**C05
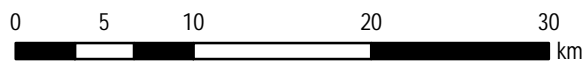GKS Railway Network Plan
2030**

Legend

- ✈ Airport
- ⚓ Port

Railway

- ▭▭▭ Proposed Railway Network (Passenger)
- ▬▬▬ Freight SProposed Railway Network (freight)
- ······ Railway (under Construction as of 2010)
- ▬▬▬ Mass Rapid Transit (MRT)
- ▭ Kab./Kota Boundary

0   5   10   20   30
km

GKS-ISP
The Study on
Formulation of Spatial Planning
for GKS Zone

C06
GKS Transport Network Plan
2030

Legend

✈ Airport
⚓ Port

Road Network

— Toll
— Arterial
— Collector
— Secondary Arterial
— Local
···· Ferry
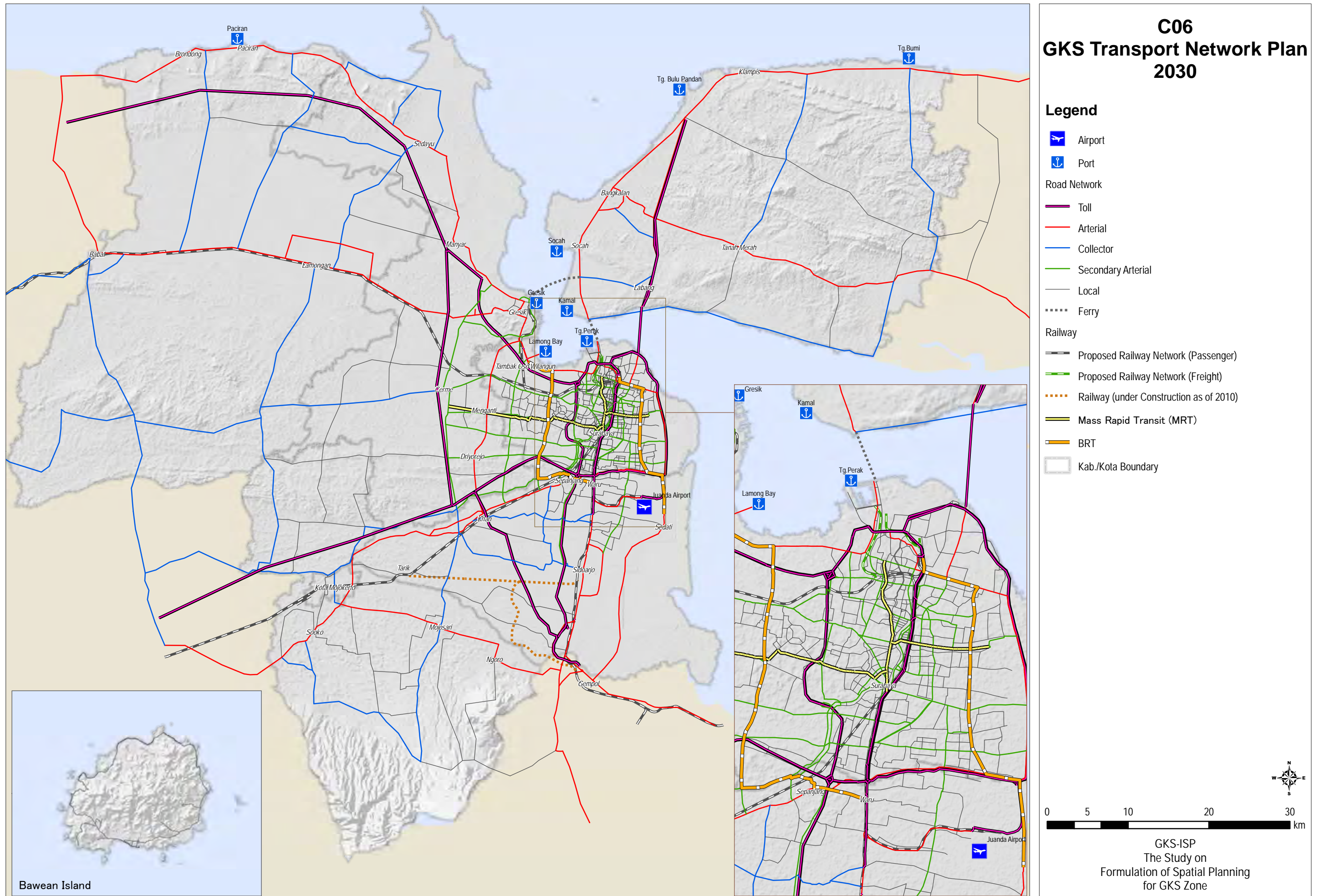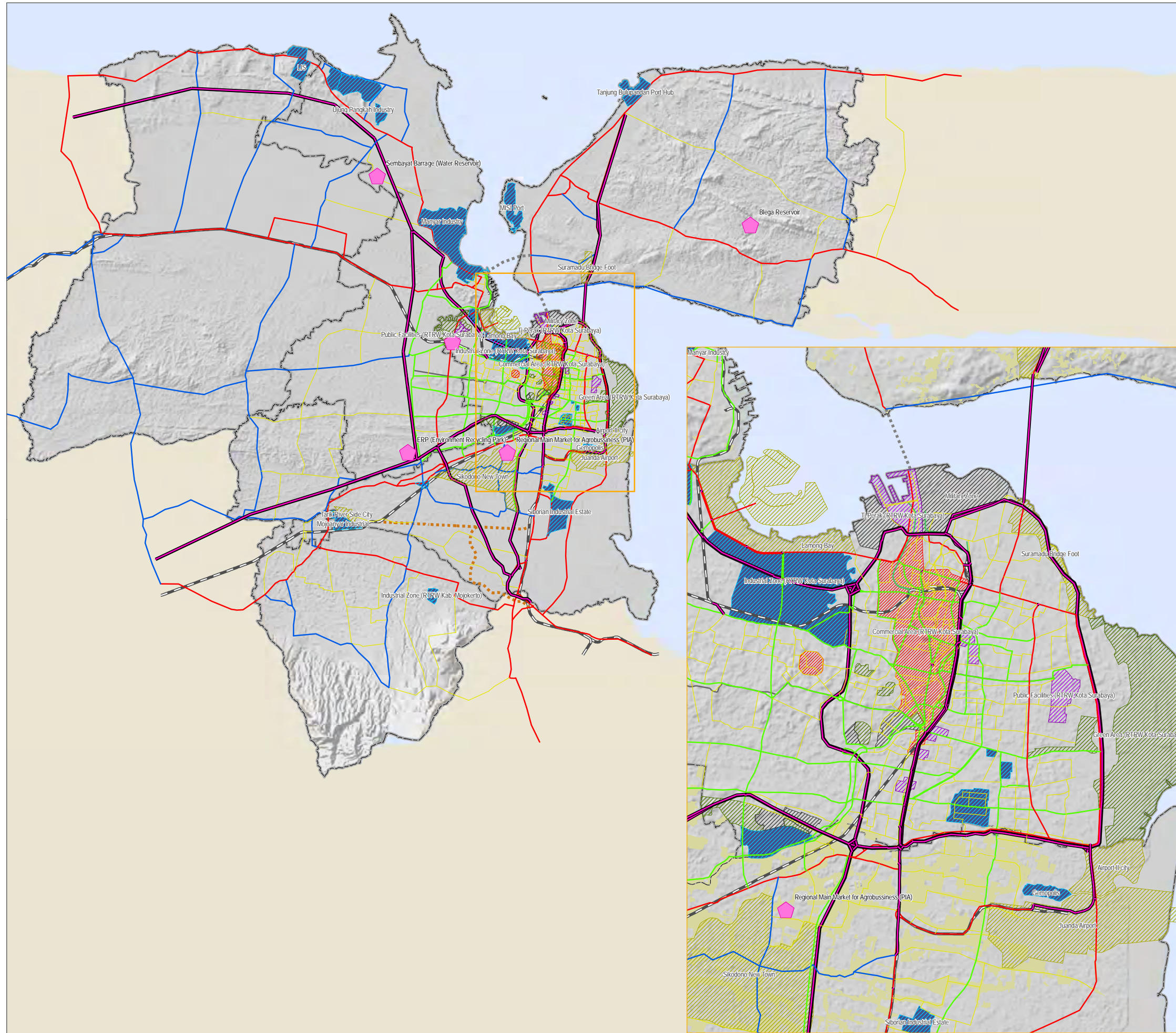
Railway

