Landscape Planning Base on Bioregional Approach
Case Study: Settlement Segment of CiLiwung River Bank in Bogor

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ABSTRACT

Riparian area in middle stream of Ciliwung watershed at Baranangsiang and Babakan Pasar, Bogor are conservation area which have to preserved. The ideal land use of these areas is greenbelt but it has been occupied as built-up in areas. The settlements have caused environmental destruction and decrease health quality. The purpose of this study is to evaluate spatial structures at riparian areas on location and study the people's activity, in order to make a landscape plan based on bioregion with sustainable environment in ecological, social and economic aspects.
Analysis of spatial structure was conducted by comparing the characteristics of the existing conditions and standard criteria. If it is not appropriate with standard criteria, there will be some purpose for the solution, but if it is appropriate, then there will be some optimalization program. Based on the analytical process, it will be synthesized, and a conceptual plan, development plan and landscape plan will be produced. There are two type of zoning to be determined, i.e. conservation zone and non-conservation zone. Conservation zone occupies about 20.7 % of the area. The structure of conservation zone is a greenbelt which has to function as a buffer, wildlife habitat, filtering pollution,and producing nutrient for the river. The non conservation zone occupied an area about 79.3 % of the area. The uses in this area are for installation of public facilities, infrastructure and ulitilies. In addition the supporting facilities has been proposed, such as an evacuation area, installation of waste water treatment, biotoilet and green management.

Keywords: Bioregion, Landscape planning, Riparian

1. INTRODUCTION

River have important role in natural process and as source of water for human and other life forms. Ecologically, river bank is protected area should be conserved as riparian. Urban development hardly paid attention and neglected to the river system. The city had lost their river image and impression of natural resources river culture as well. Orientation development of the city changed from river-base to land-base. The rivers just as a complement not as a heart of urban living and urban scenery

CiLiwung as one of the big river which passing through Bogor city and streaming to Jakarta and always making flood in Jakarta at rainy session. Any environmental activities in the up stream will make response in down stream. The fact that some part the river bank of CiLiwung are used for housings, bridges, roads, paths, other urban facilities and ulitilies. The occupation on the river bank caused rivers are narrower and reducing some river functions. Environmental problems occur such as physical function (flood, landslide, erosion) ecological function (riparian wild life, water pollution from back water, solid waste), economic function (fishing, irrigation, water resource) and socially function (river life style). Those bad attitude and behavior make problem in term of spatial arrangement, environment and living.

With increasing environmental catastrophes on the urban river, it is necessary to actively undertake ecological sustainability in order for human and other life forms to survive. The most useful starting place to transform the enviromental problem in river of the city is to recognize the particular bioregion in which it is located.

A bioregion is defined as life-in- place that means following the necessities and pleasures of life as they are uniquely presented by particular site, and evolving ways to ensure long-term occupancy of that site. Bioregion refers both geographical terrain and a terrain of consciousness—to place and the ideas that have developed about how to live in that place (Berg and Dasmann, 1978). Moreover Berg (2003) said the bioregion is the unique natural characteristics that occur throughout a particular geographic area, such as climate, landforms, watersheds, soils, native plants and animals, and other features.

Since the study site considered as part of bioregion of CiLiwung watershed, there are relationship and interdependency among other part within the (whole) watershed. Therefore, landscape planning based bioregion approach in the study site would be contribute to the other part, especially in the middle and downstream of CiLiwung watershed.

The basic goals of a bioregional approach are as follows: a) restore and maintain natural systems, b) develop sustainable means for satisfying basic human needs such as food, water, energy, shelter, resource materials, waste handling, and cultural information, and c) create and support a broad range of activities which make it possible to fit better into the life-place.

Objectives

1. To evaluate spatial structure and community activities of settlement segment on CiLiwung river bank of Baranangsiang and Babakan Pasar sub district in Bogor city.
2. To prepare landcape plan on river bank base on bioregional approach

2. METHODOLOGY

The study was conducted in the segment of CiLiwung river which is pass through the city of Bogor from March to August 2007. Study site located on the river bank involve Baranangsiang dan Kelurahan Babakan Pasar sub district, Bogor municipality (Figure 1)

