

# Environmental Controls and Standards

To preserve the historic environment in the parks and to maintain the optimum conditions as archeological parks, we made this Environmental Controls and Standards.

To cope with the increasing visitors to the park and to maintain the environment as archeological park, three grades of Environmental Module were established; sanctuary (Zone-1), Park area and Facility Site (both belong to Zone-2).

The standard was settled on the basis of each criterion.

## Environmental Index of Existing and Future Conditions

	Borobudur				Prambanan			
	existing 1978	upto 1982	upto 1989	upto 1994	existing 1978	upto 1984	upto 1989	upto 1994
Remained area (ha)	82.1	49.6	21.2		72.9	49.9	24.9	
Population (person)	1,305	616	246		1,805	1,206	611	
Population density (person/ha)	17.0	12.4	11.6		25.6	24.2	24.5	
Total building floor area (m <sup>2</sup> )	44,872	15,108	4,950		41,188	28,277	1,508	
PLO (%)	5.1	3.0	2.3		5.3	5.6	0.6	
Opening area (ha)	5.0	37.5	65.9	87.1	4.1	27.1	52.1	77.0
No. of visitors (person/day)	1,430	4,165	7,566	9,826	607	2,683	4,227	5,628
Visitor density (person/ha)	286	111	114	113	143	77	81	73
Facility floor area (m <sup>2</sup> )	-	3,260	8,020	8,600	4,500	4,420	9,310	9,950
PLO (%)	-	0.9	1.2	1.0	10.9	1.6	1.8	1.3

## Environmental Criteria

The following criteria are postulated for environmental control in the parks. The purposes of these criteria and the conditions for setting indices are noted below.

**Setback**  
Setback is considered for the purpose of establishing zones coordinating the environmental conditions of the different activities and functions of adjacent environmental units. These setbacks indicate the distances from the park boundary to the edge of the facility site. Indices here are set with special interrelation with studies for noise control and scenic control.

**Green Coverage Ratio (GCR)**  
This is used to check the distribution of green areas, especially important elements in the park areas. Because of the strong sunshine and to create an archeologically sound environment, this green cover is an important factor for providing restful shadows and visual control. The present environmental standards of the village greens within the park areas are the guidelines for setting these indices.

**Percentage of Lot Occupancy (PLO)**  
Because the buildings for the necessary activities within the parks, and especially their artificial nature, intrude upon the archeological environment, appropriate quantitative checks are needed. Different indices are set depending upon building function, topographical conditions, and other factors. The gross percentage is the building area over the total area, while the net percentage is the building area over the facility area.

**Building Height**  
In principle, building height is not to exceed the tree heights set for facility greens and screening greens. With the heights for these trees set at 10-15m in the landscape planning, buildings are not to exceed 10m at their highest point.

**Density of Visitors**  
Appropriate regulatory values are to be postulated from an environmental standards perspective for the distribution of visitor inflow for the main activities. On this visitor inflow, the distribution at the peak time on an average day was studied. The gross density is the number of visitors over the visitor activity area where visitors will concentrate in each area.

**Level-1: Sanctuary**  
These levels are the main sanctuaries at both areas. While consideration is given here for comprehensive environmental control in both Borobudur area and Prambanan area, special study is given to harmonizing with the existing environment in the vicinity and to maintaining the distinctness of the archeological parks' environment.

**Case of Borobudur**  
Borobudur hill: 40%  
Boundary area: 70%  
Other area: 20%  
**Case of Prambanan**  
First, Second Compounds: 0%  
Third Compound: 30% (only greenery)

**Level-2: Park Area Except Sanctuaries and Facility Site**  
These are the park areas in both parks. It is environmental control for these park areas considering the distinct features of each site and its relation with adjacent park areas.

**PLO indicates covering ratio of facility site in park area.**  
Operation/Maintenance: 20-40%  
Research: 20%  
Education: 20%  
Service: 40%  
Recreational use: 10%

**Level-3: Facility Site**  
These are the facility sites within the park areas. Environmental control here is for the facilities within the facility sites and the visitor activities there.

**PLO indicates covering ratio of building floor area in facility site.**  
Operation site: 10%  
Maintenance site: 25%  
Staff housing site: 25%  
Research site: 25%  
Museum site: 25%  
Service site: 30%

**Operation/Maintenance area: 20m**  
**Recreational use area: 10m**  
**Research area: 30m**  
**Education area: 30m**  
**Service area: 10m**

**Operation/Maintenance area: 30%**  
**Recreational use area: 25%**  
**Dagil hill: 25%**  
**Open river side: 40%**  
**Research: 30%**  
**Education: 30-40%**

**The height of security guard box should be under 4.0m.**  
**The height of public toilet kiosk, shelter which is the Service Facility in the Area should be under 4.0m.**

**Operation/Maintenance area: 20m**  
**Recreational use area: 10m**  
**Research area: 30m**  
**Education area: 30m**  
**Service area: 10m**

**Operation site: 50%**  
**Museum site: 60%**  
**Research site: 70%**  
**Service site: 60%**

**High density area (10-50 m<sup>2</sup>/P): Service, Operation area**  
**Medium density area (50-100 m<sup>2</sup>/P): Education (Museum area, Field museum area)**  
**Low density area (100- m<sup>2</sup>/P): Recreational Use area**

**Space between outer wall and Facility Site boundary should be 20m minimum, but Pendopo Structure's case should be 30m minimum.**

**Building height of all facilities should be under 8.0m. However, as for pendopo architecture, the maximum height should be 12.0m due to the restriction of Structure System.**

**Maximum visitor density for Archeological Museum should be 3 m<sup>2</sup>/P. In case the number exceeds it, there should be limitation on admission.**  
**Visitor density for information center should be 2 m<sup>2</sup>/P. Maximum number of visitors to admit both Borobudur and Prambanan should be 200 persons each at a time.**

**Concourse main: 20**  
**sub: 10**  
**Parkway: 6**  
**Service road: 6**  
**Mall: 3**  
**Pavement width (m): 16, 8, 4, 4, 2**  
**Pavement surface: stone, stone, asphalt, asphalt, asphalt**

**Concourse**  
Concourse means the road leading to the candis and is the route where the rate of visitors' concentration is the highest.  
The main road from the entrance of the park to the main candis is called Main Concourse, which the road from other park areas to the candis, subconcourse. This is planned as the road for the dispersion of visitors from the remains to other park areas.  
**Pathways**  
This is visitors' route connecting each area with the other; this is planned so that the vehicles for maintenance use or emergency can be entered.  
**Service Road**  
This is the road for the connection between each facility inside park and it is devised so that the vehicles for emergency for maintenance use can enter.  
**Mall**  
This is the roads diverged from park ways or concourse, and is planned so that visitors can take a walk.

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## Nuisance Control

This is the study of nuisance control to try to protect the archeological parks' environment from the noises generated by nearby activities on roadways, residential areas and farmlands. While legal restrictions are needed to control noise in the vicinity of the park area, this study deals with noise abatement policies for within the parks.

**(1) Noise Standards within the parks (L<sub>10</sub> = 65 phons)**  
This means that the noise level during operating hours may not exceed this 65 phons limit by more than 10%. This means applying a standard generally comfortable for a residential area.

**(2) Solution**  
This is a consideration of noise control policies for the national road in Prambanan, thought to be the worst problem. These same policies may also be applied with maximum security to other areas and within the complexes.

While setting wide intervening distances is, in principle, the most effective way to reduce noise levels, the effort to reduce noise levels is done here with distance and trees.  
Minimum of 10-30m width is required from the boundary of the park and foliage is to be densely planted.

**Inner Park Transportation Standards**  
To prevent the concentration of visitors on specific places inside the park (especially candi and sanctuary) and for the rapid measures against the emergent accidents that may happen in the parks, the following standard is made for the establishment of traffic system so that various places can be reached as rapidly as possible.

**Standard of Distribution**  
The road network inside the park is made so that the distance to any place is within 100m and the total of distances to two roadways is less than 300m.

**Classification of Roads Inside Parks**

	ROW (m)	Pavement width (m)	Pavement surface
Concourse main	20	16	stone
sub	10	8	stone
Parkway	6	4	asphalt
Service road	6	4	asphalt
Mall	3	2	asphalt

**Parking Space of Cars**  
Each passenger car covers a floor space of 5.0 x 2.5m<sup>2</sup> for parking area and the width of the front road is 7m. The width of mall is 1.5m. The space of the green belts on every 4 vehicles is 5.0 x 2.5m<sup>2</sup>, the same as that of a car.

**Parking Space of Buses**  
Parking of buses should be at an angle of 45°. The parking space of one vehicle at a right angle is 4.0 x 11.5m<sup>2</sup>. The width of mall is 7.0m. The space of green belts on every four vehicles is made 4.0 x 11.5m<sup>2</sup> which is the same space as that of a car, to cope with the probable change in the future.

**Greenery Zone within Parking Area**  
The planting in zone is more than GCR 60%.  
The tranches of trees planted on the driveways to bus parking should be taller than 3.0m against the entrance of buses.  
**Bus Terminal**  
It is desirable that bus terminals should be located along the mall so that pedestrians can enter parks without crossing roadways. The covering area of one bus in a bus terminal is 3.0 x 13.0m.  
**Typical Plan**  
This is the roads diverged from park ways or concourse, and is planned so that visitors can take a walk.

## Parking Area Design Standards

In case of both Borobudur and Prambanan, the access to parking area should be made by cars. However, the transportation by cars easily results in nuisances of environment such as noise, or air pollution and it needs a wide hand surface area.

The following standard was established so as to maintain a stable and settled environment against such fears as above stated.

**Location of Parking Area, Site Requirements**  
The area should be reached directly from the access road of the park. It is desirable that the distance to the remains is as far as possible, and on a flat site topographically.

**Parking System**  
Inside parking area, the one-way system is taken and the layout should be done so that there are no crossroads.  
The parking area of buses and cars should be separated from bus terminals as possible.

A Mall system is established between the rows of parking cars. Arrangement is made to separate people and cars aiming at a smooth command of view.

Green Belts are established on every four vehicles to evade the direct sun beam while taking into consideration the command of view.

The entrance and the exit of the parking area are separated.

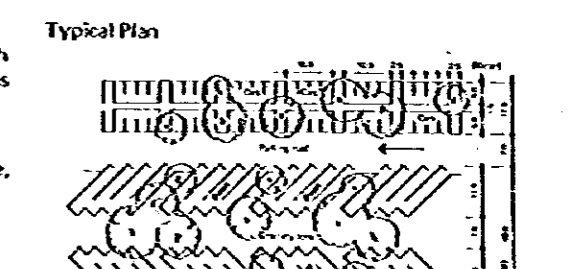
The module of division of roadway, parking areas and mall is 11.5m and 7.0m regardless of buses or passengers' cars, to cope with the probable change of layout in the future.

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# Boundary Designation Process : Borobudur

The Objects of this study are to diminish as possible the effects that the changes of landuse in Zone-2 area and equipments in the park may affect the area surrounding it and to urge the making of a harmonized environment of the park and the surrounding areas, by determining the boundary of the park, making the best use of the current landuse, and the various permanent boundary already made by nature.

## Criteria

**Existing Landuse Pattern**  
This includes such boundaries that the existing landuse makes, such as straight roads, agricultural boundary, irrigation, housing boundary vegetation boundary, etc.

**Topographical Condition**  
The boundary that topography makes, includes the difference of site levels, partial change in horizontal angles, and stormwater drainage system, etc.

**Administrative Line**  
This means the administrative boundaries of Dukuh, Desa Kecamatan, etc.

**Sanctuary Boundary**  
This means the boundary of the sanctuary determined by sanctuarization. In the determination of the boundary of Zone 2, the lining is made, in principle, in a larger scale than this.

## Case of Residential areas

Zone-2 areas must be decided in accordance with the following cases so as not to destroy existing communities:

**Case-1** Possibility of relocation of whole dukuh as units.

**Case-2** Possibility not only of formation of a new dukuh at the improvement site with the number of people and households resettled when it is not possible to relocate the whole dukuh but also of maintenance of the original dukuh with the number of people and households remaining.

**Case-3** When neither of the above two cases apply, the improvement must be confined to within the original dukuh.

## Case of Borobudur area

Specifically, these cases apply as follows in the case of Borobudur:

### Dukuh

Ngaran Krayan	Case-2	Sabrang Rowo	Case-3
Kenayan	Case-1	Goparan	Case-3
Gendingan	Case-3		

### Case of Prambanan area

#### Dukuh

Kang Kidul	Case-1	Klurak Lor	Case-1
Trogo Kidul	Case-2	Ngang Kruk	Case-1
Rimging Putih	Case-1	Kwenirejo	Case-1
Krang Lor	Case-1	Bozem	Case-3

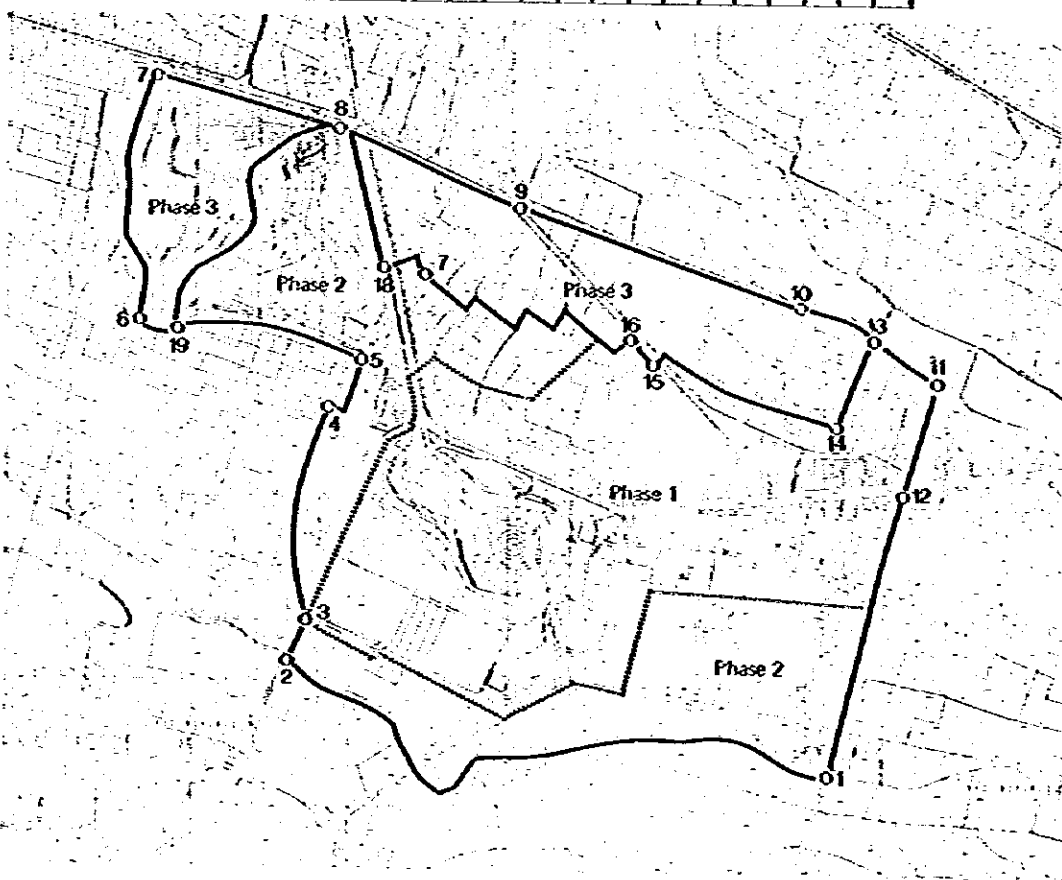
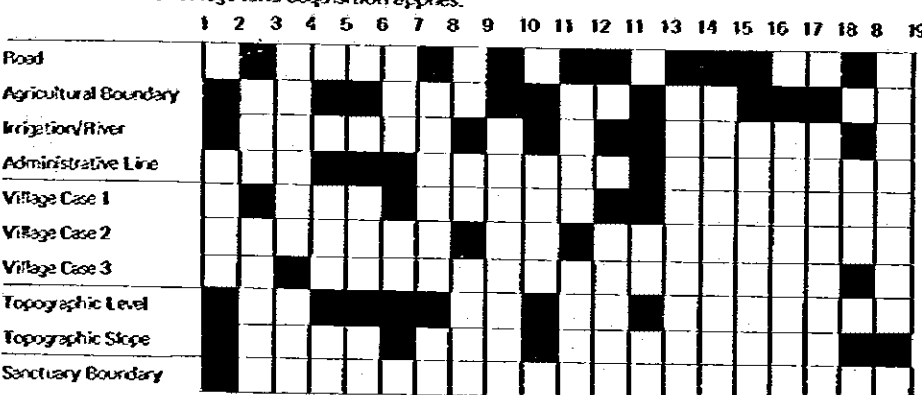
## Topographic Boundary 6-7



## Description of Boundaries

### Park Master Plan Area

- 1-2 Rice paddy boundary lines along irrigation channels. Park area topographically 1-2m higher than rice paddies. Almost coinciding with the 350m-radius sanctuary boundaries.
- 2-3 Running along the existing road, this is also the dukuh boundary line.
- 3-4 Sanctuary 35m line and the scope of Case-III of village land acquisition.
- 4-5 Line dividing school (public land) and agricultural land.
- 5-6 Dagi Hill boundary, with 2-3m difference in topographical level.
- 7-8 Line dividing existing road and Dagi Hill.
- 8-9 Line formed by existing road and irrigation channel and the extent to which Case-III of village land acquisition applies.
- 9-10 Line formed by existing road and irrigation channel.
- 10-11 Irrigation channel forming boundary between dry fields.
- 11-12 New road as boundary and extent to which Case-I of village land acquisition applies.
- 12-1 Widened road as boundary and extent to which Case-II of village land acquisition applies.