Proposed Railway Network (Passenger)
Proposed Railway Network (Freight)
Railway (under Construction as of 2010)
Mass Rapid Transit (MRT)
BRT
Kab./Kota Boundary

Bawean Island

Paciran
Brondong
Sedayu
Babat
Lamongan
Manyar
Gresik
Kamal
Lamong Bay
Tambak Oso Wilangun
Terme
Menganti
Driyorejo
Surabaya
Sepanjang
Waru
Krian
Sedati
Juanda Airport
Tarik
Sidoarjo
Kota Mojokerto
Spoko
Mojosari
Ngoro
Gempol
Socah
Sorah
Bangkalan
Tanah Merah
Labang
Klampis
Tg. Bulu Pandan
Tg. Bumi
Tg. Perak

Gresik
Kamal
Lamong Bay
Tg. Perak
Surabaya
Sepanjang
Waru
Juanda Airport

0 5 10 20 30 km

GKS-ISP
The Study on
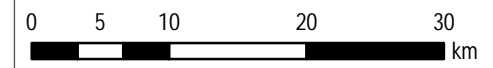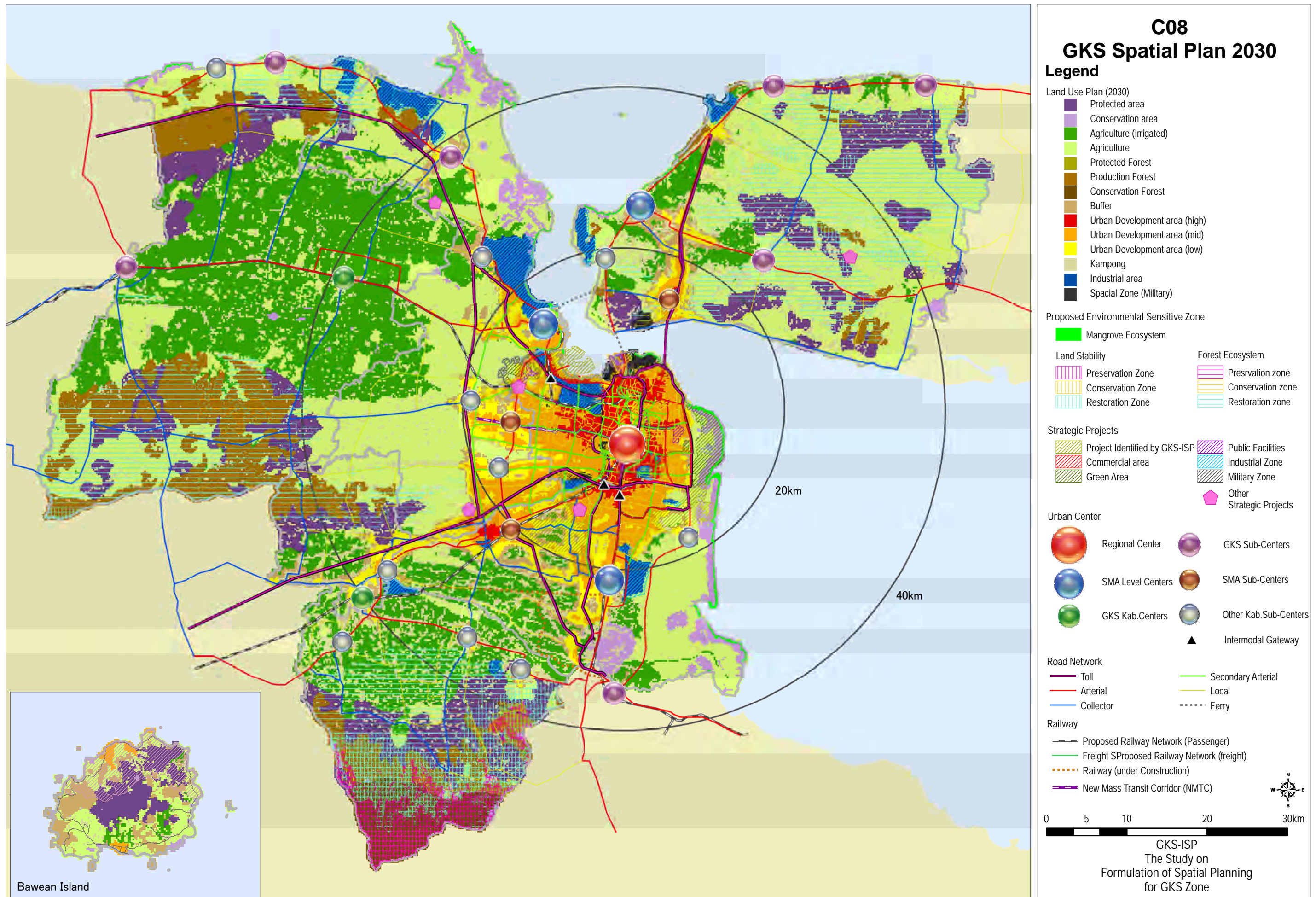Formulation of Spatial Planning
for GKS Zone

40

C07
GKS Strategic Projects 2030

Legend

⬠ Other Strategic Projects

Strategic Projects
- Project Identified by GKS-ISP
- Commercial area
- Green Area
- Public Facilities
- Industrial Zone
- Military Zone
- Industrial area

Network GKS
- Toll
- Arterial
- Collector
- Secondary Arterial
- Local
- Ferry

Railway
- Proposed Railway Network (Passenger)
- Freight SProposed Railway Network (freight)
- Railway (under Construction)
- New Mass Transit Corridor (NMTC)
- Kab./Kota Boundary

0 5 10 20 30 km

GKS-ISP
The Study on
Formulation of Spatial Planning
for GKS Zone

C08
GKS Spatial Plan 2030
Legend

Land Use Plan (2030)
- Protected area
- Conservation area
- Agriculture (Irrigated)
- Agriculture
- Protected Forest
- Production Forest
- Conservation Forest
- Buffer
- Urban Development area (high)
- Urban Development area (mid)
- Urban Development area (low)
- Kampong
- Industrial area
- Spacial Zone (Military)