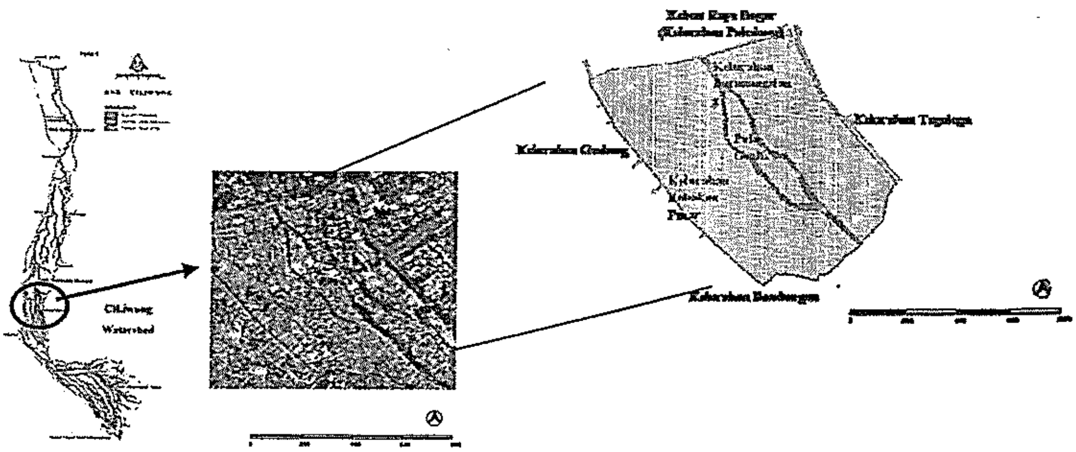


Figure 1. Study site

Material and Equipments

Data and information used for the study consist of spatial data, such as administration map (2005), topographical map, street map and Ikonos imagery. Field survey was conducted for collecting information from selected respondent, ground check and verification. Some equipment were used such as PC computer, digital camera and GPS (Global Positioning System).

Mapping and Data analysis was conducted using Computer Aided Design (CAD) and Geographic Information System (GIS), and image editing and simulation using Adobe Photoshop and Bryce 5.

Methods

Study was conducted in five steps as follow the framework of study (Figure 2). **First**, preparation of spatial data (such as base map and preliminary map), developing standard criteria and collecting related data from document, report etc. **Second**, field survey was conducted by observe the site, and interview the 35 of household as representation of each settlement category as sample respondent. Randomly, respondent was selected from sample frame of settlement types. The attribute data were collected was transfered into base map. Spatial data were produced, such as Exisiting Settlement Map, Infrastructure Map, Ulitities Map and others. **Third**, the site was analyzed and characterized in term of biophysic, social and economy. Analysis will determined the site into planning capacity by matching the site characteristics and planning standard criteria. The planning capacity of settlement, infrastructures, utilities, and others were classified in order to be able to produce some map, such as River Map, Settlement Classification Map, Household Sample Map, Infrastructure Map, Utilities Map and others map. **Fourth**, base on analysis of the planning capacity of settlement, infrastructure, utilities and others, alternative to solved the problem were proposed for those which are over the planning capacity. For those which are less than the planning capacity will be proposed solution to optimalization. **Fifth**, base on synthesis, the planning developement were porposed in form landscape plan.