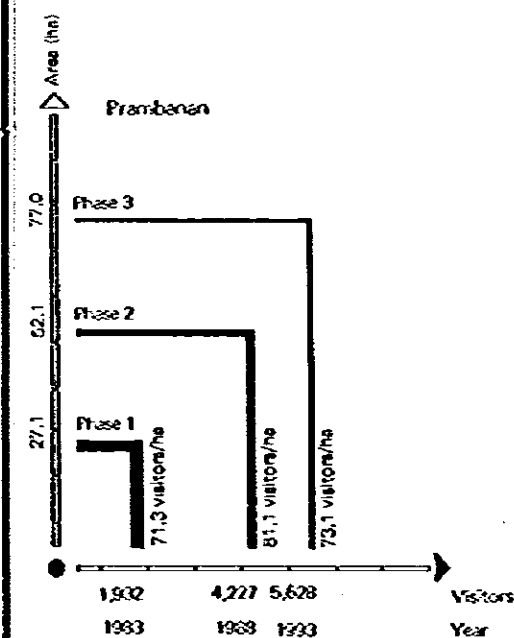
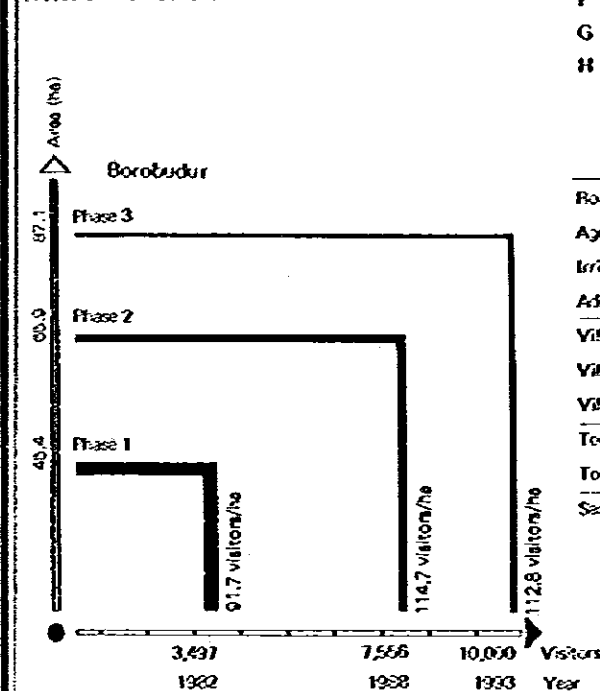
### Park Development Area (within Ten Years)

- 13-14 Use of the road within dukuh Kenayan as the boundary.
- 14-15 Use of the road within dukuh Kenayan as the boundary as above, with Case-II applying for implementation with respect to that dukuh.
- 15-16 Use of road and irrigation channel running along the boundary between the present dukuh and the agricultural production area as the boundary.
- 16-17 Use of present agricultural boundaries and pathways between paddies as the boundary, instead of the conceptual arc of a circle with a radius of 350m used at the time of the Interim Report.
- 17-18 Boundary between existing public land site and agricultural land.
- 18-8 Boundary between existing road and irrigation channel.
- 8-19 Use of Dagi Hill ridge as boundary so that all of the hill area visible from Borobudur is included in the park.

# Boundary Designation Process : Prambanan

## Development Propotion of Each Phase

To determine the frame of enlargement in the development scale in step, it is planned so that proper visitors' density is secured and to diminish the environmental change in the development steps of park, to cope with the increase in visitors' capacity. To preserve the environment of the park as a historical one, the density is planned to secure 100 visitors/ha to the average visitors' capacity per day, as a frame of enlargement of development in steps. The density fluctuations are planned within the range of 30-110 visitors/ha in Borobudur, and 70-90 visitors/ha in case of Prambanan.



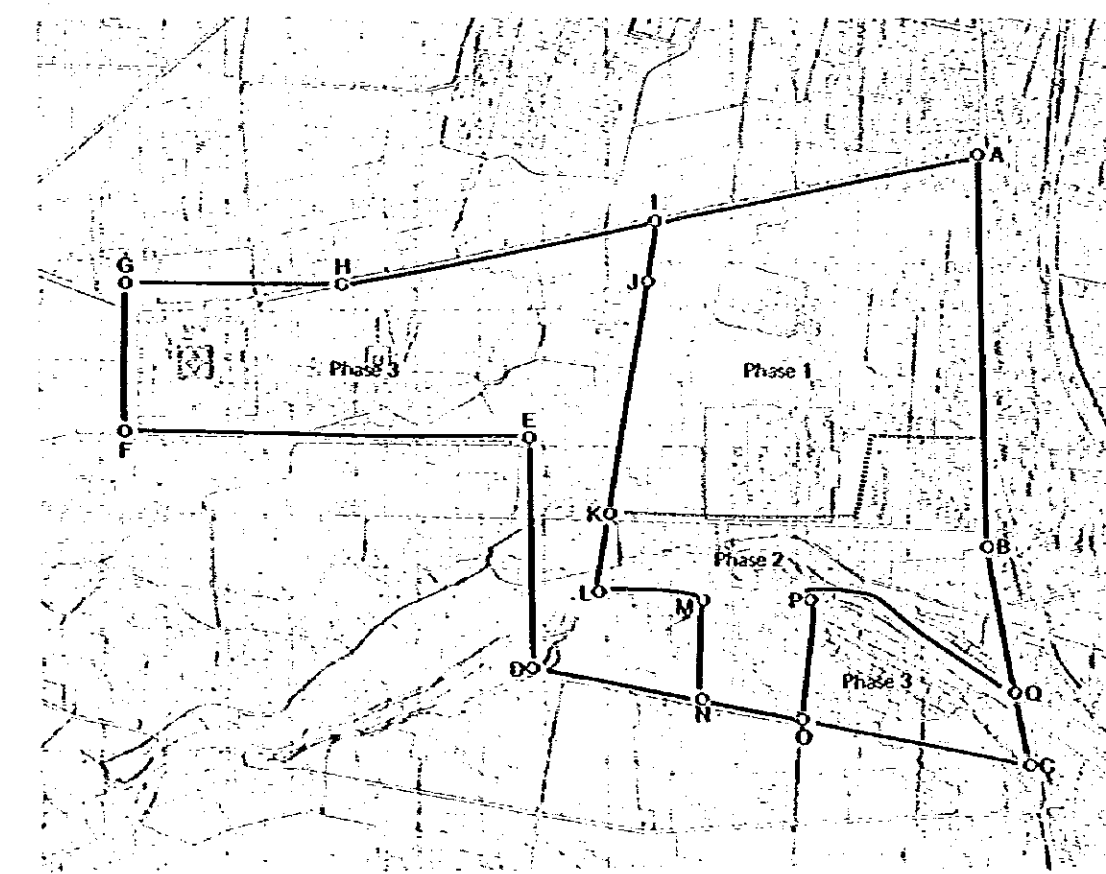
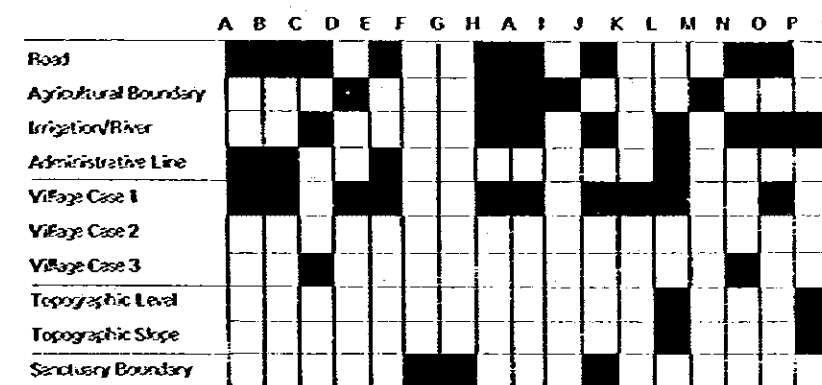
## Description of Boundaries

### Park Master Plan Area

- A-B Boundary of widened road and of dukuh
- B-C Same
- C-D Road boundary and extent to which Case-III of village land acquisition applies.
- D-E Boundary of dukuh and productive land.
- E-F Existing road as boundary, administrative division, and extent of application of Case-I of village land acquisition.
- F-G Set as sanctuary boundary
- G-H Sanctuary line as limit for dukuh relocation.
- H-A Existing road and irrigation channels as boundary and as dukuh boundary.

### Park Development Area

- I-J Use of agricultural boundary as boundary.
- J-K Use of dukuh boundary, which is also boundary of third complex of Candi Loro Jonggrang.
- K-L Use of agricultural boundary as boundary.
- L-M Use of Opak River and its river course as boundary.
- M-N Use of agricultural boundary as boundary.
- N-O Use of road boundary and line along irrigation channel as boundary.
- O-P Same as above.
- P-O Use of river course along Opak River as boundary.



# Visitor Analysis

The purpose of this study is to establish facilities, to determine entrance numbers of maximum plan as scale establishment conditions, to establish the visitors' capacity appropriate to visitors' activity and site requirement, through the analysis of the capacity, type and activities of the visitors, to cope with their various requests and to aim at the maintenance of the environment and the effective use of the limited site.

## Visitor Capacity and Fluctuation.

The purpose of this study is to plan the proper distribution of visitors according to the increasing density rate of the parks, and to establish the standards of scale determination of the park area and facilities.

### Datas

The data of this establishment was calculated on the basis of Market Study made by JICA in 1978.

### Planned Number of Visitors

Year	Borobudur		Prambanan		Prambanan/Borobudur ratio
	Year total	Average day	Year total	Average day	
1977	522,076	1,430	221,737 (295,200)	607 (810)	42.4
1983	1,520,100	4,165	760,400	2,083	50.0
1988	2,758,100	7,526	1,542,900	4,227	55.9
1993	3,586,400	9,826	2,064,400	5,628	56.3

### Fluctuation Description

Fluctuation is divided into three grades: monthly, weekly and daily.

The details and the index of each fluctuation are as follows:

### Seasonal Fluctuation

In the result of market study, one year can be divided into three grades: off season, average, and season.

off season —	Feb. March, Nov.	0.5
Average season —	Jan., April, May, June, July and Oct.	1.0
Season —	Aug., Sept., and Dec.	1.7

Regarding the visitors' capacity in average season as 1.0, the other indexes are 0.5 (off season) and 1.7 (season).

### Weekly Fluctuation

Regarding the average index of one week as 1.0, others are 2.4 (Sunday) and 0.7 (weekdays).

### Daily Fluctuation

The average staying period is 3.0 hours for both parks. In the result, the staying period of daily peak time is defined as 60% for both parks.

### Maximum Planning Visitor Capacity in Peak Time

These numbers show the maximum visitor capacity used for the plan of 1988 and of 1993.

Year	1988	1993
Borobudur	13,690	17,656
Prambanan	7,608	10,130

### Average Visitor Capacity in Peak Time

These numbers show the capacity of visitors in the peak hours of a day for seasonal fluctuation in two parks.

	Off season		(Visitors) Season
	Other month		
Borobudur			
1988	2,267	4,534	7,707
1993	2,948	5,896	10,022
Prambanan			
1988	1,268	2,536	4,312
1993	1,688	3,377	5,741

## Visitor Types

### Domestic Visitors

#### Short-term: Domestic

These are long-term tourists from throughout Indonesia, except the middle Java area, who will stay in the area an average of two nights sightseeing in Yogya-Solo and visit the parks for short periods of time.

#### Medium-term: Family tours

These are the weekend family from Java. Because they will also visit tourist sites in the vicinity, it is anticipated that their visits to the parks will be of medium length.

#### Long-term: Youth tours

These are the weekend youth tour types from Java. Composed primarily of middle school or high school students and others, their visits to the parks will also be for study.

#### Long-term: Family tours

These are recreational family tours from middle Java expected to spend an entire day on one park in leisurely schedule.

### Student Visitors

#### Long-term: Study tours

Although overlapping somewhat with the weekend youth tours from Java, these people will visit the parks in accordance with independent educational programs to study the historic culture on display there.

#### Long-term: School trips

These are visits made to one park by elementary, middle, or high school in middle Java in line with the school curriculum's field trip activities program to study the history or culture evidenced by the park.

### Foreign Visitors

#### Short-term: Foreign

These are international tourists from overseas. It is expected that their routes will include such international tourist attractions as Jakarta and Bali and that they will visit this area for an average of two nights, being sure to visit the parks even if for only short periods of time.

### Night Tours

These are visits by people staying in the area and coming to see the son et lumiere, Ramayana dance of the Prambanan Park.

### Expected Activities of Each Visitor Type

Visitor types	percentage		length of stay
Short-term Domestic	20%		2 hrs.
Medium-term Family tours	15%		2-3
Long-term Youth tours	25%		3-4
Long-term Family tours	10%		3-4
Long-term Study tours	10%		4-5
Long-term School tours	15%		4-5
Short-term Foreign	5%		2-3
Night tours	-		2

### Classification of Visitors (%)

	Borobudur		Prambanan	
	1977	1988	1977	1988
Domestic tourists	65.0	73.3	81.7	
Students	6.3	23.5	12.3	
Foreign tourists	8.7	3.2	5.8	

## Visitor Density

### Determination of Suitable Visitors' Density

In determining the frame of suitable density in each area of the park, the standard was established so as to prevent any concentration or diminution of visitors or specific place, candid etc., and to aim at a balanced distribution of service facilities etc.

The criteria of the plan is based on the relationship among the relevant people, and the state of communication of them in the following three grades of visitor capacity in which they were estimated.

#### High density (10-50m<sup>2</sup>/P)

The range in which people can carry on a conversation in adequate contact with one another.

#### Medium density (50-100m<sup>2</sup>/P)

The range in which the other person is readily perceivable but in which a conversation is not possible.

#### Low density (100-m<sup>2</sup>/P)

The range in which only particular persons or people nearby that one knows are perceptible.

### The Relationship between the Park Activity and Visitors' Density

Among the areas corresponding with the inner park activities, the appropriate density of areas where visitors enter was established. The standard of the establishment is set within the range where the characteristics concerning area and space that each activity has can be maintained.

#### Borobudur:

Low density: Dagi hill  
Medium density: sanctuary museum field museum  
High density: concourse entrance parking area

#### Prambanan:

Low density: river side park field museum  
Medium density: sanctuary museum field museum  
High density: concourse entrance parking area, service area

### Visitor Distribution

The calculation of visitors' distribution was made on the basis of the visitor capacity in the year of 1973 and that of the peak on the average time.

According to this distribution rate, the standard of each area is determined. The distribution rate of the capacity in the sanctuary was 45% for maximum, and 60% on the average time, while 30% for maximum and 20% on average time for Educational use (museum, and field museum etc.)

### Visitor distribution

Activity	Maximum (%)		Average (%)	
Sanctuary	45		60	
Education	30		20	
Recreation	5		5	
Service	20		15	

#### Borobudur

Activity	Distribution (%)	Capacity (P)	Density (m <sup>2</sup> /P)	Area (ha)
Sanctuary	45	8,000	50-100	40
Education	30	5,400	50-100	27
Recreation	5	1,000	100-	10
Service	20	3,600	10-50	3.6

#### Prambanan

Activity	Distribution (%)	Capacity (P)	Density (m <sup>2</sup> /P)	Area (ha)
Sanctuary	45	4,200	50-100	22.5
Education	30	3,000	50-100	15
Recreation	5	500	100-	5
Service	20	2,000	10-50	2

# Visitor Distribution

## Visitor Activity

### The Activities of Visitor in the Park

Recreation/Recreate  
to speak, an activity which pertains to the main activities in other ordinary parks. Mainly "to sightsee", "to pass the leisure time" and "to access the nature". This is the activity of visitors to the parks mainly.

### Study and Research

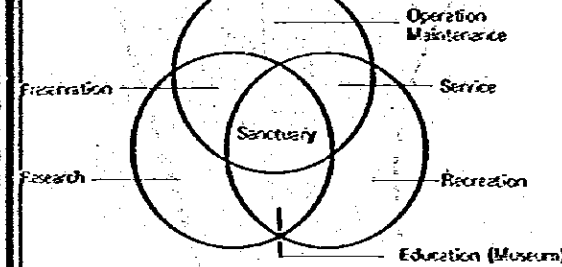
A very characteristic deed for an archeological parks. Performance of the scientific study of Indonesian archeological remains.

### Operation and Maintenance

To operate and to maintain is the elementary act for a park. In this activity, not only the business function, guarding function or the maintenance, but also the protection of this remains as an archeological park should be included.

The workers of the park are responsible for this activity.

### Activity Model



### Description of Each Activity

#### Operation, Maintenance

The "Operation" in the parks can be divided as follows: The financial, personnel management, administration plans for effects inside parks and the guarding, while the "maintenance" into maintenance of the green in the park, repairment of the buildings and keeping clean of the park.

#### Recreation

As activities corresponding with recreation, the sale of souvenirs to visitors, equipments for amenities, areas for excursion or picnicking etc., should be taken into consideration. In Prambanan Park, Ramayana theater is established for the provision of enjoying plays with visitors.

#### Research

Equipments with activity for education or study through a scientific approach of archeology, chemistry, architecture etc. with various themes, for instance, restoration or rebuilding of remains, are planned.

Concretely speaking, as to Borobudur, the introduction of SPAFA (Subcenter) as study function and educational activities on the basis of the data given through the experience of Candi Borobudur Restoration work, which is now under way, is the one example. As to Prambanan Park on the other hand, the facilities are planned with the basis of the archeological site office, which is currently within the territory of Candi Loro Jonggrang.

#### Service

The service activity in the park consists of transportation, information and rest functions.

Transportation signifies the arrangements of parking area facilities for the buses, cars or other vehicles entering the park, and inside part transportation system.

"Information" includes the guide inside the park to visitors, introduction of remains, announcement of lost children, first aid service etc.

"Rest" means the arrangement of resting places, toilets, small kiosk, shelters with the telephones for information about the park according to the visitors' capacity.

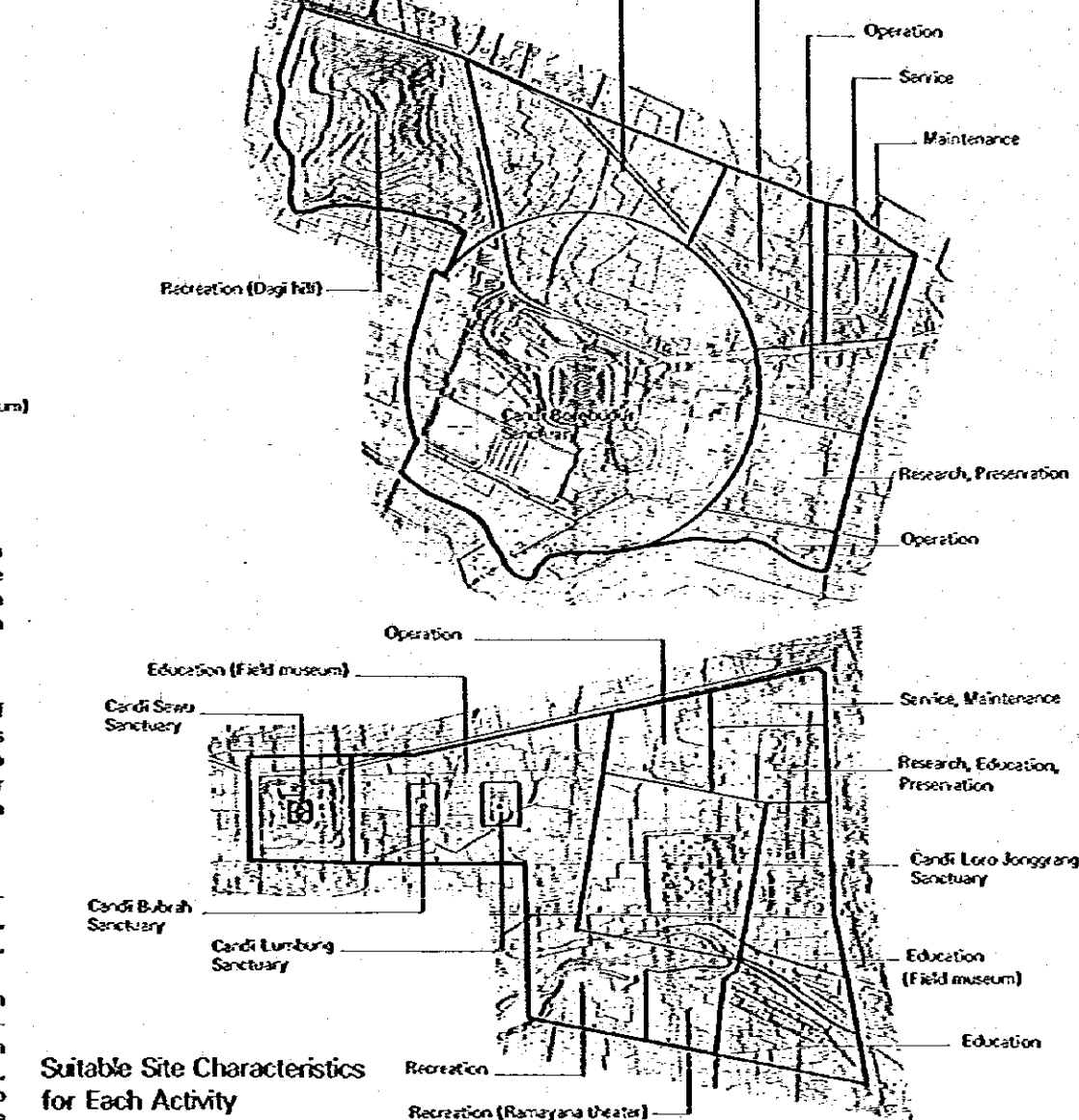
### Education

The facility to inform visitors not only of the introduction of the remains but the value of the remains, small excavation, the history of restoration etc. Archeological museum and field museum inside the park are planned to be the presentational facilities.