Proposed Environmental Sensitive Zone
- Mangrove Ecosystem

Land Stability
- Preservation Zone
- Conservation Zone
- Restoration Zone

Forest Ecosystem
- Presrvation zone
- Conservation zone
- Restoration zone

Strategic Projects
- Project Identified by GKS-ISP
- Commercial area
- Green Area
- Public Facilities
- Industrial Zone
- Military Zone
- Other Strategic Projects

Urban Center
- Regional Center
- GKS Sub-Centers
- SMA Level Centers
- SMA Sub-Centers
- GKS Kab.Centers
- Other Kab.Sub-Centers
- Intermodal Gateway

Road Network
- Toll
- Secondary Arterial
- Arterial
- Local
- Collector
- Ferry

Railway
- Proposed Railway Network (Passenger)
- Freight SProposed Railway Network (freight)
- Railway (under Construction)
- New Mass Transit Corridor (NMTC)

0 5 10 20 30km

GKS-ISP
The Study on
Formulation of Spatial Planning
for GKS Zone

20km

40km

Bawean Island

4 Land and Environment Resource Evaluation Analysis

4.1 Objectives

In this GKS-ISP Study, a simulation model was developed to identify the spatial carrying capacity to assure an appropriate and balanced land use in the GKS zone. In the simulation, environmentally sensitive areas, such as protected areas and conservation areas, especially designated by the government of East Java Province, are taken into full consideration for natural resource conservation and/or protection. Through this simulation, a land use balance between the economic development and the environmental protection is theoretically pursued.

4.2 Concept of Analysis

A land and environment resource evaluation analysis was carried out, by using a GIS technique. Evaluation criteria are classified into two groups: one is the group of environmental components which should be protected, conserved and/or reserved against urban development activities; and another is the group of development-potential components which includes accessibilities to and/or availabilities of urban services such as transportations, service centers and infrastructures. The former is also recognized as constraint factors against development, while the latter, "positive potential" for development.

The criteria taken into consideration for this analysis are as shown in Table 4.3. As seen in this table, each criterion has several ranked scores reflected by levels of the importance. This importance, "score", is carefully decided through discussion with experts in this Study team to make this analysis more realistic and reasonable.

In theory a unit land (= a cell size of 200m x 200m) has two kinds of negative and positive scores, and a sum of the two is the indigenous score given to the land. If the land is given a negative sum, it means that the land should be protected, even though it is endowed with a certain level of development potential, and vice-versa. Thus, each cell's score was computed with the following algorism:

$$LP_i = \alpha_j \Sigma PF_i + \beta_k \Sigma CF_i$$

Where,

- LP_i : Total Score of the land use evaluation of i-cell:
- PF_i : Score of development potential factor of i-cell (positive value)
- CF_i : Score of environmentally conserved factor of i-cell (negative value)
- α_j : Weight given to development potential factor
- β_k : Weight given to environmentally conserved factor

Figure 4.1 shows outline of a workflow of this analysis and relationship between the analysis and a GKS-ISP spatial plan formulation process. Various factors are utilized in this analysis. Some of them are directly taken from the data developed in this Study while the others are results of other analyses such as the "land stability" analysis and the "one-hour service coverage" simulation.
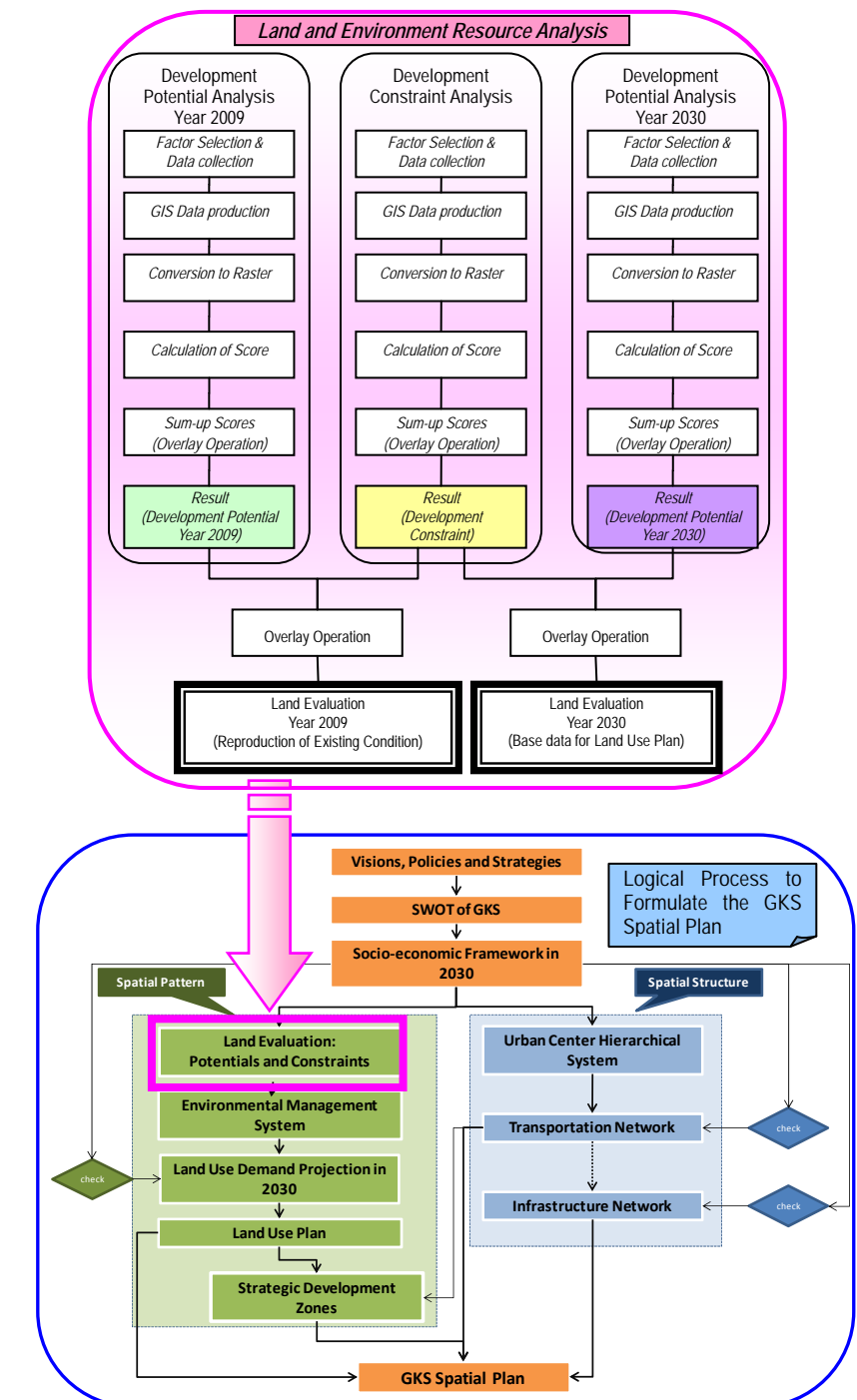

Figure 4.1 Overall Work flow and Logical Process to Formulate the GKS Spatial Plan