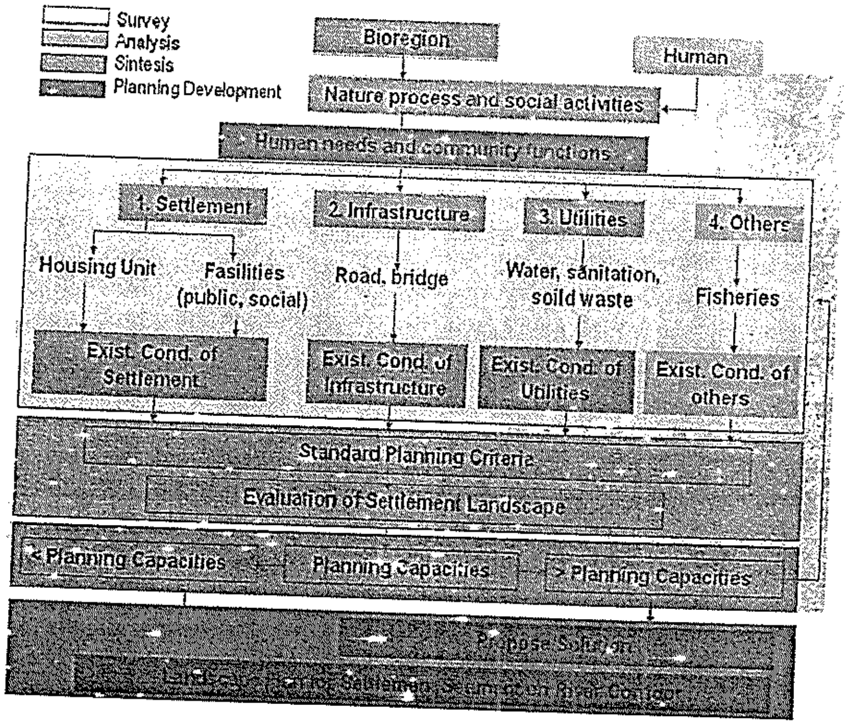


Figure 2. Framework of study

3. DATA AND ANALYSIS

3.1. General Condition

a. Biophysics

The study site, mostly located in elevation more than 200 m above sea level (a.s.l.). About 12%, 70% and 17% of the area in Baranangsiang sub district lay on 201-250 m, 251-300 m, and > 300 m a.s.l, respectively. While the area of Babakan Pasar sub district lay on 251-300 m a.s.l. Both Baranangsiang and Babakan Pasar sub district have area almost flat to steep slope.

The soil type of site is brown latosol, except the area in river bank of CiLiwung which is coverage by grey aluvial. The average temperature is 27°C, with maximum 29°C and minimum 23°C. Rainfall depth in the study site is 4680 mm/year with 156 rainy day (Bapeda, 2005), during wet season the highest rainfall in February and June. While the wind velocity is 2 km/hour predominantly to the northeast.

The river of CiLiwung passing through the site along 976 m. The average width of river is 12 m. There is a island-like in the middle of the study site, namely Pulo Geulis. In certain part of river channel is curve form and narrow. It was created by some landslide, sedimentation and settlement occupation on the river bank.

Some vegetation, such as Angsana (*Pterocarpus indicus*), Mahagony (*Swietenia mahagoni*), Bamboo (Bambusa sp), and others, mostly, covered the river bank. Those riparian vegetations are declining by occupation of unregistered settlement on the river bank.

b. Social

Baranangsiang sub district (15.7 ha) has four neighborhood units with 792 inhabitants or has population density about 50.44 inhabitants per ha. While in Babakan Pasar sub district (37.8 ha) has 10 251 inhabitants or has population density about 271.19 inhabitants per ha. Population density of Babakan Pasar is five time higher than Baranangsiang sub district.

Majority of Baranangsiang sub district are trader or services business, but the Babakan Pasar people are worker and trader. The people in study site is Moslem (96%), Christian (3.6%), Buddhist (0.36%) and Hindu (0.03%)

c. Settlement

Housing Units

The study site coverage an area about 53.6 ha. It is consist of area in Baranangsiang sub district about 15.7 ha (29.37%) and in Babakan Pasar sub district about 37.8 ha (70.63%). The coverage area of study site consist of 86.67% occupied by settlement and remain 13.33% by green open space. Since geometry of the CiLiwung have varies in depth of river, than base on the PERMEN PU NO: 63/1993 the setback of river is no less than 30 m. Mostly, the settlement was occupied within the river setback.

By analyzing the spatial data and delineation Ikonos imagery, there are 1692 of building unit. About 20% of building unit located in Baranangsiang and 80% in Babakan Pasar sub district. There are some characteristics of building, such as type, coverage, and density. Those characteristics express economic level, social background and environmental influences.

There are three type of building unit, namely Type 1, Type 2 and Type 3. Those type of building are classified base on buiding coverage index, density, building domination, amount of buiding per ha, buiding area, building pattern and width of neigbourhood road (Table 1.).

Table 1. **Criteria of Building Classification**

Criteria	Type 1	Type 2	Type 3
Floor-based Coefficient	64,4 %	90,71 %	79,52 %
Buiding Density	high	very high	High
Building Dominance	house	house	House and store (ruko)
Amount of Building per ha	30	85	30
Building area	600 m^2	70 m^2	70 -400 m^2
Building Pattern	reguler (linier)	irreguler	reguler (linier)
Width of neigbourhood road	4-5 m	1.5 m	4-5 m

Source. Field survey analysis

Randomly, in amount of 35 household as sample reprentation from each type building class was selected. There were six household units were selected for building type 1 with building area between 600 – 800 sq.m (average 750 sq.m), 24 household units for building type 2 with building area between 8 to 800 sq.m (average 150 sq.m), and five household units for buiding type 3 with building area of house and store between 600 to 800 (average 105 sq.m).

Base on inventory and analysis of those samples, the building area of type 1 > type 3 > type 2, building floor area type 1 > type 3 > type 2, the average need of space type 1 > type 3 > type 2. Moreover settlement type 1 and type 3 have similar space needed per person and comply as standard criteria. While the settlement type 2 have varies of space needed per person. These varieties are caused by different of building area, building floor area and amount of person in household. In settlement type 2, there are some household comply to standard and some others were not comply to standard yet (Figure 3).