### Preservation

As a activity to prevent the physical, chemical, or artificial destruction of the remains, it is planned to be the same structure as research activity. The desirable location is where the sanctuary and the remains are easily accessible.

## Site Division

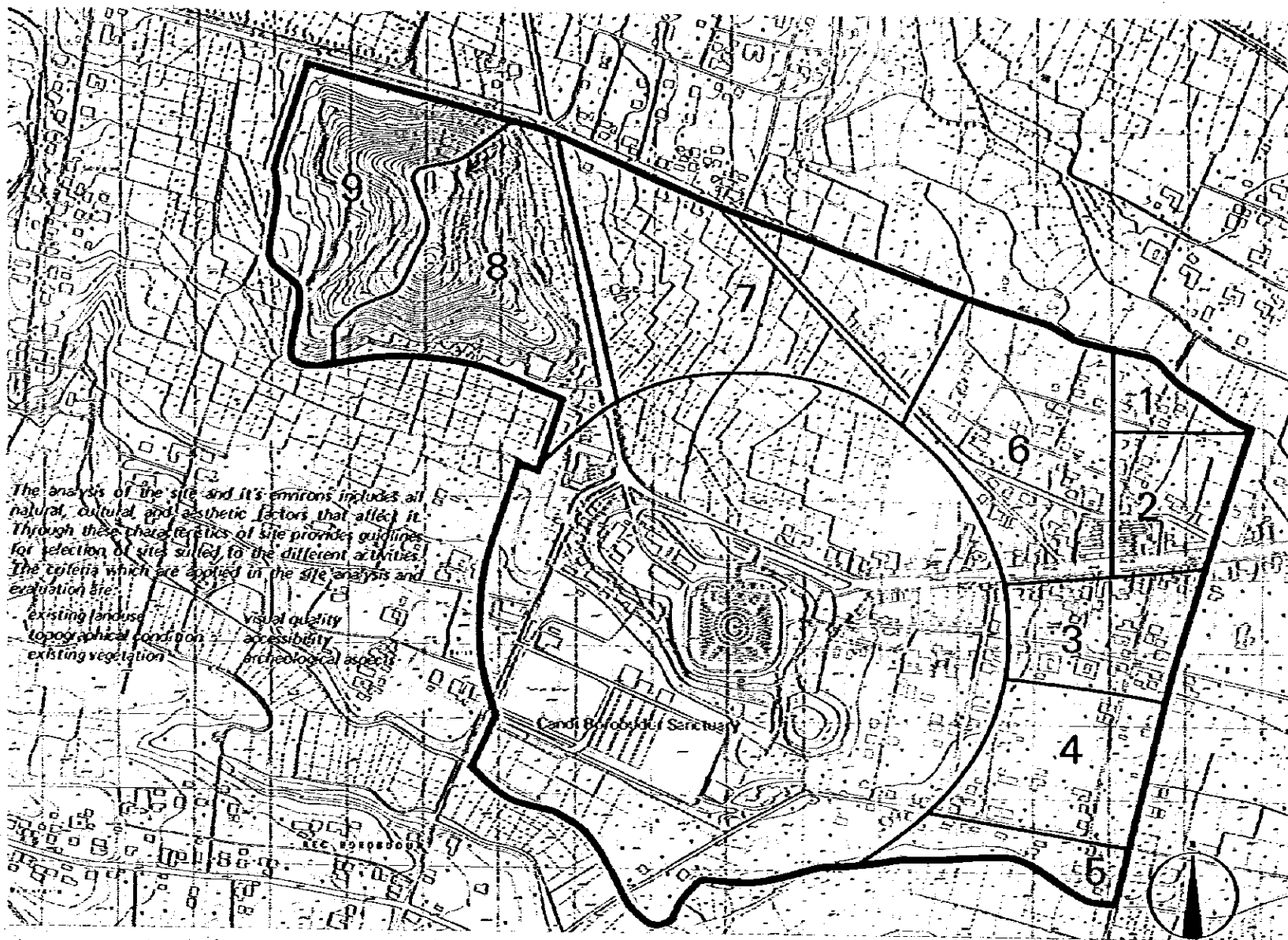


## Suitable Site Characteristics for Each Activity

	Accessibility	Topographical Condition	Vegetation	Special Condition
Operation/Maintenance	easily accessible from throughout the park and nearby roads	topographically level	high tree, medium density	sequence entrance to candi
Recreation	at ample distance from the monuments because of noisiness	topographically diverse, hilly		good view greenery open space
Research	considerable degree of separation from other functions	level topographically level	high tree high density	semi open space closed by green quiet space
Education (Museum)	good accessibility within the park	topographically variety with some slope	variety medium density	good view greenery open space
Service	direct accessibility from access road, far distance from candi	levelness	high density	possible non visible area from candi



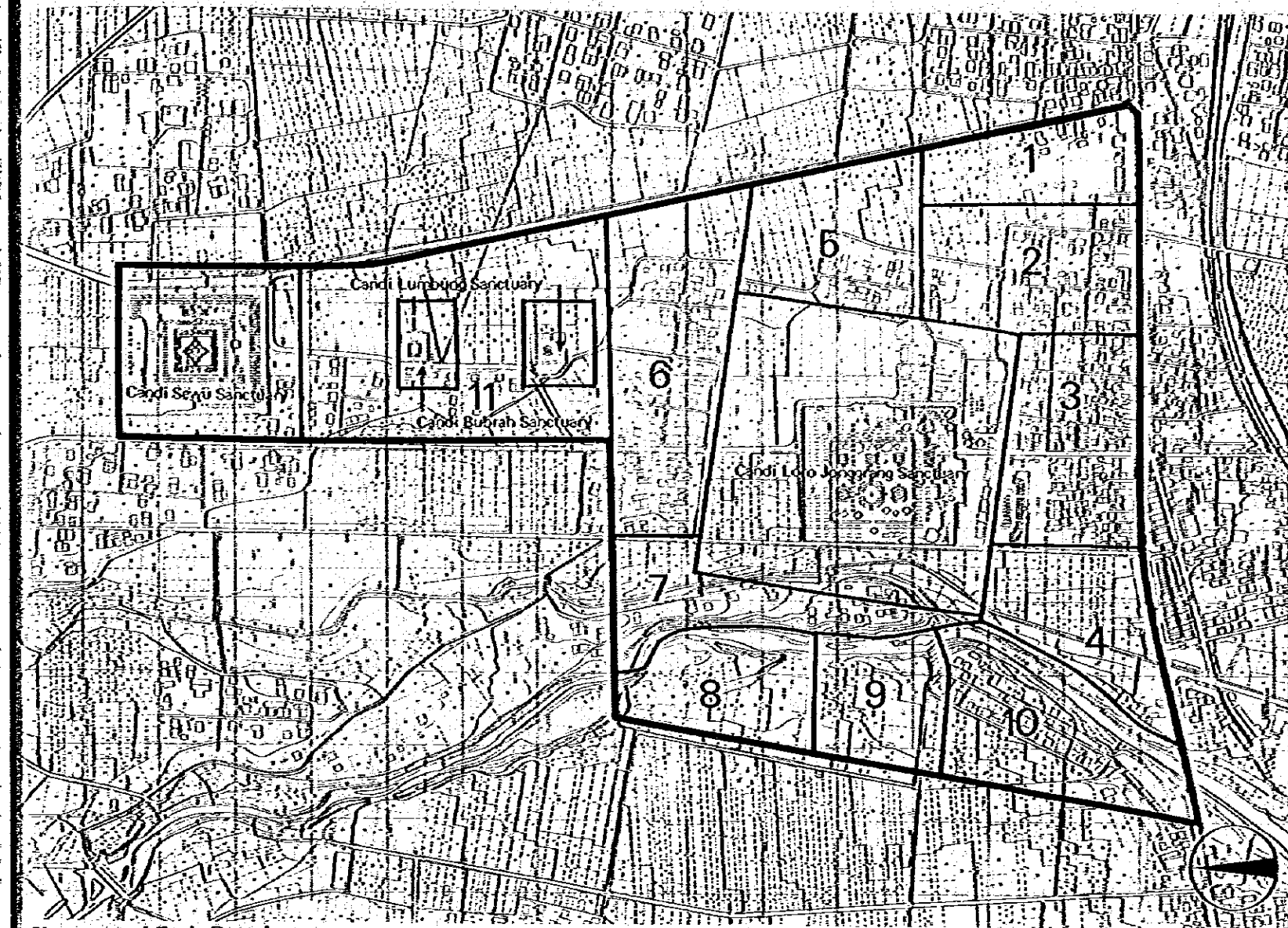
# Site Analysis and Evaluation : Borobudur



Character of Each Parcel

Code no. of parcel	Existing land use	Topographical condition (%)	Existing vegetation GCR (%)	Visual quality of candi	Accessibility from road	Accessibility from candi	Archeological aspects	Area (ha)
1	Agricultural land	5~10%	Bamboo mixed GCR 30%	Invisible area	close to access road	fair area		10
2	Residential area Agricultural land	0%	Bamboo Mixed GCR 41%	Poor visible area	Direct closed to access road	fair area		36
3	Residential area Agricultural land	0%	Coconut Bamboo GCR 35%	visible from the front of Candi	good direct closed to access road	good area	Possibility of unexcavated original concourse	31
4	Residential area Open space	0%	Coconut Bamboo GCR 78%	invisible area	fair area	fair area		43
5	Forest Residential area	5~10%	Coconut Bamboo GCR 80%	invisible area	poor area	poor area		15
6	Residential area Agricultural land	0~10%	Coconut Bamboo GCR 50%	good visible area	fair area	fair area		73
7	Agricultural land Residential area	0~5%	Crops Coconut GCR 23%	good visible area	fair area	poor area		120
8	Hill Shifting cultivation area	30~40%	Coconut GCR 30%	horizontality	poor area	fair area		75
9	Hill Shifting cultivation area	30~40%	Coconut GCR 30%	invisible area	poor area	poor area		70

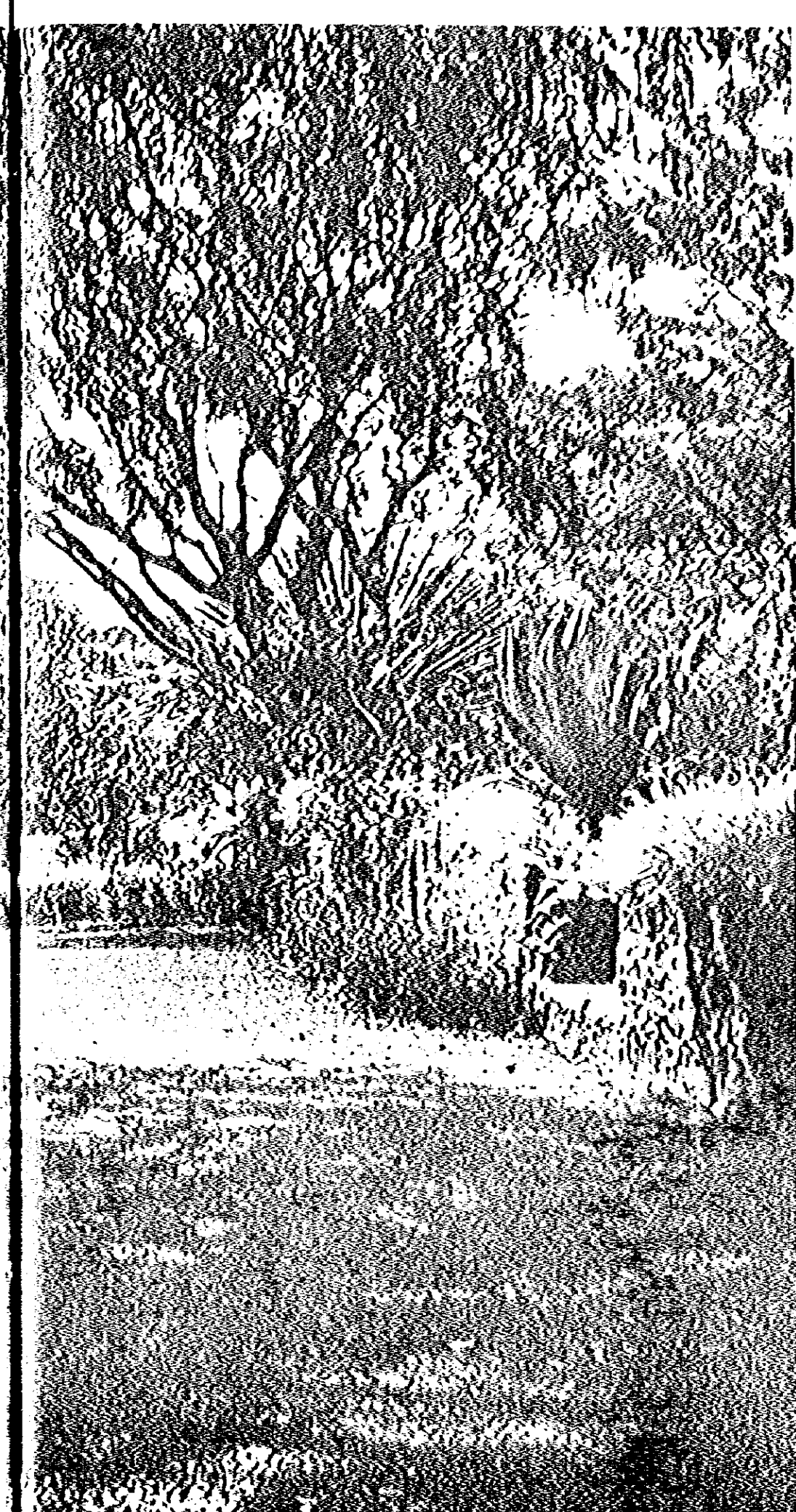
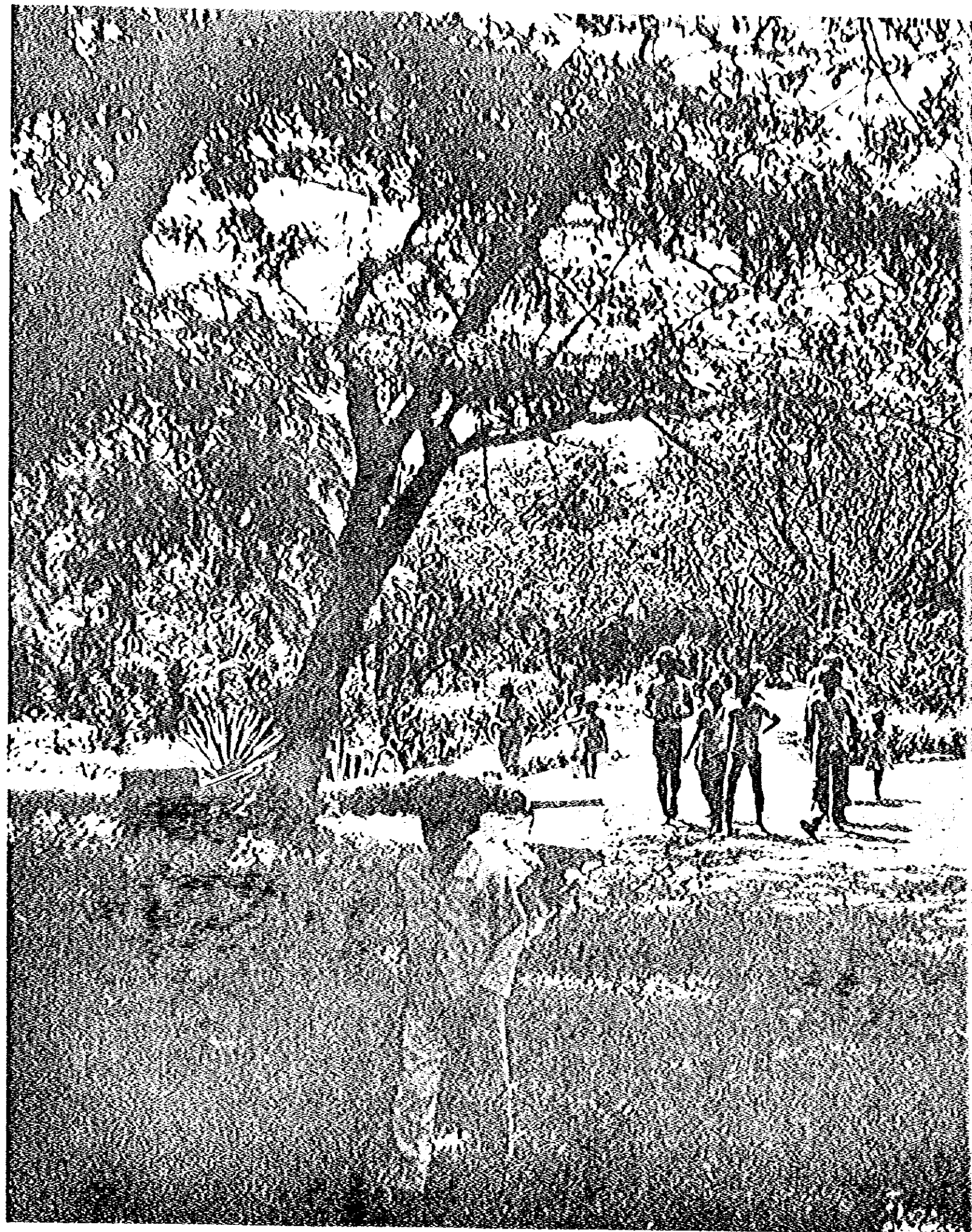
# Site Analysis and Evaluation : Prambanan



Character of Each Parcel

Code no. of parcel	Existing land use	Topographical condition (%)	Existing vegetation GCR (%)	Visual quality of candi	Accessibility from road	Accessibility from candi	Archeological aspects	Area (ha)
1	Open space Agricultural land	0%	Crops GCR 2%	invisible area	good close to access road	fair area		30
2	Residential area	0%	Mixed GCR 20%	good visible area	good close to national road	good close to third compound of Loro Jonggrang		51
3	Residential area	0%	Mixed GCR 5%	good visible area	fair area	Good close to third compound of Loro Jonggrang	Possibility of unexcavated ruins	40
4	Agricultural area	0~20%	Paddy field GCR 5%	good visible area	poor area	fair area	Possibility of unexcavated ruins	30
5	Agricultural land Residential area	0%	Mixed forest paddy field GCR 8%	good visible from front of candi	fair area	good area		34
6	Residential area Agricultural land	0%	Mixed forest Paddy field GCR 50%	good visible area	poor area	good area		63
7	Residential area Agricultural land	0~40%	Paddy field Mixed forest GCR 48%	fair area	poor area	poor area	Possibility of third compound	65
8	Agricultural land Open space	0~40%	Crops GCR 11%	poor area	poor area	poor area		30
9	Agricultural area	0~20%	Paddy field Crops GCR 3%	good area	fair area	poor area		27
10	Residential area Agricultural land	0~30%	Crops GCR 25%	fair area	good area	poor area		52
11	Residential area Agricultural land	0%	Paddy field Crops GCR 30%	good area	fair area	good area	Possibility of unexcavated ruins	90





## Landscape Design

Let's give a concrete outline of the plan. How does the work of Landscape participate in the design of parks? Please look at the picture on the right. The above picture is of the monument one can see as of the year 1979 and of the typical scenery of the surrounding area. You can see the scenery consists of the monument which are not restored or being restored, the fields continuing to the rear side of them, and BBC (Banana Bandoo, Coconut palm) - a residential forests which the people of the town have built as the necessities of life.