Figure 4.2 shows the image of GIS technique usage for the land and environment resource evaluation analysis. As seen in this figure, the pattern of constraint factors at present (as of 2009) is identical to that in the future, 2030, simply because the environmental values are not lessened over the times. On the other hand, the development potential pattern will be drastically changed in 2030, given a new transport infrastructure network.
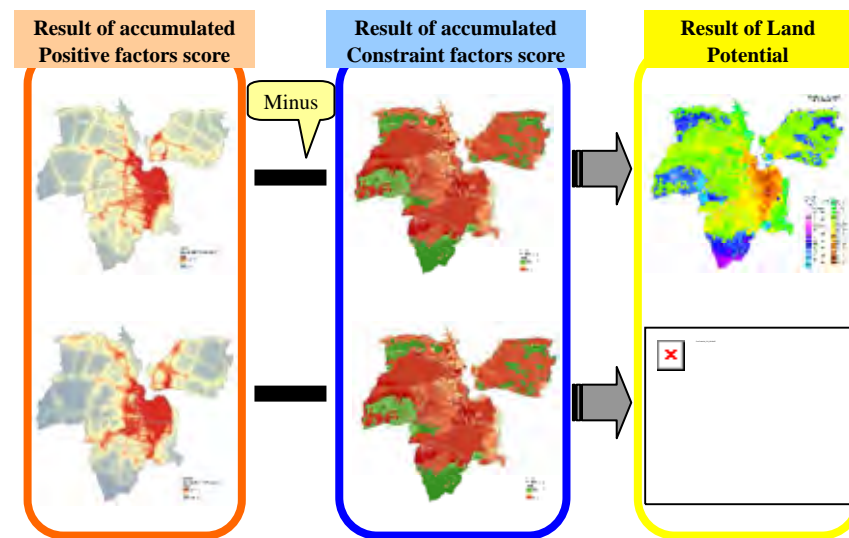

Figure 4.2 GIS Technique for Overall Land Use Analysis

4.2.1 Development Constraint Analysis

The objective of this analysis is to identify "suitable areas" or "likely areas" for future urban expansion, to put it the other way around, it is to identify "unsuitable areas," "Protection area" or "Conservation area" which are not suitable for urban development including housing and other social and economic activity purposes.

The unsuitable areas for urban development are areas which are physically difficult to be developed due to natural conditions such as possibility of flood or steep slope land. Based on various natural condition or hazardous potential map/ data/ information which were prepared by the East Java Provincial government, the unsuitable areas are identified. In addition to the above data, the Study team analyzed land stability in the

GKS zone based on "forest distribution," "land elevation" and "slope condition." The result of the land stability analysis also was incorporated in the development constraint analysis as an important factor.

Constraint factors

Table 4.1 shows collected/ prepared GIS data as constraint factors for the development constraint analysis. Detailed description of the factors and a scoring system are shown in Table 4.3 in the last Section of this Atlas.

Table 4.1 Collected/ Prepared Constraint factors

Mangrove area	Existing Mangrove area + 1km Euclidean distance area
Military area	Existing Military area + 1km Euclidean distance area
Porong Mud Flow area	Porong mud flow area +5km Euclidean distance area
Swamp/ Fish pond	Existing swamp/ fish pond area
Irrigated agriculture	Existing irrigated agriculture area
Dumping site	Existing dumping site + 2km Euclidean distance area
Forest	Existing forest area + 1km Euclidean distance area
Flood potential area	JaTIM flood potential area
Airport	Airport + 5km Euclidean distance area
Production forest	JaTIM production forest area
Protection forest	JaTIM protection forest area
Soil Condition (erosion)	JaTIM soil condition
Land stability	GKS-ISP land stability analysis result
Water catchment	JaTIM water catchment area
Conservation area	JaTIM conservation area

4.2.2 Development Potential Analysis

The objective of this analysis is to identify suitable areas for urban development and socio-economic activities. The suitable areas are identified as areas of higher accessibility to the urban development areas, the urban centers, major roads, transport hubs of bus terminals and railway stations, and so forth.

Development potential factors

Table 4.2 shows GIS data collected/ prepared as development potential factors for the development potential analysis. Detailed description of the factors and a scoring system are shown in Table 4.3 in the last section of this Map Atlas.

Development potential analysis for the year 2009 was done based on the GIS data which are selected from the existing data; on the other hand, those for the year 2030 were selected from the future plan data given by the relevant agencies and proposed by the JICA Study team.

Table 4.2 Collected/ Prepared Potential factors

	Analysis factors for Year 2009	Analysis factors for Year 2030
Distance from urban center	Distance from Surabaya city center	Distance from Regional center
	Distance from Gresik/ Sidoarjo	Distance from SMA level center
	Distance from Bangkalan/Labang/Menga/Kerian	Distance from GKS Kab.center
	Distance from Lamongan/ Mojokerto/Gempol/ Babat	Distance from GKS sub-center/ SMA sub-center/ other Kab. Sub-center
Distance from Bus service	Distance from Bus terminal (Inter Prov.)	Distance from Bus terminal (Inter Prov.)
	Distance from Bus terminal (2nd level Bus terminal)	Distance from Bus terminal (2nd level Bus terminal)
	Distance from Bus terminal (3rd level Bus terminal)	Distance from Bus terminal (3rd level Bus terminal)
	Distance from bus routes	Distance from bus routes
		Distance from bus sub-terminal
Distance from Port	Distance from Port (1st level Port)	Distance from Port (1st level Port)
	Distance from Port (2nd level Port)	Distance from Port (2nd level Port)
Distance from Railway service	Distance from Railway Station	Distance from Railway Station
Distance from terminal	Distance from Insudtrial Estate	Distance from Insudtrial Estate
	Distance from freight terminal	Distance from freight terminal
Distance from road	Distance from secondary arterial road	Distance from secondary arterial road
	Distance from toll road	Distance from toll road
	Distance from collector road	Distance from collector road
	Distance from ramp	Distance from ramp
	Distance from local road	Distance from local road
	Distance from arterial road	Distance from arterial road
Distance from airport	Distance from airport	Distance from airport
Time Distance from SBY	Time-distance 60 min. area	Time-distance 60 min. area
	Time-distance 30 min. area	Time-distance 30 min. area
Others		Distance from committed project
		Distance from New bus transit corridor
		Distance from New bus transit station
		Distance from commuter shelter

4.3 Data Preparation and Scoring method

Various factors are produced in the GIS format, and all of them are converted into a raster (cell) format to score each cell. All the data to be used for the analysis were formatted in a 200m x 200m cell size raster format. The total number of cells is 158,725 in the GKS zone. Figure 4.3 shows an example of data preparation and scoring method for an area of a 5 km Euclidean distance from the Porong mud flow area

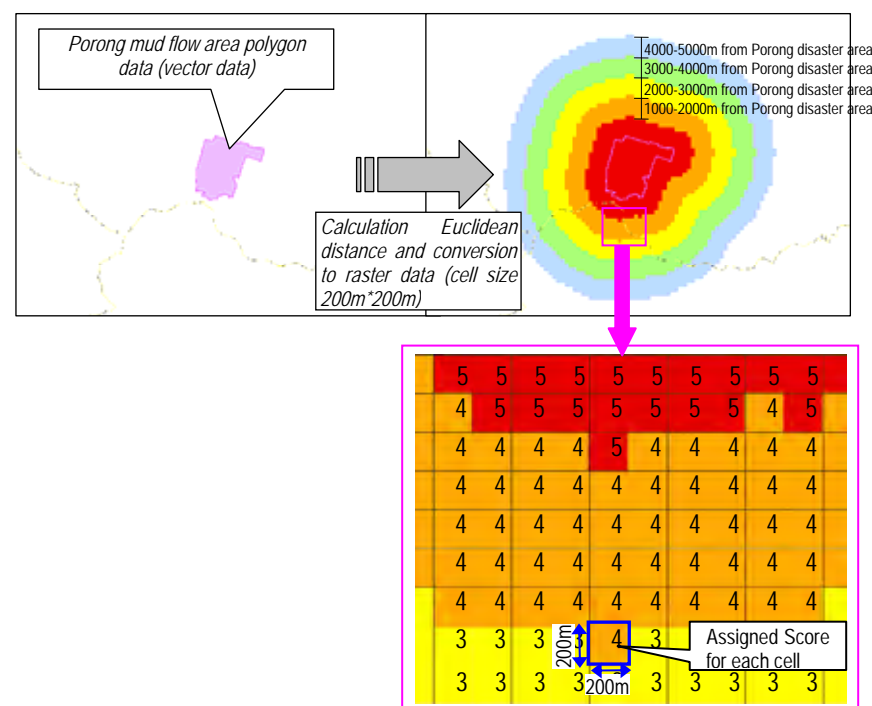The scoring system of this analysis is indicated in Table 4.3.