Figure 3. Map of Settlement Classification

Facilities

There are some facilities within study site, such as education, health, worship, economic facilities (Table 2.). Those facilities are comply to the minimum standard, but the area coverage to those facilities within the study site not fully shows the distribution of the uniform.

Table 2. **Public Facilities in Study Site**

No	Facilities	Note
1	Education	Pre-School, Primary School, Secondary School, Tertiary School
2	Health	Dru store, integrated heath service, community health center
3	Worship	Mosque, Chruch, Buddhist's Temple
4	Bussiness	Store, Ruko, petty trader
5	Open space	Park, sport field

Source: Field Survey

Infrastructures

There are infrastructures avaivable to accomodate transportation, such as road and bridge within study site. The study site was surrounded by artery road of Jalan Pajajaran, Jalan Otto Iskandardinata as collector road, and neighbourhood road. Other collector road are Jalan Roda, Jalan Bangka, Jalan Belitung, Jalan Sambu and Jalan Taman Riau. The quality of road, in term of paving and drainage system of Jalan Pajajaran, Bangka, Belitung, and Sambu area good (Figure 4).

There are five bridges connecting Baranangsiang and Babakan Pasar sub district. Four of those bridges connect each part of study site through the island-like area of Pulo Geulis. The construction of bridge are made by concrete and steel and have average length 10 m and width 3 m.

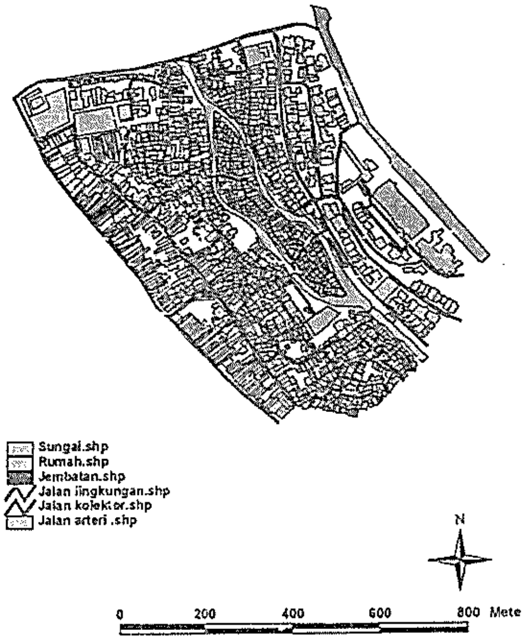


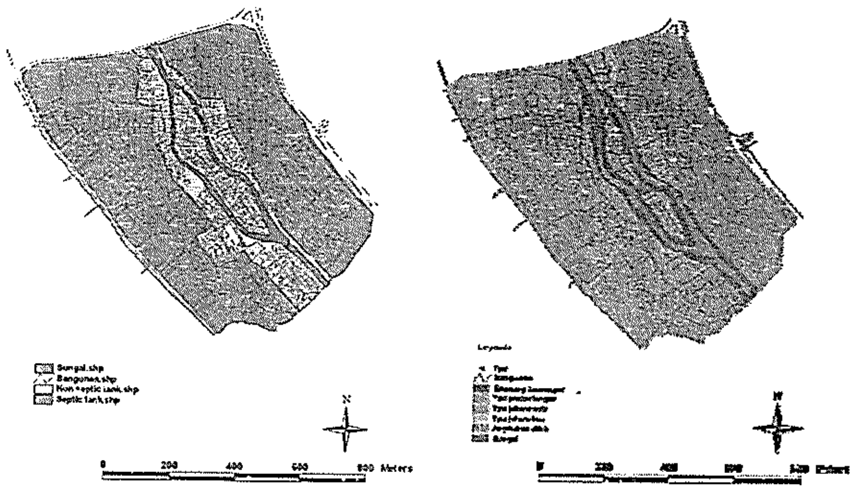
Figure 4. Map of Infrastructure

Utilities

According to the previous research, the water quality of river was C, that mean cannot used as drinking water, but possible for fisheries. About 92.8% household in Baranangsiang sub district and about 84.75% Babakan Pasar sub district are supplied drinking water from PDAM (authority responsible for drinking water supply). The PDAM have been supplied drinking water to the settlement type 1, 2 and 3. Base on interview, there were 92% respondents used PDAM, 6% used river and 2% used drill well for shower. About 79.5% of household used PDAM, 14.7% used river, and 5.8% used drill well for washing the cloth. There are seven drill well used and distribute in settlement type 2.