Here, the parks where a number of people will resort in future must provide them a pleasant resort. The restoration and the protection of the monuments are the necessary points for that purpose. For that Landscape, by participating in making parks with three great works so as to contribute both to the monuments and the visitors.

You will also understand the contents with a comparison between the terms of parks as of the completed date written on the right picture and the current form of the above picture. The three works are: (i) To make the foundation of facilities and monuments in the park and to establish footholds of visitors (ii) The handling of trees, which are main components of the park environment (iii) The provision of tools such as chairs, benches, dust bins etc. which are necessary for making a pleasant resorting atmosphere for visitors.

In this chapter, we are going to state in detail the study process, with the concentration on the three works about the landscape which is the basic element for park-making.

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# Initial Work for Landscaping: Coordination with Restoration

How will landscaping relate to the restoration of the monuments? Let us first consider the great influence that the restoration work, which is the most important element of the park, will have on the earthwork, from which the landscaping begins, depending on the methods used and then describe what steps should be taken to deal with this problem.

## The Relation between Earthwork and Restoration of the Monuments

The present ground level around archeological monuments differs from that at the time the monuments were built, the amount of different varying from monument to monument. Furthermore, the restoration work includes restoration of the immediate surroundings to the state that they were in at the time of construction. Accordingly, there will be variation in the amount of adjustment of the existing ground level, and earthworking policy will differ between monument site zones and park facility areas.

In monument site zones deep cutting will have to be avoided because of the possible existence of unexcavated monuments. Some cutting will be necessary in restricted spots, but full attention will have to be given to functional and scenic considerations.

## How to Restore the Monument: Candi Loro Jonggrang

From the surveying results obtained to date, the basic ground formation height and areal scope of the restoration will entail a great amount of the change in the topography of both the park itself and the area around it. Furthermore, the park development project itself will be affected by archeological decisions and decisions concerning the restoration program. The following are some problems that will have to be solved in this respect:

- (1) The ground formation height of the second compound.
- (2) The shape and dimensions of the outer wall of the second compound and what parts are to be restored if not all.
- (3) Whether the whole candi within the second compound is to be completed or only parts of it, and if the latter, what parts.
- (4) Whether or not there are survey or restoration plans for the third compound, and if so, what kind.  
How the third compound space is to be used as a restoration yard and whether or not such space will be sufficient.
- (5) The period the restoration schedule for Candi Loro Jonggrang will cover.
- (6) The contents of the overall restoration plan for Candi Loro Jonggrang and the areal scope.

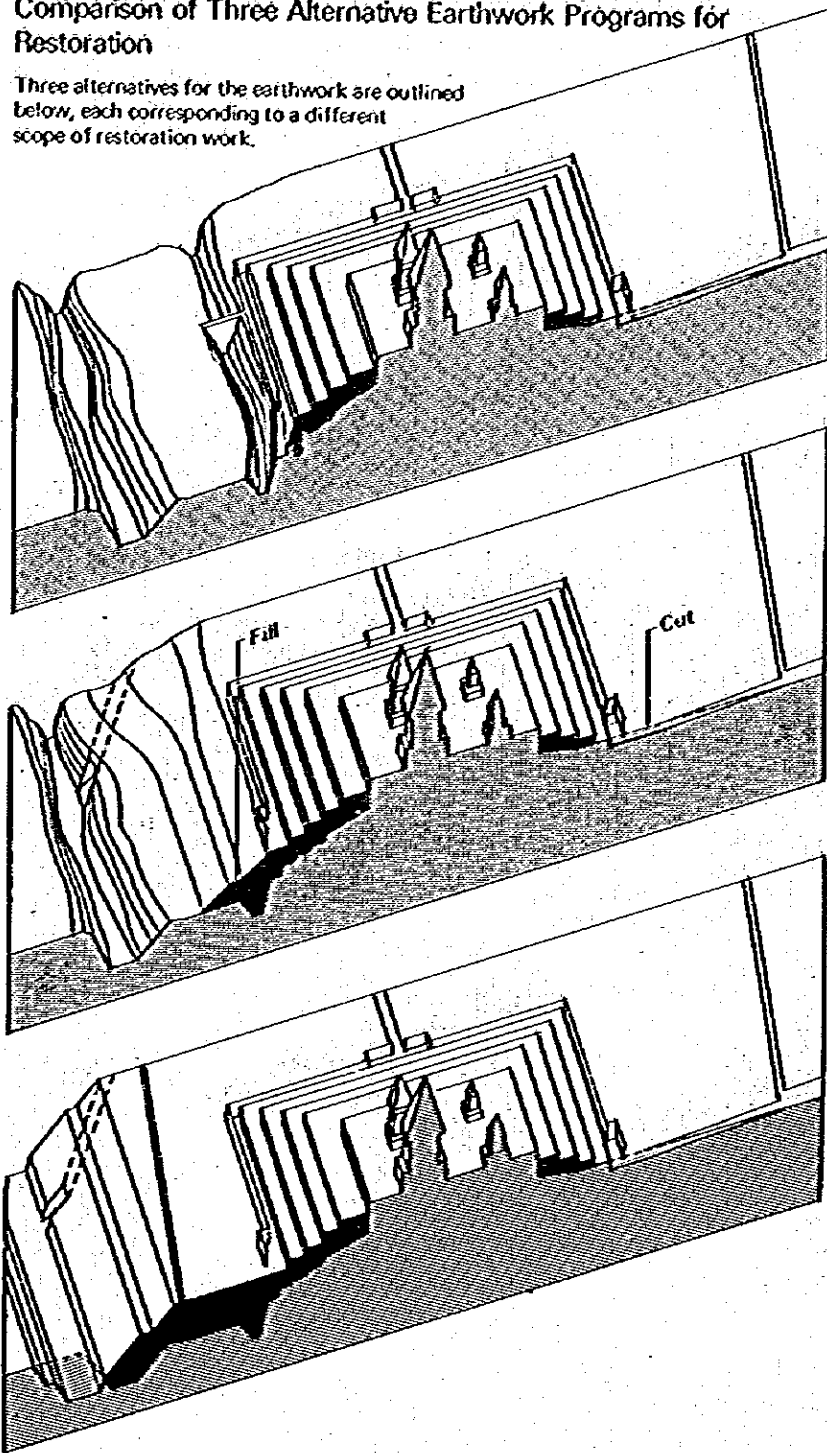
### Influences of the Restoration on the Earthwork

The following are some of the problems that will arise in connection with the earthwork:

- (1) The stormwater drainage system must function independently within the inner square, second compound, and third compound, respectively, as well as being linked with the outside.
- (2) The irrigation system and channels must be improved and be able to function in accordance with the land use outside the park area.
- (3) It will be necessary to provide revetments, retaining walls, and erosion control for the tributary.
- (4) It will be very difficult to preserve the existing vegetation.

## Comparison of Three Alternative Earthwork Programs for Restoration

Three alternatives for the earthwork are outlined below, each corresponding to a different scope of restoration work.



### Restoration of the Second Compound with All Possible Way

- (1) Noncompletion of the entrance part of the outer wall on the west side of the second compound.
- (2) Some revetment work along the tributary, with an embankment height of about 2m.
- (3) Partial replacement of present irrigation channel with underground culvert.
- (4) Considerable cutting of surrounding paddy fields.
- (5) Adjustment with the existing ground level in the third compound.

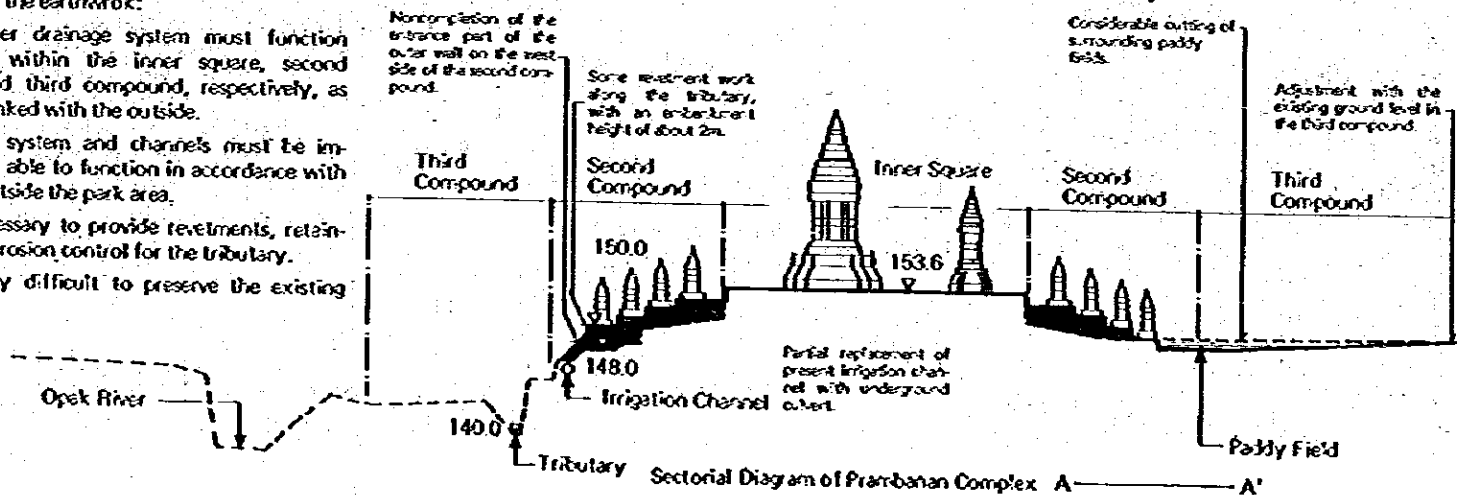
### Complete Restoration of the Second Compound

- (1) Complete restoration, including completion of the entrance part of the outer wall on the west side.
- (2) Complete infill of the tributary into the Opak River far upstream, a riparian works program will be necessary, with embankments of up to 7.0-7.5m in height.
- (3) The existing irrigation channel will cease to function at all, necessitating a new intake upstream and a new channel route.
- (4) A considerable amount of borrowed earth will have to be brought into the park area from the outside for the embankments.

### Complete Restoration as far as the Third Compound

- (1) The ground level of the third compound level will be made nearly a plane, and the second compound area will be completely restored.
- (2) Not only the tributary but even the Opak River will not be able to follow their present courses on account of the ground leveling. The latter will have to be shifted 40-50m to the west, which will involve a tremendous amount of riparian works. Furthermore, it will be necessary to adjust the irrigation channel and the rest of the irrigation network in the vicinity to the new situation.
- (3) A very large quantity of borrowed earth will have to be brought into the park area from the outside for the embankment work, the embankment height being perhaps as much as 9m.

## Optimum Program: Maximum Restoration of the Second Compound.



# Earthwork Plan: Prambanan

The following will be characteristics of the earthwork for the Prambanan park:

Since there is considerable difference between the present ground levels of Candi Prambanan and Candi Sewu and their original ground levels, much of the earthwork will have to be for the purpose of assisting the restoration work.

Another important category of the earthwork will be banking to prevent river erosion, which could greatly affect the monuments.

153.6 Proposed Ground Formation Height

Existing Contour Line

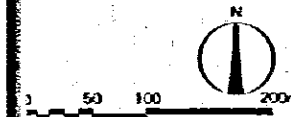
Proposed Contour Line

Cutting Area

Filling and Embankment Area

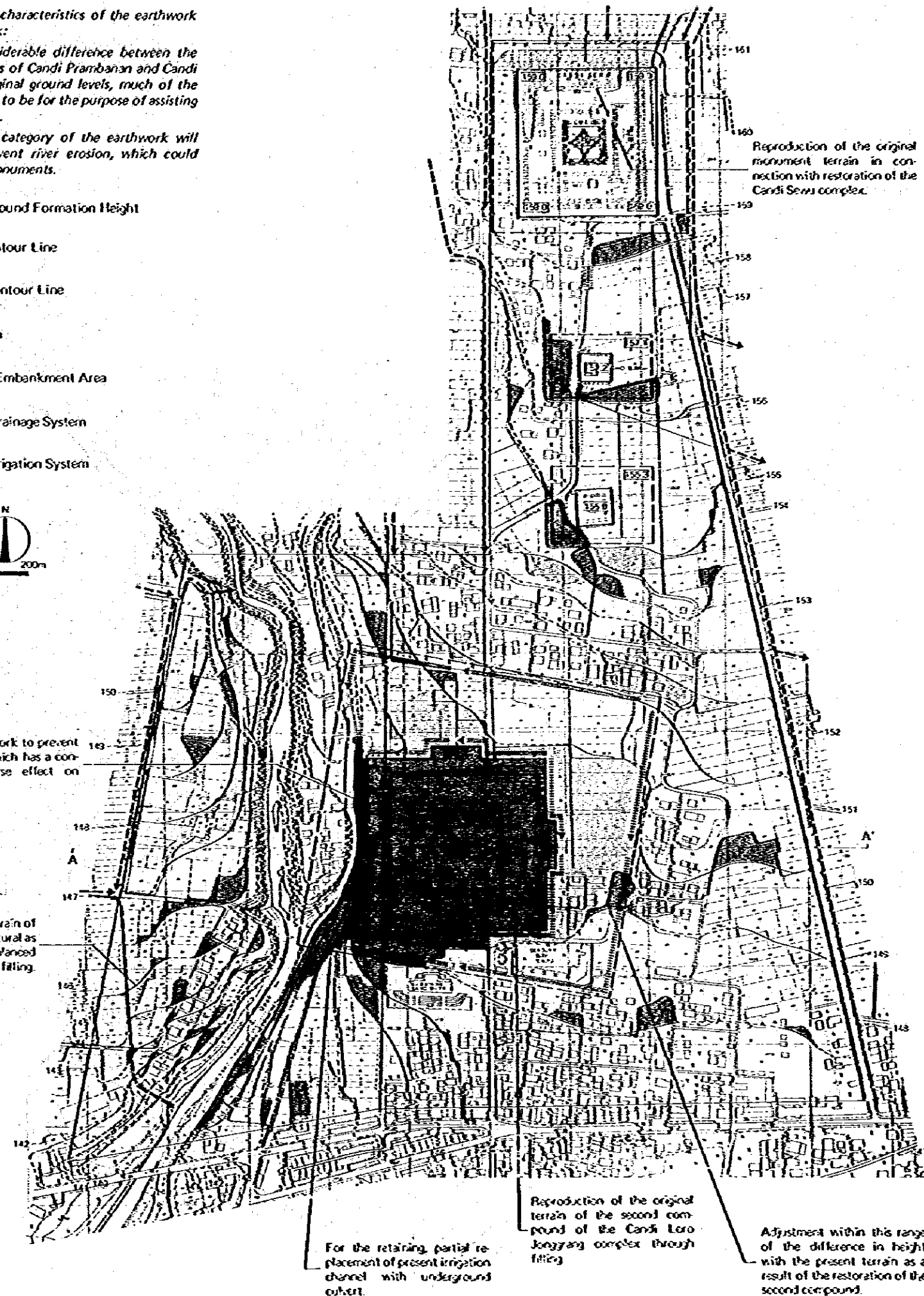
Proposed Drainage System

Proposed Irrigation System



Embankment work to prevent river erosion, which has a considerable adverse effect on monuments.

Making the artificial terrain of fields and paddies as natural as possible through a balanced mix of cutting and filling.



# Initial Work for Landscaping: Construction of Basement

Earthwork will be the basic work for the purpose of adapting the present topographical conditions to the new land use purpose (archeological park in this case). More specifically, it will be for the purpose of providing safe foundations for the monuments themselves and their surrounding environments as well as optimum foundations for the various facilities for park visitors and staff, including buildings, roads, and trees. Let us consider the problems and methods of such earthwork as a part of the park construction program.

## The Problem of the Present State of the Land: Borobudur Park.

At present a little under one-fifth of the Borobudur park area consists of agricultural land, which is the most problematic kind of land in connection with park development. Let us next consider how such agricultural land differs from land to be used for park purposes.

### Mechanism of Farm Land

Agricultural land constantly changes according to the season and the type of crop being grown in terms of the area of cultivation and the location, height, and number of ridges. In other words, the terrain changes according to the needs of farmers.

- Agricultural roads and paths between fields are convenient to farmers. Furthermore, in view of the fact that they cannot take up too much breadth or area, their layout is very orderly and complicated.
- Agricultural land is used for the production of crops, and the small number of persons engaged in agricultural work manage it in many different ways and with great frequency.
- Because of the fact that each field is level and partitioned from other fields and paddies around it, the overall topography of agricultural land is not even.
- Fields and paddies are well made for taking in water and keeping it. From a section of ground base height one can see that the terrain is as uneven as, for instance, in the case of sloped land.
- The terrain of agricultural land is based on the style of agricultural production. Most of the land has to be used for crop cultivation, leaving little space for people to walk.