Figure 4.3   Image of Data Preparation and Scoring

4.3.1 Overlay operation of all constraint factors

All scored factors are added by overlaying in a raster format to calculate an accumulated score of development constraint and development potential for each cell. Image of overlaying is illustrated in Figure 4.4.
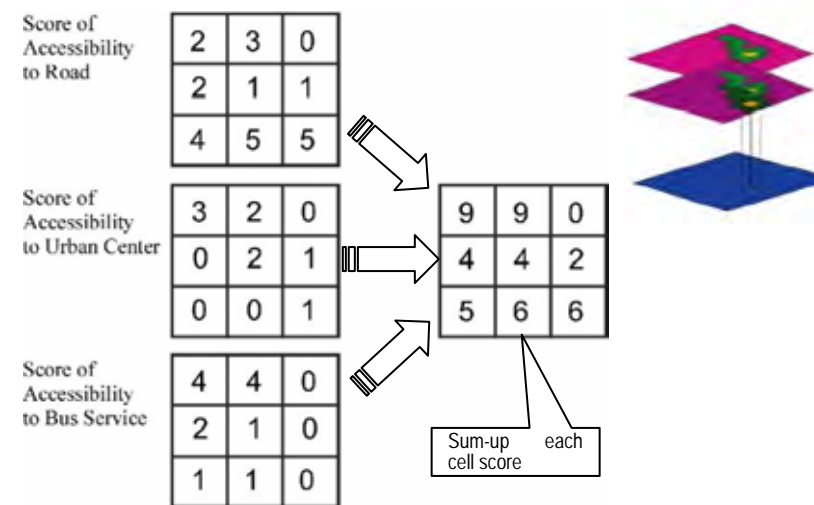

Figure 4.4   Image of Overlay Operation

4.4 Result of Development Constraint Analysis

The GIS technique reveals a distribution pattern of land with high development constraints, as illustrated on Map B16, which shows a gradation with respect to accumulated negative scores. The higher negative scored land is colored by darker brown, while the lower negative score land, by darker green.   From this map, areas to be given careful consideration against urban development or land conversion can easily be indentified in the GKS Zone.

4.5 Result of Development Potential Analysis

The GIS analysis also depicts distribution patterns of development potentials in both 2009 and 2030, as shown in Maps B17.   The higher scored land areas are colored with darker brown in a gradation scale with respect to accumulated positive scores.   It is obvious that the land development potentials will remarkably enlarge along with future transport network as proposed.   Notable changes in a comparison between 2009 and 2030 take place in the western sub-urban area of Surabaya, the northern coastal areas along Gresik and Lamongan, and the Suramadu Bridge Corridor in Bangkalan.

4.6 Overall Evaluation of Land Use Potentials

Land and environmental resource analyses are conducted to identify degrees and characteristics of land suitability for urban development/ activities, or to identify areas which should be protected/ conserved, based on the development constraint analysis and development potential analysis.

In the analyses, a number of evaluation criteria affecting urbanization were selected from the urban/ regional planning point of view.   For an overall evaluation of urbanization potentials, these criteria were weighted in consideration of their magnitude of influence on development and urbanization.

Superimposing the two categorized maps makes an overall evaluation result on land use potentials, as shown in Map B18, which shall be basic conditions to be taken into account for land use planning and environmental policy building.

In addition, in the result of year 2009 the higher score distribution area where shows in dark brown are similar to existing residential area (yellow area), commercial area (red area) and Industrial area (dark blue) distribution. This means that this analyses methodology explains the existing urbanization pattern and trend to some extent.
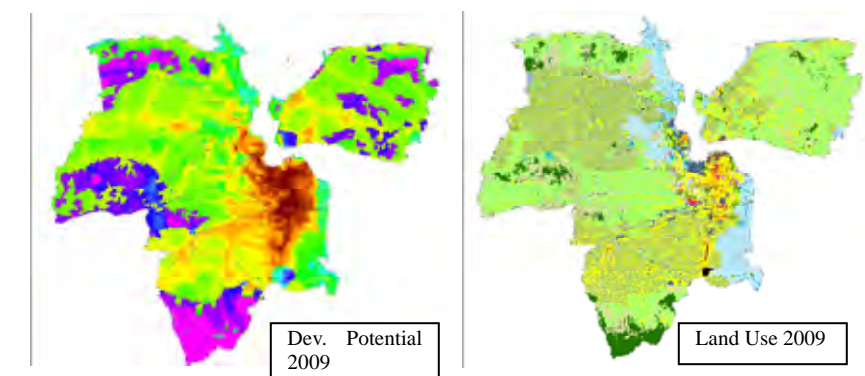
Figure 4.5   Existing Land use and Development Potential 2009

The distribution pattern of scored land areas is tabulated in Table 4.4.   In this analytical result, it can be assessed that if a land area is evaluated at a negative score, the area must strictly be

conserved or preserved, because the area's negative factor is stronger than its positive factors.   Whilst, given a great positive overall score, the area could accept development activities somewhat.   In this sense, the negative-scored area accounts for approximately 165 thousand ha in total, or shares 26.0 % of the entire GKS zone in 2030.   On the other hand, the positive-scored areas are approximately 470 thousand ha, sharing 74.0 % of the entire GKS zone in 2030.   It should be noted that the positive scored areas includes agricultural land.

These analytical results are utilized as base data for formulating a land use plan and a spatial plan in the GKS region.

Table 4.3   Scoring System of Land and Environment Resource Analysis

< Constraint Factors>

	Name of Constraint Factor	Description of constraint area	Score				
			5	4	3	2	1
Constraint Factors	Mangrove area	1km buffer area from existing Mangrove area	0-200m	200-400m	400-600m		
	Military area	1km buffer area from existing Military area	0-200m	200-400m	400-600m	600-800m	800-1000m
	Poring Mud Flow area	5km buffer area from Porong mud flow area	0-1000m	1000-2000m:			
	Swamp/ Fish pond	Existing swamp/ fish pond area	Fish pond	Swamp			
	Irrigated agriculture	Existing irrigated agriculture area				Irrigated agriculture	
	Dumping site	2km buffer area from existing dumping site	0-200m	200-400m	400-800m	800-1200m	1200-2000m
	Forest	1km buffer area from existing forest area	0-200m	200-400m	400-600m		
	Flood potential area	JaTIM flood potential area	Flood potential area				
	Airport	5km buffer area from airport	0-1000m: 5	1000-2000m: 4	2000-3000m: 3	3000-4000m: 2	4000-5000m: 1
	Production forest	JaTIM production forest area	Production forest area				
	Protection forest	JaTIM protection forest area	Protection forest area				
	Soil Condition (erosion)	JaTIM soil condition	High		Medium		Low
	Land stability	GKS-ISP land stability analysis	Preservation zone		Conservation zone	Restration zone	
	Water catchment	JaTIM water catchment	Water catchment area				
	Conservation area	JaTIM conservation area	Conservation area				