There are 5.9 % household within the study site have no toilet and using river as toilet. About 94.1% household have they own toilet. Those who have toilet, there are 50% have septic tank, and the remain 50% have no septic system, it mean the black water are throw to the river. Among those who have no septic system are the household who live in the island-like of Pulo Geulis (Figure 5).

Regarding to the solid waste system, there are three system, i.e. a. Solid waste container and collecting by the Environmental Service Agency (27%), b. Adjacent solid waste transfer station (TPS) and incinerator (56,8%), and c. Throw it to the river (16,2%).



(a) (b)

Figure 5. Map of Utilities: a. Septic system; b. Solid waste

Others Activities

The river also used for other economic activities, such as aquaculture with "karamba system". Some people rising fresh water fish, i.e. consumable fish (such as tilapia, catfish) and ornamental fish (such as "koi"). The excess of "karamba system" are in create water pollution from the residual of fish feed and blocking the stream flow.

4. SYNTHESIS

In order to be able to create the sustainable urban environment by applying bioregion concept, it was conducted evaluation to the existing condition of settlement landscape aspect, i.e. settlement, infrastructure, utilities and others base on planning capacity. Evaluation was classified the landscape into two bioregion categories, i.e. "good" and "bad". Categorization was base on two criteria, i.e. comply with standard and availability of, for example, facilities. The "good" category would be considered if the exisiting conditon is comply to the standard criteria or the standard facilities are available, in other world it is less than or same with the planning capacity. And "bad" category would be considered, if there are not comply to the standard criteria or no standard facilites are available, in other world it is more than the planning capacity.

Base on evaluation of planning capacity to the settlement landscape, there are propose alternative to control the problem for those which are over the planning capacity. For those which are less than or same with the planning capacity its will be proposed solution to optimalization.

Table 3. **Characteization of Evaluation on Planning Capacity**

Evaluation	**"Good" Categories**		**"Bad" Categories**	
	Standard	Available	Not Standard	Not Available
Settlement	√		√	
Fascilities	√		√	
Infrastructures	√		√	
Sanitation system (Utilities)		√		√
Solid Waste	√		√	

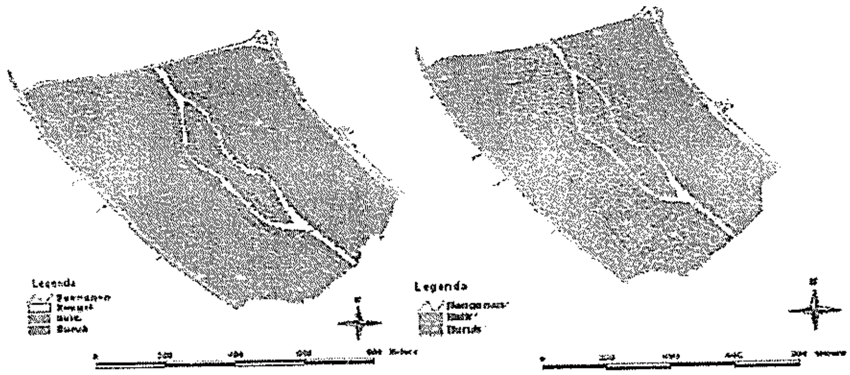
Source: Field survey analysis

Settlement

Concerning to the environmental function river bank area is unsuitable for settlement. The settlement which are occupy those river setback, less than 30m from the river, as mentioned in PERMEN PU No.63/1993, would be considered as "bad" category. On the other side, the settlement which are lay outside those setback, would be considered as "good" category (Figure 6).

The area which have density of 30 building units per ha, would be considered as "good" category. The "bad" category would be consireded to the area which has density more than planning capacity, i.e. 85 building units per ha.

Moreover "good" and 'bad" categories would be considered base on floor-based coefficient (KDB) as mention in Keputusan Mentri PU No.640/Kpts/1997 and Penmendagri No.59 tahun 1988, i.e. maximum KDB between 75 – 80%. So, the area within study site with have KDB 64.4% and 79.52% would be considered as "good" category, and the area with 90.71% would be considered as "bad" category (Figure 6).



A. Map of Settelment Evaluation base on setback regulation

B. Map of Settlement Evaluation base on Floor Ration Coefficient and Building density

Figure 6. Map of Settlement Evaluation Base on a. Setback and b. Floor Ratio Coefficient

Facilities

There were education facilites in the study site that (available and) comply to the standard (in term of location and area unit) would be considered as "good" category. On the other side the education facilites which are not standard would be considered as "bad" category (in term of location close to the river and the area smaller than standard) and will be proposed to be improved.