### Mechanism Park Land

- The park construction plans call for returning the terrain within the park areas that has been artificially distorted by field, paddies, and villages to its original shape at the time the monuments were built for a smoother ground base.
- The parks are for accommodating a large number of visitors and allowing them to walk about freely within them, and the kinds of management and frequency per unit of area will be very low.
- It is not necessary for there to be detailed division of the terrain into different topographical levels in the parks. Rather, it is preferable that the land in the parks be flat or at least have an even slope.
- The pathways and paths of the parks must be wide enough for visitors to walk along them freely and of simple structure.

## What a Kind of Earthwork?

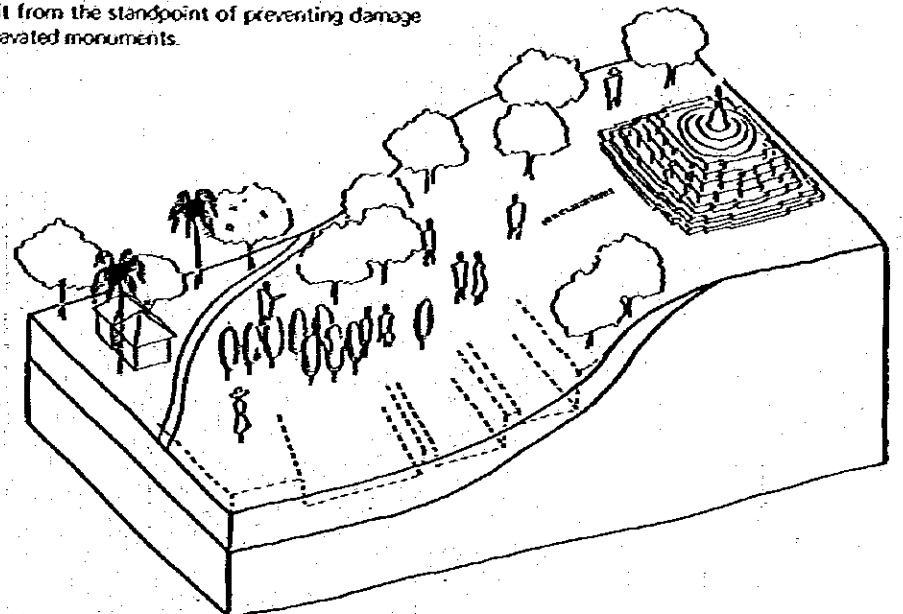
What will be the best way to prepare the present agricultural and other land within the park area for park development?

The following is considered the best way to handle the problem of topography in connection with park development.

- Minimization of alteration of the existing terrain and avoidance of extreme gradients so as to make the land as nearly natural and stable as possible.
- Maximization care in preparing ground that has not yet been archeologically surveyed and minimal alteration of it from the standpoint of preventing damage to unexcavated monuments.

## Basic Way of Handling the Earthwork

- Rational simplification of an artificially partitioned complicated terrain.
- Getting rid of ups and downs in the terrain, i.e. averaging out of localized differences in height (paths between fields, ditches, etc.)
- Evening of the slope of the ground for control of surface erosion by rainfall.
- Balanced amount of cutting and filling for achievement of overall gradient and terrain that will allow for smooth surface drainage.



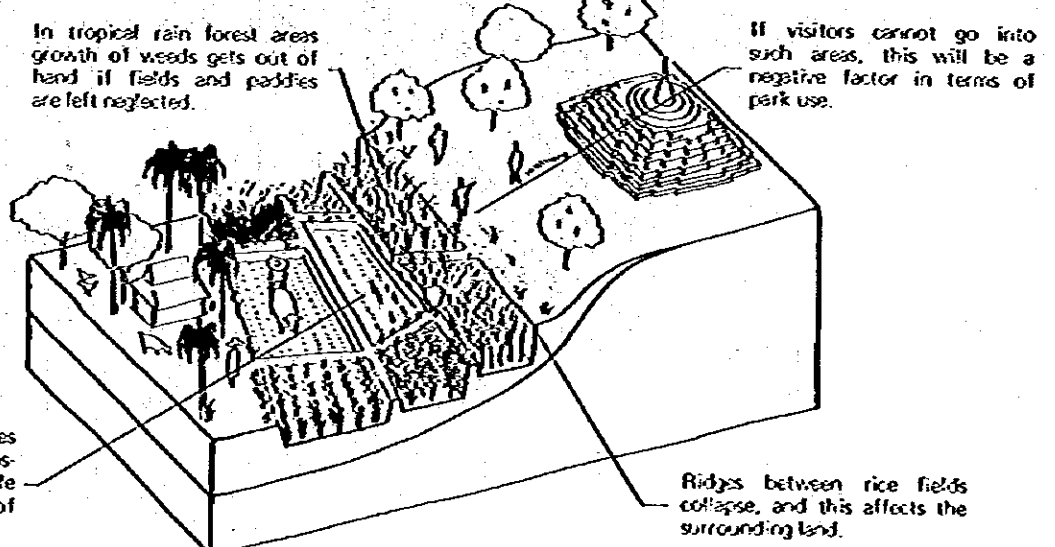
## What about Other Ways?

Will It Be Possible to Reproduce the Original Ground Form?

The ground base has been covered by 1-2m of surface soil for more than a thousand years.

- In order to restore the land in the immediate vicinity of the monuments to its original condition it will be necessary to undertake careful archeological surveys and studies, which will require a considerable amount of time and investment.
- Major alteration of the topography would have a great influence even on the land outside the park, including the ecological system.

## If the Farm Land should be Left as It is?



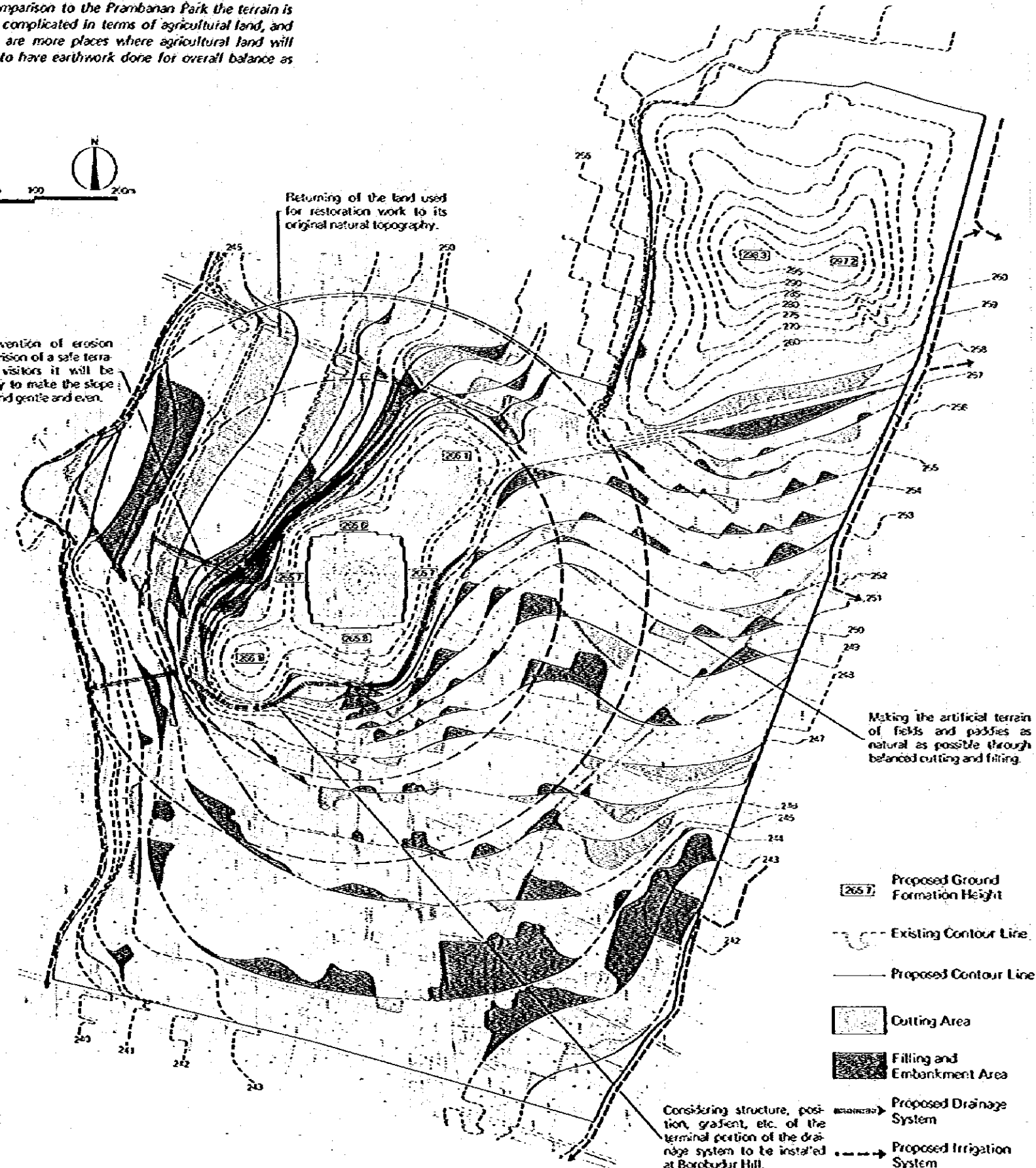
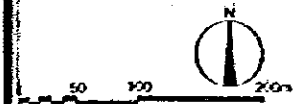
In tropical rain forest areas growth of weeds gets out of hand if fields and paddies are left neglected.

If visitors cannot go into such areas, this will be a negative factor in terms of park use.

# Earthwork Plan: Borobudur

The following are features of the Borobudur Park:

- Earthwork for the purpose of returning areas being used for restoration of monuments to their natural topographical state after such work is completed will be very important.
- The terrain will have to be stabilized so that the hill that Candi Borobudur stands on will not be damaged by erosion.
- In comparison to the Prambanan Park the terrain is more complicated in terms of agricultural land, and there are more places where agricultural land will have to have earthwork done for overall balance as well.



Returning of the land used for restoration work to its original natural topography.

For prevention of erosion and provision of a safe terrain for visitors it will be necessary to make the slope of the land gentle and even.

Making the artificial terrain of fields and paddies as natural as possible through balanced cutting and filling.

- [265] Proposed Ground Formation Height
- - - Existing Contour Line
- Proposed Contour Line
- [Stippled Area] Cutting Area
- [Hatched Area] Filling and Embankment Area
- [Dashed Line] Proposed Drainage System
- [Dotted Line] Proposed Irrigation System

Considering structure, position, gradient, etc. of the terminal portion of the drainage system to be installed at Borobudur Hill.



# Greenery Environment

## Greenery Zoning = Vegetation + Plantation

The parks must provide a pleasant and enjoyable environment for visitors, and trees will play an important role in creating such an environment, for they will make for delicate seasonal variation as well as being an indispensable element of the character and the physical shape of the parks.

The following is an outline of the program for the layout of trees in the parks as based on an understanding of their utility and functions.

## 5 Blocks of Trees

On the basis of the division of the parks into different areas for different uses corresponding to the different activities of visitors and staff, the park has been divided into five blocks with respect to trees, each with its own purpose, the layout being as described below. Furthermore, the planning for use of existing vegetation and the plan for planting have been formulated on the basis of this block layout.

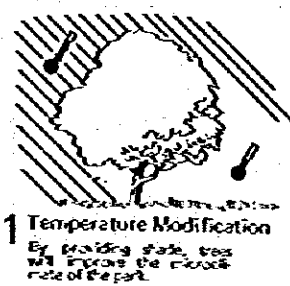
Block	Visitor Activity	Objectives	Location	Functions	GCR (%)
Sanctuary Greenery	To appreciate the monuments	<ul style="list-style-type: none"> <li>Protection of monuments and their surroundings.</li> <li>Enhancement of the religious atmosphere of the sanctuaries.</li> </ul>	Sanctuary area	4, 7, 10	30-40
Scenic Greenery	To approach the monuments and other facilities To take a view and take a rest	<ul style="list-style-type: none"> <li>Guidance of visitors and control of traffic.</li> <li>Giving the park environment greater variety and pleasantness to visitors through aesthetic effect.</li> </ul>	Concourse Parkway sides	8, 9, 10 1, 2, 3	25
Facility Greenery	To learn, and appreciate many things about the monuments in facilities To take a rest in facilities To enter the park	<ul style="list-style-type: none"> <li>Keeping buildings, parked cars, etc. out of view.</li> <li>Control of climate for more pleasant environment.</li> <li>Aesthetic effect of gardens, etc.</li> </ul>	Circumference of facilities Field Museum Parking area	6, 9 1, 2, 3	50
Recreational Greenery	To be in close contact with nature To take a rest	<ul style="list-style-type: none"> <li>Rest and relaxation on a pleasant terrain.</li> <li>Aesthetic effect.</li> <li>Securing of safety.</li> </ul>	Day Hill Opak river sides	1, 2, 3 4, 9	25 (Day Hill) 40 (Opak river)
Edge Greenery	To recognize the park area	<ul style="list-style-type: none"> <li>Demarcation of boundaries and areas.</li> <li>Prevention of visual or physical influence from outside the park (securing of safety).</li> </ul>	Perimeter of the park	4, 5 6, 7	70
Green Pavement	To take a rest To take a view	<ul style="list-style-type: none"> <li>Aesthetic effect.</li> <li>Control of climate, etc.</li> </ul>	The park's ground except hard surface pavement areas	4, 9	-

Note: GCR: Green Coverage Ratio (See p. 101, 102 Environmental Controls and Standards)

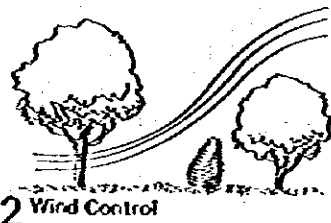
## 10 Roles of Trees

The trees will contribute to the makeup of each block by means of their own diverse functions. Just what are these functions? The following are the major ones, ranging from the physical to the psychological.

### Climate Amelioration



1 Temperature Modification  
By providing shade, trees will increase the moisture rate of the park.



2 Wind Control

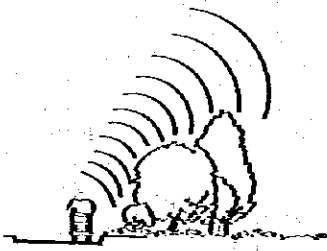
### Engineering Uses



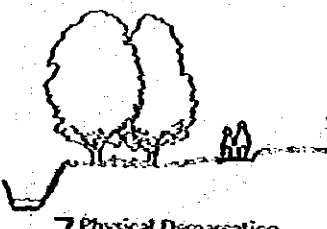
3 Protection from Water  
Some temporary shelter from sun showers can be afforded by trees.



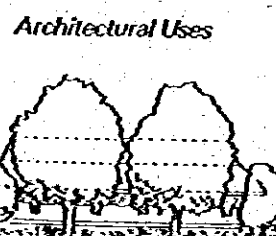
4 Erosion Control  
Erosion by wind, rain, and other natural elements will be mitigated by properly placed vegetation, including trees.



5 Noise Abatement  
Traffic just outside the park will not be as noisy.



7 Physical Demarcation  
For marking the outer boundaries of the park or the boundaries between different zones or areas within the park.



6 Visual Barrier  
For privacy inside or a better view outside.



8 Guidance  
For confirmation of position and guidance along courses.

### Aesthetic Uses

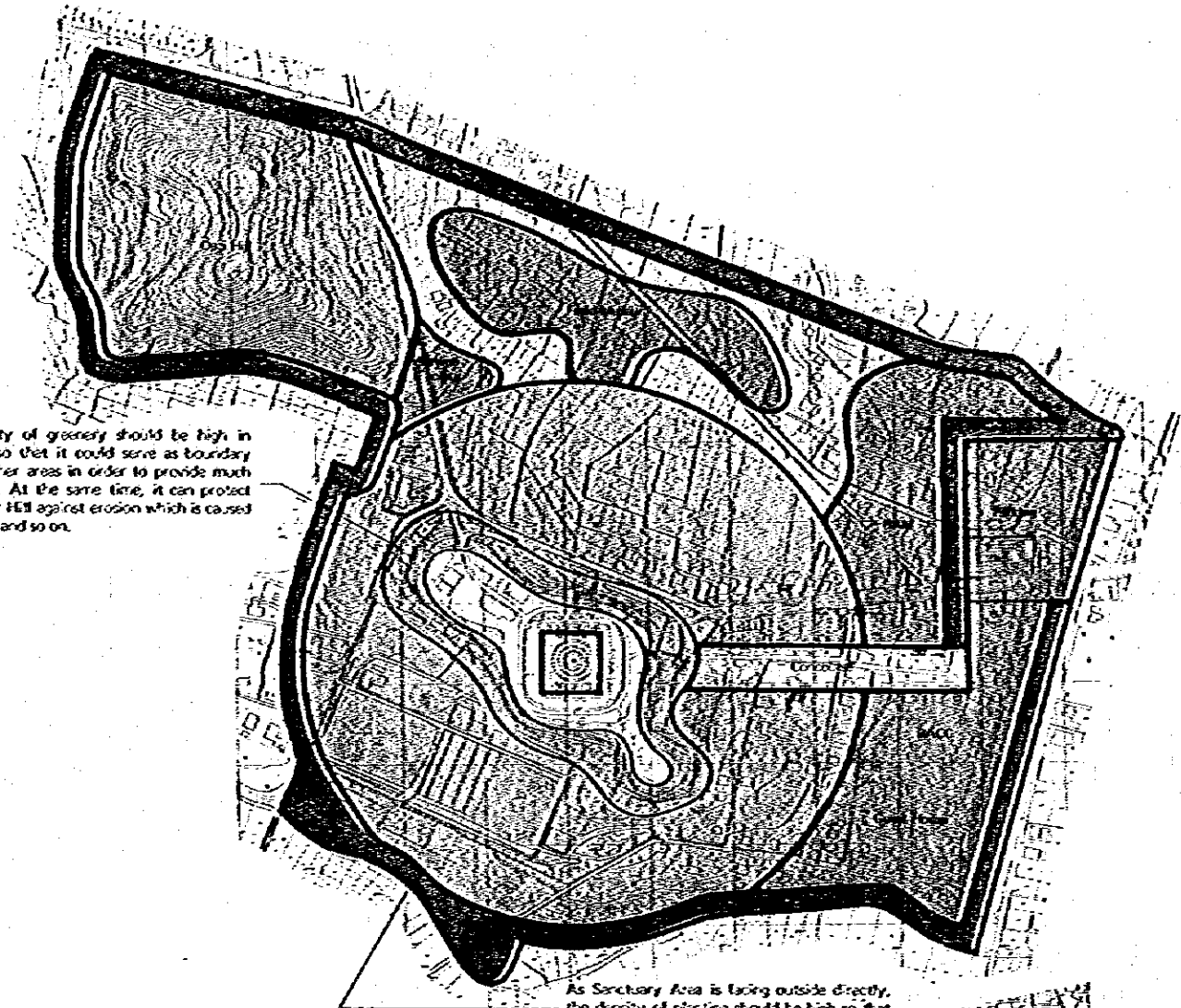


9 Beautification  
Each species will bring its own particular beauty and distinctiveness through flowers, tree and other plants, the effectiveness being enhanced by the layout and arrangement of the trees.

