quality Imp					Flow-Regime Imp.	River Space Imp				Interrelationship	Water Familiarity	Others	Evaluation
					Present BOD	Sewerage Improve	Remove BOD	Improved Length	Restriction		Present Park	Alternative Land	Acquired Area	Beneficiery				
Anyang	W.Q.I.	St.6	D	A	C	A	A	A	B							D		3 1 B
		St.5	D	A	B	A	A	B	C							D		3 0 C
		St.4	D	A	B	A	A	B	C							D		3 0 C
		St.2	D	A	B	A	A	C	C							D		2 9 C
		M1	A	A							A	A	A	B			B	3 3 B
	R.S.I.	M2	A	A							B	A	A	C			B	3 1 B
		M3	A	B							B	A	B	E			B	2 7 C
		Others	D	A														7 D
Yangjae	W.Q.I.	St.2	B	A	E	A	A	C	A						A	B	A	4 2 A
	R.S.I.	M1	A	A							C	B	A	B	A		B	3 5 A
		M2	B	A							C	B	B	B			B	2 8 C
		Others	B	A														9 D
Ui	F.L.I.	M1	A	A	E					A					A	B		2 5 C
	R.S.I.	M1	A	A							B	A	C	D	A		B	3 3 B
		Others	C	A														8 D
Chungroung	W.Q.I.	St.3	A	A	D	A	A	C	A								A	3 5 A
	R.S.I.	M1	A	A							A	A	C	D		C	B	3 2 B
		Others	A	A														1 0 D

Cf.1:W.Q.I. stands for water quality improvement.
Cf.2:R.S.I. stands for river space improvement.
Cf.3:F.R.I. stands for flow-regime improvement.

Table 5.4-3 Implementation Priority of Project

River	Project	Location	Project Expenses	Safety Factor of Flood Control	Water Quality Improvement					Flow-Regime Imp.	River Space Improvement				Interrelationship	Water Familiarity	Other Effects
					Present BOD	Sewerage Improve	Remove BOD	Improved Length	Restriction		Present Park	Alternative Land	Acquired Area	Beneficiery			
					ppm		kg/day	km	places		m^2/capit		ha			ppm	
Anyang	W.Q.I.	St.6	42,195	○	48.6	*(Need)	3,662	13.5	1							10	
		St.5	84,528	○	55.7	*(Need)	11,325	7.5	2							10	
		St.4	62,175	○	52.5	*(Need)	4,127	5.5	3							10	
		St.2	78,741	○	59.5	*(Need)	7,573	3.0	4							10	
	R.S.I.	M1(St.2)	2,918	○							0.2	hard	12	118			need
		M2(St.4)	2,534	○							1.2	hard	12	68			need
		M3(St.5)	2,819	△							1.2	hard	5	17			need
		Walkway	35,198	○									(212)				
Yangjae	W.Q.I.	St.2	7,557	○	5.5	(need)	520	3.5	(1)**						○	3	propaganda
	R.S.I.	M1(St.2)	4,366	○							4.5	easy	11	147	○		easy
		M2(St.4)	5,849	○							4.5	easy	7	110			easy
		Walkway	9,105	○									(55)				
Ui	F.R.I.	Model Site	3,544	○	3.5					need					○	3	
	R.S.I.	M1(ditto)	2,098	○							1.8	hard	4	47	○		easy
		Walkway	12,392	○									(17)				
Chungroung	W.Q.I.	St.3	3,066	○	19.0	(need)	559	3.0	0							5	know-how
	R.S.I.	M1(St.3)	1,604	○							0.7	hard	1	23			easy
		Walkway	1,584	○									(2)				

cf.1: * (need) shows that the sewerage treatment system must be improved before operating the contact oxidation with cobble plant.
cf.2: ** (need) shows the moderate restriction.

SUPPORTING REPORT Ⅷ

URBAN STRUCTURE OF SEOUL METROPOLITAN

CONTENTS