The health and worship facilties, within study site were available and comply to the standard would be considered as "good" category.

Infrastructures

The road with good paving and drainage system, would be considered as "good" category. In the other hand road with bad paving and bad drainage system, would be considered as "bad" category. Some bridge with good quality, would be considered as "good" category, and some bridge with the wood as material contruction and bad quality, would be "bad" category.

Utilities

The area within study site which have septic system, would be considered as "good" category, and vis versa. Moreover the area with the solid waste management, such as have solid waste contaner and collecting system and solid waste transfer station (TPS) and incinerator, would be considered as "good" category. But the area which have no solid waste management system and throw it to the river, would be considered as "bad" category (Figure 7).

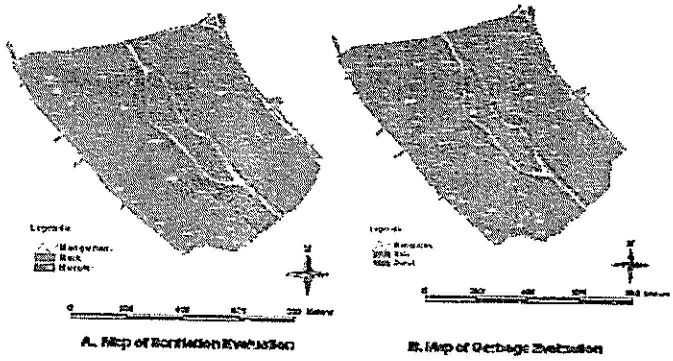


Figure 7. Map of Utilities Evaluation: a. Satination; b. Solid Waste

LANDSCAPE PLANNING

General Concept

Since the study site considered as part of bioregion of CiLiwung watershed, there are relationship and interdependency among other part within the watershed. Therefore, landscape planning based bioregion approach in the study site would be contribute to the other part, especially in the middle and downstream of CiLiwung watershed.

Moreover by applying the bioregional approach it will be restore and maintain natural systems and develop sustainable means for satisfying basic human needs such water, energy, shelter, resource materials, and waste handling,

Zonation

Base on analysis of functions, activities, facilities and space (Figure 8), there are two zone, i.e. conservation zone and and non conservatino zone. Conservation zone cover an area about 20.7% and non conservation zone about 79.3% (Figure 9). Both zone will accomodate ecological and social economy of the community in sustainable away.

Functions: (1) River bank improvement (2) River bank protection (3) Supporting social economy and cultural life (4) Access and transportation (5) Supporting for environmental services

Activities: (1) renovation river bank destruction (2) protection water table (3) providing education, religion, health, fire hazard evacuation (4) movement of human and motorized; connecting separate area, evacuation and other area, garbage collection system (5) managing black water, grey water, and garbage.

Facilities: (1) bioengineering construction (2) urban forest for water conservation (3) school (primery, junior, and senior), worship (mosque, chruch, temple), druck store, heath facilites, community health center, open space with logisticts storage for evacuation equipments (4) street and dan collector road, bridge, inspection road (5) waste water treatment, *biotoilet*, garbage management system, open space for compost Intallation

Space: (1) 30 m on the right and left river (2) island (Pulo Geulis) in middle of river (3) Settlement: type 1, 2, and 3, (4) Settlement: type 1, 2, and 3 (5) urban sewer system, public toilet, Settlement: type 1, 2,

Zone: (1) Conservation (2) Conservation (3) Non Conservation (4) Conservation dan Non Conservation (5) Non Conservation

Figure 8. Developing of Zonation

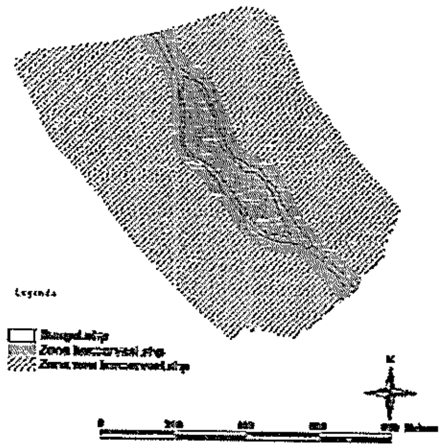


Figure 9. Map of Zonation.

Development Concept

Base on categorization and planning capacity evaluation there are proposed some alternative to control and solve the problem for "bad" category and optimalization for "good" category as (Table 4). Those propose alternative will be implemented in appropriate space within landscape plan of settlement segment of CiLiwung river bank (Figue 10).