### 10 Other Uses

- Memorial Trees
- Educational Role
- Familiarized Trees
- Religious Trees

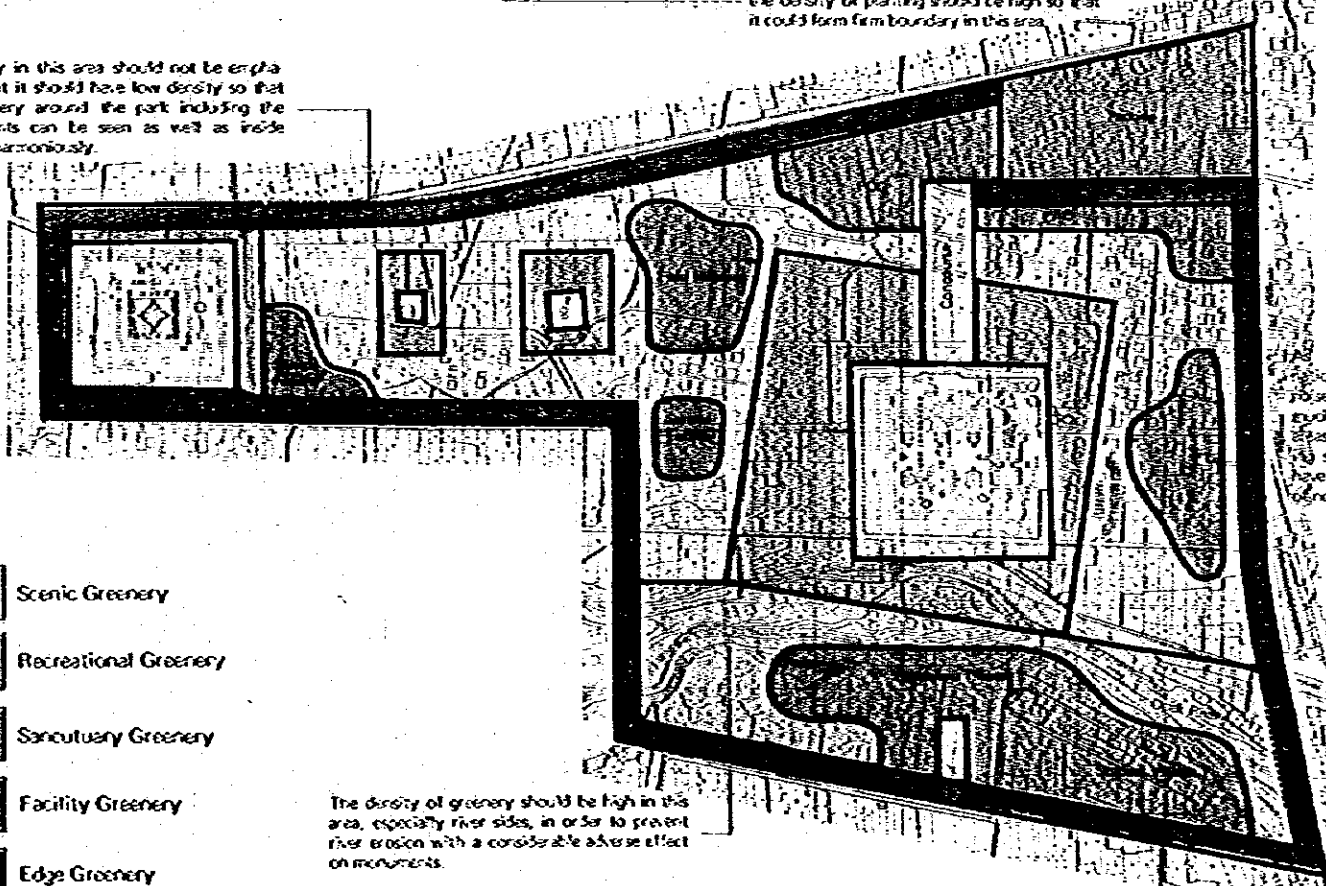
# Greenery Zoning: Borobudur, Prambanan



The density of greenery should be high in this area so that it could serve as boundary against other areas in order to provide much sacredness. At the same time, it can protect Borobudur Hill against erosion which is caused by rainfall and so on.

As Sanctuary Area is facing outside directly, the density of planting should be high so that it could form firm boundary in this area.

Boundary in this area should not be emphasized, but it should have low density so that the scenery around the park including the monuments can be seen as well as inside scenery harmoniously.



This area is facing national highways, the noise of automobiles are much louder than other areas. Accordingly, planting should be planned to have effect on prevention of noise.

The density of greenery should be high in this area, especially river sides, in order to prevent river erosion with a considerable adverse effect on monuments.



# Greenery Work I: How to Utilize Existing Trees

GZ =  $\square$  + P

One of the principles of planting is use of existing vegetation, particularly trees, which have helped to form the present environment in the course of time. Next, what is necessary is the introduction of a variety of species suitable for the purpose of composing a new environment of the sort desired. The following is an explanation of how the existing trees in the parks are to be utilized.

## Existing Vegetation

In the Borobudur and Prambanan areas there is very little vegetation remaining in its natural state. Although there is a considerable amount of forests, there are almost none that are near being what is termed in plant sociology as "climax forests". There are very few "substitution forests", which are the closest to the natural state, with only broad leaf forests mixed with coconut palms to be found along river banks and steep mountain slopes.

Most of the trees in the two areas are those on residential sites, which are closely related to the lives of village residents and are used and managed in such a way as to have a composition quite different from that of substitution forests. Bamboo thickets represent the largest area with respect to such residential site forests and are also generally to be found where the terrain is not suited to cultivation. The next most prevalent type of tree is coconut palms. Although they are considered to represent "mixed forests", such forests consist predominantly of coconut palms and bamboo. On residential sites as well broad leaf trees are outnumbered by bamboo and coconut palms and tend not to stand out when viewed from a distance on account of their low stature. For the most part, they provide fruit and other food. Such residential site trees are frequently to as "B. B. C. B" (banana, bamboo, coconut, and bread tree).

## Effective Use of Existing Trees

How are the existing trees presently being used? What kind of such trees can be used for the purposes of the park? Let us classify the existing trees by use and make an assessment on the basis of comparison with the park tree requirements (see p. 115, 116 Greenery Zoning). The following are the minimal requirements with respect to development activity affecting the existing trees:

- Preservation trees over as wide an area as possible to prevent extreme damage to the present ecological system.
- Avoidance of excessive artificial greenery in spite of its importance for the time being to the park scenery in view of the fact that it takes a long time for trees to grow.

- Considering the long years that it has taken for the existing trees to attain their present state, it is better from the standpoint of park management to make use of them wherever possible in preference to the planting of new trees.
- The following kinds of trees should be given special protection when possible:
  - Old trees
  - Trees whose roots have not taken very well
  - Particularly valuable trees that need protection
  - Trees that do not take root very easily after transplanting.

Classification of existing trees by use	Extent to which they can be used	Assessment in terms of park use	
<b>FOOD:</b> Banana and Other Fruit Trees	●	Characteristics generally favorable to park use: - Dignity and good tree shape - Attractive flowering - Trees that meet the park tree functional requirements and the greenery zoning wall	Hard to management and therefore not very suitable for park use unless especially important.
<b>GOODS:</b> Fruit Trees and bamboo, etc.	●		Same as above (Bamboo and other thick growths can be used as edge greenery)
<b>LIVING IMPLEMENT:</b> Bamboo, Coconut Palm and Banana, etc.	●		Same as above
<b>FAMILIARIZED TREES:</b> Landmarks and Religious Trees, etc.	●●		Trees that have long been a prominent part of the local scene should be preserved for park use from the standpoint of preserving the historical environment, particularly trees of religious significance.
<b>CLIMATE CONTROL/PREVENTION OF EROSION, ETC.</b>	●●		Since trees of this kind fit in well with park use purposes, they should be used wherever possible unless they present particular problems.

## What Areas Require Trees and What Kind of Trees can be Utilized?

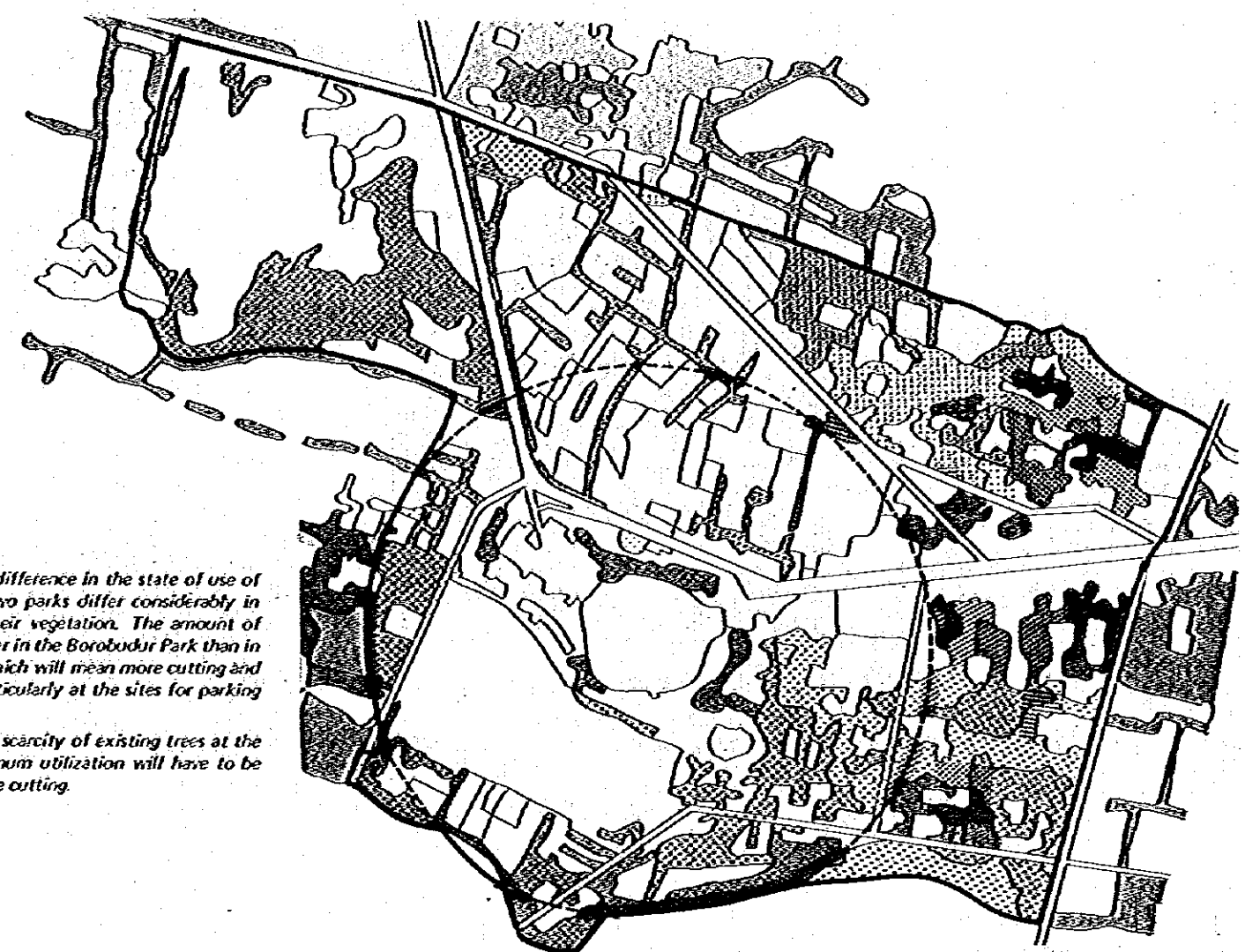
The following is an explanation of the four ways in which existing trees in the parks will be handled on the basis of the above assessment.

Trees not to be utilized for the park	Trees to be utilized for the park
<ul style="list-style-type: none"> <li>▶ Trees of little value for scenery</li> <li>▶ Trees presenting maintenance problems                             <ul style="list-style-type: none"> <li>- Fruit trees</li> <li>- Prolific weeds, etc.</li> </ul> </li> </ul> examples: Impatiens triloba, Cassia occidentalis, Portulaca oleracea, Amaranthus retrofractus, Eclipta alba, Ageratum conyzoides.	<ul style="list-style-type: none"> <li>▶ Trees useful for scenic purpose.</li> <li>▶ Religious trees</li> <li>▶ Familiarized trees                             <ul style="list-style-type: none"> <li>- Landmarks</li> <li>- Old trees, etc.</li> </ul> </li> <li>▶ Trees conforming with park trees functions</li> </ul>

Areas not requiring trees	<ul style="list-style-type: none"> <li>▶ Pavement areas                             <ul style="list-style-type: none"> <li>- Parking lots</li> <li>- Cooncourses</li> <li>- Park ways</li> <li>- Service roads</li> <li>- Mats</li> </ul> </li> <li>▶ Monument areas                             <ul style="list-style-type: none"> <li>- within monuments</li> <li>- near monuments</li> </ul> </li> <li>▶ Building sites</li> </ul>
Areas requiring trees	<ul style="list-style-type: none"> <li>▶ Other areas in the park</li> </ul>



# Utilization Plan of Existing Trees: Borobudur, Prambanan



Mainly because of the difference in the state of use of agricultural land, the two parks differ considerably in the present state of their vegetation. The amount of trees is quite a bit greater in the Borobudur Park than in the Prambanan park, which will mean more cutting and transplanting work, particularly at the sites for parking and concourses.

Because of the relative scarcity of existing trees at the Prambanan park, maximum utilization will have to be made of them, with little cutting.

**Legend for Tree Utilization:**

- A+C: Trees which are to be completely cleared out.
- A+B+C: Trees which are to be carefully selected and reserved valuable ones only. Others are to be cleared out.
- B+D: Trees which are to be selected and reserved for the park.

**Existing Vegetation:**

- Mixed trees
- Coconut palm
- Bamboo

# Greenery Work II: New Planting

$GZ = V + [P]$

Utilization of existing trees will not suffice in the formation of the park environments. It will have to be augmented with new planting to make the parks more attractive. Such planting is to be along the following lines.

## Diverse Development of Planting Design

The planting of trees, shrubs, flowers, and grass is an important item in the development of the parks, for such vegetation will be a basic element of spatial composition for expression of the image of a new park environment.

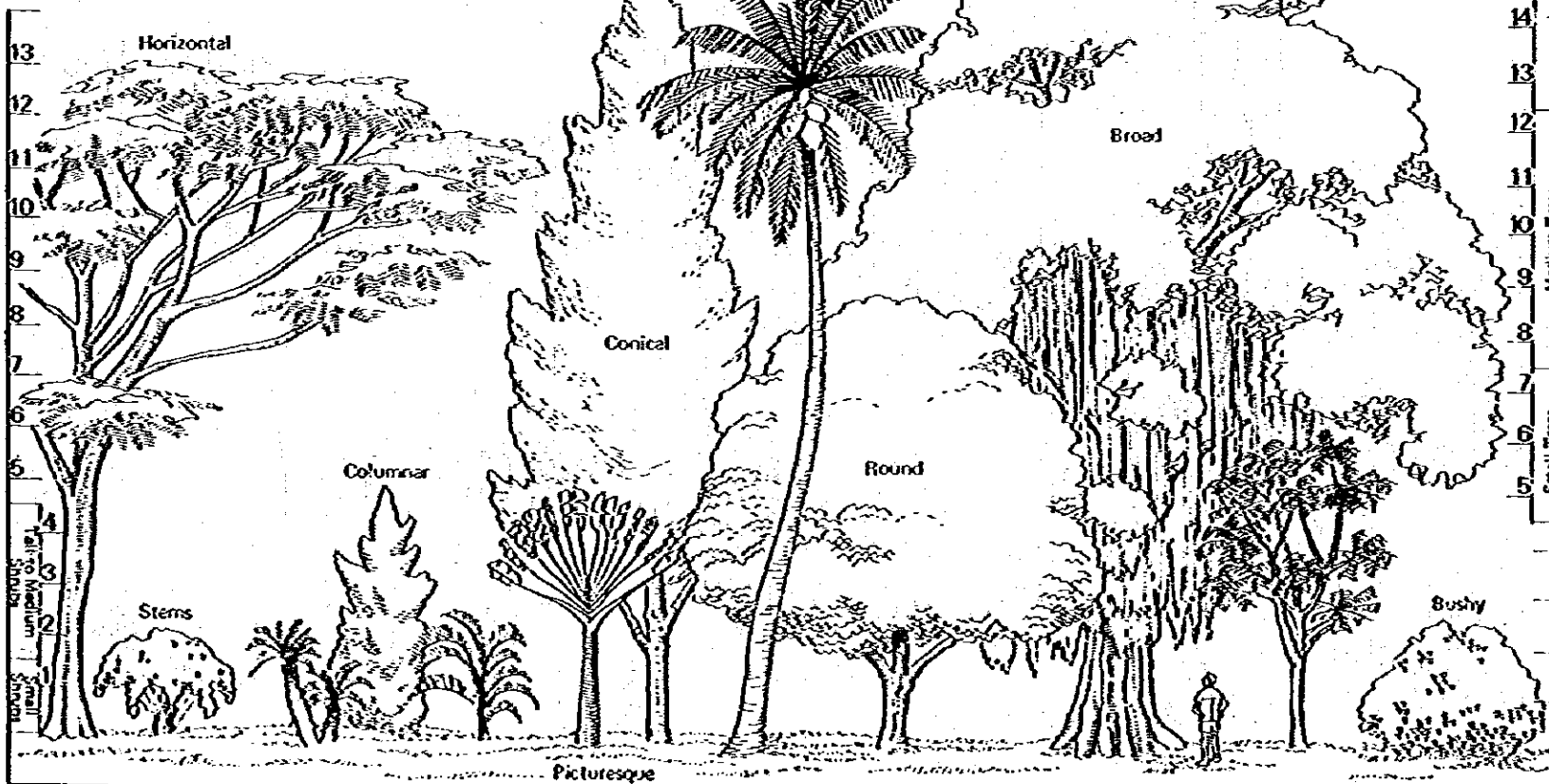
In deciding what species to select, consideration must be given to their respective features, the purposes which the planting is to serve, and aesthetic and decorative effects. Furthermore, the planting will extend throughout the parks in dot, linear, and planar form in terms of single units, rows, and clusters. If the species planted are suitable to their particular locations in terms of shape, aesthetic impression, tone, amount of foliage, texture, flowers, leaf variation, etc., the overall landscape of the parks will be very much enhanced.