< Positive Potential Factors Year 2009>

	Positive Factor	Buffer for Evaluation	Score						
			20 ~11	10~5	5	4	3	2	1
Distance from Urban center	Distance from Surabaya city center	Distance from Surabaya (Km)	0 – 9.0	9.0 – 13.7	13.7-14.5	14.5-15.4	15.4-16.3	16.3-17.1	17.1-18.5
	Distance from Gresik/ Sidoarjo	5km from Sidoarjo/ Gresik (km)	n/a	n/a	0-0.5	0.5-1.0	1.0-2.0	2.0-3.0	3.0-5.0
	Distance from Bangkalan/Labang/Menga/Kerian	4km from Bangkalan /Labang/ Menga/ Kerian (Km)	n/a	0 – 2.5	2.5-2.9	2.9-3.2	3.2-3.4	3.4-3.7	3.7-4.0
	Distance from Lamongan/ Mojokerto/Gempol/ Babat	3km from Lamongan/ Mojokerto/ Gempol/ Babat (m)	n/a	n/a	0 - 500	500 - 1000	1000 - 2000	2000 – 3000	n/a
Distance from Bus service	Distance from Bus terminal (Inter Prov.)	5km from existing Inter Prov. Bus terminal (km)	n/a	n/a	0 – 1.0	1.0-2.0	2.0-3.0	3.0-4.0	4.0-5.0
	Distance from Bus terminal (2nd level Bus terminal)	2km from existing 2nd level bus terminal (m)	n/a	n/a	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000
	Distance from Bus terminal (3rd level Bus terminal)	2km from existing 3rd level bus terminal (m)	n/a	n/a	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000
	Distance from bus routes	3km from existing bus routes (m)	n/a	n/a	n/a	n/a	0 - 1000	1000 - 2000	2000 - 3000
Distance from Port	Distance from Port (1st level Port)	25km from existing 1st level port (km)	n/a	n/a	0 - 5	5 - 10	10- 15	15 - 20	20 - 25
	Distance from Port (2nd level Port)	4km from existing 2nd level port (km)	n/a	n/a	n/a	n/a	0 – 1.0	1.0-2.0	2.0-4.0
Railway service	Distance from Railway Station	2km Euclidean distance from existing railway stations (m)	n/a	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 200m
Distance from terminal	Distance from Industrial Estate	5km from existing industrial estates (m)	n/a	n/a	0 - 1000	1000 - 2000	2000 - 3000	3000 - 4000	4000 - 5000
	Distance from freight terminal	5km from existing freight terminal (m)	n/a	n/a	0 - 1000	1000 - 2000	2000 - 3000	3000 - 4000	4000 - 5000
Distance from road & airport	Distance from secondary arterial road	5km from existing secondary arterial road (m)	n/a	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 5000
	Distance from toll road	10km from existing toll road (m)	n/a	n/a	0 - 2000	2000 - 3000	3000 - 4000	4000 - 5000	5000-10000
	Distance from collector road	5km from existing collector road (m)	n/a	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 5000
	Distance from ramp	10km from existing toll road ramp (m)	n/a	n/a	0 - 2000	2000 - 3000	3000 - 4000	4000 - 5000	5000 -10000
	Distance from local road	2km from existing local road (m)	n/a	n/a	0 - 250	250 - 500	500 - 750	750 - 1000	1000 - 2000
	Distance from arterial road	5km from existing arterial road (m)	n/a	n/a	0 - 500	500 - 1000	1000 - 2000	2000 - 3000	3000 - 5000
	Distance from airport	20km from existing airport (km)	n/a	n/a	0 – 2.5	2.5-5.0	5.0-7.5	7.5-10.0	10.0-20.0
Time Distance from SBY	Time-distance 60 min. area	1kmfrom time-distance 60 min. area from Surabaya CBD (m)	n/a	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 1000
	Time-distance 30 min. area	1km from time-distance 30 min. area from Surabaya CBD (m)	n/a	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 1000

Notes: Distance is measured with the Euclidean distance.

< Positive Potential Factors Year 2030>

	Name of Constraint Factor	Descriptions of positive factor	Score					
			20~15	5	4	3	2	1
Distance from Urban Center	Distance from Regional center	Distance from Surabaya (km)	0 – 13.7	13.7 – 14.5	14.5-15.4	15.4-16.3	16.3-17.1	17.1-18.5
	Distance from SMA level center	5km from the proposed SMA level center (m)	n/a	0-500m	500-1000	1000-2000	2000-3000	3000-5000
	Distance from GKS Kab.center	4km from GKS Kab. Center (m)	n/a	2531-2875	2875-3156	3156-34378	3438-3719	3719 - 4000
	Distance from GKS sub-center/ SMA sub-center/. Sub-center	3km from GKS sub-center/ SMA sub-center/ other Kab. Sub-center (m)	n/a	0 - 500	500 - 1000	1000 - 2000	2000-3000	3000-5000
Distance from Bus service	Distance from Bus terminal (Inter Prov.)	5km from proposed Inter Prov. Bus terminal (m)	n/a	0 - 1000	1000-2000	2000-3000	3000-4000	4000 - 5000
	Distance from Bus terminal (2nd level Bus terminal)	2km from proposed 2nd level bus terminal (m)	n/a	n/a	0-500	500-1000	1000-1500	1500-2000
	Distance from Bus terminal (3rd level Bus terminal)	2km from proposed 3rd level bus terminal (m)	n/a	n/a	0 - 500	500-1000	1000-1500	1500-2000
	Distance from bus sub-terminal	5km from proposed bus sub-terminal (m)	n/a	0-500	500-1000	1000-1500	1500-2000	2000-5000
	Distance from bus routes	3km from proposed bus routes	n/a	n/a	n/a	0-1000	1000-2000	2000-3000
Distance from Port	Distance from Port (1st level Port)	Distance from the proposed 1st level port (km)	n/a	0 - 5	5 - 10	10-15	15 - 20	20 - 25
	Distance from Port (2nd level Port)	4km from the proposed 2nd level port (m)	n/a	n/a	n/a	0 - 1000	1000 - 2000	2000 - 4000
Railway	Distance from Railway Station	2km from the proposed railway stations (m)	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 2000
Accessibility to/from road	Distance from secondary arterial road	5km from proposed the secondary arterial roads(m)	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 5000
	Distance from toll road	10km from the proposed toll roads(m)	n/a	0 - 2000	2000 - 3000	3000 - 4000	4000 - 5000	5000 - 10000
	Distance from collector road	5km from the proposed collector roads(m)	n/a	0 - 500	500 - 1000	1000 - 1500	1500 - 2000	2000 - 5000
	Distance from ramp	10km from proposed toll road ramps(m)	n/a	0 - 2000	2000 - 3000	3000 - 4000	4000 - 5000	5000 - 10000
	Distance from local road	2km from the proposed local roads (m)	n/a	0 - 250	250 - 500	500 - 750	750 - 1000	1000 - 2000
	Distance from arterial road	5km from the proposed arterial roads (m)	n/a	0 - 500m	500 - 1000	1000 - 2000	2000 - 3000	3000 - 5000
Accessibility to airport	Distance from airport	20km from the proposed airport (km)	n/a	0 – 2.5	2.5-5.0	5.0-7.5	7.5-10	10-20
Time-distance from Surabaya	Time-distance 60 min. area	1km from time-distance 60 min. area from Surabaya CBD (m)	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 1000
	Time-distance 30 min. area	1km from time-distance 30 min. area from Surabaya CBD (m)	n/a	0 - 200	200 - 400	400 - 600	600 - 800	800 - 1000
Others	Distance from Industrial Estate	5km from existing industrial estates (m)	n/a	0 - 1000	1000 - 2000	2000 - 3000	3000 - 4000	4000 - 5000
	Distance from freight terminal	5km from existing freight terminal (m)	n/a	0 - 1000	1000 - 2000	2000 - 3000	3000 - 4000	4000 - 5000
	Distance from New bus transit corridor	3km from NBTC corridor (m)	n/a	0 - 500	500 - 1000	1000 - 2000	2000 - 3000	n/a
	Distance from New bus transit station	5km from NBTC station (m)	n/a	0 - 500	500 - 1000	1000 - 2000	2000 - 3000	3000 - 5000