Table 4. **Propose Alternative**

Evaluation	Alternative
Settlement	Greenbelt concept a. Bioengineering constrcution b.Soil and water conservation
Facilities	a. Relocation facilities from setback area of river b. Provide evacuation point
Infrastructures	a. Improving phisical qualtilies b.Limited access to the vurnerable and conservation area c. Konstruct inpspection and emergency road
Sanitation system	a. Konstruct Waste water Treatment b.Konstruct Biotoilet
Solid waste	a. Provide solid waste managemen

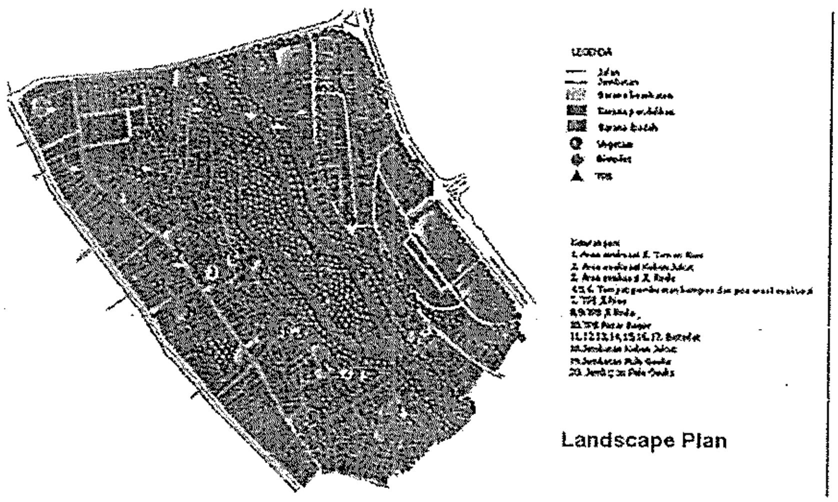


Figure 10. Landscape Plan of Settlement Segment of CiLiwung River Bank

Conservation Zone

The greenbelt will be developed about 30 m from the river. The width of greenbelt had been defining base on: Binford and Buchenau (1993, in Pribadi, 1999) and PERMEN PU No.63/1993, who recommended the buffer area minimum 30 meter in both side of river (Figure 11).

Alocated for greenbelt is about 20.7 %. The previous settlement area in both side of river will be utilized as conservation area. Bioengineering technique will be applied to improve the area. The small island-like of Pulo Geulis will be will utilizied as green space and the settlement will be relocated to the out site the study area.

The green space will be planted by multilayer system, consist of tree, shrub, and ground cover. Plan selection to this area base on the following criteria, i.e. improve soil and water quality, improve hydrological function, protect soil erosion, and enrich biodiversity.

Figure 11. Conservation Zone

<u>Bioengineering Construction Plan</u>

Bioengineering technique will be applied to improve both river side. By planting the vegetation and contruct the gabion will improve the river bank stabilization and protect from erosion and land slide. Some species will be used, such as *Gigantochloa apus, Denrocalamus asper.* and *Vetiveria zizaniodes.*

<u>Soil and Water Conservation Plan</u>

The main function of the island-like of Pulo Geulis will be used retention of river flow. Moreover, by reducing the river flow it will stabilized the river bank and avoid lateral incission, erosion, bank colapse, land slide and other natural hazard. In order to be able to so, the island should be conserved. As conservation area, it has to be stabilized and reinforced. Some conservation program are need to be implemented, such as revegetate with the follwoing criteria: local species, multiple layer (continuous cover), low transpiration rate, has deep root.

Non Conservation Zone

<u>Facilities Plan</u>

Some facilities will be relocated from conservation zone and built in non conservation zone. There are evacuation area will be built for emergency space for fire safety, especially within highest density building house and narrow acccess road. Those facilities will be built as green open space.

<u>Infrastructures Plan</u>

Since Pulo Geulis will be developed as protected area, any access to it will be reduced. There are only two bridge will be operate to connect both side of river and pass through the island. On the other hand access to evacuation facilities will be built and connect to main road. Some inspection and service road will be built for maintain the river and solid waste management.

Utilities Plan

There are some utilities will be built, such as Centralized Waste Water Treatment, biotoilet and participatory solid waste handling management with the 5R (Reduce, Reuse, Recycle, Reform dan Replanting).