## Creation of Beautiful Parks With Tropical Plants

(1) Not only existing species but also other species suited to the park functions and modes of use should be selected in order to enhance the overall image of the parks, making them more attractive to visitors. The following are the categories of species that should be selected:

- Tropical trees with pleasant shapes that will make a contribution to the scenery.
- Species that have long been considered to have a special relationship to Buddhism or Hinduism.
- Species of special significance that have been used for landscaping purposes and that are particularly dignified.
- Species with beautiful flowers or leaves.

(2) In selecting the species to be planted in the parks, consideration should also be given to flower and leaf color schemes for seasonal scenic variation, the basic considerations with regard to type and layout being as follows:



- The main scenic component of the higher space is variation in the tone of the green foliage of tall trees. In the case of single such tall trees standing alone, consideration should be given to their flowers so that they can better serve as landmarks within the parks.
- During seasons when the flowers of particular trees bloom or their leaves are especially beautiful, they will help to accent sanctuary areas, concourse, parkways, and axiality of the candi as one of the main elements of the scenery.
- In lower spaces the tones of shrubs and ground cover plants can be used to indicate the direction in which pedestrians should proceed as well as assist in identifying particular facilities.

## Design Criteria and Outlines

**Sanctuary Greenery**  
In the Borobudur Park, the emphasis will be on shrubbery of medium and above medium height, with large crowns, and in the selection of the tree types preference will be given to those with special significance. The ground will have to be covered with lawn grass. For the Prambanan park the trees selected will be of lower height and will have even crowns and otherwise make for a sense of unity. They will have religious significance and be arranged along grids, it is necessary that there be overall unity with respect to shape, size, and quality. The ground will be covered with lawn grass. An important landscape point is harmony with Candi Loro Jonggrang.

**Scenic Greenery**  
In the concourse, the axial line will be emphasized by rows of tall trees of a single type to give the impression of orderliness. This ideal avenue space will afford visitors lots of shade. Shrubby will be used sparingly as supplementary growth, and except for hard surfaces, the ground will be covered by lawn grass and some shrubbery or ground cover plants.  
In the road side, this greenery along roads and parking areas will provide not only shade but also visual continuity and orientation toward facilities, it will consist

of trees of medium height and shrubbery for different purposes. The types, colors, forms, etc. of the vegetation will put the lines of visitor movement into greater relief.

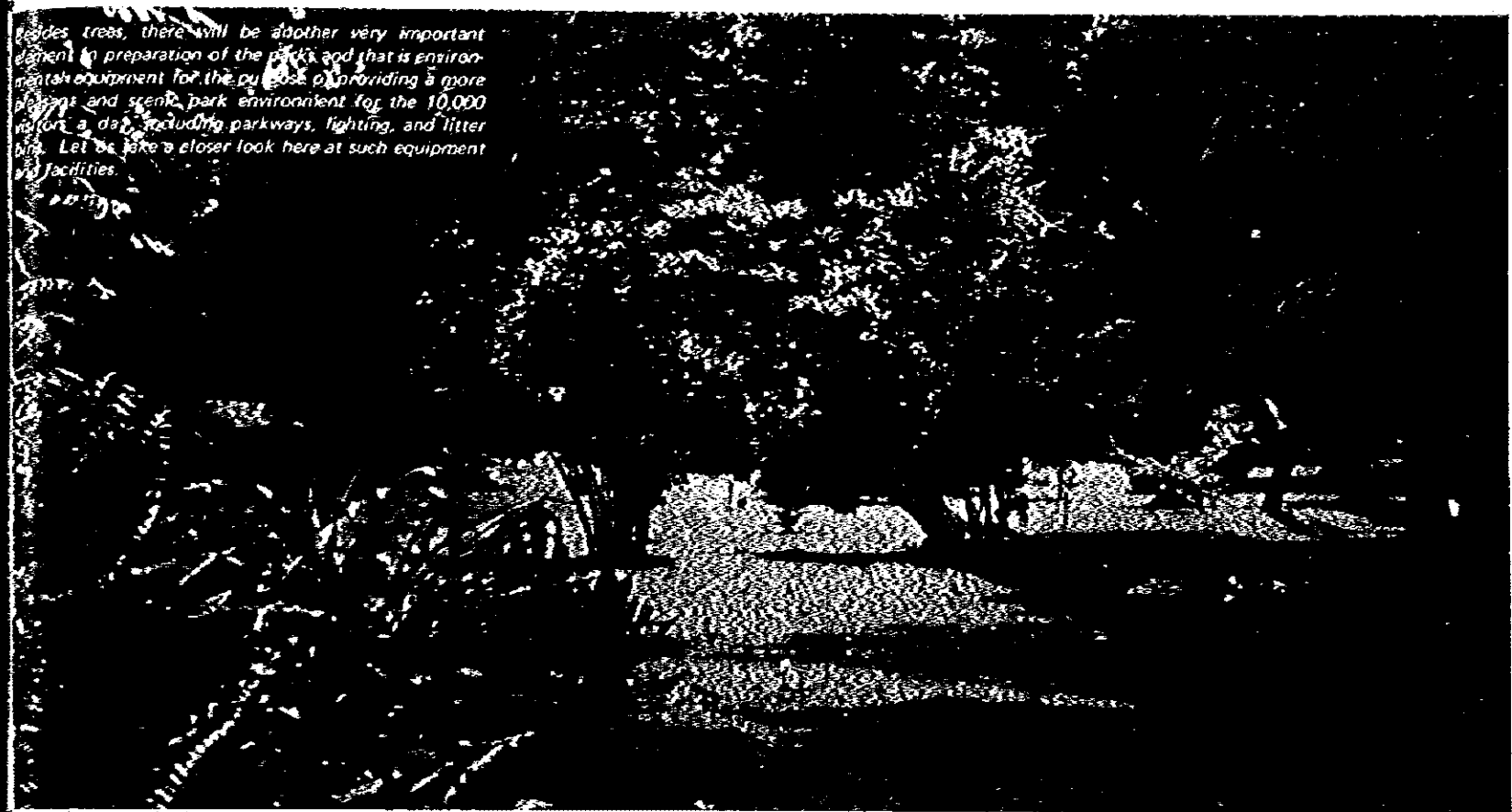
**Facility Greenery**  
This is the greenery around and on the grounds of the park facilities use will be made of medium and big trees of outstanding shape, shrubbery rich in variation, and tropical plants with beautiful flowers, leaves, and coloring. Small ponds, too, will be one of the gardening elements and this greenery, too, is for screening facilities buildings and shade by tall trees with large crowns.

**Recreational Greenery**  
This will consist of two types of greenery, one greenery on Dagi Hill will consist of the existing coconut trees some additional palms of other types for variety, and some selective shrubbery, giving the overall impression of a palm garden with a magnificent view of the surrounding area. Another greenery along the Opak fire for erosion control and safety will constitute a river-side park. The existing greenery will be made full use of and the density of the trees and shrubs will be relatively low.

**Edge Greenery**  
This greenery, located along the perimeter of the park areas, will have a boundary-making function, setting the visual and physical limits of the parks. It will consist of lines of tall trees densely planted and supplemented by shrubbery.

**Green Pavement**  
This greenery will consist of various kinds of lawn grass and ground cover plants for different sun light and soil conditions in the parks. It will preserve the surface soil, control the weeds to grow and provide attractive space for various kinds of activities.

# Hard Structure and Outdoor Furniture for Landscaping



Typical scene in the Bogor Botanic Gardens

## Comfortable Place by Landscape Equipment: Hard Structure and Outdoor Furniture.

### Plasticity of Landscape Facility Structures

In areas where it is thought that there might be unexcavated structures or monuments consideration should be given to structures of pavement and other landscape facilities that will allow for partial removal and easy repair from the standpoint of protection of undiscovered monuments. Furthermore, it is important that benches and other seating in the parks and signs and other information equipment be adaptable to changing values as time passes. In other words, plasticity of landscape facility structures is an important design factor from the standpoint of park administration and operation, including archeological surveys and restoration efforts over the years. Specific possibilities include the use of sandstone, andesite, or other stone blocks for pavement and natural rocks and wood for other equipment.

### Hard Surfaces

- Roles**  
Visual: It may be required to demarcate access, to relate building to site, or merely to look exciting or restful.  
Pedestrian: It may be required for walking over, or sitting on.  
Vehicular: Even in predominantly pedestrian areas access may be required for service vehicles, ambulances, refuse disposal lorries and fire fighting appliances.  
The concourses, plazas, axis malls, etc. will be paved with stone blocks or bricks, and the parkways, service roads and parking areas with asphalt.  
The concourse right of way will be approx. 60m, approx. 10m to 40m of which will be paved accordance with the location.  
In the case of parkway, the right of way and the pavement width will be about 10m and 6m, respectively. They will be about 4m and 2-3m, respectively, in the case of malls.

The following being specific items present, problems with respect to design:

### Borobudur

- The design scale and structure of the stairway for Borobudur Hill, the number of steps that it should have from an archeological point of view, and design restraints on the retaining wall and slope from the standpoint of erosion control, as well as materials and other detailed design considerations.
- Materials of the concourses, axial malls, parkways, and other paved surfaces, as well as sections and design form from the standpoint of terminal drainage.

### Prambanan

- The way of accomplishing areal classification of parts not to be completely restored as well as change in ground level, the problem of drainage, visual considerations, difficulty of control, and other aspects thereof.
- Sections and structure of concourse, axial malls, and other paved areas and stairways as well as details of parts connecting them with restored structures.

### Outdoor Furnitures

- Roles**  
Under public control  
- Public lighting of parks and precincts.  
- Lighting for information and control of movement.  
Not usually controlled  
- Display lighting: floodlit buildings  
- Lighting in buildings, and lighting units are important elements of street furniture and are visible by day as well as night.
- (1) Benches and seatings are to be provided at plaza, concourse, in the facility greenery or along the parkways and malls where visitors stop and taking rest. These are to be strong and simple enough that can be maintenance free.
  - (2) Litter bins are to be installed depend on the areal person minutes distribution of park area, and strong and simple enough that can be maintenance free.
  - (3) Flag poles will be installed at the entrance area in the park.

### Lighting

- Lighting facilities are important in operating the image of the park during evening hours and preventing crime and accidents. In determining their layout, whether linear as along lines of movement or areal as at squares and plazas, the following considerations should be taken into account:
- (1) Use on a large scale of lightening methods that impart a sense of overall unity.
  - (2) Avoidance of gaudiness and flashing lights.
  - (3) Along park roads and other similar places the lighting should not be brighter than necessary for visitor safety. At narrow entranceways and stairs, however, a somewhat higher degree of illumination will be needed.
  - (4) The lighting equipment should not be visually obtrusive.
  - (5) Particular attention should be given to prevention of accidents and crime.
  - (6) Lighting at parking areas should be somewhat brighter than along roads.

### Signs

- The functions of sign are divided into three categories shown as follows:
- (1) Regulation sign which show the regulation of the park area what is forced by the government or the organization.
  - (2) Warning sign which show the warning to the visitors to avoid the danger and miss use of park facilities.
  - (3) Guide sign which give the information what visitors want to know, and have them to find new information and events in the park area. Symbols are part of guide sign and also land mark. All signs are indicated the informations by using graphical display rather than using letters, as much as possible. And the design of signs must be fit their surrounding environment.  
(See p. 167-168: Graphic Design standards, Visual Communication System)



# Tree Catalog

In order to enhance the overall image of the parks and to make them more attractive to visitors, many kinds of trees should be planted such as tropical trees, religious trees, beautiful trees and soon, harmonizing with existing trees.

Following trees which are just adequate and important to them, are listed by their botanical names, common names and their illustrations.

## Large trees: Height 12.5m plus

<i>Areca catechu</i>	PINANG
<i>Artocarpus integra</i>	MANGKA
<i>Casuarina equisetifolia</i>	CEMARA
<i>Ceiba pentandra</i>	Kapok tree
<i>Cocos nucifera</i>	KEPARA



**COCOS NUCIFERA**  
 Family: Palmae  
 Etymology: The name seems to be derived from the Portuguese word, monkey.  
 Habitat: Widespread and cultivated for centuries throughout the tropics, but believed to be of Indo-Malayan origin.  
 Description: This palm has a relatively slender, flexible stem which can grow to a height of 30-40m.

<i>Delonix regia</i>	FLAMBOYAN (F)
<i>Durio zibethinus</i>	DURIAN
<i>Ficus benjamina</i>	BERINGIN
<i>Ficus religiosa</i>	Bo tree
<i>Filicium decipiens</i>	KERE PAYUNG
<i>Ficus elastica</i>	Rubber Tree
<i>Hibiscus tiliaceus</i>	WARU
<i>Magnifera Indica</i>	MANGGA
<i>Melia azedarach</i>	Bead tree (F)
<i>Minusops elengi</i>	TANJUNG



**MAGNIFERA INDICA**  
 Family: Anacardiaceae  
 Etymology: The generic name is derived from mango, the Indian name for the fruit, and the Latin word, bear.  
 Habitat: Native to India, Burma and Malaysia, but now growing in most tropical countries.  
 Description: An erect, widely branching tree, which can reach a height of 30m.



**DELONIX REGIA**  
 Family: Leguminosae  
 Etymology: The generic name is derived from the Greek *delos*, visible, and *onyx*, claw, referring to the shape of the petals. The popular name of the tree in all tropical countries is Flamboyan.  
 Habitat: Originally from Madagascar.  
 Description: A deciduous tree that can grow to a height of 12m (40ft), with a stout, knobby trunk and thick greyish-brown bark.



**ROYSTONIA REGIA**  
 Family: Palmae  
 Etymology: The name commemorates General Roy Stone (1836-1906) who was in Puerto Rico with the American army. The tree was formerly called *Crocodora* and is still sometimes so called.  
 Habitat: Has a vast area of natural distribution, from Florida as far as the northern parts of South America.



**FICUS ELASTICA**  
 Family: Moraceae  
 Etymology: The name comes from that of the edible fig, *F. carica* L. 1753.  
 Habitat: Native to tropical Asia.  
 Description: Very young specimens of this tree are often seen as house plants, but in its natural surroundings it is a tall tree that may grow as high as 30m (100ft), with spreading branches that give it a round crown.

<i>Nephetium lappaceum</i>	RANBUTAN
<i>Persea americana</i>	ADPOKAT
<i>Roystonea regia</i>	PALEM RAJA
<i>Srietenia mahagoni</i>	MAHONI
<i>Tamarindus indica</i>	ASAM

## Medium trees: Height 7.5m plus

<i>Achras zapota</i>	SAWO MANILA
<i>Albizia julibrissin</i>	Mimosa (F)

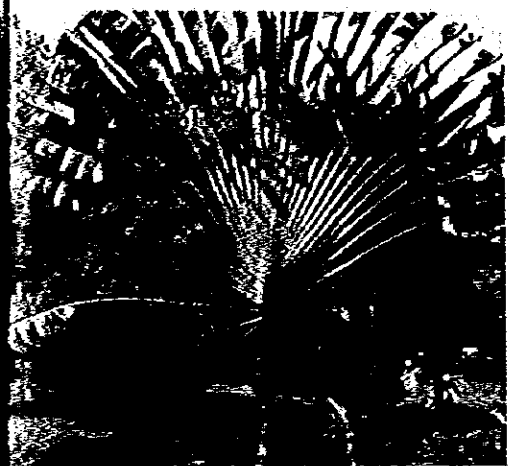


**ALBIZIA JULIBRISSIN**  
 Family: Leguminosae  
 Etymology: The name commemorates the Florentine nobleman Fabrizio Albizzi, who introduced the plant into cultivation in the middle of the 18th century.  
 Habitat: Asia, from Iran to Ind.  
 Description: This tree, up to 10m (33ft) high, has spreading branches growing horizontally, which often produce pendulous branches.

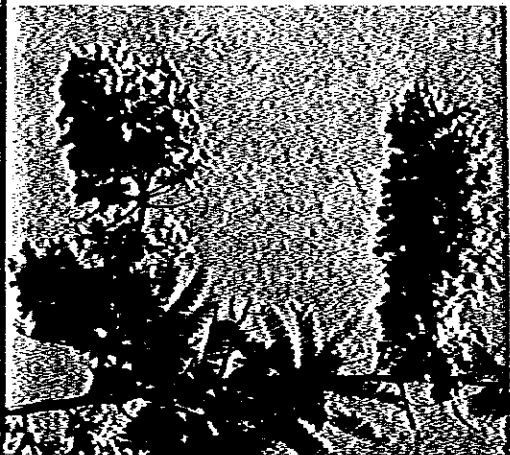
<i>Annona muricata</i>	SIRSAK
<i>Annona squamosa</i>	SRIKAYA
<i>Annona cherimola</i>	Cherimoya
<i>Artocarpus communis</i>	NANGKA
<i>Averrhoa bilimbi</i>	BELINBING WULUH
<i>Bouea macrophylla</i>	GANDARIA
<i>Carica papaya</i>	PAPAYA
<i>Cassia javanica</i>	— (F)
<i>Delonix regia</i>	FLAMBOYAN
<i>Eugenia arnea</i>	JAMBU AIR
<i>Eugenia polyantha</i>	SALAM
<i>Garcinia magostena</i>	MANGGIS
<i>Lagerstroemia flos reginae</i>	BUNGUR (F)
<i>Leucaena glauca</i>	PETAJ CINA
<i>Psidium guajava</i>	JAMBU BIJI
<i>Ravenala Madagascariensis</i>	PISAN KIPAS
<i>Syzygium polyccephalum</i>	GOWOK



**LAGERSTROEMIA INDICA**  
 Family: Lythraceae  
 Etymology: Named for a Swedish merchant, Magnus von Lagerstrom.  
 Habitat: The species name refers to its point of origin, China, but probably first identified in India.  
 Description: The Orange Myrtle is to the southern United States what it is to the North: an extremely popular small tree covered with profuse bloom in summer. It grows (1) to about 6 ft (20ft) or a bit more.



**ARENARIA MADAGASCARIENSIS**  
 Family: Musaceae  
 Etymology: From the local name. This tree is called "Traveller's Palm". Looks like a peacock's tail in shape. Its trunk has a great supply of water in it, so a traveller can both quench his thirst and find his way.  
 Habitat: Native to Madagascar (Malagasy Republic).  
 Description: A large, arborescent plant as much as 10m (33ft) in height.



**CASSIA JAVANICA**  
 Family: Leguminosae  
 Etymology: The name is derived from the Greek *kasia* for plants with therapeutic properties; it was applied by Linnaeus to this genus, and particularly to *C. fistula*, the source of the senna used in pharmacy.  
 Habitat: Native to the Malay Archipelago.  
 Description: A deciduous tree of medium height, 6-8m (20-26ft), though it may grow taller in its native surroundings.

## Small trees: Height 4.5m plus



**PLUMERIA ALBA**  
 Family: Apocynaceae  
 Etymology: The name commemorates the French botanist Charles Plumier (1696-1764).  
 Habitat: Native to the East Indies, but nowadays found in all tropical countries.  
 Description: A small tree that can reach a height of 8m (26ft), but which sometimes remains in the shrubby stage.