Notes: Distance is measured with Euclidean distance.

Table 4.4   Over all result of land and environment resource analysis

Score	Attribute	Y2009				Y2030			
		Area (ha)		Categorized Area		Area (ha)		Categorized Area	
less than -81	High Constained	288	0.0%			520	0.1%		
-71 - -80		652	0.1%			424	0.1%		
-61 - -70		5,460	0.9%			8,424	1.3%		
-51 - -60		4,960	0.8%			4,272	0.7%		
-41 - -50		18,856	3.0%	157,188	24.8%	23,880	3.8%	164,892	26.0%
-31 - -40		72,020	11.3%			71,448	11.3%		
-21 - -30		28,604	4.5%			21,068	3.3%		
-11 - -20	Low Constrained	4,024	0.6%			5,952	0.9%		
-1 - -10		22,324	3.5%			28,904	4.6%		
0-10	Low Potential	50,028	7.9%			58,172	9.2%		
11-20		235,028	37.0%			197,956	31.2%		
21-30		111,012	17.5%			99,392	15.7%		
31-40		38,796	6.1%	477,712	75.2%	46,148	7.3%	470,008	74.0%
41-50		18,820	3.0%			29,824	4.7%		
51-60	High Potential	18,420	2.9%			24,252	3.8%		
more than 60		5,608	0.9%			14,264	2.2%		
		634,900	100.0%	634,900	100.0%	634,900	100.0%	634,900	100.0%

Table 4.5   Land Use Changes from the Existing Pattern to the Land Use Plan 2030 in GKS Zone

Land Use Plan Name	Existing Land Use (2009)																				
	Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Transportation	Vacant Land	Water body
Protected area	8,044	35,700	9,964	0	20	0	168	8,288	732	56	0	0	0	0	0	0	88	616	0	8	264
Conservation area	88	312	696	0	8	0	10,800	384	28	8	1,624	0	0	580	0	0	8	732	0	0	204
Agriculture area (irrigated)	0	4	126,860	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
Buffer area	1,912	3,684	9,092	0	72	32	812	4,892	340	260	12	0	80	0	48	8	12	60	136	20	256
Agriculture area	22,924	117,608	16	24	132	4	36,264	6,072	3,788	380	996	0	76	20	8	36	72	1,128	172	44	3,684
Industrial area	68	3,160	2,716	0	100	0	2,364	444	1,324	2,780	140	0	0	0	24	0	0	232	0	132	264
Special zone (military)	0	0	0	0	0	0	0	340	28	0	0	1,184	0	0	0	0	0	0	0	0	0
Kampung	0	12	28	0	12	0	120	0	58,240	12	0	0	0	0	0	0	0	0	0	0	116
Protected forest	60	64	0	0	0	0	0	1,168	0	0	0	0	0	0	0	0	0	0	0	0	0
Production forest	18,040	19,044	3,720	0	0	0	428	11,052	184	4	0	0	0	0	0	0	0	140	0	4	116
Conservation forest	1,860	172	0	0	0	0	0	9,076	0	0	0	0	0	0	0	0	0	0	0	0	0
Urban development area (High)	80	96	384	0	912	0	36	412	6,996	768	0	0	372	0	400	56	0	4	52	344	152
Urban development area (Mid)	1,740	4,768	4,792	0	1,080	0	324	1,412	15,728	2,980	4	0	1,792	0	700	104	8	68	216	2,288	476
Urban development area (Low)	1,284	5,540	7,052	0	156	40	776	540	7,456	800	0	0	368	0	32	48	8	88	176	116	428

Land Use Plan (2030)

Source: JICA Study Team

Table 4.6 Summary of Existing land use and Land use plan by Kabupaten/ Kota

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Trans-portation	Vacant Land	Water body
Kab. Bangkalan	Protected area	3,120	15,756	592	0	20	0	16	776	340	8	0	0	0	0	0	0	0	40	0	0	88
	Conservation area	0	56	0	0	0	0	316	4	0	0	24	0	0	0	0	0	0	244	0	0	32
	Agriculture area (irrigated)	0	0	9,348	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	256	1,216	2,492	0	40	0	16	260	112	0	0	0	0	0	32	0	0	8	0	0	12
	Agriculture area	8,224	51,876	0	0	20	0	2,028	1,992	1,448	0	104	0	0	0	0	0	8	528	0	4	440
	Industrial area	16	832	384	0	0	0	208	72	428	0	0	0	0	0	0	0	0	216	0	0	12
	Special zone (military)	0	0	0	0	0	0	0	340	28	0	0	0	0	0	0	0	0	0	0	0	0
	Kampung	0	4	0	0	8	0	0	0	18,332	0	0	0	0	0	0	0	0	0	0	0	8
	Production forest	708	1,540	388	0	0	0	408	428	36	0	0	0	0	0	0	0	0	136	0	0	16
	Urban development area (High)	4	40	28	0	0	0	0	0	12	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Mid)	56	312	388	0	0	0	0	4	304	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Low)	164	488	1,412	0	0	0	0	44	760	8	0	0	0	0	0	0	0	8	4	0	8
	Total	12,548	72,120	15,032	0	88	0	2,992	3,920	21,800	16	128	0	0	0	32	0	8	1,180	4	4	616

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grass land/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Trans-portation	Vacant Land	Water body
Kab. Gresik	Protected area	52	1,912	116	0	0	0	8	5,756	8	4	0	0	0	0	0	0	0	0	0	4	4
	Conservation area	20	84	8	0	0	0	4,980	24	4	0	676	0	0	0	0	0	8	20	0	0	72
	Agriculture area (irrigated)	0	4	13,176	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	1,412	2,020	836	0	12	0	384	4,560	92	20	8	0	0	0	4	0	0	12	4	20	64
	Agriculture area	7,108	29,500	16	0	8	0	16,512	1,516	436	100	548	0	0	0	0	0	12	60	4	16	1,064
	Industrial area	40	1,432	1,496	0	16	0	1,200	240	264	808	140	0	0	0	0	0	0	4	0	48	148
	Kampung	0	0	8	0	0	0	52	0	5,640	0	0	0	0	0	0	0	0	0	0	0	0
	Production forest	4	344	92	0	0	0	0	632	0	4	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (High)	12	4	0	0	0	0	0	0	20	36	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Mid)	1,184	3,472	140	0	88	0	60	528	3,476	1,084	4	0	0	0	16	8	8	16	0	52	76
	Urban development area (Low)	776	4,348	440	0	52	0	316	344	1,468	212	0	0	4	0	0	44	8	8	16	20	32
	Total	10,608	43,120	16,328	0	176	0	23,512	13,600	11,424	2,268	1,376	0	4	0	20	52	36	120	24	160	1,460