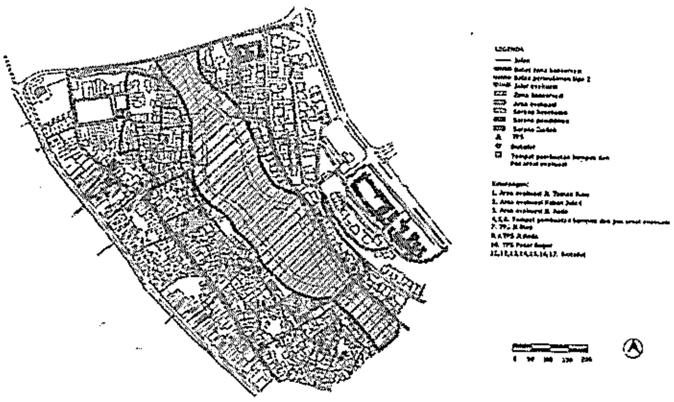


Figure 12. Non Conservation Zone

5. REMARKS

1. There are varies settlement characteristics in study site, in term of type, coverage area, density etc. Those different characteristics express different back ground, level of economic prosperity, socio culture and environmental factors.
2. There three type of settlement class, i.e. type 1, type 2 and type 3. Since, most of settlements type 2 were occupied on the river bank, their need to be improved and controlled.
3. The facilities available in study site are comply to the standard. Even, there are some facilities not fully shows the distribution of the uniform.
4. By applying the bioregional approach it will be restore, maintain natural systems and develop sustainable means for satisfying basic human needs such settlement, facilities (worship, heath, education), infrastructures (road, bridge) and utilities (water, sanitation, solid waste).
5. Since the study site considered as part of bioregion of CiLiwung watershed, therefore, landscape plan based bioregion approach in the study site will contribute to other part, especially in the middle and downstream of CiLiwung watershed
6. Base on developing concept of landscape planning, there are two zone will be developed in study site, i.e. Conservation Zone and Non-Conservation Zone, with the area about 20.7% and 79.3%, respectively. Those two zone will accommodate ecological, social and economic need in sustainable way.

REFERENCES

Berg, P. and R. Dasmann. 1978. Reinhabiting California. In: Berg, P. Reinhabiting Separate Country. A Bioregional Anthology of Northern California, p: 217-220. San Francisco: Planet Drum Foundation.

______. 2003. Guayaquil Green City 2003: an outline for bioregional action. URL: http://www.planetdrum.org/guayq_plan_2003_.htm

Binford, M.W. and M.J. Buchenau. 1999. *Riparian Greenways and water resources.* Dalam: Robbi M. Pribadi, Perencanaan Greenbelt Sepanjang Sungai (Dengan Strategi

Identifikasi Tebal Koridor Hijau dan Manajemen Tapak-Studi kasus Sungai Mookevart, Jakarta) (Skripsi). 1999. Bogor: Fakultas Pertanian, Institut Pertanian Bogor.

Budinetro, H.S. 2005. *Bio-engineering* pengendali erosi bantaran dan tebing sungai. Dalam: Agus Maryono, Eko Hidraulik Pembangunan Sungai. Edisi ke-2. 2005. Jakarta: Magister Sistem Teknik Program Pascasarjana, Universitas Gajah Mada Yogyakarta.

Maryono, A. 2005. Menangani Banjir, Kekeringan, Dan Lingkungan. Yogyakarta: Gadjah Mada University Press, Yogyakarta.

_______.2005. Eko Hidraulik Pembangunan Sungai. Edisi ke-2. Jakarta: Magister Sistem Teknik Program Pascasarjana, Universitas Gajah Mada Yogyakarta.

Patt, H., P. Jurging, and W. Kraus.1999. *Naturanaher Gewsserausbau* Dalam: Agus Maryono, Eko Hidraulik Pembangunan Sungai. Edisi ke-2. 2005. Jakarta: Magister Sistem Teknik Program Pascasarjana, Universitas Gajah Mada Yogyakarta.

Pribadi, M. 1999. Perencanaan Greenbelt Sepanjang Sungai (Dengan Strategi Identifikasi Tebal Koridor Hijau dan Manajemen Tapak-Studi kasus Sungai Mookevart, Jakarta) (Skripsi). Bogor: Fakultas Pertanian, Institut Pertanian Bogor.

Scherch, J.M. 1997. *Living Responsibly: A Study of Sustainable Living in East Tennessee and the Southern Appalachian Bioregion.* Dissertation. The University of Tennessee, Knoxville.

Tim Sampoerna Hijau. 2007. Sampoerna Hijau Kotaku Hijau. Buku Panduan Penataan Taman Umum, Penanaman Tanaman, Penanganan Sampah dan Pemberdayaan Masyarakat. Jakarta: Sampoerna Hijau.