<i>Antidesma bunius</i>	BUNI
<i>Cananga odorata</i>	KENAGA
<i>Cassia fistula</i>	TENGGULI
<i>Cinnamomum burmani</i>	LENGKUKAS
<i>Citrus nobilis</i>	JERUK KEPROK
<i>Croton figium</i>	CERAKIN
<i>Cupressus funebris</i>	CEMARA NATAL
<i>Cycas revoluta</i>	PAKISHIAS
<i>Erythrina sepium</i>	DADAP
<i>Eugenia aromatica</i>	CENGKEH
<i>Michelia champaca</i>	CENPAKA
<i>Plumeria rubra</i>	Red frangipani (F)
<i>Rhodomyrtus tomentosa</i>	KARAMUNTING (F)
<i>Theobroma cacao</i>	COKLAT

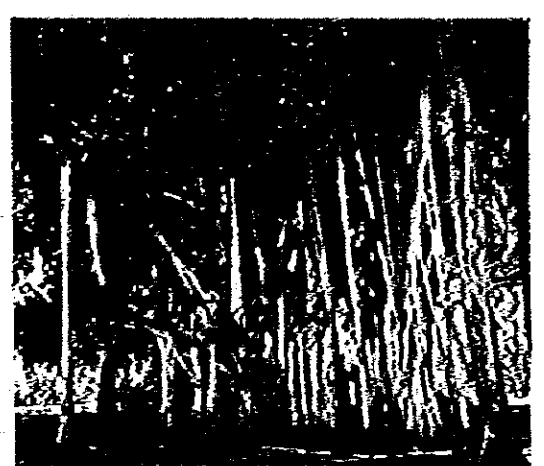


**CYCAS REVOLUTA**  
 Family: Cycadaceae  
 Etymology: The name comes from the Greek *kykas*, used by Theophrastus for a plant not definitely identified.  
 Habitat: Originally from eastern Asia, from southern Japan to Java.  
 Description: Though very like a palm, this slow-growing little tree will reach a height of only 3.5m (11ft) in ideal conditions. It does not belong to the palm family but to one of the oldest known classes of plants.

## Religious trees

Three religious trees, which have the most close relation to four Buddha's events of his birth, marriage, deliverance, and expire in his life, is called "big three of Buddhism", that is, *Saraca indica* relative to his birth and marriage, *Ficus religiosa* relative to his deliverance, *Shorea robusta* relative to his expire. Other trees, too, have close relation to Buddhism, or Hinduism. For instance, about Buddha's teaching and the medical tree, etc. ....

<i>Borassus flabellifera</i>	Palmyra palm
<i>Cochlospermum gossypium</i>	Yellow cotton tree
<i>Cocos nucifera</i>	KELPA
<i>Corypha utan</i>	—
<i>Crataeva religiosa</i>	Marsh d'aur
<i>Dalbergia usiso</i>	—
<i>Eugenia janborana</i>	—
<i>Ficus bengalensis</i>	Banyan
<i>Ficus benjamina</i>	BERINGING
<i>Ficus religiosa</i>	Bo tree
<i>Magnifera indica</i>	MANGGA
<i>Saraca indica</i>	Asoka tree
<i>Shorea robusta</i>	Sal
<i>Wrightia religiosa</i>	—



**FICUS RELIGIOSA**  
 Family: Moraceae  
 Etymology: The specific name comes from Latin "religiosus", sacred. According to legend, it was under one of these trees that Buddha received the enlightenment (Bodhi) which was to form the basis of his teaching. The tree is often planted beside Indian temples. In Indonesia, at the celebration of Buddha's birth - Waisaka - in 1934, a cutting of this Bodhi tree was planted east of the Borobudur by the Buddhist priest Narda Mahatera. A cutting of the Bodhi tree under which Buddha attained Enlightenment, was presented to the Thuparama Dagaba temple in Ceylon in 234 B.C. It is probably the oldest historical tree in the world. Now a Buddha statue is placed in its shade, around which Buddha's followers during Waisaka celebrations commemorate their leader.  
 Habitat: Native to India.  
 Description: This is one of the so-called pagoda figs, a category that includes nearly all those with aerial roots which start from the branches and grow down to and into the ground, where they form new rooted trunks. This plant can grow up to 30m (100ft) in height, and its widely spreading branches make a dense crown.

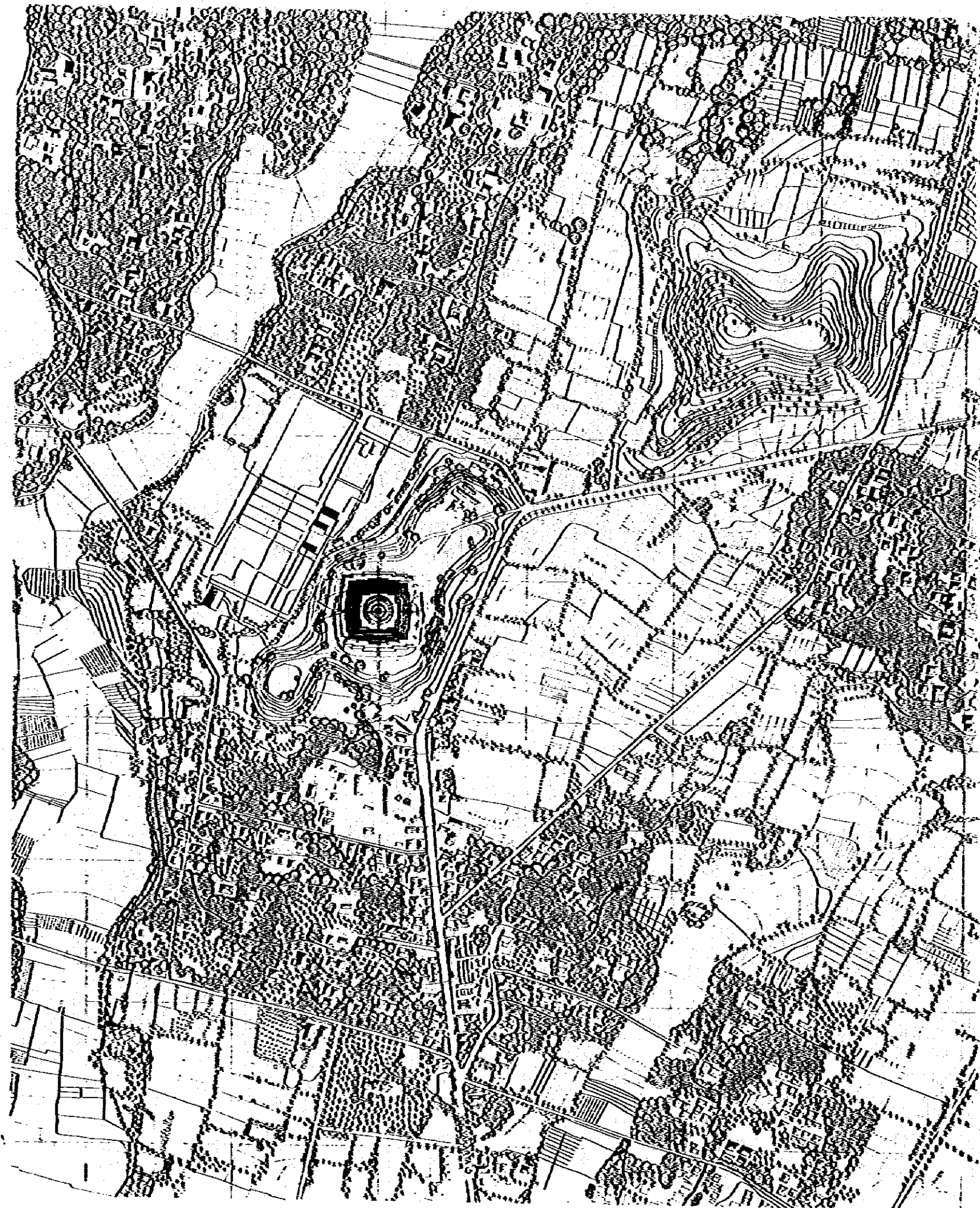
## Tall to medium shrubs: Height 2.5m

<i>Agave americana</i>	DURI LANDAK
<i>Caesalpinia pulcherrima</i>	KEMBANG MERAK
<i>Chrysalidocarpus lutescens</i>	PALEM HIAS
<i>Cyrtia sp dan Alsophila sp.</i>	PAKIS POHON
<i>Erythroxylon coca</i>	KOKA
<i>Hibiscus sp</i>	KEMBANG LANPU
<i>Bixa coccinea</i>	KEMBANG ASOKA
<i>Jasminum sambac</i>	MELATI
<i>Lagerstroemia indica</i>	BUNGUR CINA
<i>Murraya paniculata</i>	KEMUNING
<i>Nerium indicum</i>	OLEANDER
<i>Plumeria rubra</i>	KAMBOJA MERAH
<i>Rhododendron mucronatum</i>	RHODODENDRON

## Low shrubs: Height 1.5m

<i>Asplenium nidus</i>	KADAKA
<i>Bougainvillea spectabilis</i>	BUGENVIL
<i>Cleome spinosa</i>	MAMAM
<i>Cosmos diversifolius</i>	KEMBANG CAKRA
<i>Eupatorium triplinerve</i>	TEKLAN
<i>Gardenia augusta</i>	KALA PIRING
<i>Monstera deliciosa</i>	MONSTERA
<i>Salvia splendens</i>	KEMBANG TUNGAU

Notes:  
*Ficus Religiosa*: Latin botanical name  
 BERINGING: Indonesian common name  
 Kapok tree: English common name  
 (F) Flower tree  
 On the occasion of drawing up "Tree catalog", Messrs. Soelipto and Soenarto of Counterpart team had been a great help for arranging this chapter.



Landscape Plan: Borobudur

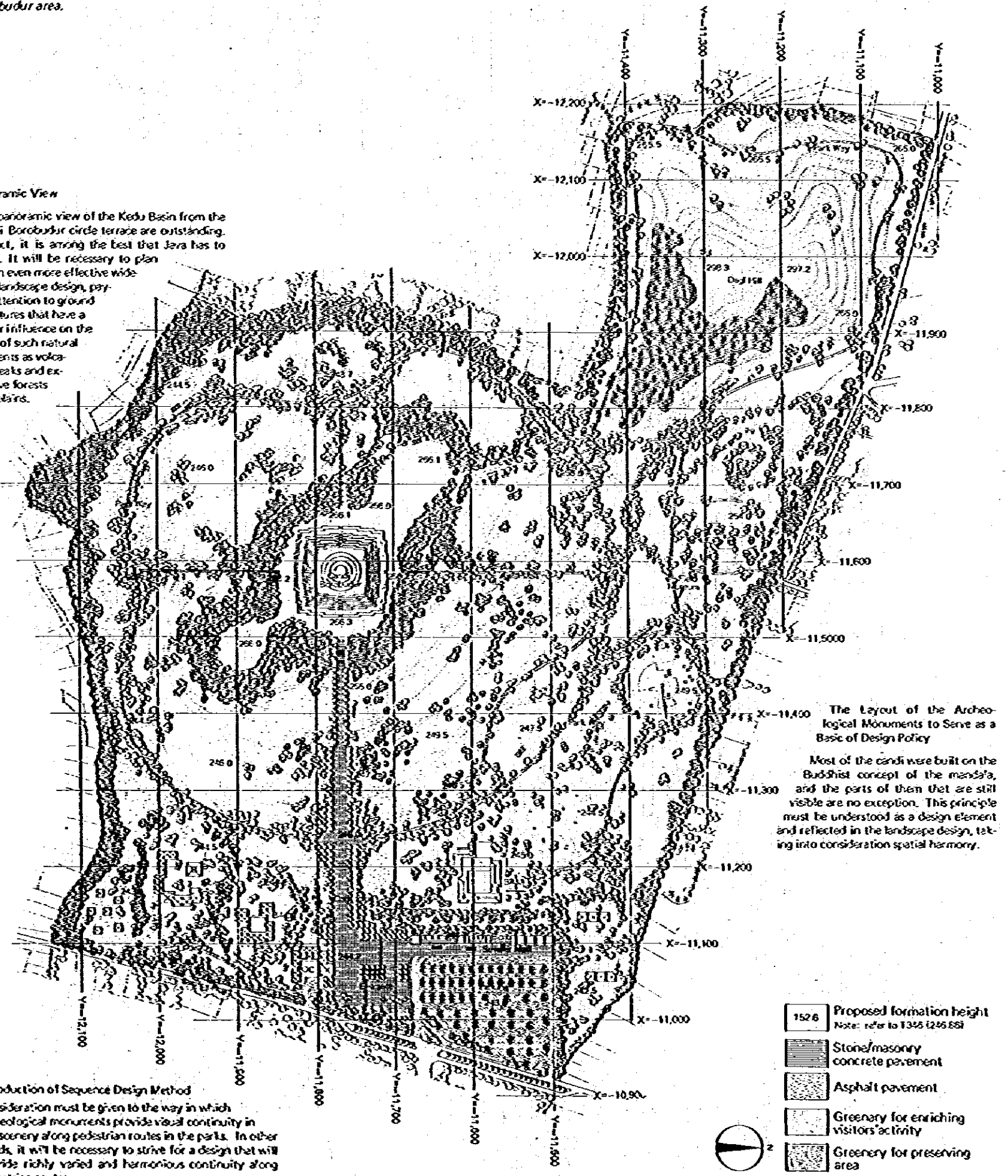
It is necessary that the course of the historical change of the landscape be reflected in the present project in the present state of the archeological monuments on the basis of a good understanding of the existing environment of the Borobudur area.

Panoramic View

The panoramic view of the Kedu Basin from the Borobudur circle terrace are outstanding. In fact, it is among the best that Java has to offer. It will be necessary to plan an even more effective wide landscape design, paying attention to ground structures that have a special influence on the view of such natural elements as volcanic peaks and extensive forests and plains.

Introduction of Sequence Design Method

Consideration must be given to the way in which archeological monuments provide visual continuity in the scenery along pedestrian routes in the parks. In other words, it will be necessary to strive for a design that will provide richly varied and harmonious continuity along pedestrian routes.

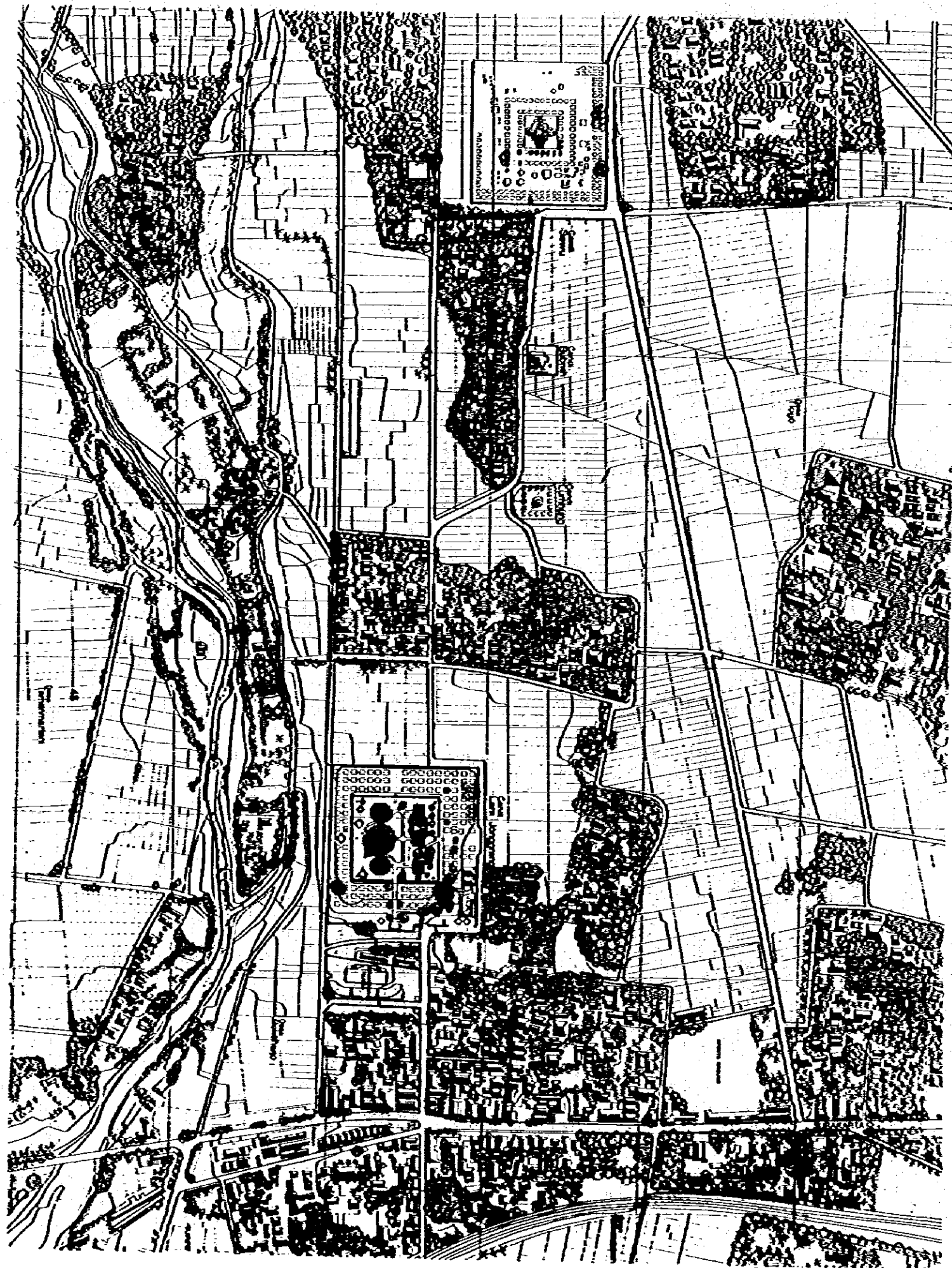


The Layout of the Archeological Monuments to Serve as a Basic of Design Policy

Most of the candi were built on the Buddhist concept of the mandala, and the parts of them that are still visible are no exception. This principle must be understood as a design element and reflected in the landscape design, taking into consideration spatial harmony.

- 152.6 Proposed formation height  
Note: refer to 1395 (295.65)
- Stone/masonry concrete pavement
- Asphalt pavement
- Greenery for enriching visitors' activity
- Greenery for preserving area





Landscape Plan: Prambanan

It is necessary that the course of the historical change of era be reflected in the present project in the present space of the archeological monuments on the basis of a good understanding of the existing environment of Prambanan area.

- 150.7 Proposed formation height  
Note: refer to T365 (245 85)
- Stone/masonry concrete pavement
- Asphalt pavement
- Area for preserving some trees
- Area for optimum preserving



Emphasis on Axiality of Archeological Monuments

In general the axiality of archeological monuments has both a spatial nature and a religious and psychological nature. It is necessary that both of these special characteristics be incorporated as the basis of the landscape design in the overall actual 3-dimensional environment.

Observance of Principles of Perception

Maximum possibilities on the basis of general human awareness principles, particularly the principles of visual awareness are to be pursued as grounds for determination of the scenic composition of the landscape design.