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grass land/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Trans-portation	Vacant Land	Water body
Kab. Lamongan	Protected area	2,088	8,344	4,940	0	0	0	120	764	144	0	0	0	0	0	0	0	24	572	0	4	164
	Conservation area	12	44	16	0	0	0	896	20	0	0	80	0	0	0	0	0	0	132	0	0	0
	Agriculture area (irrigated)	0	0	70,264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	0	4	164	0	0	0	16	20	12	0	0	0	0	0	0	8	0	0	0	0	0
	Agriculture area	4,848	27,748	0	0	44	0	2,112	2,064	948	48	8	0	0	0	0	32	16	72	0	12	1,124
	Industrial area	0	840	0	0	0	0	0	24	16	4	0	0	0	0	0	0	0	0	0	0	0
	Kampung	0	0	0	0	0	0	20	0	12,360	4	0	0	0	0	0	0	0	0	0	0	20
	Production forest	11,848	12,192	2,396	0	0	0	20	7,000	96	0	0	0	0	0	0	0	0	4	0	4	100
	Urban development area (Low)	0	0	4	0	4	0	0	0	24	0	0	0	0	0	0	0	0	0	0	0	0
	Total	18,796	49,172	77,784	0	48	0	3,184	9,892	13,600	56	88	0	0	0	0	40	40	780	0	20	1,408

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland / Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Trans-portation	Vacant Land	Water body
Kab. Mojokerto	Protected area	2,784	9,688	4,316	0	0	0	24	992	240	44	0	0	0	0	0	0	64	4	0	0	8
	Conservation area	56	124	8	0	0	0	0	332	0	0	0	0	0	0	0	0	0	0	0	0	0
	Agriculture area (irrigated)	0	0	21,892	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	140	228	1,468	0	12	0	0	8	36	152	0	0	0	0	0	0	8	0	0	0	76
	Agriculture area	2,688	7,040	0	24	24	0	4	224	680	188	0	0	0	0	0	4	36	0	0	0	296
	Industrial area	0	20	552	0	0	0	0	0	228	0	0	0	0	0	0	0	0	0	0	0	24
	Kampung	0	0	16	0	4	0	0	0	14,004	8	0	0	0	0	0	0	0	0	0	0	40
	Protected forest	60	64	0	0	0	0	0	1,168	0	0	0	0	0	0	0	0	0	0	0	0	0
	Production forest	5,480	4,968	844	0	0	0	0	2,992	52	0	0	0	0	0	0	0	0	0	0	0	0
	Conservation forest	1,860	172	0	0	0	0	0	9,076	0	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Mid)	0	4	52	0	0	0	0	0	72	4	0	0	0	0	0	0	0	0	0	0	24
	Urban development area (Low)	136	212	508	0	4	0	0	4	672	188	0	0	0	0	0	0	0	0	0	0	80
	Total	13,204	22,520	29,656	24	44	0	28	14,796	15,984	584	0	0	0	0	0	4	108	4	0	0	548

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation / Sports	Sea sand/ Sand dune	Swamp	Trans portation	Vacant Land	Water body
Kab. Sidoarjo	Conservation area	0	4	664	0	8	0	3,608	4	24	8	552	0	0	580	0	0	0	336	0	0	100
	Agriculture area (irrigated)	0	0	11,844	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	104	176	3,828	0	0	0	88	28	76	88	0	0	0	0	0	0	4	0	132	0	80
	Agriculture area	56	1,348	0	0	32	0	13,832	248	268	40	88	0	0	20	0	0	0	428	168	0	712
	Industrial area	12	32	284	0	0	0	912	16	200	4	0	0	0	0	0	0	0	4	0	0	20
	Kampung	0	0	0	0	0	0	32	0	7,432	0	0	0	0	0	0	0	0	0	0	0	48
	Urban development area (High)	4	32	336	0	40	0	0	56	828	324	0	0	0	0	0	0	0	0	8	0	20
	Urban development area (Mid)	248	288	4,036	0	472	0	20	284	5,628	1,368	0	0	0	0	80	0	0	0	84	0	116
	Urban development area (Low)	208	296	4,552	0	48	0	48	120	3,536	368	0	0	0	0	0	0	0	4	148	0	156
	Total	632	2,176	25,544	0	600	0	18,540	756	17,992	2,200	640	0	0	600	80	0	4	772	540	0	1,252

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																				
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation/ Sports	Sea sand/ Sand dune	Swamp	Trans- portation	Vacant Land	Water body
Kota Mojokerto	Agriculture area (irrigated)	0	0	336	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Buffer area	0	32	304	0	8	0	0	8	12	0	0	0	4	0	4	0	0	0	0	0	4
	Agriculture area	0	72	0	0	4	0	0	16	8	0	0	0	4	0	8	0	0	0	0	0	12
	Kampung	0	8	4	0	0	0	0	0	352	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Mid)	0	0	0	0	4	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (Low)	0	36	128	0	44	0	0	4	492	4	0	0	12	0	20	0	0	0	0	0	44
	Total	0	148	772	0	60	0	0	28	872	4	0	0	20	0	32	0	0	0	0	0	60

Kab./ Kota Name	Land Use Plan Category	Existing Land Use Category																					
		Agriculture	Agriculture (non-irrigated)	Agriculture (irrigated)	Cemetery	Commercial	Dumping Site	Fishpond	Forest/ Grassland/ Shrub	Housing/ Settlement	Industry	Mangrove	Military	Open Space	Porong Mud Disaster	Public Institution	Recreation / Sports	Sea sand/ Sand dune	Swamp	Transporta tion	Vacant Land	Water body
Kota Surabaya	Conservation area	0	0	0	0	0	0	1,000	0	0	0	292	0	0	0	0	0	0	0	0	0	0
	Buffer area	0	8	0	0	0	32	308	8	0	0	4	0	76	0	8	0	0	40	0	0	20
	Agriculture area	0	24	0	0	0	4	1,776	12	0	4	248	0	72	0	0	0	0	40	0	12	36
	Industrial area	0	4	0	0	84	0	44	92	188	1,964	0	0	0	0	24	0	0	8	0	84	60
	Special zone (military)	0	0	0	0	0	0	0	0	0	0	0	1,184	0	0	0	0	0	0	0	0	0
	Kampung	0	0	0	0	0	0	16	0	120	0	0	0	0	0	0	0	0	0	0	0	0
	Urban development area (High)	60	20	20	0	872	0	36	356	6,136	408	0	0	372	0	400	56	0	4	44	344	132
	Urban development area (Mid)	252	692	176	0	516	0	244	596	6,240	524	0	0	1,792	0	604	96	0	52	132	2,236	260
	Urban development area (Low)	0	160	8	0	4	40	412	24	504	20	0	0	352	0	12	4	0	68	8	96	108
	Total	312	908	204	0	1,476	76	3,836	1,088	13,188	2,920	544	1,184	2,664	0	1,048	156	0	212	184	2,772	616